Management of Upper Limb Amputation Rehabilitation

Synopsis of the 2022 US Department of Veterans Affairs and US Department of Defense Clinical Practice Guideline for Acquired Amputation

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Abstract: Upper limb amputation can result in significant functional impairment necessitating a comprehensive rehabilitation approach throughout the continuum of care. In 2022, the Departments of Veteran Affairs and Defense completed an updated clinical practice guideline for the management of upper limb amputation rehabilitation. This practice guideline was developed by a workgroup of subject-matter experts from a variety of disciplines. Twelve key questions were developed by the workgroup using the PICOTS (population, intervention, comparator, outcomes, timing of outcomes measurement, and setting) format to establish the scope of the literature review. Eighteen recommendations were developed through extensive review of the available literature and use of the Grading of Recommendations, Assessment, Development and Evaluation criteria. The strength of each recommendation was determined based on the quality of the research evidence and the additional domains of the Grading of Recommendations, Assessment, Development and Evaluation criteria. Of the 18 recommendations, 4 were found to have sufficient evidence to suggest for use of a particular rehabilitation management strategy. Thus, the 2022 Department of Veteran Affairs and Department of Defense clinical practice guideline provides updated, evidence-based information on the care and rehabilitation of persons with upper limb amputation. However, a significant lack of high-quality evidence in upper limb amputation rehabilitation limited evidence-based clinical guidance to assist healthcare providers in managing this population.

Key Words: Amputation, Prosthesis, Prosthetic Limb, Rehabilitation

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There are an estimated two million individuals in the United States living with limb loss with approximately 185,000 Americans undergoing amputation each year.[1] While dysvascular disease increases the incidence of lower limb amputation in individuals 65 yrs and older, traumatic injuries are estimated to account for 80% of acquired upper limb amputation (ULA). These injuries and resultant amputations often occur in younger individuals resulting in significant functional impairment and substantial psychosocial and vocational consequences.[2] This necessitates a comprehensive rehabilitation care program to address the multifarious spectrum of needs that can develop throughout the continuum of care.

In 2014, the Departments of Veteran Affairs (VA) and Defense (DOD) published a clinical practice guideline for the Management of Upper Extremity Amputation Rehabilitation (2014 VA/DOD UEAR CPG).[2] The intent was to guide healthcare providers along evidence supported pathways in the complex rehabilitation of individuals with ULA with the goal of systemwide improvement in the patients' health and well-being. While this CPG was one of only two in a systematic review (SR) of CPGs for management of limb amputation determined to be both comprehensive and high quality,[3] a growing body of research since the previous review through June 2013 spurred the decision to update the 2014 CPG using available evidence through April 2021.

The 2022 VA/DOD Clinical Practice Guideline for the Management of Upper Limb Amputation Rehabilitation (2022 CPG) described in this article was developed by a workgroup composed of clinical experts across a spectrum of disciplines.[4] The goal was to be comprehensive in scope and to provide management recommendations throughout the lifetime of the patient and to address many of the challenges faced by patients with ULA. The CPG is designed to provide general guidance for healthcare providers engaged in the care of patients with ULA. In contrast to the 2014 UEAR CPG, the 2022 CPG developed recommendations using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) Working Group criteria.[5] This resulted in fewer recommendations and further emphasized the ongoing need for

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high-quality research in all fields of ULA rehabilitation. The purpose of this article is to summarize the guideline methodology and structure as well as highlight key findings and recommendations. The entire CPG may be obtained at https://www.healthquality.va.gov/.

METHODOLOGY

The joint VA and DOD Evidence-Based Practice Work Group established standards and provided oversight for the development and publication of practice guidelines that are of clinical importance to both agencies. The methodology used in developing the referenced CPG follows the Guideline for Guidelines, an internal document of the VA and DOD Evidence-Based Practice Work Group, which was updated in January 2019.[6] The Lewin Group (Falls Church, VA; https://www.lewin.com/) and ECRI (Plymouth Meeting, PA; https://www.ecri.org/) facilitated the CPG development and conducted the literature review. The Evidence-Based Practice Work Group selected a multidisciplinary workgroup of 22 VA and DOD experienced providers in internal medicine, occupational and physical therapy, pharmacology, physical medicine and rehabilitation, plastic surgery, polytrauma nursing, prosthetics, and rehabilitation psychology. All members of the workgroup engaged in each component of the development process, and each member was required to submit a disclosure statement for potential conflicts of interest to ensure a guideline free from bias.

