AHA Scientific Statement

Comprehensive Overview of Nursing and Interdisciplinary Rehabilitation Care of the Stroke Patient

A Scientific Statement From the American Heart Association

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I. Introduction

In the United States, the incidence rate of new or recurrent stroke is approximately 795 000 per year, and stroke prevalence for individuals over the age of 20 years is estimated at 6.5 million.[1] Mortality rates in the first 30 days after stroke have decreased because of advances in emergency medicine and acute stroke care. In addition, there is strong evidence that organized postacute, inpatient stroke care delivered within the first 4 weeks by an interdisciplinary healthcare team results in an absolute reduction in the number of deaths.[2,3] Despite these positive achievements, stroke continues to represent the leading cause of long-term disability in Americans: An estimated 50 million stroke survivors worldwide currently cope with significant physical, cognitive, and emotional deficits, and 25% to 74% of these survivors require some assistance or are fully dependent on caregivers for activities of daily living (ADLs).[4,5]

Notwithstanding the substantial progress in acute stroke care over the past 15 years, the focus of stroke medical advances and healthcare resources has been on acute and subacute recovery phases, which has resulted in substantial health disparities in later phases of stroke care. Additionally, healthcare providers (HCPs) are often unaware of not only patients' potential for improvement during more chronic recovery phases but also common issues that stroke survivors and their caregivers experience. Furthermore, even with evidence that documents neuroplasticity potential regardless of age and time after stroke,[6] the mean lifetime cost of ischemic stroke (which accounts for 87% of all strokes) in the United States is an estimated $140 000 (for inpatient, rehabilitation, and follow-up costs), with 70% of first-year stroke costs attributed to acute inpatient hospital care[1]; therefore, fewer financial resources appear to be dedicated to providing optimal care during the later phases of stroke recovery.

Because there remains a need to educate nursing and other members of the interdisciplinary team about the potential for recovery in the later or more chronic phases of stroke care, the present scientific statement summarizes the best available evidence and recommendations for interdisciplinary management of the needs of stroke survivors and their families during inpatient and outpatient rehabilitation and in chronic care and end-of-life settings. The guidelines for making decisions regarding classes and levels of evidence are listed in Table 1 and are the same as those used by previous American Heart Association (AHA) writing groups.[7] Before reviewing the evidence pertaining to stroke rehabilitation, we first briefly review the World Health Organization's (WHO) international classification of functioning, disability, and health (ICF),[8] which serves as an organizational scaffold for the present statement; provide an overview of the interdisciplinary team approach to rehabilitation; and define the different care settings in which stroke survivors may receive services during the more chronic phases of their recovery. As a reference, a list of abbreviations used within this statement can be found in Table 2.

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Table 1. Applying Classification of Recommendations and Level of Evidence[7]

SIZE OF TREATMENT EFFECT →

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/ administered	CLASS IIa *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	CLASS III *Risk ≥ Benefit* Procedure/Treatment should **NOT** be performed/administered **SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL**
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations†	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	is not recommended is not indicated should not is not useful/effective/beneficial may be harmful

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as sex, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Even though randomized trials are not available, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

†In 2003, the ACCF/AHA Task Force on Practice Guidelines developed a list of suggested phrases to use when writing recommendations. All guideline recommendations have been written in full sentences that express a complete thought, such that a recommendation, even if separated and presented apart from the rest of the document (including headings above sets of recommendations), would still convey the full intent of the recommendation. It is hoped that this will increase readers' comprehension of the guidelines and will allow queries at the individual recommendation level.

A. The WHO ICF Model

Because of the complexity and importance of continuity across the rehabilitation care continuum, the WHO's ICF[8] has been adopted as the organizational framework for the present review. The WHO ICF model acknowledges that recovery after stroke (as well as other health conditions) is a multifaceted process that encompasses the interplay of (1) the pathophysiological processes directly related to the stroke and its associated comorbidities, (2) the impact this condition has on the individual, and (3) contextual variables such as each survivor's personal and environmental resources. Therefore, the WHO ICF serves as an effective guide for assessing and addressing the functional and societal impact that stroke has at the level of individual stroke survivors and their caregivers, and it has been adopted by many of the healthcare disciplines responsible for providing organized stroke care[9] and more broadly by many countries around the world to examine health and disability issues. The Commission on Accreditation of Rehabilitation Facilities also uses the ICF terminology and rubric to assess the quality of rehabilitation care.[10] Within the ICF, the impact of stroke is described according to the following dimensions[8]:

- *Loss of body functions and structures* includes impairments of structures and physiological and psychological functions that result as a primary (eg, hemiparesis, cognitive dysfunction) or secondary (eg, contractures, decubiti) consequence of stroke.
- *Activities limitations* reflect the difficulties stroke survivors experience in functional task performance, including ADLs and instrumental ADLs (IADLs; eg, difficulties with telephone use due to communication impairments).

Table 2. Alphabetical Listing of Abbreviations Used

ADL	activity of daily living
AHA	American Heart Association
FES	functional electric stimulation
HCP	healthcare provider
IADL	instrumental activity of daily living
ICF	International Classification of Functioning, Disability, and Health
IRF	inpatient rehabilitation facility
LE	lower extremity
OT	occupational therapy/therapist
PROM	passive range of motion
PT	physical therapy/therapist
RCT	randomized controlled trial
SLP	speech-language pathology/pathologist
UE	upper extremity
WHO	World Health Organization

- *Participation restrictions* refer to problems stroke survivors encounter when reestablishing previous or developing new life and societal involvements (eg, problems returning to work due to mobility and cognitive issues).
- *Contextual factors* include the unique personal and environmental variables of each stroke survivor that influence how his or her disability is experienced, as well as access to health care. Personal factors include internal attributes (eg, sex, comorbidities, ethnocultural background), whereas environmental factors are external attributes (eg, family support, social attitudes, architectural barriers, healthcare resources).

The Figure illustrates the interactions among these ICF dimensions. Importantly, there is no 1-to-1 relationship among the dimensions; for example, one cannot assume that mild body structure and function deficits will result in mild activity limitations or participation restrictions or that a survivor with numerous facilitative personal and environmental supports will demonstrate few activity limitations. Accordingly, the model underscores consideration of all ICF dimensions when one provides assessment or treatment services to stroke and other patient populations, because failure to consider all dimensions may result in overestimation or underestimation of the effects of stroke on a given survivor and his or her significant others and consequently may lead to the provision of inappropriate treatment services. Indeed, recent trends in stroke rehabilitation research have concentrated on incorporating outcome measures that reflect all ICF dimensions.[11]

The present statement reviews chronic stroke care diagnostic and therapeutic techniques with respect to structure and function, activity, and participation ICF dimensions. Although the WHO ICF model defines activity and participation dimensions separately, the model applies these dimensions as a singular construct when clinically qualifying and quantifying the consequences of a health condition.[8] Hence, in the present statement, activity and participation dimensions are also considered as 1 construct when stroke management

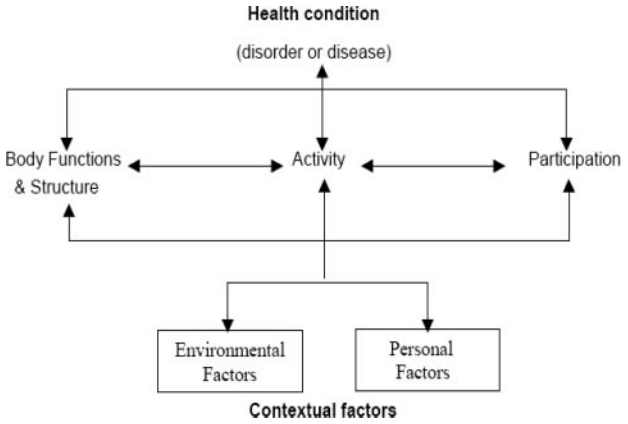

Figure. Diagrammatic representation of the WHO's ICF,[8] reflecting interactions between the consequences of disease and contextual factors.

evidence is reviewed. Finally, given the number and complexity of factors that may affect stroke survivor outcomes, specific personal and environmental factors are reviewed to exemplify why consideration of contextual factors is essential to stroke management. Personal factors include such issues as secondary stroke prevention, medication compliance, depression, and coping, as well as learning capabilities of the stroke patients. The major environmental factor addressed in the present statement is family caregiver education and support.

B. The Interdisciplinary Approach to Stroke Management Across Care Settings

The holistic, comprehensive, interactive approach of an interdisciplinary team is the hallmark of stroke rehabilitation.[12] Stroke patients and caregivers are central participants in the rehabilitation process to foster therapy adherence and facilitate optimal community integration and continued quality of life despite residual impairments. With collaborative input from all rehabilitation team members, including stroke survivors and their family, comprehensive and individualized assessment and treatment plans are formulated. Table 3 describes the major disciplines involved in stroke care in the United States and identifies the World Wide Web site of each discipline's primary umbrella organization.

Because stroke is a complex disease process that requires the skills of an interdisciplinary team, nurses frequently play a central role in care coordination throughout the recovery continuum. For example, a prospective observational study of 54 US rehabilitation facilities with a geographically stratified random sample found that a 1% increase in the number of certified rehabilitation nurses on units was associated with an approximately 6% decrease in patient length of stay.[13] This finding suggests the value-added benefit of nurses with this specialty expertise. Furthermore, because across care settings, nurses commonly have the most direct contact with stroke patients and their caregivers, they are often called on to implement management techniques developed by other rehabilitation team members. Consequently, nurses should be familiar with the variety of services and procedures provided by the other disciplines that are central to stroke rehabilitation teams.

Table 3. HCPs Commonly Part of the Stroke Rehabilitation Team

Discipline	World Wide Web Site	Description
Certified rehabilitation counselors	www.crccertification.com	Assist individuals with disabilities to maximize their vocational and avocational living goals in the most integrated setting possible through the application of the counseling process, including vocational and counseling, case management, referral, and service coordination; identifying and addressing employment and attitudinal barriers; and job analysis, development, and placement services.
Neuropsychologists	www.apa.org	Specialize in brain-behavior relationships and have extensive training in anatomy, physiology, and neuropathology. They identify and treat cognitive and neurobehavioral dysfunction, and through assessment also monitor recovery and thereby enhance community reintegration.
Occupational therapists	www.aota.org	Focus on the "skills of living" necessary for independent and satisfying living. OT services include customized treatment programs to perform daily activities, comprehensive home and job site evaluations and adaptation recommendations, performance skills assessment and interventions, adaptive equipment recommendations and training, and family and caregiver education.
Rehabilitation nurses (RNs)	www.rehabnurse.org	Manage complex medical issues, provide ongoing patient and caregiver education, and establish care plans to maintain optimal wellness. RNs use a holistic approach to fulfill patients' medical, environmental, spiritual, vocational, and educational needs via principles from other disciplines and their own unique medical expertise (bowel, bladder, and skin management). In all care settings, RNs function as coordinators/case managers, collaborators, and counselors. A registered nurse with at least 2 years of practice in rehabilitation who passes the Association of Rehabilitation Nurses examination can earn the Certified Rehabilitation Nurse distinction.
Physical therapists	www.apta.org	Experts in examining and treating neuromuscular problems that affect the abilities of individuals to move. PTs practice in many settings and with all age groups.
Physicians	www.aapmr.org	Usually coordinate the rehabilitation team and manage medical conditions pertaining to stroke and comorbidities. A physician may be a physiatrist (ie, specializing in physical medicine and rehabilitation and thus restoration of function in individuals with problems that range from simple physical mobility to more complex cognitive issues).
Recreational therapists	www.atra-online.com	Provide treatment services and recreation activities to individuals with disabilities to facilitate independent physical, cognitive, emotional, and social functioning by enhancing individuals' current skills and assisting new skill development for daily living and community function. Besides discharge planning for community reintegration, they help individuals develop or redevelop social, discretionary time, decision-making, coping, self-advocacy, and basic skills to enhance overall quality of life.
Social workers	www.naswdc.org	Assist individuals, groups, or communities restore or enhance their capacity for social functioning, while creating societal conditions favorable to their goals. Requires knowledge of human development and behavior; social, economic, and cultural institutions; and interactions among these factors. Social workers help prevent crises; counsel individuals, families, and communities to facilitate coping with everyday stresses; and identify resources to allow individuals with disabilities to remain in the community.
SLPs	www.asha.org	Assess speech, language and other cognitive functions, as well as swallowing, and provide interventions and counseling/education to address language and speech disorders (eg, aphasia, apraxia of speech, dysarthria, and cognitive-communication impairment). SLPs also intervene when swallowing and cognitive disorders exist. They provide services to all age groups and in all care settings.

RN indicates rehabilitation nurse.

