VA/DoD CLINICAL PRACTICE GUIDELINE FOR THE MANAGEMENT OF STROKE REHABILITATION

Department of Veterans Affairs
Department of Defense

QUALIFYING STATEMENTS

The Department of Veterans Affairs and the Department of Defense guidelines are based upon the best information available at the time of publication. They are designed to provide information and assist decision making. They are not intended to define a standard of care and should not be construed as one. Neither should they be interpreted as prescribing an exclusive course of management.

This Clinical Practice Guideline is based on a systematic review of both clinical and epidemiological evidence. Developed by a panel of multidisciplinary experts, it provides a clear explanation of the logical relationships between various care options and health outcomes while rating both the quality of the evidence and the strength of the recommendation.

Variations in practice will inevitably and appropriately occur when clinicians take into account the needs of individual patients, available resources, and limitations unique to an institution or type of practice. Every healthcare professional making use of these guidelines is responsible for evaluating the appropriateness of applying them in the setting of any particular clinical situation.

These guidelines are not intended to represent Department of Veterans Affairs or TRICARE policy. Further, inclusion of recommendations for specific testing and/or therapeutic interventions within these guidelines does not guarantee coverage of civilian sector care. Additional information on current TRICARE benefits may be found at www.tricare.mil or by contacting your regional TRICARE Managed Care Support Contractor.

Version 4.0 – 2019

Prepared by:

The Management of Stroke Rehabilitation Work Group

With support from:

The Office of Quality, Safety and Value, VA, Washington, DC
&
Office of Evidence Based Practice, U.S. Army Medical Command

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I. Introduction

The Department of Veterans Affairs (VA) and Department of Defense (DoD) Evidence-Based Practice Work Group (EBPWG) was established and first chartered in 2004, with a mission to advise the Health Executive Committee (HEC) "…on the use of clinical and epidemiological evidence to improve the health of the population…" across the Veterans Health Administration (VHA) and Military Health System (MHS), by facilitating the development of clinical practice guidelines (CPGs) for the VA and DoD populations.[1] This CPG is intended to provide healthcare providers with a framework by which to evaluate, treat, and manage the individual needs and preferences of patients rehabilitating from stroke, thereby leading to improved clinical outcomes.

In 2010, the VA and DoD published a CPG for the Management of Stroke Rehabilitation (2010 Stroke Rehabilitation CPG), which was based on evidence reviewed through March 2009. Since the release of that guideline, a growing body of research has expanded the general knowledge and understanding of stroke rehabilitation.

Consequently, a recommendation to update the 2010 Stroke Rehabilitation CPG was initiated in 2018. The updated CPG, which includes objective, evidence-based information, is intended to assist healthcare providers in all aspects of stroke rehabilitation (e.g., assessment, treatment, follow-up). The system-wide goal of evidence-based guidelines is to improve the patient's health and well-being by guiding health providers who are taking care of patients recovering from stroke along management pathways that are supported by evidence. The expected outcomes of successful implementation of this guideline is include:

- Assessing the patient's condition and determining, in collaboration with the patient, family, and caregivers, the optimal treatment and rehabilitation method
- Optimizing each individual's health outcomes and improve quality of life
- Minimizing preventable complications and morbidity
- Emphasizing the use of patient-centered care (PCC)

II. Background

A. Stroke Epidemiology and Impact in the General Population

Stroke is a condition that affects nearly 800,000 individuals annually in the United States (U.S.). Approximately 75% of these are first-time strokes, while the remaining 25% are recurrent strokes.[2] While often viewed as a disease of the elderly, stroke can occur at any age. Approximately 10% of all strokes occur in individuals aged 18-50.[2] Currently, stroke is the fifth most common cause of death in the U.S. and a leading cause of long-term disability.[2] While younger patients may be more physically capable of recovering from stroke than older patients, poor functional outcomes are commonplace. Approximately 44% of individuals aged 18-50 experience moderate disability after stroke, requiring at least some assistance with activities of daily living (ADL) and/or mobility (modified Rankin Scale score >2).[3] Even in patients with so-called "mild" or "improving" stroke, a recent study found that only 28% were discharged to home, 16% required admission to acute rehabilitation facilities, and 11% were admitted to skilled nursing facilities.[4]

Disability from stroke can present in a myriad of ways depending on the affected area(s) of the central nervous system. The most common presentations include focal weakness and sensory disturbances, speech and swallowing impairments, vision loss or neglect, cognitive problems with inattention or memory loss, as well as emotional difficulties with mood or anxiety. The early management of stroke in the form of medical, surgical, or rehabilitation interventions is essential to help reduce disability severity, decrease the risk of further complications, and lessen potentially life-long deficits.[5,6]

Unfortunately, in approximately 30% of ischemic stroke cases, the cause of the stroke remains unknown.[7] Ischemic strokes with no obvious cause are labelled as "cryptogenic" strokes and are more common in younger patients than in the elderly.[8] This is largely due to the lack of comorbidities associated with stroke risk more commonly seen in the older population (e.g., uncontrolled hypertension, atrial dysrhythmias, cerebrovascular disease). Research is ongoing to try to identify patients with the highest risk of cryptogenic stroke recurrence; however, risk factors are difficult to quantify given the lack of a clearly identifiable primary etiology. This is of particular importance in the active duty military population, in which both residual disability and the likelihood of recurrence can directly impact duty restrictions, deployability, and/or disability ratings.

B. Stroke Rehabilitation in the Department of Veterans Affairs Population

The Veterans Health Administration (VHA) estimates that 15,000 Veterans are hospitalized for stroke-related diagnoses each year. In 2017, just over 8,000 unique patients with stroke were admitted to the VA. The number of new patients with stroke at the VA was 8,125. Approximately 15-30% of survivors of stroke are left with severe disability, while 40% experience functional impairments.[9] In 2019, there are 33 Primary Stroke Centers, 32 limited hours Stroke Centers, 43 supporting stroke facilities, and over 45 acute rehabilitation units (ARU) in the VA. Comprehensive outpatient neurorehabilitation programs are also located throughout the VA, but many Veterans who are admitted to a VA medical center after surviving a stroke will find themselves in a facility that does not offer comprehensive, integrated, and coordinated care. Additionally, Veterans may receive acute treatment for stroke in facilities outside the VHA and later present for follow-up care at their local VA facility.

C. Stroke Rehabilitation in the Department of Defense Population

While less common than in the VA population, stroke does occur in active duty, retiree, and other beneficiary populations served by the DoD. Comprehensive acute management of stroke is accomplished at military treatment facilities (MTFs) unless the patient meets criteria for transfer to the nearest certified stroke center. At this time, the DoD has no certified stroke centers. The DoD has limited inpatient rehabilitation beds and often partners with VA or civilian network providers when these services are needed. At some of the larger MTFs, comprehensive outpatient stroke rehabilitation services may be available. Some military medical facilities may offer these services through their traumatic brain injury (TBI) rehabilitation clinics. Survivors of stroke who live outside of military medical center catchment areas are able to access community stroke resources through the TRICARE network.

III. About this Clinical Practice Guideline

This guideline is aimed at improving the management of stroke rehabilitation in the VA and DoD. As with other CPGs, however, challenges remain, including evidence gaps, the need to develop effective strategies for guideline implementation and the need to evaluate the effect of guideline adherence on clinical outcomes. This guideline is intended for use by VA and DoD healthcare practitioners including physicians, nurses, nurse practitioners, physician assistants, psychologists and other mental health providers, social workers, pharmacists, physical therapists, occupational therapists, case managers, speech language pathologists, vision therapists, vocational rehabilitation specialists, recreation therapists, and others involved in the care of Service Members or Veterans undergoing stroke rehabilitation.

As elaborated in the qualifying statement on page one, this CPG is not intended to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns evolve. This CPG is based on information available on or before July 5, 2018 (see Appendix D for additional information on the evidence review methodology; note, discussion of topics related to Key Questions 3 and 9 [see Table D-2] is based on information available on or before December 18, 2018 [see General Criteria for Inclusion in Systematic Review]) and is intended to provide a general guide to best leading evidence-based practices. While this guideline can assist care providers, the use of a CPG must always be considered as a recommendation, within the context of a provider's clinical judgment and patient values and preferences, for the care of an individual patient. Additional materials including an abbreviated provider summary, patient summary, and pocket card are available at the following link: https://www.healthquality.va.gov/guidelines/Rehab/stroke/.

A. Methods

The current document is an update to the 2010 Stroke Rehabilitation CPG. The methodology used in developing the 2019 CPG follows the *Guideline for Guidelines*, an internal document of the VA and DoD EBPWG that was updated in January 2019.[10] The *Guideline for Guidelines* can be downloaded from http://www.healthquality.va.gov/policy/index.asp. This document provides information regarding the process of developing guidelines, including the identification and assembly of the Guideline Champions (Champions) and other subject matter experts from within the VA and DoD, known as the Work Group and, ultimately, the development and submission of a new or updated Stroke Rehabilitation CPG. Appendix D provides a detailed description of each of the tasks carried out as part of the guideline development process.

The Champions and Work Group for this CPG (see Guideline Work Group) were tasked with developing a guideline, including evidence-based clinical practice recommendations, to be used by providers within the VA and DoD healthcare systems as well as by those providers within the community who treat individuals within the VA and DoD. Specifically, the Champions and Work Group members for this guideline were responsible for identifying the key questions (KQs) of the most clinical relevance, importance, and interest for the management of stroke rehabilitation. The Champions and the Work Group also provided direction on inclusion and exclusion criteria for the evidence review and assessed the level and quality of the evidence. The amount of new scientific evidence that had accumulated since

the previous version of the CPG was also taken into consideration in the identification of the KQs. In addition, the Champions assisted in:

- Identifying appropriate disciplines of individuals to be included as part of the Work Group
- Directing and coordinating the Work Group
- Participating throughout the guideline development and review processes

The VA Office of Quality, Safety and Value, in collaboration with the Office of Evidence Based Practice, U.S. Army Medical Command, the proponent for CPGs for the DoD, identified four clinical leaders, Blessen C. Eapen, MD and Johanna Tran, MD from the VA and Amy O. Bowles, MD and Lt Col Andrew W. Bursaw, DO from the DoD, as Champions for the 2019 CPG.

The Lewin Team, including The Lewin Group, Duty First Consulting, ECRI Institute, and Sigma Health Consulting, LLC, was contracted by the VA and DoD to support the development of this CPG and conduct the evidence review. In February 2018, the contracting officer's representative (COR), leaders from the VA Office of Quality, Safety and Value and the DoD Office of Evidence Based Practice, and the Champions kicked off the guideline development effort. During this call, participants discussed the scope of the guideline initiative, the roles and responsibilities of the Champions, the project timeline, and the approach for developing and prioritizing specific research questions on which to base a systematic review (SR) about the management of patients rehabilitating from stroke. The group also identified a list of clinical specialties and areas of expertise that are important and relevant to the management of stroke rehabilitation, from which Work Group members were recruited. The specialties and clinical areas of interest included: primary care, neurology, physical therapy, occupational therapy, rehabilitation psychology, neuropsychology, psychiatry, nursing, social work, physical and rehabilitation medicine, vocational rehabilitation, speech language pathology, vision therapy, clinical pharmacology, internal medicine, case management, medical management, public health, and evidence-based medicine.

The guideline development process for the 2019 CPG update consisted of the following steps:

1. Formulating and prioritizing KQs
2. Convening a patient focus group
3. Conducting the systematic evidence review
4. Convening a face-to-face meeting with the CPG Champions and Work Group members to review the evidence, craft evidence-based recommendations, and develop an algorithm
5. Drafting and submitting a final CPG on the management of stroke rehabilitation to the VA/DoD EBPWG

a. Grading Recommendations

The Champions and Work Group used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system to assess the quality of the evidence base and assign a strength for each

recommendation.[25] The GRADE system uses the following four domains to assess the strength of each recommendation:[25]

- Balance of desirable and undesirable outcomes
- Confidence in the quality of the evidence
- Values and preferences
- Other implications, as appropriate, e.g.,:
    - Resource use
    - Equity
    - Acceptability
    - Feasibility
    - Subgroup considerations

Using these four domains, the Work Group determined the relative strength of each recommendation ("Strong" or "Weak"). A "Strong" recommendation generally indicates a high confidence in the quality of the available scientific evidence, a clear difference in magnitude between the benefits and harms of an intervention, similar values and preferences, and understood influence of other implications (e.g., resource use, feasibility). If the Work Group has less confidence after the assessment across these domains and believes that additional evidence may change the recommendation, it generally assigns a "Weak" recommendation. It is important to note that the GRADE terminology (i.e., "Strong" versus "Weak") used to indicate the assessment across the four domains should not be confused with the clinical importance of the recommendation. A weak recommendation may still be important to the clinical care of a patient rehabilitating from a stroke.

Occasionally, instances may occur when the Work Group feels there is insufficient evidence to make a recommendation for or against a particular therapy or preventive measure. These can occur when there is an absence of studies on a particular topic that met evidence review inclusion criteria, when studies included in the evidence review report conflicting results, or when studies included in the evidence review report inconclusive results regarding the desirable and undesirable outcomes.

Using these elements, the grade of each recommendation is presented as part of a continuum:

- Strong for (or "We recommend offering this option …")
- Weak for (or "We suggest offering this option …")
- No recommendation for or against (or "There is insufficient evidence…")
- Weak against (or "We suggest not offering this option …")
- Strong against (or "We recommend against offering this option …")

The grade of each recommendation made in the 2019 CPG can be found in the section on Recommendations. Additional information regarding the use of the GRADE system can be found in Appendix D.

b. Reconciling 2010 Clinical Practice Guideline Recommendations

Evidence-based CPGs should be current, which typically requires revisions of previous guidelines based on new evidence, or as scheduled and subject to time-based expirations.[11] For example, the U.S. Preventive Services Task Force (USPSTF) has a process for refining or otherwise updating its recommendations pertaining to preventive services.[12]

The Stroke Rehabilitation Guideline Work Group focused largely on developing new and updated recommendations based on the evidence review conducted for the priority areas addressed by the KQs. The Work Group also considered the current applicability of the recommendations included in the 2010 Stroke Rehabilitation CPG that were not addressed by the KQs in light of evolving practice in today's environment. Accordingly, some recommendations found in the 2010 Stroke Rehabilitation CPG do not appear in this updated CPG.

A set of recommendation categories was adapted from those used by the National Institute for Health and Care Excellence (NICE).[13,14] These categories, along with their corresponding definitions, were used to account for the various ways in which older recommendations could have been updated. In brief, the categories took into account whether or not the evidence that related to a recommendation was systematically reviewed, the degree to which the recommendation was modified, and the degree to which a recommendation is relevant in the current care environment and within the scope of the CPG. Additional information regarding these categories and their definitions can be found in Recommendation Categorization. The categories for the recommendations included in the 2019 version of the guideline can be found in the section on Recommendations. The categories for the recommendations carried forward from the 2010 Stroke Rehabilitation CPG are noted in Appendix F.

The CPG Work Group recognized the need to accommodate the transition in evidence rating systems from the 2010 Stroke Rehabilitation CPG to the current CPG. In order to report the strength of all recommendations using a consistent format (i.e., the GRADE system), the CPG Work Group converted the USPSTF strengths of the recommendation accompanying the carryover recommendations from the 2010 guideline to the GRADE system. As such, the CPG Work Group considered the strength of the evidence cited for each recommendation in the 2010 Stroke Rehabilitation CPG as well as the harms and benefits of the intervention, values and preferences, and other implications of the intervention, where possible. The CPG Work Group referred to the available evidence as summarized in the body of the 2010 Stroke Rehabilitation CPG and did not systematically re-assess the evidence. In some instances, relevant peer-reviewed literature published since the 2010 Stroke Rehabilitation CPG was considered along with the original evidence base for the specific recommendation. Instances where such newer literature was considered when converting the strength of the recommendation from the USPSTF to the GRADE system are referenced in the discussion that follows the corresponding recommendation, as well as in Appendix E.

The CPG Work Group recognizes that, while there are sometimes practical reasons for incorporating findings from a previous SR, previous recommendations,[15] or recent peer-reviewed publications into an updated CPG, doing so does not involve an original, comprehensive SR and, therefore, may introduce bias.

c. Peer Review Process

The CPG was developed through an iterative process in which the Work Group produced multiple drafts of the CPG. The process for developing the initial draft is described in more detail in Drafting and Submitting the Final Clinical Practice Guideline.

Once the Champions and Work Group members agreed upon a near-final draft of the guideline, the draft was sent out for a 14 business day peer review and comment period. The peer reviewers comprised individuals working within the VA and DoD healthcare systems as well as experts from relevant outside organizations designated by the Work Group members. Organizations designated by the Work Group to participate in the peer review and who provided feedback include the following:

- American Physical Therapy Association
- Association of Academic Physiatrists
- Case Management Society of America

The VA and DoD Leadership reached out to both the internal and external peer reviewers to solicit their feedback on the CPG. All feedback from the peer reviewers was discussed and considered by the Work Group. Modifications made throughout the CPG development process were made in accordance with the evidence.

B. Summary of Patient Focus Group Methods and Findings

When forming guideline recommendations, consideration should be given to the values of those most affected by the recommendations, i.e., patients. Patients bring perspectives, values, and preferences into their healthcare experience that can vary from those of clinicians. These differences can affect decision-making in various situations, and should thus be highlighted and made explicit due to their potential to influence a recommendation's implementation.[16,17] Focus groups can be used as an efficient method to explore ideas and perspectives of a group of individuals and collect qualitative data on a thoughtfully predetermined set of questions.

Therefore, as part of the effort to update this CPG, VA and DoD Leadership, along with the Stroke Rehabilitation CPG Work Group, held a patient focus group on May 9, 2018 at the Audie L. Murphy Memorial VA Hospital in San Antonio, TX. The aim of the focus group was to further understand and incorporate the perspective of patients who had experienced a stroke and are covered and/or receiving their care through the VA and/or DoD healthcare systems, as these patients are most affected by the recommendations put forth in the CPG. The focus group delved into the patients' perspectives on a set of topics related to their stroke rehabilitation management, including their priorities, challenges they have experienced, and the information they received regarding their care, as well as the impacts of their care on their lives.

It is important to note the focus group comprised a convenience sample and the Work Group recognizes the lack of generalizability and other limitations inherent in the small sample size. Less than 10 people in total were included in the focus group to be consistent with the requirements of the Federal Paperwork Reduction Act, 1980. The Work Group acknowledges that the sample included in the focus group is not representative of all patients within the VA and DoD healthcare systems. Further, time limitations for the

focus group prevented exhaustive exploration of all topics related to stroke rehabilitation management in the VA and DoD and the patients' broader experiences with their care. Thus, the Work Group made decisions regarding the priority of topics to discuss at the focus group. These limitations, as well as others, were considered during guideline development as the information collected from the focus group was being used. The Champions and VA and DoD Leadership managed recruitment for participation in the focus group, with assistance from coordinators at the facility at which the focus group took place.

The following concepts are ideas and suggestions about aspects of stroke rehabilitation that are important to patients who have experienced a stroke, which emerged as recurring themes during the discussions (Table 1). These concepts were important parts of the participants' care and added to the Work Group's understanding of patient values and perspectives. Additional details regarding the patient focus group methods and findings can be found in Appendix C.

Table 1. Stroke Rehabilitation CPG Focus Group Concepts

Stroke Rehabilitation CPG Patient Focus Group Concepts	
A.	Using shared decision making and a whole-health approach, discuss treatment options and develop a treatment plan tailored to individual patients, taking into account their comorbidities, patient-specific goals, values, and preferences.
B.	Guide patients on self-management during stroke rehabilitation as well as on use of other resources that are available to assist them with their ADLs.
C.	Assist patients with navigating the complex health system.
D.	Provide patients and family, and their caregivers with education and health information to improve understanding of stroke, common comorbidities, and stroke rehabilitation management. Materials need to be individualized to preferred learning methods (e.g., online videos, websites, newsletters).
E.	Provide coordinated care and an interdisciplinary team approach to care for patients with stroke. VA, DoD, and private providers should coordinate treatment plans between primary care, medical specialists, and community rehabilitation providers. Case managers are needed to assist in communication, continuity and coordination of an integrated, interdisciplinary treatment plan for patients, especially those with comorbidities.
F.	Provide comprehensive care and rehabilitation starting early in the post-acute phase.
G.	Create a support system for patients with stroke and their caregivers. Suggested actions include monthly provider-facilitated meetings either in-person or online groups, other support groups, and stroke education classes to enhance involvement and support among patients with stroke.
H.	Screen for, identify, and treat post-stroke depression.
I.	Provide home care and community support resources to optimize quality of life and independence.

Abbreviations: ADLs: activities of daily living; DoD: Department of Defense; VA: Department of Veterans Affairs

C. Conflicts of Interest

At the start of this guideline development process and at other key points throughout, the project team was required to submit disclosure statements to reveal any areas of potential conflict of interest (COI) in the past 24 months. Verbal affirmations of no COI were used as necessary during meetings throughout the guideline development process. The project team was also subject to random web-based surveillance (e.g., Centers for Medicare and Medicaid Services open payments or ProPublica).

If a project team member reported a COI (actual or potential), then it was reported to the Office of Evidence Based Practice. It was also discussed with the Stroke Rehabilitation CPG Champions in tandem

with their review of the evidence and development of recommendations. The Office of Evidence Based Practice and the Stroke Rehabilitation CPG Champions determined whether or not action, such as restricting participation and/or voting on sections related to the conflict or removal from the Work Group, was necessary. If it was deemed necessary, action to mitigate the COI was taken by the Champions and VA and DoD Program Leadership based on the level and extent of involvement. No conflicts of interest were identified for the Stroke Rehabilitation CPG Work Group members or Champions. Disclosure forms are on file with the VA Office of Quality, Safety and Value and available upon request.

D. Scope of this Clinical Practice Guideline

This CPG is designed to assist providers in managing or co-managing patients undergoing stroke rehabilitation. The acute medical management of stroke is not included in the scope of this guideline. The patient population of interest for this CPG is adult patients who have experienced a stroke and are eligible for care in the VA and DoD healthcare delivery systems. It includes Veterans as well as deployed and non-deployed active duty Service, Guard, and Reserve Members and their dependents.

Guideline recommendations are intended to be patient centered. Thus, stroke rehabilitation should take into account a patient's needs and preferences. Good communication between healthcare professionals and the patient is essential and should be supported by evidence-based information tailored to the patient's needs. Use of an empathetic and non-judgmental approach facilitates discussions sensitive to gender, culture, ethnicity, and other differences. The information that patients are given about treatment and care should be culturally appropriate and also available to people with limited literacy skills. It should also be accessible to people with additional needs such as physical, sensory, or learning disabilities. Family involvement should be considered, if appropriate.

E. Highlighted Features of this Clinical Practice Guideline

The 2019 edition of the VA/DoD Stroke Rehabilitation CPG is the third update to the original CPG. It provides practice recommendations for rehabilitation of stroke as well as guidance for specialty referral. A particular strength of this CPG is the interdisciplinary stakeholder involvement from its inception, ensuring representation from the broad spectrum of clinicians engaged in the treatment and management of stroke rehabilitation with and without co-occurring conditions.

The framework for recommendations in this CPG considered factors beyond the strength of the evidence, including balancing desired outcomes with potential harms of the intervention, equity of resource availability, the potential for variation in patient values and preferences, and other considerations (e.g., resource use, subgroup considerations) as appropriate. Applicability of the evidence to VA/DoD populations was also taken into consideration. An algorithm accompanies the guideline to provide an overview of the recommendations in the context of the flow of patient care and to assist with training providers (see the section Algorithm). The algorithm may be used to help facilitate translation of guideline recommendations into effective practice.

F. Patient-centered Care

VA/DoD CPGs encourage clinicians to use a PCC approach, meaning treatment that is individualized based on patient needs, characteristics, and preferences. Regardless of setting, all patients in the healthcare system should be able to access evidence-based care appropriate to that patient. When properly

executed, PCC may decrease patient anxiety, increase trust in clinicians, and improve treatment adherence.[18-20] Improved patient-clinician communication and a PCC approach conveys openness and supports disclosure of current and future concerns.

As part of the PCC approach, it is important for providers to review the outcomes of previous healthcare experiences with the patients who have experienced a stroke. Providers explore concerns the patient has or barriers to high quality care he or she might experience. Then, providers address post-stroke concerns related to social, occupational (including return-to-duty), and family functioning. As part of PCC, providers educate the patient on the actions that need to be taken and any decisions that need to be made and involve the patient in decision making regarding management of stroke rehabilitation.

G. Shared Decision Making

Throughout this VA/DoD CPG, the authors encourage clinicians to focus on shared decision making. The shared decision making model was introduced in *Crossing the Quality Chasm,* an Institute of Medicine (IOM) (now called the National Academy of Medicine [NAM]) report, in 2001.[21] It is readily apparent that patients, together with their clinicians, make decisions regarding their plan of care and management options. Patients in stroke rehabilitation require sufficient information and time to be able to make informed decisions. Clinicians must be adept at presenting information to their patients regarding individual treatments, expected outcomes, and levels and/or locations of care. Clinicians are encouraged to use shared decision making to individualize treatment goals and plans based on patient capabilities, needs, goals, and preferences.

H. Co-occurring Conditions

Co-occurring physical and mental health conditions are important to recognize because they can modify the management of stroke rehabilitation, patient or provider treatment priorities, clinical decisions, and the provider who will manage stroke and ongoing healthcare. Providers should expect that many Veterans, Service Members, and their family will have one or more co-occurring health conditions. Because of the nature of stroke rehabilitation, which sometimes takes place in parallel with ongoing care for co-occurring conditions, it is generally best to manage stroke rehabilitation in collaboration with the care for other health conditions that are being treated in primary or specialty care. As such, early identification of an interdisciplinary team, which may include providers external to the rehabilitation team, may improve care coordination.

I. Implementation

This CPG and algorithm are designed to be adapted by individual healthcare providers with consideration of local needs and resources. The algorithm serves as a tool to prompt providers to consider key decision points in the course of an episode of care.

Although this CPG represents the recommended practice on the date of its publication, medical practice is evolving, and this evolution requires continuous updating based on published information. New technology and more research will improve patient care in the future. The CPG can assist in identifying priority areas for research and informing optimal allocation of resources. Future studies examining the results of CPG implementation may lead to the development of new evidence particularly relevant to clinical practice.

IV. Guideline Work Group

Organization	Name*
Department of Veterans Affairs	**Blessen C. Eapen, MD (Champion)**
	Johanna E. Tran, MD (Champion)
	Lee Ann Brumble, BSW
	Rose Collins, PhD
	Lesli Culver, LCSW, CBIS, BCD, C-ASWCM, VHA-CM
	Kimberly Eichhorn, MS, CCC-SLP, ATP
	Julie Gliesing, MS, CCC-SLP, ATP
	Paul Koons, MS, OMS, CLVT, CBIS
	Joseph Krebs, MD
	David Lawler, OTR/L, CDRS
	Joanne Nguyen, PharmD, BCACP, NCTTP
	Lisa Perla, MSN, FNP, CNRN, CRRN
	Michelle Peterson, PT, DPT, NCS
	Bruno Subbarao, DO
Department of Defense	**Amy O. Bowles, MD (Champion)**
	Lt Col Andrew W. Bursaw, DO (Champion)
	Rebecca Briar, RPh, CACP
	Russell Carroll, PsyD
	MAJ Meghan J. McHenry, MD
	CDR Peter G. Seguin, MD, MPH, MA
	Christina Smith, RN, BSN
Office of Quality, Safety and Value Veterans Health Administration	M. Eric Rodgers, PhD, FNP-BC
	James Sall, PhD, FNP-BC
	Rene Sutton, BS, HCA
Office of Evidence Based Practice U.S. Army Medical Command	Corinne K. B. Devlin, MSN, RN, FNP-BC
	Lisa Jones, BSN, RN, MHA, CPHQ
	Christina Smith, RN, BSN

Organization	Name*
The Lewin Group	Clifford Goodman, PhD
	Christine Jones, MS, MPH, PMP
	Erika Beam, MS
	Ruben Ganesh, BS
	Nicolas Stettler-Davis, MD, MSCE
ECRI Institute	Kristen D'Anci, PhD
	Amy Tsou, MD, MSc
	Nancy Sullivan, BA
	Jeff Oristaglio, PhD
	Constance Martin, BA
	Linnea Hermanson, MA
	Evelyn Kuserk, MA, MLS
Sigma Health Consulting, LLC	Frances Murphy, MD, MPH
DutyFirst Consulting	Rachel Piccolino, BA
	Megan McGovern, BA

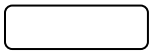
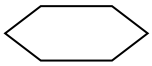
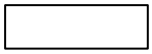
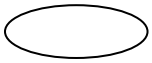
*Additional contributor contact information is available in Appendix G.

V. Algorithm

This CPG follows an algorithm, which is designed to facilitate understanding of the clinical pathway and decision-making process used in the management of stroke rehabilitation. The use of the algorithm format as a way to represent patient management was chosen based on the understanding that such a format may promote more efficient diagnostic and therapeutic decision-making and has the potential to change patterns of resource use. Although the Work Group recognizes that not all clinical practices are linear, the simplified linear approach depicted through the algorithm and its format allows the provider to assess the critical information needed at the major decision points in the clinical process. It includes:

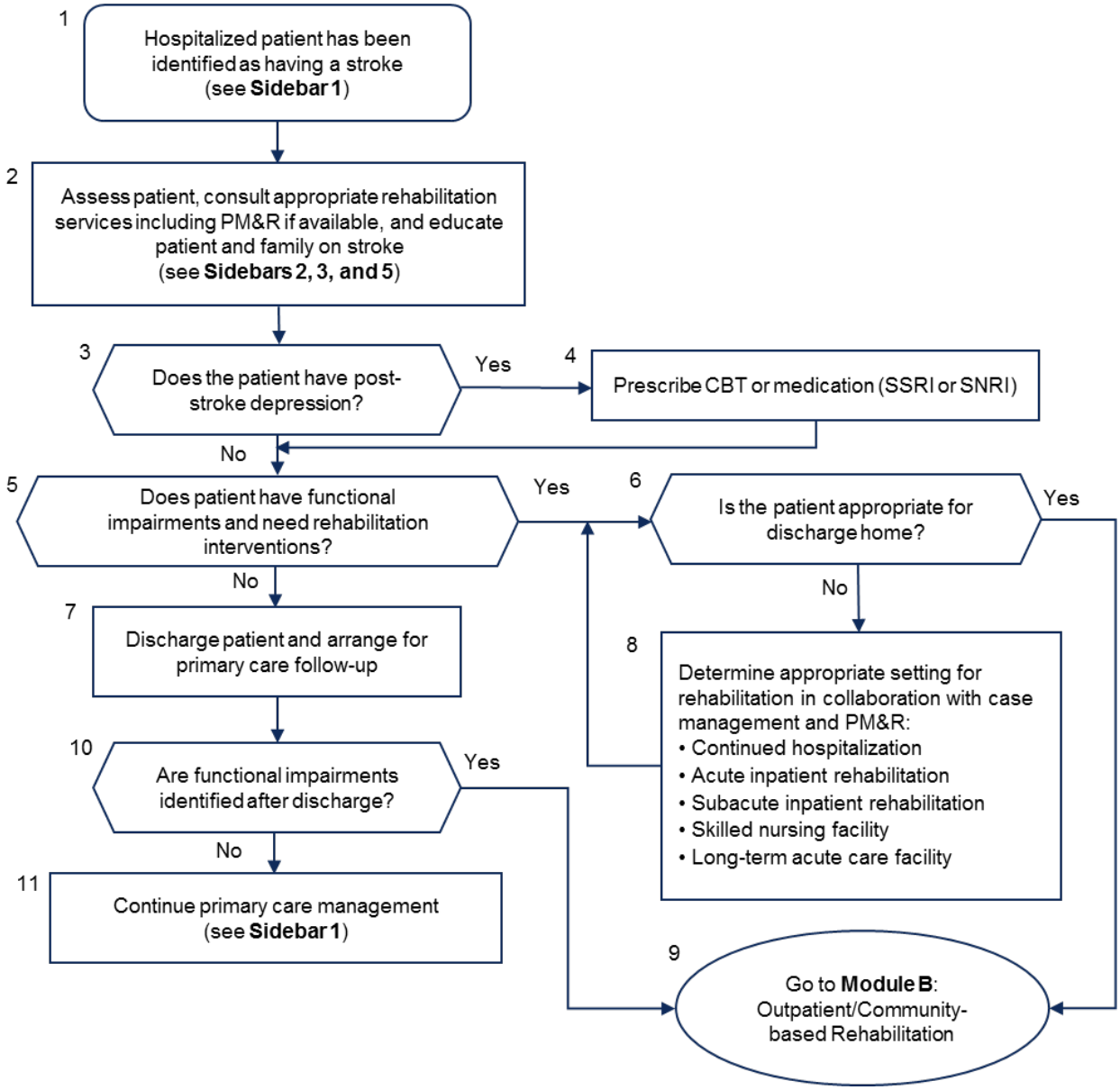
- An ordered sequence of steps of care
- Recommended observations and examinations
- Decisions to be considered
- Actions to be taken

For each guideline, there is a corresponding clinical algorithm that is depicted by a step-by-step decision tree. Standardized symbols are used to display each step in the algorithm, and arrows connect the numbered boxes indicating the order in which the steps should be followed.[22]

Shape	Description
	Rounded rectangles represent a clinical state or condition
	Hexagons represent a decision point in the guideline, formulated as a question that can be answered Yes or No
	Rectangles represent an action in the process of care
	Ovals represent a link to another section within the guideline.

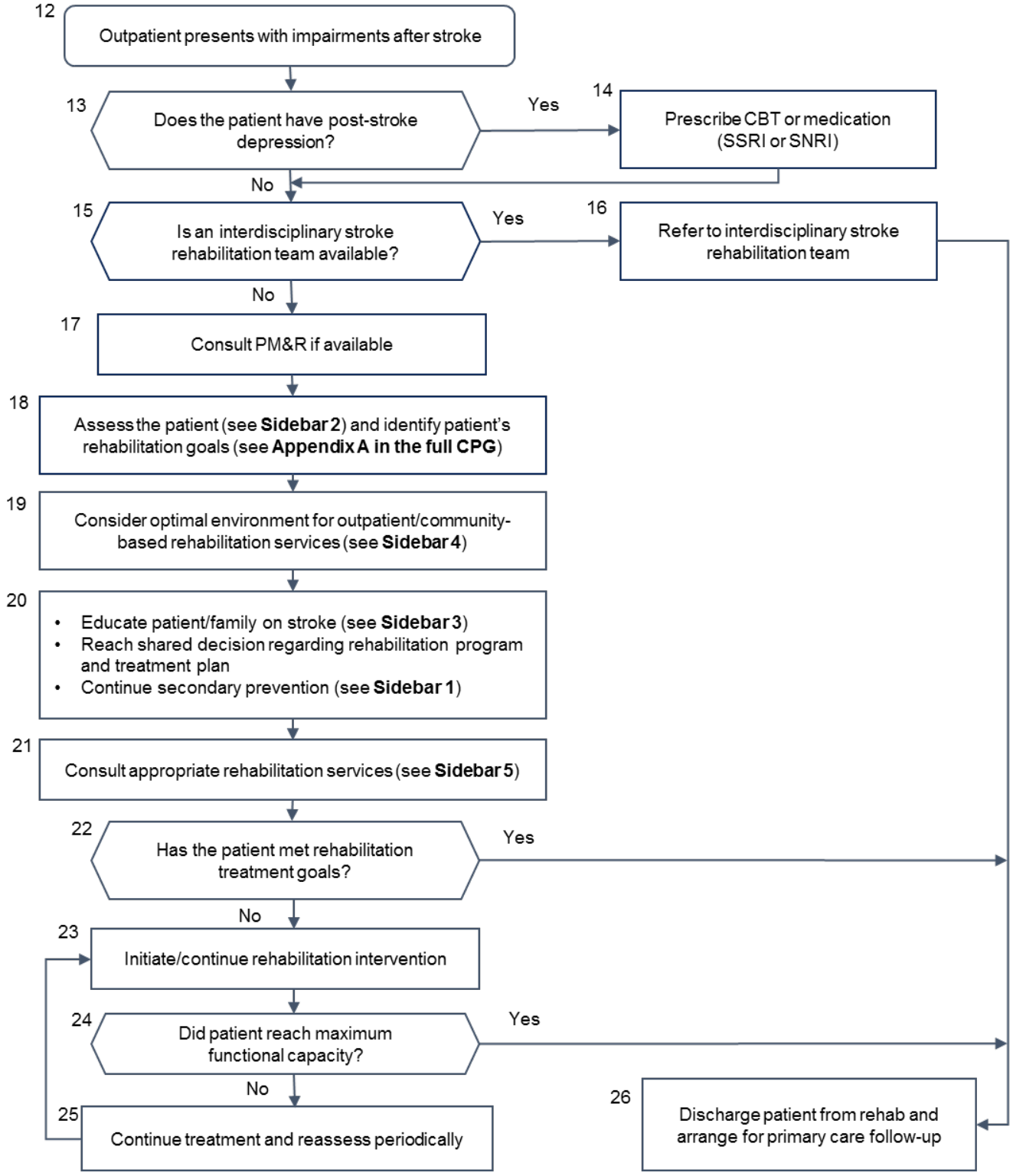
Appendix I contains alternative text descriptions of Module A and Module B.

A. Module A: Rehabilitation Disposition of the Inpatient with Stroke



Abbreviations: CBT: cognitive behavioral therapy; PM&R: physical medicine and rehabilitation; SNRI: serotonin–norepinephrine reuptake inhibitor; SSRI: selective serotonin reuptake inhibitor

B. Module B: Outpatient/Community-Based Rehabilitation



Abbreviations: CBT: cognitive behavioral therapy; CPG: clinical practice guideline; PM&R: physical medicine and rehabilitation; SNRI: serotonin–norepinephrine reuptake inhibitor; SSRI: selective serotonin reuptake inhibitor

Sidebar 1: Essential Guidelines for the Medical Management of Stroke

- AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke [5]
- AHA/ASA Guidelines for the Management of Spontaneous Intracerebral Hemorrhage [6]
- AHA/ASA Guidelines for the Prevention of Stroke in Patients with Stroke and Transient Ischemic Attack [23]

Abbreviations: AHA: American Heart Association; ASA: American Stroke Association

Sidebar 2: Assessment of Impairments and Disabilities

- Assessment of impairments
  - Auditory/hearing
  - Bowel and bladder function
  - Cognition
  - Communication
  - Emotion and behavior
  - Inattention/neglect
  - Motor/mobility
  - Swallowing and nutrition
  - Tactile/touch
  - Vision function and formal visual field
- Assessment of barriers to participation in therapy
  - Cognitive impairment
  - Fatigue and sleep disorders
  - Medical conditions
  - Pain
  - Psychological and psychosocial factors
- Assessment of activity and function
  - ADLs (e.g., feeding, dressing, grooming), IADLs (e.g., finances, shopping)
  - Driving
  - Meaningful roles (e.g., parent, spouse)
  - Return to work or school
  - Sexual function and intimacy
- Assessment of support system
  - Family, caregivers, community

Abbreviations: ADLs: activities of daily living; IADLs: instrumental activities of daily living

Sidebar 3: Stroke Education Topics

- When to seek emergency care
- Etiology/warning signs and symptoms of stroke
- Risk factors/medical management (including education on new medications):
  - Blood pressure
  - Blood sugar
  - Blood thinners
  - Body weight
  - Cholesterol
  - Other cardiac disease
  - Smoking cessation
- Nutrition
- Physical activity and falls prevention
- Continuum of care options/follow-up after discharge
- Inpatient rehabilitation
- Outpatient rehabilitation
- Therapy at home
- Primary medicine

Sidebar 4: Considerations for Outpatient / Community-based Rehabilitation Services

- Current functional status and endurance level
- Family/caregiver support
- Home assessment for safety
- Motivation and preferences
- Necessary equipment
- Resources, availability, and eligibility
- Transportation

Sidebar 5: Resources for Management of Post-Stroke Impairments/Needs

Impairment/Need	Consultants/Referrals
▪ Pain ▪ Prevention of post-stroke complications ▪ Rehabilitation management, oversight, and direction ▪ Sexual function and intimacy ▪ Spasticity	▪ PM&R
▪ Balance disorders and dizziness ▪ Durable medical equipment recommendations ▪ Motor/mobility problems ▪ Pain ▪ Sexual function and intimacy ▪ Spasticity ▪ Strength	▪ Physical therapy

Sidebar 5: Resources for Management of Post-Stroke Impairments/Needs	
Impairment/Need	**Consultants/Referrals**
▪ Cognition ▪ Driving ▪ Durable medical equipment recommendations ▪ Self-management skills, ADLs, IADLs ▪ Sexual function and intimacy ▪ Spasticity ▪ Vision/vision perception	▪ Occupational therapy
▪ Cognition ▪ Communication ▪ Swallowing and nutrition	▪ Speech-language pathology
▪ Community resources ▪ Emotion and behavior ▪ Family/caregiver support ▪ Financial resources	▪ Case management (social work and/or nursing)
▪ Return to work or school	▪ Vocational rehabilitation
▪ Healthy eating and nutritional needs	▪ Dietetics
▪ Adjustment and coping ▪ Cognition ▪ Emotion and behavior ▪ Family/caregiver support ▪ Sexual function and intimacy	▪ Mental and behavioral health
▪ Adaptive sports ▪ Community re-entry ▪ Leisure/recreation participation	▪ Recreation therapy
▪ Functional eye exam ▪ Non-operative strabismus management ▪ Visual field cut	▪ Optometry/visual rehabilitation
▪ Eye health ▪ Eye surgeries ▪ Strabismus assessment and procedures	▪ Ophthalmology
▪ Bowel and bladder function ▪ Medication ▪ Patient and family education ▪ Skin care	▪ Nursing

Abbreviations: ADLs: activities of daily living; IADLs: instrumental activities of daily living; PM&R: physical medicine and rehabilitation

VI. Recommendations

Topic	Sub-topic	#	Recommendation	Strength*	Category†
Approach and Timing		1.	We recommend a team-based approach in an organized inpatient unit that encompasses comprehensive rehabilitation in order to improve likelihood of discharge to home after acute stroke.	Strong for	Reviewed, Amended
		2.	We recommend that rehabilitation therapy should start as soon as medical stability is reached.	Strong for	Not reviewed, Amended
		3.	There is insufficient evidence to recommend for or against implementing very early mobilization (within 24-48 hours) to improve functional outcomes.	Neither for nor against	Reviewed, New-added
		4.	There is insufficient evidence to recommend for or against early supported discharge.	Neither for nor against	Reviewed, Amended
Motor Therapy	*Upper and Lower Limbs Rehabilitation*	5.	We recommend task-specific practice (also known as task-oriented practice or repetitive task practice) for improving upper and lower extremity motor function, gait, posture, and activities of daily living.	Strong for	Reviewed, New-replaced
		6.	We recommend cardiovascular exercise to increase maximum walking speed after stroke.	Strong for	Reviewed, New-replaced
		7.	We suggest offering body-weight support treadmill training as an adjunct to gait training in the non-ambulatory patient.	Weak for	Reviewed, Amended
		8.	We suggest offering rhythmic auditory cueing as a modality to include in multimodal interventions to improve walking speed.	Weak for	Reviewed, Amended
		9.	We suggest offering Constraint-Induced Movement Therapy or modified Constraint-Induced Movement Therapy for individuals with at least 10 degrees of active extension in two fingers, the thumb, and the wrist.	Weak for	Reviewed, Amended
		10.	There is insufficient evidence to recommend for or against mirror therapy for improvements in limb function.	Neither for nor against	Reviewed, Amended
	Technology-Assisted Physical Rehabilitation	11.	We suggest offering functional electrical stimulation, neuromuscular electrical stimulation, or transcutaneous electrical nerve stimulation as an adjunctive treatment to improve upper and lower extremity motor function.	Weak for	Reviewed, New-replaced
		12.	We suggest offering functional electrical stimulation to manage shoulder subluxation.	Weak for	Not Reviewed, Amended
		13.	For patients with foot drop, we suggest offering either functional electrical stimulation or traditional ankle foot orthoses to improve gait speed, as both are equally effective.	Weak for	Reviewed, New- added
		14.	We suggest offering robot-assisted movement therapy as an adjunct to conventional therapy in patients with deficits in upper limb function to improve motor skill.	Weak for	Reviewed, Amended
		15.	There is insufficient evidence to recommend for or against the use of robotic devices during gait training.	Neither for nor against	Reviewed, Amended

Topic	Sub-topic	#	Recommendation	Strength*	Category†
Motor Therapy (cont.)	*Technology-Assisted Physical Rehabilitation (cont.)*	16.	We suggest offering virtual reality to enhance gait recovery.	Weak for	Reviewed, Amended
		17.	There is insufficient evidence to recommend for or against the use of virtual reality for improving activities of daily living and non-gait motor function.	Neither for nor against	Reviewed, New-replaced
		18.	There is insufficient evidence to recommend for or against the use of transcranial direct current stimulation to improve activities of daily living.	Neither for nor against	Reviewed, New-added
		19.	There is insufficient evidence to recommend for or against repetitive transcranial magnetic stimulation to improve upper or lower extremity motor function.	Neither for nor against	Reviewed, New-added
	Pharmacological Treatment	20.	In patients with motor deficits, there is insufficient evidence to recommend for or against starting a selective serotonin reuptake inhibitor within 30 days of stroke to improve motor recovery and functional outcomes.	Neither for nor against	Reviewed, New-added
		21.	We recommend botulinum toxin for patients with focal spasticity that is painful, impairs function, reduces the ability to participate in rehabilitation, or compromises proper positioning or skin care.	Strong for	Not reviewed, Amended
		22.	We suggest offering intrathecal baclofen treatments for patients with severe chronic lower extremity spasticity that cannot be effectively managed by other interventions.	Weak for	Not reviewed, Amended
Dysphagia Therapy		23.	We suggest offering Shaker or chin tuck against resistance exercises in addition to conventional dysphagia therapy.	Weak for	Reviewed, New-replaced
		24.	We suggest offering expiratory muscle strength training for treatment of dysphagia in patients without a tracheostomy.	Weak for	Reviewed, New-replaced
		25.	There is insufficient evidence to recommend for or against tongue to palate resistance training for treatment of dysphagia.	Neither for nor against	Reviewed, New-replaced
		26.	There is insufficient evidence to recommend for or against neuromuscular electrical stimulation for treatment of dysphagia.	Neither for nor against	Reviewed, New-replaced
		27.	There is insufficient evidence to recommend for or against pharyngeal electrical stimulation for treatment of dysphagia.	Neither for nor against	Reviewed, New-replaced
		28.	In patients with dysphagia in the post-acute phase of stroke who require tube feeding, we suggest offering gastrostomy tube over nasogastric tube for maintenance of optimal nutrition.	Weak for	Reviewed, New-replaced
Cognitive, Speech, and Sensory Therapy	*Cognitive Therapy*	29.	There is insufficient evidence to recommend for or against the use of any specific cognitive rehabilitation methodology or pharmacotherapy to improve cognitive outcomes.	Neither for nor against	Reviewed, New-replaced
	Speech Therapy	30.	There is insufficient evidence to recommend for or against the use of intensive language therapy for aphasia.	Neither for nor against	Reviewed, New-added

Topic	Sub-topic	#	Recommendation	Strength*	Category†
Cognitive, Speech, and Sensory Therapy (cont.)	*Spatial Neglect Therapy*	31.	There is insufficient evidence to recommend for or against hemi-field eye patching in addition to traditional therapy for patients with unilateral spatial neglect following stroke.	Neither for nor against	Reviewed, New-replaced
		32.	Among patients with unilateral spatial neglect, there is insufficient evidence to recommend for or against the use of prisms.	Neither for nor against	Reviewed, New-replaced
	Visual Therapy	33.	Among patients with hemianopsia, there is insufficient evidence to recommend for or against the use of prisms or visual search training.	Neither for nor against	Reviewed, New-replaced
Mental Health Therapy	*Prevention of Post-Stroke Depression*	34.	For the prevention of post-stroke depression, there is insufficient evidence for or against the universal use of selective serotonin reuptake inhibitor or a serotonin norepinephrine reuptake inhibitor due to the risk of fractures.	Neither for nor against	Reviewed, New-added
	Treatment of Post-Stroke Depression	35.	We suggest offering a selective serotonin reuptake inhibitor or a serotonin norepinephrine reuptake inhibitor for treatment of post-stroke depression.	Weak for	Reviewed, New-replaced
		36.	We suggest offering cognitive behavioral therapy for treatment of post-stroke depression.	Weak for	Reviewed, New-added
		37.	There is insufficient evidence to recommend for or against treatment with a combination of pharmacotherapy (selective serotonin reuptake inhibitor/serotonin norepinephrine reuptake inhibitor) and psychotherapy (cognitive behavioral therapy) for treatment of post-stroke depression.	Neither for nor against	Reviewed, New-added
	Treatment of Post-Stroke Anxiety	38.	There is insufficient evidence to recommend for or against pharmacotherapy or psychotherapy for the treatment of post-stroke anxiety.	Neither for nor against	Reviewed, New-added
	Adjunctive Treatment	39.	We suggest offering exercise as adjunctive treatment for post-stroke depression or anxiety symptoms.	Weak for	Reviewed, New-replaced
		40.	We suggest offering mind-body exercise (e.g., tai chi, yoga, qigong) as adjunctive treatment for post-stroke depression or anxiety symptoms.	Weak for	Reviewed, New-added

Topic	Sub-topic	#	Recommendation	Strength*	Category†
Other Functions		41.	There is insufficient evidence to recommend for or against any specific assessments or interventions regarding return to work.	Neither for nor against	Reviewed, Amended
		42.	There is insufficient evidence to recommend for or against using any specific assessments or interventions to facilitate return to driving.	Neither for nor against	Reviewed, Amended

*For additional information, please refer to Grading Recommendations.