Twelve key questions were developed by the workgroup using the PICOTS (population, intervention, comparator, outcomes, timing of outcomes measurement, and setting) format to establish the scope of the literature review. The 12 questions were spread over six core clinical areas as defined by the workgroup. These six core areas or clinical topics were as follows: surgical/preprosthetic care, rehabilitation, prosthetic restoration, medical considerations, outcomes, and psychosocial considerations. The patient population of interest for this CPG was adults (≥18 yrs) with acquired ULA, including veterans as well

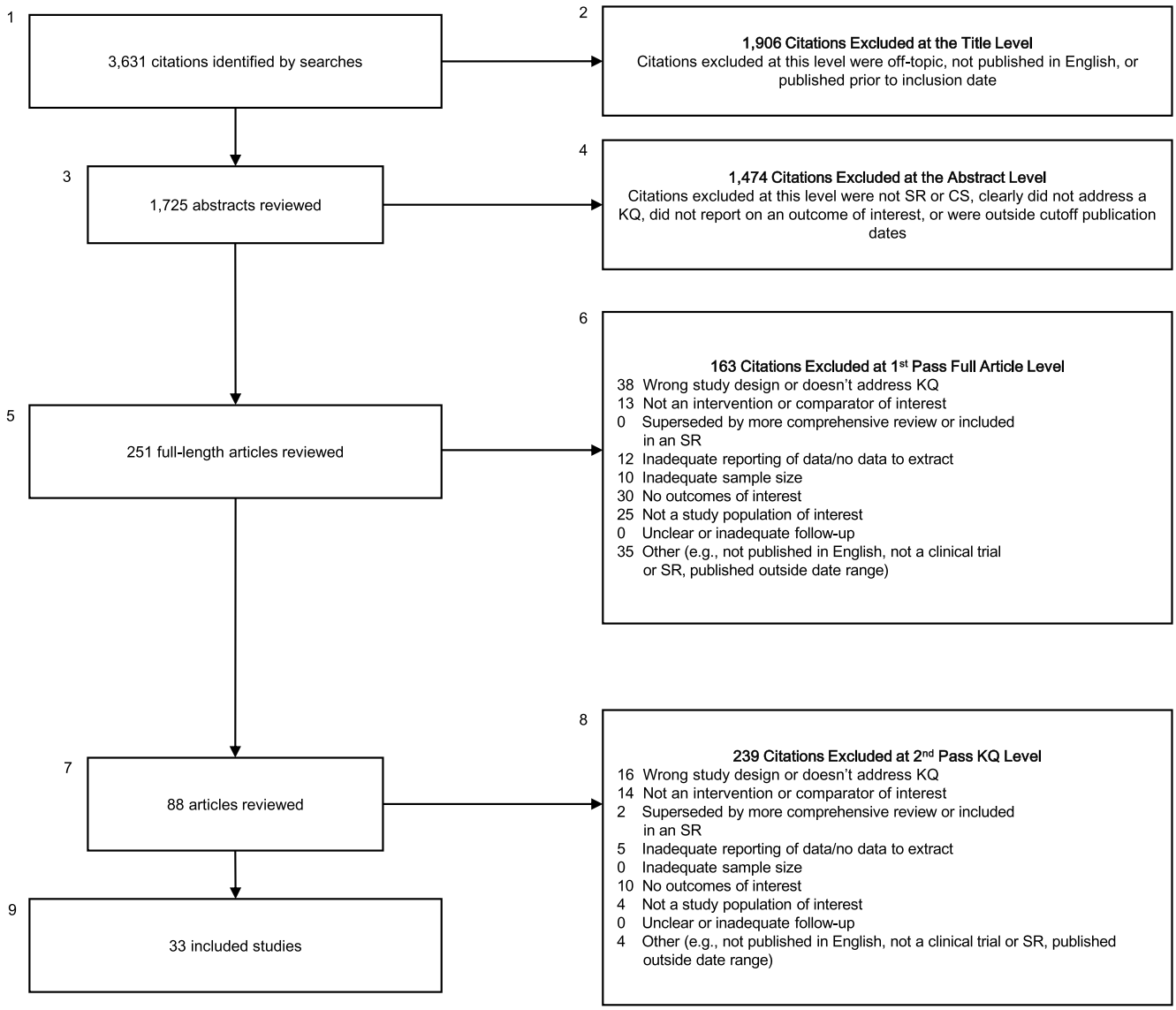


FIGURE 1. Evidence review process flow diagram.

as service members, military retirees, and beneficiaries. Using search strategies detailed in the full guideline, the follow-on standardized search of the peer-reviewed literature identified 3631 potentially relevant studies published before April 30, 2021. The literature review search terms and strategy excluded congenital upper limb deficiency. After several rounds of reviews, 33 studies were identified that addressed one or more of the key questions and met the criteria for use as evidence (Fig. 1). These remaining studies served as the basis for the recommendation development. Table 1 shows the distribution of these 33 articles across the 12 key questions. The key questions along with the identified literature were used to guide the development of the CPG recommendations.

The workgroup developed the final 2022 CPG recommendations using the National Academies of Science GRADE methodology. The development of each recommendation followed a standardized process that included an extensive review of the identified literature and grading the strength of the research evidence. Draft recommendations were reviewed by the entire workgroup, and workgroup consensus was required for each of the recommendations before inclusion in the CPG. This methodology does not allow for recommendations based on expert opinion alone, so the strength of each recommendation was determined based on the quality of the research evidence as well as the additional domains of the GRADE criteria (Table 2). The four GRADE domains are confidence in the (quality of the) evidence, the balance of desirable and undesirable outcomes, patient values and preferences, and other considerations (e.g., resource use, equity, acceptability, feasibility, subgroup considerations, etc.).[5] This contrasts with the 2014 CPG methodology, in which 26 of 27 recommendations were based solely on expert opinion. In addition to a more stringent development methodology, the 2022 CPG was strengthened by the utilization of gender-specific patient focus groups to identify priority clinical issues and gender-specific management considerations. Important concepts that emerged from the focus group were shared with the workgroup and informed guideline recommendation development.