There is strong evidence that organized, interdisciplinary stroke care will not only reduce mortality rates and the likelihood of institutional care and long-term disability but also may enhance recovery and increase ADL independence.[5,14–19] Most stroke research, however, has focused on acute and postacute care, with less attention given to the more chronic recovery phases. As survivors progress beyond acute intensive care, they are confronted with the impact of stroke on their daily life. Whereas initial acute management focuses on pathophysiological processes at the body structure and function level, subacute and chronic phases tend to shift the focus to improving performance of functional tasks at the activity level and to facilitating community integration, including addressing vocational and avocational needs, at the participation level. Throughout the poststroke recovery continuum, personal and environmental factors modulate and influence outcomes and each individual's structure and function, activity, and participation status.[6] To manage these multifaceted and evolving aspects of stroke recovery, interdisciplinary care is required,[5] with the attributes of this care not only changing over time for a given stroke survivor but also varying by national healthcare delivery systems and care standards. Table 4 summarizes the representative patterns in poststroke healthcare delivery in the United States by setting and time elapsed since the stroke.[20–23] In addition, the

Table 4. Admission and Discharge Estimates and Interdisciplinary Team Features Across the Poststroke Care Continuum*

Phase	Admission	Length of Stay (Mean±SD)	Interdisciplinary Team Features
Hospital-based care			
Acute intensive care	Onset to hours	Subarachnoid hemorrhage: 9.2 ±12.3 h Intracerebral hemorrhage: 5.1 ±9.2 h Ischemic stroke: 1.8 ±12.3 h	MD care required High nurse staffing Life support OT/PT/SLP possible if medically stable
Acute care	2–3 d	Subarachnoid hemorrhage: 11.3 ±11.6 d Intracerebral hemorrhage: 8. 0 ±9.2 d Ischemic stroke: 6.3 ±6.8 d	MD care required High nurse staffing Close physiological monitoring Limited OT, PT, SLP SW for discharge planning
Inpatient rehabilitation care	5–7 d	Mean of 8–30 d; median of 15 d	MD care required Decrease nurse staffing Minimum therapy need of 3 h OT/PT/SLP SW for discharge planning Psychiatry as needed
Skilled nursing facility care			
Inpatient SNF rehabilitation	5–7 d after stroke	Dependent on individual stroke severity (with maximum of 100 d)	MD monthly visit required Decreased nursing staffing OT/PT/SLP as needed
Long-term care	Dependent on stroke severity, individual resources, multiple comorbidities	Variable depending on care needs (eg, long-term care vs palliative/end-of-life)	Decreased nursing staffing Predominately skilled nursing assistant care Therapy on consultation basis
Community-based rehabilitation, including home health care			
Early supported discharge services	20–30 d	1–44 mo	Clinic visits by MD or nurse OT/PT/SLP appropriate for mobility, ADL, and communication goals Psychiatry as needed
Chronic outpatient rehabilitation	>4–6 mo Variable onset based on individual resources and functional needs	Variable termination based on individual resources and functional needs	Care coordination/referral transitioned to primary care provider (MD, nurse practitioner) Interdisciplinary therapy or psychiatry care as needed

SD indicates standard deviation; MD, physician; SW, social work; and SNF, skilled nursing facility.
*Table reflects representative trends for stroke healthcare delivery in the United States.[20–23] Actual care delivery varies by region and healthcare third-party provider.

predominant interdisciplinary team features are listed for each setting and poststroke phase. Next, we briefly review the inpatient, outpatient, chronic care, and end-of-life settings in which stroke survivors might receive rehabilitation and other healthcare services.

1. Definition of Inpatient Care Settings in the United States

An inpatient rehabilitation facility (IRF) offers hospital-level care to patients needing intensive, interdisciplinary rehabilitation programs to upgrade their ability to function.[24] In an IRF, stroke survivors must have medical comorbidities that require 24-hour availability and close supervision of a physician and a registered nurse with specialized training or experience in rehabilitation. Additionally, these patients must require and receive at least 3 hours a day of occupational therapy (OT) or physical therapy (PT) for no fewer than 5 days per week. Exceptions can be made if (1) other skilled rehabilitation modalities (eg, speech-language pathology [SLP] or prosthetic-orthotic services) can be combined with OT and PT to meet the 3-hour per day requirement, or (2) an IRF is the only reasonable means by which a low-intensity rehabilitation program may be executed. IRF admissions are justified only when the rehabilitation team determines that significant functional improvement can be expected within a reasonable time period and the patient can return to a community setting after IRF discharge rather than being transferred to another inpatient or residential facility (eg, skilled nursing or long-term acute care facility).

The interdisciplinary team in the IRF patient's care must document evidence of frequent, direct, and medically necessary physician involvement in the patient's care at least every 2 to 3 days during the patient's stay, as well as evidence of a coordinated program through team conferences held at least every 2 weeks. Documentation must also assess the patient's progress or problems impeding progress, consider possible solutions to such problems, and reassess whether the initial rehabilitation goals are still attainable or require modification based on progress or performance. Decisions concerning discharge planning and adjustments in goals or the prescribed treatment program must be reported.

Another inpatient rehabilitation setting is the skilled nursing facility, an institution or a distinct part of an institution in which the primary focus is the provision of either rehabilitation services or skilled nursing care and related services to residents requiring medical or nursing care.[25] When located within a nursing home or hospital, the skilled nursing facility must be physically distinguishable from the larger institution (eg, a wing, separate building, or 1 side of a corridor). In a skilled nursing facility, stroke survivors must require daily skilled nursing or rehabilitation services that can be provided only on an inpatient basis (Table 4) and require the skills of qualified HCPs (eg, nurses, SLPs). Even if a stroke survivor is not expected to reach full or partial recovery, skilled services within a skilled nursing facility can be requested to maintain or prevent deterioration of the patient's current medical status.

Inpatient rehabilitation may be provided in a long-term-care hospital, a facility with a mean Medicare inpatient length of stay of at least 25 days that provides extended medical and rehabilitation care to clinically complex patients with multiple acute or chronic comorbidities.[26] In addition to comprehensive rehabilitation, stroke survivors in these facilities may receive a range of post–acute care services (eg, ventilator-dependent care, pain management, other chronic disease care).

2. Definition of Outpatient Settings in the United States

Rehabilitation services outside of an institution may take place in 2 environments. A *home health agency* is a public agency or private organization (or a subdivision of such an agency or organization) that focuses on providing skilled nursing and other therapeutic (eg, OT, SLP), medical, social, and home health aide services.[27] Under current US law, home health services are reimbursed under a prospective payment system that provides a 60-day episode rate and includes all covered services. Services may be recertified for an additional 60 days if they continue to be justified. To be eligible for home health services, a physician must certify that the stroke survivor is confined to his or her home, with exceptions for medical (eg, outpatient hemodialysis, attending an adult day center to receive medical care) or nonmedical (eg, occasional trip to the barber, attending an infrequent family or unique event) purposes. Home health services may be performed in assisted living facilities, group homes, or personal care homes but are not reimbursed if the services are duplicative of another facility's or agency's services.

Outpatient therapies may also take place at hospital-based or free-standing facilities.[28] A physician must certify outpatient OT, PT, and SLP services. The physician must state that he or she has established a plan for therapy services, reviewed the plan periodically, and recertified the treatment at least every 30 days. Services must be reasonable and necessary, restorative in nature, and complex and sophisticated enough that they can only be performed safely and effectively by or under the supervision of a qualified HCP. In general, therapist input is required to establish maintenance program services if the services are to maintain function only.

Comprehensive outpatient rehabilitation facilities also offer rehabilitation services.[28] At a minimum, these facilities provide physician, PT, and social or psychological services. They may additionally offer OT, SLP, respiratory therapy, nursing care, prosthetic and orthotic services and devices, drugs and biological agents that cannot be self-administered, issuing of durable medical equipment, and a single home visit to evaluate the potential impact of the home environment on rehabilitation goals.

3. Definition of Chronic Care Settings in the United States

Chronic care settings focus on supporting and providing external resources that may be necessary to manage the stroke survivor's level of health successfully. These services may be preventative, diagnostic, and/or therapeutic, including counseling and educational services, and must be prescribed by a physician or other qualified HCP.[29] On admission, initial evaluations are performed to determine the needs of the individual, as well as discharge plans, which may include posthospital extended care and hospice services that are reasonable and necessary.

4. Definition of End-of-Life Settings in the United States

For some patients, strokes may be a terminal life event. When it becomes apparent that a patient may die within a short time, it is essential that an appropriate plan for end-of-life be established. Because of the unique principles that guide end-of-life care, issues and procedures that pertain to end-of-life stroke care, including ramifications for interdisciplinary rehabilitation practice, are described separately in the last section of the present statement. Importantly, however, many of the stroke management procedures appropriate for inpatient, outpatient, and chronic care settings that are reviewed in the next section of this statement are also used to address the needs of terminal patients. Therefore, inclusion of an end-of-life section is consistent with the overall purpose of the present statement, with a focus on educating nurses and other interdisciplinary team members who contribute to the more chronic phases of the stroke care continuum.

In summary, stroke care and rehabilitation may take place in a number of inpatient, outpatient, and chronic care settings, including settings that provide end-of-life care.[30] Next, evidence is reviewed regarding organized, interdisciplinary stroke care across these settings and with respect to first, the body structure and function dimension of the ICF model, and second, the activity and participation ICF dimensions. The roles of nursing and other interdisciplinary team members are also highlighted in the review of this evidence.

II. ICF Dimensions Across the Inpatient-to–Chronic Care Continuum

A. Approach to Body Structure and Function Issues

1. Deficits Associated With Poststroke Motor Control (ie, Upper- and Lower-Extremity Motor Issues, Dysphagia, and Bowel and Bladder Issues)

a. Upper- and Lower-Extremity Motor Issues

Despite improved survival rates and rehabilitative efforts, most stroke survivors will continue to experience motor deficits that can reduce satisfactory engagement in activities

and participation.[31] These deficits can include decreased postural control, balance deficits, hemiparesis, and neuromuscular incoordination of the upper extremities (UEs) and lower extremities (LEs). In turn, such poststroke motor issues compromise engagement in activities and participation because of reaching deficits, loss of deftness (which disrupts object manipulation), asymmetrical gait patterns, decreased walking speed, and increased energy expenditure (which challenge ambulation).[32–34]

The stroke population is at a higher risk for falls than the general population, with fall rates as high as 50% in community-dwelling stroke survivors.[35] Although difficulty exists in determining which factors predict poststroke falls, 1 study suggested that near-falls in the hospital and poor UE function at the time of hospital discharge were the 2 best predictors of repeated falls in the first 12 months of community living.[36] The inability to use the hemiparetic UE to prevent a fall in combination with trunk instability and decreased LE function increases fall risk as well, even in individuals who were independently mobile before their stroke.[35,36] During stroke recovery, additional factors that increase falling risk are older age, greater trunk sway, inability to walk, visuospatial deficits, apraxia, and use of sedatives. Additionally, community-dwelling stroke survivors frequently demonstrate balance problems (particularly when performing complex tasks such as dressing), which have been strongly linked to falls.[37] Accordingly, the interdisciplinary rehabilitation team should consider all people after stroke as having an increased risk of falls.

i. Motor Assessment.

Table 5 identifies various tests suitable across inpatient, outpatient, and chronic care settings to assess body structure and function motor issues after stroke; this list is not comprehensive but provides examples of more commonly used, reliable assessments (further tests can be found in Duncan et al[11]). Regardless of care setting, strength, coordination,[75–78] and sensation (particularly joint position sense and tactile discrimination)[79–82] should be assessed (Table 6). Although hypertonicity should be assessed,[75] a clear recommendation for its assessment is not forthcoming. Spasticity, the typically measured component of hypertonicity, is most commonly measured with the Modified Ashworth Scale[131,132]; however, its validity and interrater reliability have been questioned.[131,132] Other spasticity measures exist in the research literature (eg, Condliffe et al[133]), but their clinical feasibility remains an issue, and there are limitations in the number of joints that can be assessed. An additional concern with motor tests that evaluate body structure and function issues is that although several assessments have established psychometric properties, the item structure of many tests is still being evaluated.[43,44,133,134] Whatever tests are chosen, it is further recommended that clinicians obtain not only training to establish administration and scoring consistency, but also over time, routine retraining to ensure they maintain this consistency.

ii. Motor Treatment.

A recent flurry of studies have shown that motor practice can improve motor function, both immediately and long after stroke.[31,135–137] Some approaches have been found to be superior to traditional rehabilitation (eg, Wolf et al[138]), although this result is often confounded by the amount of therapy (with more treatment given to the experimental groups). Unfortunately, few studies have compared different therapy doses or equal intensities of diverse therapy programs. Thus, there is little evidence to guide the selection of a particular type of therapy over another or the best intensity and amount of therapy to provide. In the present statement, we review those motor treatments that have had the greatest amount of investigation. See Table 7 for a summary of treatment recommendations.

iii. Inpatient Settings.

Motor practice. Therapies to improve UE function and gait are 2 of the most common interventions provided during inpatient rehabilitation.[172,173] These motor function therapies consist of repetitive movement practice with the paretic limb: Most LE motor practice occurs in the context of walking, whereas UE practice involves repeating either specific movements or functional tasks. Despite the frequency with which these treatments are used in clinical settings, relatively few efficacy studies have been completed within the acute or subacute stroke population; instead, most research has involved only individuals with chronic stroke (ie, >6 months after stroke). Therefore, most recommendations for inpatient care settings are based on studies with individuals with chronic stroke, although some direct evidence for therapy in the inpatient setting is discussed below.

Constraint-induced movement therapy is the most studied UE motor rehabilitation approach. In inpatient settings, its intensity has been modified by decreasing the amount of time in graded task practice and the amount of time individuals must wear the mitt on the nonparetic limb. Page and colleagues[139] provided 30 minutes of graded task practice, 3 days per week, with 5 to 6 hours of daily mitt wearing for 10 weeks and found greater motor function gains with constraint-induced movement therapy than with traditional therapy. Dromerick et al[140] provided either 2 or 3 hours of graded task practice 5 days per week for 2 weeks and had their subjects wear a mitt on the nonparetic UE 6 hours per day; although both the 2- and 3-hour groups in that study improved motor function, the 2-hour group displayed more improvement.