†For additional information, please refer to Recommendation Categorization and Appendix F.

A. Approach and Timing

Recommendation

1. We recommend a team-based approach in an organized inpatient unit that encompasses comprehensive rehabilitation in order to improve likelihood of discharge to home after acute stroke.
   (Strong for | Reviewed, Amended)

Discussion

Rehabilitation provided by a dedicated rehabilitation team in a physically distinct inpatient unit has been found to improve the likelihood of discharge to home in patients with a recent history of stroke. A 2013 Cochrane review of 28 studies with a total of 5,855 participants found that more patients who underwent organized stroke unit care, which included team-based rehabilitation, were living at home at one year post stroke when compared to patients who participated in less organized care post discharge.[24] This was independent of patient's age, gender, stroke type, and stroke severity. The authors concluded, "Stroke patients who receive organized inpatient care in a stroke unit are more likely to be alive, independent, and living at home one year after the stroke."[24] While many of the included studies took place outside of the U.S., there were several system and organizational components in common with medical care provided in the U.S. Specifically, on these organized inpatient stroke units, care was provided by a coordinated and expert multidisciplinary team which met regularly, involved caregivers in the process, and had regular education and training programs.[24] These teams included physicians, nurses, and therapists with expertise in stroke. The exact makeup of the team varied somewhat among studies, and the optimal composition of such a team is not yet known. Outcomes from these units were consistently superior to outcomes following care on a general medical unit in terms of death, dependency, and discharge to home. Several studies within the review evaluated mobile stroke teams, made up of a group of stroke rehabilitation experts who provided care to patients who were not co-located on a dedicated ward.[25-27] This organizational approach was found to be superior to routine care on a general medical ward, but the outcomes of death, dependency, and discharge to home were not as good as they were for a geographically distinct and co-located rehabilitation unit. Other studies compared outcomes from dedicated stroke rehabilitation units with those from mixed-diagnosis rehabilitation units, but there was insufficient evidence to draw conclusions about which approach was superior.[28,29] There was also insufficient data to comment on the use of a post-discharge, outpatient, community-based rehabilitation utilizing an interdisciplinary team versus usual care.[30]

This was a strong recommendation in the 2010 Stroke Rehabilitation CPG, based upon an earlier Cochrane review [31] and an SR from the Agency for Health Care Policy and Research (AHCPR) Guidelines for Stroke Rehabilitation.[32]

The Work Group initially identified quality of life as a critical outcome for this particular body of evidence. Ultimately, however, the Work Group elected not to draw conclusions regarding this outcome because of the limited number of studies evaluating quality of life (n=3) as well as concerns over the selected instruments used for evaluation. One such instrument was the Nottingham Health Profile,[33] which measures health-related quality of life. Because the Work Group was interested in different quality of life constructs such as disability, a focus on health-related quality of life did not address the issues of interest.

A second instrument was the EuroQol Quality of Life Scale (Part II),[34] which consists of a single visual analog scale rating health status. The Work Group determined that this measure lacked specificity to identify the impact of rehabilitation. Ultimately, the Work Group concluded that the impact of interdisciplinary care on quality of life is currently unclear.

Benefits were felt to outweigh harms and risks, although this is a relatively resource-intensive way to provide care. This organizational approach also requires multiple experts who may not be available in more remote areas. Also factoring into the Work Group's decision making for making a strong recommendation was the feedback from the patient focus group. Focus group participants were consistent and vocal in their preference for coordinated care with professionals working closely together. One main theme from the patient focus group was to, "Provide coordinated care and an interdisciplinary team approach to care for patients with stroke. VA, DoD, and private providers should coordinate treatment plans between primary care, medical specialists, and community rehabilitation providers."

As this is a *Reviewed, Amended* recommendation, the Work Group systematically reviewed evidence identified in the evidence review conducted for this CPG update [24,30] and considered the assessment of the evidence put forth in the 2010 CPG.[31,32] The Work Group determined that confidence in the quality of the evidence was moderate. The body of evidence had some limitations including the fact that many of the studies included took place in European health systems, which organize and approach stroke care somewhat differently from the VA and DoD health systems. The Work Group determined that the benefits, including improved outcomes for return to home, outweighed the potential harm of adverse events, which was small. Patient values and preferences strongly favor organized, interdisciplinary care. Thus, the Work Group decided upon a "Strong for" recommendation.

Recommendation

2. We recommend that rehabilitation therapy should start as soon as medical stability is reached. **(Strong for |Not reviewed, Amended)**

Discussion

The 2010 Stroke Rehabilitation CPG recommended that rehabilitation therapy after stroke should start as soon as medical stability is reached. A 1999 SR by Cifu and Stewart, which examined 79 articles from 1950 to 1998, found that rehabilitation within 3-30 days post stroke was strongly associated with improved functional outcomes.[35] One meta-analysis and one large prospective observational study included in the 2010 Stroke Rehabilitation CPG also demonstrated similar findings, which included improved functional independence measures (FIM) scores at discharge, shorter rehabilitation lengths of stay, and improved mobility when there were fewer days from stroke symptom onset to admission to a rehabilitation facility.[36,37]

Despite general consistency in the evidence supporting rehabilitation therapy as soon as medical stability is reached, there may be some variability in provider and patient preferences regarding this treatment. For example, while patients may want to mobilize as soon as possible, providers might be reluctant due to medical concerns in the acute phase or the potential for falls. Resource use must also be considered, as availability of hospital beds and staffing demands can influence rehabilitation timing. Lastly, there is variability with insurance coverage and each patient's ability to fund his or her own rehabilitation.

As this is a *Not Reviewed, Amended* recommendation, the Work Group did not systematically review evidence related to this recommendation. Based on the assessment of the quality of the evidence put forth in the 2010 Stroke Rehabilitation CPG,[35-37] the Work Group determined that confidence in the quality of the evidence is high. Other considerations regarding this recommendation are that the benefits, including improved functional outcomes, decreased length of stay, and decreased readmission rates, outweighed the potential harm of adverse events. Although patient values and preferences may be somewhat varied, the Work Group decided upon a "Strong for" recommendation.

Recommendation

3. There is insufficient evidence to recommend for or against implementing very early mobilization (within 24-48 hours) to improve functional outcomes.
   (Neither for nor against | Reviewed, New-added)

Discussion

The Work Group found insufficient evidence to recommend for or against very early mobilization, defined as rehabilitation occurring within 24-48 hours post stroke, to improve functional outcomes. Two SRs found no statistical benefit on function at three months, and there were mixed results for improvement in independence with ADLs for patients who were mobilized very early.[38,39] A recent Phase III, multicenter, randomized controlled trial (RCT) (A Very Early Rehabilitation Trial [AVERT]) studied very early mobilization in patients with stroke across 56 acute stroke units in five countries and surprisingly concluded there were reduced odds of favorable outcomes when compared to usual stroke unit care at three months. Regardless, the study demonstrated very low rates of adverse events and an overall high level of recovery for the patients, without significant differences in quality of life measures at 12 months.[40]

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed evidence related to this recommendation in the evidence review conducted as part of this guideline update.[38-40] The Work Group's confidence in the quality of the evidence is very low, as serious inconsistencies were noted by the differing findings in the two SRs studied. Other considerations regarding this recommendation are that the benefits outweighed the harms, as there were very low rates of adverse events and an overall high level of recovery. There may be some variation in values and preferences, as providers and patients might be concerned about the potential for harm in very early mobilization; however, others may want to mobilize as quickly as possible. Ultimately, the Work Group decided upon an insufficient evidence recommendation.

Recommendation

4. There is insufficient evidence to recommend for or against early supported discharge.
   (Neither for nor against | Reviewed, Amended)

Discussion

Early supported discharge (ESD) refers to post-acute care and rehabilitation at home after an early discharge and has been suggested as a possible alternative to conventional hospitalization. Langhorne et al. (2017) conducted an SR on ESD which included 17 trials and recruited 2,422 patients diagnosed with stroke to evaluate whether ESD versus conventional care can result in better patient recovery.[41] ESD

services were provided by multidisciplinary teams consisting of therapists, nurses, and physicians for a median follow-up of six months. The review reported statistically significant findings favoring the ESD group for reductions in length of hospital stay (LOS) by approximately 3-8 days. However, because there was considerable heterogeneity among the studies for LOS, this can reduce the confidence in the estimates. Small improvements in extended ADL scores were also reported, which is an assessment of patients' ability to perform everyday activities while living in the community. However, no statistically significant differences between groups were found for ADLs or quality of life outcomes. There were also no statistically significant differences between groups for hospital readmissions. Additionally, two RCTs assessed whether inter-professional home care support improved quality of life, but no statistically significant between-group differences were identified in either study.[30,42]

As this is a *Reviewed, Amended* recommendation, the Work Group systematically reviewed the evidence identified in the evidence review conducted for this CPG update.[30,41,42] The Work Group determined the confidence in the quality of the evidence was very low and found the evidence insufficient to recommend for or against ESD. The main limitations of these studies include lack of blinding of patient and providers to the intervention [30,41,42] and not completing an intent to treat analysis.[30,42] Although early discharge can be cost effective and preferred by patients, it can increase the risk of patients not achieving full rehabilitation potential, as well as lead to caregiver burnout. Thus, the Work Group decided there was insufficient evidence to recommend for or against the use of ESD.

B. Motor Therapy

a. Upper and Lower Limbs Rehabilitation

Recommendation

5. We recommend task-specific practice (also known as task-oriented practice or repetitive task practice) for improving upper and lower extremity motor function, gait, posture, and activities of daily living.
   (Strong for | Reviewed, New-replaced)

Discussion

Task-specific practice involves practice of a whole task or pre-task movements for a whole limb or limb segment such as grasp, grip, or movement in a trajectory to facilitate an ADL or mobility. These movements can include upper and lower limb movements, balance activities in a sitting or standing position, transfers, and functional mobility (e.g., stairs, household ambulation). The approach typically includes application of motor learning principles in regard to feedback, practice schedules, task variation, and challenge of activity.[43] These interventions were labeled differently across publications as "task-specific practice," "task-oriented practice," and "repetitive task practice," but appeared to have similar intervention structure in that the task or the part or segment of the task was repeated multiple times during a single therapy session. The Work Group elected to use the term "task-specific practice" for this recommendation. Exact dosing parameters of the motor learning principles varied but the key concept was the repetition of the task or component of the task within the same therapy session. The number of repetitions performed varied in the evidence.

An SR by French et al. (2016) provided moderate quality evidence to support this recommendation.[43] It compiled 32 RCTs and one quasi-RCT that compared repetitive task practice with standard/usual care.

Trials of repetitive activity were required to involve complex, multi-joint, functional movement patterns, rather than exercise of a single joint or muscle group oriented toward strengthening of an extremity. Duration of training ranged from 2-20 weeks. The results found statistically significant improvements in ADLs for patients at various stages post stroke when they received task-specific practice compared to usual care. This finding was maintained beyond six months follow-up and was still noted in a few studies at the four year follow-up. Richards et al. (2004) found that the efficacy of the task-oriented approach is not dependent upon rehabilitation technology.[44] Evidence for the use of technology will be discussed in separate recommendations as follows: body-weight support treadmill training (Recommendation 7), constraint-induced movement therapy (Recommendation 9), neuromuscular electrical stimulation (NMES)/ functional electrical stimulation (FES) (Recommendation 11), and robotics (Recommendations 14 and 15).

The 2010 Stroke Rehabilitation CPG found moderate quality evidence in a review of the literature regarding task-specific training.[44-52] This body of evidence included nine separate RCTs that found positive results from techniques that included training dynamic sitting balance,[46] mobility (walking over ground and on treadmill),[45] agility and balance activities,[45,47,48,51] walking programs,[49] body-weight support treadmill training,[50] backwards walking,[52] and upper limb function.[48] The 2010 Stroke Rehabilitation CPG also reported high quality evidence regarding ADL training. This evidence was included in the strength of this recommendation, as the studies included repetition of whole/pre-task movements. The primary article was an SR by Legg et al. (2006) that found task-specific training to be superior to usual or no training of ADLs.[53] This SR included nine articles (eight of them RCTs) comparing whole ADL and pre-task movements to promote ADL training versus usual or no training. This SR addressed areas of dressing, bathing, feeding, transfers, mobility (e.g., stairs), and home tasks such as meal preparation activities.

With task-specific training, the benefits appear to outweigh the harms. There were significant gains in many areas that were maintained for at least six months. A potential risk for falls was the main concern; however, risk for falls is no greater than for other therapy interventions. This intervention can be performed in any environment (e.g., hospital room, clinics, home, community settings). Caregivers and patients can be educated in how to carry out this intervention at home. This approach does not require additional equipment not routinely found in therapy clinics or home settings. This intervention tends to be more engaging, as it can be tailored to the patient's preferences and individual goals. The patient focus group stated that they wanted to have a treatment plan tailored to their individual needs, taking into account their comorbidities, patient-specific goals, values, and preferences. This approach exemplifies that desire. Those who are severely impaired may require increased staff or the use of technology to assist with safe performance of tasks.

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed new evidence related to this recommendation [43] as well as the evidence from the 2010 Stroke Rehabilitation CPG.[44-53] The Work Group found the overall quality of this evidence to be moderate. The body of evidence had limitations due to poor reporting of risk of bias. Other considerations for this intervention include the risk versus benefits analysis. The Work Group identified the risk for falls, but did not believe that the risk was significantly greater with this approach compared with other therapy techniques. In terms of patient values and preferences, patients generally favor this technique, as it is easily

individualized to address their specific goals. One of the main messages from the focus group was that patient goals and preferences should be identified and incorporated into the individualized treatment plan. Because patients can be involved in customizing their treatment with this intervention, the ability to perform this intervention in most environments, and the moderate level of evidence, the Work Group decided on a "Strong for" recommendation.

Recommendation

6. We recommend cardiovascular exercise to increase maximum walking speed after stroke. **(Strong for | Reviewed, New-replaced)**

Discussion

Cardiovascular exercise and/or training (e.g., walking, aquatics and rowing) has been found to improve the maximum walking speed in patients post stroke.[54] The evidence review identified one SR that addressed cardiovascular training.[54] There were 58 RCTs within this review that addressed the critical outcomes of walking speed (maximum and preferred), mobility (preferred gait speed), disability (Barthel Index [BI] and FIMs), and quality of life (Stroke Adapted-Sickness Impact Profile). The SR found a statistically significant benefit favoring cardiovascular training, in particular walking, to increase maximum walking speed after stroke. There was no other statistically significant benefit of cardiovascular exercise on the other identified critical outcomes.

Cardiovascular exercise is also a component for the management of several comorbidities commonly found in stroke survivors. It is also recommended as a favored intervention in several VA/DoD CPGs (i.e., Management of Type 2 Diabetes Mellitus in Primary Care [DM CPG],[1] Management of Dyslipidemia for Cardiovascular Risk Reduction [Lipids CPG],[2] Management of Hypertension in Primary Care [HTN CPG],[3] Management of Chronic Kidney Disease in Primary Care [CKD CPG],[4] and Management of Overweight and Obesity [OBE CPG][5]). The 2010 VA/DoD Stroke Rehabilitation CPG made a strong recommendation based on high quality evidence that patients participate in a regular aerobic exercise program as a way to increase walking speed, endurance, and walking symmetry. There appears to be limited harm in offering this intervention; benefits seem to outweigh any potential risk. For patients who may have pre-existing cardiorespiratory conditions, cognitive deficits, or risk for falls, providers should consider these conditions prior to recommending cardiovascular exercise interventions. Considerations should also be made for patient preferences, access to exercise facilities and equipment, neighborhood setting/safety, and local climate.

When considering the balance of desirable and undesirable outcomes, the Work Group determined the benefits of this recommendation outweigh any potential harms/burdens. There appeared to be an overall

[1] See the VA/DoD Clinical Practice Guideline for the Management of Type 2 Diabetes Mellitus in Primary Care. Available at: https://www.healthquality.va.gov/guidelines/CD/diabetes/

[2] See the VA/DoD Clinical Practice Guideline for the Management of Dyslipidemia for Cardiovascular Risk Reduction. Available at: https://www.healthquality.va.gov/guidelines/CD/lipids/

[3] See the VA/DoD Clinical Practice Guideline for the Management of Hypertension in Primary Care. Available at: https://www.healthquality.va.gov/guidelines/CD/htn/

[4] See the VA/DoD Clinical Practice Guideline for the Management of Chronic Kidney Disease in Primary Care. Available at: https://www.healthquality.va.gov/guidelines/CD/ckd/

[5] See the VA/DoD Clinical Practice Guideline for the Management of Overweight and Obesity. Available at: https://www.healthquality.va.gov/guidelines/CD/obesity/

benefit for improving the maximum walking speed with potential additional benefits of improving common comorbidities that are well-established modifiable risk factors for stroke (e.g., obesity, diabetes, dyslipidemia, hypertension).

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed the evidence identified in the evidence review conducted for this CPG update as well as the evidence from the 2010 Stroke Rehabilitation CPG. The Work Group determined the confidence in the quality of the evidence was moderate based on a Cochrane review of one SR consisting of 58 RCTs with five studies showing a significant difference favoring cardiorespiratory training to improve maximum walking speed.[54] The Work Group determined the benefits of cardiovascular exercise outweigh potential risk. However, there may be some subgroup considerations, particularly regarding patients with pre-existing cardiorespiratory conditions.

Recommendation

7. We suggest offering body-weight support treadmill training as an adjunct to gait training in the non-ambulatory patient.
   (Weak for | Reviewed, Amended)

Discussion

Body-weight support treadmill training (BWSTT) is a task-specific technique for improving gait. The patient is partially suspended using a body harness from the ceiling or a frame in order to reduce (offload) the relative weight of the patient and provide postural support while walking on a treadmill. The amount of offloading can gradually be decreased as indicated by improved control of posture and gait by the patient. The results of the two SRs included in the evidence review were mixed.[55,56] Twenty-eight RCT studies were reviewed in the first SR by Mehrholz et al. (2017).[56] Based on these studies, there was no significant difference found between the use of BWSTT versus other physical therapy interventions with the exception of conventional treadmill training. When BWSTT was compared to conventional treadmill training, there was a slight trend favoring the use of the BWSTT; however, there were mixed results and the data was not pooled. The second SR, by Ada et al. (2010), included six RCTs; however, only three studies had adequate follow-up.[55] The target population for this SR was subacute, non-ambulatory patients. The intervention included any type of BWSTT (treadmill with harness, treadmill electromagnetic gait trainer with harness, treadmill with robotic device with harness) compared to over ground walking with assistance from therapists or aids. Both walking speed and level of independence with walking showed significant differences at six months favoring use of BWSTT compared to usual care.

The 2010 Stroke Rehabilitation CPG referred to several large RCTs that were underway at that time and have since been completed. The MOBILISE (early mobility for non-ambulatory patients with stroke) trial by Ada et al. [57] and the LEAPS trial (Locomotor Experience Applied Post-Stroke) by Duncan et al. [58] both addressed the use of BWSTT compared to over ground ambulation and/or a home exercise program targeting weakness and balance. The MOBILISE trial consisted of 126 patients who were not able to ambulate after their stroke. More subjects in the BWSTT group achieved independent ambulation and did so in less time (five weeks versus seven weeks) than in the control group. Although these results were not statistically significant, one could consider that a two week shorter length of stay may both benefit the patient and decrease health care costs. The LEAPS trial consisted of 408 subjects divided between three

training groups (BWSTT at two months, BWSTT at six months, and home exercise program targeting weakness and balance). After one year, there was no significant difference between the three groups. The results regarding BWSTT varied among the RCTs reviewed as part of the development of the 2010 Stroke Rehabilitation CPG.[59,60] Results from Barbeau and Visintin (2003) supported improved ambulation and postural abilities with BWSTT compared to other full body-weight interventions, finding the most improvement in the group with greater gait impairments,[59] whereas Suputtitada et al. (2004) did not find a difference between BWSTT and over ground ambulation outcomes.[60]

The most significant adverse effects associated with BWSTT compared to other gait interventions are musculoskeletal problems, skin abrasion/breakdown, and anxiety. One notable consideration with BWSTT is the correct application of the harness to prevent increased pressure through the groin and avoid skin breakdown. There is subgroup variation in regard to those who cannot tolerate the tightness of the harness such as those with feeding tubes or anxiety. Other concerns associated with gait training interventions are falls and cardiac issues (dizziness, fainting, and heart rate regulation). These also apply to BWSTT and may lead to greater risk in this population. The mixed results in the literature appears to be divided between severity levels of stroke. Those who were ambulatory did not appear to benefit compared to programs addressing weakness and balance. The patients who were non-ambulatory appeared to have greater improvement in ambulation with use of BWSTT.[60] There appears to be limited harm in offering this intervention if one monitors activity tolerance (both cardiac and emotional responses) and skin integrity. Other considerations for use of this modality are the costs of the equipment and the need for trained staff. There is some subgroup variation among therapists as well regarding the comfort level and skill in providing this modality, as BWSTT needs to be used frequently to maintain therapist skills and comfort.

As this is a *Reviewed, Amended* recommendation, the Work Group systematically reviewed the new evidence related to this recommendation,[55,56] along with several references from the 2010 Stroke Rehabilitation CPG addressing BWSTT.[57-61] The results of the evidence were mixed, though slightly in favor of the use of BWSTT in the non-ambulatory patient. The Work Group's overall confidence in the quality of the new evidence was very low due to issues with appropriate randomization, allocation concealment, and blinding. Overall, the benefits for using BWSTT slightly outweigh the harms, as it appears to offer a safe way to gait train non-ambulatory patients. In several studies, this early mobility appeared to show benefit of more people ambulating independently and achieving that goal in less time in the subgroup with severe impairments.[55,56] Overall, most patients generally are willing to try the intervention. Thus, the Work Group decided upon a "Weak for" recommendation.

Recommendation

8. We suggest offering rhythmic auditory cueing as a modality to include in multimodal interventions to improve walking speed.
   (Weak for | Reviewed, Amended)

Discussion

The use of rhythmic auditory cueing during gait training helps to coordinate movement with timing, to stimulate and incorporate overlapping brain areas, and to improve walking speed. This therapeutic modality has been used in persons with stroke and other movement disorders. As this is a *Reviewed,*

Amended recommendation, the Work Group systematically reviewed the new evidence related to this recommendation. However, no new studies related to rhythmic auditory cueing were identified in the literature search. Therefore, this recommendation is based on studies included in the 2010 Stroke Rehabilitation CPG.[62-65] The quality of evidence in support of rhythmic auditory cueing to improve walking speed after stroke was found to be low.[62-64] Despite general consistency in the literature supporting this intervention, there was one study which found no benefit for this treatment.[65] Furthermore, there is some variability in provider and patient preference regarding the use of this treatment modality. Support for a "Weak for" recommendation stemmed from the relatively low cost, ease of use, and accessibility of the equipment. As benefits outweigh harms for using rhythmic auditory cueing to improve walking speed, it is suggested that this modality be offered as an adjunctive treatment to conventional gait training while considering comorbid diagnoses which may decrease the effectiveness of this intervention (e.g., cognitive impairments, stress disorders, hearing impairments).

Recommendation

9. We suggest offering Constraint-Induced Movement Therapy or modified Constraint-Induced Movement Therapy for individuals with at least 10 degrees of active extension in two fingers, the thumb, and the wrist.
   (Weak for | Reviewed, Amended)

Discussion

Constraint-Induced Movement Therapy (CIMT) and modified Constraint-Induced Movement Therapy (mCIMT) are multi-component interventions designed to help patients overcome learned non-use of a paretic upper extremity and increase motor function. CIMT is a neurorehabilitation technique consisting of three components: (1) immobilization of the non-paretic upper extremity to prevent its use in daily activities, (2) task-specific practice of the paretic upper extremity with frequent repetitions for about six hours per day, and (3) instruction in transfer of skills from the clinical setting to the home environment in performance of ADLs and instrumental ADLs (IADLs). The main difference between CIMT and mCIMT is the number of hours of therapy per day, with CIMT requiring more than three hours per day, and mCIMT requiring three hours or less of therapy per day (as defined by Corbetta et al. [2015]).[66] Based on an SR by Etoom et al. (2016) including 38 RCTs, CIMT was associated with improvements in outcome measures of upper extremity function (i.e., Fugl-Meyer Assessment [FMA], Motor Activity Log, Wolf Motor Function Test [WMFT], and Action Research Arm Test [ARAT]) in the majority of patients.[67] Findings from a single RCT by Yadav et al. (2016) were consistent with increased motor recovery as measured by FMA-Upper Extremity (FMA-UE) with use of mCIMT.[68] Based on an SR by Corbetta et al. (2015) that included 42 RCTs, CIMT was not found to demonstrate a significant difference compared with control groups in ADL outcome measures.[66]

Despite general consistency in the evidence supporting CIMT, there is some variability in provider and patient preferences regarding this treatment. CIMT intervention can be burdensome to patients, as the duration of treatment may average from 3-6 hours per day, for a period of two weeks. High-intensity CIMT may make the patient anxious, and restricting the non-paretic side for a long duration may make the rehabilitation experience less satisfactory for the patient. However, in the patient whose paretic upper extremity also happens to be his or her dominant hand, there may be strong internal motivation to be compliant with the intensity of this intervention. This intervention is time intensive to providers as well,

and the ability to provide adequate staffing may be of concern to clinics. The Work Group did not identify any additional risks for the patients in trialing CIMT or mCIMT. Overall, benefits slightly outweighed harms. If a patient is motivated to engage in this treatment, there may be a transfer of learned motor functions to the home setting, though RCTs to date have not documented such improvement.

As this is a *Reviewed, Amended* recommendation, the Work Group systematically reviewed the evidence identified in the evidence review conducted for this CPG update.[66-68] The Work Group's overall confidence in the quality of the evidence is very low. The Work Group determined that the FIM scale may not be a direct indicator of improvement, nor the best outcome measure, because it measures functional performance and considers the level of caregiver burden. Improvements in FIM, therefore, may be due to a patient's compensation strategy or reliance on the non-paretic upper extremity rather than improved use of the paretic extremity.[67] Thus, the Work Group decided upon a "Weak for" recommendation.

Recommendation

10. There is insufficient evidence to recommend for or against mirror therapy for improvements in limb function.
    (Neither for nor against | Reviewed, Amended)

Discussion

Mirror therapy uses a mirror that reflects movement of the non-paretic limb back to the patient, creating a visual illusion that the paretic limb is moving. The paretic limb is typically hidden by the mirror. The concept behind this therapy is that cortical activation in the lesioned hemisphere may be induced by both the perception of movement in the paretic limb and stimulation from the non-paretic limb through interhemispheric communication.

There was very little evidence evaluating the use of mirror therapy in the post-stroke population. Two RCTs were reviewed, one focusing on upper extremities and the other focusing on lower extremities. Michielsen et al. (2011) focused on upper extremity improvement using mirror therapy in chronic stroke.[69] There was no difference in return of motor function when comparing the experimental and control groups during follow-up. Arya et al. (2011) addressed the effect of mirror therapy on lower limb motor recovery and gait in chronic stroke.[70] The experimental group performed mirror therapy in addition to the conventional intervention protocol; the control group performed the conventional protocol twice. There were no significant differences between the groups.

While there is insufficient evidence to suggest routine use of mirror therapy, this therapy could be considered as a treatment technique to add variety to a treatment program or to increase patient engagement. There is some variation between patient suitability, as those with vision impairments, neglect, or cognitive deficits will not be able to perform or will require additional assistance to trial mirror therapy. Patients are usually seated for this activity, which places them at a low risk for falls. There is minimal set-up required to use a mirror. The Work Group did not identify any additional risks for patients in trialing mirror therapy. Overall, benefits and harms appeared balanced. If a patient performed this independently and was motivated, it might allow for safe increased practice when outside of therapy.

As this is a *Reviewed, Amended* recommendation, the Work Group systematically reviewed the evidence identified in the evidence review conducted for this CPG update.[69,70] The Work Group's confidence in

the quality of evidence was low. Although there appeared to be adequate randomization and appropriate allocation concealment within the studies, there were serious imprecision concerns. Both of these RCTs were small studies; Arya et al. (2011) had a total of 36 subjects [70] and Michielsen et al. (2011) had a total of 40 subjects.[69] No significant change was found in the outcomes of gait speed and upper extremity function when compared to controls. More research is needed to determine if mirror therapy is an effective therapy. This therapy can easily be performed at home or on the ward outside of skilled therapies if the patient does not have visual or cognitive impairments. It may be an avenue for increasing independent, safe practice. Thus, the Work Group decided upon an insufficient evidence recommendation.

b. Technology-Assisted Physical Rehabilitation

Recommendation

11. We suggest offering functional electrical stimulation, neuromuscular electrical stimulation, or transcutaneous electrical nerve stimulation as an adjunctive treatment to improve upper and lower extremity motor function.
    (Weak for | Reviewed, New-replaced)

Discussion

This recommendation addresses the use of electrical stimulation for muscle re-education and strengthening. (The use of electrical stimulation as a neuro-prosthesis is addressed in Recommendation 13. Electrical stimulation for re-education involves the application of an electrical current to a targeted muscle or muscle group. This results in the activation of the targeted muscles. The Work Group reviewed one SR [71] (which included 21 RCTs) and seven RCTs [72-78] pertaining to three different modes of electrical stimulation (FES, NMES, and transcutaneous electrical nerve stimulation [TENS]) used in stroke rehabilitation. FES was consistent with application of electrical stimulation that controlled an upper or lower extremity pattern during functional performance of a task (stepping or reaching).[71,72,74,78] The method with which NMES was applied in the studies varied, as some protocols used NMES during function (consistent with FES) while others targeted isolated joint movements or functional patterns. At times, NMES was completed with no active participation from the patient; at other times, NMES was completed with active attempts at engagement of the targeted muscle group by the patient. The intensity used for the FES and NMES studies was targeted to the level of visible muscle contraction. The evidence that addressed TENS used sensory-level stimulation in conjunction with attempts at active engagement of the targeted muscle group by the patient.[71,76] There were various technical differences between the devices studied, which limits generalizability of results. These studies also had variation in electrode set-up and placement; some were externally applied [71-78] while others were implanted intramuscularly.[71]

When the different modes of electrical stimulation (FES, NMES and TENS) were compared to placebo electrical stimulation or no electrical stimulation treatment interventions, statistically significant results were in favor of the use of electrical stimulation in the majority of trials. Improvements were found in one or more of the following domains: gait speed,[71,72] functional abilities as measured by the BI and physical function subscale of the 36-Item Short Form Health Survey (SF-36),[75,76,78] and upper extremity motor function.[73,75] Use of complex devices such as FES-induced cycling,[72] electromyogram (EMG)-driven NMES robotic arm,[76] or contralateral controlled FES system [74] were not associated with significant differences in motor recovery, gait speed, or FIM outcomes when compared to controls (placebo FES cycling, routine therapy with NMES, traditional physical therapy treatments, respectively).

The use of an EMG-driven NMES robotic arm did show significantly better improvement on the SF-36 over routine therapy.[76]

The benefit of using this intervention (external electrodes) greatly outweighs the harms. The risks are primarily related to infrequent skin irritation/burns. Some subgroup variations to consider are those patients with impaired skin integrity, decreased muscular endurance (fatigue factor), and pre-existing swelling (affects stimulation dose). Implanted electrical devices, pregnancy, and active cancer are contra-indications for this modality. Further studies are necessary to determine if the benefits outweigh the risk for placement of indwelling electrodes, given the potential harms of the procedure itself, post-operative pain, and the possibility of post-operative infection. There is variability in the types of electrical stimulation units available in therapy clinics. Many clinics have a standard 2-channel hand-held unit or multi-channel system that can be used for FES, NMES, and TENS application, but the more complex devices did not appear to show significant differences in functional outcomes, are not as widely available, and have cost implications. Patient's tolerance for the stimulation is also a consideration. The current evidence did show that TENS (sensory stimulation level) could be provided in lieu of FES/NMES with positive results if muscle contraction intensity is not tolerated by the patient.

As this is a *Reviewed, New-Replaced* recommendation, the Work Group systematically reviewed the new evidence related to this recommendation and found the quality of the evidence to be very low.[71-78] The body of evidence had limitations, including issues with blinding, allocation concealment, reporting bias, substantial subject attrition, and incomplete statistical analysis. The benefits of using this intervention (external electrodes) outweigh the harms and could provide improved function over standard of care. FES/NMES/TENS units are readily available in most clinics and can be used as an adjunct to task-specific training. The Work Group considered the very low level of evidence and the potential for benefit and decided upon a "Weak for" recommendation.

Recommendation

12. We suggest offering functional electrical stimulation to manage shoulder subluxation. **(Weak for | Not Reviewed, Amended)**

Discussion

FES causes contraction of muscles in an organized fashion to achieve various therapeutic and functional goals, including creating better joint alignment or limb position and facilitating the recovery of limb function. (The use of FES for motor recovery is reviewed in Recommendation 11). This recommendation reviews the use of surface electrical stimulation for creating better glenohumeral joint alignment by reducing shoulder subluxation.

As this is a *Not Reviewed, Amended* recommendation, the Work Group did not systematically review new evidence related to this recommendation. Based on the assessment of the quality of evidence put forth in the 2010 Stroke Rehabilitation CPG,[79,80] the Work Group determined the confidence in the quality of the evidence to be moderate for offering FES to manage shoulder subluxation. The 2010 Stroke Rehabilitation CPG recommended FES for persons with shoulder subluxation based on three studies.[79-81] However, one study was excluded from the evidence review conducted as part of this guideline update, as the electrodes were implanted and this invasive technique is not widely available.[81] A Cochrane review concluded that FES increases pain-free passive motion and reduces

glenohumeral subluxation.[79] A summary study of clinical trials also concluded that FES is effective in reducing shoulder subluxation.[80] Other support for this recommendation stemmed from the benefits outweighing the harms.

Recommendation

13. For patients with foot drop, we suggest offering either functional electrical stimulation or traditional ankle foot orthoses to improve gait speed, as both are equally effective.
(Weak for | Reviewed, New-added)

Discussion

This recommendation reviews the use of FES application as an alternative to traditional orthoses for improving foot clearance during ambulation in persons with post-stroke foot drop. The use of the ankle foot orthoses (AFO) is currently considered the standard of care in the U.S. to treat foot drop. FES is also used, but less frequently. However, it has been found to be effective as an adjunctive treatment to improve upper and lower extremity motor function (see Recommendation 11). Some postulate that an AFO has only an immediate orthotic effect (meaning that it passively holds the foot in a neutral position to remedy the loss of dorsiflexion and can provide some dorsiflexion assist depending upon the type of AFO), but that there is no carryover of the support when the device is removed beyond that of spontaneous recovery. Conversely, it has been postulated that stimulating the peroneal nerve during key phases of the gait cycle to correct foot drop might contribute to neuroplastic change, thereby enhancing muscular strength and neuroplasticity which could provide a distinct advantage over AFO. However, a recent meta-analysis of five RCTs with 815 participants comparing the effects of FES versus AFO on walking for foot drop of central neurologic origin concluded that these interventions both demonstrated similar improvements in multiple outcomes, (including walking speed over 10 meters, functional exercise capacity, Timed Up and Go test, and the mobility sub-scale of the Stroke Impact Scale [SIS]).[82] The study suggested that no statistically or clinically significant difference existed between the two interventions.

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed evidence related to this recommendation in the evidence review conducted as part of this guideline update.[82] Based on the data suggesting equal efficacy, the Work Group cannot recommend one intervention over the other for management of foot drop. Consideration of individual patient's values, preferences, and financial resources will be essential when deciding between these two interventions, as will acceptability and resource use. Additionally, skin integrity issues from common comorbid conditions such as diabetes mellitus, peripheral vascular disease, or peripheral neuropathy may require closer care or follow-up and may contraindicate use of AFOs. Regarding patients' values and preferences, some patients find the stimulation intensity required for FES to achieve muscle contraction too painful, as discussed in Recommendation 11. On the other hand, certain other patients may find AFOs cosmetically unacceptable, as they can be bulky and thus require some users to wear wider or larger shoes to accommodate the orthosis. In summary, for persons with post-stroke foot drop, FES and AFO are both effective management options and each individual's values, preferences, and resources should be considered when choosing between the two.

Recommendations

14. We suggest offering robot-assisted movement therapy as an adjunct to conventional therapy in patients with deficits in upper limb function to improve motor skill.
    (Weak for | Reviewed, Amended)
15. There is insufficient evidence to recommend for or against the use of robotic devices during gait training.
    (Neither for nor against | Reviewed, Amended)

Discussion

There has been an increase in the number of robotic-assisted devices available for use in stroke rehabilitation. The majority of these systems focus on improving strength and functional activity of the upper extremity or improving walking speed and independence with ambulation. Most of the available devices can be programmed to perform passive motion, active-assist with movement, or resistance to the patient's movement, and some are able to adapt automatically based on the patient's ability. These devices are often combined with some type of augmented feedback such as a video screen, most commonly in a game-like format for visual feedback or tone adjustment for auditory feedback. The rationale for the use of robotics is that the patient can practice the movement in a more natural pattern and increase the amount of task-specific practice of the pattern or activity. The device can assist the movement when there is a lack of motor recruitment to perform the movement, and allow for more controlled movement earlier than standard therapies, and potentially decrease the number of staff needed for safety with movement.

Our review included two SRs [83,84] and three RCTs [77,85,86] that addressed the use of robotics for upper extremity rehabilitation. The SRs by Merholz (2015) and Norouzi-Gheidari (2012) included 36 RCTs (24 and 12, respectively).[83,84] The majority of ADL outcome measures chosen in these studies were the FIM or BI; the upper extremity function outcome measures were the FMA-UE or WMFT. Qian (2017) and Reinkensmeyer (2012) both found significant differences in upper extremity function with use of robotics over control groups,[77,86] while studies by Masiero (2014) and Norouzi-Gheidari (2012) did not show improvement when conventional therapy and robotic therapy were compared.[84,85] Norouzi-Gheidari et al., however, did report a significant improvement when robotic therapy was added to the conventional therapy in the acute and subacute phases, suggesting the extra time in therapy may be responsible for the improved outcome during these periods.[84] The only study demonstrating significant functional change in ADLs using the BI or FIM was Merholz et al. (2015) in the acute and subacute population;[83] no significant difference was noted in the population with chronic impairments. This study also found no significant difference in upper extremity function measures in acute, subacute, or chronic populations. The subgroup comparisons for those who used a device that targeted distal arm (finger, hand, wrist) versus proximal arm (shoulder, elbow) did not show a significant difference in the results.