The guideline development process also included a review of the near-final draft guideline by expert reviewers both inside and outside the federal sector. Reviewer comments and edits were incorporated into the final guideline based on panel consensus and consistency with the evidence review. The VA/DOD Evidence-Based Practice Work Group provided final review and approval of the CPG for release in April 2022.

SUMMARY OF RECOMMENDATIONS AND EVIDENCE

The 2022 CPG recommendations were organized by clinical care topics to mirror the key question organization: surgical/preprosthetic, rehabilitation, prosthetic restoration, medical care, outcomes, and psychosocial considerations. The workgroup went through a deliberate process of reviewing, grading, and determining acceptability of the evidence for making clinical recommendations for or against specific clinical practices. Through that process, the workgroup identified that much of the available research evidence was limited by serious methodological issues, such as convenience sampling, selection bias, confounder control, and lack of blinding. In terms of the GRADE domains (Table 2), the workgroup had low confidence in most of the evidence as it was determined to be of insufficient quality

TABLE 1. Key questions and evidence base by key question

Key Question Number	Key Question	Number and Study Type
1	In adults with ULA, what is the impact of treatment advances, including hardware, software, surgical, technology, or supplemental surgical interventions on outcomes?	1 RCT, 2 observational
2	In adults with ULA, do psychosocial interventions affect outcomes?	No studies identified
3	In adults with ULA, what treatment parameters (e.g., setting, treatment intensity, or service delivery model) are most effective in improving outcomes?	No studies identified
4	In adults with ULA, what assessment measures are effective in guiding prosthesis candidacy determination, determining the need for therapy, or identifying improvement or worsening of function and quality of life?	3 observational
5	In patients with ULA, with and/or without prostheses, what patient-related factors and/or co-occurring conditions are associated with rehabilitation outcomes?	12 observational
6	How do outcomes vary by control strategy, prosthesis type, socket design and/or suspension method, and/or prosthesis component selection?	7 observational
7	In patients with ULA, what is the effectiveness of pharmacologic and nonpharmacologic interventions for the prevention of phantom and residual limb pain?	No studies identified
8	In patients with ULA, what is the effectiveness of pharmacologic interventions for the management of phantom and residual limb pain?	1 RCT
9	In patients with ULA, what is the effectiveness of nonpharmacologic interventions for the management of phantom and residual limb pain?	1 SR, 2 randomized crossover trials
10	In patients with ULA, does level of amputation and/or amputation surgical procedure type impact patient outcomes?	2 SRs, 3 observational
11	In patients undergoing ULA surgery (initial or revision), what factors predict speed and quality of wound healing, prosthesis fitting, or need for revision surgery?	No studies identified
12	In patients with ULA, what therapy interventions (e.g., PT/OT), therapy intervention timing, or therapy protocols are associated with better function and health outcomes?	No studies identified
	Total Evidence Base	33 studies

TABLE 2. GRADE evidence to recommendation framework

Decision Domain	Questions to Consider	Judgment
Confidence in the quality of the evidence	Among the designated critical outcomes, what is the lowest quality of relevant evidence? How likely is further research to change the confidence in the estimate of effect?	High Moderate Low Very low
Balance of desirable and undesirable outcomes	What is the magnitude of the anticipated desirable outcomes? What is the magnitude of the anticipated undesirable outcomes? Given the best estimate of typical values and preferences, are you confident that benefits outweigh harms/burdens or vice versa?	Benefits outweigh harms/burdens Benefits slightly outweigh harm/burden Benefits and harms/burdens are balanced Harms/burdens slightly outweigh benefits Harms/burdens outweigh benefits
Patient values and preferences	What are the patients' values and preferences? Are values and preferences similar across the target population? Are you confident about typical values and preferences?	Similar values Some variation Large variation
Other implications (e.g., resource use, equity, acceptability, feasibility, subgroup considerations)	What are the costs per resource unit? Is this intervention generally available? What is the variability in resource requirements across the target population and settings? Are the resources worth the expected net benefit from the recommendation? Is this intervention and its effects worth withdrawing or not allocating resources from other interventions?	Various considerations

and quantity and the balance of desirable and undesirable outcomes, assessed patient values and preferences, and other considerations were inadequate to support crafting recommendations without supporting evidence from the literature review. Lastly, while the patient focus group findings were included in the workgroup decision making, patient need alone was not sufficient to support recommendation statements. Thus, of 14 recommendation statements, only four recommendations were able to be developed to guide clinical practice (Tables 3, 4).