Robot-assisted therapy offers the amount of motor practice needed to relearn motor skills with less therapist assistance. Most robots for motor rehabilitation not only allow for robot assistance in movement initiation and guidance but also provide accurate feedback; some robots additionally provide movement resistance. Most trials of robot-assisted motor rehabilitation concern the UE, with robotics for the LE still in its infancy. Current robots tend to exercise only the proximal arm, and thus, they improve motor skills at the shoulder and elbow but not those of the unexercised wrist and hand; consequently, robots that only train the shoulder and elbow are limited in their ability to improve completion of ADLs.[174] Robot-assisted UE therapy, however, can improve motor function during the inpatient period after stroke.[174–176]

Therapy based on neurodevelopmental techniques has been a major emphasis of motor rehabilitation over the past half century.[177] Neurodevelopmental techniques focus on

Table 5. Examples of UE and LE Motor Assessments That Can Be Used With Stroke Survivors

Tool	Domain	Time to Administer	Comments
Grip dynamometry[38,39]	Unilateral hand strength	10 min	A commonly used single-item assessment that correlates with function, morbidity and mortality. Reliability and validity data are available. It can be painful for people with arthritis, and it only measures static strength.
Handheld dynamometry[40–42]	Unilateral muscle strength	Depends on No. of motions tested; ≈2 min/motion	Quick and uses inexpensive equipment. The No. of items depends on the No. of muscle groups tested. Some reliability and validity data are available. Results can depend on the strength of the therapist to resist the movements of the person with stroke.
Fugl-Meyer Motor Assessment–UE subscale[43–47]	Unilateral UE and LE gross motor coordination, balance, sensation, and ROM	45–50 min	A 113-item scale divided into UE, LE, sensation, ROM, pain, and balance scales. UE and LE subscales are most commonly used in the literature. Stroke rehabilitation guidelines recommend this tool. Data are available on reliability, validity, sensitivity to change, and item functioning. Weaknesses include that it is lengthy, has ceiling effects in more mild stroke patients, offers limited assessment of object manipulation and finger individualization, and has inconsistency in its administration across the literature.
Action Research Arm Test[48–53]	Unilateral arm and hand coordination	30 min	A 20-item, quick assessment commonly used in literature; however, because items are presented in ascending difficulty and each subtest stops when the patient cannot perform an item, not all items are necessarily given. Data on reliability, validity, and sensitivity to change are available. It does not measure tasks that require finger individualization, and only task completion is scored.
Box & Block Test[54,55]	Unilateral gross finger coordination	10 min	A quick, single-item, commonly used assessment that is available commercially. Reliability and validity data are available. Its weakness is that it only measures 1 task.
Motor Assessment Scale[56–58]	UE, LE, general mobility, sitting balance, and coordination	10–15 min	This 9-item test offers a quick assessment of motor function. Reliability and validity have been reported.
Chedoke-McMaster Stroke Assessment[59]*	Unilateral gross motor coordination	1 h	Created for stroke assessment and contains 2 subscales: Impairment Inventory (22 items) and Activity Inventory (15 items). It is commercially available, and training workshops are offered. Reliability and validity data are available. Its weakness is its length.
Wolf Motor Function Test[60–62]*	Arm and hand coordination; combination of single joint movements and simulated unilateral functional activities	20–30 min	A 15-item assessment created for stroke rehabilitation that uses inexpensive materials. Assesses time to perform items and quality of item performance. Little test administration training is required. Some reliability and validity data are available. Weaknesses are that it is lengthy, it consists of a mixture of body function and activity–level items, and the tester needs to fabricate the test because it is not available commercially.
Stroke Rehabilitation Assessment of Movement (STREAM)[63–65]	LE movement and mobility	15 min	Has 30 items equally distributed among 3 subscales: Upper-limb movements, lower-limb movements, and basic mobility. Movements are scored on a 3-point scale. Mobility items are scored on a 4-point scale, with 1 additional category to allow for independence with the help of a mobility aid. The STREAM is quick to administer, and reliability and minimal clinically important difference data are available.
Activity level			
Wolf Motor Function Test[60–62]*	See above	See above	See above
Chedoke-McMaster Stroke Assessment[59]*	See above	See above	See above
Jebsen Test of Motor Function[66,67]	Arm and hand coordination; simulated unilateral functional activities	20–30 min	A 7-item assessment that is available commercially and commonly used. Some reliability and validity data are available. Weaknesses are that it is lengthy, and only time to perform is assessed.
Chedoke Arm and Hand Inventory[68–70]	Arm and hand coordination; simulated bilateral functional activities	25–35 min	A 13-item tool with some reliability and validity data available. The only UE assessment consisting of all bilateral real life tasks; however, it requires some fabrication, only quality of performance is measured, and training is required to use the rating scale.
Motor Activity Log[71,72]	Self-report measure of arm and hand use in daily activities	15 min	Has several versions but most commonly has 30 items divided into unilateral and bilateral tasks. A quick, self-report assessment of hand use in real life. Some reliability and validity data are available. It cannot be used with people with aphasia or cognitive problems that limit comprehension.
Rivermead Mobility Index[73,74]	General mobility	5–10 min	A 15-item tool that quickly quantifies mobility function. Except for 1 item (standing unsupported) observed by the therapist, the rest are the individual's self-report (yes/no). Some reliability and validity data are available. A weakness is the uncertainty regarding its sensitivity to change, and because of self-report items, it may be inappropriate for some individuals with aphasia.

ROM indicates range of motion.

*The Wolf Motor Function Test and the Chedoke McMaster Stroke Assessment are both body structure and function and activity level assessments, because they have items that are purely movements and some items that are simulated activities.

analyzing and treating posture and movement dysfunctions that lead to functional activity limitations. Despite its popularity, strong evidence indicates that neurodevelopmental technique therapy is not superior to any other type of therapy.[178,179] Instead, the results of these randomized control trials (RCTs) indicated that individuals in each treatment group demonstrated improvements in function, with no significant differences between treatment approaches. For example, van Vliet et al[180] completed an RCT to compare Bobath-based/neurodevelopmental techniques treatment with motor learning techniques; comparisons at baseline and 1, 3, and 6 months after stroke

Table 6. Recommendations and Levels of Evidence Across Patient Settings According to ICF Dimensions for Assessment of Motor Issues

Recommendations for Interdisciplinary Care by ICF Dimension	Care in the Inpatient Rehabilitation Setting	Care in the Outpatient Setting	Care in Chronic Care Settings
Body structure and function			
Standardized, valid, and reliable test procedures to document the severity of UE and LE impairment (strength, coordination, tone, ROM, pain) are recommended in inpatient and outpatient settings. It is reasonable to perform such procedures in chronic care settings.	Sources:[11,78,83–91] Class I; Level of Evidence B	Sources:[11,45,78,83–92] Class I; Level of Evidence B	Source: Working Group Consensus; Class IIa; Level of Evidence C
It might be considered that dysphagia assessment should include bedside screening (including a water-swallowing test), and when failed, that it should be followed by objective assessment, including either a videofluoroscopic modified barium swallow study or the Flexible Endoscopic Examination of Swallowing.	Sources:[15,93,94–98] Class IIb; Level of Evidence B	Sources:[15,93,94–98] Class IIb; Level of Evidence B	Source: Working Group Consensus Class IIa; Level of Evidence C
It might be considered that routine and specific assessment of bladder function include assessing urinary retention through the use of a bladder scanner or an in-and-out catheterization and measuring urinary frequency, volume, control, and presence of dysuria.	Sources:[99], Working Group Consensus Class IIb; Level of Evidence C	Sources:[99], Working Group Consensus Class IIb; Level of Evidence C	Sources:[99], Working Group Consensus Class IIb; Level of Evidence C
Routine and specific assessment of bowel function is recommended to determine whether there is persistent constipation or bowel incontinence.	Source:[100] Class I; Level of Evidence B	Source:[100] Class I; Level of Evidence B	Source:[100] Class I; Level of Evidence B
Assessment for major medical poststroke complications (DVT/PE, skin breakdown, spasticity, aspiration, malnutrition, contractures and seizures) using reliable, valid, and widely accepted assessment methods is recommended.	Sources:[101–106] Class I; Level of Evidence A	Sources:[101–106] Class I; Level of Evidence A	Sources:[101–106] Class I; Level of Evidence A
Activities and participation			
It is reasonable to provide a comprehensive interdisciplinary assessment of mobility and self-care needs (at a minimum, the FIM) and necessary IADLs to increase likelihood of discharge from rehabilitation facility to home, as well as optimal mobility, comfort, and quality of life during institutional care.	Sources:[99,107–111] Class IIa; Level of Evidence B	Sources:[112,113] Class IIa; Level of Evidence B	Source: Working Group Consensus Class IIa; Level of Evidence C
It is reasonable to assess IADLs, leisure, and participation using such tools as the Frenchay Activities Index and Canadian Occupational Performance Measure for maintained functional independence and optimal participation.	Sources:[99,107,108,110,111,114–117] Class IIa; Level of Evidence B	Sources:[99,108,110,115–119] Class IIa; Level of Evidence B	Source: Working Group Consensus Class IIa; Level of Evidence C
It is reasonable to use standardized, valid, and reliable tools to document the level of assistance needed for mobility (bed mobility, transfers, sitting, walking) and self-care (toileting, eating, washing oneself, dressing, domestic life). At a minimum, FIM mobility items, Berg Balance Score, and the 10-meter walk should be used to assess gait velocity, Functional Ambulation Classification, and assistance needed during daily activities.	Sources:[89,120–130] Class IIa; Level of Evidence B	Sources:[89,120–130] Class IIa; Level of Evidence C	Source: Working Group Consensus Class IIa; Level of Evidence C

DVT/PE indicates deep vein thrombosis/pulmonary embolism; FIM, Functional Independence Measure.

demonstrated improvements in both treatment groups from baseline but no significant group differences on the Rivermead Motor Assessment (leg and trunk), 6-minute walk test, or Motor Assessment Scale.

Adjuvant techniques. Functional electric stimulation (FES) or neuromuscular electric stimulation is a common adjuvant therapy in stroke rehabilitation. The rationale for electric stimulation is that sensory input by itself promotes neural reorganization, and by stimulating a more complete contraction in the targeted muscles and associated movement, there is increased proprioceptive feedback to the central nervous system that will promote motor learning and neural reorganization.[181] There is strong evidence for the efficacy of electric stimulation for individuals <6 months after stroke, with most of these studies comparing regular therapy coupled with FES to regular therapy alone.[182–190]

Shoulder pain, subluxation, and passive range of motion. Shoulder pain has been associated with poor glenohumeral joint alignment, decreased shoulder passive range of motion (PROM), and reduced muscular, ligamentous, and tendinous function around the shoulder.[191,192] Traditional behavioral treatments for shoulder pain and contracture include support for the arm against gravity, PROM, and facilitation of the muscles around the shoulder. There is, however, conflicting evidence for positioning, strapping, or PROM as interventions for shoulder contracture and pain prevention.[156,157,164,165,193] A few small, nonrandomized trials provide limited evidence that shoulder slings may prevent subluxation,[194,195] but no trial has provided evidence that these methods increase function. There is also conflicting evidence that electric stimulation to the shoulder improves pain or shoulder function.[148,184,196–201]

Table 7. Recommendations and Levels of Evidence Across Patient Settings According to ICF Dimensions for Treatment of Motor Issues

Recommendations by ICF Dimension	Care in the Inpatient Setting	Care in the Outpatient Setting	Care in Chronic Care Settings
Body function and structure			
Varied repetitive task practice (eg, CIMT, robot-assisted therapy) to improve UE motor coordination in individuals with some voluntary finger extension in outpatient and chronic care settings is recommended; it is reasonable to do so in inpatient settings. No recommendations are made for 1 type of varied repetitive task practice over another.	Sources:[139–141] Class IIa; Level of Evidence A	Sources:[31,138,142–145] Class I; Level of Evidence A	Sources:[31,138,142–144] Class I; Level of Evidence A
The usefulness of single or a limited variety of repetitive practice in inpatient, outpatient, and/or chronic care settings may be considered.	Source: Working Group Consensus Class IIb; Level of Evidence C	Sources:[146,147] Class IIb; Level of Evidence B	Sources:[146,147] Class IIb; Level of Evidence B
The usefulness of electrical stimulation as an adjunctive therapy to motor practice to improve motor control and a number of motor outcomes at the shoulder (particularly in acute stroke) may be considered.	Sources:[148–150] Class IIb; Level of Evidence B	Sources:[149–153] Class IIb; Level of Evidence B	Sources:[150,152–155] Class IIb; Level of Evidence B
The usefulness of static positioning and strapping of the UE to prevent loss of PROM or the development of UE pain is not well established.	Sources:[156–163] Class IIb; Level of Evidence C	Source:[164] Class IIb; Level of Evidence C	Sources:[164,165] Class IIb; Level of Evidence C
It is reasonable to use multipronged dysphagia interventions (eg, diet modification, swallowing exercises, and airway protection strategies; biofeedback plus swallowing maneuvers).	Source:[98] Class IIa; Level of Evidence B	Sources:[98,166] Class IIa; Level of Evidence B	Sources:[98,166] Class IIa; Level of Evidence B
It is reasonable to use low-risk feeding strategies (eg, eat while sitting; minimize distractions) to compensate for dysphagia.	Source:[98] Class IIa; Level of Evidence C	Source:[98] Class IIa; Level of Evidence C	Source:[98] Class IIa; Level of Evidence C
Activities and participation			
Training of specific ADLs and IADLs in chronic care settings is recommended; it is reasonable to do so in inpatient and outpatient settings.	Sources:[167,168] Class IIa; Level of Evidence B	Sources:[169–171] Class IIa; Level of Evidence B	Source: Working Group Consensus Class I; Level of Evidence C

iv. Outpatient and Chronic Care Settings.