For robotic use in gait training, the Work Group found only one SR that met our criteria. Merholz (2017) consisted of nine RCTs that addressed gait velocity and six RCTs that addressed return to independent walking.[87] This review captured both non-ambulatory and ambulatory patient populations. There was no significant difference found in the experimental group compared with the control group in achievement of independent walking or gait velocity.

There was a great deal of variability in the robotic devices used and in their availability from clinic to clinic in the research trials. Some of the upper extremity devices isolated movement at a joint where others were able to move in multiple degrees of freedom simulating reaching. The lower extremity devices utilized in the studies included automated electromechanical gait devices (fixed device incorporated in to a body-weight support system) and robot-driven exoskeletons (mobile units). The variability in and availability of these devices are also reflected in the clinical environment. Using robotics requires additional therapist training and may or may not decrease the number of staff required to operate the systems safely or supervise the patient during use. The robotic system needs to be used frequently to maintain therapist skills and comfort with the device. The initial set-up can take increased time, but the time to apply the device decreases once parameters have been determined. The potential side effects or harms tend to be related to musculoskeletal complaints, discomfort from the harnesses, and skin integrity issues. With gait, the concern for cardiac issues is on par with other forms of gait training. The higher prevalence of extremity pain, spasticity, limited range of motion, and cognitive impairments in the stroke population limits the use of robotic devices to those who fit device-specific criteria. With the robotic gait devices, there are also parameters for body morphology that may limit use of the device. For some upper extremity devices, the patient needs to be able to transfer into the device for optimal upper extremity alignment. Transfers to the device may be difficult due to patient's abilities and/or suboptimal location of the device within the clinic, as robotic devices can be large and require a significant area in the clinic for safe use. The majority of patients appear to tolerate the use of upper extremity robotics. This differs with the robotic gait devices, as some patients are anxious with the use of technology and others do not tolerate the compression of the device necessary for appropriate fit. The cost to acquire these devices is substantial. On the other hand, devices may offer additional modes of therapy for upper extremity function and gait rehabilitation which may increase patient's motivation or compliance.

As these are *Reviewed, Amended* recommendations, the Work Group systematically reviewed the new evidence related to these recommendations.[55,56,77,83-87] The Work Group's confidence in the quality of the evidence is low for the use of robotics in upper extremity and gait rehabilitation. There were serious limitations found in the body of evidence, including failure to report allocation concealment, reporting bias, rudimentary analysis, failure to describe randomization procedures, failure to blind outcome assessors, serious indirectness, and serious imprecision. The results for the use of robotics for upper extremity strength and function were mixed; half of the studies addressing motor recovery found significant benefit with use of robotics, and only one out of four studies found significant improvements in ADL function over the control group. No significant differences were found for the use of robotics to improve gait velocity or independence with ambulation.[56] Patient preference for these devices is variable. Devices for upper extremity rehabilitation tend to be more accepted than devices for gait training. Thus, there seems to be a smaller difference in patient preferences for upper extremity rehabilitation than for gait training. The benefits of robotic devices for upper extremity rehabilitation slightly outweigh the harms, as there were several studies that showed a favorable outcome. For use in gait rehabilitation there is more of a balance, as the harms are minimal but there is no significant benefit over standard gait training methods. Cost of systems, clinic space, and patient preferences should be considered if a clinic is considering purchasing a robotic gait system as an option. This literature continues to support the findings of the 2010 Stroke Rehabilitation CPG and the Work Group decided upon a "Weak for" recommendation for use of robotics for rehabilitation of the upper extremity and an insufficient evidence recommendation for the use of robotics for gait rehabilitation.

Recommendations

16. We suggest offering virtual reality to enhance gait recovery.
    (Weak for | Reviewed, Amended)

17. There is insufficient evidence to recommend for or against the use of virtual reality for improving activities of daily living and non-gait motor function.
    (Neither for nor against | Reviewed, New-replaced)

Discussion

According to Henderson et al. (2007), "Virtual reality [VR] is a computer-based, interactive, multi-sensory environment that occurs in real time."[88] Nonetheless, there are vast differences in types of VR. For instance, VR can be non-immersive with primarily visual and auditory sensory input, such as a person interacting with a computer screen (e.g., simple computer games).[88] Alternatively, VR can involve a completely immersive environment, in which the person has the sense that he or she is within the VR environment. This may include the addition of haptic information through a haptic interface device such as a glove or exoskeleton, increasing a patient's perception that he or she is actually present in and able to control the simulated environment. Regardless of the type of VR, when it is used as part of a rehabilitation intervention, a person's interaction with the virtual environment is designed so that the person can carry out task-specific practice to facilitate motor learning in a more engaging manner.

The 2010 Stroke Rehabilitation CPG recommended considering VR for gait rehabilitation. This was based on a number of small RCTs using VR to augment more traditional therapeutic approaches including conventional physical therapy,[89] treadmill training,[90] and a robotic ankle rehabilitation system.[91] While there are small sample sizes and significant heterogeneity among interventions in these studies, all of these RCTs found significantly greater improvements in the experimental (VR-augmented therapy) groups compared to the control groups on a variety of gait parameters including, but not limited to, gait velocity, community walking speed, and community ambulation. A more recent RCT used a non-immersive VR method for balance-related training. While both experimental and control groups received a total of 90 minutes of therapy twice a week for six weeks, the experimental group substituted half (45 of the 90 minutes) of the standard therapy time with VR balance-related training (specifically balance-related games using Kinect for Xbox®).[92] After six weeks, both groups exhibited significant improvement in the Berg Balance Scale and Timed Up and Go test, but the VR group rated the therapy experience as more pleasurable. Based on the assessment of the quality of evidence put forth in the 2010 Stroke Rehabilitation CPG [89-91] and the more recent RCT included in our updated evidence review,[92] the Work Group determined there was low quality evidence for offering VR to enhance gait recovery.

Although VR has been found to be effective for gait recovery, there is insufficient evidence to recommend for or against the use of VR for improving ADLs and non-gait motor function. The 2010 Stroke Rehabilitation CPG suggested that "providers consider VR as a practice context," based on an SR that included one good quality RCT investigating immersive VR and one poor quality RCT investigating non-immersive VR. These studies indicated that motor practice within immersive VR was more effective than no therapy, but that non-immersive VR may be no better than conventional therapy.[88] The Work Group reviewed three additional RCTs comparing various non-immersive VR systems to standard occupational therapy for upper extremity motor training.[93-95] One of the smaller studies found significantly greater improvement in upper extremity motor recovery (as measured by the FMA-UE, Brunnstrom stage, and

manual muscle testing) in the experimental group, which used a mobile game-based VR program for 30 minutes in addition to conventional occupational therapy for 30 minutes for upper extremity motor recovery, compared to a control group that, which received one hour of conventional occupational therapy.[95] The other studies reviewed found no significant difference between VR and control groups in ADLs for upper extremity function.[93,94]

As these are *Reviewed* recommendations (*Reviewed, New-replaced* and *Reviewed, Amended*), the Work Group systematically reviewed new evidence related to these recommendations [92-95] as well as the evidence from the 2010 Stroke Rehabilitation CPG.[88-91] The Work Group found the overall quality of this evidence to be low. Other considerations for this intervention include the risk/benefits analysis. While no adverse effects were reported in the studies that were reviewed, the Work Group expressed concern that perhaps the perceived ability to continue with rehabilitation efforts through a smart phone or tablet might lead to some patients being prematurely discharged, which could be a potential harm. In terms of patient values and preferences, the Work Group suspects that there might be some variation. However, for persons who enjoy this kind of activity (playing games on a computer or smart phone or other commercial gaming system), VR could be a way to offer opportunities to enhance motivation to participate in therapies and increase engagement in repetitive task-specific practice.

This Work Group believes that further research is needed to investigate the role of VR in enhancing motor recovery following stroke. Studies that evaluate the comparative effectiveness of immersive versus non-immersive VR environments may also be helpful. As discussed above, for appropriately selected patients (i.e., those without significant cognitive or visual impairments who are amenable to this kind of technology-assisted therapy), VR may be a valuable motivating tool to encourage the task-specific practice that is important for motor recovery. And, while this emerging technology is becoming more widely available, it may not be feasible in all care settings. Non-immersive VR systems, such as computer games or mobile apps, can be accessed on a low budget, while immersive environments may be more cost prohibitive. Aside from cost, additional resource considerations include the need for a designated space to use VR safely, and provider training on individual systems.

Recommendation

18. There is insufficient evidence to recommend for or against the use of transcranial direct current stimulation to improve activities of daily living.
    (Neither for nor against | Reviewed, New-added)

Discussion

Transcranial direct current stimulation (tDCS) is a non-invasive form of neurostimulation using low voltage direct electrical current stimulation delivered through electrodes placed on the head in order to modulate neuronal activity. Currently, tDCS is not approved by the U.S. Food and Drug Administration (FDA) for the clinical treatment of any conditions.

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed the evidence related to tDCS and found that there was insufficient evidence to recommend for or against the use of tDCS for the improvement of ADLs.[96,97] One SR compared the effectiveness of tDCS versus control (sham/any other intervention) for improving ADL performance after stroke and showed low quality evidence for the improvement of ADLs after stroke.[96] However, one RCT by Koh and colleagues showed

no significant difference between tDCS and sham tDCS for improvement of ADLs during an eight week intervention where the tDCS group received bilateral tDCS, bilateral cutaneous anesthesia, and high repetition of passive movement of the paretic hand while the control group received the same passive movement, sham bilateral tDCS, and sham anesthesia.[97] The most common complications included skin irritation and some reported cases of headaches, dizziness, and nausea. At this time, as benefits are unclear, benefits and harms appear balanced. tDCS in stroke rehabilitation is an emerging technology. Additional research is required to investigate effectiveness, duration, intensity, dosage, and the long-term safety profile of tDCS as a modality in stroke rehabilitation.

Recommendation

19. There is insufficient evidence to recommend for or against repetitive transcranial magnetic stimulation to improve upper or lower extremity motor function.
(Neither for nor against | Reviewed, New-added)

Discussion

Repetitive transcranial magnetic stimulation (rTMS) is a non-invasive form of neurostimulation which uses a rapidly pulsed magnetic field from a coil placed over the scalp to modulate a specific part of the brain. rTMS has been approved by the FDA only for the management of treatment-resistant major depressive disorder (MDD). The Work Group found that there was insufficient evidence to recommend for or against the use of rTMS to improve upper and lower extremity function after stroke. Several studies showed no statistically significant difference between rTMS and control (sham rTMS) for improvement in critical outcomes related to motor functions in the upper and lower extremities.[98-100] Guan et al. (2017) divided patients into a rTMS treatment group and a sham group in a random and double-blinded manner with patients receiving 10 consecutive days of rTMS at 5 Hz versus sham treatment; results at 3, 6, and 12 months showed no significant differences in improvement of motor function between the two groups.[98] Huang et al. (2018) found insufficient evidence that contralesional priming with 1 Hz rTMS improves ambulatory and other motor functions among patients with a severe leg dysfunction in subacute stroke.[99] Seniow et al. (2012) found that rTMS suppression of the contralesional motor cortex did not augment motor improvements in upper limb hemiparesis.[100] Du et al. (2016) provided low quality evidence for improvement in upper and lower extremity function following rTMS relative to control (sham rTMS).[101]

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed the evidence related to this recommendation and found the confidence in the quality of the evidence to be very low.[98-101] The benefits and harms are balanced, with the most common adverse events being skin irritation and headaches. rTMS for stroke rehabilitation is an emerging technology and additional research is needed to determine if there are effective durations, intensities, dosages, or other aspects of this treatment. In addition, the long-term safety profile of this modality should be further investigated.

c. Pharmacological Treatment in Motor Therapy

Recommendation

20. In patients with motor deficits, there is insufficient evidence to recommend for or against starting a selective serotonin reuptake inhibitor within 30 days of stroke to improve motor recovery and functional outcomes.
    (Neither for nor against | Reviewed, New-added)

Discussion

Selective serotonin reuptake inhibitors (SSRIs) have been studied to try to determine if they improve functional outcomes in patients with recent stroke.[102-105] The Work Group evaluated the available evidence regarding improvement in motor deficits and functional outcomes overall and found mixed results.

One SR of eight RCTs including 1,549 patients found that treatment with SSRIs ≤ 30 days after stroke was associated with improvements in both National Institutes of Health Stroke Scale (NIHSS) scores (p=0.002) and likelihood of functional independence (modified Rankin Scale [mRS] score 0-2, relative risk [RR] = 2.54; p<0.0001) when compared to placebo.[103] Asadollahi et al. (2018) evaluated fluoxetine and citalopram when used in the first 90 days after stroke and found both were associated with improved motor function as measured by the FMA score when compared to placebo (p=0.001).[102] Pan et al. (2018) similarly evaluated paroxetine for 90 days after stroke and showed improved motor function compared to placebo (FMA scores, <0.05).[104]

The above-mentioned studies suggest a benefit to motor and functional outcomes with SSRIs used after stroke, but additional evidence was published in late 2018 challenging these findings. Therefore, a supplemental evidence review was conducted to identify evidence published through December 18, 2018 (see General Criteria for Inclusion in Systematic Review). The only study included in the supplemental evidence review was an RCT published by the FOCUS Trial Collaboration which studied outcomes in over 3,000 patients with recent stroke. Approximately 1,500 patients received fluoxetine and 1,500 patients received placebo.[105] They found no significant differences in functional outcomes at six months (mRS category distributions, p=0.439). This trial was the largest conducted to date on this subject and had greater than 99% follow-up at six months. Interestingly, this study noted a modestly reduced incidence of new depression in patients taking fluoxetine, but this was offset by a near doubling in the risk of fractures when compared to placebo.

Since SSRIs have been used for other indications for many years, their side effect profiles are well understood. In recent years, increased bleeding risk has been shown among patients taking both SSRIs and oral anticoagulants, specifically warfarin.[106] This is of particular relevance in patients with stroke as one of the most common causes of ischemic stroke is atrial fibrillation, which is often best managed with oral anticoagulation to reduce risk of stroke.[5] In a large population-based cohort study (Renoux et al., 2017), patients on SSRIs were matched to control patients and found to have a RR of intracerebral hemorrhage (ICH) of 1.73 when also taking oral anticoagulants.[106] The spontaneous ICH (sICH) risk was found to be higher in the first 30 days of SSRI use (RR = 1.68) or with stronger inhibitors of serotonin reuptake (fluoxetine, paroxetine, and sertraline; RR = 1.25) versus weaker inhibitors. While these findings are statistically significant, the absolute risk of ICH in these patients remained low with an overall ICH rate of

approximately four cases per 100,000 patients per year. Further reducing the applicability of results to today's stroke rehabilitation population, over 90% of the patients on anticoagulation were on warfarin, a drug currently used with declining frequency given that direct-acting oral anticoagulants are readily available with decreased bleeding risk and more standardized dosing regimens.[107] Thus, in patients with motor deficits after stroke who require oral anticoagulation, especially warfarin, it may be reasonable to avoid use of SSRIs unless there is another clinical indication or at least avoid the SSRIs with relatively potent serotonin reuptake inhibition (i.e., fluoxetine, paroxetine, or sertraline).

In addition to the varied quality of evidence for this recommendation, the Work Group considered the importance of motor deficits to patients and providers as well as the reluctance of some individuals to take "anti-depressant" medications, especially in the absence of clear depressive symptoms.

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed the evidence related to this recommendation.[102-105] The Work Group's confidence in the quality of the evidence is moderate, but given conflicting results we are unable to endorse the use of SSRIs for motor or functional outcome gains at this time. Thus, the Work Group decided upon an insufficient evidence recommendation.

Recommendation

21. We recommend botulinum toxin for patients with focal spasticity that is painful, impairs function, reduces the ability to participate in rehabilitation, or compromises proper positioning or skin care. **(Strong for | Not reviewed, Amended)**

Discussion

The use of botulinum toxin has been found to decrease spasticity in patients with a history of stroke.[108-111] Since the publication of the 2010 Stroke Rehabilitation CPG, the use of botulinum toxin for post-stroke spasticity has become standard care. Though new evidence for botulinum toxin was not reviewed specifically for this guideline update, the Work Group determined that botulinum toxin should be recommended for those patients with focal spasticity that is painful, impairs function, reduces the ability to participate in rehabilitation, or compromises proper positioning or skin care. In some patients, however, treatment of focal spasticity may actually worsen function (e.g., a patient who utilizes lower limb extensor spasticity to aid with standing, transfers, or ambulation). Thus, we would not recommend this treatment be used in all patients experiencing post-stroke spasticity.

Aside from some initial injection site discomfort, botulinum toxin injections are felt to have many advantages over medications for spasticity that are taken orally. The advantages include the ability to be placed directly into the muscles affected—allowing for higher dosing without limiting the function of other muscles, long duration of effect (approximately three months), and lack of sedation or other systemic side effects typical of oral anti-spasticity treatments. These advantages make botulinum toxin injections a highly desirable treatment option for both patients post stroke and their providers.

Despite general consistency in the evidence supporting the use of botulinum toxin for post-stroke spasticity, there is some variability in provider and patient preferences regarding this treatment. The patient focus group revealed that it could be burdensome to patients, as it is temporary and requires

repeat injections as often as every three months. Furthermore, there is limited access to this treatment, as there are relatively few providers with adequate training and the treatment is relatively expensive.

As this is a *Not Reviewed, Amended* recommendation, the Work Group did not systematically review new evidence related to this recommendation. Prior evidence cited in the previous version of this guideline remains an acceptable foundation for a strong recommendation.[108-111] The Work Group's confidence in the quality of the evidence is moderate due to potential bias of study authors and the lack of more recent evidence (as this topic was not included in the systematic evidence review conducted as part of this guideline update). Other considerations regarding this recommendation included the expected improvement in motor function, reduced pain, and increased quality of life. These benefits are felt to outweigh the potential costs detailed above. As the use of botulinum toxin for post-stroke spasticity is increasingly common and has the potential to benefit an even greater number of patients with post-stroke spasticity, the Work Group decided upon a "Strong for" recommendation.

Recommendation

22. We suggest offering intrathecal baclofen treatments for patients with severe chronic lower extremity spasticity that cannot be effectively managed by other interventions.
    (Weak for | Not reviewed, Amended)

Discussion

The use of intrathecal baclofen in patients with chronic stroke has been shown to reduce lower extremity spasticity. In the development of the 2010 Stroke Rehabilitation CPG, the Work Group reviewed both a small case series and a small randomized controlled cross-over trial assessing the efficacy of intrathecal baclofen for post-stroke spasticity and determined that this may be a reasonable option for some patients.[112,113] Though additional evidence for intrathecal baclofen was not reviewed for this updated guideline, this Work Group determined that the use of intrathecal baclofen is reasonable in the subgroup of patients for whom oral medications or chemodenervation (i.e., botulinum toxin) are not effective or appropriate. There is a potential for harm associated with baclofen pump use including surgical complications during device implantation or possibly superficial abdominal injury during attempted pump refill. Most concerning is the risk of baclofen withdrawal or overdose due to pump or catheter malfunction, improper refilling of the reservoir, or improper pump programming. Such cases have been reported in the literature and can be life threatening, but are felt to be rare.

This treatment is fairly burdensome to both patients and providers; therefore, patient selection is paramount. Intrathecal baclofen requires the implantation of a baclofen pump—an expensive and invasive procedure. The patient must also undergo subsequent injections through the skin approximately every 3-6 months in order for the pump to be refilled.

As this is a *Not Reviewed, Amended* recommendation, the Work Group did not systematically review new evidence related to this recommendation. Prior evidence cited in the previous version of this guideline remains an acceptable foundation for a weak recommendation.[112,113] The Work Group's confidence in the quality of the evidence is low. The body of previously reviewed evidence had significant limitations due to very small sample sizes. Other considerations regarding this recommendation included the expected benefits of improved motor function and decreased pain in patients otherwise not suitable for oral

treatments and/or chemodenervation. The potential harms of intrathecal baclofen including implantation and/or pump refill complications (which can include a potentially life-threatening withdrawal syndrome) and the need for repeat visits to experienced providers to continue the treatment further limit the strength of this recommendation. Thus, the Work Group decided upon a "Weak for" recommendation and wish to emphasize the consideration of other agents prior to use of intrathecal baclofen.

C. Dysphagia Therapy

Recommendation

23. We suggest offering Shaker or chin tuck against resistance exercises in addition to conventional dysphagia therapy.
    (Weak for | Reviewed, New-replaced)

Discussion

Implementing chin tuck against resistance (CTAR) or Shaker exercises as an adjunct to conventional dysphagia therapy improves oral pharyngeal swallowing in patients with dysphagia following stroke.[114-116] Both techniques involve isometric and isokinetic or isotonic contractions targeting activation of the suprahyoid muscles, which are essential in the swallow mechanism. The CTAR method incorporates resistance training by pressing the chin strongly against an inflatable rubber ball or dedicated device. The Shaker method is performed by raising the head to look at the toes while lying in the supine position.

Three RCTs evaluated CTAR exercises and/or Shaker exercises versus conventional dysphagia therapy alone.[114-116] Conventional dysphagia therapy involved combinations of oral motor exercises, additional swallows, thermal stimulation, and therapeutic or compensatory maneuvers. Dysphagia severity was determined by scores on the Penetration Aspiration Scale (PAS) and the Functional Oral Intake Scale (FOIS). The PAS evaluates the extent of penetration and aspiration, and whether the material entering the airway is expelled.[117,118] The FOIS documents changes in the level and complexity of oral intake for patients following stroke. [117] In patients with subacute or chronic stroke, dysphagia severity was evaluated at baseline and 4-6 weeks after intervention. There was a statistically and clinically significant improvement in PAS scores in all three trials.[114-116] Choi et al. additionally found statistically and clinically significant improvement in FOIS scores in patients treated with Shaker exercises plus conventional dysphagia therapy versus conventional dysphagia therapy alone.[114]

Despite general consistency in the evidence supporting treatment with Shaker and/or CTAR exercises, there is some variability in provider and patient preferences regarding this treatment. Shaker and/or CTAR exercises are not widely practiced in the U.S. by speech-language pathologists. Patients may not tolerate this therapy due to fatigue, neck pain, or abdominal muscle pain. In fact, Choi et al. noted significant attrition due to patient refusal to continue Shaker exercises.[114] Of note, patients with chronic neck pain or a history of neck surgery or tracheostomy are not eligible for these treatments.

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[114-116] The Work Group's confidence in the quality of the evidence is very low. Limitations in the body of evidence included small sample size, lack of allocation concealment, high attrition rate, and unclear blinding of outcome assessors. Patient values and preferences concerning these interventions were somewhat varied. However, the benefits, such as a clinically significant

improvement in oral pharyngeal swallowing, were considered to outweigh the potential harms, which were relatively mild. Thus, the Work Group decided upon a "Weak for" recommendation.

Recommendation

24. We suggest offering expiratory muscle strength training for treatment of dysphagia in patients without a tracheostomy.
    (Weak for | Reviewed, New-replaced)

Discussion

Expiratory muscle strength training (EMST) has been found to improve oral pharyngeal swallowing in patients with a history of stroke.[117,118] The EMST protocol incorporates a pressure release valve device through which a patient forcefully expels air. A successful trial is confirmed when the rush of air can be heard through the EMST device, indicating the pressure release valve opened. EMST targets improvement in a patient's cough response and contraction of the suprahyoid muscles, which play a critical role in airway protection during swallowing.

Two RCTs evaluated improvement in swallow function following 20 sessions of EMST versus a sham device. Outcome measures included PAS and FOIS scores (see Recommendation 23 for description). Park et al. found statistically significant improvement in FOIS scores in favor of the intervention group.[117] Eom et al. (2017) found dysphagia treatment with EMST was associated with significant improvement in PAS scores, demonstrating decreased risk of aspiration.[118] Park et al. (2016) reported consistent results regarding liquids, though they did not find a statistically significant improvement in PAS scores with solids.[117] The noted improvement in PAS scores with liquids may have been associated with improved cough response or activation of suprahyoid contraction. A strong voluntary cough can reduce aspiration by removing foreign materials entering the airway. Physiologically, suprahyoid contraction protects the airway by pulling the hyoid bone and larynx in the necessary anterior and superior directions to promote epiglottic inversion, glottal adduction, and upper esophageal sphincter opening. Park et al. (2016) confirmed via single fiber EMG that EMST effectively activated the suprahyoid musculature.[117]

Despite general consistency in the evidence supporting the use of EMST in treating dysphagia following stroke, there is some variability in patient preferences regarding this treatment. EMST may be burdensome to patients due to the increased respiratory pressure required to perform this intervention. Though resources are required, including equipment and training from a provider, this treatment tool is widely available, relatively inexpensive, portable, and easily implemented via a standard protocol.

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[117,118] The Work Group's confidence in the quality of the evidence is low. Some limitations in the body of evidence confound the analysis, including small sample size, elevated rate of attrition, and unclear allocation concealment.[117] Though the rate of attrition was high due to discharge from the hospital setting, Eom et al. (2017) found no differences between these rates across groups.[118] Other considerations regarding the benefits of this recommendation, such as an increased oral intake and decreased risk of aspiration, outweigh the potential small risk of adverse events. Thus, the Work Group decided upon a "Weak for" recommendation.

Recommendation

25. There is insufficient evidence to recommend for or against tongue to palate resistance training for treatment of dysphagia.
    (Neither for nor against | Reviewed, New-replaced)

Discussion

Tongue to palate resistance training (TPRT) is an exercise performed by pressing the tongue strongly against the palate. Tools objectively measuring lingual strength, such as the Iowa Oral Performance Instrument (IOPI), may be utilized as biofeedback instruments to increase the response specificity of muscle activation and recruitment. The IOPI is a portable pressure sensor consisting of an air-filled bulb, which when compressed, provides visual feedback of pressure generation via a light array.

An RCT by Kim et al. (2017) of 41 patients seen approximately five months following cortical stroke found that TPRT paired with conventional dysphagia therapy is not superior to conventional dysphagia therapy alone.[119] In that study, they initially assessed anterior and posterior lingual contraction using the IOPI and systematically re-calibrated throughout intervention. Both intervention and control groups received conventional dysphagia therapy including thermal tactile stimulation, facial massage, and unspecified maneuvers. The PAS, which scores the depth to which material passes into the airway or is expelled, was used to determine improvement in oral pharyngeal swallowing. No statistically significant differences in PAS scores were identified between the control and intervention groups at one-month follow-up.

TPRT is widely available and easily implemented. Though this intervention has limited risk of adverse effects, evidence indicates some patients have aversion to the tongue bulb due to a hypersensitive gag reflex.[120]

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[119] The Work Group's confidence in the quality of the evidence is low. The body of evidence revealed some limitations including small sample size within a single study, unclear allocation concealment, and undocumented outcome assessor blinding.[119] Patient values and preferences are somewhat varied with TPRT. Additionally, this recommendation considered the balance of potential benefit, which is unproven in this body of evidence, and the minimal risk of harm associated with this intervention. Thus, the Work Group decided there is insufficient evidence to recommend for or against this treatment.

Recommendation

26. There is insufficient evidence to recommend for or against neuromuscular electrical stimulation for treatment of dysphagia.
    (Neither for nor against | Reviewed, New-replaced)

Discussion

In treatment of dysphagia, NMES is a technique involving the application of surface electrodes on the skin overlying submental and laryngeal regions. The premise of surface NMES for the treatment of dysphagia is to elicit the contraction of oropharyngeal musculature and stimulate sensory input for swallowing.[121-124] Despite some evidence supporting NMES as an adjunct for conventional dysphagia therapy, SRs and meta-analyses to date have not demonstrated definitive agreement regarding the treatment efficacy of

NMES. Significant concerns regarding the mechanics of this treatment modality continue to arise. Based on the body of evidence reviewed, there is insufficient information to determine the balance of benefits versus harms.

Numerous studies outside the scope of the evidence review conducted for this CPG describe the harm associated with surface electrical stimulation inaccurately or inadvertently stimulating anatomy that opposes the physiology of safe swallowing.[125-127] Effective swallowing requires suprahyoid muscle contraction to pull the hyoid bone and larynx in superior and anterior directions, which protects the airway and prevents aspiration. Humbert et al. examined physiologic effects of transcutaneous electrodes placed in combinations of submental and laryngeal regions on healthy adults. This study reported the major immediate effect of stimulation at rest was to pull the hyolaryngeal complex downwards without significant horizontal excursion appreciated.[127] When stimulation producing hyoid descent at rest was applied during swallowing, it reduced the extent of laryngeal and hyoid bone elevation. As patients with dysphagia are likely to have compromised hyolaryngeal elevation and excursion, the authors concluded that patients with dysphagia could experience detrimental effects on swallowing with most electrode placements.[127] Additional studies analyzed effects of electrode placement in the laryngeal area. The only infrahyoid muscle to elevate the larynx, the thyrohyoid, is overlain by a larger muscle which interferes with a safe swallow mechanism. Due to the transcutaneous placement of electrodes, the electrical current is greatest in the superficial muscles and correspondingly reduced in the deep muscles. Thus, it is unlikely that the thyrohyoid muscle can be stimulated by surface electrodes without simultaneously stimulating the sternohyoid muscle.[125-127]

Within the body of evidence reviewed, four RCTs studied NMES in patients with dysphagia to determine the potential effects of transcutaneous electrical stimulation in facilitating muscle contraction or increasing sensory input for swallowing.[121-124] In these RCTs, the control group treatment consisted of conventional dysphagia therapy, including postural adjustments, diet modification, thermal-tactile stimulation, oral motor strengthening exercises, and swallowing maneuvers. Dysphagia severity was determined by scores on the PAS, FOIS, and the Dysphagia Outcome and Severity Scale (DOSS). (See Recommendation 23 for description of the PAS and FOIS.) The DOSS evaluates the extent of penetration or aspiration, and the amount of oral pharyngeal retention following each swallow. The Swallowing-Related Quality of Life (SWAL-QOL) Scale was also used to capture qualitative patient ratings in various domains of dysphagia.

Conflicting evidence has been found regarding NMES as an adjunct treatment for dysphagia in patients following stroke. Evidence from one RCT found no statistically significant change in PAS scores in patients completing NMES concurrently with swallow strengthening exercises versus conventional dysphagia therapy following a four-week intervention.[121] Two RCTs found statistically significant improvement in FOIS scores in patients completing NMES with conventional dysphagia therapy versus conventional dysphagia therapy alone following a three-week [122] or four-week [123] intervention. Sproson et al. (2018) reported clinically significant changes in the FOIS in favor of the intervention; however, these changes were not statistically significant.[121] Meng et al. (2018) found significant improvement in DOSS scores in patients completing NMES with conventional dysphagia therapy versus conventional dysphagia therapy alone after a two-week intervention.[124] Though two RCTs identified the SWAL-QOL Scale as an outcome measure, neither demonstrated statistically significant changes between groups.[121,123]

The overall quality of evidence is very low. Serious study limitations were found in all four RCTs including inadequate randomization and unclear descriptions of blinding in the studies. Unblinded researchers or data collectors may be subject to observation bias. Additional limitations included unclear allocation concealment, high attrition rates, heterogeneity of treatment protocols across studies, and baseline characteristic differences between control and intervention groups. Lack of standardized treatment parameters cause significant difficulty in extrapolating definitive insight from the current evidence base regarding NMES.

Clear indications and contra-indications for use of NMES to treat dysphagia have not been determined. Potential adverse effects related to NMES treatment include skin irritation, allergic reaction in the electrode placement area, laryngeal muscle spasms, bradycardia, or fluctuations in blood pressure.[123] A significant number of individuals are not eligible for treatment with NMES, including those with electrically sensitive implanted stimulators (pacemaker or defibrillator), skin lesions or implants containing metal within the area of treatment, history of epilepsy, or spastic paralysis.[123] As providers are required to complete a certification program prior to treating patients with dysphagia using NMES, this may reduce the prevalence of adverse effects patients may experience. However, requirements of certification further limit the feasibility and increase the resource demand of this modality. There is large variation in patient preference and provider acceptability regarding this treatment. Some patients with chronic dysphagia following stroke may be motivated to trial any possible intervention to improve swallow function. However, discomfort associated with this modality may cause other patients to decline use of NMES. Meng et al. observed neck pain and increased coughing at the electrical threshold required to achieve more contraction.[124]

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[121-124] The Work Group's confidence in the quality of the evidence is very low. The body of evidence has severe limitations as previously described.[121-124] Patient values and provider acceptability vary greatly with this treatment modality. An important consideration is the inability to determine a balance of benefits and harms. Thus, the Work Group decided there is insufficient evidence to recommend for or against this treatment.

Recommendation

27. There is insufficient evidence to recommend for or against pharyngeal electrical stimulation for treatment of dysphagia.
    (Neither for nor against | Reviewed, New-replaced)

Discussion

Pharyngeal electrical stimulation (PES) is theorized to improve swallowing function by creating increased sensory input to the swallowing cortex from the cranial nerves innervating the pharynx, thereby driving beneficial neuroplastic changes. PES is an invasive treatment, which involves delivery of stimulation via a nasogastric tube (NGT) housing a pair of electrodes positioned at the mid-pharyngeal level. Of note, this treatment is currently not FDA approved and is only available in the U.S. through clinical trials.

Two RCTs [128,129] and one meta-analysis [130] provided the evidence base for this recommendation. Dysphagia severity was determined by scores on the PAS or the FOIS (see Recommendation 23 for

description). A meta-analysis of three studies with a total of 73 patients within 90 days of stroke onset compared PES versus sham device delivering no stimulation.[130] At two-week follow-up, PES intervention was associated with significantly lower PAS scores, indicating decreased extent of aspiration or penetration. In contrast, in an international RCT, the STEPS trial (Swallowing Treatment Using Pharyngeal Electrical Stimulation), 162 patients were treated within seven weeks of stroke onset with PES versus sham stimulation.[129] No differences were found between PAS scores at two weeks or twelve weeks. The authors noted that 45 patients in the intervention group may have received suboptimal stimulation. An additional RCT by Suntrup et al. (2015) compared PES versus sham device in 30 intensive care unit patients with tracheostomies; no difference was found between groups on the FOIS or in functional status.[128] However, this trial was highly confounded, as after three sessions of the study treatment, those patients continuing to require tube feeding for nutrition were unblinded, and received PES. Significant limitations were present in all three studies.[128-130] One RCT was excluded from the evidence base due to very serious limitations in study design (changes in outcome data collection during the study), and high rates of attrition in both the intervention and control group.[131]

Though all three studies reported no adverse effects directly related to PES treatment, some potential harms need to be considered. Bath et al. (2016) specifically noted investigator concerns about the potential to harm patients with the magnitude of stimulation at the treatment threshold shown to be associated with improvement in aspiration.[129] Suntrup et al. noted that NGTs can cause direct trauma to anatomical structures involved in swallowing.[128] There is likely to be large variability in patient preferences regarding this intervention given the need for a NGT to remain in place for three days, which some patients may not tolerate. Additional factors include the resource use associated with placement of PES catheters, accessibility of provider training for this intervention, and lack of access to this treatment in the U.S. beyond clinical trials.

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[128-130] The Work Group's confidence in the quality of the evidence is very low. Limitations in the body of evidence include high rates of attrition, possible lack of consistency in intervention delivery, incomplete outcome reporting, and unclear outcome assessor blinding.[128-130] Other considerations regarding this recommendation include variable patient/provider acceptability, elevated resource use requirements, and lack of access to the treatment in the U.S. Thus, the Work Group decided there is insufficient evidence to recommend for or against this treatment.

Recommendation

28. In patients with dysphagia in the post-acute phase of stroke who require tube feeding, we suggest offering gastrostomy tube over nasogastric tube for maintenance of optimal nutrition.
(Weak for | Reviewed, New-replaced)

Discussion

Malnutrition is associated with increased mortality, increased length of hospital stay, inability to rehabilitate, and poor functional status among patients with stroke.[132] Dysphagia after stroke affects 27% to 64% of patients, and consequently can lead to increased risk of infection and poor clinical outcomes.[132] In patients with severe post-stroke dysphagia, supplemental nutrition may be given

directly into the stomach through feeding tubes, either via an NGT or percutaneous endoscopic gastrostomy (PEG) tube. Supplemental nutrition given directly into the jejunum is another option to be considered when longer term enteral feeding is expected; however, evidence regarding this route was not reviewed as part of the systematic evidence review carried out for this CPG update. A Cochrane SR and meta-analysis of three studies comprised of 63 patients with subacute stroke (length of hospital stay ranged from 2-3 months) found that compared to NGT, PEG tube placement was associated with significantly increased albumin concentration, indicating improvement in nutritional status.[132] Furthermore, the authors noted that nutritional supplementation was associated with reduced pressure sores, increased energy intake, and increased protein intake.[132]

Though one of the goals of supplemental tube nutrition is to decrease the risk of aspiration in patients with dysphagia, PEG and NGT placement have both been associated with aspiration pneumonia. PEG placement is an invasive procedure and can be complicated by bleeding, local infection, peritonitis, and organ perforation.[132] NGT placement is a relatively low-risk procedure; however, in rare cases it has been associated with hydrothorax, inadvertent intracranial or bronchial insertion, and direct trauma to anatomical structures involved in swallowing including perforation during placement or abscess formation following placement.[132] The risk is amplified if the tube is repeatedly (either inadvertently or purposefully) displaced and requires reinsertion. Brazier et al. (2017) found that securing an NGT using tape was correlated with repeated tube loss, which was associated with clinically significant delays in nutrition, hydration and drug treatments.[133] Results from another study are consistent with this finding.[134] PEG tube placement is more resource intensive, requiring placement by a subspecialty physician in a procedure suite, whereas NGTs can be placed expeditiously by non-physician providers who are properly trained. However, if longer-term feeding is required, PEG feeding provides better nutrition and is more secure than a NGT.[132]

Patient preferences regarding NGT and PEG tube placement vary greatly. Though a PEG tube can be removed once no longer needed, some patients/caregivers delay PEG tube placement due to a sense of permanence and to body image concerns. However, once placed, a PEG tube is generally well tolerated and is considered a relatively low burden of care by most patients and caregivers. In contrast, long-term use of NGTs is often disliked by patients due to discomfort from the tube itself and the need for frequent replacement. Furthermore, a NGT left in place between feedings is more difficult to conceal than a PEG, since it is fixed at the nostril. This sometimes results in patients being apprehensive about interacting in public or with friends/family not familiar with NGTs. From a provider standpoint, PEG tubes are often preferred in order to promote optimal nutrition. Compared with NGT placement, PEG placement demonstrates higher delivery rate and is more secure.[132]

As this is a *Reviewed, New-replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[132] The quality of the evidence is very low due to serious limitations including small sample size, lack of outcome assessor blinding, and lack of reported follow-up intervals.[132] Though patient values and preferences vary greatly, the benefits considered, including improved nutritional status, slightly outweigh the harms associated with PEG versus NGT placement for enteral nutritional support. Thus, the Work Group decided upon a “Weak for” recommendation.

D. Cognitive, Speech, and Sensory Therapy

a. Cognitive Therapy

Recommendation

29. There is insufficient evidence to recommend for or against the use of any specific cognitive rehabilitation methodology or pharmacotherapy to improve cognitive outcomes.
(Neither for nor against | Reviewed, New- replaced)

Discussion

Since the publication of the 2010 Stroke Rehabilitation CPG, there has been very little advancement in the evidence regarding the use of specific cognitive rehabilitation strategies or techniques to improve clinical outcomes following stroke. Only four new studies met inclusion criteria for the evidence review conducted as part of the development of this CPG. The reviewed evidence base consisted of one SR [135] and three RCTs.[136-138] A 2016 SR examined the effectiveness of cognitive rehabilitation to treat memory deficits following stroke.[135] Participants included inpatients and outpatients, evaluating various memory retraining techniques and compensatory strategies delivered in both individual and group formats. At the conclusion of treatment, mild-to-moderate improved memory performance was seen in the experimental group, but these benefits did not persist on follow-up examinations. Similarly, a multi-center RCT (2014) with 153 participants that evaluated the long-term effects of Memory Self Efficacy (a specific type of intervention focused on education, compensatory strategy use, and reduction of interference generated by emotional overlay) demonstrated no statistically significant difference between groups at a 12-month follow-up.[136]

A 2009 RCT examining the effectiveness of Attention Process Training (APT) (a computer-based training program administered in both verbal and visual modalities) did, however, find a statistically significant difference between groups at a six-month follow-up with a large effect size for a primary outcome measure assessing sustained attention skills (Integrated Visual and Auditory-Continuous Performance Task [IVA-CPT] Full Scale Attention Quotient).[137] No statistically significant difference was found on other neurocognitive measures included in this RCT, such as the Trail Making Test (Parts A or B), the Bells Test, or the Paced Auditory Serial Addition Test (PASAT). A 2015 RCT examining the effectiveness of the use of meta-cognitive strategy training (a technique focused on teaching "how" to think about or approach novel tasks in a more efficient way) in the first six months following stroke found a statistically significant difference between groups on a measure of ADL performance (FIM). This same study also found a statistically significant difference in an aspect of executive systems functioning involving the inhibition of an over-learned response, but only when combined with complex switching task demands (Delis–Kaplan Executive Function System Color-Word Switching).[138] It is interesting to note that there was no statistically significant difference between groups on a more "pure" inhibition task assessing the ability to name the discordant color of ink, for example utilizing yellow text to write the word "purple " (Delis–Kaplan Executive Function System Color-Word Inhibition).

Regarding the use of pharmacotherapy to enhance or improve cognitive function, an SR by Mead et al. (2012) failed to show evidence to support the use of SSRIs to improve cognitive function after stroke.[139] An additional RCT by Jorge et al. (2010) similarly failed to show benefit for cognition after stroke with escitalopram (an SSRI).[140] Evaluation of the individual studies included in the SR by Mead et al. reveals

significant variability in both the outcome measures studied and the timing of SSRI use. Additionally, these studies, even collectively, had relatively small sample sizes.

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed evidence related to this recommendation in the evidence review conducted as part of this guideline update.[135-140] Taken as a whole, the overall confidence in the quality of the evidence for the use of any specific cognitive rehabilitation methodology or pharmacotherapy to enhance cognitive performance post stroke is very low, necessitating the statement of insufficient evidence for or against the use of any specific interventions. It is important to highlight that the FOCUS trial did report an increased incidence of bone fractures in patients treated with fluoxetine versus placebo, but this trial did not specifically assess cognition in a direct or precise manner.[105] There were, however, no observed or reported adverse effects with any specific cognitive rehabilitation methodology reported in the studies reviewed. Based on one RCT reporting some support for improved ADL and executive systems functioning, designing similar studies to further examine the effectiveness of metacognitive strategy training may prove helpful and is consistent with the values expressed in the focus group. Further clarification and refinement in this area may be facilitated by developing a consensus in the VA/DoD community regarding the development of a unified "core" testing battery to evaluate functional abilities post stroke.

b. Speech Therapy

Recommendation

30. There is insufficient evidence to recommend for or against the use of intensive language therapy for aphasia.
    (Neither for nor against | Reviewed, New-added)

Discussion

Resuming functional communication following stroke is an important aspect of recovery for many stroke survivors and can directly impact quality of life. Evidence reviewed in development of this recommendation included two RCTs that evaluated outcomes for patients with aphasia who received structured, intensive speech and language therapy.[141,142] In both studies, the intensive speech and language therapy was manual based, but individualized by the therapist and focused on lexical/semantic retrieval and pragmatic skills (the functional use of language in context, involving the combined use of verbal and nonverbal communication). In an RCT by Breitenstein et al. (2017), persons with chronic aphasia were randomly assigned to either three weeks or more of intensive speech and language therapy or three weeks deferral of intensive speech and language therapy. Participants in the treatment group received a minimum of 45 hours of therapy (individual, group, and self-study) over three weeks. Those in the deferral group were permitted to participate in usual care (one hour per week of community-based low-intensity therapy) during the three-week waiting period. The primary endpoint was between-group difference in the change in verbal communication effectiveness in everyday life. Statistically significant improvements on standard measures were seen in the areas of effectiveness of verbal communication, linguistic performance scores, and aphasia-related quality of life.[141] The study by Godecke et al. (2012) in persons with aphasia treated in an acute care facility with an intensive model (150 minutes of therapy over a five-day hospital stay up to a maximum of 1,600 minutes of therapy for the four-week intervention period) found a statistically significant effect of daily treatment for all speech outcomes measured as compared to usual care. Those in the usual care group received one session per week (maximum of 80

minutes per session) for a maximum of four sessions (maximum of 320 minutes of therapy for the four-week intervention period). At the six-month follow-up, communication scores adjusted for initial aphasia severity did not show a statistically significant difference between treatment groups.[142]

There are limitations to the findings from these studies, as treatments were individualized [141,142] and treatment was limited to three weeks [141] or four [142] weeks. The need for patient-specific treatment interventions makes it difficult to perform controlled comparative analysis. Additionally, follow-up longer than six months to evaluate the durability of the outcomes was not reported.