Five recommendations had no evidence meeting inclusion criteria with which to support a statement for or against clinical practices (recommendations 2, 4, 6, 8, 9). All studies found in the initial literature review relevant to these key questions and recommendations were removed from further consideration because of methodological flaws, including biases in the selection of controls, determination of risk factors, difficulty in assessing true temporal relationship, small sample sizes, limited study participants with ULA, lack of relevant data to abstract, or weak design. While some evidence was available for review for another five recommendations (recommendations 1, 3, 10–12), through the SR process, the identified evidence was found to be insufficient to support any statement for or against clinical practices. Four recommendations (recommendations 5, 7, 13, 14) had minimally sufficient evidence that, combined with considerations under all GRADE domains, resulted in sufficient strength for suggestions for clinical practice.

There were three evidence statements developed for the surgery/preprosthetic topic (recommendations 1–3). There was insufficient evidence to assess the impact of the level of amputation or amputation surgical procedure type on functional status and prosthesis-related outcomes. The workgroup also determined there to be insufficient evidence to recommend the use of any particular factors to predict the speed and quality of postoperative wound healing, successful prosthesis fitting, or need for revision surgery.

For rehabilitation considerations, the workgroup found sufficient evidence to develop one new recommendation (recommendation 5). This recommendation was supported by one study that found treatment with mirror therapy resulted in short-term improved pain outcomes when compared with the control patients with ULA at 4-day to 6-week follow-up.[7] The workgroup also determined that the potential benefits of mirror therapy as a nonpharmacologic intervention to reduce phantom limb pain in upper extremity amputees outweighed the potential harms. No studies met inclusion criteria on training protocols to improve function and outcomes (recommendation 4) nor did the systematic evidence review retrieve any relevant studies on the relationship between various treatment parameters (e.g., setting, treatment intensity, or service delivery model) and rehabilitation outcomes (recommendation 6).

Under the prosthetic restoration topic area, the workgroup found sufficient evidence to suggest use of a body-powered or externally powered prosthesis to improve independence and reduce disability for individuals with unilateral limb loss through or proximal to the wrist joint (recommendation 7). There are essentially six categorical options involving prostheses available to the individual with upper extremity limb loss: no prostheses, passive prostheses, body-powered prostheses, externally powered, hybrid (combination of external and body power), and activity-specific prostheses.[3] Recommendation 7 recognizes that utilization of an actively controlled prosthesis, referring to a body-powered, externally powered device or hybrid, improves independence and reduces disability.[8] However, between body-powered systems and those using external

TABLE 3. Recommendations for topic areas surgery/preprosthetic, rehabilitation, and prosthetic restoration

Topic	#	Recommendation	Strength
Surgery/preprosthetic	1.	There is insufficient evidence to assess the impact of the level of amputation or amputation surgical procedure type on functional status and prosthesis-related outcomes.	Neither for nor against
	2.	For patients undergoing upper limb amputation surgery, there is insufficient evidence to recommend the use of any particular factors to predict the speed and quality of wound healing, successful prosthesis fitting, or need for revision surgery.	Neither for nor against
	3.	There is insufficient evidence to recommend for or against the use of any particular recent treatment advances including hardware, software, surgical, technology, or supplemental surgical interventions, such as: • targeted muscle reinnervation (TMR) • regenerative peripheral nerve interfaces (RPNI) • vascularized composite allotransplantation (VCA) • agonist-antagonist myoneural interface (AMI) • implantable myoelectric sensor system (IMES) • osseointegration (OI)	Neither for nor against
Rehabilitation	4.	There is insufficient evidence to recommend for or against any particular training protocol to improve function and outcomes.	Neither for nor against
	5.	We suggest the use of mirror therapy for the short-term reduction of phantom limb pain.	Weak for
	6.	There is insufficient evidence to recommend for or against any particular treatment setting, intensity, or service delivery model.	Neither for nor against
Prosthetic restoration	7.	For patients with major unilateral upper limb amputation (i.e., through or proximal to the wrist), we suggest use of a body-powered or externally powered prosthesis to improve independence and reduce disability.	Weak for
	8.	There is insufficient evidence to recommend for or against any specific control strategy, socket design, suspension method, or component.	Neither for nor against

power, there was no evidence in the SR to recommend one individual type of prosthetic system over another.

There are a large number and wide range of options with control strategies, socket designs, suspension methods, and prosthetic components, which often have markedly different characteristics, advantages, and disadvantages. However, the workgroup found insufficient evidence to recommend for or against any specific control strategy, socket design, suspension method, or component (recommendation 8). Although seven observational studies were identified that examined prosthesis type and control strategy, they did not meet criteria for inclusion in the evidence review.