Motor practice. The evidence is mixed as to the efficacy of repetitive UE practice of 1 or a small number of specific movements[146,202–206] or whether bilateral practice is better than unilateral practice.[207–213] In contrast, interventions in which a variety of arm and hand movements are practiced have resulted in increased motor control and/or use of the paretic UE in daily life tasks.[214,215] Constraint-induced movement therapy shows evidence of facilitating some increases in motor control and use in the chronic poststroke recovery phase.[31,135,138,142,216] There are mixed findings, however, regarding whether individuals with $<10°$ of voluntary wrist and digit extension benefit from constraint-induced movement therapy.[217,218]

Treadmill training, either with or without body-weight support, is a very common LE intervention that has demonstrated positive effects on walking performance. Hesse et al[219] argued that such a task-specific therapy enables hemiplegic patients to practice walking repetitively, in contrast to more conventional treatment in which tone-inhibiting maneuvers and gait-preparatory tasks during sitting and standing dominate. A systematic review of 21 RCTs[137] identified that gait speed and walking distance improved significantly when gait-oriented training occurred. Several studies with a pretest/posttest study design have examined the effects of task-specific treadmill walking on gait kinematics[33,220–222] and endurance during the 6-minute walk test[221] and reported improvements on these outcome measures after treadmill training. Additionally, 1 RCT demonstrated that progressive treadmill walking improves cardiovascular fitness, economy of gait, and endurance (ie, 6-minute walk test) compared with stretching and low-intensity walking.[32] Recently, brain activity changes were observed with functional magnetic resonance imaging after treadmill training,[223,224] which suggests that cortical reorganization is possible during task-specific LE activity.

For stroke survivors who are nonambulatory or require extensive assistance, repeated bouts of body-weight support treadmill training can improve their walking performance.[225–231] In 2 RCTs, individuals receiving body-weight support treadmill training improved their overground walking speed compared with those practicing usual overground walking.[225,228] McCain and colleagues[228] found walking improvements not only on the 6-minute walk test but also in gait kinematics; however, a meta-analysis yielded conflicting evidence regarding whether body-weight support treadmill training improved walking and motor recovery compared with conventional therapy.[232] Specifically, in 1 study, body-weight support treadmill training was no more effective at improving walking performance than traditional techniques.[233]

Robot-assisted therapy has been shown to improve UE motor function in outpatient and chronic care settings.[143] A few trials also suggested that motor practice with robots assisting distal UE movements can improve distal UE function.[234] The efficacy of robot-assisted therapy compared with intensity-matched conventional therapy in patients with both moderate and severe poststroke motor impairment is currently being tested in the first multisite RCT; in that study, motor practice with robots interacting with both proximal and distal UE joints is being provided.[235]

Virtual reality as a practice environment provides a controlled way to offer complex multimodal sensory information to stroke survivors. There is evidence that motor rehabilitation within a virtual reality environment is beneficial,[204,234,236–240] but all studies have been small, mostly uncontrolled trials and primarily involved the UE. Controlled trials comparing practice in virtual reality environments to more intense practice protocols are needed to determine whether virtual reality practice is more beneficial than practice that does not require high-technology and thus expensive equipment. As in inpatient care settings, there is strong evidence to suggest that neurodevelopmental techniques are not superior to any other type of therapy in outpatient or chronic care settings.[178–180,202,204,216]

Strength training. Increasing LE muscle strength can have positive benefits for functional mobility and walking. That is, there is strong evidence that resistive exercise training increases gait speed[241–244] and muscular strength in the hemiparetic leg.[241,243–246] Although several studies have provided strong evidence of the overall benefit of strengthening exercises for hemiparetic stroke patients, the literature is unclear regarding the effectiveness of traditional resistive versus functional (ie, weight-bearing activities) strength training on walking outcomes. For example, 2 studies reported no significant improvements in gait speed after LE resistive strengthening.[230,246] According to a recent study, the most important muscle group on the hemiparetic leg that predicts gait speed is the knee extensors[247]; therefore, interventions that target increased gait speed should focus on the hemiparetic knee extensors to maximize walking outcomes. A 2008 systematic review[248] concluded that LE strengthening interventions improve strength and activity without increasing spasticity.

UE outcomes are less clear. A 2006 systematic review of 21 RCTs[249] concluded that both UE and LE strengthening interventions slightly improved strength and activity without increasing spasticity; however, Stein et al[250] found that adding progressive resistance to robot-assisted UE training did not facilitate greater motor function gains than robot-assisted training without the resistance training. Similarly, Winstein and colleagues[215] found that acutely, strength training through elastic band exercises resulted in equivalent motor gains as functional task training; the functional task–training group, however, continued to improve at 9 months, whereas the strength-trained group did not. Importantly, both of these studies also showed that strength training did not increase spasticity. As Pak and Patten noted,[248] it is not clear whether the strength-training programs of either of these studies were of sufficient intensity to optimally induce strength gains in stroke survivors. Regardless, the current data support strengthening programs as an integral part of stroke rehabilitation, especially for the LE and probably also for the UE.

Adjuvant techniques. There is conflicting evidence regarding the use of mental imagery, a technique in which clients imagine themselves performing motor actions before initiation, to improve UE motor function after stroke.[204] Although many small studies have found that mental imagery in concert with physical practice improves motor outcomes, individual differences in lesion location may influence the utility of mental imagery.[154,251,252]

There is strong evidence for the efficacy of electric stimulation for individuals with chronic stroke,[151,152,154,155,189,253,254] yet the effects of electric stimulation on the maintenance of functional gains are variable,[151] and although the selection of included articles was limited, a recent meta-analysis failed to find an advantage of electric stimulation to the wrist and fingers over usual care.[149] For the LE, Cozean et al[255] determined that FES combined with biofeedback produced better results than standard PT, FES, or biofeedback alone. Similarly, Burridge et al[256] found that FES combined with PT was superior to PT alone in improving gait speed while reducing energy cost; the benefit, however, was only evident when the stimulator was used. More recently, implantable nerve stimulators have been found to be safe and effective in reducing foot drop during ambulation in stroke survivors: Although 2 RCTs reported improvements in gait speed and walking endurance,[257,258] 1 study found no difference between the implantable stimulators and an ankle-foot orthosis.[259]

Biofeedback therapy has also been used to increase gross motor function after stroke. Traditional electromyography biofeedback has been used to reduce spasticity or improve function in hemiparetic limbs.[260,261] Visual electromyography biofeedback has evoked positive effects on ankle function after 12 sessions of treadmill walking,[261] but no follow-up was performed to determine whether these effects were maintained. A recent study reported that visual feedback tracking for knee extensor movements improved walking, with functional magnetic resonance imaging indicating cortical reorganization[262]; because the sample size was small, however, these results should be interpreted cautiously. Electromyography biofeedback added to task practice with FES was shown to enhance UE function to a greater extent than the task practice with FES alone.[263] In contrast, Hemmen and Seelen[264] failed to find such an effect. A recent systematic review[260] concluded that there is no treatment effect from the addition of biofeedback to therapy, but results were limited because of small sample sizes, methodology variability, and other study quality issues.

According to a recent Cochrane review, visual feedback with a force platform used for standing balance appears beneficial.[265] However, 1 study found no difference in balance and mobility effects between traditional PT and therapy with the addition of biofeedback.[266] Finally, 1 study reported conflicting evidence that visual feedback may in fact negate improvements in balance once the visual feedback is removed.[267]

Shoulder pain, subluxation, and PROM. In outpatient and chronic care settings, there is conflicting evidence for posi-

tioning, strapping, or PROM as interventions for shoulder contracture and pain prevention.[165,158] No trial has shown that these methods increase function. There is also conflicting evidence that electric stimulation to the shoulder improves pain or shoulder function.[150,181,192,197,199]

Balance training. There is no strong evidence that balance training improves poststroke outcome,[265] although some treatment approaches appear more effective than others. For instance, Katz-Leurer et al[268] identified the benefits of cycle training as a means to improve standing balance through muscle strength and control of the LE. Cheng and colleagues[269] used visual feedback with dynamic balance activities in conjunction with traditional therapy; the visual feedback group demonstrated a significant improvement in dynamic balance and a reduction in falls even 6 months after training compared with the traditional therapy group. In contrast, Pollock et al[270] found that independent balance training did not improve balance. Similarly, a recent RCT found that balance training used in conjunction with traditional rehabilitation did not provide any additional benefit.[271]

b. Dysphagia

Dysphagia (impairment in swallowing) occurs in 30% to 64% of patients in the acute phase of stroke recovery[93,272,273] and in 37% to 78% of the general stroke population.[274] With respect to SLP, it is the most commonly treated impairment in patients with neurological disorders.[274] Patients with dysphagia are more likely to experience aspiration pneumonia, which leads to higher mortality rates.[93,98] Dysphagia has also been associated with poorer ability to complete ADLs, greater caregiver burden, and more frequent nursing home placement.[276,277] Therefore, swallowing assessment and dysphagia treatment are critical during stroke rehabilitation. Because only a small body of literature currently exists pertaining to poststroke dysphagia assessment and treatment, the following recommendations should be considered to apply across inpatient, outpatient, and chronic care settings.

i. Dysphagia Assessment.

Although a wide variety of screening tests are available (eg, 3-oz water swallow test; fiber optic examination or FEES), none have acceptable sensitivity and specificity to ensure accurate detection of dysphagia.[98] Recently, however, Suiter and Leder[278] reported, on the basis of a study with >3000 participants, that the 3-oz water swallow test is an accurate predictor of an individual's ability to tolerate thin liquids. Because this test was not accurate in predicting an individual's ability to eat by mouth, these researchers recommended a follow-up instrumental assessment rather than a bedside evaluation if the patient failed the 3-oz water test. According to the Heart and Stroke Dysphagia Guidelines,[98] screening should be performed to identify dysphagia presence or absence and, when present, to help determine the severity of the swallowing problem and management strategies. As soon as an acute stroke has been diagnosed and emergency treatment provided, stroke survivors who are awake and alert should be screened for dysphagia before oral intake is allowed. Survivors who fail the screen are allowed to eat or drink nothing orally until they receive a more comprehensive assessment, preferably before the third day after stroke. Comprehensive assessment should include a bedside evaluation and, if indicated by clinical signs, an instrumented examination (eg, videofluoroscopy). On the basis of this individualized assessment, including consideration of patient factors (eg, edentulous; presence of cognitive deficits), decisions are then made related to modification of diet or enteral feeding.[278,279] See Table 6 for dysphagia assessment recommendations.

ii. Dysphagia Treatment.

There is little empirical evidence for how to improve swallowing ability after stroke. A recent systematic review[280] of the dysphagia intervention research for individuals with neurological diagnoses (including stroke) noted that previous studies have had insufficient methodological rigor (eg, small sample sizes, inclusion of participants with mixed neurological etiologies, weak study designs), with the exception of 2 recent RCTs.[281,282] Furthermore, only 6% of the participants in the studies reviewed by Ashford et al[280] were stroke survivors. Almost all studies that did include stroke survivors involved only those very early after their stroke. Expert consensus[98,283] suggests that individuals with stroke should not be allowed anything by mouth until a swallowing screening or evaluation can be performed. Having the person self-feed and the use of low-risk feeding strategies (eg, appropriate diet consistency, reducing distractions during meals, eating from a seated position, ensuring a slow feeding rate with small amounts of food per bite) are recommended, but these recommendations are based on consensus or lower levels of evidence.[98,284] Although these compensatory strategies may provide some protection against aspiration, there is no evidence that they lead to the recovery of swallowing ability.