There is some variability in provider and patient preferences regarding intensity of intervention. The patient focus group indicated that consideration of their goals and preferences, including the opportunity to explore all potential treatment options, is paramount. Patients were eager to have access to various rehabilitation treatments and devices that would enhance their function and be individualized to their impairments and needs.

As this is a *Reviewed, New Added* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[141,142] The Work Group's confidence in the quality of the evidence related to intensive language therapy for aphasia was low.[141,142] Additional considerations in development of this recommendation included the potential benefits of intensive language therapy which may advance language outcomes, outweighing any potential harms from the burden of an intensive therapy program. Future research examining the long-term impact of intensive language interventions post stroke would be helpful. Thus, the Work Group decided that there is insufficient evidence to recommend for or against the use of intensive language therapy for aphasia.

For additional aphasia resources, please see Appendix B.

c. Spatial Neglect Therapy

Recommendation

31. There is insufficient evidence to recommend for or against hemi-field eye patching in addition to traditional therapy for patients with unilateral spatial neglect following stroke.
(Neither for nor against | Reviewed, New-replaced)

Discussion

Unilateral spatial neglect (USN) is defined as a failure to report, respond, or orient to novel or meaningful stimuli presented to the side opposite the brain lesion. USN affects two thirds of patients with acute right hemispheric stroke.[143] Because of the profound lack of awareness for the contralesional hemispace, patients with USN are severely functionally impaired. Traditional therapy for USN includes compensatory strategies directed towards the side of the deficit, including verbal cueing, visual scanning, full head turn (proprioceptive), anchoring techniques, limb activation aids and environmental adaptations. Hemi-field eye patching has been used in addition to traditional therapy for patients with USN following stroke.

Hemi-field eye patching may be regarded as a remedial visual-type of constraint-induced (forced use) therapy. For an individual with a right hemisphere stroke resulting in left visual field loss and/or left neglect, typically the right half of eyeglasses are patched with dark non-translucent tape. Hemi-field eye

patching has been suggested to work by reducing stimulation of the left hemisphere, thereby stimulating the right hemisphere and leading to interhemispheric re-balance.[144]

An RCT of 23 patients with USN after acute right hemispheric stroke compared hemi-field eye patching and repetitive optokinetic stimulation (OKS) with no treatment.[143] Patients in the intervention group wore patched non-corrective glasses all day for seven days. Glasses were only removed for daily OKS sessions, which involved 15 minutes of viewing of colored geometric objects moving right to left at varying speeds on a screen. Both groups improved; however, there was no significant difference between groups on the critical outcomes of neuropsychological test batteries, BI, Rankin Scale, or NIHSS score.

An RCT of 35 patients with USN within eight weeks after acute right hemispheric stroke compared hemi-field eye patching and conventional occupational therapy.[145] Control group patients participated in 20 one-hour occupational therapy sessions over the course of one month while the intervention group patients wore right half-field eye patching throughout the same treatment regimen. At discharge, there was no significant difference between groups for the critical outcome of total FIM gain. However, the three FIM categories of eating, bathing, and lower body dressing showed statistically significant improvement in the intervention group when analyzed independently.

Cholinergic agents have been studied for use in spatial neglect; however, evidence was not reviewed or considered as part of the development of this CPG.[146]

There is some variability in provider and patient preferences regarding hemi-field eye patching treatment. Some individuals simply reject hemi-field eye patching treatment due to discomfort. On the other hand, hemi-field eye patching is low cost, instructor led, and reinforced during therapies to improve attention to the neglected side. Hemi-field eye patching can easily be used during ADL training, though providers must be trained regarding proper patch placement; consultation with an eye care practitioner may be needed. The potential benefits of hemi-field eye patching slightly outweigh the harms/burden. Potential harm includes increased fall risk if patients wear patched glasses during dynamic tasks; patched glasses are only recommended for use during static tasks.

As this is a *Reviewed-New replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[143,145] The Work Group's confidence in the quality of evidence is very low. The body of evidence had limitations that included small sample size and lack of blinding of outcome assessors in one trial.[143] Other considerations regarding this recommendation included the balance of benefits, which are unproven, and the potential harms, which are small. Patient values and preferences were somewhat varied. Thus, the Work Group decided upon an insufficient evidence recommendation. In the future, larger scale trials of the use of hemi-field eye patching in USN post-stroke are needed; the use of hemi-field eye patching in chronic stroke also requires more study.

Recommendation

32. Among patients with unilateral spatial neglect, there is insufficient evidence to recommend for or against the use of prisms.
    (Neither for nor against | Reviewed, New-replaced)

Discussion

USN occurs much more frequently with right-sided brain lesions than with left-sided lesions.[147] An important clinical problem for patients with USN is interference with the rehabilitation process by the profound lack of awareness for the contralesional hemispace, which results in poor functional outcome. Prism adaptation (PA) is a treatment used for USN which involves brief, daily visuomotor training sessions while wearing optical prisms. PA realigns the left visual field into attentional focus.

A double-blind RCT of 20 patients with left moderate-to-severe USN at least one month following stroke compared prism intervention with placebo glasses.[148] The prism glasses produced a 10-degree rightward deviation of the visual field. Intervention group patients were exposed to prisms for 6-10 minutes daily for four weeks. All patients performed a rapid finger pointing to visual target task. Although both the intervention and control group improved over time, there was no difference between groups on the outcome measure of FIM at treatment conclusion or at six-month follow-up.

A multi-center double-blind RCT of 38 patients with subacute (within three months) stroke and mild or severe USN compared prism glasses that shifted the visual field 12 degrees to the right (Fresnel prisms) with sham glasses.[147] The patients also performed a pointing task. Prism exposure was 20 minutes twice per day for 10 days. Significant differences were found in total FIM and FIM gains for the mild USN group in post-hoc analyses.

There is some variability in provider and patient preferences regarding PA treatment. Some patients do not tolerate PA due to multiple adverse effects including headache, difficulty with navigation, diplopia, optical glare/aberrations, or visual confusion; headache being most common.[149] A moderate amount of time is needed for training in PA. In addition, PA treatment requires not only the cost of the prism glasses themselves, but also eye specialists with neurological training to prescribe the glasses and a vision therapist to provide treatment. There is limited access to PA treatment, as such specialists/therapists are not available in all areas.

As this is a *Reviewed-New replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[147-149] The Work Group's confidence in the quality of evidence is low. The body of evidence had limitations including small sample size and confounders in the analysis. Other considerations regarding this recommendation included the balance of benefits, which are unproven, and the potential adverse effects, which may be significant for PA treatment.[149] Patient values and preferences were somewhat varied. Thus, the Work Group decided upon an insufficient evidence recommendation. Larger scale trials of the use of PA in patients with USN are needed.

d. Visual Therapy

Recommendation

33. Among patients with hemianopsia, there is insufficient evidence to recommend for or against the use of prisms or visual search training.
(Neither for nor against | Reviewed, New-replaced)

Discussion

Homonymous hemianopsia (HH) is the loss of half of the visual field of both eyes, creating a "blind spot" on the left or right side. Patients with visual field defects may experience bumping into objects and missing visual information on the side of deficit. Visual field defects can significantly impact functional ability and quality of life following stroke. Visual field loss may also impact a patient's ability to participate in rehabilitation and resulting in poor long-term recovery.

Compensatory visual search training and provision of prism glasses are two key interventions commonly used to improve a patient's safety. Compensatory visual search training teaches patients to improve the efficiency of eye and head movements to visually locate an item in the missing hemi-field or blind field. Training can take place in both static and dynamic environments depending on a patient's goal. An example of static training may include visual search training to locate a water glass on the left while seated at a table. Dynamic training may include visual search strategies to locate a wall target or room number on the left side while ambulating. Prisms can be placed on lenses to allow a person to see images from the impaired visual field (blind spot) and direct the image into the healthy visual field (see Recommendation 32 for more information on prisms). Since the images are transposed from the blind hemi-field to the seeing hemi-field, some patients wearing prisms may complain of vertigo or dizziness, especially while ambulating.

A multi-center RCT by Rowe et al. (2017) studied 87 patients with partial or complete HH approximately three months after stroke.[149] This time period was chosen in order to capture patients with non-recovering HH. Patients with ocular motility impairment and/or neglect were excluded from the trial. Interventions included six weeks of therapy with prism glasses, visual search training, or simply information provided about visual impairment after stroke. No difference was found in the outcomes of mobility or quality of life at all follow-up points. Of note, there was a high rate of adverse effects in the prism treatment arm, with 70% of patients experiencing headaches and others experiencing difficulty with navigation, diplopia, optical glare/aberrations, or visual confusion. Adverse events in the visual search training arm were low, consisting of fatigue and headache in a few patients.

There is some variability in provider and patient preferences regarding these treatments for HH. For visual search training, the potential benefits are balanced with patient burden; the training involved only 30 minutes of treatment per day and adverse effects were minimal. For prism therapy, the adverse effects as noted above were quite common, resulting in 80% of patients discontinuing the treatment after the trial, and seemed to outweigh any potential benefits. There is a wide range of acceptance of prism therapy in practice. In addition, prism therapy requires not only the cost of the prism glasses themselves, but also eye specialists with neurological training to prescribe the glasses and a vision therapist to provide treatment. There is limited access to prism therapy, as specialists/therapists are not available in all areas.

As this is a *Reviewed-New replaced* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[149] The Work Group's confidence in the quality of evidence is very low. The body of evidence had limitations including differential attrition across groups and lack of fidelity of treatment. Other considerations regarding this recommendation included the balance of benefits, which are unproven, and the potential adverse effects, which were significant for prism therapy and mild for visual search training. Patient values and preferences were somewhat varied. Thus, the Work Group decided upon an insufficient evidence recommendation. Further research on prism therapy and visual search training for the treatment of HH after stroke with larger sample sizes is recommended.

E. Mental Health Therapy

a. Prevention of Post-Stroke Depression

Recommendation

34. For the prevention of post-stroke depression, there is insufficient evidence for or against the universal use of selective serotonin reuptake inhibitor or a serotonin norepinephrine reuptake inhibitor due to the risk of fractures.
    (Neither for nor against | Reviewed, New-added)

Discussion

The evidence reviewed by the Work Group provided mixed results regarding the use of an SSRI or a serotonin norepinephrine reuptake inhibitor (SNRI) for the prevention of post-stroke depression. Although the majority of studies showed a positive prophylactic effect, evidence regarding adverse effects generated caution regarding use of these medications for prevention of depression in all patients with stroke.

Salter et al. (2013) conducted a large SR and meta-analysis to investigate the impact of pharmacological treatment in the prevention of post-stroke depression.[150] The meta-analysis included eight RCTs with 776 participants. Seven out of eight studies compared pharmacotherapy to placebo and used standardized interview or valid depression rating scales to determine presence/absence of depression. Individuals were excluded if they had diagnosable depression at baseline. Five trials examined the use of SSRIs (fluoxetine, sertraline, escitalopram); the remaining trials studied antidepressants in different classes (mirtazapine, mianserin, milnacipran). Pooled analysis revealed a significantly reduced risk for depression associated with pharmacological therapy overall. There was a wide range of time since stroke (less than one month in six of eight studies), and duration of treatment was one year in 63% of the studies (range of three months to one year). Pooled analysis of studies by class of antidepressant demonstrated that SSRIs were associated with a reduction in the risk of post-stroke depression. Four of the studies of SSRIs systematically assessed adverse effects; the most commonly reported side effects were fatigue, dizziness, and gastrointestinal upset (e.g., nausea, diarrhea). One study reported that patients receiving sertraline experienced significantly more tremors and agitation compared to patients receiving placebo. The overall quality rating of the meta-analysis was fair, and generalizability may be decreased as individuals with aphasia and significant cognitive impairment were excluded.

Zhang et al. (2013) conducted an RCT with 118 patients to examine the preventative effects of three months of therapy with duloxetine on post-stroke depression.[151] The control group received standard

care but no placebo drug. Incidence of minor and major depression was significantly lower in the duloxetine group. The lack of patient blinding and the lack of reporting on randomization procedures and allocation concealment led to a poor quality rating and limited the interpretation of these results.

Kim et al. (2017) conducted a large (n=478) multi-center, double-blind, randomized, placebo-controlled study of the efficacy of early administration of escitalopram on depressive, emotional, and neurological symptoms post stroke.[152] Inclusion criteria consisted of individuals who had an acute stroke or intracerebral hemorrhage within the previous 21 days and had a modified Rankin Scale score ≥2 (at least slightly disabled). Depression was measured with the Montgomery-Asberg Depression Rating Scale (MADRS). Treatment duration was three months. Results indicated that the proportion of patients with moderate-to-severe depression at three months did not differ between the treatment and placebo groups, both in the full analysis and in the intention-to-treat groups. MADRS scores decreased over time in both the treatment and control groups. No differences were found between groups in secondary outcomes, including health-related quality of life and motor dysfunction. The most common side effects reported across groups were constipation, dizziness, insomnia, and muscle pain; however, there were no significant differences in adverse effects between groups, except for diarrhea, which was more common in the escitalopram group. This study was confounded, as greater than one half of the study sample reported at least mild depressive symptoms on the MADRS at baseline, even though patients with a diagnosis of depression prior to the index stroke were excluded. The quality of the study was rated as good due to the inclusion of information on randomization and allocation procedures, blinding of patients and outcome assessors, and no significant attrition.

Although not a direct investigation of prevention of post-stroke depression, a recent study that examined the effects of fluoxetine on motor function in acute stroke provided systematic data on adverse effects that are relevant to this topic. In a multi-center, double-blind, randomized placebo-controlled study, the FOCUS Trial Collaboration (2018) compared use of fluoxetine versus placebo for six months in 3,127 patients with persisting focal neurological impairments, recruited 2-15 days post stroke.[105] Although the primary outcome was motor function, secondary outcome measures of mood indicated that patients who received fluoxetine were significantly less likely to develop new depression at six months compared to those who received placebo (13.43% versus 17.21%, respectively). However, there was an increased risk of bone fractures seen in patients who received fluoxetine compared to those who received placebo (difference between treatment and placebo group 1.41%, confidence interval [CI] 0.38-2.43, p=0.007). There were no significant differences between groups on other measures of adverse effects. The quality of the evidence was moderate for the six-month mood outcomes; however, there was no psychiatric assessment at baseline or follow-up.

Depression is common after stroke (approximately 30% incidence rate) and is associated with increased rates of disability and mortality.[153,154] Thus, prevention and treatment efforts are important. While three of the four studies showed positive preventive effects,[119,150,151] the FOCUS Trial found an increased risk of bone fractures in patients receiving six months of fluoxetine.[105] In addition to the FOCUS Trial, a cohort study (outside the scope of the evidence review conducted for this CPG update) by Coupland et al. (2011) found that SSRI use in patients age 65 and older was associated with significantly higher rates of serious fractures (hazard ratio 1.58; 95% CI: 1.48-1.68) at 10-year follow-up.[155] While these results may not extrapolate to all SSRIs, the increased risk of bone fractures may offset the benefits

of universally prescribing SSRIs for all patients with stroke to prevent post-stroke depression. For patients with stroke and a history and/or signs of depression, the risk-benefit ratio may shift in favor of prophylactic treatment. Other potentially significant adverse effects in the stroke population include bleeding, such as intracranial bleeding and gastrointestinal bleeding, as well as falls, stroke, seizures, and hyponatremia. Less serious side effects of SSRIs include insomnia (most prominent with fluoxetine), anxiety (most prominent with fluoxetine), diarrhea, nausea, anorexia, dry mouth, sexual dysfunction, and possible prolongation of the QTc interval (the heart rate's corrected time interval from the start of the Q wave to the end of the T wave).[156] In general the probability of these adverse effects is small but must be considered in each individual patient and weighed against the risks of untreated depression, which results in increased disability and death in individuals with stroke. Additional information on SSRIs is included in the VA/DoD CPG for Management of Major Depressive Disorder [VA/DoD MDD CPG].[6] We are not including tricyclic antidepressants (TCAs) in our recommendation since the VA/DoD MDD CPG[6] cautions against using TCAs as a first-line treatment of depression due to the side-effect profile.

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed the evidence related to this recommendation.[105,119,150,151] The Work Group's confidence in the quality of the evidence is low due to the methodological limitations noted above. There is large variation in patient values and preferences for initiating an SSRI or SNRI, particularly in the absence of depression symptoms and for an extended period of time (up to one year in Salter et al. [2013] [150]). Benefits and potential harms are balanced, when considering the potential adverse effects for the estimated 70% of patients with stroke taking prophylactic medication who might never have developed depression. Based on these factors, the Work Group decided on an insufficient evidence recommendation of the use of SSRIs/SNRIs for the prevention of post-stroke depression.

b. Treatment of Post-Stroke Depression

Recommendation

35. We suggest offering a selective serotonin reuptake inhibitor or a serotonin norepinephrine reuptake inhibitor for treatment of post-stroke depression.
    (Weak for | Reviewed, New-replaced)

Discussion

A network meta-analysis by Deng et al. (2018) consisted of 15 RCTs with 876 participants with post-stroke depression according to Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria or scores on the Hamilton Depression Rating Scale (HAMD).[157] Participants had diagnosed ischemic or hemorrhagic stroke. Age ranged from 51 to 76 years and approximately half of the sample population was female. Baseline severity of depression ranged from mild-to-severe (mean baseline HAMD range: 13.9-32.8). Median treatment duration was eight weeks, with a range of 4-16 weeks. The primary outcome was mean difference in HAMD scores after completion of treatment. All antidepressants were directly compared to at least one other active drug and eight antidepressants had at least one placebo-controlled comparison. All of the SSRIs that were compared to placebo (paroxetine, citalopram and fluoxetine) were effective in

[6] See the VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder. Available at: https://www.healthquality.va.gov/guidelines/MH/mdd/

reducing the symptoms of depression. There were no significant differences in any of the head-to-head antidepressant comparisons, which included SSRIs (citalopram, fluoxetine, paroxetine, sertraline), SNRIs (duloxetine, venlafaxine), norepinephrine reuptake inhibitors (reboxetine), and TCAs (imipramine, desipramine, nortriptyline, clomipramine). We are not including TCAs in our recommendation since the VA/DoD MDD CPG[7] cautions against using TCAs as a first-line treatment of depression due to the side-effect profile. Of note, there was one study in the network meta-analysis that showed treatment with duloxetine had a significantly greater reduction in depressive symptoms compared to citalopram and sertraline at four weeks, but all three drugs showed equivalent efficacy at eight-week and 12-week follow-up. Although effect sizes were large, confidence in the quality of studies within the meta-analysis was low due to problems with precision and directness. Variable participant and study characteristics (e.g., age, time since stroke, medication dosages, relatively small sample size of some trials), as well as retrieval methodology (e.g., only studies that used the HAMD) may have introduced bias.

The potential benefits of SSRIs/SNRIs must be balanced with the potential harms. Common side effects of these medications include drowsiness, dry mouth, diarrhea, nausea, restlessness, dizziness, headache, and reduced sexual desire or function. In a recent, large-scale study in the stroke population, an additional side effect was identified. The FOCUS Trial Collaboration (2018) examined the effects of six months of fluoxetine (versus placebo) on functional outcomes in 3,127 acute stroke patients with persisting focal neurological impairments.[105] Secondary outcome measures of mood demonstrated a modestly reduced incidence of new depression in patients taking fluoxetine; however, the risk of bone fractures in the fluoxetine group nearly doubled (difference between treatment and placebo group 1.41%, CI 0.38-2.43, p=0.007). Although the absolute number of individuals affected may be small, the potential risk must be considered in each case and weighed against the risks of untreated depression, which is associated with increased disability and death in individuals with stroke.[154] Additional information on SSRIs/SNRIs can be found in the VA/DoD MDD CPG.[8]

As this is a *Reviewed, New-Replaced* recommendation, the Work Group systematically reviewed the evidence related to this recommendation.[105,157] The Work Group's confidence in the quality of the evidence is low. The body of evidence had some limitations, as described above. Other considerations regarding this recommendation included the benefits, such as improvement in depressive symptoms, outweighing the potential harms. Patient values and preferences were somewhat varied. Thus, the Work Group decided on a "Weak for" recommendation.

[7] See the VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder. Available at: https://www.healthquality.va.gov/guidelines/MH/mdd/

[8] See the VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder. Available at: https://www.healthquality.va.gov/guidelines/MH/mdd/

Recommendation

36. We suggest offering cognitive behavioral therapy for treatment of post-stroke depression. **(Weak for | Reviewed, New-added)**

Discussion

Post-stroke depression might include new-onset of depression or worsening of pre-existing depression. In the general population there is evidence of the effectiveness of a variety of psychotherapeutic interventions for the treatment of depression (e.g., behavioral therapy/behavioral activation, cognitive behavioral therapy [CBT], acceptance and commitment therapy, interpersonal therapy, mindfulness-based cognitive therapy; see the VA/DoD MDD CPG).[9] The research literature on the psychotherapeutic treatment of post-stroke depression, however, is limited. Despite using broad search terms (e.g., "psychotherapy") in our systematic review, CBT was the only type of psychotherapy that yielded evidence for use with the stroke population. A few additional RCT's were identified, however they were excluded for a number of reasons. Fang et al. (2017) examined an investigator-developed treatment,[158] Peng et al. (2015) examined neurolinguistic programming, which lacks a scientific evidence base,[159] and Wichowicz et al. (2017) excluded individuals over the age of 65 and thus was not representative of the stroke population.[160]

CBT is a short-term, structured form of psychotherapy that focuses on solving current problems by teaching patients to identify, challenge, and change unhelpful thoughts and patterns of behavior. It is a collaborative approach aimed at developing and practicing problem-solving and coping skills. A meta-analysis by Wang et al. (2018) of 23 RCTs including 1,972 participants with post-stroke depression demonstrated that CBT alone (compared to attention control or standard rehabilitation) or CBT in combination with an antidepressant (versus antidepressant alone) significantly reduced symptoms of depression. Patients treated with CBT also demonstrated significantly greater remission and response rates. Median treatment duration was eight weeks (range 3–40 weeks), and median number of CBT sessions was 14.3 (range 3–40).[161]

Despite the large positive effect of CBT noted in this meta-analysis, the quality of the included studies limits the conclusions that can be drawn from the results. Sixty percent (14/23) of the RCTs within this meta-analysis were rated as low quality due to lack of adequate information on randomization procedures and blinding, as well as low compliance with the intervention and high attrition rates. There was significant heterogeneity of results. Twenty-one of the 23 studies in the Wang et al. SR were conducted in China with an open label design (with the exception of one double-blinded study), which introduces an inherent risk of bias and concerns about generalizability to U.S. patients. The remaining two studies in the Wang et al. SR were of higher methodological quality (single-blinded trials conducted in the United Kingdom and the Netherlands) and had nonsignificant results. Generalizability is limited by the exclusion of patients with common stroke sequelae such as aphasia and significant cognitive impairments. Finally, the wide range of

[9] See the VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder. Available at: https://www.healthquality.va.gov/guidelines/MH/mdd/

treatment duration (3-40 weeks), makes it difficult to determine the long-term effectiveness of CBT in the stroke population.

Given the relatively large overall benefit of CBT on decreasing symptoms of post-stroke depression and the low risk of CBT, particularly in comparison to the potential risks of pharmacotherapy in the elderly or the risks of untreated depression, the benefits of CBT likely outweigh the harms.

Despite general consistency in the evidence supporting CBT, there is some variability in provider and patient preferences regarding this treatment. Some patients wish to avoid the stigma of a mental health diagnosis and may not accept CBT. Other patients may not be willing to commit the time and effort that CBT requires (homework assignments, practice, introspection). Although stroke-related cognitive linguistic impairments may impede engagement in psychotherapy, CBT is well suited for adaptation and utilizes methods that support involvement for those with cognitive challenges. The present-focused approach of CBT and its organized structure with worksheets and other concrete methods make it appropriate for many patients with stroke. CBT is administered by a licensed mental health practitioner and, when conducted in a one-on-one setting, can be somewhat resource intensive. Evidence on other modalities that can be used for CBT, such as group CBT, was not identified in the evidence review. CBT is a widely available form of treatment for depression, and is generally well regarded among medical care providers.

As this is a *Reviewed, New-Added* recommendation, the Work Group systematically reviewed the evidence related to this recommendation.[161] The Work Group's confidence in the quality of the evidence is low due to the limitations noted above.[161] Other considerations regarding this recommendation included the benefits, including reduction in depressive symptoms, outweighing the potential harm of adverse events, which was small. Thus, the Work Group decided upon a "Weak for" recommendation.

Future research on the effect of CBT on post-stroke depressive symptoms should include high-quality methodology, including adequate randomization, blinding, and close monitoring of adherence to the treatment regimen.

Recommendation

37. There is insufficient evidence to recommend for or against treatment with a combination of pharmacotherapy (selective serotonin reuptake inhibitor/serotonin norepinephrine reuptake inhibitor) and psychotherapy (cognitive behavioral therapy) for treatment of post-stroke depression.
    (Neither for nor against | Reviewed, New-added)

Discussion

Wang et al. (2018) conducted an SR of the effectiveness of SSRI or SNRI treatment in combination with CBT versus antidepressant alone.[161] The evidence base consisted of 14 trials including over 1,000 patients diagnosed with post-stroke depression. Mean age of patients ranged from 48 to 68 years. Median treatment duration was eight weeks (range 3-40 weeks). Mean number of CBT sessions was 14 (range 3-40 sessions). Critical outcomes included mean change in HAMD or other validated measures of depression. Follow-up ranged from 2-292 weeks. Results indicated that the combination of CBT with SSRI/SNRI was not superior to SSRI/SSNRI therapy alone. Adverse events were not reported in this SR.[161]

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[161] The Work Group's confidence in the quality of evidence is low due to limitations including in adequate information provided regarding randomization procedures, blinding of participants, study personnel, and outcome assessors, as well as low compliance with intervention and high drop-out rates.[161] Other considerations regarding this recommendation include the benefits, such as reduction in depressive symptoms, outweighing the potential harm of adverse events, which was small. Patient values and preferences were somewhat varied. Thus, the Work Group decided upon a "Neither for nor against" recommendation regarding combination treatment with an SSRI/SNRI and CBT.

c. Treatment of Post-Stroke Anxiety

Recommendation

38. There is insufficient evidence to recommend for or against pharmacotherapy or psychotherapy for the treatment of post-stroke anxiety.
    (Neither for nor against | Reviewed, New-added)

Discussion

Although providers should treat anxiety for patients following stroke, there is insufficient evidence regarding the most effective treatment in the post-stroke population specifically. Chun et al. (2018) conducted an SR/meta-analysis of three RCTs which investigated the effect of pharmacotherapy interventions for post-stroke anxiety.[162] Trials that exclusively recruited Veterans were excluded from the review. In all, 265 patients with stroke and anxiety disorder or anxiety symptoms were studied, although one trial did not specify a baseline anxiety level for inclusion. Two trials studied patients with "mixed anxiety and depression" and one study did not specify anxiety disorder/type targeted. The age range of patients was 57 to 64 years; 26-48% were female. Time since stroke was not specified in two studies and the remaining trial included patients three weeks post stroke. Patients with cognitive impairment/aphasia were excluded from two of the trials. Two studies compared paroxetine versus routine care (one of these also compared imipramine versus routine care), and one study compared buspirone versus routine care. The routine care intervention was not described. Treatment duration with paroxetine ranged from 6-12 weeks; treatment with imipramine was for 12 weeks; and treatment with buspirone was for two weeks. Mean change in the Hamilton Anxiety Rating Scale (HAMA) was measured at the end of the intervention. The meta-analysis showed a significant reduction in scores on measures of anxiety.

The authors rated the quality of the included RCTs as low, due to unclear or high risk of bias in all of the following areas: reporting on random sequence generation and allocation concealment, lack of blinding of participants/clinicians, and unclear or lack of blinding of outcome assessors.

Of note, as stated in the VA/DoD MDD CPG,[10] TCAs, such as imipramine, are not recommended as first-line agents due to their intolerability, adverse effects, and safety profile. Thus, the Work Group is not including TCAs in our recommendations.

[10] See the VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder. Available at: https://www.healthquality.va.gov/guidelines/MH/mdd/

Although adverse effects were not reported in this SR/meta-analysis, the potential benefits of SSRI therapy (such as paroxetine) must be balanced with the potential harms (e.g., increased risk of bone fractures [105]), especially in the stroke population, which is largely comprised of older individuals. A detailed discussion of the known adverse events associated with the use of SSRIs in the general population and among patients with stroke is provided in Recommendation 20 and Recommendation 34 and applies to the evaluation of the benefit and risk balance among patients with post-stroke anxiety. In general, the probability of these adverse effects is small but must be considered in each case and weighed against the risks of untreated anxiety, which may impede therapy progress and cause patient distress. Regarding buspirone, the most common adverse effects include dizziness, nausea, and headache.

Chun et al. also examined the efficacy of psychotherapeutic interventions for post-stroke anxiety.[162] Age ranged from 57-64 years and included 281 individuals (148 intervention, 133 control). Participants had either anxiety, mixed anxiety and depression, or "emotional distress" which consisted of anxiety and/or depression. The intervention outcome was measured by a variety of standardized measures of anxiety. Six studies provided eight comparisons. Three of the comparisons were based on studies with a mixed sample of individuals with stroke or TBI. Chun et al. expanded the SR inclusion criteria to allow studies with TBI as there were not enough studies on anxiety treatment exclusively in the stroke population. A meta-analysis was performed on five studies with similar types of intervention and demonstrated an overall positive effect of psychotherapy intervention. Seventy percent of the patients in the meta-analysis came from one study in which the intervention was broadly described as "psychotherapy" delivered in 20-30 minute sessions. One of the three studies that were not included in the meta-analysis showed a positive effect of a "problem solving" intervention verses placebo pill; the other two studies did not show significance between intervention ("coping skills" delivered by a psychologist or "self-management" delivered by an occupational therapist) and usual multidisciplinary rehabilitation.

Chun et al. concluded that the results do not provide definitive evidence on the efficacy of interventions for anxiety due to poor study quality and small sample sizes. The mixed samples that include individuals with TBI, as well as samples that are not anxiety specific, are problematic in determining the effectiveness of treatment for post-stroke anxiety. The lack of clarity on the type of psychotherapeutic intervention is also problematic, as the majority of individuals were from a study that described the intervention as "psychotherapy." Although many of the studies appear to have included some psychoeducation and skill building, the exact nature of the intervention is unclear.

Four additional psychotherapy studies were identified during the systematic evidence review conducted as part of this guideline update.[158-161] However, they were not considered in the development of this recommendation, as the interventions were not clearly defined (see Recommendation 35 for additional information).

Patient values and preferences are expected to vary, as some may wish to avoid the stigma of a mental health diagnosis, and some may not accept medication or wish to engage in psychotherapy.

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed evidence related to this recommendation.[105,162] The Work Group's confidence in the quality of the evidence for the use of pharmacotherapy or psychotherapy for the treatment of post-stroke anxiety is very low, given the limitations detailed above. Other considerations regarding this recommendation included limited

generalizability of the results, including exclusion of studies with exclusively Veteran populations and exclusion of patients with cognitive impairment or aphasia. In addition, study populations were not clearly defined with the majority of study subjects showing symptoms of both depression and anxiety. Furthermore, the psychotherapeutic interventions were not clearly defined. The potential benefits of pharmacotherapy must be balanced with the potential harm, including potential risk of bone fractures with use of SSRIs. Regarding psychotherapy, although there is little evidence in the stroke population of benefit, potential harm is minimal. Patient values and preferences were somewhat varied. Thus, the Work Group decided upon an insufficient evidence recommendation.

d. Adjunctive Treatment

Recommendation

39. We suggest offering exercise as adjunctive treatment for post-stroke depression or anxiety symptoms.
    (Weak for | Reviewed, New-replaced)

Discussion

Improvement in depression/anxiety symptoms is a critical outcome for patients post stroke. Exercise has been found to improve depression and anxiety symptoms in patients with a history of stroke.[163,164] A SR and meta-analysis of 13 RCTs conducted by Eng et al. (2014) showed various exercise interventions resulted in a small reduction in depression symptoms in patients post-stroke. Of note, 10 of the 13 studies that completed a follow-up evaluation of depression symptoms after the initial intervention was completed (from 10 weeks to nine months) found no lasting benefits.[164]

The study by Eng at et al. included 1,022 patients with subacute stroke (less than or equal to six months since stroke onset) and chronic stroke (greater than six months since stroke onset) who reported symptoms of depression. Patient symptoms were assessed using a variety of depression scales (Hospital Anxiety and Depression Scale, Brief Depression Scale, Geriatric Depression Scale, and the Centre for Epidemiology Scale for Depression). The duration of treatment was 4-12 weeks with a minimum of 2-3 sessions per week. Physical activity included various interventions, including "progressive resistance training, functional training, aerobic exercises, treadmill exercises, Bobath exercises, individualized exercises with education, and community-based rehabilitation services including physical therapy and occupational therapy."[164] Control groups received a variety of interventions including standard care, attention control, waitlist, phone calls, group education, and no treatment. Overall, the studies showed a statistically significant reduction in symptoms of depression immediately following an exercise program.

One RCT by Aidar et al. (2018) showed a small reduction in depression and anxiety symptoms after a three-month aquatic therapy intervention in patients with a history of stroke.[163] The effect of aquatic exercise for patients with depression and anxiety post ischemic stroke with hemiplegia or hemiparesis was studied and compared to a control group that received no intervention. Depression and anxiety symptoms were evaluated using the BDI and the State-Trait Anxiety Inventory (STAI I and II), respectively. The exercise group received 45-60 minutes of a combination of dry land and aquatic exercises twice weekly for 12 weeks. The intervention group had a statistically significant decrease in depression/anxiety symptoms, as measured by the BDI and the STAI I and II, whereas no change was found in the control group.

Despite general consistency in the evidence supporting a small benefit of physical activity for the treatment of post-stroke anxiety and depression, there is some variability in patient and provider preferences regarding this treatment. Some patients simply dislike exercise. Some interventions may require additional resources and training on the part of the provider to address the specific and unique needs of the patient. Overall, the Work Group considered the balance of the desirable outcomes and it was determined that the benefits of exercise outweigh the harms/burdens.

The quality rating of the Eng et al. SR was fair due to lack of intention-to-treat analysis (three studies), lack of blinding outcome assessors (six studies), and attrition (four studies).[164] There is a risk of bias in the Aidar et al. (2018) study due to lack of reporting about blinding of outcome assessors, allocation concealment, and no intention-to-treat analysis.[163] For the outcome of change in depression and anxiety symptoms, interpretation of study results was limited by methodological limitations, including serious risk of bias, serious inconsistency, indirectness, and imprecision.

The Work Group also reviewed the VA/DoD MDD CPG[11] and noted the following recommendation from that publication: "For patients with MDD, we suggest offering patient education on the benefits of exercise as an adjunct to other evidence-based treatments for depression or as monotherapy when patients are unwilling or unable to engage in first-line evidence-based psychotherapy or pharmacotherapy."

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed evidence related to this recommendation in the evidence review conducted as part of this guideline update.[163,164] The Work Group determined the confidence in the quality of evidence was very low. The body of evidence had some limitations, including small sample sizes and confounders in the analysis.[163,164] Other considerations regarding this recommendation included the well-studied benefits of physical activity on general health, outweighing the potential harm of adverse events, which is small. Physical restrictions and limitations due to medical conditions should be observed to minimize any potential harm, and a method to accomplish this goal is a formal exercise prescription detailing the type (aerobic, anaerobic, progressive resistive or maintenance), intensity, frequency, duration, special restrictions or instructions, and follow-up. The benefits may be more far reaching than just improvement of anxiety and depression in this population. Patient values and preferences were somewhat varied. Thus, the Work Group decided upon a "Weak for" recommendation.

Recommendation

40. We suggest offering mind-body exercise (e.g., tai chi, yoga, qigong) as adjunctive treatment for post-stroke depression or anxiety symptoms.
    (Weak for | Reviewed, New-added)

Discussion

This recommendation focused on the specific mind-body exercises of tai chi, yoga, and qigong. These are all types of movement exercise that combine breathing and meditation techniques to promote and

[11] See the VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder. Available at: https://www.healthquality.va.gov/guidelines/MH/mdd/

maintain health and relaxation. The evidence review did not include search terms for other types of mind-body approaches.

Evidence from two SRs on the effects of mind-body exercises (which included studies on tai chi, yoga, and qigong) on mood and functional capabilities in patients with stroke was considered in the development of this recommendation.[162,165] One SR included 16 RCTs with 1,136 patients with post-stroke depression or anxiety symptoms. The intervention groups received self-practiced, group-based, or mixed-method tai chi, yoga, or qigong exercises in addition to standard care, while the control groups received standard care alone.[165] The duration of treatment was 4-12 weeks with at least two sessions per week. Outcomes were mean changes in several depression and anxiety rating scales (HAMD, Geriatric Depression Scale-Short Form, STAI, Center for Epidemiologic Studies Depression Scale [CES-D]) and other validated measures of ADLs. Timing of follow-up ranged from four weeks to nine months. There was an overall statistically significant reduction in depression and anxiety symptoms as well as overall improvement in ADLs and mobility. This study found no effect on sleep quality. Another SR included 14 RCTs.[162] However, only two RCTs with a total of 40 patients with post-stroke anxiety disorder/symptoms focused specifically on an exercise intervention. In one study, the intervention group received yoga plus exercise while the control group received exercise alone. In the other study, the intervention group received resistance training while the control group received standard care. The results were not statistically significant.

The benefits of this recommendation outweigh the harms/burdens, which would be expected to be minimal in this low impact form of exercise, particularly after adaptation of these interventions for individuals with stroke.

There may be some variation in patient preferences for this type of exercise/physical activity, as some patients simply may not enjoy a mind-body approach. Some interventions may require additional resources and training on the part of the provider to address the specific and unique needs of the patient. Future research is recommended on the benefits of these interventions on patients with stroke and depression and anxiety symptoms, particularly in Western cultures.

It should also be noted that the VA/DoD MDD CPG[12] includes the following recommendation: “For patients with MDD, there is insufficient evidence to recommend for or against tai chi, yoga, qigong either as monotherapy or as an adjunctive treatment to pharmacotherapy.”

As this is a *Reviewed, New-added* recommendation, the Work Group systematically reviewed evidence related to this recommendation in the evidence review conducted as part of this guideline update.[162,165] The Work Group determined the confidence in the quality of evidence was very low. However, the risk for harm was judged to be minimal, and there was some evidence for benefit. It is noted that since most studies were conducted in an Asian population, it is unknown whether the results are generalizable to other, non-Asian populations.[162] Limitations of the studies included lack of adequate blinding [162,165] and high attrition rates.[162] One study specifically excluded Veteran participants and results were not statistically significant.[162]

[12] See the VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder. Available at: https://www.healthquality.va.gov/guidelines/MH/mdd/

Overall, the Work Group determined that the benefits of tai chi, yoga, and qigong may be more far reaching than just on the improvement of anxiety and depression and may foster enhanced stress management skills in addition to other overall health improvements from exercise across the patient's life span. Thus, the Work Group decided upon a "Weak for" recommendation.

F. Other Functions

Recommendation

41. There is insufficient evidence to recommend for or against any specific assessments or interventions regarding return to work.
    (Neither for nor against | Reviewed, Amended)

Discussion

Work has long been thought to be beneficial to the overall psychological well-being of individuals who have experienced a stroke and return to work is a frequent goal. The best approach to achieving that goal, however, has been the focus of limited research. It is thought that there may be long-term improved cognitive status after stroke by returning to work. Unfortunately, no studies examining the effectiveness of vocational rehabilitation assessment or interventions to support return to work for individuals with stroke met inclusion criteria for the systematic review conducted as part of this CPG update. Additionally, to date, there has been no comprehensive review of the barriers to engagement in vocational rehabilitation for individuals with stroke. Potential barriers include the frequent absence of vocational rehabilitation from the inpatient rehabilitation and discharge process, as well as the paucity of referrals for vocational rehabilitation assistance post-discharge.

The 2010 Stroke Rehabilitation CPG recommendations related to returning to work were supported by publications from other organizations.[32,166] Additional studies identified outside the scope of the SR conducted as part of this CPG update seem to suggest that stroke survivors may benefit from vocational rehabilitation services. Sinclair et al. (2014) found that vocational rehabilitation as part of a multi-disciplinary team was associated with improvements in return to work and stability in the workplace post stroke.[167] Early and ongoing collaboration with the vocational rehabilitation team reduced the potential of the patient returning home with suboptimal support and enhanced the potential of returning to a productive work setting. Morris et al. (2011) suggests that the singular lack of vocational rehabilitation within existing stroke rehabilitation services highlights the urgent need for research to facilitate return to work for individuals who have experienced stroke.[168]

In general, there is a lack of evidence examining effectiveness of interventions, including vocational rehabilitation services, in improving the likelihood of returning to work. In addition, there are multiple barriers to the provision of services. Vocational rehabilitation is not often a part of the inpatient or discharge process, and involvement by vocational rehabilitation in the interdisciplinary team is infrequent. Patients are rarely referred for assistance post discharge. Work has long been thought to be beneficial cognitively, emotionally, and psychologically for individuals who have experienced a stroke, and return to work is a frequent goal; however, the best approach to achieving that goal has been the focus of limited research. Although the evidence is insufficient to make a specific recommendation, usual practice suggests that an interdisciplinary approach, including vocational rehabilitation, with subsequent follow-up may improve outcomes.

As this is a *Reviewed, Amended* recommendation, the Work Group systematically reviewed evidence related to this recommendation; however, no new evidence that met inclusion criteria for the evidence review conducted as part of this CPG update was identified. Therefore, this recommendation is primarily based on publications from other organizations that were used to support the relevant recommendations in the 2010 Stroke Rehabilitation CPG.[32,166]

Recommendation

42. There is insufficient evidence to recommend for or against using any specific assessments or interventions to facilitate return to driving.
    (Neither for nor against | Reviewed, Amended)

Discussion

There were no specific interventions to facilitate return to driving. The systematic evidence review conducted as part of this guideline update focused on adults with subacute and chronic stroke and examined multiple outcomes, including improved driving skill, neuropsychological testing, quality of life, and safety (e.g., reduced accidents). However, the review found no evidence on specific interventions to facilitate return to driving. There was limited evidence available on assessments to determine if patients have appropriate ability to return to driving.[169]

In terms of interventions to facilitate return to driving, only one RCT was identified and it provided very low quality evidence. Research conducted by Crotty et al. (2009) examined the Dynavision™ apparatus, which is a training tool that assesses the patient's accuracy and speed in identifying a visual target in a wide visual field. Crotty et al. demonstrated that treatment with the Dynavision™ apparatus for 18 sessions (40-minute sessions three times per week for six weeks) did not improve the outcomes of an on-road driving assessment for people after stroke; however, the study was limited by small sample size (N=26).[169] Although assessments and interventions aimed at facilitating return to driving appear to cause no harm, they could falsely increase or decrease a patient's confidence in his or her ability to return to driving, possibly resulting in harm to self or others or an unnecessary dependence on other means of transportation. On the other hand, the interventions could reveal hidden disabilities or appropriately identify a patient's inability to return to driving.