Based on the systematic literature review findings related to medical care, the workgroup developed three recommendations (9, 10, and 11) to address either the prevention or management of post-amputation pain conditions. The literature review encompassed both pharmacologic and nonpharmacologic intervention strategies. Despite this comprehensive approach, insufficient evidence was identified to recommend for or against interventions targeting the prevention or management of residual limb pain and/or phantom limb pain. The CPG's systematic evidence review identified one Randomized Controlled Trial meeting inclusion criteria, addressing ropivacaine as a 6-day perineural infusion.[9] The study reported short-term clinical benefit for phantom limb pain and residual limb pain; however, only 16% of the study participants had an ULA and the clinical significance of the reduction in pain was unclear. In addition, from a feasibility and acceptability standpoint, the intervention may be burdensome because it requires a continuous catheter implant in an ambulatory setting. In the area of nonpharmacologic treatments, a recommendation suggesting the use of mirror therapy for the short-term reduction of phantom pain was included in the rehabilitation

TABLE 4. Recommendations for topic areas medical, outcomes, and psychosocial considerations

Medical	9.	There is insufficient evidence to recommend for or against a particular intervention for the *prevention* of phantom and/or residual limb pain.	Neither for nor against
	10.	There is insufficient evidence to recommend for or against any particular pharmacologic intervention for the *management* of phantom and/or residual limb pain.	Neither for nor against
	11.	There is insufficient evidence to recommend for or against the use of noninvasive brain stimulation for the management of phantom limb pain.	Neither for nor against
Outcomes	12.	There is insufficient evidence to recommend for or against the use of any specific assessment tool to guide the determination of prosthetic candidacy, the need for therapy, or for identifying improvement or worsening of function and quality of life.	Neither for nor against
Psychosocial considerations	13.	We suggest screening patients for cognition, mental health conditions such as posttraumatic stress disorder and depression, and pain during the initial evaluation and across the continuum of care.	Weak for
	14.	We suggest offering peer support services.	Weak for

considerations section as noted previously. In addition, the workgroup found insufficient evidence to recommend for or against the use of noninvasive brain stimulation for the management of phantom limb pain. No studies were identified that addressed the use of other recognized nonpharmacologic interventions: acceptance and commitment therapy, biofeedback, cognitive behavioral therapy, desensitization, graded motor imagery, meditation, mindfulness-based stress reduction, pain neuroscience education, spinal cord stimulation, peripheral nerve stimulation, psychotherapy, radiofrequency ablation, relaxation therapy, or virtual/augmented reality.

The workgroup did not find sufficient evidence on the use of any specific assessment tool to determine prosthetic candidacy, the need for therapy, or measuring improvement or worsening of function and quality of life for the outcomes topic. The three observational studies identified in the SR were too specific to either hand injury or use of the DEKA arm to be generalizable to the ULA community. Based on the workgroup's desire to underscore the importance of integrating outcome measures in clinical practice, the workgroup updated Appendix C to provide clinicians with a selection of valid and reliable tools to assist in clinical decision making.

For the psychosocial topic, recommendation 13 suggests screening patients for cognition, mental health conditions such as posttraumatic stress disorder and depression, and pain during the initial evaluation and across the continuum of care. A review of nine observational studies examined the relationship between patient-related factors and rehabilitation outcomes in ULA. These studies indicated that cognitive, mental health conditions, and pain are all factors that can impact patient outcomes. One important finding is that there are specific cognitive control functions involved in the use of some ULA prosthetic devices. Hancock et al.[10] (2017) found that cognitive domains of attention and processing speed were significantly associated with higher scores on measures of function in patients receiving training on the DEKA arm. Thus, it is useful to ascertain the cognitive functioning of those considering an advanced upper limb prosthesis. Other studies suggested association between greater pain interference, posttraumatic stress disorder, and depression and clinically significant levels of psychological distress[11]; associations between levels of ULA and psychological well-being[12]; and pain and quality of life in persons with ULA.[10] However, one study found no significant association between resilience or pain and posttraumatic stress disorder or depression.[13]

The updated CPG suggests offering peer support services to persons with ULA (recommendation 14) as concern for potential lack of acceptance by friends and family, loss of function, and alteration in body image are all typical responses that patients experience with an ULA. This is slightly different from previous recommendations which stated that the care team should facilitate the early involvement of a trained peer visitor. This recommendation recognizes peer support as more all-encompassing: integrating trained peer visitor visits under the umbrella of peer support or those opportunities that are social, recreational, or educational. Peer support is widely recognized as beneficial by both clinicians and patients. In addition to support from the systematic evidence review, those with amputation report that peer support programs are often very useful and provide a sense of hopefulness.[14]