There is moderate-level evidence that a multi-intervention dysphagia program (eg, modified diet, airway protection strategies such as a chin tuck or head rotation, swallowing exercises) is beneficial for promoting better swallowing and a return to a normal diet after stroke.[98,285] There has been nominal investigation of different behavioral interventions to restore swallowing ability. In the evidence-based review by the Canadian Stroke Network,[98] only limited evidence supported the use of either thermal or electric stimulation to the faucial arches to improve swallowing. Although an additional study showed some limited improvements in some swallowing measures after electric stimulation,[286] a more recent study comparing electric stimulation to traditional therapy reported improvements with both treatments but no significant difference between the effects of the 2 treatments.[166] Ashford et al[280] reported that although clinically popular, training in the use of the chin-tuck posture provides aspiration protection in fewer than 50% of neurogenic dysphagia cases and that some patients have difficulty using this strategy because of physical and cognitive issues. More encouraging findings were obtained in an intervention that combined swallowing maneuver training with electromyography biofeedback[286]; approximately half of the 25 stroke patients in that study improved their oral intake after treatment. See Table 7 for dysphagia treatment recommendations.

c. Bladder and Bowel Issues

Poststroke bladder and bowel dysfunction affects approximately 25% to 50% of stroke survivors.[100,287] Persistent bladder and bowel difficulties can significantly affect the rehabilitation process (time) and negatively influence stroke survivors' physical and mental health, leading to social isolation and restrictions in subsequent employment and leisure activities.[288,289]

Before any interventions are performed, the nurse and other interdisciplinary team members should determine the stroke survivor's premorbid bladder and bowel patterns.[288,289] Although urinary retention is common during the initial stages of stroke recovery, by 1 year after stroke, it occurs in only 15% of patients. In these patients, bladder emptying must be monitored, because retention is a significant contributing factor to urinary tract infections (Table 6).[100] Poststroke urinary incontinence must also be addressed given that when persistent and associated with other disabilities and institutionalization, it is a strong predictor of survival and recovery at 3 months.[290,291] Management choices are based on the type of poststroke incontinence (eg, neurogenic bladder, urinary retention, hyperreflexia with urge incontinence). Because few RCTs have evaluated treatments for poststroke urinary incontinence, Borrie[292] advocated a stepwise approach; that is, nursing should initiate management via a behavioral bladder-training program (eg, offering the commode, bedpan, or urinal every 2 hours while the patient is awake and every 4 hours at night; limiting fluids in early evening), progressing to medication only when needed, and as a last alternative, surgical intervention. Nursing traditionally assumes primary responsibility for activating this approach.[113]

Prevalence of fecal incontinence among stroke survivors ranges between 30% and 40% while the patient is in the hospital, 18% at discharge, and between 7% and 9% at 6 months after stroke.[293] During the rehabilitation phase, patients are evaluated to identify and address potential contributing factors (eg, diet, drug side effects, rectal muscle weakness); however, the strongest independent risk factor for fecal incontinence at 3 months after stroke is needing help getting to the toilet. Unfortunately, management of poststroke fecal incontinence has not yet been well investigated.

Stroke survivors with constipation require an interdisciplinary approach to diagnosis and treatment of the underlying cause.[289,293] Generally, effective intervention involves medications and assurance of appropriate fiber and fluid intake and bowel habits.[294] Bulk-forming laxatives, bisacodyl suppositories, stool softeners, osmotic agents, and/or stimulant laxatives may be indicated or contraindicated depending on the individual patient. In some cases of fecal impaction, treatment with enemas or digital evacuation may be required. In Table 6, bowel and bladder recommendations across inpatient, outpatient, and chronic care settings are provided.

2. Communication and Cognition Disorders

Inpatient Settings

The goals of communicative and cognitive evaluations within the inpatient rehabilitation setting are (1) to determine the presence of deficits and thus the need for treatment and (2) to quantify and qualify the nature of impaired and spared abilities, including use of compensatory strategies, to inform selection of treatment stimuli and procedures. Although time limitations often are imposed by healthcare mandates, patient factors (eg, stamina, frustration level, medical status, rate of recovery), or both, communicative and cognitive assessments should be as thorough as possible to ensure accurate prognoses and development of appropriate management plans.[295,296]

Because of the heterogeneity among stroke patients, a variety of evaluation tools are available (Table 8; for more comprehensive listings of tests see, Lezak[297] or Murray and Clark[298]) that vary in terms of (1) what general (eg, language versus motor speech) or specific (eg, auditory-verbal working memory versus visual short-term span) communication or cognition ability is evaluated, (2) test format (eg, rating scale versus stimulus-response test), (3) length (eg, bedside screening versus comprehensive battery), and (4) standardization sample. Because each test has its particular advantages and disadvantages, there is no ideal assessment battery or specific test for a given stroke-related communication or cognitive disorder. In cases in which the presence of a disorder is being documented, assessment tools should include normative data from populations that resemble the given stroke patient in terms of sociodemographic characteristics (eg, age, ethnocultural background) and language background (eg, monolingual English, bilingual Spanish-English). Additionally, patient and caregiver input are essential components of communication and cognitive assessments. Not only are their contributions mandated by certain auditing bodies (eg, the Commission on Accreditation of Rehabilitation Facilities), but research has identified discrepancies among the perceptions of patients, families, and clinicians regarding the nature of symptoms and the need for rehabilitation services.[321,322]

The purposes of inpatient rehabilitation treatments are (1) to enhance the recovery of impaired cognitive and communication abilities, (2) to establish positive compensatory strategies while eliminating negative strategies, and (3) to educate and counsel patients and caregivers regarding cognitive and communication disorders and their consequences. A plethora of communication and cognitive treatment approaches address the particular deficits and needs of a broad spectrum of stroke patients. There is no single apposite treatment for any specific communication or cognitive disorder, and most frequently, intervention consists of a combination of retraining and compensatory treatment techniques. Although a limited number of RCTs have evaluated the outcomes of specific communication or cognitive treatments, several researchers and professional organizations have begun to question the validity of adopting RCTs as the gold standard for making decisions regarding quality of evidence and have acknowledged the methodological rigor and value of single-subject research designs.[323–327] Although individual approaches vary in terms of their level of evidence, collectively, the empirical literature supports the provision of

Table 8. Examples of Communication and Cognition Tests That Can Be Used With Stroke Survivors

Tool	Domain	Time to Administer, min	Comments
Western Aphasia Battery–Enhanced*[199]	Body function and structure: aphasia	≈60	Widely used in research and clinical practice to assess spoken and written language production and comprehension, calculation, drawing, and visuoconstruction skills. Includes a shortened version for bedside administration or screening purposes.
Mini Inventory of Right Brain Injury–2*[300]	Body function and structure: right-hemisphere disorders	≈30	Screening tool to identify cognitive and communicative deficits common after right-hemisphere brain damage (eg, impaired higher-level language, affect processing, visual scanning).
Apraxia Battery for Adults–2*[301]	Body function and structure: apraxia	≈20	6 Subtests to identify apraxia of speech and limb and oral apraxia. Classifies deficits as mild, moderate, severe, or profound. Acceptable psychometric qualities.
Dysarthria Examination Battery[302,303]	Body function and structure: dysarthria	≈60	Identifies presence and severity of dysarthria by evaluating respiration, phonation, resonation, articulation, and prosody via 21 quantitative tasks and 15 rating scales. Like other dysarthria tests, it has weak psychometric qualities.
Reading Comprehension Battery–2*[304]	Body function and structure: reading	≈30	10 Subtests to assess reading at single-word to paragraph levels. Most appropriate for patients with aphasia. Acceptable psychometric qualities.
Boston Naming Test, 2nd Ed.*[305–308]	Body function and structure: spoken word retrieval	≈15–30	Confrontation naming test widely used in both research and clinical practice, primarily as part of an aphasia evaluation. Guidelines for normal and impaired performance in a variety of populations (eg, other languages, high vs low education) can be found in the empirical literature.
Assessment of Language-Related Functional Activities*[309]	Activities and participation: communication	30–90	Includes functional activities (eg, check writing, telephone tasks) to assess listening, reading, speaking, and writing, and some cognitive and basic motor skills. Standardized on a large sample of individuals with and without neurological damage.
ASHA Functional Assessment of Communication Skills for Adults*[310]	Activities and participation: communication	≈20	HCP or family caregiver rates 43 items pertaining to patient's social communication, communication of basic needs, reading, writing, and number concepts, as well as daily planning. Reliable, valid, and sensitive measure for individuals with aphasia due to left-hemisphere stroke.
Quality of Communication Life Scale*[311]	Activities and participation: quality of life	≈15	18 Statements that reflect social participation and quality-of-life issues specific to communication are rated by the patient on a 5-point vertical scale. One of the few quality-of-life tools designed for patients with aphasia.
Cognitive Linguistic Quick Test*[312]	Body function and structure: cognition and language	15–30	Available in English and Spanish to assess attention, memory, executive function, language, and visuospatial perception. Suitable for individuals with diverse neurological diagnoses.
Test of Everyday Attention[313]	Body function and structure: attention	≈60	Although more widely used with traumatic brain injury survivors, can also be administered to stroke patients to assess auditory and visual sustained, selective, and divided attention, as well as attention switching.
Color Trails Test*[314]	Body function and structure: attention	≈5–15	Assesses sustained attention and attention switching, with nominal language or cultural bias. Good psychometric qualities.
Behavioral Inattention Test*[315]	Body function and structure; activities: neglect	15–30	Identifies presence and severity of unilateral visual neglect via traditional paper-pencil tasks (eg, letter cancellation, line bisection) and everyday activities (eg, making a phone call).
Wechsler Memory Scale–IV[316]	Body function and structure: memory	Depends on whether part or whole test given	Comprehensive test of auditory and visual immediate and delayed memory and visual working memory. Includes an Older Adult (65–90 years) and Adult (16–69 years) battery. Has strong psychometric qualities and software to assist with scoring.
Location Learning Test*[317]	Body function and structure: memory	≈15–25	Assesses visuospatial learning and recall in older adults (50–96 years), particularly those with suspected dementia. Involves learning and recalling the location of pictured everyday objects in array.
Delis-Kaplan Executive Function System[318]	Body function and structure: executive functions	Depends on whether part or whole test given	9 Subtests designed to assess a number of executive functions (eg, cognitive flexibility, inhibition, planning, problem solving) in individuals 8 through 89 years of age. Strong psychometric qualities.
Rivermead Behavioral Memory Test–II[319]	Activities and participation: memory	≈30	Evaluates everyday memory abilities (eg, remembering a person's name, story retelling, route recall) with 4 parallel versions to allow reliable, repeated administrations. Not recommended if patient has significant visuoperceptual deficits.
Behavioral Assessment of the Dysexecutive Functioning Syndrome[320]	Activities and participation: executive functions	≈60	7 Subtests to evaluate several executive skills (eg, planning, temporal judgment) using everyday activities (eg, key search task). Includes a questionnaire that can be completed by both the patient and caregiver to evaluate their perceptions of the patient's executive abilities.

*Indicates that subtests or the entire test may be suitable for patients with language production or comprehension impairments.

communication and cognitive treatment and suggests that better outcomes are associated with more intense therapy regimens.[328]

Regardless of the approach selected, clinicians should target cognitive and communicative skills that will facilitate patients' participation in other components of their inpatient rehabilitation program and include education and counseling of the patients and family members. Lastly, a significant proportion of the communication and cognitive treatment literature has involved stroke patients who are no longer in inpatient settings; that is, to establish experimental control, researchers typically include only those stroke patients who

Table 9. Communication and Cognitive Deficits Subsequent to Stroke

Type of Disorder	Definition	Examples of Characteristics
Communication disorders		
Motoric		
Dysarthria	Impaired speech production due to articulation, phonation, resonance, prosody, and/or respiration deficits related to muscle weakness, abnormal tone, and/or incoordination	Imprecise articulation, slow speech rate, breathy voice, hypernasality, monopitch
Apraxia of speech	Impaired planning and sequencing of muscle movements needed to produce speech sounds or sound sequences	Excessive pausing, inconsistent sound substitutions or omissions
Linguistic		
Aphasia	Impaired production and comprehension of spoken and written language	Word-retrieval difficulties, impaired grammar usage
Cognitive		
Cognitive-communicative	Impaired social language and complex communication skills due to underlying attention, memory, and/or executive function deficits	Verbose or taciturn verbal output, confabulation, impaired understanding of implied information
Cognition disorders		
Attention		
Neglect syndrome	A cluster of attention problems associated with slow and/or inaccurate processing of and responding to stimuli occurring contralateral to the side of the brain damage	Failure to eat food on 1 side of the plate; impaired localization of sound on 1 side; perception of bilateral stimulation as unilateral stimulation
Impairments of specific attention functions	Other functions, including attention switching and sustained, focused, and divided attention	Poor concentration; distractible; unable to complete 2 tasks concurrently
Memory		
Anterograde amnesia	Impaired ability to store and retrieve memories subsequent to the onset of brain damage	Difficulties recalling what one did earlier in the day; compromised orientation to time and place
Retrograde amnesia	Impaired ability to retrieve memories stored before the onset of brain damage	Unable to recall one's birth date
Executive functioning		
Anosognosia	Decreased awareness of one's deficits and/or the implications of those deficits	Denies ownership of a hemiparetic limb; unwilling to attend therapy sessions
Disinhibition	Problems inhibiting behaviors that are inappropriate for the given context	Impulsive behavior; inappropriate swearing

are beyond the period of possible spontaneous recovery (eg, at least 6 months after stroke).

Outpatient Settings

Overall, the communication and cognitive management goals and procedures described for inpatient rehabilitation settings are appropriate for outpatient care settings as well.[298,329] That is, stroke patients receiving outpatient services continue to display a similar spectrum of types and severities of communication and cognitive impairments, and thus, information already reviewed for inpatient settings also applies to outpatient settings.

Chronic Care Settings

The communication and cognitive assessment and treatment procedures used in inpatient and outpatient rehabilitation settings are also appropriate for stroke patients in chronic care settings. Research indicates that stroke patients can continue to make gains for years after onset; thus, continued management of these individuals in chronic care settings is recommended.[330–332] Patients may be discharged from acute care to nursing homes if their hospital has insufficient rehabilitation services or they have inadequate home support[333]; for these patients, their nursing home placement should be viewed as inpatient rehabilitation. Although previously reviewed communication and cognitive management procedures are often appropriate for the chronic care stroke population, further research is needed to (1) evaluate the direct application of these procedures for this patient population and (2) develop further tests and treatment protocols designed to address the specific characteristics and needs of this stroke population.