Although the 2010 Stroke Rehabilitation CPG recommended assessment prior to return to driving, this recommendation was based on expert opinion, and, therefore, could not be carried forward in this updated guideline. The 2019 Work Group concluded, however, that it is reasonable for all patients to be given a clinical assessment of their physical, cognitive, and behavioral function to determine their readiness to resume driving. In individual cases, where concerns are identified by the family or medical staff, the patient may be required to pass the state road test as administered by the licensing department. Each medical facility should be familiar with their state laws regarding driving after a stroke.

Despite most patients' desire to return to driving, local laws and resources to assess and provide interventions to improve likelihood of return to driving may vary (e.g., availability of both intervention equipment and trained administration personnel). The patient focus group revealed that return to driving is of high importance, but, currently, there are no clear evidenced-based steps to guide the process.

As this is a *Reviewed, Amended* recommendation, the Work Group systematically reviewed the evidence identified in the evidence review conducted for this CPG update and considered the quality of the evidence put forth in the 2010 Stroke Rehabilitation CPG.[169] However, the evidence was insufficient to recommend for or against using any specific assessments and/or interventions aimed at facilitating return to driving. Only one RCT was identified that addressed interventions for returning to driving and the Work Group's confidence in the quality of the evidence is very low due to the small sample size and lack of statistically significant results for the critical outcomes.[169] Patient values and preferences typically include desire to return to driving, but family members are often hesitant or anxious regarding the patient's ability to return to driving. Potential benefits related to this recommendation, including the benefits of identifying unrealized cognitive and physical impairments, are balanced with the potential harm of false confidence in ability to return to drive, which could result in harm to the patient or others. Thus, the Work Group decided upon an insufficient evidence recommendation. See Appendix B for additional information on driving.

VII. Research Priorities

In many ways, the evidence Study Flow Diagram (see Figure D-1) for the 2019 VA/DoD Stroke Rehabilitation CPG says it all: while there are many publications and studies on stroke and stroke rehabilitation (over 11,000 were identified in the search), only about 1% of those (104) touched on topics and outcomes that were considered critical by this Work Group. Clearly, patients need their providers to learn more about these topics – and many others – in rigorous, systematic, and meaningful ways.

Many patients experience long-term complications from stroke, making it a chronic condition. However, research regarding the most effective management in the chronic phase is lacking. Future research should incorporate the entire continuum of care, including acute, subacute, and chronic phases of stroke rehabilitation. Further research should also be carried out related to use of shared decision making and patient engagement with stroke survivors, also involving their family members and caregivers. Research into the most effective methods of shared decision making and engagement as well as the impact of these approaches should be a focus in the future.

There is a distinct lack of scientifically rigorous studies evaluating many community reintegration topics that are important to our patient population. Specifically, the Work Group identified very few studies evaluating return to driving or return to work. With improved stroke survival, an aging population, and increasing numbers of older workers, it is critical to identify best practices to guide decision making in these areas. Interestingly, return to work is rarely considered to be an important outcome in clinical research whereas it is often extremely important to patients and their families; the same can be said of return to driving. Scientifically validated information on identification of appropriate patients, objective assessments, targeted rehabilitation programming, and the role of restrictions is sorely needed in both of these areas. Quality of life was also an infrequently measured outcome that merits further study. That is, specifically what stroke rehabilitation, and in many ways, the medical system in general, are aiming to improve. The conspicuous absence of this metric in many studies speaks to the challenges in measuring how rehabilitation affects quality of life. Do we need new or different metrics? Are there better ways to measure what providers are trying to do and what is important to their patients?

The intensity, frequency, and duration of rehabilitation interventions is a common point of conflict for patients, providers, families, and payers. Often, these decisions are based on administrative, convenience, emotional, monetary, or other factors rather than scientific evidence. It seems logical to conclude that there can be "too little" rehabilitation, and cogent arguments can be made that there can also be "too much." Is there an "optimal window" in terms of timing? Does earlier rehabilitation improve outcomes? Or is it better to do things in stages, perhaps tailored specifically to the individual patient's needs? Is there a point beyond which rehabilitation is futile? Is there a minimum effective amount of rehabilitation, and is it the same for everyone? How can clinicians make the best recommendations for individual patients? What is the role of pharmacological interventions in stroke rehabilitation? These questions are critically important to maximize the efficient use of limited resources (e.g., patient/family time, provider availability, cost) and achieve the best possible outcomes. Unfortunately, the available evidence provides minimal guidance at this time.

Cognitive impairment is a particular challenge for patients, families, and rehabilitation professionals. While the Work Group found some evidence about cognitive rehabilitation, it was insufficient to help guide practice. Many more high-quality studies in this area are needed. Currently, there is significant uncertainty regarding the timing and value of various assessments, the use of compensatory versus restorative treatment approaches, the role of pharmacologic intervention, and the value of technology in improving cognition. Studying rehabilitation techniques to improve cognition presents a great challenge for researchers given the heterogeneity of populations and our limited understanding of how cognition works. Some deficits such as hemispatial neglect, lack of insight, and aphasia present particular challenges. Two relatively new tools may be particularly suited to help address these issues in a more efficient manner: the Rehabilitation Treatment Specification System facilitates a framework and common language where rehabilitation interventions are defined by their ingredients and mechanism of action with targets categorized into organ functions, skills and habits, and representations; practice-based evidence provides a mechanism where evidence is derived from actual clinical practice by studying large sample sizes over multiple sites in a systematic way. These two strategies may help us answer important questions about complex interventions for complex patients more efficiently than the traditional RCT. Given the importance of cognitive functioning in patients' lives and the lives of their families, it would be well worth investing in research to maximize this domain efficaciously.

Sexuality is also important to address in rehabilitation. It is well established that stroke can have a major impact on intimacy for many reasons (e.g., medical stability, motor strength/positioning, sensation, emotional regulation, incontinence) and is closely tied to issues of identity, psychological functioning, and life roles. Again, there was lack of evidence in this area to guide practitioners in how best to address this issue for this guideline. With advancement in medications to address sexual dysfunction and changes in culture that allow for improved communication on this topic, the Work Group sincerely hopes more scientific evidence about sexuality following stroke will be available for the next update of this guideline.

The rapid development and deployment of new technologies makes this an exciting time to be in the medical and rehabilitation field, but we have limited evidence to show their efficacy, let alone the best ways to integrate these breakthroughs into treatment. Specific areas identified by the Work Group included TMS, tDCS, robotics, telemedicine, virtual reality, and the use of cognitive prostheses (e.g., various computer programs, "smart" devices, and apps).

Among one of the most important questions is the role of case management. The patient focus group was particularly vocal in their desire for help in navigating today's complex medical systems, but the Work Group found little research on which to develop evidenced-based recommendations regarding the best way to provide case management for the patient and caregiver rehabilitation process. In addition, there was limited information on how best to support the unsung heroes in these situations – the caregivers. It is still unclear regarding the method with which the medical system can better educate, prepare, reduce strain, and sustain support for these individuals to prevent caregiver fatigue. A healthy caregiver is critical in helping patients reach their full potential, and these areas are in tremendous need of further research with which to guide practitioners.

Stroke-related impairments provide unique challenges and stressors for the patient and the family, which in turn may affect the development and treatment of depression/anxiety. Further research is also needed to improve the identification, prevention, and treatment of depression and anxiety during the acute, post-acute, and long-term follow-up phases of stroke recovery. There is a well-established research literature in the assessment and treatment of depression and anxiety in the general population; however, there is a critical lack of empirical studies within the population of stroke survivors.

Further study of post-stroke anxiety specifically is also needed, especially in Veteran populations which were excluded from the SRs/meta-analyses reviewed by the Work Group. High quality RCTs including clearly defined study populations (e.g., limit subject pool to post stroke anxiety, not mixed anxiety and/or depression) and measurement of anxiety with a valid tool both at baseline and pre-specified time points are needed. Trials that examine clearly defined psychotherapeutic interventions, delivered in a standardized fashion by trained psychotherapists, are also needed. Such studies should include measures of the reliability of intervention delivery, appropriate psychotherapeutic comparison groups and longer term follow-up. For pharmacotherapy trials, placebo control is recommended (rather than undescribed "usual care"). Reporting of adverse effects is also recommended.

Appendix A: Identifying Patient Rehabilitation Goals

Box 18 in Algorithm B of the algorithm instructs providers to, "Assess the patient and identify patient's rehabilitation goals." Initially, the idea of identifying these goals may seem daunting, but it is well within the scope and experience of all healthcare providers. For example, providers are very comfortable with the idea of assessing and establishing blood pressure or glucose level goals; rehabilitation goals are equally within reach for a patient-provider conversation. Patients are often well aware of their rehabilitation goals, and they readily share this information with providers. It is not unusual to hear, "I want to walk again" or "I wish I could live alone again" or "When can I return to driving?" Simply stated, these are patient goals.

Sometimes patient goals are not so simply and readily presented, and providers find themselves in a position of having to more actively elicit them. It is important to remember to communicate with the patient and family member/caregiver in laymen's terms and assess the patient's and family member's/ caregiver's understanding of the information. The participants in the patient focus group conducted as part of this CPG update placed particular value on providers identifying and addressing individual, patient-specific goals. Patients and families emphasized communication and how important it is to them for providers to understand their experiences, goals, and challenges. Some helpful questions for a starting point might include:

- Who is your current support system and how available/able are they to help you with your needs?
- What do you need help with the most at home (e.g., bathing, dressing, toileting, eating)?
- Do your friends or family have any concerns about you staying at home alone? For short periods? Overnight? Days/weeks at a time?
- How are you managing your medications? Your medical appointments?
- Are you concerned about your current and future ability to pay your living expenses and medical bills? Do you anticipate you will require financial assistance to assist in paying current and future medical expenses related to your stroke? Have you received any information regarding financial assistance/resources which may be available to you? Do you have any additional questions? Are you interested in learning more?
- Are you able to clean your house? Maintain your yard or property? How are you managing your groceries and meals? Do you need any help? Is help available to you, should you need it, now or in the future?
- Have you returned to work? If not, why? If so, are you having any problems? Do you need assistance to return to work, worksite modifications, or a different job?
- Do you want to return to driving? Have you returned to driving? Do your friends or family have concerns about your driving?
- Have you been able to return to your pre-stroke leisure activities? What's prevented you from doing so? Are you having trouble with anything?
- How's your vision? Are you reading okay? Are you having any difficulty navigating from one location to another?

- Are you having any difficulties communicating or thinking clearly? Do others seem to have a hard time understanding what you are trying to tell or show them?
- Do you feel like you have to repeat yourself more than you did in the past? Do you ever feel lost in conversations when talking to others?
- Do you have any concerns about sex or intimacy issues?
- Do you have any concerns regarding your bowel or bladder? Are you experiencing bladder incontinence, leakage, or retention? Are you experiencing bowel incontinence, diarrhea, or constipation?
- Do you feel stuck thinking about the way things used to be in the past or do you feel a lack of self-confidence now?
- How is your mood? Has your family communicated with you regarding changes that they have noticed with your mood? If this represents a big change; how are you adjusting? How is your family adjusting?
- Over the past two weeks, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way?
- How are your relationships? How are things going with your spouse, significant other, kids, co-workers, friends?
- How do you spend your time during the day? What's a typical day like?
- What are your biggest worries?
- What do you miss since having your stroke?
- What are the things that are most important for you in your life? Are you able to engage in those activities, relationships, interests, etc.?

Exploring these issues can really help the clinician understand how a stroke has impacted a person's ability to function and participate in meaningful every day activities. Follow-up questions can help evaluate whether or not any deficits are important to a patient or his/her family and whether or not they represent therapeutic targets. Some ways to explore how these deficits interact with a patient's values and priorities include:

- Are these things you want to do again?
- Would you like to do more or increase your capabilities in any of these important areas?
- Is this level of support okay with you or do you want to work on being more independent in a certain activity?
- How would you like to spend your free time?
- Do you feel so incapable or lacking in ability that you will not even consider trying to do something new or in a different way?
- Have you become more isolated, cut off, or irritable with others? Do you feel removed or distant from important, meaningful relationships in your life?

If further psychosocial intervention is needed to address issues related to patient goals the provider may consider a referral to social work, rehabilitation psychology, integrated behavioral health, or the case management team for additional assessment and assistance.

Patients with a history of stroke should have a holistic approach to their health care, with close attention paid to their current and desired levels of function. This includes both basic self-care and mobility as well as higher-level function such as return to driving, return to work, and leisure activities.

Appendix B: Additional Information on Management of Stroke

A. Education

The following sites provide additional resources on patient education:

- Centers for Disease Control and Prevention (CDC) Stroke Patient Education Handouts: https://www.cdc.gov/stroke/materials_for_patients.htm
- VA Resources & Education for Stroke Caregivers' Understanding & Empowerment: https://www.cidrr8.research.va.gov/rescue/library
- American Stroke Association: https://www.strokeassociation.org/

B. Communication

All stroke survivors should be screened for communication deficits. Individuals with suspected communication difficulties should receive a formal, comprehensive assessment to determine the nature and type of their communication impairment. Assessments of communication can be included in the context of a neuropsychological evaluation or in consultation with speech-language pathology.

Words, sentences, and discourse (two or more sentences that are organized to convey information) are verbal means of relating intent to others. The most commonly known communication impairment after stroke is aphasia, a language disorder which impairs one's ability to understand, speak, read, and write. Other communication deficits associated with relating communicative intent are due to a break down or lack of integration of nonverbal contextual cues such as facial expression, body language, and prosody (intonation contours that are created by manipulating frequency, stress, duration, and pitch). Pragmatics, the functional use of language in context, often involves the combined use of verbal and nonverbal mechanisms to infer or relate meaning and can also be impaired following stroke.

Another class of communication impairment is motor-speech based disorders including dysarthria and apraxia. Most simply, dysarthria can be considered an impairment in *muscular control* due to central or peripheral nervous system damage whereas apraxia is an impairment in the *planning* and/or *programming* of the muscular movements. Both dysarthria and apraxia tend to hinder successful verbal output.

For stroke survivors with any identified communication impairments, speech and language therapy should be provided to improve functional communication skills with treatment offered as early as it is tolerated. Education about communication impairments, etiologies, and treatment options, including multiple levels of service delivery, should be provided to the patient/caregiver. Treatment plans and goals should be individualized, evidence based, and include the patient/caregiver. Patients should only be discharged from therapy once modalities for communication have been thoroughly explored to ensure his/her optimal level of independence or modified-independence using assisted communication.

Additional resources:

- A unique resource for Veterans and active duty Service Members with aphasia is VA Pittsburgh's Program for Intensive Residential Aphasia Treatment & Education (PIRATE). Participants in the program are exposed to an integrated team of clinical providers, educators, and scientist-

practitioners dedicated to improving the functioning and well-being of people with aphasia. For additional information: https://www.pittsburgh.va.gov/pirate/index.asp

- American Speech Language Hearing Association: https://www.asha.org/Evidence-Maps/
- The Aphasia Institute: https://www.aphasia.ca/
- National Aphasia Association: https://www.aphasia.org/
- The Academy of Aphasia: http://www2.academyofaphasia.org/
- Veterans Affairs Assistive Technology: https://www.prosthetics.va.gov/AssistiveTechnology/index.asp

C. Dysphagia

All stroke survivors should be screened for dysphagia. Individuals identified with dysphagia may require food or liquid texture alterations to ensure safety with oral intake. These modifications have previously encompassed the following terminology:

- Regular texture
- Mechanical soft texture
- Dysphagia advanced texture
- Mechanically altered texture
- Puree texture
- Thin liquid
- Nectar thick liquid
- Honey thick liquid

In 2020, the national VA health care system will implement new terminology adapted from the International Dysphagia Diet Standardization Initiative (IDDSI).[170] The new framework consists of a continuum of numbers representing complexity levels for food and liquid texture modifications. The goal of implementation is to standardize terminology and definitions of texture modifications for patients, services, and facilities nationwide. IDDSI framework includes the following complexity levels:

- 7 - Regular and Easy to Chew Foods
- 6 - Soft and Bite-Sized Foods
- 5 - Minced and Moist Foods
- 4 - Puree Foods / Extremely Thick Liquids
- 3 - Liquidized Foods / Moderately Thick Liquids
- 2 - Mildly Thick Liquids
- 1 - Slightly Thick Liquids
- 0 - Thin Liquids

For further description of the framework see http://IDDSI.org.

D. Driving

Personal vehicles are the primary mode of transportation in many parts of the U.S. In addition, driving is emotionally tied to concepts of adulthood and independence that many Americans value. However, driving is a complex task that carries a high risk of serious injury to self and others. It is important to note that driving skills needed for cars also apply to other motorized vehicles. Accordingly, patients should also be evaluated before being issued or cleared for use of motorized vehicles. Thus, it is critically important for clinicians, stroke survivors, and their family members to carefully evaluate return-to-drive decisions in a coordinated manner.

Additional resources:

- Ethical statement
  - American Medical Association (AMA) Code of Medical Ethics: Impaired Drivers and Their Physicians: https://www.ama-assn.org/delivering-care/impaired-drivers-their-physicians
- Recommendations in mild stroke and dementia
  - American Congress of Rehabilitation Medicine (ACRM): Driving After Mild Stroke: https://www.archives-pmr.org/article/S0003-9993(18)30313-7/pdf
  - American Neurologic Association (AAN): Evaluation and management of driving risk in dementia: https://www.aan.com/PressRoom/home/GetDigitalAsset/8471
- Patient materials
  - American Stroke Association- Driving After Stroke: http://www.strokeassociation.org/STROKEORG/LifeAfterStroke/RegainingIndependence/Driving/Driving-After-Stroke_UCM_311016_Article.jsp
  - National Highway Traffic Safety Administration- Driving after You've Had a Stroke: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/10900h-drivewell-handout-stroke.pdf
  - National Institute on Aging- Older Drivers: https://www.nia.nih.gov/health/older-drivers
  - National Institute on Aging (printable and shareable info-graphics): https://www.nia.nih.gov/health/infographics/concerned-about-driving-safety
- Rehabilitation providers for driving
  - Certified Driving Rehabilitation Specialist (CDRS), Association for Driver Rehabilitation Specialists: http://www.aded.net/.
  - Occupational Therapist: https://www.aota.org/olderdriver
- Vehicle modifications
  - National Highway and Traffic Safety Administration: https://www.nhtsa.gov/road-safety/adapted-vehicles
  - National Mobility Equipment Dealers Association (NMEDA): http://www.nmeda.com/
  - CarFit (technicians to assess for vehicle adaptations): https://www.car-fit.org

- Financial assistance
  - Vocational rehabilitation state listings: https://rsa.ed.gov/people.cfm
  - Centers for independent living: http://www.ilru.org/projects/cil-net/cil-center-and-association-directory
  - Veteran services: https://www.benefits.va.gov/vocrehab/index.asp
- Additional resources
  - AAA Foundation for Traffic Safety (general traffic safety information and testing): https://www.aaafoundation.org
  - Eldercare Locator (delivery services for those who can no longer drive): www.eldercare.gov

E. Pseudobulbar Affect

Pseudobulbar affect (PBA) (also known as "emotionalism," "pathological crying or laughing," "emotional incontinence," or “emotional lability”) is characterized by involuntary, sudden, and frequent episodes of crying and/or laughing which may or may not be associated with a precipitant. In a 2016 SR and meta-analysis of over 3,000 patients with stroke, PBA was found to affect 17% of patients less than one month post stroke, 20% of patients one to six months post stroke, and 12% of patients greater than six months post-stroke.[171] This condition may be socially disabling and interfere with the rehabilitation process. It can be potentially dangerous if it occurs during eating in a patient with dysphagia.

SSRIs have been found to improve symptoms in patients with PBA following stroke.[172-175] Hackett et al. (2010), in a Cochrane Database SR of five trials with 213 participants, concluded that antidepressants can reduce the frequency and severity of crying or laughing episodes. Of note, this review included not only RCTs of SSRIs but also TCAs.[172] A double-blind placebo-controlled trial in patients with stroke and PBA conducted by Choi-Kwon et al. (2007) showed a significant reduction in excessive inappropriate crying after three months of treatment with 20 mg of fluoxetine daily.[175]

Medical treatment for PBA with SSRIs is widely available, inexpensive, and benefits of PBA treatment outweigh potential harms (see Recommendation 20 for further information on potential adverse events). Medical treatment is often desired by the patient and loved ones for this disabling condition, though some individuals prefer no pharmacological therapy. Medical treatment for PBA with TCA is not recommended for the elderly by the Work Group due to the known adverse effects of TCA, including anticholinergic side effects.

Of note, in 2010, the FDA approved dextromethorphan/quinidine for the treatment of PBA. This is the only FDA approved medication for the treatment of this condition at this time. However, dextromethorphan/quinidine is a costly medication (greater than $1,000 per month). Dextromethorphan/quinidine is generally well tolerated and has a wide safety margin when used at therapeutically approved doses.[176]

Appendix C: Patient Focus Group Methods and Findings

A. Methods

As part of the effort to update this CPG, the VA and DoD Leadership held a patient focus group. The aim of the focus group was to further understand and incorporate the perspective of patients receiving treatment for stroke rehabilitation within the VA and/or DoD healthcare systems, as these patients are most affected by the recommendations put forth in the CPG. The patient focus group was held on May 9, 2018 at the Audie L. Murphy Memorial VA Hospital – South Texas Veterans Health Care System in San Antonio, TX. The focus group delved into the patients' perspectives on a set of topics related to their stroke rehabilitation, including their priorities, challenges they have experienced, the information they received regarding their care, as well as the impact of their care on their lives.

Participants for the focus group were recruited by VA and DoD Leadership as well as by the Stroke Rehabilitation CPG Champions. Patient focus group participants were not designed to be a representative sample of VA and DoD patients. However, recruitment focused on eliciting a range of perspectives likely to be relevant and informative in the guideline development process. Patients were not incentivized for their participation or reimbursed for travel expenses.

The Stroke Rehabilitation CPG Champions and Work Group, with support from the Lewin Team, developed a set of questions to help guide the focus group. The focus group facilitator led the discussion using the previously prepared questions as a general guide to elicit the most important information from the patients regarding their experiences and views about their treatment and overall care. Given the limited time and the range of interests of the focus group participants, not all of the listed questions were addressed. Eight patients participated in the focus group.

B. Patient Focus Group Findings

a. Using shared decision making and a whole-health approach, discuss treatment options and develop a treatment plan tailored to individual patients, taking into account their comorbidities, patient-specific goals, values, and preferences.

- Use shared decision making and a whole-health approach to develop an individualized treatment plan; discuss each treatment option in conjunction with each patient's goals, priorities, values, and preferences.
- Provide information on available rehabilitation treatments and prosthetic devices. Patients want to understand options and express their preferences for rehabilitation treatments that can meet their needs and values.

b. Guide patients on self-management during stroke rehabilitation as well as on use of other resources that are available to assist them with their activities of daily living.

- Guide patients on self-management during stroke rehabilitation.
- Educate patients on various resources that are available to assist them with their activities of daily living.

c. Assist patients with navigating the complex health system.

- Stroke rehabilitation care and care for comorbidities is complex.
- Patients and family members/caregivers need help navigating the health system to access the care they require and coordinate among providers delivering services after a stroke.

d. Provide patients, family, and their caregivers with education and health information to improve understanding of stroke, common comorbidities, and stroke rehabilitation management. Materials need to be individualized to preferred learning methods (e.g., online videos, websites, newsletters).

- Educate patients and family members/caregivers regarding treatments for stroke, common comorbidities and stroke rehabilitation management.
- Provide learning materials that are individualized to patients' preferred learning methods.

e. Provide coordinated care and an interdisciplinary team approach to care for patients with stroke. VA, DoD, and private providers should coordinate treatment plans between primary care, medical specialists, and community rehabilitation providers. Case managers are needed to assist in communication, continuity and coordination of an integrated, interdisciplinary treatment plan for patients, especially those with comorbidities.

- Clinicians should provide coordinated care and an interdisciplinary team approach and assist patients in navigating the complex health system.
- Provide seamless transitions in treatment settings within and between VA, DoD, and other healthcare systems.

f. Provide comprehensive treatments and rehabilitation starting early in the post-acute phase.

- Patients want early comprehensive treatment and therapy for stroke, including rehabilitation, starting early in the post-acute phase.

g. Create a support system for patients with stroke and caregivers. Suggested actions include monthly provider-facilitated meetings either in-person or online groups, other support groups, and stroke education classes to enhance involvement and support among patients with stroke.

- Patients expressed strong interest for a support system, including monthly provider-facilitated meetings either in-person or online groups, other support groups, and stroke education classes for patients with stroke and caregivers to enhance involvement and support among patients with stroke.

h. Screen for, identify, and treat post-stroke depression.

- Patients stated that they experienced depression post-stroke and stressed the need for their health care providers to screen, identify, and treat post-stroke depression.

i. Provide home care and community support resources to optimize quality of life and independence.

- Patients want home care and community support resources in order to become independent and improve their quality of life.

Appendix D: Evidence Review Methodology

A. Developing the Key Questions

The CPG Champions, along with the Work Group, were tasked with identifying KQs to guide the SR of the literature on stroke rehabilitation. These questions, which were developed in consultation with the Lewin Team, addressed clinical topics of the highest priority for the VA and DoD populations. The KQs follow the population, intervention, comparison, outcome, timing and setting (PICOTS) framework for evidence questions, as established by the Agency for Healthcare Research and Quality (AHRQ). Table D-1 provides a brief overview of the PICOTS typology.

The Champions, Work Group, and evidence review team carried out several iterations of this process, each time narrowing the scope of the CPG and the literature review by prioritizing the topics of interest. Due to resource constraints, all developed KQs were not able to be included in the systematic evidence review. Thus, the Champions and Work Group determined which questions were of highest priority, and those were included in the review. Table D-2 contains the final set of KQs used to guide the SR for this CPG.

Once the KQs were finalized, the Work Group prioritized the outcomes they had defined for each KQ based on how important the Work Group judged each outcome to be. Rating outcomes by their relative importance can help focus attention on those outcomes that are considered most important for clinical decision making when making judgements regarding the overall quality of the evidence to support a recommendation.[177]

Using GRADE methodology, the Work Group rated each outcome on a 1-9 scale (7-9, critical for decision making; 4-6, important, but not critical, for decision making; and 1-3, of limited importance for decision making). Critical and important outcomes were included in the evidence review (see Outcomes); however, only outcomes judged to be critical were used to determine the overall quality of evidence (see Grading Recommendations).

Table D-1. PICOTS [178]

PICOTS Element	Description
Population, Patients, or Problem	A description of the patients of interest. It includes the condition(s), populations or sub-populations, disease severity or stage, co-occurring conditions, and other patient characteristics or demographics.
Intervention or Exposure	Refers to the specific treatments or approaches used with the patient or population. It includes doses, frequency, methods of administering treatments, etc.
Comparison	Describes the interventions or care that is being compared with the intervention(s) of interest described above. It includes alternatives such as placebo, drugs, surgery, lifestyle changes, standard of care, etc.
Outcome	Describes the specific results of interest. Outcomes can include short, intermediate, and long-term outcomes, or specific results such as quality of life, complications, mortality, morbidity, etc.
Timing, if applicable	Describes the duration of time that is of interest for the particular patient intervention and outcome, benefit, or harm to occur (or not occur).
Setting, if applicable	Describes the setting or context of interest. Setting can be a location (such as primary, specialty, or inpatient care).

a. Population(s)

- Adults 18 years or older treated in any VA/DoD primary care setting who have experienced stroke.

b. Interventions

- Key Question 1

  Non-pharmacologic motor interventions:

  - Balance/postural retraining
  - Biofeedback
  - Body weight supported treadmill training
  - Brain computer interface
  - Cardiovascular exercise/endurance training
  - CIMT
  - Contracture prevention
  - Direct current stimulation
  - FES
  - Graded motor imagery
  - Mental practice/visualization
  - Mirror therapy
  - Neuromuscular electrical stimulation
  - Repetitive task practice
  - Rhythmic auditory cueing
  - Robotics
  - Transcranial magnetic stimulation
  - TENS
  - Virtual reality

- Key Question 2

  Non-pharmacologic cognitive interventions

  - Transcranial magnetic stimulation
  - Direct current stimulation
  - Brain computer interface
  - Assistive technologies for cognition
  - Virtual reality

  - "Traditional" cognitive rehabilitation interventions
    - Attention process training
    - Chaining technique
    - Compensatory strategy training
    - Errorless learning
    - Goal attainment scale and goal management training
    - Goal plan do review
    - Metacognitive retraining
    - N-back procedure
    - Plan implement evaluate therapy
    - Spaced retrieval
    - Systematic instruction
    - Time pressure management
    - Training external cognitive aids
    - Visual Imagery Training: Lighthouse Strategy
- Key Question 3

  Pharmacologic interventions:
  - SSRIs (e.g., fluoxetine)
  - Dextroamphetamine
  - L-dopa
  - Ampyra
- Key Question 4

  Pharmacologic interventions initiated in acute/subacute phase:
  - SSRIs
  - Donepezil
  - Memantine
  - Modafinil
  - Atomoxetine
  - Rivastigmine
- Key Question 5

  Non-pharmacologic motor interventions:
  - Balance/postural retraining
  - Biofeedback
  - Body weight supported treadmill training

  - Brain computer interface
  - Cardiovascular exercise/endurance training
  - CIMT
  - Contracture prevention
  - Direct current stimulation
  - FES
  - Graded motor imagery
  - Mental practice/visualization
  - Mirror therapy
  - Neuromuscular electrical stimulation
  - Repetitive task practice
  - Rhythmic auditory cueing
  - Robotics
  - Transcranial magnetic stimulation
  - TENS
  - Virtual reality
- Key Question 6

  Non-pharmacologic cognitive interventions:
  - Speech/language rehabilitation interventions
  - Anagram and Copy Treatment
  - Attentive Reading and Constrained Summarization
  - Beeson's Phonological Treatment
  - Conversational coaching
  - Constraint-induced language therapy
  - Copy and Recall Treatment
  - Life participation approach to aphasia
  - Mapping therapy
  - Multiple oral re-reading
  - Oral reading for language in aphasia
  - Phonological component analysis
  - Phonological complexity training
  - Phonomotor treatment protocol
  - PQRST – Preview, Question, Read, State, Test

  - Promoting aphasics' communicative effectiveness
  - Response elaboration training
  - Script training
  - Semantic feature analysis
  - Sentence production program for aphasia
  - SQ3R – Survey, Question, Read, Recite, Review
  - Supported communication intervention
  - Treatment for underlying forms
  - Verb network strengthening treatment
  - Visual action therapy
  - Visual feature analysis
  - Alternative/augmentative Communication
- Key Question 7

  Technology-assisted tools initiated in the subacute/chronic phase:
  - Mobile apps (smartphone, tablet)
  - Web-based apps
  - Environmental control unit/smart home technology
  - Teaching videos
- Key Question 8

  Visual rehabilitation treatments:
  - Ocular health exam
  - Visual field compensatory training
  - Oculomotor training
  - Prism glasses
    - Optical therapies
- Key Question 9
  - Exercise
  - Pharmacotherapy
  - Psychotherapy

- Key Question 10

  Dysphagia rehabilitative interventions:

  - Shaker
  - Mendelsohn
  - Masako
  - Expiratory muscle strength training
  - Swallow Strong
  - Chin Tuck Against Resistance
  - IOPI
  - Submental EMG

  Dysphagia compensatory maneuvers:

  - Chin tuck
  - Head turns (to right or left)
  - Head tilts (to right or left)
  - Diet texture alterations
    - Dysphagia puree
    - Dysphagia mechanically altered
    - Dysphagia mechanical soft
    - Dysphagia advanced
    - Regular texture
  - Altered liquid consistencies
    - Honey thick liquid
    - Nectar thick liquid
    - Thin liquid
  - Adaptive feeding equipment (specifically for dysphagia, different from adaptive feeding equipment implemented by occupational therapy)
    - Provale cup (to manage amount of liquid per sip)
    - Nosey cup (to maintain recommended head positioning)
  - Conventional dysphagia therapy plus head lift
  - Transcutaneous electrical stimulation
  - Neuromuscular electrical stimulation
  - PEG
  - Surface EMG

- Deep pharyngeal neuromuscular stimulation
- Dietary adjustment
- Artificial nutrition and hydration via nasogastric tube or permanent access via PEG
- Nasogastric tube

- Key Question 11

  Case management interdisciplinary care teams; caregiver involvement, including caregiver's education and support

  - Examples of members of an interdisciplinary team: primary care, physical medicine & rehabilitation (PM&R), neurology, occupational therapy, PT, speech therapy, social work, health coach, care management, case management, caregiver, clinical pharmacy, behavioral health

- Key Question 12

  Interventions initiated in subacute and chronic phases:

  - Driving evaluation
  - Neuropsychological test
  - Retraining of visual skills and visual motor skills
  - Paper and computer-based retraining programs
  - Driving simulator
  - On-road driving
  - Driving adaptation

c. Comparators

- Key Question 1
  - Listed intervention compared to one another
  - Usual care
- Key Question 2
  - Listed intervention compared to one another
  - Usual care
- Key Question 3
  - Listed intervention compared to one another
  - Usual care
  - Placebo

- Key Question 4
  - Listed intervention compared to one another
  - Usual care
  - Placebo
- Key Question 5
  - Different duration (e.g., number of weeks)
  - Frequency (e.g., number of sessions/ week)
  - Intensity (e.g., hours/session or hours/day)
- Key Question 6
  - Different duration (e.g., number of weeks)
  - Frequency (e.g., number of sessions/ week)
  - Intensity (e.g., hours/session or hours/day)
- Key Question 7
  - Usual care
- Key Question 8
  - Usual care
- Key Question 9
  - Usual care
- Key Question 10
  - Usual care
- Key Question 11
  - Usual care
  - Individual provider versus primary care team
- Key Question 12
  - No treatment or evaluation

d. Outcomes

- Key Questions 1, 3, 5, 7
  - Critical outcomes
    - FIM/ADLs (include the list from National Institute of Neurological Disorders and Stroke)
    - Gait speed/velocity
    - Stroke-related quality of life measurements
    - Performance measures (e.g., Canadian Occupational Performance Measure, walking speed)
    - Return to work
  - Important outcomes
    - Upper and lower extremity Fugl-Meyer
- Key Questions 2, 4, 6, 7
  - Critical outcomes
    - Neuropsychological tests (specific domains should be itemized, below-list of tests in text)
      - Cognitive status (global)
      - Executive function
      - Memory
      - Attention
    - Quality of life
      - EuroQol-5 Dimension (EQ-5D)
      - SF-36
      - SIS
      - Stroke Specific Quality of Life Scale (SS-QOL)
    - ADLs, level of supervision required, functional independence
    - Instrumental ADLs
    - Disposition
      - Place (e.g., home, skilled nursing facility, long term care)
      - Time to disposition (shorter versus longer)
      - Mayo-Portland Adaptability Inventory
    - Return to work

- Speech Outcomes
  - NIHSS
    - Dysarthria test
    - Language/aphasia test

- Key Question 8
  - Critical outcomes
    - Diplopia
    - Visual function
      - Rey-O
      - Wechsler Adult Intelligence Scale-III/IV: Block design, symbol-digit coding, symbol search, matrix reasoning, cancellation
      - Wechsler Memory Scale-IV: Symbol span
      - Neuropsychological Assessment Battery: Mazes, visual discrimination, design construction
      - Repeatable Battery for the Assessment of Neuropsychological Status: Line orientation, figure copy
      - Delis–Kaplan Executive Function System: Trails 1-5, tower, design fluency
      - Trail making test parts A and B
      - Digit vigilance test
      - Benton: Facial recognition test, visual-form discrimination, judgment of line orientation, and line bi-section
      - Ruff figural fluency
    - ADLs, level of supervision required
    - Quality of life: EQ-5D, SF-36, SIS, SS-QOL
    - Mobility
      - Validated mobility scales e.g., Rivermead Mobility Index
      - Rise-to-walk test
  - Important outcomes
    - Motility (e.g., developmental eye movement, Visagraph)
    - Balance

- Key Question 9
  - Critical outcomes
    - Validated depression measures (e.g., CES-D; BDI; HAMD)
    - Validated anxiety measures (e.g., Generalized Anxiety Disorder 7-item scale; Beck Anxiety Inventory; HAMA)
    - Quality of life: EQ-5D, SF-36, SIS, SS-QOL
- Key Question 10
  - Critical outcomes
    - Adequate oral intake/nutritional status (e.g., percent of ingestion of oral diet, maintenance of weight, calorie count, albumin, pre-albumin)
    - Dysphagia severity (e.g., modified barium swallow study; fiberoptic endoscopic evaluation of swallowing [FEES])
    - MBS Study Overall Impairment Score
    - Penetration-aspiration scale (PAS)
    - SWAL-QOL
    - Eating assessment tool
    - FOIS
    - DOSS
    - American Speech-Language-Hearing Association National Outcome Measures
    - Karnofsky Performance Scale Rating
    - Patient satisfaction/quality of life
    - Decreased aspiration
    - Pneumonia
- Key Question 11
  - Critical outcomes
    - Discharge to home
    - Readmission rates
    - FIM/functional status
    - Neurological impairment: NIHSS
    - ADL
    - Quality of life: EQ-5D, SF-36, SIS, SS-QOL

- Key Question 12
  - Critical outcomes
    - Suicide deaths
    - Improved driving skill: staying in lane while driving, Useful Field of View, speed, on-road evaluations, Trails A and B, visual
    - Neuropsychological testing (e.g., Neuropsychological Assessment Battery including driving-focused subtests)
    - Increased safety/reduced accidents
    - Quality of life: EQ-5D, SF-36, SIS, SS-QOL

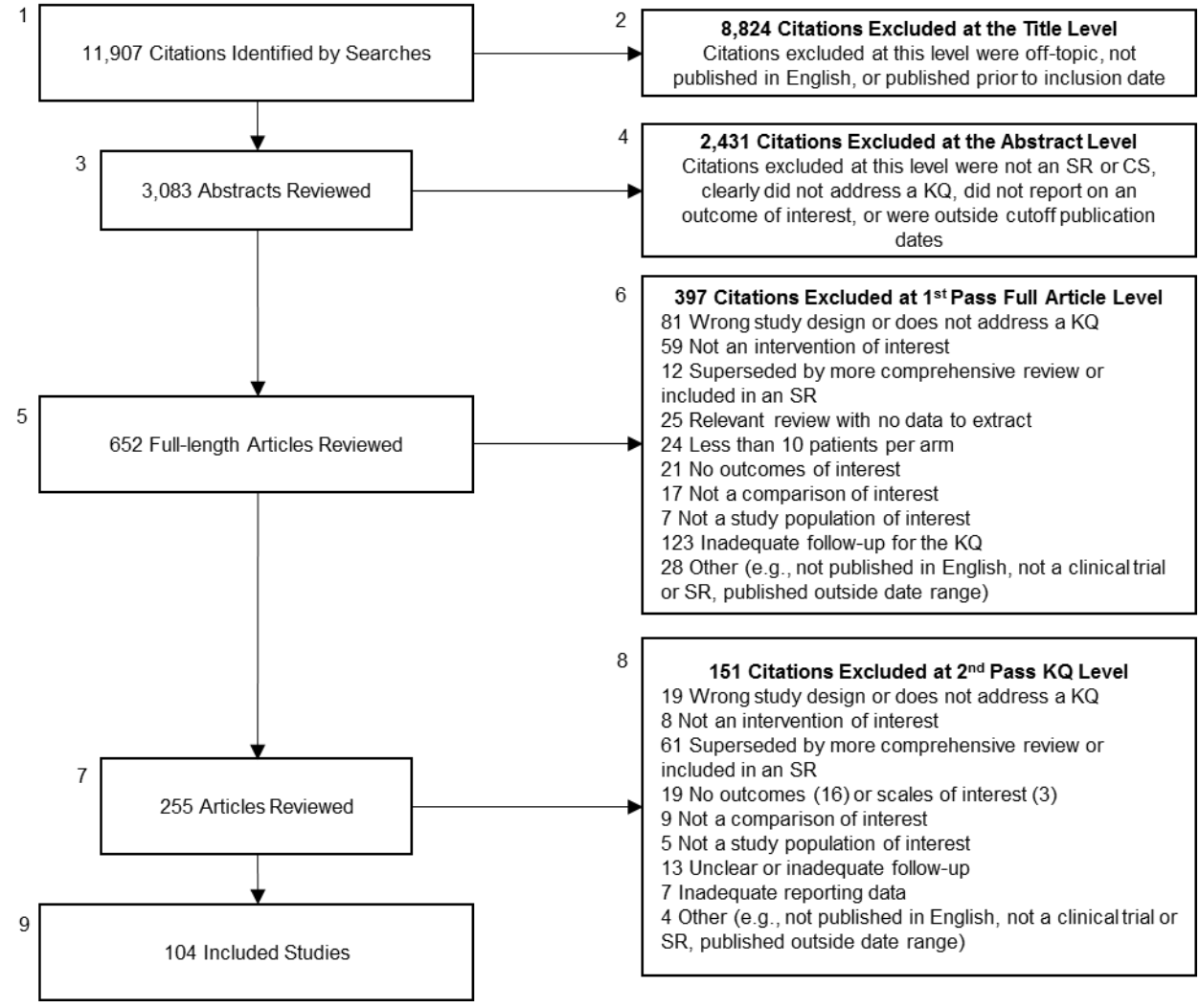
B. Conducting the Systematic Review

Based on the decisions made by the Champions and Work Group members regarding the scope, the KQs, and the PICOTS statements, the Lewin Team produced an SR protocol prior to conducting the review. The protocol was reviewed and approved by the Champions and Work Group members. It described in detail the final set of KQs, the methodology to be used during the systematic review process, and the inclusion/exclusion criteria to be applied to each potential study, including, but not limited to, study type, sample size, and PICOTS criteria.

Extensive literature searches identified 11,907 citations potentially addressing the KQs of interest to this evidence review. Of those, 8,824 were excluded upon title review for clearly not meeting inclusion criteria (e.g., not pertinent to the topic, not published in English, published prior to study inclusion publication date, or not a full-length article). Overall, 3,083 abstracts were reviewed with 2,431 of those being excluded for the following reasons: not an SR or an accepted study design (see the General Criteria for Inclusion in Systematic Review and Key Question Specific Criteria), did not address a KQ of interest to this review, did not report on an outcome of interest, or published outside cut-off publication dates. A total of 652 full-length articles were reviewed. Of those, 397 were excluded at a first pass review for the following: not addressing a KQ of interest, not enrolling the population of interest, not meeting inclusion criteria for study design, not meeting inclusion criteria for any KQ, or being a duplicate. A total of 255 full-length articles were thought to address one or more KQs and were further reviewed. Of these, 151 were ultimately excluded. Reasons for their exclusion are presented in Figure D-1 below (an alternative text description is available directly below the figure).

Overall, 104 studies addressed one or more of the KQs and were considered as evidence in this review. Table D-2 indicates the number of studies that addressed each of the questions.

Figure D-1. Study Flow Diagram



Abbreviations: CS: clinical study; KQ: key question; SR: systematic review

Alternative Text Description of Study Flow Diagram

Figure D-1. Study Flow Diagram is a flow chart with nine labeled boxes linked by arrows that describe the literature review inclusion/exclusion process. Arrows point down to boxes that describe the next literature review step and arrows point right to boxes that describe the excluded citations at each step (including the reasons for exclusion and the numbers of excluded citations).