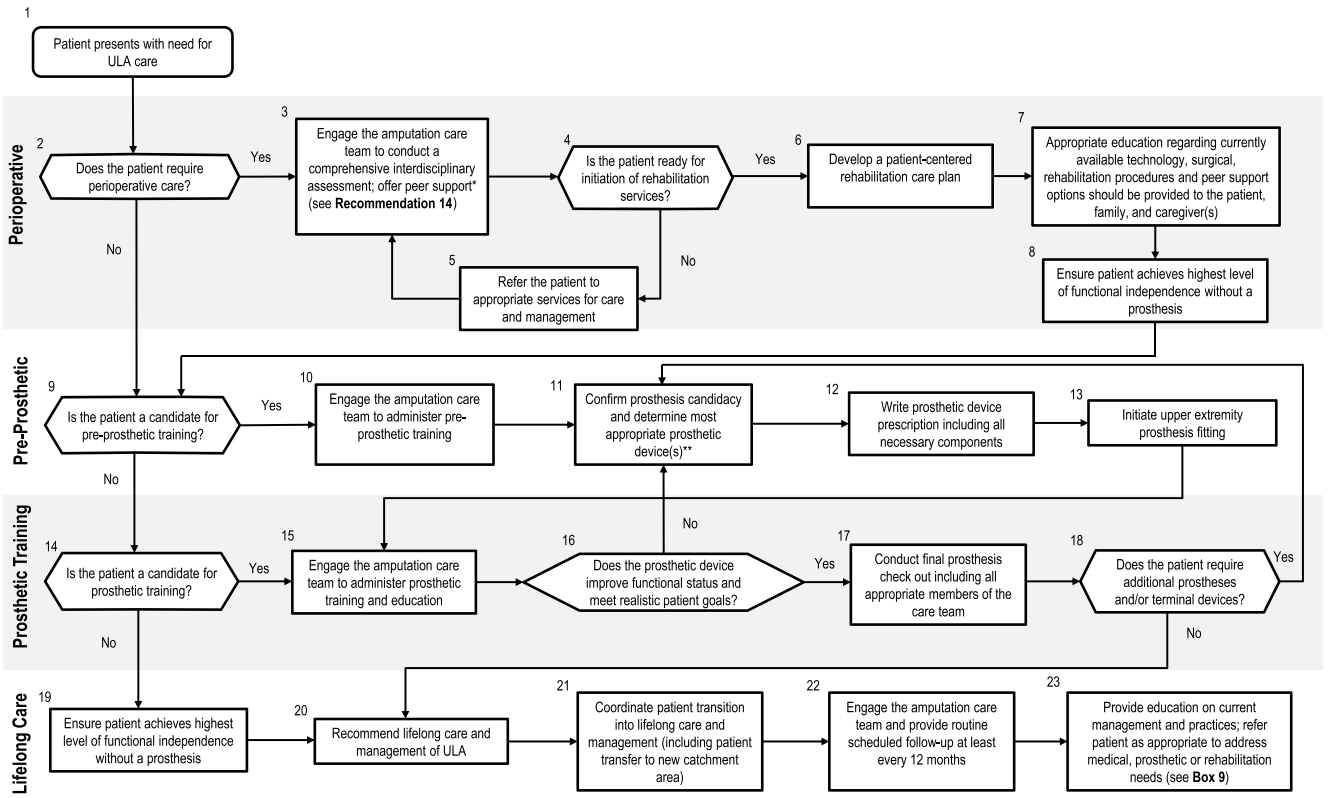


FIGURE 2. Upper limb amputation management algorithm for rehabilitation providers. Please refer to the full CPG[4] for additional sidebar information.

TREATMENT ALGORITHMS

In addition to the formal recommendations noted previously, the 2022 CPG provides a host of clinically oriented resources including two clinical treatment algorithms. The first algorithm (Fig. 2) is designed for rehabilitation providers across a variety of disciplines and outlines the essential elements and key decision points for patient management across the entire care continuum. A similar algorithm was included in the 2014 CPG and modifications for the new CPG were primarily focused on clarification of language and assuring that each step in the algorithm was complete and clear. The second algorithm (Fig. 3), a completely new algorithm not included in the 2014 CPG, aims to assist primary care providers in the management of people with upper limb amputation. This resource provides referral recommendations based on the patient's presenting complaints as well as promoting at least annual follow-up with the amputation care team.