Communication Assessment

Communication deficits after stroke may be a product of impaired motor skills, language abilities, or cognitive processes (Table 9). Within inpatient settings, the presence, type, and severity of these deficits should be documented, as should positive and negative communication strategies used by patients and caregivers. Comprehensive evaluation of communication abilities continues to be necessary in outpatient and extended care settings for several reasons. First, given today's healthcare system in the United States, patients may receive only limited inpatient rehabilitation services[1,334]; these patients may not yet have had a complete evaluation. Second, certain communication and cognitive disorders (eg, mild aphasia,

certain high-level language disorders associated with right-hemisphere stroke) may remain unnoticed within structured inpatient settings[335] or may not be fully appreciated by patients and caregivers until the patients return home.[322] For example, patients with executive dysfunction often function appropriately in inpatient settings because of their predictable and prearranged daily schedules; this external support helps them compensate for executive deficits that are more likely to manifest once they return to their typically less structured and controlled home and other daily environments and when they become responsible for implementing compensatory strategies.[298,336,337] Only a small set of tests have been developed with the chronic care patient population in mind. Given that individuals in chronic care settings are often elderly and have several comorbidities,[333] these tests tend to offer normative data for older adults, include tasks that are appropriate for more severely involved individuals, or both (eg, Ross Information Processing Assessment–Geriatric[338]).

Motor speech evaluations establish the presence and severity of apraxia of speech and the presence, type, and severity of dysarthria.[339–341] The integrity of each component of the motor speech system is determined, including (1) respiration (eg, breath support and control), (2) phonation (ie, voice production), (3) resonance (eg, degree of hypernasality), (4) articulation, (5) prosody (eg, production of emphatic stress or intonation contours), and (6) overall intelligibility (ie, how well familiar/unfamiliar listeners understand the patient's speech). Auditory-perceptual (eg, rating articulation precision), acoustic (eg, identifying fundamental frequency), and physiological (eg, determining airway resistance) measures are used in concert to assess speech output in simple (eg, isolated sounds; consonant-vowel syllables) through complex (eg, conversational speech) contexts.

Language assessment procedures vary depending on whether aphasia or cognitive-communicative problems associated with nondominant-hemisphere (typically right hemisphere) stroke are suspected. For aphasia, all language modalities, including auditory comprehension (ie, listening), reading, spoken language, writing, and, in more severely impaired patients, other augmentative communication modes such as gesture and drawing, should be assessed; within each modality, the linguistic level at which patients experience difficulty should be determined in terms of length (eg, single word versus connected discourse) and features (eg, lexical semantics versus morphosyntax; nouns versus verbs).[298,324,342] For right-hemisphere cognitive-communicative disorders, higher-level language (eg, interpretation of humor or figurative language) and pragmatic skills (eg, adapting verbal output complexity to the given conversational context) are evaluated in a variety of communication modalities.[298,343]

When patients who speak >1 language are evaluated, communication assessment of each of their languages is recommended.[344] Assessment of bilingual and multilingual patients often necessitates the use of interpreters and the administration of language use questionnaires/interviews to identify which language is used for which daily communicative activities.[345,346]

Currently, there is a need to expand the normative data of most communication (and cognitive) tests to include individuals over the age of 90 years, a broader spectrum of education levels, and individuals who reflect the rapidly growing minority and bilingual populations in the United States.[1,305,347] There are also few commercially available test options for quantifying and qualifying right-hemisphere cognitive-communicative disorders or motor speech disorders; with respect to motor speech disorders, however, protocols and normative data for auditory-perceptual, acoustic, and physiological procedures can be found in textbooks (eg, Duffy[348]) and the empirical literature (eg, Hoit and Hixon[349]; Kent et al[340]). See Table 10 for recommendations pertaining to communication assessment.

Cognitive Assessment

Rehabilitation teams must establish which member(s) will administer cognitive tests, because cognition evaluation falls under the purview of several rehabilitation disciplines.[343] Insufficient communication within the rehabilitation team may result in failure to include or unnecessary replication of cognitive tests. For patients with communication impairments, the SLP should be involved to assist in identifying cognitive tests and testing accommodations appropriate for the given patient's language comprehension and communication output abilities.

Across healthcare settings, the presence, type, and severity of disorders in each of the following cognitive domains should be evaluated: (1) Attention, including sustained, focused, and divided attention, attention switching, and neglect; (2) memory, including working memory, short-term memory span, and long-term memory; and (3) executive functions, including awareness of one's strengths and weaknesses, self-monitoring, reasoning, inhibition, and cognitive flexibility (Table 10).[352,353] Notably, many cognitive tests are inappropriate for patients with communication disorders because of the speech and language demands of the tests' instructions, stimuli, or required responses.[358] With respect to neglect, use of multiple tests is recommended because of the variable sensitivity of neglect tests and to assist with the identification of neglect subtypes.[323,359]

Communication Treatment

A growing number of meta-analyses[360–362] and evidence-based systematic reviews[363] conducted by professional associations such as the American Speech-Language-Hearing Association and the Academy of Neurological Communication Disorders and Sciences indicate that aphasia treatment produces positive outcomes. That is, patients who receive aphasia treatment achieve better outcomes than those who receive no treatment, and those who receive more frequent and intense (eg, >8 h/wk) aphasia treatment do better than those who receive less frequent (ie, ≤2 h/wk) treatment.[364,365] In contrast, there are currently no RCTs and few single-subject or group-design investigations that document outcomes associated with treatments for cognitive-communication disorders due to right-hemisphere brain damage. Initial research, however, does suggest that patients with right-hemisphere brain damage benefit from

Table 10. Recommendations and Levels of Evidence Across Patient Settings According to ICF Dimensions for the Evaluation of Communication and Cognitive Disorders

Recommendations by ICF Dimension	Care in the Inpatient Setting	Care in the Outpatient Setting	Care in Chronic Care Settings
Body structure and function			
Comprehensive cognition- communication assessment (ie, collect case history; observe in multiple contexts; screen motor, perceptual, and psychiatric conditions that may confound cognitive or communicative test performance; use formal communicative and cognitive tests; assess caregivers' communicative style and use of adaptive cognitive and communicative strategies) by the appropriate HCP is recommended.	Sources:[324,343,350] Class I; Level of Evidence B	Sources:[324,343,350] Class I; Level of Evidence B	Sources:[324,343,350] Class I; Level of Evidence B
Use of standardized, valid, and reliable test procedures to document the presence and qualify the nature of communication and cognitive disorders is recommended.	Source:[343] Class I; Level of Evidence B	Source:[343] Class I; Level of Evidence B	Source:[343] Class I; Level of Evidence B
It is reasonable that motor speech evaluations include acoustic, auditory- perceptual, and physiological measures to assess respiration, phonation, resonance, articulation, prosody, and intelligibility.	Sources:[339–341] Class IIa; Level of Evidence C	Sources:[339–341] Class IIa; Level of Evidence C	Sources:[339–341] Class IIa; Level of Evidence C
Aphasia evaluations that assess all communication modalities, including listening, speaking, reading, writing, and, in severe cases, alternate modes such as gesturing and drawing, are recommended.	Sources:[324,342] Class I; Level of Evidence B	Sources:[324,342] Class I; Level of Evidence B	Sources:[324,342] Class I; Level of Evidence B
Right-hemisphere cognitive-communicative disorders evaluations should assess higher-level language and pragmatic abilities in a variety of communication modalities.	Sources:[298,343] Class I; Level of Evidence C	Sources:[298,343] Class I; Level of Evidence C	Sources:[298,343] Class I; Level of Evidence C
It is reasonable to evaluate communication in each language if patients use multiple languages, using interpreters as needed.	Sources:[344–346,351] Class IIa; Level of Evidence C	Sources:[344–346,351] Class IIa; Level of Evidence C	Sources:[344–346,351] Class IIa; Level of Evidence C
Cognitive evaluations should assess all cognitive domains, and if stroke patients have communication disorders, there should be direct and/or indirect SLP involvement in the evaluation.	Sources:[352,353] Class I; Level of Evidence B	Sources:[352,353] Class I; Level of Evidence B	Sources:[352,353] Class I; Level of Evidence B
Activities and participation			
Standardized, valid, and reliable test procedures to document the impact of cognitive-communicative disorders on activities and participation should be used.	Sources:[337,350,354] Class I; Level of Evidence B	Sources:[334,337,350,354] Class I; Level of Evidence B	Sources:[337,350,354] Class I; Level of Evidence B
The collection and analysis of data from unstructured observations and interviews during communication and cognitive assessments is recommended.	Sources:[322,337,343,355] Class I; Level of Evidence C	Sources:[322,337,343,355] Class I; Level of Evidence C	Sources:[322,337,343,355] Class I; Level of Evidence C
The collection and analysis of discourse samples for aphasia and right-hemisphere brain damage cognitive-communication disorders is recommended.	Sources:[356,357] Class I; Level of Evidence C	Sources:[356,357] Class I; Level of Evidence C	Sources:[355,357] Class I; Level of Evidence C

speech-language therapy[366,367]; for example, the American Speech-Language-Hearing Association[367] reported that 77% of right-hemisphere brain damage patients who receive speech-language therapy services showed improvements in pragmatics as documented by the National Outcomes Measurement System. Further development and description of specific treatment protocols, particularly those that address high-level language and pragmatic disorders, however, are desperately needed.[368,369] Similarly, only a limited body of literature is available pertaining to motor speech treatments for stroke patients. On the basis of studies with non-RCT designs for which stroke patients were included in the participant sample, the following motor speech treatments have potential[370–372]: Biofeedback, device use (eg, voice amplifiers), and speech supplementation (eg, alphabet cueing, gestures).

Cognitive Treatment

There are 2 general cognitive treatment approaches: (1) Retraining impaired cognitive skills and (2) training strategies to compensate for impaired skills. Several reviews of the evidence-based literature have concluded, on the basis of the growing number of RCTs and studies with other strong research designs, that there is empirical support for both approaches.[332,373] Outcomes associated with cognitive retraining treatments tend to be more task specific than those associated with compensatory strategy training. As with

assessment, cognitive treatments are performed by a variety of healthcare disciplines, and thus, team communication is essential to avoid duplicating or omitting cognitive treatment services.

Several studies indicate that attention-retraining programs, which tend to involve activities that represent a hierarchy of task and response demand complexities across a variety of stimulus modalities and strategy training, are effective but are associated with varying degrees of generalization to untrained tasks or contexts.[331,373,374] Retraining (eg, scanning training), compensatory (eg, limb activation, trunk rotation), and passive sensory stimulation treatment approaches have been found to remediate neglect in individuals with right-hemisphere brain damage[323,375–378]; task-specific effects, however, tend to predominate, particularly after scanning protocols and in patients with poor awareness of neglect.[359] There has been nominal exploration of the effects of these treatments, however, for individuals with neglect subsequent to left-hemisphere brain damage.

Although several RCTs have been conducted to evaluate memory treatments for individuals who have had traumatic brain injuries, only sparse literature has examined memory treatment outcomes in stroke patients.[332,367,379] Internal compensatory strategies (eg, mnemonics) may have some potential if patients are motivated and have mild cognitive impairments in concert with relatively good awareness of their memory limitations.[373,380] External compensatory strategies (eg, Neuropage; memory books) have been found to be useful for a broader spectrum of patients, including those with more severe memory issues.[332]

No RCTs have been conducted to evaluate executive function treatments for stroke patients (or any other neurogenic patient population). A growing number of studies using other research designs, however, have reported positive outcomes when patients have been trained in the use of compensatory strategies to assist with planning and problem solving.[367,381]

In summary, the primary difference between inpatient versus outpatient or chronic care therapy regimens lies in treatment intensity and frequency versus treatment goals and activities. Even though shorter and less frequent treatment sessions are characteristic of outpatient and chronic care settings,[334,382] research indicates that better outcomes are associated with more intense treatment, even in individuals with more chronic (eg, >6 months after stroke) communication and/or cognitive disorders.[361,364,365] Additionally, research studies pertaining to group therapy,[383,384] computer-assisted treatments,[385,386] compensatory strategies,[331,387] and caregiver training,[388–390] are most frequently conducted within outpatient versus inpatient settings, although these approaches are appropriate for inpatient settings as well. Although initial research has concluded that patients in chronic care settings can continue to benefit from treatment,[391,392] some literature reviews have noted that few treatment studies include elderly individuals, who represent the age group most frequently encountered in these extended-care settings.[393] Accordingly, inclusion of this segment of the stroke population should be a priority in future communication and cognitive treatment research. Table 11 provides further information regarding levels of evidence for communication and cognitive treatments.