1. Box 1: 11,907 citations identified by searches
    a. Right to Box 2: 8,824 citations excluded at the title level
        i. Citations excluded at this level were off-topic, not published in English, or published prior to inclusion date
    b. Down to Box 3: 3,083 abstracts reviewed

2. Box 3: 3,083 abstracts reviewed
    a. Right to Box 4: 2,431 citations excluded at the abstract level
        i. Citations excluded at this level were not an SR or clinical study, clearly did not address a KQ, did not report on an outcome of interest, or were outside cutoff publication dates
    b. Down to Box 5: 652 full-length articles reviewed
3. Box 5: 652 full-length articles reviewed
    a. Right to Box 6: 397 citations excluded at 1st pass full article level
        i. 81 wrong study design or does not address a KQ
        ii. 59 not an intervention of interest
        iii. 12 superseded by more comprehensive review or included in an SR
        iv. 25 relevant review with no data to extract
        v. 24 less than 10 patients per arm
        vi. 21 no outcomes of interest
        vii. 17 not a comparison of interest
        viii. 7 not a study population of interest
        ix. 123 inadequate follow-up for the KQ
        x. 28 other (e.g., not published in English, not a clinical trial or SR, published outside date range)
    b. Down to Box 7: 255 articles reviewed
4. Box 7: 255 articles reviewed
    a. Right to Box 8: 151 citations excluded at 2nd pass KQ level
        i. 19 wrong study design or does not address a KQ
        ii. 8 not an intervention of interest
        iii. 61 superseded by more comprehensive review or included in an SR
        iv. 19 no outcomes (16) or scales of interest (3)
        v. 9 not a comparison of interest
        vi. 5 not a study population of interest
        vii. 13 unclear or inadequate follow-up
        viii. 7 inadequate reporting data
        ix. 4 other (e.g., not published in English, not a clinical trial or SR, published outside date range)
    b. Down to Box 9: 104 included studies
5. Box 9: 104 included studies

Table D-2. Evidence Base for KQs

Question Number	Question	Number of Studies & Type of Studies
1	In adults with motor deficits following stroke, what is the comparative effectiveness of various modes of rehabilitation for motor weakness?	12 SRs 28 RCTs
2	In adults with cognitive deficits following stroke, what is the comparative effectiveness of rehabilitative and compensatory non-pharmacologic interventions for improving cognitive function?	3 RCTs
3	In adults with motor deficits following stroke, what is the comparative effectiveness and safety of pharmacologic interventions for improving motor function?	1 SR 3 RCTs
4	In adults with cognitive deficits following stroke, what is the comparative effectiveness and safety of pharmacologic interventions for improving attention, concentration, executive function, and memory?	2 SRs 3 RCTs
5	In adults with motor deficits following stroke, what duration, intensity, and/or frequency of motor rehabilitation interventions improves recovery/increases the duration of treatment gains?	5 SRs 4 RCTs
6	In adults post stroke, what duration, intensity, and/or frequency of cognitive and/or speech/language rehabilitation interventions improve recovery/increases the duration of treatment gains?	2 RCTs
7	In adults following stroke, what technology-assisted tools improve motor, cognitive and speech outcomes?	3 RCTs
8	In patients with stroke resulting in a visual impairment (e.g., visual fields cuts) and visual dysfunction (e.g., diplopia due to eye motility impairment), what interventions improve stroke rehabilitation outcomes?	5 RCTs
9	In adults post stroke, what interventions are effective in preventing or treating behavioral health complications?	6 SRs 9 RCTs
10	In patients with dysphagia following stroke, what treatments are effective in increasing oral intake and decreasing aspiration pneumonia?	2 SRs 13 RCTs
11	For adults post stroke, does case management and/or interdisciplinary care team approach improve outcomes?	2 SRs 2 RCTs
12	In adults post stroke, does evaluation and treatment for driving capability improve performance and safety?	1 RCT
	Total Evidence Base	**106 studies***

*Some studies were used to address more than one KQ, therefore, the total evidence base number does not equal the number of included studies (104)
Abbreviations: RCT: randomized controlled trial; SR: systematic review

a. General Criteria for Inclusion in Systematic Review

- Clinical studies or SRs published on or after April 1, 2009 to July 5, 2018. If multiple SRs addressed a KQ, we selected the most recent and/or comprehensive review. SRs were supplemented with clinical studies published subsequent to the SR.
    - Subsequent to the face-to-face meeting, the Work Group identified a new publication critical to inform recommendations related to KQs 3 and 9 (see Table D-2). Additional targeted searches for KQs 3 and 9 were undertaken to cover the period from July 5, 2018 to December 18, 2018.
- Studies must have been published in English.

- Publication must have been a full clinical study or SR; abstracts alone were not included. Similarly, letters, editorials, and other publications that are not full-length clinical studies were not accepted as evidence.
- SRs must have searched MEDLINE or EMBASE for eligible publications, performed a risk of bias assessment of included studies, and assessed the quality of evidence using a recognizable rating system, such as GRADE or something compatible (e.g., the one used by the Evidence-based Practice Centers of AHRQ). If an existing review did not assess the overall quality of the evidence, evidence from the review must be reported in a manner that allowed us to judge the overall risk of bias, consistency, directness, and precision of evidence. We did not use an existing review as evidence if we were not able to assess the overall quality of the evidence in the review.
- Intervention studies must have assessed pharmacological or non-pharmacological treatment, care management approach, or community-based interventions and be a prospective, RCT with an independent control group. Crossover trials were not included.
- Study must have enrolled at least 20 patients (10 per study group) unless otherwise noted (see Key Question Specific Criteria below)
- Study must have enrolled at least 85% of patients who meet the study population criteria: adults aged 18 years or older who have experienced stroke.
- Study must have reported on at least one outcome of interest.

b. Key Question Specific Criteria

- No specific additional criteria.

Information regarding the bibliographic databases, date limits, and platform/provider can be found in Table D-3, below. Additional information on the search strategies, including topic-specific search terms and search strategies can be found in Appendix H.

Table D-3. Bibliographic Database Information

Name	Date Limits	Platform/Provider
Cochrane Database of Systematic Reviews (Cochrane Reviews)	April 1, 2009 to July 5, 2018	Wiley
Cochrane Central Register of Controlled Trials	April 1, 2009 to July 5, 2018	Wiley
Database of Abstracts of Reviews of Effects	April 1, 2009 to July 5, 2018	Wiley
EMBASE (Excerpta Medica)	April 1, 2009 to July 5, 2018*	Elsevier
Health Technology Assessment Database (HTA)	April 1, 2009 to July 5, 2018	Wiley
MEDLINE/PreMEDLINE	April 1, 2009 to July 5, 2018*	Elsevier
PsycINFO	April 1, 2009 to July 5, 2018*	OvidSP
PubMed (In-process and Publisher records)	April 1, 2009 to July 5, 2018*	National Library of Medicine

*The end date of the search for KQs 3 and 9 was December 18, 2018.

C. Convening the Face-to-face Meeting

In consultation with the COR, the Champions, and the Work Group, the Lewin Team convened a three and one-half day face-to-face meeting of the CPG Champions and Work Group members on September 18 – 21, 2018. These experts were gathered to develop and draft the clinical recommendations for an update to the 2010 Stroke Rehabilitation CPG. The Lewin Team presented findings from the evidence review in order to facilitate and inform the process.

Under the direction of the Champions, the Work Group members were charged with interpreting the results of the evidence review and were asked to categorize and carry forward recommendations from the 2010 Stroke Rehabilitation CPG, modifying the recommendations as necessary. The members also developed new clinical practice recommendations not presented in the 2010 Stroke Rehabilitation CPG based on the 2018 evidence review. The subject matter experts were divided into three smaller subgroups at this meeting.

As the Work Group members drafted clinical practice recommendations, they also assigned a grade for each recommendation based on a modified GRADE and USPSTF methodology. Each recommendation was graded by assessing the quality of the overall evidence base, the associated benefits and harms, the variation in values and preferences, and other implications of the recommendation.

In addition to developing recommendations during the face-to-face meeting, the Work Group members also revised the 2010 Stroke Rehabilitation CPG algorithms to reflect the new and amended recommendations. They discussed the available evidence as well as changes in clinical practice since 2010, as necessary, to update the algorithms.

D. Grading Recommendations

This CPG uses the GRADE methodology to assess the quality of the evidence base and assign a strength for each recommendation. The GRADE system uses the following four domains to assess the strength of each recommendation: [179]

- Balance of desirable and undesirable outcomes
- Confidence in the quality of the evidence
- Values and preferences
- Other implications, as appropriate, e.g.,:
    - Resource use
    - Equity
    - Acceptability
    - Feasibility
    - Subgroup considerations

The following sections further describe each domain.

Balance of desirable and undesirable outcomes refers to the size of anticipated benefits (e.g., increased longevity, reduction in morbid event, resolution of symptoms, improved quality of life, decreased resource use) and harms (e.g., decreased longevity, immediate serious complications, adverse events, impaired quality of life, increased resource use, inconvenience/hassle) relative to each other. This domain is based on the understanding that the majority of clinicians will offer patients therapeutic or preventive measures as long as the advantages of the intervention exceed the risks and adverse effects. The certainty or uncertainty of the clinician about the risk-benefit balance will greatly influence the strength of the recommendation.

Some of the discussion questions that fall under this domain include:

- Given the best estimate of typical values and preferences, are you confident that the benefits outweigh the harms and burden or vice versa?
- Are the desirable anticipated effects large?
- Are the undesirable anticipated effects small?
- Are the desirable effects large relative to undesirable effects?

Confidence in the quality of the evidence reflects the quality of the evidence base and the certainty in that evidence. This second domain reflects the methodological quality of the studies for each outcome variable. In general, the strength of recommendation follows the level of evidence, but not always, as other domains may increase or decrease the strength. The evidence review used for the development of recommendations, conducted by ECRI, assessed the confidence in the quality of the evidence base using GRADE methodology and assigned a rating of "High," "Moderate," "Low," or "Very Low." The outcomes judged to be critical were used to determine the overall quality of evidence. Per GRADE, if the quality of evidence differs across the critical outcomes, the lowest quality of evidence for any of the relevant critical outcomes determines the overall quality of the evidence for a recommendation; the overall confidence cannot be higher than the lowest confidence in effect estimates for any outcome that is determined to be critical for clinical decision making.[17,177]

The elements that go into the confidence in the quality of the evidence include:

- Is there high or moderate quality evidence that answers this question?
- What is the overall certainty of this evidence?

Values and preferences is an overarching term that includes patients' perspectives, beliefs, expectations, and goals for health and life. More precisely, it refers to the processes that individuals use in considering the potential benefits, harms, costs, limitations, and inconvenience of the therapeutic or preventive measures in relation to one another. For some, the term "values" has the closest connotation to these processes. For others, the connotation of "preferences" best captures the notion of choice. In general, values and preferences increase the strength of the recommendation when there is high concordance and decrease it when there is great variability. In a situation in which the balance of benefits and risks are uncertain, eliciting the values and preferences of patients and empowering them and their surrogates to make decisions consistent with their goals of care becomes even more important. A recommendation can

be described as having "similar values," "some variation," or "large variation" in typical values and preferences between patients and the larger populations of interest.

Some of the discussion questions that fall under the purview of values and preferences include:

- Are you confident about the typical values and preferences and are they similar across the target population?
- What are the patient's values and preferences?
- Are the assumed or identified relative values similar across the target population?

Other implications consider the practicality of the recommendation, including resource use, equity, acceptability, feasibility and subgroup considerations. Resource use is related to the uncertainty around the cost-effectiveness of a therapeutic or preventive measure. For example, statin use in the frail elderly and others with multiple co-occurring conditions may not be effective and, depending on the societal benchmark for willingness to pay, may not be a good use of resources. Equity, acceptability, feasibility, and subgroup considerations require similar judgments around the practically of the recommendation.

The framework below (Table D-4) was used by the Work Group to guide discussions on each domain.

Table D-4. GRADE Evidence to Recommendation Framework

Decision Domain	Questions to Consider	Judgment
Balance of desirable and undesirable outcomes	▪ Given the best estimate of typical values and preferences, are you confident that the benefits outweigh the harms and burden or vice versa? ▪ Are the desirable anticipated effects large? ▪ Are the undesirable anticipated effects small? ▪ Are the desirable effects large relative to undesirable effects?	▪ Benefits outweigh harms/burden ▪ Benefits slightly outweigh harms/ burden ▪ Benefits and harms/burden are balanced ▪ Harms/burden slightly outweigh benefits ▪ Harms/burden outweigh benefits
Confidence in the quality of the evidence	▪ Is there high or moderate quality evidence that answers this question? ▪ What is the overall certainty of this evidence?	▪ High ▪ Moderate ▪ Low ▪ Very low
Values and preferences	▪ Are you confident about the typical values and preferences and are they similar across the target population? ▪ What are the patient's values and preferences? ▪ Are the assumed or identified relative values similar across the target population?	▪ Similar values ▪ Some variation ▪ Large variation
Other implications (e.g., resource use, equity, acceptability, feasibility, subgroup considerations)	▪ Are the resources worth the expected net benefit from the recommendation? ▪ What are the costs per resource unit? ▪ Is this intervention generally available? ▪ Is this intervention and its effects worth withdrawing or not allocating resources from other interventions? ▪ Is there lots of variability in resource requirements across settings?	▪ Various considerations

The strength of a recommendation is defined as the extent to which one can be confident that the desirable effects of an intervention outweigh its undesirable effects and is based on the framework above, which combines the four domains.[180] GRADE methodology does not allow for recommendations to be made based on expert opinion alone. While strong recommendations are usually based on high or moderate confidence in the estimates of effect (quality of the evidence) there may be instances where strong recommendations are warranted even when the quality of evidence is low.[179] In these types of instances where the balance of desirable and undesirable outcomes and values and preferences played large roles in determining the strength of a recommendation, this is explained in the discussion section for the recommendation.

The GRADE of a recommendation is based on the following elements:

- Four decision domains used to determine the strength and direction (described above)
- Relative strength (Strong or Weak)
- Direction (For or Against)

The relative strength of the recommendation is based on a binary scale, "Strong" or "Weak." A strong recommendation indicates that the Work Group is highly confident that desirable outcomes outweigh undesirable outcomes. If the Work Group is less confident of the balance between desirable and undesirable outcomes, they present a weak recommendation.

Similarly, a recommendation for a therapy or preventive measure indicates that the desirable consequences outweigh the undesirable consequences. A recommendation against a therapy or preventive measure indicates that the undesirable consequences outweigh the desirable consequences.

Occasionally, instances may occur when the Work Group feels there is insufficient evidence to make a recommendation for or against a particular therapy or preventive measure. This can occur when there is an absence of studies on a particular topic that met evidence review inclusion criteria, studies included in the evidence review report conflicting results, or studies included in the evidence review report inconclusive results regarding the desirable and undesirable outcomes.

Using these elements, the grade of each recommendation is presented as part of a continuum:

- Strong For (or "We recommend offering this option …")
- Weak For (or "We suggest offering this option …")
- No recommendation for or against (or "There is insufficient evidence…")
- Weak Against (or "We suggest not offering this option …")
- Strong Against (or "We recommend against offering this option …")

Note that weak (For or Against) recommendations may also be termed "Conditional," "Discretionary," or "Qualified." Recommendations may be conditional based upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented. Recommendations may be at the discretion of the patient and clinician or they may be qualified with an explanation about the issues that would lead decisions to vary.

E. Recommendation Categorization

a. Recommendation Categories and Definitions

A set of recommendation categories was adapted from those used by NICE.[13,14] These categories, along with their corresponding definitions, were used to account for the various ways in which recommendations could have been updated from the 2010 Stoke Rehabilitation CPG. The categories and definitions can be found in Table D-5.

Table D-5. Recommendation Categories and Definitions

Evidence Reviewed*	Recommendation Category*	Definition*
Reviewed	New-added	New recommendation following review of the evidence
	New-replaced	Recommendation from previous CPG that has been carried over to the updated CPG that has been changed following review of the evidence
	Not changed	Recommendation from previous CPG that has been carried forward to the updated CPG where the evidence has been reviewed but the recommendation is not changed
	Amended	Recommendation from the previous CPG that has been carried forward to the updated CPG where the evidence has been reviewed and a minor amendment has been made
	Deleted	Recommendation from the previous CPG that has been removed based on review of the evidence
Not reviewed	Not changed	Recommendation from previous CPG that has been carried forward to the updated CPG, but for which the evidence has not been reviewed
	Amended	Recommendation from the previous CPG that has been carried forward to the updated CPG where the evidence has not been reviewed and a minor amendment has been made
	Deleted	Recommendation from the previous CPG that has been removed because it was deemed out of scope for the updated CPG

*Adapted from the NICE guideline manual (2012) [13] and Garcia et al. (2014) [14]
Abbreviation: CPG: clinical practice guideline

b. Categorizing Recommendations with an Updated Review of the Evidence

Recommendations were first categorized by whether or not they were based on an updated review of the evidence. If evidence had been reviewed, recommendations were categorized as "New-added," "New-replaced," "Not changed," "Amended," or "Deleted."

"Reviewed, New-added" recommendations were original, new recommendations that were not in the 2010 Stroke Rehabilitation CPG. "Reviewed, New-replaced" recommendations were in the previous version of the guideline, but were modified to align with the updated review of the evidence. These recommendations could have also included clinically significant changes to the previous version. Recommendations categorized as "Reviewed, Not changed" were carried forward from the previous version of the CPG unchanged.

To maintain consistency between 2010 recommendations, which were developed using the USPSTF methodology, and 2019 recommendations, which were developed using the GRADE methodology, it was necessary to modify the 2010 recommendations to include verbiage to signify the strength of the recommendation (e.g., "We recommend," "We suggest"). Because the 2010 recommendations inherently needed to be modified at least slightly to include this language, the "Not changed" category was not used. For recommendations carried forward to the updated CPG with review of the evidence and slightly modified wording, the "Reviewed, Amended" recommendation category was used. This allowed for the wording of the recommendation to reflect GRADE methodology as well as for any other non-substantive (i.e., not clinically meaningful) language changes deemed necessary. The evidence used to support these

recommendations was carried forward from the previous version of the CPG and/or was identified in the evidence review for the update.

Recommendations could have also been designated "Reviewed, Deleted." These were recommendations from the previous version of the CPG that were not brought forward to the updated guideline after review of the evidence. This occurred if the evidence supporting the recommendations was out of date, to the extent that there was no longer any basis to recommend a particular course of care and/or new evidence suggests a shift in care, rendering recommendations in the previous version of the guideline obsolete.

c. Categorizing Recommendations without an Updated Review of the Evidence

There were also cases in which it was necessary to carry forward recommendations from the previous version of the CPG without an updated SR of the evidence. Due to time and budget constraints, the update of the Stroke Rehabilitation CPG could not review all available evidence on management of stroke, but instead focused its KQs on areas of new or updated scientific research or areas that were not previously covered in the CPG.

For areas of research that have not changed, and for which recommendations made in the previous version of the guideline were still relevant, recommendations could have been carried forward to the updated guideline without an updated SR of the evidence. The support for these recommendations in the updated CPG was thus also carried forward from the previous version of the CPG. These recommendations were categorized as "Not reviewed." If evidence had not been reviewed, recommendations could have been categorized as "Not changed," "Amended," or "Deleted."

"Not reviewed, Not changed" recommendations refer to recommendations from the previous version of the Stroke Rehabilitation CPG that were carried forward unchanged to the updated version. The category of "Not reviewed, Amended" was used to designate recommendations which were modified from the 2010 Stroke Rehabilitation CPG with the updated GRADE language, as explained above.

Recommendations could also have been categorized as "Not reviewed, Deleted" if they were determined to be out of scope. A recommendation was out of scope if it pertained to a topic (e.g., population, care setting, treatment, and condition) outside of the scope for the updated CPG as defined by the Work Group.

The categories for the recommendations included in the 2019 version of the guideline are noted in the Recommendations. The categories for the recommendations from the 2010 Stroke Rehabilitation CPG are noted in Appendix F.

F. Drafting and Submitting the Final Clinical Practice Guideline

Following the face-to-face meeting, the Champions and Work Group members were given writing assignments to craft discussion sections to support each of the new recommendations and/or to update discussion sections from the 2010 Stroke Rehabilitation CPG to support the amended "carried forward" recommendations. The Work Group also considered tables, appendices, and other sections from the 2010 Stroke Rehabilitation CPG for inclusion in the update. During this time, the Champions and Work Group also made additional revisions to the algorithms, as necessary.

After developing the initial draft of the updated CPG, an iterative review process was used to solicit feedback on and make revisions to the CPG. Once they were developed, the first two drafts of the CPG were posted on a wiki website for a period of 14-20 business days for internal review and comment by the Work Group. All feedback submitted during each review period was reviewed and discussed by the Work Group and appropriate revisions were made to the CPG.

Draft 3 of the CPG was made available for peer review and comment. This process is described in the section titled Peer Review Process. After revisions were made based on the feedback received during the peer review and comment period, the Champions presented the CPG to the EBPWG for their approval. Changes were made based on feedback from the EBPWG and the guideline was finalized.

The Work Group also produced a set of guideline toolkit materials which included a provider summary, pocket card, and patient summary. The final 2019 Stroke Rehabilitation CPG was submitted to the EBPWG in May 2019.

Appendix E: Evidence Table

Table E-1. Evidence Table[1,2,3,4]

Recommendation	2010 Grade	Evidence	Strength of Recommendation	Recommendation Category
1. We recommend a team-based approach in an organized inpatient unit that encompasses comprehensive rehabilitation in order to improve likelihood of discharge to home after acute stroke.	A	[24,30-32] **Additional References:** [25-29,33,34]	Strong for	Reviewed, Amended
2. We recommend that rehabilitation therapy should start as soon as medical stability is reached.	A	[35-37]	Strong for	Not Reviewed, Amended
3. There is insufficient evidence to recommend for or against implementing very early mobilization (within 24-48 hours) to improve functional outcomes.	N/A	[38-40]	Neither for nor against	Reviewed, New-added
4. There is insufficient evidence to recommend for or against early supported discharge.	B	[30,41,42]	Neither for nor against	Reviewed, Amended
5. We recommend task-specific practice (also known as task-oriented practice or repetitive task practice) for improving upper and lower extremity motor function, gait, posture, and activities of daily living.	B, None	[43-53]	Strong for	Reviewed, New-replaced

[1] 2010 Grade column: The 2010 VA/DoD Stroke Rehabilitation CPG used the USPSTF evidence grading system (http://www.uspreventiveservicestaskforce.org). Inclusion of more than one 2010 Grade indicates that more than one 2010 CPG recommendation is covered under the 2019 recommendation. The strength of recommendations were rated as follows: A- a strong recommendation that the clinicians provide the intervention to eligible patients; B- a recommendation that clinicians provide (the service) to eligible patients; C- no recommendation for or against the routine provision of the intervention is made; D- recommendation is made against routinely providing the intervention; I- the conclusion is that the evidence is insufficient to recommend for or against routinely providing the intervention. "Not applicable" (or "N/A") indicates that the 2019 Stroke Rehabilitation CPG recommendation was a new recommendation, and therefore does not have an associated 2010 Grade. "None" indicates that the 2010 VA/DoD Stroke Rehabilitation CPG was not graded.

[2] Evidence column: The first set of references listed in each row in the evidence column constitutes the evidence base for the recommendation. To be included in the evidence base for a recommendation, a reference needed to be identified through the 2018 evidence review or included in the evidence base for the 2010 VA/DoD Stroke Rehabilitation CPG. The second set of references in the evidence column (called "Additional References") includes references that provide additional information related to the recommendation, but which were not systematically identified through a literature review. These references were not included in the evidence base for the recommendation and therefore did not influence the strength and direction of the recommendation.

[3] Strength of Recommendation column: Refer to the Grading Recommendations section for more information on how the strength of the recommendation was determined using GRADE methodology.

[4] Strength of Recommendation column: Refer to the Grading Recommendations section for more information on how the strength of the recommendation was determined using GRADE methodology.

Recommendation	2010 Grade	Evidence	Strength of Recommendation	Recommendation Category
6. We recommend cardiovascular exercise to increase maximum walking speed after stroke.	A	[54]	Strong for	Reviewed, New-replaced
7. We suggest offering body-weight support treadmill training as an adjunct to gait training in the non-ambulatory patient.	B	[55-61]	Weak for	Reviewed, Amended
8. We suggest offering rhythmic auditory cueing as a modality to include in multimodal interventions to improve walking speed.	B	[62-65]	Weak for	Reviewed, Amended
9. We suggest offering Constraint-Induced Movement Therapy or modified Constraint-Induced Movement Therapy for individuals with at least 10 degrees of active extension in two fingers, the thumb, and the wrist.	A	[66-68]	Weak for	Reviewed, Amended
10. There is insufficient evidence to recommend for or against mirror therapy for improvements in limb function.	I	[69,70]	Neither for nor against	Reviewed, Amended
11. We suggest offering functional electrical stimulation, neuromuscular electrical stimulation, or transcutaneous electrical nerve stimulation as an adjunctive treatment to improve upper and lower extremity motor function.	B	[71-78]	Weak for	Reviewed, New-replaced
12. We suggest offering functional electrical stimulation to manage shoulder subluxation.	B	[79,80] **Additional Reference:** [81]	Weak for	Not Reviewed, Amended
13. For patients with foot drop, we suggest offering either functional electrical stimulation or traditional ankle foot orthoses to improve gait speed, as both are equally effective.	N/A	[82]	Weak for	Reviewed, New-added
14. We suggest offering robot-assisted movement therapy as an adjunct to conventional therapy in patients with deficits in upper limb function to improve motor skill.	B	[55,56,77,83-87]	Weak for	Reviewed, Amended
15. There is insufficient evidence to recommend for or against the use of robotic devices during gait training.	D	[55,56,77,83-87]	Neither for nor against	Reviewed, Amended
16. We suggest offering virtual reality to enhance gait recovery.	D	[88-95]	Weak for	Reviewed, Amended
17. There is insufficient evidence to recommend for or against the use of virtual reality for improving activities of daily living and non-gait motor function.	C	[88-95]	Neither for nor against	Reviewed, New-replaced

Recommendation	2010 Grade	Evidence	Strength of Recommendation	Recommendation Category
18. There is insufficient evidence to recommend for or against the use of transcranial direct current stimulation to improve activities of daily living.	N/A	[96,97]	Neither for nor against	Reviewed, New-added
19. There is insufficient evidence to recommend for or against repetitive transcranial magnetic stimulation to improve upper or lower extremity motor function.	N/A	[98-101]	Neither for nor against	Reviewed, New-added
20. In patients with motor deficits, there is insufficient evidence to recommend for or against starting a selective serotonin reuptake inhibitor within 30 days of stroke to improve motor recovery and functional outcomes.	N/A	[102-105] **Additional References:** [5,106,107]	Neither for nor against	Reviewed, New-added
21. We recommend botulinum toxin for patients with focal spasticity that is painful, impairs function, reduces the ability to participate in rehabilitation, or compromises proper positioning or skin care.	B	[108-111]	Strong for	Not Reviewed, Amended
22. We suggest offering intrathecal baclofen treatments for patients with severe chronic lower extremity spasticity that cannot be effectively managed by other interventions.	B	[112,113]	Weak for	Not Reviewed, Amended
23. We suggest offering Shaker or chin tuck against resistance exercises in addition to conventional dysphagia therapy.	None	[114-116] **Additional References:** [117,118]	Weak for	Reviewed, New-replaced
24. We suggest offering expiratory muscle strength training for treatment of dysphagia in patients without a tracheostomy.	None	[117,118]	Weak for	Reviewed, New-replaced
25. There is insufficient evidence to recommend for or against tongue to palate resistance training for treatment of dysphagia.	None	[119] **Additional Reference:** [120]	Neither for nor against	Reviewed, New-replaced
26. There is insufficient evidence to recommend for or against neuromuscular electrical stimulation for treatment of dysphagia.	None	[121-124] **Additional References:** [125-127]	Neither for nor against	Reviewed, New-replaced
27. There is insufficient evidence to recommend for or against pharyngeal electrical stimulation for treatment of dysphagia.	None	[128-130] **Additional References:** [131]	Neither for nor against	Reviewed, New-replaced

Recommendation	2010 Grade	Evidence	Strength of Recommendation	Recommendation Category
28. In patients with dysphagia in the post-acute phase of stroke who require tube feeding, we suggest offering gastrostomy tube over nasogastric tube for maintenance of optimal nutrition.	None	[132] **Additional References:** [133,134]	Weak for	Reviewed, New-replaced
29. There is insufficient evidence to recommend for or against the use of any specific cognitive rehabilitation methodology or pharmacotherapy to improve cognitive outcomes.	C, B	[135-140]	Neither for nor against	Reviewed, New-replaced
30. There is insufficient evidence to recommend for or against the use of intensive language therapy for aphasia.	N/A	[141,142]	Neither for nor against	Reviewed, New-added
31. There is insufficient evidence to recommend for or against hemi-field eye patching in addition to traditional therapy for patients with unilateral spatial neglect following stroke.	I, None, None	[143,145] **Additional Reference:** [144,146]	Neither for nor against	Reviewed, New-replaced
32. Among patients with unilateral spatial neglect, there is insufficient evidence to recommend for or against the use of prisms.	I, None, None	[147-149]	Neither for nor against	Reviewed, New-replaced
33. Among patients with hemianopsia, there is insufficient evidence to recommend for or against the use of prisms or visual search training.	I, None, None	[149]	Neither for nor against	Reviewed, New-replaced
34. For the prevention of post-stroke depression, there is insufficient evidence for or against the universal use of selective serotonin reuptake inhibitor or a serotonin norepinephrine reuptake inhibitor due to the risk of fractures.	N/A	[105,119,150-152] **Additional Reference:** [153-156]	Neither for nor against	Reviewed, New-added
35. We suggest offering a selective serotonin reuptake inhibitor or a serotonin norepinephrine reuptake inhibitor for treatment of post-stroke depression.	None	[105,157] **Additional Reference:** [154]	Weak for	Reviewed, New-replaced
36. We suggest offering cognitive behavioral therapy for treatment of post-stroke depression.	N/A	[161] **Additional References:** [158-160]	Weak for	Reviewed, New-added
37. There is insufficient evidence to recommend for or against treatment with a combination of pharmacotherapy (selective serotonin reuptake inhibitor/serotonin norepinephrine reuptake inhibitor) and psychotherapy (cognitive behavioral therapy) for treatment of post-stroke depression.	N/A	[161]	Neither for nor against	Reviewed, New-added

Recommendation	2010 Grade	Evidence	Strength of Recommendation	Recommendation Category
38. There is insufficient evidence to recommend for or against pharmacotherapy or psychotherapy for the treatment of post-stroke anxiety.	N/A	[105,162] **Additional References:** [158-161]	Neither for nor against	Reviewed, New-added
39. We suggest offering exercise as adjunctive treatment for post-stroke depression or anxiety symptoms.	None	[163,164]	Weak for	Reviewed, New-added
40. We suggest offering mind-body exercise (e.g., tai chi, yoga, qigong) as adjunctive treatment for post-stroke depression or anxiety symptoms.	N/A	[162,165]	Weak for	Reviewed, New-added
41. There is insufficient evidence to recommend for or against any specific assessments or interventions regarding return to work.	C	[32,166] **Additional References:** [167,168]	Neither for nor against	Reviewed, Amended
42. There is insufficient evidence to recommend for or against using any specific assessments or interventions to facilitate return to driving.	I, I	[169]	Neither for nor against	Reviewed, Amended

Appendix F: 2010 Recommendation Categorization Table

Table F-1. 2010 Recommendation Categorization Table[1,2,3,4,5]

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
1.2	1	16	The initial assessment should have special emphasis on the following: Medical Status a. Level of consciousness and cognitive status b. Risk factors for stroke recurrence c. History of previous antiplatelet or anticoagulation use, especially at the time of stroke d. Medical co-morbidities (See Annotation E: 3.1-3.5) Risk of Complications e. Screening for aspiration risk (Brief swallowing assessment) (see Section 1.3) f. Malnutrition and dehydration (See Annotation E: 2.2) g. Skin assessment and risk for pressure ulcers (see Annotation E: 2.3) h. Risk of deep vein thrombosis (DVT) (see Annotation E: 2.4) i. Bowel and bladder dysfunction (see Annotation E: 2.5) j. Sensation and pain (see Annotation E: 2.6) Function k. Motor function and muscle tone l. Mobility, with respect to the patient's needs for assistance in movement m. Emotional support for the family and caregiver.	None	Not Reviewed, Deleted	--
1.3	1	16	Strongly recommend that all acute/newly diagnosed stroke patients be screened for swallowing problems prior to oral intake of any medication, foods, or fluids to determine risk for aspiration.	None	Not Reviewed, Deleted	--

[1] 2010 Location columns: The first three columns indicate the location of each recommendation within the 2010 VA/DoD Stroke Rehabilitation CPG.
[2] 2010 Recommendation Text column: This column contains the wording of each recommendation from the 2010 VA/DoD Stroke Rehabilitation CPG.
[3] 2010 Grade column: The 2010 VA/DoD Stroke Rehabilitation CPG used the U.S. Preventive Services Task Force (USPSTF) evidence grading system: http://www.uspreventiveservicestaskforce.org. The strength of recommendations were rated as follows: A- a strong recommendation that the clinicians provide the intervention to eligible patients; B- a recommendation that clinicians provide (the service) to eligible patients; C- no recommendation for or against the routine provision of the intervention is made; D- recommendation is made against routinely providing the intervention; I- the conclusion is that the evidence is insufficient to recommend for or against routinely providing the intervention. "None" indicates there was no grade assigned to the recommendation in the 2010 VA/DoD Stroke Rehabilitation CPG.
[4] Recommendation Category column: This column indicates the way in which each 2010 VA/DoD Stroke Rehabilitation CPG recommendation was updated.
[5] 2019 Recommendation column: For recommendations that were carried forward to the 2019 VA/DoD Stroke Rehabilitation CPG, this column indicates the new recommendation(s) to which they correspond.

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
1.3	2	17	Screening should be performed by an appropriately trained provider within the first 24 hours of admission to determine the risk of aspiration: ▪ Low risk for aspiration: Patients who are cooperative, able to talk, voluntarily cough, swallow saliva and pass a simple swallowing screening test (water) ▪ High risk for aspiration: Patients who are non cooperative, failed the simple swallowing screening test (wet hoarse voice or coughing are noted, or volume of water consumed is below population norms), or have a history of swallowing problems, aspiration or dysphagia	None	Not reviewed, Deleted	--
1.3	3	17	Patients who are not alert should be monitored closely and swallowing screening performed when clinically appropriate.	None	Not reviewed, Deleted	--
1.3	4	17	If screening results indicate that the patient is at high risk for dysphagia, oral food and fluids should be withheld from the patient (i.e., the patient should be Nil per os [NPO]) and a comprehensive clinical evaluation of swallowing food and fluids be performed within 24 hours by a clinician trained in the diagnosis and management of swallowing disorders.	None	Not reviewed, Deleted	--
1.4	1	18	Strongly recommend that the National Institutes of Health Stroke Scale (NIHSS) be used at the time of presentation/hospital admission, or at least within the first 24 hours following presentation.	A	Not reviewed, Deleted	--
1.4	2	18	Recommend that all patients should be screened for depression and motor, sensory, cognitive, communication, and swallowing deficits by appropriately trained clinicians, using standardized and valid screening tools.	C	Not reviewed, Deleted	--
1.4	3	18	If depression, or motor, sensory, cognitive, communication, or swallowing deficits are found on initial screening assessment, patients should be formally assessed by the appropriate clinician from the coordinated rehabilitation team.	C	Not reviewed, Deleted	--
1.4	4	19	Recommend that the clinician use standardized, validated assessment instruments to evaluate the patient's stroke-related impairments, functional status and participation in community and social activities.	C	Not reviewed, Deleted	--
1.4	5	19	Recommend that the standardized assessment results be used to assess probability of outcome, determine the appropriate level of care, and develop interventions.	None	Not reviewed, Deleted	--
1.4	6	19	Recommend that the assessment findings be shared and the expected outcomes discussed with the patient and family/caregivers.	None	Not reviewed, Deleted	--
1.6	1	20	Strongly recommend that rehabilitation therapy should start as early as possible, once medical stability is reached.	A	Not reviewed, Amended	Recommendation 2