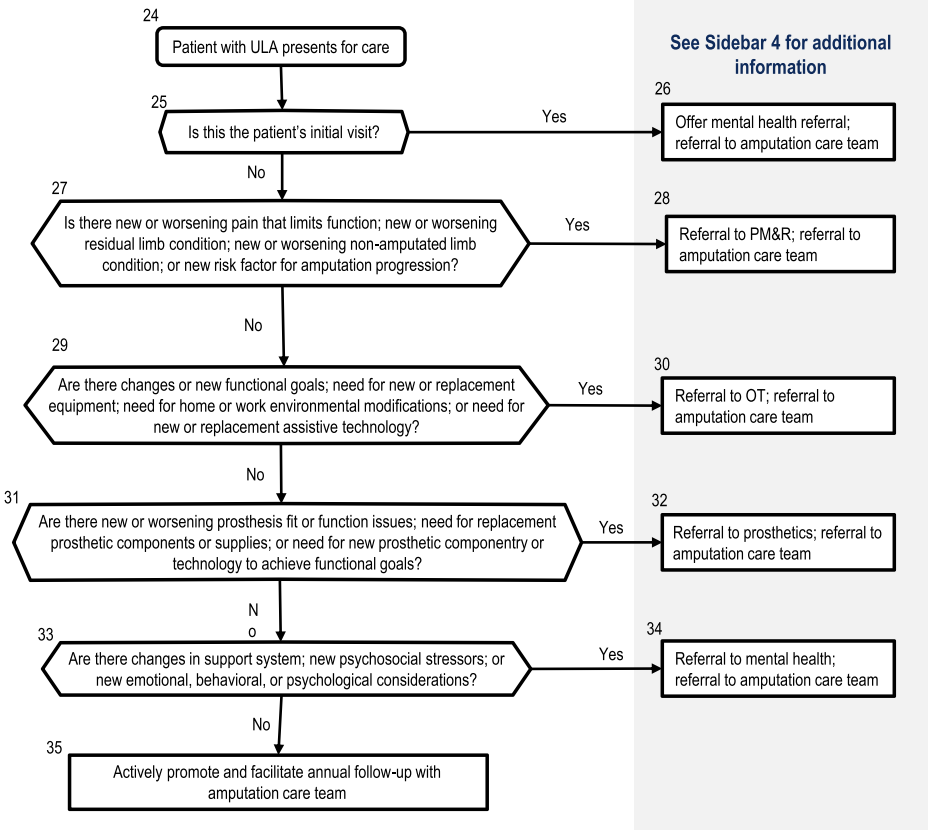
GUIDELINE APPENDICES

Each appendix from the 2014 CPG was reviewed, updated, combined with others, or removed to ensure relevant general guidance is available to clinicians despite the lack of high-quality evidence. Only one appendix from the 2014 CPG was deleted without being combined with another. A summary comparison of changes to the Appendices from 2014 to 2022 is included in Supplemental Table 1 (Supplemental Digital Content 1, http://links.lww.com/PHM/B903).

Appendix J from the 2014 CPG, "Preparatory Prosthesis Recommendations," was removed as the workgroup determined that any specific recommendations on components and prosthetic design would not be supported by any SR or randomized control trial findings. It is also not consistent with VA/DOD best practice, which recognizes that prescriptions for upper extremity prostheses should be based on the patient's needs, capabilities, amputation level, as well as anticipated compliance with training and intention of use. The prescription is ultimately a case-by-case collaborative decision between the individual patient and the amputation care team. The CPG algorithm sidebars and appendices are useful references during prosthetic prescription.

Five of the 15 appendices in the 2022 updated CPG are new. These additional appendices cover both administrative topics as well as clinical areas, such as outcome measures, essential elements of the annual contact, surgical considerations, and control strategies for upper limb prosthetics. The CPG workgroup members considered the topics covered in these appendices to be clinically relevant and of high importance to enhancing the quality and consistency of care for Veterans with ULA. Because these topic areas were not able to be specifically addressed in the formal CPG recommendations, the decision was made to incorporate them into the appendices. The administratively oriented appendices can be further reviewed in the CPG.

As a summary of the results of the patient focus groups, Appendix I, Patient Focus Group Methods and Findings, may be of particular interest to clinicians. There were a number of



Sidebar 4. Amputation Care Team

The amputation care team is an interdisciplinary team consisting of, at a minimum, a physiatrist (or prescribing clinician), therapist and prosthetist, providing assessment and treatment for amputation-related needs. Other providers who may be included are mental health, social work, nursing, wound care, surgery, vocational planning, etc. Members of the team may participate face to face or via telehealth as appropriate.

FIGURE 3. Upper limb amputation management algorithm for primary care.

notable findings from the focus group. Participants of the patient focus group valued the team-based approach to care and believed an individualized care plan with emphasis on patient-provider communication was extremely important, as was peer support. In general, function of a prosthesis was preferred over cosmesis, and participants expressed value in having a range of prosthetic devices available to meet their unique functional goals. However, the participants noted that the fitting process was often challenging, leading some to discontinue prosthetic use. Those who do use prostheses stated that they do not wear their prostheses all day as they find some tasks easier to accomplish without a device. Adaptive sports programs and behavioral health interventions were viewed as valuable additions to their rehabilitative therapy. In addition, gender differences were noted as female participants requested prostheses to be designed for their body sizes and muscle strength. Although the number of participants in the focus group was small, the results are consistent with what many VA/DOD clinical subject matter experts hear from other Veterans with upper extremity limb loss.

RESEARCH RECOMMENDATIONS

A focus for the workgroup was developing research recommendations and priorities. The lack of high-quality evidence to answer even basic key clinical questions was readily apparent throughout the yearlong effort to craft this CPG update and significantly hindered the ability to develop well supported clinical recommendations. This requires a high-level commitment to advance the science behind the clinical care provided to those with upper limb loss or difference. Section X in the CPG gives a thorough review of research priorities as well as simple steps researchers can take to improve their inclusion in the literature reviews performed for CPGs, such as using research rating tools and checklists when developing grant proposals, manuscripts and other scientific products. Meeting inclusion criteria for CPGs should be an essential part of planning effective research, presuming it is meant to inform, advance and shape not only clinical practice but patient outcomes.