3. Poststroke Depression

Depression is one of the most underdiagnosed and undertreated complications after stroke.[401,402] Its origin may be organic, related to poststroke dysfunction of catecholamine-containing neurons, premorbid, or reactive to the catastrophe of losing function. Reported prevalence rates range from 25% to 79%.[403–405] In 1 follow-up study, 54% of stroke survivors felt at least mildly depressed during follow-up, and 46% of those who expressed feelings of depression during the first 2 months after stroke also felt depressed at 12 and/or 18 months; 12% reported depression for the first time at 12 or 18 months.[406] Major risk factors for poststroke depression include female sex, premorbid depression or other psychiatric illness, social isolation, and functional or cognitive impairment.[407] Studies examining the relationship between stroke location and depression have produced disparate results, and more recent meta-analyses failed to establish a definitive relationship between lesion site and depression.[407,408] Although depression has been proposed to influence motor and functional recovery, 1 study found that its negative impact on functional recovery appeared most significant after hospital discharge rather than during the hospital stay.[409] Poststroke depression is also associated with higher mortality, poorer functional recovery, and less social activity.[407]

Assessment

Given the 24/7 nature of nursing contact with patients, particularly in inpatient settings, nurses most frequently first notice poststroke depression, perform an initial assessment, and request a consultation. Although in their review, Salter and colleagues[407] provide no recommendation for use of any single specific diagnostic tool (Table 12), the Patient Health Questionnaire 9-item depression scale has advantages over other depression measures because of its brevity and strong psychometric properties when used as either a diagnostic tool or screening instrument with stroke patients.[414] The 2-item version of this scale also has psychometric support as a screening tool, but those scoring ≥3 should be administered the remaining 7 items to complete the full 9-item version. More generally, depression assessment within inpatient, outpatient, and chronic care settings should include clinical interview and history, collateral information from family and caregivers, observational standardized screening measures, and standardized self-report screening measures when appropriate.[415]

Treatment

Depression treatment primarily consists of pharmacotherapy and psychotherapy. In a meta-analysis of 13 pharmaceutical agents and 4 trials of psychotherapy with 1655 participants, there was some evidence of complete depression remission and a reduction in depression rating scale scores with pharmacotherapy but no evidence of benefit from psychotherapy.[416] In

Table 11. Recommendations and Levels of Evidence Across Patient Settings According to ICF Dimensions for Treatment of Communication and Cognitive Disorders

Recommendations by ICF Dimension	Care in the Inpatient Setting	Care in the Outpatient Setting	Care in Chronic Care Settings
Body structure and function			
Treatment of communication and/or cognitive disorders to facilitate restoration of impaired abilities and to teach compensatory strategies is recommended, with procedures selected on a case-by-case basis to address each patient's specific deficits and needs.			
Aphasia	Sources:[15,330,360–362,380,394] Class I; Level of Evidence A	Sources:[15,268,330,350–362,380,385,386,394] Class I; Level of Evidence A	Source:[391] Class I; Level of Evidence C
RHD cognitive-communicative disorders	Sources:[333,366,367,395] Class I; Level of Evidence C	Sources:[333,367] Class I; Level of Evidence C	Source:[333] Class I; Level of Evidence C
Motor speech disorders	Sources:[368,370–372,380] Class I; Level of Evidence B	Sources:[368,370–372,380] Class I; Level of Evidence B	Source: Working Group Consensus Class I; Level of Evidence C
Neglect	Sources:[323,359,373,375–378,380] Class I; Level of Evidence B	Sources:[322,359,373,375–378,380] Class I; Level of Evidence B	Source: Working Group Consensus Class I; Level of Evidence C
Other attention disorders	Sources:[331,367,373,374] Class I; Level of Evidence B	Sources:[331,367,373,374] Class I; Level of Evidence B	Source: Working Group Consensus Class I; Level of Evidence C
Memory disorders	Sources:[332,367,379,380] Class I; Level of Evidence B	Sources:[332,367,379,380] Class I; Level of Evidence B	Source: Working Group Consensus Class I; Level of Evidence C
Awareness disorders	Sources:[367,373,381,384,393,396] Class I; Level of Evidence C	Sources:[367,373,381,384,393] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Other executive function disorders	Sources:[367,373,381,384,393,396] Class I; Level of Evidence C	Sources:[367,373,381,384 393,396] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Treatment should be provided at as intensive a schedule as the patient can tolerate.	Sources:[333,361,364,365 367,394] Class I; Level of Evidence B	Sources:[333,361,364,365,367,394] Class I; Level of Evidence B	Source:[333] Class I; Level of Evidence C
Activities and participation			
Cognitive and/or communication disorders should be treated to facilitate resumption of daily cognitive and communicative activities and social participation/interactions.			
Aphasia	Sources:[329,367,397] Class I; Level of Evidence B	Sources:[329,367,383,388,389,397] Class I; Level of Evidence B	Source:[391] Class I; Level of Evidence C
RHD cognitive-communicative disorders	Source:[367] Class I; Level of Evidence C	Source:[367] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Motor speech disorders	Source: Working Group Consensus Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Neglect	Sources:[359,398] Class I; Level of Evidence B	Sources:[359,398] Class I; Level of Evidence B	Source: Working Group Consensus Class I; Level of Evidence C
Other attention disorders	Sources:[331,388] Class I; Level of Evidence C	Sources:[331,388] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Memory disorders	Sources:[332,387,399,400] Class I; Level of Evidence B	Sources:[332,387,399,400] Class I; Level of Evidence B	Source:[392] Class I; Level of Evidence C
Awareness disorders	Source: Working Group Consensus Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Other executive function disorders	Sources:[373,384,387,393] Class I; Level of Evidence C	Sources:[373,384,387,393] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C

RHD indicates right-hemisphere brain damage.

another meta-analysis of 10 pharmaceutical trials and 4 psychotherapy trials, there was no clear effect of pharmacotherapy (prevention of depression or other end points)[416]; a significant improvement in mood and the prevention of depression were evident with psychotherapy, but the treatment effects were small.

In summary, all stroke patients in all care settings should be assessed for depression, and if diagnosed with depression,

Table 12. Examples of Tools to Screen for Depression

Tool	Domain	Time to Administer, min	Comments
Beck Depression Inventory[410]	Body function; contextual factors	10	A 21-item instrument with a 4-point scale that is widely used, easy to administer, and good at assessing somatic symptoms but less useful with the elderly. It has established internal consistency and construct validity. Sensitivity and specificity are best with a cutoff score of 10 or greater.
Center for Epidemiologic Studies of Depression[411]	Body function; contextual factors	<15	A 20-item, self-report, 4-point Likert measure that assesses depression symptoms in the general population. Easy to administer and has established internal consistency and construct validity. Not appropriate for aphasic patients.
Geriatric Depression Scale[412]	Body function; contextual factors	10	A 30-item, self-report tool with a yes/no response. It is easy to administer with the elderly, the cognitively impaired, or those with visual and/or physical problems or low motivation. Has established reliability and validity but yields high false-negatives for minor depression. There is also a short form of 15 items.
Hamilton Depression Scale[413]	Body function; contextual factors	<30	A 17-item tool with a 5-point scale used to assess depression severity in children and adults, including those with stroke. There is also a 21-item version, but the shorter version is more commonly used. Has established reliability and validity and correlates highly with other clinician-rated and self-report depression measures.
Patient Health Questionnaire 9-Item Depression Scale[414]	Body function; contextual factors	<5	A 9-item, easy-to-administer tool based on the 9 Diagnostic Statistical Manual of Mental Disorders-IV depression criteria. A score ≥10 has excellent sensitivity and specificity with stroke survivors, and it performs equally well regardless of client age, gender, or ethnicity. A score ≥3 on the 2-item version of this questionnaire also has excellent sensitivity and specificity as a brief screening tool, but for diagnosis and a more complete depression evaluation, the additional 7 items should be given.

they should receive prompt treatment.[407] There is strong evidence that heterocyclic antidepressants improve poststroke depression, but their side effects in older adults must be monitored closely.[407,417–419] On the basis of meta-analysis results, there is strong evidence that selective serotonin reuptake inhibitors also effectively treat poststroke depression.[407] Moderate evidence (Class I; Level of Evidence B) indicates that an active care management program that includes patient education and ongoing monitoring may enhance the effectiveness of pharmacological treatments for poststroke depression.[407,420] Strong evidence (Class I; Level of Evidence A) further indicates that pharmacological treatment of depression is associated with improved functional recovery among stroke survivors.[407,409] Guidelines for treating poststroke depression also recommend screening, assessment, and treatment with an appropriate antidepressant for a period of approximately 6 months.[407,421] In addition, treatment and its subsequent withdrawal should be monitored closely by an appropriately trained HCP professional.

4. Basic Supportive Care for Preventing Major Poststroke Complications

Across inpatient, outpatient, and chronic care settings, the interdisciplinary team needs to focus on preventing serious complications that can dramatically impede the rehabilitation process and desired patient outcomes. These major complications are pulmonary embolism and deep vein thrombosis, skin integrity issues, spasticity, aspiration, malnutrition, severe sleep apnea, seizures, and falls.

a. Pulmonary Embolism and Deep Vein Thrombosis

Pulmonary embolism risk is highest during the first 3 to 120 days after stroke, with a 50% sudden death rate.[422] Because most stroke survivors (hemorrhagic and ischemic alike) begin rehabilitation in this time period, nurses and all other interdisciplinary team members must be cognizant of any potential signs of a pulmonary embolism or deep vein thrombosis and take immediate action. Deep vein thrombosis prevention is a major performance measure for Medicare and the Commission on Accreditation of Rehabilitation Facilities.[101] While the patient is in rehabilitation, ambulation should be started as soon as safely possible to prevent deep vein thromboses.[423] To prevent pulmonary embolisms and deep vein thromboses, pneumatic compression devices and compression stockings can be used.[424] Research has also shown that a 40-mg dose injection of enoxaparin daily was more effective than 5000 IU of unfractionated heparin twice daily to prevent deep vein thromboses.[102] In stroke patients taking anticoagulants, nursing should assess daily for any signs of bleeding.

b. Skin Integrity

Loss of sensation, impaired circulation, older age, decreased level of consciousness, inability to move oneself due to paralysis, and incontinence of urine or stool can lead to skin breakdown in stroke survivors.[103] Therefore, nursing and other staff members should assess patients' skin every shift and every time patients have been repositioned or sitting, being particularly attentive to the patient's affected side. Across care settings, the Braden scale[425,426] is commonly used to predict the likelihood of pressure ulcer development. Patients should be repositioned at least every 2 hours, and special care should be taken when patients are moved to avoid any excessive friction or pressure. In addition, the skin should always be kept clean and dry, and special mattresses and other padding may be required on wheelchairs. When appropriate, patients and family members should be educated regarding proper skin care and assessed as appropriate in preparation for discharge.

c. Spasticity

Spasticity occurs in approximately 35% of stroke survivors.[427] Left untreated, spasticity can lead to contracture, and activity limitations and participation restrictions will vary dramatically depending on spasticity location(s) and severity (eg, from difficulties cleaning a palm to problems with ambulation). Spasticity should be treated if it causes pain or affects mobility, ADLs, or sleep. Indirect management of spasticity involves addressing conditions that may exacerbate spasticity (eg, urinary tract infections, fecal impaction, pressure sores). To treat spasticity directly and effectively, a combination of physical and pharmacological modalities usually is necessary. Physical approaches include range-of-motion exercises; heat, cold, and electric stimulation; and splinting. Oral medications for spasticity of cerebral origin include dantrolene and tizanidine, and phenol or botulinum toxin injections may be used to target specific muscles or muscle groups.[428,429] For severe spastic hemiplegia, intrathecal baclofen also may be used.[430] Currently, neurosurgical procedures (eg, selective dorsal rhizotomy, dorsal root entry zone lesions) lack clinical trial evidence. See Duncan et al[15] for a more detailed discussion of spasticity management recommendations.

d. Aspiration

Immediately after stroke, up to half of stroke survivors are dysphagic, with many regaining a safe swallow within the acute recovery phase.[104] Despite the propensity for recovery, dysphagia increases the risk of aspiration pneumonia 7-fold and is an independent predictor of mortality. Furthermore, Galvan[431] found that approximately half of aspirations that result from dysphagia are silent and go unrecognized until a pulmonary manifestation or other complication occurs. Accordingly, Iwamoto et al[432] emphasized the necessity of performing a bedside swallowing assessment in patients, even after initial recovery from stroke.

Within most settings, nurses are at the forefront of consistently evaluating patients' swallowing capability, in conjunction with the SLP and, in some facilities, the OT. As previously discussed in the present statement, swallowing assessment must be performed with an evidence-based tool (eg, Massey Bedside Swallowing Screen[105]), and treatment includes strategies such as posture changes, increased sensory input, swallowing maneuvers, active exercise programs, diet modifications, nonoral feeding, psychological support, and supportive nursing interventions.[15]

e. Malnutrition

Across care settings, a variety of factors such as compromised level of consciousness, dysphagia, sensory and/or perceptual deficits, reduced mobility, or depression may contribute to decreased patient interest in eating.[416] At 2 to 3 weeks after stroke, 50% of severe stroke survivors are reported to be malnourished,[433] and from early assessment to 3 months after stroke, the number of patients with malnutrition has been found to increase significantly.[434] Furthermore, patients who were undernourished before their stroke usually remain undernourished during hospitalization.[106] Weight loss exceeding 3 kg after stroke further indicates the need for close observation of the patient's nutritional status[435]; monitoring of body weight is particularly important among patients with severe stroke, eating difficulties, low prealbumin levels, or impaired glucose metabolism. Nutrition and hydration assessment are also essential, including monitoring intake, urinary and fecal outputs, body mass index, caloric counts, and levels of serum protein, electrolytes, and blood counts. A nutritional assessment should be performed along with a diet history with close monitoring by the dietician.

f. Severe Sleep Apnea

Munoz and colleagues[436] reported that independent of known confounding factors, severe obstructive sleep apnea/hypopnea (defined as an apnea/hypopnea index $\geq$30) increases stroke risk in adults 70 to 100 years of age. Data from several recent well-designed prospective studies involving middle-aged adults also support the relationship between sleep apnea and stroke, but experts recommend additional research with older adults before treatment standards are established.[437–439] Nurses are the most likely members of the interdisciplinary team to recognize whether sleep apnea is present. All patients who may have this potential problem should be assessed, with follow-up monitoring when apnea is identified. Lifestyle changes (eg, stop smoking, lose weight, sleep on side versus back), mouthpieces, breathing devices (eg, continuous positive airway pressure), and/or surgery can be used to treat sleep apnea.

g. Seizures

Seizures occur more commonly after hemorrhagic stroke (11%) than after ischemic stroke (9%).[440] New data indicate that stroke patients with seizures are more likely to die within 30 days after stroke than patients without seizures,[441] and therefore, it is important that patients be monitored for seizure activity and evaluated immediately when it occurs.