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
1.6	2	20	Recommend that the patient receive as much therapy as "needed" and tolerated to adapt, recover, and/or reestablish the premorbid or optimal level of functional independence.	None	Reviewed, Deleted	--
1.6	1	21	Recommend that risk of complications should be assessed in the initial phase and throughout the rehabilitation process and followed by intervention to address the identified risk. Areas of assessment include: a. Swallowing problems (risk of aspiration) (see 2.1) b. Malnutrition and dehydration (See 2.2) c. Skin assessment and risk for pressure ulcers (see 2.3) d. Risk of deep vein thrombosis (DVT) (see 2.4) e. Bowel and bladder dysfunction (see 2.5) f. Sensation and pain (see 2.6) g. Risk of falling (see 2.7) h. Osteoporosis (see 2.8) i. Seizures (see 2.9)	None	Not reviewed, Deleted	--
1.6	1	22	A thorough history and physical examination should be completed on all patients and should include, at a minimum: a. Chief complaint and history of present illness b. Past medical and psychiatric history c. Past surgical history d. Medications e. Allergies f. Family history g. Social history h. Functional history i. Review of systems j. Physical examination k. Imaging studies	None	Not reviewed, Deleted	--
1.6	2	22	The assessment should cover the following areas: a. Risk of Complications (swallowing problems, malnutrition, skin breakdown, risk for DVT, bowel and bladder dysfunction, falls, and pain) (see Sections 2.1-2.7) b. Determination of Impairment (Communication, Cognition, Motor, Psychological, and Safety Awareness) (see Annotations G: 4.1-4.6) and assessment of prior and current functional status (e.g., FIM™) (see Annotation G: 5.1) c. Assessment of participation in community and social activities, and a complete psychosocial assessment (Family and Caregivers, Social Support, Financial, and Cultural Support) (see Annotation G: 6.1)	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
2.1	1	23	Recommend all patients receive evaluation of nutrition and hydration status, as soon as possible after admission. Food and fluid intake should be monitored daily in all patients and body weight should be determined regularly.	None	Not reviewed, Deleted	--
2.1	2	23	Recommend that if screening for swallowing problems indicates that the patient is at risk for dysphagia, the patient should be Nil per os (NPO) and a comprehensive clinical evaluation of swallowing of food and fluid be performed within 24 hours by a professional trained in the diagnosis and management of swallowing disorders. Documentation of this exam should include information about signs and symptoms of dysphagia, likelihood of penetration and aspiration, and specific recommendations for follow-up including need for a dynamic instrumental assessment, treatment, and follow-up.	I	Not reviewed, Deleted	--
2.1	3	23	Recommend patients who are diagnosed as having dysphagia based on comprehensive clinical evaluation of swallowing should have a dynamic instrumental evaluation to specify swallowing anatomy and physiology, mode of nutritional intake, diet, immediate effectiveness of swallowing compensations and rehabilitative techniques, and referral to specialist. The optimal diagnostic procedure (VFSS, FEES) should be determined by the clinician based on patient needs and clinical setting.	None	Not reviewed, Deleted	--
2.2	1	24	Recommend all patients receive evaluation of nutrition and hydration, as soon as possible after admission. Food and fluid intake should be monitored in all patients, and body weight should be determined regularly.	None	Not reviewed, Deleted	--
2.2	2	24	Recommend that a variety of methods be used to maintain and improve intake of food and fluids. This will require treating the specific problems that interfere with intake, providing assistance in feeding if needed, consistently offering fluid by mouth to patients with dysphagia, and catering to the patient's food preferences. If intake is not maintained, feeding by a feeding gastrostomy may be necessary.	None	Reviewed, New-replaced	--
2.2	3	24	Patients at high risk for, or problems with, nutrition and their family/caregiver should receive counseling by a Registered Dietitian upon discharge regarding healthy diet and food choices.	None	Not reviewed, Deleted	--
2.3	1	25	Recommend a thorough assessment of skin integrity be completed upon admission and monitored at least daily, thereafter.	C	Not reviewed, Deleted	--
2.3	2	25	Risk for skin breakdown should be assessed using a standardized assessment tool (such as the Braden Scale).	I	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
2.3	3	25	Recommend the use of proper positioning, turning, and transferring techniques and judicious use of barrier sprays, lubricants, special mattresses, and protective dressings and padding to avoid skin injury due to maceration, friction or excessive pressure.	C	Not reviewed, Deleted	--
2.4	1	26	Concurrent risk factors that increase the risk of DVT should be assessed in all patients post stroke to determine the choice of therapy. These risk factors include mobility status, congestive heart failure (CHF), obesity, prior DVT or pulmonary embolism, limb trauma or long bone fracture.	None	Not reviewed, Deleted	--
2.4	2	26	Recommend all patients be mobilized, as soon as possible.	None	Not reviewed, Deleted	--
2.4	3	26	Recommend the use of subcutaneous low-dose low molecular weight heparin (LMWH) to prevent DVT/ PE for patients with ischemic stroke or hemorrhagic stroke and leg weakness with impaired mobility.	None	Not reviewed, Deleted	--
2.4	4	26	Attention to a history of heparin-induced thrombocytopenia will affect treatment choice. A platelet count obtained 7-10 days after initiation of heparin therapy should be considered.	None	Not reviewed, Deleted	--
2.4	5	26	Consider the use of graduated compression stockings or an intermittent pneumatic compression device as an adjunct to heparin for non-ambulatory patients or as an alternative to heparin for patients in whom anticoagulation is contraindicated.	None	Not reviewed, Deleted	--
2.4	6	26	Consider IVCF is patients at risk for PE, in whom anticoagulation is contraindicated.	None	Not reviewed, Deleted	--
2.5	1	28	Recommend a structured assessment of bladder function in acute stroke patients, as indicated. Assessment should include: ▪ Assessment of urinary retention through the use of a bladder scanner or an in-and-out catheterization ▪ Measurement of urinary frequency, volume, and control ▪ Presence of dysuria.	None	Not reviewed, Deleted	--
2.5	2	28	There is insufficient evidence to recommend for or against the use of urodynamics over other methods of assessing bladder function.	None	Not reviewed, Deleted	--
2.5	3	28	Consider removal of the indwelling catheter within 48 hours to avoid increased risk of urinary tract infection; however, if a catheter is needed for a longer period, it should be removed as soon as possible.	None	Not reviewed, Deleted	--
2.5	4	28	Recommend the use of silver alloy-coated urinary catheters, if a catheter is required.	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
2.5	5	28	Consider an individualized bladder training program (such as pelvic floor muscle training in women) be developed and implemented for patients who are incontinent of urine.	None	Not reviewed, Deleted	--
2.5	6	28	Recommend the use of prompted voiding in stroke patients with urinary incontinence.	None	Not reviewed, Deleted	--
2.5	7	28	Recommend a bowel management program be implemented in patients with persistent constipation or bowel incontinence.	I	Not reviewed, Deleted	--
2.6	1	29	Recommend pain assessment using the 0 to 10 scale.	C	Not reviewed, Deleted	--
2.6	2	29	Recommend a pain management plan that includes assessment of the following: likely etiology (i.e., musculoskeletal and neuropathic), pain location, quality, quantity, duration, intensity, and aggravating and relieving factors.	C	Not reviewed, Deleted	--
2.6	3	29	Recommend balancing the benefits of pain control with possible adverse effects of medications on an individual's ability to participate in and benefit from rehabilitation.	I	Not reviewed, Deleted	--
2.6	4	29	When practical, utilize a behavioral health provider to address psychological aspects of pain and to improve adherence to the pain treatment plan.	C	Not reviewed, Deleted	--
2.6	5	29	When appropriate, recommend use of non-pharmacologic modalities for pain control such as biofeedback, massage, imaging therapy, and physical therapy.	C	Not reviewed, Deleted	--
2.6	6	29	Recommend that the clinician tailor the pain treatment to the type of pain.	C	Not reviewed, Deleted	--
2.6	7	29	Musculoskeletal pain syndromes can respond to correcting the underlying condition such as reducing spasticity or preventing or correcting joint subluxation.	None	Not reviewed, Deleted	--
2.6	8	29	Non-steroidal anti-inflammatory drugs (NSAIDs) may also be useful in treating musculoskeletal pain.	None	Not reviewed, Deleted	--
2.6	9	29	Neuropathic pain can respond to agents that reduce the activity of abnormally excitable peripheral or central neurons.	None	Not reviewed, Deleted	--
2.6	10	29	Opioids and other medications that can impair cognition should be used with caution.	None	Not reviewed, Deleted	--
2.6	11	29	Recommend use of lower doses of centrally acting analgesics, which may cause confusion and deterioration of cognitive performance and interfere with the rehabilitation process.	C	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
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2.6	12	29	Shoulder mobility should be monitored and maintained during rehabilitation. Subluxation can be reduced and pain decreased using functional electrical stimulation applied to the shoulder girdle.	B	Not reviewed, Deleted	--
2.7	1	32	Recommend that all patients be assessed for fall risk during the inpatient phase, using an established tool.	B	Not reviewed, Deleted	--
2.7	2	32	Recommend that fall prevention precautions be implemented for all patients identified to be at risk for falls while they are in the hospital.	None	Not reviewed, Deleted	--
2.7	3	32	Refer to the falls prevention toolkit on the National Center for Patient Safety (NCPS) for specific interventions.	None	Not reviewed, Deleted	--
2.7	4	32	Recommend regular reassessments for risk of falling including at discharge, ideally in the patient's discharge environment.	B	Not reviewed, Deleted	--
2.7	5	32	Recommend that patient and family/caregiver be provided education on fall prevention both in the hospital setting and in the home environment.	B	Not reviewed, Deleted	--
2.8	1	33	Early mobilization and movement of the paretic limbs will reduce the risk of bone fracture after stroke.	A	Not reviewed, Deleted	--
2.8	2	33	Consider medications to reduce bone loss which will reduce the development of osteoporosis.	B	Not reviewed, Deleted	--
2.8	3	33	Consider assessing bone density for patients with known osteoporosis who have been mobilized for 4 weeks before having the patient bear weight.	None	Not reviewed, Deleted	--
2.8	4	33	Assess for level of Vitamin D and consider supplemental Vitamin D in patients with insufficient levels.	B	Not reviewed, Deleted	--
2.9	1	33	Obtain an EEG of individuals who have a clinical seizure or manifest in a prolonged or intermittent stage of consciousness.	None	Not reviewed, Deleted	--
2.9	2	33	Treat patients with post-stroke epilepsy with anti-epileptic medications (AEDs).	B	Not reviewed, Deleted	--
2.9	3	33	Consider the side effect profile of AEDs when choosing a chronic anticonvulsant.	B	Not reviewed, Deleted	--
2.9	4	33	Levetiracetam, and lamotrigine are the first-line anticonvulsants for post-stroke seizure and epilepsy in elderly patients or in younger patients requiring anticoagulants.	B	Not reviewed, Deleted	--
2.9	5	33	Extended-release carbamazepine might be a reasonable and less expensive option in patients under 60 years of age with appropriate bone health who do not require anticoagulation.	C	Not reviewed, Deleted	--
2.9	6	33	Prophylactic treatment with an AED is not indicated in patients without a seizure after a stroke.	A	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
3.1	1	34	Recommend obtaining clinical information for a history of diabetes or other glycemic disorder and including a blood test with admission labs in a patient with suspected stroke.	A	Not reviewed, Deleted	--
3.1	2	34	Recommend monitoring blood glucose levels for a minimum of 72 hours post-stroke.	B	Not reviewed, Deleted	--
3.1	3	34	Insulin should be adjusted to maintain a BG < 180 mg/dl with the goal of achieving a mean glucose around 140 mg/dl. Evidence is lacking to support a lower limit of target blood glucose but based on a recent trial suggesting that blood glucose < 110 mg/dl may be harmful, we do not recommend blood glucose levels < 110 mg/dl.	A	Not reviewed, Deleted	--
3.1	4	34	Insulin therapy should be guided by local protocols and preferably "dynamic" protocols that account for varied and changing insulin requirements. A nurse-driven protocol for the treatment of hypoglycemia is highly recommended to ensure prompt and effective correction of hypoglycemia.	I	Not reviewed, Deleted	--
3.1	5	34	To minimize the risk of hypoglycemia and severe hyperglycemia after discharge it is reasonable to provide hospitalized patients who have DM and knowledge deficits, or patients with newly discovered hyperglycemia, basic education in "survival skills".	I	Not reviewed, Deleted	--
3.1	6	34	Patients who experienced hyperglycemia during hospitalization but who are not known to have DM should be re-evaluated for DM after recovery and discharge.	B	Not reviewed, Deleted	--
3.1	7	34	Recommend maintenance of near-normoglycemic levels (80-140 mg/dl) for long-term prevention of microvascular and macrovascular complications.	A	Not reviewed, Deleted	--
3.2	1	36	Monitor vital signs at the time of physical therapy interventions, particularly in patients with CHD.	None	Not reviewed, Deleted	--
3.2	2	36	Consider modifying or discontinuing therapy for significant changes in heart rate, blood pressure, temperature, pulse-oximetry, or if symptoms develop including excessive shortness of breath, syncope, or chest pain.	None	Not reviewed, Deleted	--
3.2	3	36	Management of heart disease and cardiac rehabilitation should follow AHA, VA/DoD, and AHCPR guidelines.	None	Not reviewed, Deleted	--
3.3	1	36	Blood pressure should be carefully monitored following stroke.	None	Not reviewed, Deleted	--
3.3	2	36	The type of stroke (ischemic, hemorrhagic, aneurismal), the clinical situation, and co-morbidities must be considered in blood pressure management. (See VA/DoD CPG for Management of Hypertension.)	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
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3.4	1	37	People who have survived a stroke should be educated about the risks associated with excessive alcohol usage, substance abuse, and the risk for stroke recurrence.	None	Not reviewed, Deleted	--
3.4	2	37	Patients who are smokers should be counseled about the benefits of smoking cessation on reducing the risk for a future stroke, and they should be considered for nicotine replacement therapy and other interventions that promote smoking cessation.	None	Not reviewed, Deleted	--
3.5	1	37	There are several treatment options for the patient with stroke and mild depression that can be used alone or in combination based on the patient's individual need and preference for services. Refer to VA/DoD guidelines for the management of Major Depression Disorder (MDD).	None	Reviewed, New-replaced	Recommendation 35
3.5	2	37	Patients diagnosed with moderate to severe depression after stroke should be referred to Mental Health specialty for evaluation and treatment.	None	Not reviewed, Deleted	--
3.5	3	37	There is conflicting evidence regarding the use of routine pharmacotherapy or psychotherapy to prevent depression or other mood disorders following stroke.	None	Reviewed, New-replaced	Recommendation 34
3.5	4	37	Patients with stroke who are suspected of wishing to harm themselves or others (suicidal or homicidal ideation) should be referred immediately to Mental Health for evaluation.	None	Not reviewed, Deleted	--
3.5	5	37	Recommend that patients with stroke should be given information, advice, and the opportunity to talk about the impact of the illness upon their lives.	None	Not reviewed, Deleted	--
3.5	6	37	Patients following stroke exhibiting extreme emotional lability (i.e. pathological crying/tearfulness) should be given a trial of antidepressant medication, if no contraindication exists. SSRIs are recommended in this patient population.	A	Not reviewed, Deleted	--
3.5	7	37	Patients with stroke who are diagnosed with anxiety related disorders should be evaluated for pharmacotherapy options. Consider psychotherapy intervention for anxiety and panic. Cognitive Behavioral Therapy has been found to be a more efficacious treatment for anxiety and panic disorder than other therapeutic interventions.	None	Reviewed, Deleted	--
3.5	8	37	Recommend skills training regarding Activities of Daily Living (ADL's), and psychoeducation regarding stroke recovery with the family.	None	Not reviewed, Deleted	--
3.5	9	37	Encourage the patient with stroke to become involved in physical and/or other leisure activities.	None	Reviewed, New-replaced	Recommendation 39
4.1	1	40	Strongly recommend the patient be assessed for stroke severity using the NIHSS at the time of presentation/hospital admission, or at least within the first 24 hours following presentation.	A	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
4.1	2	40	Strongly recommend that all professionals involved in any aspect of the stroke care be trained and certified to perform the NIHSS.	A	Not reviewed, Deleted	--
4.1	3	40	Consider reassessing severity using the NIHSS at the time of acute care discharge to validate the first assessment or identify neurological changes.	None	Not reviewed, Deleted	--
4.1	4	40	If the patient is transferred to rehabilitation and there are no NIHSS scores in the record, the rehabilitation team should complete an NIHSS.	None	Not reviewed, Deleted	--
4.2	1	41	Assessment of communication ability should address the following areas: listening, speaking, reading, writing, gesturing, and pragmatics. Problems in communication can be language-based (as with aphasia), sensory/motor based (as with dysarthria), or cognitive-based (as with dementia).	None	Not reviewed, Deleted	--
4.2	2	41	Assessment should include standardized testing and procedures.	B	Not reviewed, Deleted	--
4.3	1	42	Motor function should be assessed at the impairment level (ability to move in a coordinated manner in designated patterns), and at the activity level (performance in real life or simulated real life tasks), using assessments with established psychometric properties.	None	Not reviewed, Deleted	--
4.3	2	42	The following components should be considered in assessment of motor function: muscle strength for all muscle groups, active and passive range of motion available, muscle tone, ability to isolate the movements of one joint from another, gross and fine motor coordination.	None	Not reviewed, Deleted	--
4.3	3	42	The daily use of the paretic extremity should be assessed using a self-report measure (e.g., the Motor Activity Log), and with accelerometry.	None	Not reviewed, Deleted	--
4.3	4	42	Balance should be assessed using a standardized assessment tool (e.g., Berg Balance Scale).	None	Not reviewed, Deleted	--
4.3	5	42	Apraxia should be assessed using an established apraxia measure (e.g., Florida Apraxia Screen).	None	Not reviewed, Deleted	--
4.3	6	42	Stroke survivors with impaired mobility should be referred to a mobility-training program (physical therapy and/or occupational therapy) where specific and individualized goals can be established.	None	Not reviewed, Deleted	--
4.4	1	43	Assessment of arousal, cognition, and attention should address the following areas: a. Arousal b. Attention deficits c. Visual neglect d. Learning and Memory deficits e. Executive function and problem-solving difficulties	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
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4.4	2	43	There is insufficient evidence to recommend for the use of any specific tools to assess cognition. Several screening and assessment tools exist. (See Appendix B for standard screening instruments for cognitive assessment.)	None	Not reviewed, Deleted	--
4.5	1	43	Recommend that all patients be screened for sensory deficits by appropriately trained clinicians. This assessment should include an evaluation of sharp/dull, temperature, light touch, vibratory and position sensation.	None	Not reviewed, Deleted	--
4.5	2	43	Consider using Semmes-Weinstein monofilament to assess cutaneous sensation.	None	Not reviewed, Deleted	--
4.5	3	43	Recommend that all individuals with stroke should have a vision exam that includes visual acuity, contrast sensitivity (using Pelli chart), perimetry for visual field integrity, eye movements (including diplopia) and visual scanning.	None	Not reviewed, Deleted	--
4.5	4	43	Recommend that a careful history related to hearing impairment be elicited from the patient and or family and that a hearing evaluation be completed for patients who demonstrate difficulty with communication where hearing impairment is suspected.	None	Not reviewed, Deleted	--
4.6	1	44	Initial evaluation of the patient should include a psychosocial history that covers pre-morbid personality characteristics, psychological disorders, pre-morbid social roles, and level of available social support.	None	Not reviewed, Deleted	--
4.6	2	44	Brief, continual assessments of psychological adjustment should be conducted to quickly identify when new problems occur. These assessments should also include ongoing monitoring of suicidal ideation and substance abuse. Other psychological factors deserving attention include: level of insight, level of self-efficacy/locus of control, loss of identity concerns, social support, sexuality, and sleep.	None	Not reviewed, Deleted	--
4.6	3	44	Review all medications and supplements including over the counter (OTC) medications that may affect behavior and function.	None	Not reviewed, Deleted	--
4.6	4	44	Inclusion of collateral information (e.g., spouse, children) is recommended to obtain a comprehensive picture of the patient's pre-morbid functioning and psychological changes since the stroke.	None	Not reviewed, Deleted	--
4.6	5	44	There is insufficient evidence to recommend the use of any specific tools to assess psychological adjustment. Several screening and assessment tools exist. (See Appendix B for standard instruments for psychological assessment.)	None	Not reviewed, Deleted	--
4.6	6	44	Post-stroke patients should be assessed for other psychiatric illnesses, including anxiety, bipolar illness, SUD, and nicotine dependence. Refer for further evaluation by mental health if indicated.	None	Not reviewed, Deleted	--
5.1	1	45	Recommend that a standardized assessment tool be used to assess functional status (ADL/IADL) of stroke patients. [B]	B	Not reviewed, Deleted	--

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5.1	2	45	Consider the use of the Functional Independence Measure (FIMTM) as the standardized functional assessment. (See Appendix B – Functional Independence Measure [FIMTM] Instrument, and a list of other standard instruments for assessment of function and impact of stroke)	None	Not reviewed, Deleted	--
6.1	1	47	Recommend all stroke patients and family caregivers receive a thorough psychosocial assessment with psychosocial intervention and referrals as needed.	None	Not reviewed, Deleted	--
6.1	2	47	The psychosocial assessment of both the patient with stroke and the primary family caregiver should include the following areas: a. History of pre-stroke functioning of both the patient and the primary family caregiver (e.g., demographic information, past physical conditions and response to treatment, substance use and abuse, psychiatric, emotional and mental status and history, education and employment, military, legal, and coping strategies) b. Capabilities and care giving experiences of the person identified as the primary caregiver c. Caregiver understanding of the patient's needs for assistance and caregiver's ability to meet those needs d. Family dynamics and relationships e. Availability, proximity, and anticipated involvement of other family members f. Resources (e.g., income and benefits, housing, and social network) g. Spiritual and cultural activities h. Leisure time and preferred activities i. Patient/family/caregiver understanding of the condition, treatment, and prognosis, as well as hopes and expectations for recovery j. Patient/family/caregiver expectations of stroke-related outcomes and preferences for follow-up care	None	Not reviewed, Deleted	--
6.1	3	47	Recommend a home assessment for all patients who will be discharged home with functional impairments.	None	Not reviewed, Deleted	--
6.1	1	48	Families and caregivers should be educated in the care of patients who have experienced a severe stroke, who are maximally dependent in ADL, or have a poor prognosis for functional recovery; as these patients are not candidates for rehabilitation intervention.	None	Not reviewed, Deleted	--
6.1	2	48	Families should receive counseling on the benefits of nursing home placement for long-term care.	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
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7.1	1	49	Once the patient is medically stable, the primary physician should consult with rehabilitation services (i.e., physical therapy, occupational therapy, speech and language pathology, kinesiotherapy, and physical medicine) to assess the patient's impairments as well as activity and participation deficiencies to establish the patient's rehabilitation needs and goals.	None	Not reviewed, Deleted	--
7.1	2	49	A multidisciplinary assessment should be undertaken and documented for all patients.	A	Reviewed, Amended	Recommendation 1
7.1	3	49	Patients with no residual disability post acute stroke who do not need rehabilitation services may be discharged back to home.	None	Not reviewed, Deleted	--
7.1	4	49	Strongly recommend that patients with mild to moderate disability in need of rehabilitation services have access to a setting with a coordinated and organized rehabilitation care team that is experienced in providing stroke services.	A	Not reviewed, Deleted	--
7.1	5	49	Post-acute stroke care should be delivered in a setting where rehabilitation care is formally coordinated and organized.	None	Not reviewed, Deleted	--
7.1	6	49	If an organized rehabilitation team is not available in the facility, patients with moderate or severe disability should be offered a referral to a facility with such a team. Alternately, a physician or rehabilitation specialist with some experience in stroke should be involved in the patient's care.	None	Not reviewed, Deleted	--
7.1	7	49	Post-acute stroke care should be delivered by a variety of treatment disciplines which are experienced in providing post-stroke care, to ensure consistency and reduce the risk of complications.	None	Not reviewed, Deleted	--
7.1	8	49	The multidisciplinary team may consist of a physician, nurse, physical therapist, occupational therapist, kinesiotherapist, speech and language pathologist, psychologist, recreational therapist, social worker, patient, and family/caregivers.	None	Not reviewed, Deleted	--
7.1	9	49	Patients who are severely disabled and for whom prognosis for recovery is poor may not benefit from rehabilitation services and may be discharged to home or nursing home in coordination with family/care giver.	None	Not reviewed, Deleted	--
7.2	1	52	The medical team, including the patient and family, must analyze the patient's medical and functional status, as well as expected prognosis in order to establish the most appropriate rehab setting.	I	Not reviewed, Deleted	--
7.2	2	52	The severity of the patient's impairment, the rehabilitation needs, the availability of family/social support and resources, the patient/family goals and preferences and the availability of community resources will determine the optimal environment for care.	I	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
7.2	3	52	Where comprehensive interdisciplinary community rehabilitation services and caregiver support services are available, early supported discharge services may be provided for people with mild to moderate disability.	B	Reviewed, Amended	Recommendation 4
7.2	4	52	Recommend that patients remain in an inpatient setting for their rehabilitation care if they are in need of daily professional nursing services, intensive physician care, and/or multiple therapeutic interventions.	None	Not reviewed, Deleted	--
7.2	5	52	Inconclusive evidence to recommend the superiority of one type of rehabilitation setting over another.	None	Not reviewed, Deleted	--
7.2	6	52	Patients should receive as much therapy as they are able to tolerate in order to adapt, recover, and/or reestablish their premorbid or optimal level of functional independence.	B	Reviewed, Deleted	--
7.3	1	57	Patients and/or their family members should be educated in order to make informed decisions and become good advocates.	None	Not reviewed, Deleted	--
7.3	2	57	The patient/family member's learning style must be assessed (through questioning or observation) and supplemental materials (including handouts) must be available when appropriate.	None	Not reviewed, Deleted	--
7.3	3	57	The following list includes topics that (at a minimum) must be addressed during a patient's rehabilitation program: a. Etiology of stroke b. Patient's diagnosis and any complications/co-morbidities c. Prognosis d. Expectations for what to expect during recovery and rehabilitation e. Secondary prevention f. Discharge plan g. Follow-up care including medications.	None	Not reviewed, Deleted	--
7.3	4	57	The clinical team and family/caregiver should reach a shared decision regarding the rehabilitation program.	None	Not reviewed, Deleted	--
7.3	5	57	The rehabilitation program should be guided by specific goals developed in consensus with the patient, family, and rehabilitation team.	None	Not reviewed, Deleted	--
7.3	6	58	Document the detailed treatment plan in the patient's record to provide integrated rehabilitation care.	None	Not reviewed, Deleted	--
7.3	7	58	The patient's family/caregiver should participate in the rehabilitation sessions, and should be trained to assist patient with functional activities, when needed.	None	Not reviewed, Deleted	--
7.3	8	58	As patients progress, additional important educational topics include subjects such as the resumption of driving, sexual activity, adjustment and adaptation to disability, patient rights/responsibilities, and support group information.	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
7.4	1	59	Initiate/continue rehabilitation program and interventions indicated by patient status, impairment, function, activity level and participation.	None	Not reviewed, Deleted	--
7.5	1	60	Patients should be re-evaluated intermittently during their rehabilitation progress. Particular attention should be paid to interval change and progress towards stated goals.	None	Not reviewed, Deleted	--
7.5	2	60	Patients who show a decline in functional status may no longer be candidates for rehabilitation interventions. Considerations about the etiology of the decline and its prognosis can help guide decisions about when/if further rehabilitation evaluation should occur.	None	Not reviewed, Deleted	--
7.5	3	60	Psychosocial status and community integration needs should be re-assessed, particularly for patients who have experienced a functional decline or reached a plateau.	None	Not reviewed, Deleted	--
7.6	1	61	Recommend that all patients planning to return to independent community living should be assessed for mobility, ADL and IADL prior to discharge (including a community skills evaluation and home assessment).	None	Not reviewed, Deleted	--
7.6	2	61	Recommend that the patient, family, and caregivers are fully informed about, prepared for, and involved in all aspects of healthcare and safety needs.	I	Not reviewed, Deleted	--
7.6	3	61	Recommend that case management be put in place for complex patient and family situations.	I	Not reviewed, Deleted	--
7.6	4	61	Recommend that acute care hospitals and rehabilitation facilities maintain up-to-date inventories of community resources, provide this information to stroke patients and their families and caregivers, and offer assistance in obtaining needed services. Patients should be given information about, and offered contact with, appropriate local statutory and voluntary agencies.	I	Not reviewed, Deleted	--
7.7	1	62	Patients and family caregivers should have their individual psychosocial and support needs reviewed on a regular basis post-discharge.	None	Not reviewed, Deleted	--
7.7	2	62	Referrals to family counseling should be offered. Counseling should focus on psychosocial and emotional issues and role adjustment.	None	Not reviewed, Deleted	--
7.7	3	62	Caregivers should be screened for high levels of burden and counseled in problem solving and adaptation skills as needed.	None	Not reviewed, Deleted	--
7.7	4	62	Caregivers and patients should be screened for depressive symptoms and referred to appropriate treatment resources as needed.	None	Not reviewed, Deleted	--
7.7	5	62	Health and social services professionals should ensure that patients and their families have information about the community resources available specific to these needs.	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
7.7	6	62	Provide advocacy and outreach to patients and families living in the community to help them adapt to changes and access community resources.	None	Not reviewed, Deleted	--
7.8	1	63	Recommend that leisure activities should be identified and encouraged and the patient enabled to participate in these activities.	I	Not reviewed, Deleted	--
7.8	2	63	Therapy for individuals with stroke should include the development of problem solving skills for overcoming the barriers to engagement in physical activity and leisure pursuits.	None	Not reviewed, Deleted	--
7.8	3	63	Individuals with stroke and their caregivers should be provided with a list of resources for engaging in aerobic and leisure activities in the community prior to discharge	None	Not reviewed, Deleted	--
7.8	4	63	Recommend that the patient participates in a regular strengthening and aerobic exercise program at home or in an appropriate community program that is designed with consideration of the patient's co-morbidities and functional limitations. (See Intervention – Physical Activity)	B	Not reviewed, Deleted	--
7.9	1	63	Recommend that all patients, if interested and their condition permits, be evaluated for the potential of returning to work.	C	Reviewed, Amended	Recommendation 41
7.9	2	63	Recommend that all patients who were previously employed, be referred to vocational counseling for assistance in returning to work.	C	Reviewed, Amended	Recommendation 41
7.9	3	64	Recommend that all patients who are considering a return to work, but who may have psychosocial barriers (e.g. motivation, emotional, and psychological concerns) be referred for supportive services, such as vocational counseling or psychological services.	C	Reviewed, Amended	Recommendation 41
7.10	1	64	Recommend all patients be given a clinical assessment of their physical, cognitive, and behavioral functions to determine their readiness to resume driving. In individual cases, where concerns are identified by the family or medical staff, the patient should be required to pass the state road test as administered by the licensing department. Each medical facility should be familiar with their state laws regarding driving after a stroke.	I	Reviewed, Amended	Recommendation 42
7.10	2	64	Consider referring patients with residual deficits to adaptive driving instruction programs to minimize the deficits, eliminate safety concerns, and optimize the chances that the patient will be able to pass the state driving test.	I	Reviewed, Amended	Recommendation 42

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
7.11	1	65	Sexual issues should be discussed during rehabilitation and addressed again after transition to the community when the post-stroke patient and partner are ready.	None	Not reviewed, Deleted	--
7.11	1	65	When an encountered barrier, such as a medical illness, makes participation difficult, referral to the appropriate service for treatment is warranted.	None	Not reviewed, Deleted	--
7.11	2	65	When the issue is related to mental health factors, assessment of these factors by a psychiatrist/psychologist and intervention/treatment is appropriate.	None	Not reviewed, Deleted	--
7.11	1	66	Recommend that the rehabilitation team ensure that a discharge plan is complete for the patient's continued medical and functional needs prior to discharge from rehabilitation services.	None	Not reviewed, Deleted	--
7.11	2	66	Recommend that every patient participate in a secondary prevention program (see Annotation D).	A	Not reviewed, Deleted	--
7.11	3	66	Recommend post-acute stroke patients be followed by a primary care provider to address stroke risk factors and continue treatment of co-morbidities.	None	Not reviewed, Deleted	--
7.11	4	66	Recommend patient and family are educated regarding pertinent risk factors for stroke.	None	Not reviewed, Deleted	--
7.11	5	66	Recommend that the family and caregivers receive all necessary equipment and training prior to discharge from rehabilitation services.	I	Not reviewed, Deleted	--
7.11	6	66	Family counseling focusing on psychosocial and emotional issues and role adjustment should be encouraged and made available to patients and their family members upon discharge.	None	Not reviewed, Deleted	--
8.1	1	68	Recommend post-discharge telephone follow-up with patients and caregivers be initiated and include problem solving and educational information.	None	Not reviewed, Deleted	--
8.1	2	68	If available, asynchronous and real-time tele-health, video, and web-based technologies, (e.g., web- based support groups, tele-rehabilitation), should be considered for patients who are unable to travel into the facility for care and services.	None	Not reviewed, Deleted	--
8.1	3	68	Ongoing monitoring of anticoagulant or antiplatelet therapy, treatment of hypertension and hypercholesterolemia, and other secondary prevention strategies are lifelong needs of patients after stroke and should normally be performed by the patient's primary healthcare provider.	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
8.1	4	68	Recommend post-acute stroke patients be followed up by a primary care provider to address stroke risk factors and continue treatment of co-morbidities.	None	Not reviewed, Deleted	--
8.1	5	68	Patient and family should be educated regarding pertinent risk factors for stroke.	None	Not reviewed, Deleted	--
8.1	6	68	Provide patient information about, and access to community based resources.	None	Not reviewed, Deleted	--
9	1	70	An oral care protocol should be implemented for patients with dysphagia and dentures to promote oral health and patient comfort.	None	Not reviewed, Deleted	--
9	2	70	Patients with persistent dysphagia should be offered an individualized treatment program guided by a dynamic instrumental swallowing assessment. The treatment program may include: a. Modification of food texture and fluids to address swallowing on an individual basis b. Education regarding swallowing postures and maneuvers on an individual basis following instrumental assessment to verify the treatment effect c. Addressing appropriate method of medication administration for patients with evidence of pill dysphagia on clinical or instrumental assessment d. Training patients and care givers, in feeding techniques and the use of thickening agents e. Patients with chronic oropharyngeal dysphagia should be seen for regular reassessment to ensure effectiveness and appropriateness of long-standing diet, continued need for compensations, and/or modification of rehabilitative techniques.	None	Reviewed, New-replaced	Recommendation 23 Recommendation 24 Recommendation 25 Recommendation 26 Recommendation 27
10	1	71	The nutritional and hydration status of stroke patients should be assessed within the first 48 hours of admission.	None	Not reviewed, Deleted	--
10	2	71	Stroke patients with suspected nutritional and/or hydration deficits, including dysphagia, should be referred to a dietitian.	None	Not reviewed, Deleted	--
10	3	71	Consider the use of feeding tubes to prevent or reverse the effects of malnutrition in patients who are unable to safely eat and those who may be unwilling to eat.	None	Reviewed, New-replaced	Recommendation 28
10	4	71	Oral supplementation may be considered for patients who are safe with oral intake, but do not receive sufficient quantities to meet their nutritional requirements.	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
11.1	1	73	Recommend that patients be given cognitive re-training, if any of the following conditions are present: a. Attention deficits b. Visual neglect c. Memory deficits d. Executive function and problem-solving difficulties	A, B, B, C	Not reviewed, Deleted	--
11.1	2	73	Patients with multiple areas of cognitive impairment may benefit from a variety of cognitive re- training approaches that may involve multiple disciplines.	C	Reviewed, New-replaced	
11.1	3	73	Recommend the use of training to develop compensatory strategies for memory deficits in post- stroke patients who have mild short term memory deficits.	B	Reviewed, New-replaced	
11.2	1	74	Consider using acetylcholinesterase inhibitors (AChEIs), specifically galantamine, donepezil, and rivastigmine, in patients with vascular dementia or vascular cognitive impairment in the doses and frequency used for Alzheimer's disease.	None	Not reviewed, Deleted	--
11.2	2	74	Consider using the NMDA receptor inhibitor memantine (Namenda) for patients with vascular dementia (VaD) or vascular cognitive impairment (VCI).	B	Not reviewed, Deleted	--
11.2	3	74	The use of conventional or atypical antipsychotics for dementia-related psychosis or behavioral disturbance should be used with caution for short term, acute changes.	None	Not reviewed, Deleted	--
11.2	4	74	Recommend against centrally acting a2-adrenergic receptor agonists (such as clonidine and others) and a1-receptor antagonists (such as prazosin and others) as antihypertensive medications for stroke patients because of their potential to impair recovery.	D	Not reviewed, Deleted	--
11.2	5	74	Recommend against the use of amphetamines to enhance motor recovery following stroke.	D	Reviewed, Deleted	--
11.3	1	76	Insufficient evidence to support specific therapeutic interventions for apraxia following stroke.	I	Not reviewed, Deleted	--
11.4	1	77	Recommend cognitive rehabilitation for patients with unilateral spatial neglect such as cueing, scanning, limb activation, aids and environmental adaptations.	B	Not reviewed, Deleted	--
11.4	2	77	Nursing and therapy sessions (e.g., for shoulder pain, postural control, feeding) need to be modified to cue attention to the impaired side in patients with impaired spatial awareness.	I	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
12	1	78	If the communication assessment indicates impairment in speech, language, and/or cognition, treatment should be considered for those affected components. Treatment can be provided individually, in groups, or by computer or trained volunteer under the supervision of a clinician.	None	Not reviewed, Deleted	--
12	2	78	Maximum restoration of the impaired ability should initially be considered: ▪ For dysarthria (and other impairments of speech), treatment can include techniques to improve articulation, phonation, fluency, resonance, and/or respiration ▪ For aphasia (and other impairments of language), treatment can include models designed to improve comprehension (e.g., stimulation/facilitation) and/or expression (e.g., word retrieval strategies) of language. It is recommended that the rate of treatment ("intensity", "dosage") should be higher rather than lower ▪ For dementia (and other impairments of cognitive aspects of communication), treatment can include techniques to maximize attention, memory, problem-solving, and executive functions	None	Not reviewed, Deleted	--
12	3	78	Once maximum restoration is achieved, compensation of the remaining impairment should be considered: ▪ For dysarthria, compensatory approaches include prostheses (e.g., palatal lift for hypernasality), alternate modalities (e.g., writing or gesturing), and augmentative/alternative communication (AAC) devices (e.g., a portable typing device that generates synthesized speech) ▪ For aphasia, compensatory approaches include alternate modalities (e.g., gesturing) and AAC devices (e.g., a portable electronic pointing board) ▪ For dementia, compensatory approaches include memory books, portable alarms, Personal Digital Assistants (PDA's), and similar devices to provide reminders and other information as needed.	None	Not reviewed, Deleted	--
12	4	78	Once maximum restoration and maximum benefits of compensation are achieved, counsel and educate those closest to the patient to modify the patient's environment to minimize and eliminate obstacles to communication, assisting them in such activities as helping them pay their bills or recording a message on their phone answering machine instructing callers to leave a message.	None	Not reviewed, Deleted	--
13.1	1	81	Strongly recommend a comprehensive motor recovery program early on in stroke rehab.	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
13.1	2	81	There is insufficient evidence to recommend for or against using NDT in comparison to other treatment approaches for motor retraining following an acute stroke.	I	Not reviewed, Deleted	--
13.1	3	81	Recommend that motor recovery program should incorporate multiple interventions, emphasizing progressive difficulties, repetition, and functional task practice,	B	Reviewed, New-replaced	Recommendation 5
13.1	4	81	Interventions for motor recovery (including improving ambulation) should include cardiovascular exercise fitness and strengthening. (see Sections 13.1.5, and 13.7)	A	Reviewed, New-replaced	Recommendation 6
13.1.5	1	84	Consider using strength training as a component of the therapeutic approach in paretic patients.	B	Not reviewed, Deleted	--
13.2	1	85	Consider active and passive ROM prolonged stretching program to decrease risk of contracture development (night splints, tilt table) in early period following stroke.	C	Not reviewed, Deleted	--
13.2	2	85	Joint movement and positioning needs to be carefully monitored during rehabilitation to prevent the development of maladaptive activity patterns.	None	Not reviewed, Deleted	--
13.3	1	86	Consider deterring spasticity with antispastic positioning, range of motion exercises, stretching and splinting. Contractures may need to be treated using splinting, serial casting, or surgical correction.	C	Not reviewed, Deleted	--
13.3	2	86	Consider use of oral agents such as tizanidine and oral baclofen for spasticity especially if the spasticity is associated with pain, poor skin hygiene, or decreased function. Tizanidine should be used specifically for chronic stroke patients.	B	Not reviewed, Deleted	--
13.3	3	86	Diazepam and other benzodiazepines should be avoided during the stroke recovery period because this class of medication may interfere with cerebral functions associated with recovery of function after stroke, and these agents are likely to produce sedation which will compromise an individual's ability to participate effectively in rehabilitation.	D	Not reviewed, Deleted	--
13.3	4	86	Consider use of botulinum toxin, on its own, or in conjunction with oral medication for patients with spasticity that is painful, impairs function, reduces the ability to participate in rehabilitation or compromises proper positioning or skin care.	B	Not reviewed, Amended	Recommendation 21
13.3	5	86	Intrathecal baclofen treatments may be considered for stroke patients with chronic lower extremity spasticity that cannot be effectively managed by oral medication or botulinum toxin.	B	Not reviewed, Amended	Recommendation 22

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
13.3	6	86	Consider neurosurgical procedures, such as selective dorsal rhizotomy or dorsal root entry zone lesion, for spasticity that cannot be managed by non-surgical modalities.	I	Not reviewed, Deleted	--
13.4	1	88	Recommend that patients demonstrating balance impairments following stroke should be provided a balance training program.	C	Not reviewed, Deleted	--
13.5	1	89	Consider using treadmill training in conjunction with other task specific practice and exercise training techniques in individuals with gait impairments post stroke without known cardiac risks for treadmill exercise.	B	Reviewed, New-replaced	Recommendation 5
13.5	2	89	Consider the use of partial bodyweight support for treadmill training (partial BWSTT) (up to 40% of individuals' weight) in conjunction with other task specific and exercise training techniques for individuals with gait impairments post stroke without known cardiac risks for treadmill exercise.	B	Reviewed, Amended	Recommendation 7
13.5	3	89	Recommend for patient with foot drop, ankle foot orthoses (AFO) to prevent foot drop and improve knee stability during walking.	B	Not reviewed, Deleted	--
13.5	4	89	Recommend Functional electrical stimulation (FES) as an adjunctive treatment for patients with impaired muscle contraction, specifically for patients with impaired gait due to ankle/knee motor impairment. FES can be utilized for individuals with acute or chronic deficits after stroke.	B	Reviewed, New-replaced	Recommendation 11
13.5	5	89	Consider Transcutaneous electrical nerve stimulation (TNS or TENS) as an adjunctive treatment for enhancing recovery of gait function after stroke.	C	Not reviewed, Deleted	--
13.5	6	89	Consider rhythmic auditory cueing as a modality to include in multimodal interventions to improve walking speed	B	Reviewed, Amended	Recommendation 8
13.5	7	89	There is no sufficient evidence supporting use of robotic devices during gait training in patients post stroke	D	Reviewed, Amended	Recommendation 15
13.5	8	89	Consider using Virtual Reality (VRT) to enhance gait recovery following stroke.	B	Reviewed, Amended	Recommendation 16
13.6	1	96	Recommend that UE functional recovery should consist of the practice of functional tasks, emphasizing progressive difficulty and repetition.	None	Reviewed, New-replaced	Recommendation 5
13.6	2	96	Recommend that treatment should be tailored to the individual patients considering the intervention that are most appropriate, engaging the patient, and are accessible and available.	None	Not reviewed, Deleted	--
13.6	3	96	Recommend Constraint-Induced Movement Therapy (CIMT) for individuals with at least 10 degrees of extension in two fingers, the thumb and the wrist.	A	Reviewed, Amended	Recommendation 9
13.6	4	96	Recommend robot-assisted movement therapy as an adjunct to conventional therapy in patients with deficits in arm function to improve motor skill at the joints trained.	B	Reviewed, Amended	Recommendation 14

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
13.6	5	96	Recommend bilateral practice to improve UE function.	B	Not reviewed, Deleted	--
13.6	6	96	Recommend treatment with FES for patients who have impaired upper extremity muscle contraction, specifically with patients with elbow/wrist motor impairment.	B	Reviewed, New-replaced	Recommendation 11
13.6	7	96	Recommend FES for patients who have shoulder subluxation.	B	Not reviewed, Amended	Recommendation 12
13.6	8	96	Consider FES and mental practice combined with repetitive and intense motor practice of functional tasks.	B	Reviewed, New-replaced	Recommendation 11
13.6	9	96	Consider strengthening exercises in addition to functional task practice.	C	Not reviewed, Deleted	--
13.6	10	96	Consider virtual reality as practice context.	C	Reviewed, New-replaced	Recommendation 17
13.6	11	96	Insufficient evidence to recommend Mirror therapy.	I	Reviewed, Amended	Recommendation 10
13.6	12	96	Do NOT use repetitive practice of movements in rehabilitation of upper extremity.	None	Reviewed, Deleted	--
13.7	1	101	Strongly recommend that patients participate in a regular aerobic exercise program at home or in an appropriate community program that is designed with consideration of the patient's co- morbidities and functional limitations.	A	Not reviewed, Deleted	--
13.8	1	102	Recommend adaptive devices be used for safety and function if other methods of performing the task are not available or cannot be learned or if the patient's safety is a concern.	C	Not reviewed, Deleted	--
13.8	2	102	Recommend lower extremity orthotic devices be considered, if ankle or knee stabilization is needed to improve the patient's gait and prevent falls.	C	Not reviewed, Deleted	--
13.8	3	102	Recommend that a prefabricated brace be initially used and only patients who demonstrate long- term need for bracing have customized orthoses made.	C	Not reviewed, Deleted	--
13.8	4	102	Recommend wheelchair prescriptions be based on careful assessment of the patient and the environment in which the wheelchair will be used.	C	Not reviewed, Deleted	--
13.8	5	102	Recommend walking assistive devices be used to help with mobility efficiency and safety, when needed.	C	Not reviewed, Deleted	--
14.1	1	104	Consider that all patients with sensory impairments be provided sensory-specific training	None	Not reviewed, Deleted	--

2010 Location			2010 Recommendation Text	2010 Grade	Recommendation Category	2019 Recommendation
Section	Number	Page				
14.1	2	104	Consider that patients with sensory impairments be provided a trial of cutaneous electrical stimulation in conjunction with conventional therapy when appropriate.	None	Not reviewed, Deleted	--
14.2	1	104	Patient who have visual field cuts/hemianopsia or eye motility impairments after stroke should be provided with an intervention program for that visual impairment or compensatory strategies.	I	Reviewed, New-replaced	Recommendation 31 Recommendation 32 Recommendation 33
14.2	2	104	Consider scanning training, visual field stimulation, prisms, and eye exercises as restorative intervention strategies.	None	Reviewed, New-replaced	Recommendation 31 Recommendation 32 Recommendation 33
14.2	3	104	Consider prisms and/or patching as compensatory intervention strategies.	None	Reviewed, New-replaced	Recommendation 31 Recommendation 32 Recommendation 33
14.3	1	104	Recommend appropriate hearing aids be obtained and used, for patients with known hearing loss.	None	Not reviewed, Deleted	--
15	1	105	Recommend all patients receive ADL training	A	Not reviewed, Deleted	--
15	2	105	Recommend all patients receive IADL training in areas of need	C	Not reviewed, Deleted	--
15	3	105	Recommend those individuals with stroke who exhibit ADL /IADL deficits should be given a training program that is tailored to the individual needs and anticipated discharge setting.	I	Not reviewed, Deleted	--
16.1	1	107	There is insufficient evidence to recommend acupuncture to improve stroke rehabilitation outcomes.	D	Not reviewed, Deleted	--
16.2	1	108	The use of hyperbaric oxygen therapy is not recommended.	D	Not reviewed, Deleted	--
17	1	109	Patients and caregivers should be educated throughout the rehabilitation process to address patient's rehabilitation needs, expected outcomes, procedures and treatment as well as appropriate follow-up in the home/ community.	B	Not reviewed, Deleted	--
17	2	109	Patient and caregiver education should be provided in both interactive and written formats.	B	Not reviewed, Deleted	--
17	3	109	Caregivers should be provided in a variety of methods of training based on their specific needs, cognitive capability, and local resources; Training may be provided in individual or group format, and in community-based programs.	B	Not reviewed, Deleted	--

Appendix G: Participant List

Amy O. Bowles, MD
Chief, Brain Injury Rehabilitation Service
Department of Rehabilitation Medicine
Brooke Army Medical Center (BAMC)
Joint Base San Antonio, TX

Rebecca Briar, RPh, CACP
Cardiology Clinical Pharmacist
Cardiology Clinic
Evans Army Community Hospital
Colorado Springs, CO

Lee Ann Brumble, BSW
Vocational Rehabilitation Supervisor
James A Haley VA Hospital
Tampa, FL

Lt Col Andrew W. Bursaw, DO
General and Vascular Neurologist
Neurology Clinic
U.S. Air Force Academy
Colorado Springs, CO

Russell Carroll, PsyD
Clinical Neuropsychologist
Brain Injury Rehabilitation Service
Brooke Army Medical Center
Joint Base San Antonio, TX

Rose Collins, PhD, LP
Staff Rehabilitation Psychologist
Minneapolis VA Health Care System
TBI-Polytrauma Rehabilitation Center (4K)
Minneapolis, MN

Lesli Culver, LCSW, CBIS, BCD, C-ASWCM, VHA-CM
National Program Coordinator Telerehabilitation Enterprise Wide Initiative (TREWI)
Department of Veterans Affairs (DVA), VHA, Physical Medicine and Rehabilitation Services
Tampa, FL

Blessen C. Eapen, MD
Chief, Physical Medicine & Rehabilitation Service
VA Greater Los Angeles Health Care System
Los Angeles, CA

Kimberly Eichhorn, MS, CCC-SLP, ATP
Speech-Language Pathologist
Department of Veterans Affairs, VA Pittsburgh Healthcare System
Pittsburgh, PA

Julie Gliesing, MS, CCC-SLP, ATP
Speech-Language Pathologist
Puget Sound VA Health Care System
Seattle, WA

Paul Koons, MS, OMS, CLVT, CBIS
VISN 22 – BRC Chief, GS 14
Long Beach VAMC
Long Beach, CA

Joseph Krebs, MD
Staff Physician, Federal Employee, Ambulatory Care Section
James A. Haley Veterans' Hospital
Tampa, FL

David Lawler, OTR/L, CDRS
Occupational Therapist, Certified Driver Rehabilitation Specialist
Minneapolis VAHCS PM&R Occupational Therapy Department
Minneapolis, MN

MAJ Meghan J. Mchenry, MD
Staff Physician
Department of Pain Management
Brooke Army Medical Center
Joint Base San Antonio, TX

Joanne Nguyen, PharmD, BCACP, NCTTP
Mental Health Pharmacist
Carl Vinson VA Medical Center
Dublin, GA

Lisa Perla, MSN, FNP, CNRN, CRRN
National Polytrauma Coordinator, ARNP
Rehabilitation and Prosthetic Services
VA Central Office
Washington, DC

Michelle Peterson, PT, DPT, NCS
Polytrauma/TBI Clinical Specialist
Veterans Affairs HealthCare System
Minneapolis, MN

CDR Peter G. Seguin, MD, MPH, MA
Preventive Medicine Officer
III Marine Expeditionary Force
Okinawa, Japan

Christina Smith, RN, BSN
Medical Management Nurse Consultant and CPG Coordinator
HQ MEDCOM, Clinical Performance Assurance Directorate
San Antonio, TX

Bruno Subbarao, DO
Physiatrist, Medical Director of the Polytrauma / Transition and Care Management Program
Phoenix Veterans Health Care System
Phoenix, AZ

Johanna E. Tran, MD
Medical Director, Comprehensive Interdisciplinary Inpatient Rehabilitation Program
Department of Physical Medicine and Rehabilitation
James A. Haley Veterans' Hospital
Tampa, FL