DISCUSSION

The 2022 VA/DOD Clinical Practice Guideline for the Management of Upper Limb Amputation Rehabilitation remains comprehensive in scope and provides an important update to the original 2014 version. The 2022 CPG provides management recommendations across the life span of the person with ULA and across the spectrum of clinical conditions and management challenges faced after ULA. Consistent with the 2014 CPG, the 2022 CPG is targeted to be of greatest value to rehabilitation care providers involved in the management of persons with ULA. However, the 2022 update includes an additional treatment algorithm that is designed specifically for primary care providers. The 2022 CPG developed recommendations using the more rigorous GRADE methodology that does not allow for recommendations based on expert opinion alone. In comparison, 26 of 27 recommendations from the original 2014 CPG were based solely on expert opinion. In addition, the 2022 CPG was strengthened by the utilization of gender-specific patient focus groups to identify gender-specific management considerations and through use of a different organizational structure for the guideline recommendations.

The development of this updated CPG revealed a dearth of sufficient quality research evidence for ULA rehabilitation as evidenced by the limited clinical recommendations. It is further evident by the limited SRs in this space[15] and the fact that others[16] were compelled to use consensus to formulate clinical guidance.

Other professional and industry entities have pursued development of clinical guidance in this area with very limited results. There was an effort by the American Academy of Orthotists and Prosthetists (AAOP) in 2017 to develop an SR from which to further support a State of the Science Consensus Conference (SSC) Proceeding for the management of upper extremity amputation and prosthetic management.[17] This effort yielded an SR that provided 11 empirical evidence statements. The empirical evidence statements predominantly focused on differences between body-powered and myoelectric prostheses but expanded slightly beyond this to include some statements regarding activity-specific prostheses, suspension, EMG control, and other topics. Of the 11 empirical evidence statements, the strength of evidence supporting them was insufficient in the case of two statements, moderate for two others, and predominantly low in the case of the majority, which was seven additional statements.[17]

The AAOP's support of the previously described SR was used as the focal point for a 2017 consensus-based SSC that yielded numerous editorial manuscripts. The editorials provided varied perspectives on upper limb prosthetic management including those of the user, engineer, physiatrist, therapist, an international perspective, and more. The function of the SSC editorials were less about making clinical practice recommendations and more about informing regarding knowledge gaps to focus researchers and research sponsors in terms of where to focus efforts and funding.

In 2009, the AAOP also led an SSC, with funding from the US Department of Education, on the subject of outcome measures (OMs) in the upper extremity amputee population.[18] At that time, the AAOP SSC was unable to recommend any OM at the body function level because of a lack of psychometric properties among other issues. Conversely, at the activity level, the Canadian Occupational Performance Measure and Goal Attainment Scaling were reported then to allow individualized goal setting, which is ideal for a clinical prosthetic setting. However, at that time, prosthetist-specific training on these OMs was an issue. Satisfaction, device use, and acceptance were further identified as important topics for the prosthetist. To assess these domains, it was recommended that prosthetists use existing, psychometrically sound surveys such as the upper limb module of the Orthotics and Prosthetics User Survey rather than developing entirely new surveys. Other outcome topics (e.g., specific functional assessment) were referenced but were described in the context of an interdisciplinary team approach as opposed to a prosthetist-specific approach.

Both the current CPG and the AAOP 2009 SSC on OM considered the International Classification of Functioning framework[19] as well as psychometric properties when determining eligibility for the inclusion of OM in their recommendations. While both documents include information on numerous measures, the one agreed upon OM in both documents is

the Orthotics and Prosthetics User Survey.[20–22] While this document concurrence is important, it should be noted that the Orthotics and Prosthetics User Survey is a survey and thus will not provide comprehensive assessment in all domains of the International Classification of Functioning. Thus, other factors remain important in determining which OM to use such as clinical judgment, institutional policy, electronic health record inclusion and capabilities, clinical domain of interest, and others.

The Hanger Institute for Clinical Research and Education recently developed a clinical practice guidance document on the more focused topic of provision of unilateral transradial prostheses.[15] The intent of their guideline is to serve as assistance for clinical decision-making processes in this specific clinical space. Their guideline, noting the absence of research of sufficient quantity, quality, and consistency, indicate that Delphi survey methodologies have been used with increasing frequency within orthotics and prosthetics to create guidelines for clinical practice. Their guideline uses a three-round Delphi survey to gain consensus on clinical statements regarding unilateral transradial prosthesis provision. They achieved consensus (>80% agreement) on a total of 40 statements by surveying 22 experts on upper limb prosthetics over three rounds of surveys.

The 2022 VA/DOD CPG differs from other available ULA rehabilitation guidance in the manner at which recommendation statements were formulated and the scope of the document. The VA/DOD recommendations were formulated on the basis of an extensive and thorough evidence review and grading process, workgroup consensus, and gender-specific limb-loss individuals and are more broadly aimed at the continuum of care for patients with all levels of upper extremity amputation regardless of prosthetic use.

CONCLUSIONS

The 2022 VA/DOD Management of Upper Limb Amputation Rehabilitation CPG provides updated, evidence-based information on the care and rehabilitation of persons with ULA. It is intended to provide guidance to assist healthcare providers in managing the care of persons with ULA through an interdisciplinary approach across the entire care continuum. The strength and validity of the CPG recommendations are founded upon use of the GRADE methodology development process, engagement of an interdisciplinary workgroup of subject-matter experts, utilization of patient focus groups to identify priority clinical issues, and a formal external peer-review process.

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