Appendix H: Literature Review Search Terms and Strategy

A. Embase.com syntax

Question	Set #	Concept	Strategy
Question 1 – Modes of rehabilitation for motor weakness	#1	Population (adults with acute/chronic stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Motor dysfunction	'motor dysfunction'/exp OR mobility OR ((motor OR movement OR walk* OR locomotion OR stand OR standing OR balance OR gait) NEAR/3 (disab* OR dysfunction* OR disorder* OR disturb* OR impair* OR weak* OR trouble OR imped* OR performance)) OR 'apraxia'/de OR 'physical mobility'/de OR 'physical performance'/exp OR 'motor activity'/de OR ((muscle OR muscular) NEAR/5 contract*)
	#3	Intervention (rehabilitation)	'stroke rehabilitation'/de OR 'rehabilitation'/de OR 'rehabilitation care'/de OR 'rehabilitation':lnk OR rehab*
	#4	Intervention (exercise)	'exercise'/exp OR 'kinesiotherapy'/exp OR 'physiotherapy'/de OR 'physical therap*' OR exercise*:ti,ab OR physiotherap*
	#5	Motor therapy interventions	((motor OR movement) NEAR/5 (treatment* OR therap* OR recovery OR rehab* OR learning)) OR 'functional training'/de OR 'motor recovery'/de OR recovery-of-function OR 'motor rehabilitation'/de OR (motor NEAR/3 (function OR performance OR intervention*)) OR 'motor learning'/de OR motor NEAR/5 (train* OR re-train* OR learn* OR re-learn*) OR mobilization OR mobilization
	#6	Device-related interventions	'functional electrical stimulation'/de OR 'constraint induced therapy'/de OR 'functional training'/de OR ('muscle contracture'/de AND ('prevention'/lnk OR 'rehabilitation'/lnk)) OR 'body weight supported treadmill training'/de OR 'robotics'/de OR 'transcranial magnetic stimulation'/exp OR 'direct current stimulation'/de OR 'brain computer interface'/de OR 'virtual reality'/de OR 'exoskeleton (rehabilitation)'/exp
	#7	Device-related interventions	FES OR functional-electric*-stimulation OR functional-electrostimulation OR (constraint-induced NEAR/2 therapy) OR virtual-reality OR exoskeleton OR ekso OR lokomat OR ('repetitive task*' NEAR/2 (practice OR training)) OR ('functional task*' NEAR/2 (practice OR training))
	#8	Device-related interventions	(Body-weight OR weight-bearing) NEAR/5 treadmill) OR Robot* OR robot*-assisted OR robo(t*-aided OR Direct-current-stimulat* OR tDCS OR cathode-stimulation OR (transcranial NEAR/5 stimulation) OR anodal-stimulation OR brain-machine-interface* OR brain-computer-interface*
	#9	Combine sets	#1 AND #2 AND (#3 OR #4 OR #5 OR #6 OR #7 OR #8)
	#10	Meta-analyses and systematic reviews	See hedge at end of table
	#11	RCTs	See hedge at end of table
	#12	Comparative studies	See hedge at end of table
	#13	Combine sets	#10 OR #11 OR #12

Question	Set #	Concept	Strategy
Question 2 – Non-pharmacological interventions for cognitive deficits post-stroke	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Cognitive dysfunction	'cognitive defect'/de OR 'attention'/exp OR 'memory'/exp OR 'cognition'/exp OR 'vascular cognitive impairment'/de OR ((cognit* OR attention OR memory) NEAR/3 (dysfunction* OR defect* OR impairment* OR impaired OR function* OR disorder* OR difficult* OR problem* OR deficit* OR disturbance* OR disabilit*)) OR confusion OR 'executive function*' OR 'executive dysfunction' OR cognition OR comprehension OR comprehend* OR 'vascular cognitive impairment' OR (concentration OR cognitive NEAR/3 (accessibility OR dissonance OR structure OR symptoms OR task* OR thinking OR remembering))
	#3	Non-pharmacological interventions	'cognitive rehabilitation'/de OR 'cognitive therapy'/exp OR 'neurorehabilitation'/exp OR 'neuro rehabilitation' OR 'neurolog* rehabilitation':ti,ab OR ((cognitive OR cognition) NEAR/3 (treatment* OR therap* OR rehab* OR intervention* OR recovery))
	#4	Device-related interventions	'assistive technology'/de OR 'assistive technology device'/exp OR 'assistive technolog*' OR 'transcranial magnetic stimulation'/exp OR 'direct current stimulation'/de OR 'brain computer interface'/de OR 'self help device'/de
	#5	Device-related interventions	(transcranial NEAR/5 stimulat*) OR 'anodal stimulation' OR 'direct current stimulat*' OR tdcs OR 'cathode stimulation' OR 'brain machine interface*' OR 'brain computer interface*'
	#6	Traditional interventions	((Attention OR compensatory OR goal OR metacognitive OR 'visual imagery') NEAR/3 (training OR re-training)) OR 'goal attainment'/mj OR 'spaced retrieval':ti,ab OR 'systematic instruction':ti,ab OR 'goal attainment' OR 'errorless learning' OR 'goal plan' OR 'time pressure management' OR 'cognitive aids':ti,ab OR 'n back' NEAR/3 (procedure* OR test OR tests)
	#7	Combine sets	#1 AND #2 AND (#3 OR #4 OR #5 OR #6)
	#8	Meta-analyses and systematic reviews	See hedge at end of table
	#9	RCTs	See hedge at end of table
	#10	Comparative studies	See hedge at end of table
	#11	Combine sets	#8 OR #9 OR #10

Question	Set #	Concept	Strategy
Question 3 – Pharmacologic interventions for improving motor function in adults post-stroke	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Motor dysfunction	'motor dysfunction'/exp OR mobility OR ((motor OR movement OR walk* OR locomotion OR stand OR standing OR balance OR gait) NEAR/3 (disab* OR dysfunction* OR disorder* OR disturb* OR impair* OR weak* OR trouble OR imped* OR performance)) OR 'apraxia'/de OR 'physical mobility'/de OR 'physical performance'/exp OR 'motor activity'/de OR ((muscle OR muscular) NEAR/5 contract*)
	#3	Pharmacologic interventions	'serotonin uptake inhibitor'/exp OR 'fluoxetine'/de OR 'fampridine'/de OR 'dexamphetamine'/de OR 'levodopa'/de
	#4	Pharmacotherapy	'drug therapy'/de OR pharmacotherap* OR ((drug OR medication OR medicinal OR pharmaceutical OR pharmacological) NEAR/3 (treatment* OR therap*)) OR 'pharmaco therap*' OR 'pharmaco treatment*' OR pharmacotreatment* OR 'serotonin uptake inhibitor*' OR 'serotonin specific reuptake inhibitor*' OR 'selective serotonin reuptake-inhibitor*' OR 'serotonin reuptake inhibitor*' OR ssri* OR fluoxetine OR dalfampridine OR fampridine OR dextroamphetamine OR dexamphetamine OR levodopa OR 'l dopa' OR ampyra
	#5	Combine sets	#1 AND #2 AND (#3 OR #4)
	#6	Meta-analyses and systematic reviews	See hedge at end of table
	#7	RCTs	See hedge at end of table
	#8	Comparative studies	See hedge at end of table
	#9	Combine sets	#6 OR #7 OR #8
Question 4 – Pharmacologic interventions for cognitive defects in adults post-stroke	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Cognitive dysfunction	'cognitive defect'/de OR 'attention'/exp OR 'memory'/exp OR 'cognition'/exp OR 'vascular cognitive impairment'/de OR ((cognit* OR attention OR memory) NEAR/3 (dysfunction* OR defect* OR impairment* OR impaired OR function* OR disorder* OR difficult* OR problem* OR deficit* OR disturbance* OR disabilit*)) OR confusion OR 'executive function*' OR 'executive dysfunction' OR cognition OR comprehension OR comprehend* OR 'vascular cognitive impairment' OR (concentration OR cognitive NEAR/3 (accessibility OR dissonance OR structure OR symptoms OR task* OR thinking OR remembering))

Question	Set #	Concept	Strategy
Question 4 – Pharmacologic interventions for cognitive defects in adults post-stroke (continued)	#3	Pharmacotherapy	'drug therapy'/de OR 'pharmaceutical care'/de OR ((drug* OR medication* OR medicinal OR pharmaceutical* OR pharmacologic*) NEAR/3 (treatment* OR therap* OR intervention*)) OR 'pharmaco therap*' OR 'pharmaco treatment*' OR pharmacotherap* OR pharmacotreatment*
	#4	Pharmacologic interventions	'serotonin uptake inhibitor'/exp OR 'methylphenidate'/de OR 'donepezil'/de OR 'memantine'/de OR 'atomoxetine'/de OR 'rivastigmine'/de OR 'modafinil'/de
	#5	Pharmacologic interventions	'serotonin uptake inhibitor*' OR 'serotonin specific reuptake inhibitor*' OR 'selective serotonin reuptake inhibitor*' OR 'serotonin reuptake inhibitor' OR ssri* OR methylphenidate OR donepezil OR aricept OR namenda OR memantine OR atomxetine OR Strattera OR rivastigmine OR exelon OR modafinil OR Provigil
	#6	Combine sets	#1 AND #2 AND (#3 OR #4 OR #5)
	#7	Meta-analyses and systematic reviews	See hedge at end of table
	#8	RCTs	See hedge at end of table
	#9	Comparative studies	See hedge at end of table
	#10	Combine sets	#7 OR #8 OR #9
Question 5 – Duration, intensity, frequency of rehabilitations for motor recovery	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Motor dysfunction	'motor dysfunction'/exp OR mobility OR ((motor OR movement OR walk* OR locomotion OR stand OR standing OR balance OR gait) NEAR/3 (disab* OR dysfunction* OR disorder* OR disturb* OR impair* OR weak* OR trouble OR imped* OR performance)) OR 'apraxia'/de OR 'physical mobility'/de OR 'physical performance'/exp OR 'motor activity'/de OR ((muscle OR muscular) NEAR/5 contract*)
	#3	Exercise and rehabilitation	'stroke rehabilitation'/de OR 'rehabilitation'/de OR 'rehabilitation care'/de OR 'rehabilitation':lnk OR rehab* OR 'exercise'/exp OR 'kinesiotherapy'/exp OR 'physiotherapy'/de OR 'physical therap*' OR exercise*:ti,ab OR physiotherap*
	#4	Motor therapy interventions	((motor OR movement) NEAR/5 (treatment* OR therap* OR recovery OR rehab* OR learning)) OR 'functional training'/de OR 'motor recovery'/de OR recovery-of-function OR 'motor rehabilitation'/de OR (motor NEAR/3 (function OR performance OR intervention*)) OR 'motor learning'/de OR motor NEAR/5 (train* OR re-train* OR learn* OR re-learn*) OR mobilization OR mobilization
	#5	Device-related interventions	'functional electrical stimulation'/de OR 'constraint induced therapy'/de OR 'functional training'/de OR ('muscle contracture'/de AND ('prevention'/lnk OR 'rehabilitation'/lnk)) OR 'body weight supported treadmill training'/de OR 'robotics'/de OR 'transcranial magnetic stimulation'/exp OR 'direct current stimulation'/de OR 'brain computer interface'/de OR 'virtual reality'/de OR 'exoskeleton (rehabilitation)'/exp

Question	Set #	Concept	Strategy
Question 5 – Duration, intensity, frequency of rehabilitations for motor recovery (continued)	#6	Device-related Interventions	FES OR functional- electric*-stimulation OR functional- electrostimulation OR (constraint-induced NEAR/2 therapy) OR virtual-reality OR exoskeleton OR ekso OR lokomat OR ('repetitive task*' NEAR/2 (practice OR training)) OR ('functional task*' NEAR/2 (practice OR training)) OR ((Body-weight OR weight-bearing) NEAR/5 treadmill)) OR Robot* OR robot*-assisted OR robot*-aided OR Direct-current-stimulat* OR tDCS OR cathode-stimulation OR (transcranial NEAR/5 stimulation) OR anodal-stimulation OR brain-machine-interface* OR brain-computer-interface*
	#7	Duration/intensity	(early OR earlier OR timing OR initiat*) NEAR/5 rehab* OR 'treatment duration'/de OR (duration NEAR/3 (therapy OR treatment OR rehab*)) OR (length NEAR/3 (therapy OR treatment OR rehab*)) OR duration:ti OR intensity:ti OR (number NEAR/3 sessions) OR timing:ti,ab OR 'very early rehabilitation'
	#8	Combine sets	#1 AND #2 AND (#3 OR #4 OR #5 OR #6) AND #7
	#9	Meta-analyses and systematic reviews	See hedge at end of table
	#10	RCTs	See hedge at end of table
	#11	Combine sets	#9 OR #10
Question 6 – Duration, intensity, frequency of rehabilitation interventions for cognitive and/or speech language	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Cognitive dysfunction	'cognitive defect'/de OR 'attention'/exp OR 'memory'/exp OR 'cognition'/exp OR 'vascular cognitive impairment'/de OR ((cognit* OR attention OR memory) NEAR/3 (dysfunction* OR defect* OR impairment* OR impaired OR function* OR disorder* OR difficult* OR problem* OR deficit* OR disturbance* OR disabilit*)) OR confusion OR 'executive function*' OR 'executive dysfunction' OR cognition OR comprehension OR comprehend* OR 'vascular cognitive impairment' OR (concentration OR cognitive NEAR/3 (accessibility OR dissonance OR structure OR symptoms OR task* OR thinking OR remembering))
	#3	Speech/language dysfunction	'aphasia'/exp OR aphasi* OR 'apraxia of speech'/de OR 'dysarthria'/exp OR 'speech disorder'/de OR 'language disability'/de OR 'post stroke aphasia'/de OR ((speech OR language* OR communicat*) NEAR/3 (disorder* OR disturbance OR impair* OR dysfunction OR difficult* OR disabilit*)) OR 'dysphasia'/de OR (apraxia NEAR/2 speech) OR articulationdisorder* OR dysarthria OR dysphas* OR anomia OR anomic
	#4	Cognitive interventions	'cognitive rehabilitation'/de OR 'cognitive therapy'/exp OR 'neurorehabilitation'/exp OR 'neuro rehabilitation' OR 'neurolog* rehabilitation':ti,ab OR ((cognitive OR cognition) NEAR/3 (treatment* OR therap* OR rehab* OR intervention* OR recovery))
	#5	Device-related interventions	'assistive technology'/de OR 'assistive technology device'/exp OR 'assistive technolog*' OR 'transcranial magnetic stimulation'/exp OR 'direct current stimulation'/de OR 'brain computer interface'/de OR 'self help device'/de
	#6	Device-related interventions	'assistive technology'/de OR 'assistive technology device'/exp OR 'assistive technolog*' OR 'transcranial magnetic stimulation'/exp OR 'direct current stimulation'/de OR 'brain computer interface'/de OR 'self help device'/de

Question	Set #	Concept	Strategy
Question 6 – Duration, intensity, frequency of rehabilitation interventions for cognitive and/or speech language (continued)	#7	Traditional cognitive interventions	((Attention OR compensatory OR goal OR metacognitive OR 'visual imagery') NEAR/3 (training OR re-training)) OR 'goal attainment'/mj OR 'spaced retrieval':ti,ab OR 'systematic instruction':ti,ab OR 'goal attainment' OR 'errorless learning' OR 'goal plan' OR 'time pressure management' OR 'cognitive aids':ti,ab OR 'n back' NEAR/3 (procedure* OR test OR tests)
	#8	Speech/language rehabilitation	'speech and language rehabilitation'/exp OR 'speech therapy'/de OR 'speech rehabilitation'/exp OR 'speech generating device'/de
	#9	Speech/language rehabilitation	(speech OR language* OR linguistic OR aphasi* OR dysphasi* OR anomia OR anomic) NEAR/5 (therap* OR train* OR rehabilitat* OR treat* OR remediat* OR intervention*) OR Facilitated-communication OR augmentative-communication OR speech-generating-device* OR systematic-instruction
	#10	Aphasia treatment interventions	(Anagram* OR reading OR phonological OR conversation* OR communicat* OR 'copy and recall' OR 'constraint induced aphasia therapy' OR 'life participation' OR 'elaboration training' OR 'script training' OR semantic* OR 'visual feature'):ti,ab
	#11	Aphasia treatment interventions	((mapping:ti,ab OR 'visual action':ti,ab OR phonomotor:ti,ab) AND (therap*:ti,ab OR treatment*:ti,ab)) OR 'reading'/mj OR 'phonetics'/mj OR 'language ability'/mj OR 'speech intelligibility'/mj OR 'conversation'/mj OR 'language therapy'/mj OR 'social participation'/mj OR 'semantics'/mj OR 'sentence processing'/de OR 'sentence comprehension'/de
	#12	Duration/intensity	(early OR earlier OR timing OR initiat*) NEAR/5 rehab* OR 'treatment duration'/de OR (duration NEAR/3 (therapy OR treatment OR rehab*)) OR (length NEAR/3 (therapy OR treatment OR rehab*)) OR duration:ti OR intensity:ti OR (number NEAR/3 sessions) OR timing:ti,ab
	#13	Combine sets	#1 AND (#2 OR #3) AND (#4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11) AND #12
	#14	Meta-analyses and systematic reviews	See hedge at end of table
	#15	RCTs	See hedge at end of table
	#16	Combine sets	#14 OR #15
Question 7 – Technology-assisted tools for motor, cognitive and speech outcomes	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Technology-assisted tools	'mhealth' OR 'm-health' OR 'mobile health'/de OR 'environmental control unit' OR 'home environment'/de OR 'sensor technolog*' OR 'mobile phone'/de OR 'wireless communication'/de OR 'mobile application'/de OR 'social media'/de OR 'social media' OR twitter OR tweet OR facebook OR 'smartphone' OR 'smart phone' OR 'smartwatch' OR 'smart watch' OR 'personal digital assistant' OR 'information technology based' OR 'app-based' OR 'application based' OR Android OR jawbone OR 'web 2.0' OR sensewear OR ('videorecording'/exp AND 'teaching'/exp)
	#3	Technology-assisted tools	('cell phone' OR 'iPhone' OR ((mobile OR wireless OR Bluetooth) NEAR/2 (health* OR device OR phone OR internet OR application OR app)))

Question	Set #	Concept	Strategy
Question 7 – Technology-assisted tools for motor, cognitive and speech outcomes (continued)	#1	Technology-assisted tools	(wearable NEAR/3 device*) OR fitbit
	#5	Technology-assisted tools	laptop OR (tablet NEAR/3 (computer* OR mobile)) OR ipad
	#6	Technology-assisted tools	'text messaging'/de OR texting OR (text* NEAR/2 messag*) OR 'sms' OR 'short message service'
	#7	Smart home	(environment* NEAR/3 control*) OR (smart NEAR/3 (home* OR environment* OR device*))
	#8	Technology-assisted tools	video* NEAR/3 teach*
	#9	Combine mHealth sets	#2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8
	#10	Motor dysfunction	'motor dysfunction'/exp OR mobility OR ((motor OR movement OR walk* OR locomotion OR stand OR standing OR balance OR gait) NEAR/3 (disab* OR dysfunction* OR disorder* OR disturb* OR impair* OR weak* OR trouble OR imped* OR performance)) OR 'apraxia'/de OR 'physical mobility'/de OR 'physical performance'/exp OR 'motor activity'/de OR ((muscle OR muscular) NEAR/5 contract*)
	#11	Cognitive dysfunction	'cognitive defect'/de OR 'attention'/exp OR 'memory'/exp OR 'cognition'/exp OR 'vascular cognitive impairment'/de OR ((cognit* OR attention OR memory) NEAR/3 (dysfunction* OR defect* OR impairment* OR impaired OR function* OR disorder* OR difficult* OR problem* OR deficit* OR disturbance* OR disabilit*)) OR confusion OR 'executive function*' OR 'executive dysfunction' OR cognition OR comprehension OR comprehend* OR 'vascular cognitive impairment' OR (concentration OR cognitive NEAR/3 (accessibility OR dissonance OR structure OR symptoms OR task* OR thinking OR remembering))
	#12	Speech dysfunction	'aphasia'/exp OR aphasi* OR 'apraxia of speech'/de OR 'dysarthria'/exp OR 'speech disorder'/de OR 'language disability'/de OR 'post stroke aphasia'/de OR ((speech OR language* OR communicat*) NEAR/3 (disorder* OR disturbance OR impair* OR dysfunction OR difficult* OR disabilit*)) OR 'dysphasia'/de OR (apraxia NEAR/2 speech) OR articulationdisorder* OR dysarthria OR dysphas* OR anomia OR anomic
	#13	Combine sets	#1 AND #9 AND (#10 OR #11 OR #12)
	#14	Stroke rehabilitation	'stroke rehabilitation'/de OR 'rehabilitation'/de OR 'rehabilitation care'/de OR 'rehabilitation':lnk OR rehab*
	#15	Combine sets	#13 AND #14
	#16	Meta-analyses and systematic reviews	See hedge at end of table
	#17	RCTs	See hedge at end of table
	#18	Combine sets	#16 OR #17

Question	Set #	Concept	Strategy
Question 8 – Interventions for visual dysfunction	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Visual impairments	'visual impairment'/exp OR 'visual disorder'/exp OR 'visual field defect'/de OR 'eye movement disorder'/exp OR 'visuospatial neglect' OR 'eye motility impairment*' OR 'eye movement disorder*' OR 'depth perception'/de OR 'depth perception' OR 'stereoscopic vision'/de OR 'ocular motility' OR 'visual field'/de OR 'visual acuity'/de OR 'visual field cuts' OR diplopia OR hemianop* OR blindness OR 'low vision' OR 'refractive errors' OR scotoma OR stereoception OR stereopsis
	#3	Visual impairments	((Vision OR visual* OR sight OR eye OR eyes OR eyesight OR spatial OR oculomotor) NEAR/5 (impair* OR defect* OR loss OR handicap OR dysfunction OR disorder* OR problem* OR disability* OR disease* OR manifestation*)) OR (visual NEAR/3 (acuity OR resolution OR sharpness OR field* OR track*))
	#4	Interventions	'visual system examination'/exp OR 'eye examination'/de OR 'vision test'/exp OR 'ophthalmology'/exp OR 'orthoptics'/de OR 'visual system function'/exp OR ophthalmol* OR optometry* OR orthoptic*
	#5	Interventions	((visual* or vision or eye or eyes or eyesight or sight OR oculomotor OR oculo-motor) NEAR/5 (screening OR test* OR examination* OR training OR rehab*)) OR (Ocular NEAR/3 exam*) OR 'visual aid'/exp OR 'spectacles'/de OR 'fresnel prism'/de OR ((prism NEAR/3 (glasses OR eyeglasses OR spectacles))) OR 'fresnel prism*'
	#6	Combine sets	#1 AND (#2 OR #3) AND (#4 OR #5)
	#7	Meta-analyses and systematic reviews	See hedge at end of table
	#8	RCTs	See hedge at end of table
	#9	Combine sets	#7 OR #8
Question 9 – Interventions for post-stroke anxiety and depression	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Post-stroke depression or anxiety	'post-stroke depression'/de OR 'anxiety'/mj OR 'anxiety disorder'/exp/mj OR depression/mj OR 'major depression'/de OR 'dysthymia'/de OR (Depress* OR dysthymi* OR anxiety OR anxieties OR anxious OR phobi* OR panic-disorder* OR panic-attack*):ti,ab
	#3	Pharmacotherapy	'drug therapy'/de OR 'pharmaceutical care'/de OR ((drug* OR medication* OR medicinal OR pharmaceutical* OR pharmacologic*) NEAR/3 (treatment* OR therap* OR intervention*)) OR 'pharmaco therap*' OR 'pharmaco treatment*' OR pharmacotherap* OR pharmacotreatment*
	#4	Anti-depressives and anti-anxiety pharmaceuticals	'anxiolytic agent'/exp OR 'antidepressant agent'/exp OR (('anti anxiety' OR antianxiety) NEAR/2 (agent* OR drug*)):ti,ab OR antidepressant*:ti,ab OR 'anti depressant*':ti,ab OR 'anti depressive*':ti,ab OR antidepressive*:ti,ab

Question	Set #	Concept	Strategy
Question 9 – Interventions for post-stroke anxiety and depression (continued)	#1	Therapy	therapy:ti,ab OR therapies:ti,ab OR treatment*:ti,ab OR intervention*:ti,ab OR prevent*:ti,ab
	#6	Exercise	'exercise'/exp OR 'kinesiotherapy'/exp OR 'physiotherapy'/de OR 'physical therap*' OR exercis* OR physiotherap*
	#7	Psychotherapy	'psychotherapy'/exp OR psychotherap*:ti,ab
	#8	Combine sets	#1 AND #2 AND (#3 OR #4 OR #5 OR #6 OR#7)
	#9	Meta-analyses and systematic reviews	See hedge at end of table
	#10	RCTs	See hedge at end of table
	#11	Combine sets	#9 OR #10
Question 10 – Treatments for post-stroke dysphagia	#1	Populations (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de
	#2	Dysphagia	'dysphagia'/exp OR dysphagia OR deglutition OR swallow* OR 'aspiration pneumonia'/de OR 'aspiration pneumonia' OR 'malnutrition'/de OR undernutrition OR under-nutrition OR malnourished
	#3	Interventions	Intervention* OR exercise* OR 'stroke rehabilitation'/de OR 'Rehabilitation'/de OR 'rehabilitation care'/de OR 'Rehabilitation':lnk OR rehab* OR therap* OR 'lingual strengthening' OR 'nutritional support'/de OR 'diet supplementation'/de OR transcutaneous electrical nerve stimulation'/de OR TENS OR 'tube feeding' OR 'sip feeding' OR 'enteric feeding'/de OR 'enteral feeding' OR 'enteral nutrition' OR 'enteric nutrition' OR 'intragastric feeding' OR 'intraintestinal feeding' OR head-lift OR feeding OR nutrition OR 'fluid supplementation*" OR 'feeding route' OR hydration OR 'electrotherapy'/de OR 'electric stimulation therapy' OR 'electro therapy' OR electrostimulation OR 'neuromuscular electric* stimulation' OR 'neuro-muscular electric* stimulat*' OR dpns OR 'deep pharyngeal neuromuscular stimulation'
	#4	Interventions	((transcutaneous OR percutaneous) NEAR/3 (electrostimulat* OR 'electric* nerve stimulat*' OR 'electric* stimulat*')) OR ((diet* OR nutrition*) NEAR/3 (modification* OR supplement* OR adjustment*))
	#5	Interventions	Expiratory-muscle-strength-training OR chin-tuck OR submental-emg OR Swallow-strong OR swallowstrong OR ((swallow* NEAR/2 (instrument* OR therapy OR device* OR aid*))) OR ((Shaker OR swallowing) NEAR/2 exercise*) OR ((Mendelsohn OR masako) NEAR/2 (exercise* OR maneuver))
	#6	Combine sets	#1 AND #2 AND (#3 OR #4 OR #5)
	#7	Meta-analyses and systematic reviews	See hedge at end of table
	#8	RCTs	See hedge at end of table
	#9	Combine sets	#7 OR #8

Question	Set #	Concept	Strategy
Question 11 – Effectiveness of case management or interdisciplinary care teams	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de OR 'stroke unit'/de
	#2	Rehabilitation	'stroke rehabilitation'/de OR 'Rehabilitation'/de OR 'rehabilitation care'/de OR 'Rehabilitation':lnk OR rehab* OR 'treatment planning'/de OR 'Health Care Delivery'/exp
	#3	Teams	team OR teams OR teaming OR teamwork OR 'team work' OR 'team based' OR 'interprofessional collaboration'/de OR 'healthcare team*' OR 'health care team*' OR 'care team*' OR 'teamwork'/de
	#4	Stroke teams	(stroke NEAR/3 team*):ti,ab
	#5	Combine sets	#2 AND (#3 OR #4)
	#6	Rehabilitation teams	(rehabilit * NEAR/5 team*):ti,ab
	#7	Case management	'Case management'/de OR 'patient care planning'/de OR 'patient care plan*' OR 'Patient Care Management' OR 'case manager'/de OR 'case management' OR 'care management' OR 'care manager*' OR 'coordinated care' OR 'co-ordinated care' OR 'care navigator*' OR 'case navigator*' OR 'stroke coordinator*'
	#8	Multi-disciplinary planning	('treatment planning':ti,ab OR 'therapy planning':ti,ab OR 'care planning':ti,ab) AND (multidisciplinary:ti,ab OR multidisciplinary:ti,ab OR interprofessional*:ti,ab OR interprofessional*:ti,ab OR Interdisciplinary:ti,ab OR collaborat*:ti,ab OR integrated:ti,ab OR multimodal:ti,ab OR multi-modal:ti,ab OR multi-professional:ti,ab)
	#9	Combine sets	#1 AND (#5 OR #6 OR #7 OR #8)
	#10	Meta-analyses and systematic reviews	See hedge at end of table
	#11	RCTs	See hedge at end of table
	#12	Combine sets	#10 OR #11

Question	Set #	Concept	Strategy
Question 12 – Effectiveness of evaluation and treatment for driving capability	#1	Population (adults with stroke)	'cerebrovascular accident'/exp OR stroke* OR apoplex* OR (cerebrovasc* NEAR/3 (disease* OR accident* OR lesion* OR arrest OR failure OR injur* OR insufficiency OR insult*)) OR (('cerebro vascular' OR cerebrum) NEAR/3 accident*) OR (brain NEAR/3 (accident* OR attack OR insult* OR infarct* OR ischemi* OR ischaemi* OR hemorrhage OR haemorrhage)) OR (cerebral NEAR/3 (insult OR accident OR insufficiency OR vasculopathy OR incident* OR infarct*)) OR ((Ischaemi* OR ischemi*) NEAR/3 (attack OR seizure)) OR Brain-blood-flow-disturbance OR poststroke OR 'stroke patient'/de OR 'stroke unit'/de
	#2	Driving	'car driving'/de OR 'driving ability'/de OR 'driver licence'/de OR 'driver* license' OR driver:ti,ab OR drivers:ti,ab OR driving:ti,ab OR 'motor vehicle*':ti,ab OR automobile*:ti,ab OR motorist*:ti,ab OR 'traffic accident*':ti,ab OR 'car accident*':ti,ab OR 'on road':ti,ab
	#3		((car OR cars OR vehicle*) NEAR/5 (drive OR driving)) OR ((Driver* OR driving) NEAR/5 (fitness OR skill OR performance OR abilit* OR assess* OR evaluat* OR re-train* OR training OR rehab* OR simulat* OR capabilit* OR adapt*)) OR ((driving OR driver*) NEAR/5 ('motor skill*' OR 'visual skill*'))
	#4	Combine sets	#1 AND (#2 OR #3)
	#5	Meta-analyses and systematic reviews	See hedge at end of table
	#6	RCTs	See hedge at end of table
	#7	Combine sets	#5 OR #6
General Hedges Applied to Each Search		Limit to English language publications	AND [English]/lim
		Limit to humans and include in-process publications	AND ([humans]/lim OR [article in press]/lim OR [in process]/lim)
		Remove undesired publication types (e.g., conferences, editorials)	NOT (abstract:nc OR annual:nc OR book/de OR 'case report'/de OR 'case study'/de OR conference:nc OR 'conference abstract':it OR 'conference paper'/de OR 'conference paper':it OR 'conference proceeding':pt OR 'conference review':it OR congress:nc OR editorial/de OR editorial:it OR erratum/de OR letter:it OR note/de OR note:it OR meeting:nc OR sessions:nc OR 'short survey'/de OR symposium:nc)
		Limit by publication date	AND [2009-2018]/py
Study Type Hedges Applied as Needed		Limit to meta-analyses and systematic reviews	AND ('meta analysis'/de OR 'systematic review'/de OR 'meta analysis':ti,ab OR 'meta analytic':ti,ab OR metaanaly*:ti,ab OR 'research synthesis':ti,ab OR 'systematic review':ti,ab OR pooled:ti,ab OR pooling:ti,ab OR search*:ti,ab OR 'critical review':ti OR 'evidence based':ti)
		Limit to randomized controlled trials	AND ('randomized controlled trial'/exp OR 'randomization'/de OR 'double blind procedure'/de OR 'single blind procedure'/de OR 'placebo'/de OR 'crossover procedure'/de OR placebo* OR random*:ti OR crossover* OR 'cross over' OR ((singl* OR doubl* OR tripl* OR trebl*) AND (blind* OR mask* OR sham*)) OR 'latin square' OR isrtcn* OR actrn* OR (nct* NOT nct))
		Comparative studies (for questions 1,2,3,4 only)	AND (('comparative study'/exp OR 'controlled study'/exp) OR ('case control' OR compar* OR 'control group' OR 'controlled study' OR 'controlled trial' OR 'cross over' OR crossover OR 'double blind' OR 'double blinded' OR 'matched controls' OR placebo* OR random* OR sham):ti,ab OR (versus OR vs):ti)

B. PsycINFO syntax

Question	Set #	Concept	Strategy
Question 9 – Interventions for post-stroke anxiety and depression	#1	Population (adults with stroke)	cerebrovascular accidents/ or (stroke or poststroke or post-stroke).tw.
	#2	Depression/anxiety	exp *"depression (emotion)"/ or dysthymic disorder/ or exp anxiety/ or exp anxiety disorders/ or panic/ or panic attack/ or fear/
	#3		(Depress* or dysthymi* or anxiety or anxieties or anxious or phobi* or panic-disorder* or panic-attack*).tw.
	#4		(feel$ adj5 (apprehens$ or dread or disaster$ or fear$ or worry or worried or terror)).tw.
	#5	Combine sets	1 and (2 or 3 or 4)
	#6	Meta-analyses and systematic reviews	meta analysis/ or ("meta analysis" or "meta analytic" or metaanaly* or "research synthesis" or "systematic review" or pooled or pooling or search*).ti,ab. or ("critical review" or "evidence based").ti.
	#7	RCTs	(Randomized controlled trials or random allocation or double-blind method or random sampling or single-blind method or placebos or cross-over studies).de. or placebo*.mp. or random*.ti. or randomized controlled trial.pt. or crossover*.mp. or cross over.mp. or ((singl* or doubl* or tripl* or trebl*) and (blind* or mask* or sham*)).mp. or latin square.mp. or ISRTCN.mp. or ACTRN*.mp. or (NCT* not NCT).mp. or (clinical trials/ and random*.ti.)
	#8	Combine sets	5 and (6 or 7)
	#9	Eliminate unwanted publication types	("column/opinion" or "comment/reply" or dissertation or editorial or letter or book).dt.
	#10		letter/ or editorial/ or news/ or comment/ or case report.mp. or case reports/ or note/ or conference paper/ or (letter or editorial or news or comment or case reports or conference abstract$ or book).pt.
	#11	Combine sets	8 not (9 or 10)
	#12	Apply limits for human, English language and publication years	limit 11 to (human and english language and yr="2009-Current")

Appendix I: Alternative Text Descriptions of Algorithms

The following outlines narratively describe Module A and Module B. An explanation of the purpose of the algorithms and description of the various shapes used within the algorithms can be found in the Algorithm section. The sidebars referenced within these outlines can also be found in the Algorithm section.

Module A: Rehabilitation Disposition of the Inpatient with Stroke

1. Algorithm A begins with Box 1, in the shape of a rounded rectangle: "Hospitalized patient has been identified as having a stroke (see Sidebar 1)"
2. Box 1 connects Box 2, in the shape of a rectangle: "Assess patient, consult appropriate rehabilitation services including PM&R if available, and educate patient and family on stroke (see Sidebars 2, 3, and 5)"
3. Box 2 connects to Box 3, in the shape of a hexagon, asks the question: "Does the patient have post-stroke depression?"
    a. If the answer is "Yes" to Box 3, then Box 4, in the shape of a rectangle: "Prescribe CBT or medication (SSRI or SNRI)"
    b. If the answer is "No" to Box 3, then Box 5, in the shape of a hexagon, asks the question: "Does patient have functional impairments and need rehabilitation interventions?"
        1. If the answer is "Yes" to Box 5, then Box 6, in the shape of a hexagon, asks the question: "Is the patient appropriate for discharge home?"
            a. If the answer is "Yes" to Box 6, then Box 9, in the shape of an oval: "Go to Algorithm B: Outpatient/Community-based Rehabilitation"
            b. If the answer is "No" to Box 6, then Box 8, in the shape of a rectangle, "Determine appropriate setting for rehabilitation in collaboration with case management and PM&R: Continued hospitalization, acute inpatient rehabilitation, subacute inpatient rehabilitation, skilled nursing facility, long term acute care facility"
        2. If the answer is "No" to Box 5, then Box 7, in the shape of a rectangle: "Discharge patient and arrange for primary care follow-up"
4. Box 7 connects to Box 10, in the shape of a hexagon, asks the question: "Are functional impairments identified after discharge?"
    a. If the answer is "Yes" to Box 10, then Box 9, in the shape of an oval: "Go to Algorithm B: Outpatient/Community-based Rehabilitation"
    b. If the answer is "No" to Box 10, then Box 11, in the shape of a rectangle: "Continue primary care management (see Sidebar 1)"

Module B: Outpatient/Community-based Rehabilitation

1. Algorithm B begins with Box 12, in the shape of a rounded rectangle: "Outpatient presents with impairments after stroke"
2. Box 12 connects to Box 13, in the shape of a hexagon, asks the question: "Does the patient have post-stroke depression?"
    a. If the answer is "Yes" to Box 13, then Box 14, in the shape of a rectangle: "Prescribe CBT or medication (SSRI or SNRI)"
        i. Box 14 connects to Box 15, in the shape of a hexagon, asks the question: "Is an interdisciplinary stroke rehabilitation team available?"
            1. If the answer is "Yes" to Box 15, then Box 16, in the shape of a rectangle: "Refer to interdisciplinary stroke rehabilitation team"
                a. Box 16 connects to Box 26, in the shape of an oval: "Discharge patient from rehab and arrange for primary care follow-up"
            2. If the answer is "No" to Box 15, then Box 17, in the shape of a rectangle: "Consult PM&R if available"
    b. If the answer is "No" to Box 13, then Box 15, in the shape of a hexagon, asks the question: "Is an interdisciplinary stroke rehabilitation team available?"
        i. If the answer is "Yes" to Box 15, then Box 16, in the shape of a rectangle: "Refer to interdisciplinary stroke rehabilitation team"
            1. Box 16 connects to Box 26, in the shape of an oval: "Discharge patient from rehab and arrange for primary care follow-up"
        ii. If the answer is "No" to Box 15, then Box 17, in the shape of a rectangle: "Consult PM&R if available"
3. Box 17 connects to Box 18, in the shape of a rectangle: "Assess the patient (see Sidebar 2) and identify patient's rehabilitation goals (see Appendix A)"
4. Box 18 connects to Box 19, in the shape of a rectangle: "Consider optimal environment for outpatient/community-based rehabilitation services (see Sidebar 4)"
5. Box 19 connects to Box 20, in the shape of a rectangle: "Educate patient/family on stroke (see Sidebar 3), reach shared decision regarding rehabilitation program and treatment plan, and continue secondary prevention (see Sidebar 1)"
6. Box 20 connects to Box 21, in the shape of a rectangle: "Consult appropriate rehabilitation services (see Sidebar 5)"
7. Box 21 connects to Box 22, in the shape of a hexagon, asks the question: "Has the patient met rehabilitation treatment goals?"
    a. If the answer is "Yes" to Box 22, then Box 26, in the shape of a rectangle: "Discharge patient from rehab and arrange for primary care follow-up"
    b. If the answer is "No" to Box 22, then Box 23, in the shape of a rectangle: "Initiate/continue rehabilitation intervention"

8. Box 23 connects to Box 24, in the shape of a hexagon, asks the question: "Did patient reach maximum functional capacity?"
    a. If the answer is "Yes" to Box 24, then Box 26, in the shape of a rectangle: "Discharge patient from rehab and arrange for primary care follow-up"
    b. If the answer is "No" to Box 24, then Box 25, in the shape of a rectangle: "Continue treatment and reassess periodically"
9. Box 25 connects to Box 23, in the shape of a rectangle: "Initiate /continue rehabilitation intervention"

Appendix J: Abbreviation List

Abbreviation	Definition
ADL	activities of daily living
AFO	ankle foot orthoses
AHCPR	Agency for Health Care Policy and Research
AHRQ	Agency for Healthcare Research and Quality
APT	Attention Process Training
AVERT	A Very Early Rehabilitation Trial
BI	Barthel Index
BDI	Beck Depression Inventory
BWSTT	body-weight support treadmill training
CBT	cognitive behavioral therapy
CIMT	Constraint-Induced Movement Therapy
COI	conflict of interest
COR	Contracting Officer's Representative
CPG	clinical practice guideline
CTAR	chin tuck against resistance
DoD	Department of Defense
DOSS	Dysphagia Outcome and Severity Scale
EBPWG	Evidence-Based Practice Work Group
EMG	electromyogram
EMST	expiratory muscle strength training
ESD	early supported discharge
EQ-5D	EuroQol-5 Dimension
FDA	Food and Drug Administration
FEES	fiberoptic endoscopic evaluation of swallowing
FES	functional electrical stimulation
FIM	Functional Independence Measure
FMA	Fugl-Meyer Assessment
FMA-UE	Fugl-Meyer Assessment-Upper Extremity
FOCUS	effects of fluoxetine on functional outcomes after acute stroke
FOIS	Functional Oral Intake Scale
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HAMA	Hamilton Anxiety Rating Scale
HAMD	Hamilton Depression Rating Scale
HEC	Health Executive Council
HH	homonymous hemianopsia
IADL	Instrumental activities of daily living
ICH	intracerebral hemorrhage
ICU	intensive care unit

Abbreviation	Definition
IOM	Institute of Medicine
IOPI	Iowa Oral Performance Instrument
IVA-CPT	Integrated Visual and Auditory- Continuous Performance Task
KQ	key question
LEAPS	Locomotor Experience Applied Post-Stroke
LOS	length of stay
MADRS	Montgomery-Asberg Depression Rating Scale
mCIMT	modified Constraint-Induced Movement Therapy
MDD	Major Depressive Disorder
MOBILISE	early mobility for non-ambulatory patients with stroke
MTF	military treatment facility
NAM	National Academy of Medicine
NGT	nasogastric tube
NICE	National Institute for Health and Care Excellence
NIHSS	National Institutes of Health Stroke Scale
NMA	network meta-analysis
NMES	neuromuscular electrical stimulation
OKS	optokinetic stimulation
PA	prism adaptation
PAS	Penetration Aspiration Scale
PASAT	Paced Auditory Serial Addition Test
PBA	pseudobulbar affect
PCC	patient-centered care
PEG	percutaneous endoscopic gastrostomy
PES	pharyngeal electrical stimulation
PICOTS	population, intervention, comparison, outcome, timing and setting
PIRATE	Program for Intensive Residential Aphasia Treatment & Education
PM&R	physical medicine and rehabilitation
PT	physical therapy
RCT	randomized controlled trials
rTMS	repetitive transcranial magnetic stimulation
rt-PA	recombinant tissue-type plasminogen activator
SF-36	36-Item Short Form Health Survey
sICH	spontaneous intracerebral hemorrhage
SIS	Stroke Impact Scale
SNRI	serotonin norepinephrine reuptake inhibitor
SR	systematic review
SS-QOL	Stroke Specific Quality of Life Scale
SSRI	selective serotonin reuptake inhibitor
STAI I and II	State-Trait Anxiety Inventory

Abbreviation	Definition
STEPS	Swallowing Treatment Using Pharyngeal Electrical Stimulation
SWAL-QOL	Swallowing-Related Quality of Life Scale
TBI	traumatic brain injury
TCAs	tricyclic antidepressants
tDCS	transcranial direct current stimulation
TENS	transcutaneous electrical nerve stimulation
TMS	transcranial magnetic stimulation
TPRT	tongue to palate resistance training
USN	unilateral spatial neglect
USPSTF	United States Preventive Services Task Force
VA	Department of Veterans Affairs
VR	virtual reality
WMFT	Wolf Motor Function Test

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