The initial step in treatment is to verify whether the episode was a seizure versus another type of transient event; additional diagnostic tests may be required to determine this. After the differential diagnosis, treatment choice depends on the likelihood and potential morbidity of another seizure versus risks of pharmacotherapy.[442–444] Generally, treatment will include the identification and elimination of toxic or

metabolic disturbances that lower the seizure threshold, as well as the use of antiepileptic drugs.

h. Falls

People are more likely to fall as a consequence of stroke secondary to the complexity of the deficits that may be present days or months after stroke. As mentioned previously, the stroke population has a greater risk of falling than adults without stroke. For example, Kerse et al[35] reported 37% of poststroke individuals fell within 6 months, and of those fallers, 12% fell >5 times. Many factors can affect fall risk, such as balance issues, poor limb coordination, cognitive deficits (eg, awareness issues, disinhibition, visual neglect), sensory impairments (eg, visual field cuts, hemianesthesia), older age, time after stroke, and previous history of falls.[35–37] The interdisciplinary rehabilitation team should work together to identify individual risk factors for falls and environmental hazards and address those with the stroke survivor and caregiver. During stroke recovery, the interdisciplinary rehabilitation team should (1) identify strategies and balance activities to minimize falls during ADLs, (2) identify assistive devices needed for reaching and walking, and (3) work with the stroke survivor and caregiver on safety with transfers and mobility. The interdisciplinary team should also provide education for the stroke survivor and caregiver on common strategies they can use to help avoid falls in the home and community environment, particularly given that Kerse et al[35] found that stroke survivors most frequently fall indoors in their home. Examples of such strategies include (1) avoiding loose rugs or clutter on the floor for a clear walking path, (2) avoiding slippery surfaces (eg, spills on the floor or icy sidewalks), (3) providing adequate lighting (eg, opening curtains during the day or using a night light during the evening or night hours), (4) wearing shoes that fit with nonskid soles, and (5) slowing down movements for transfers or walking, because quick, impulsive movements could result in dizziness or a fall.

5. The Role of the Interdisciplinary Team in Implementing Recommendations for Addressing Body and Function Issues Across Care Settings

The interdisciplinary team collectively plays a pivotal role in enhancing the ability of stroke patients to progress in the rehabilitation process via implementing the previously described recommendations. Each discipline has a unique contribution, but the teamwork and unified evidence-based approach facilitates short- and long-term goal achievement. In addition, team conferences permit individualization of the care approach (eg, motor issues, communication and cognition disorders, emotional needs, prevention of major medical complications) and partnering with patients and their families to develop, implement, and evaluate the care plan and outcome parameters in the inpatient setting and beyond. Accordingly, the unified team approach enhances the coordination of care, quality outcomes, and patients' ability to achieve goals related to the ICF dimension of body structure and function.

Within the interdisciplinary team, the nurse brings a distinctive holistic perspective to the patient care process. Nurses traditionally ensure consistent and timely implementation and evaluation of the recommendations presented. Whereas members of other disciplines treat particular ICF body structures and functions, the nurse focuses on the person as a whole, thus providing continuity and integrity to patients' and families' rehabilitation experience.[445] According to the American Association of Colleges of Nursing,[446] the nurse is a care provider who can be considered a skill- and evidence-based caregiver, patient advocate, educator, and professional partner with other interdisciplinary team members. Because nurses care for patients 24 hours a day, 7 days a week, they are the primary professionals expected to communicate effectively with all involved, collaborate to achieve patients' individualized care needs (eg, repositioning, PROM, fall prevention, assistance with eating), serve as astute observers and problem solvers, and uphold a major role in evaluating the overall team's efforts and patient outcomes. Because of their close contact and holistic orientation, nurses frequently are the first to note changes in patients' body structure and function status (eg, motor, communication, cognition, major medical complications) that may be life-threatening or that may deter progression of the rehabilitation treatment plan. Moreover, they diligently collaborate with the team to manage these difficulties as they emerge.

As reviewed in Section A of the present statement, nurses, in concert with their other interdisciplinary rehabilitation team members, are responsible for identifying, developing, and then implementing treatment plans to address losses within the ICF dimension of body structure and function, including motoric impairments, communication and cognition deficits, and depression, that stroke survivors exhibit when receiving care within inpatient and outpatient rehabilitation settings and in chronic care settings; management of conditions that may lead to major poststroke complications has also been summarized briefly. Next, we review the evidence pertaining to diagnosing and remediating problems stroke survivors may experience within the activity and participation dimensions of the ICF model.

B. Approach to Activities and Participation Issues

1. Deficits Associated With Poststroke Motor Control (ie, UE and LE Motor Issues, Bowel and Bladder Issues)

a. UE and LE Motor Issues

Strong evidence exists that patients who receive rehabilitation in specialized stroke units achieve greater functional improvement, which is sustained over the short- and long-term, than those in general medical units.[447] There is also strong evidence that functional outcomes achieved through stroke rehabilitation are maintained and can actually improve for at least 1 year. Central to these mobility improvements are unified mobility assessments that allow HCPs to select the best treatments and therapies to assist stroke survivors in the performance of ADLs and to regain or maintain their highest level of mobility.

i. Assessment in Inpatient, Outpatient, and Chronic Care Settings.

The goals for functional UE and LE assessment are to (1) determine the functional deficits and level of assistance

required for mobility (eg, bed mobility, transfers, sitting, walking), ADLs (eg, toileting, eating, washing oneself, dressing), and IADLS (ie, those activities necessary to live independently, such as using the telephone, shopping, managing finances, cooking, and taking medications), and (2) integrate this patient-related information from the assessment to select the most appropriate intervention strategies to achieve the highest level of functional independence. In inpatient settings, this information is used to determine the functional needs to promote the transition from inpatient rehabilitation to home. During inpatient stroke rehabilitation, HCPs primarily focus on self-care and mobility.[172,173,448–450] Yet, the limited activity engagement and community reintegration by stroke survivors[451] suggest that IADLs and leisure/recreational pursuits should be addressed before inpatient discharge and during outpatient therapy. In chronic care settings, UE and LE assessment goals surround maintenance of independence in self-care tasks, involvement in leisure/recreation activities, and in some cases, management of work responsibilities to maintain qualify of life. Recommendations for UE and LE activity and participation assessment are listed in Table 5.

ii. Treatment in Inpatient Settings.

A large portion of time (19% to 43%) in inpatient stroke rehabilitation is spent on ADL training,[173] because the ability to perform these activities is often necessary to move to levels of less structured care, particularly the ability to return to community living. Despite this, few studies have examined the most efficacious methods for facilitating improvements in ADL skills. Typically, ADLs are addressed with a mixture of restorative (eg, motor training for the paretic UE) and compensatory (eg, 1-handed techniques, adaptive equipment) interventions. Although OTs often introduce and begin the ADL training, nurses are responsible for daily practice of these techniques. In the United States, much less time is spent on IADL training during inpatient rehabilitation because of the short lengths of stays.[173] As with ADLs, IADL training is a mixture of body structure and function restorative training along with compensatory intervention. Compared with the ADL treatment literature, there are even fewer studies that examine the efficacy of IADL training.

Many of the studies reviewed in the previous body structure and function section of the present statement have documented that improvements in motor, swallowing, cognitive, psychosocial, UE, and LE functions can also improve the ability to engage successfully in ADLs and IADLs.[452–455] The complexity of IADL and leisure activities often limits the impact of addressing just 1 or 2 body structures or functions on engagement in these activities.[456] Most studies of traditional inpatient rehabilitation, however, show that in general, stroke survivors improve their ability to complete ADLs from admission to discharge,[457–461] although the level of ADL independence is linked to initial stroke severity, overall level of dependency,[11,462] and factors such as depression.[463] Teasell and colleagues[464] reported that even severely impaired individuals can make gains in ADL performance with extended rehabilitation designed for their tolerance levels; unfortunately, such extended rehabilitation is not typically provided in the US healthcare system.

Collectively, the evidence suggests that ADL and IADL training results in greater ADL and IADL independence than no ADL or IADL training[167–171] (but see Logan et al[465]). Furthermore, Liu and colleagues[466] reported that training stroke patients to mentally rehearse ADL sequences and related problem solving resulted in even greater ADL gains than ADL training alone. Yet some studies have found that ADL performance deteriorates within the first year after discharge from stroke rehabilitation.[467] Two factors that may moderate ADL/IADL training gains are the amount and type of rehabilitation received. For example, functional gains were less in individuals who received shortened lengths of stay in poststroke inpatient rehabilitation due to the prospective payment system.[468] In a study comparing rehabilitation outcomes among 4 rehabilitation facilities in 4 different European countries,[469] stroke survivors in the United Kingdom facility had more favorable ADL outcomes than those in the 3 other facilities: The United Kingdom facility provided much more nursing care focused on practicing compensatory ADL techniques than the other facilities. In contrast, stroke survivors in the Swiss facility had better IADL outcomes than those in other facilities, possibly because of the greater number of hours of OT they received.

iii. Treatment in Outpatient and Chronic Care Settings.

The majority of stroke survivors who received inpatient rehabilitation continue to need help with some basic self-care, such as dressing or bathing, even 1 year after stroke.[470] Thus, ADL training often continues in outpatient and chronic care settings, and as in inpatient settings, a combination of restorative and compensatory training methods is used. Even for individuals requiring chronic care, ADL training, environment adaptation, and remediation of impairments may at least retard deterioration of self-care abilities.[471] The amount of time and the type of IADL training depend on the stroke patient's living situation. For those living alone or planning to return to independent living, more time may be spent on IADL training across a variety of tasks; for those in supported settings where there are fewer IADL needs, fewer types of IADLs are trained.

b. Bowel and Bladder Issues

Across rehabilitation and chronic care settings, bladder and bowel assessment and management are a central aspect of poststroke care. Nursing plays a particularly important role in this process, with nurses assuming major responsibility in working with patients, their families, and other interdisciplinary team members. Patients and their families must also be educated to recognize and report signs of difficulty (eg, urgency, dysuria, diarrhea, or constipation) and to follow the prescribed bladder and bowel treatment plan. The same recommendations for assessment and treatment reviewed in Section A of the present statement apply when managing bowel and bladder issues relating to activity and participation.

2. Communication and Cognition Disorders

a. Inpatient Settings

Most currently available tests of communication and cognition that are suitable for the inpatient stroke population focus

on evaluating the type and degree of impairment, and thus, they primarily evaluate the ICF dimension of body structure and function.[298,344] Accordingly, a smaller pool of tests examine the impact of communication and cognitive problems on patients' daily activities and interactions and resumption of their social and vocational roles (Table 9). Because fewer structured activity and participation tests are currently available, informal or semistructured observational sessions are a recommended component of assessment aimed at these dimensions of the ICF model.[337,343,472]

Similarly, the vast majority of the cognitive and communicative treatment literature, particularly within inpatient care settings, has restricted its focus on developing and evaluating protocols for remediating body structure and function limitations (Table 11). Only a minimal body of literature has explored whether these treatments impact daily cognitive and communicative outcomes associated with the WHO activity and participation dimensions. Likewise, only a small, albeit growing number of treatment protocols have been designed to directly address cognitive and communication deficits within ICF activity and participation dimensions.

b. Outpatient and Chronic Care Settings

Inclusion of activity and participation measures is essential when the communication and cognitive status of outpatient and chronic care stroke patients is evaluated, because a growing body of literature has questioned the degree of association between body function and structure tests and communication and cognitive functioning in everyday environments.[322,343,355,472] It is often useful to administer activity and participation measures once patients have returned to their long-term living environment and daily schedules. For example, stroke patients and their caregivers may have acquired a better appreciation of the implications of their cognitive and communicative symptoms.[298,322] Indeed, Katz and colleagues[334] found that HCPs reported using these measures more frequently in outpatient than in inpatient rehabilitation settings.

Outpatient and chronic care treatment approaches should focus on cognitive and communicative behaviors and strategies that patients will regularly utilize in home, social, and/or work settings to ensure change in the ICF dimensions of activity and participation. Research further suggests that communication and cognitive treatments that incorporate everyday contexts are associated with improvements on activity and participation measures.[399] Overall, assessment and treatment procedures identified as appropriate for addressing activity and participation issues in the inpatient stroke population are also suitable in both outpatient and chronic care settings.

c. Assessment

There remains a need to develop more activity and participation tools given the disputed 1-to-1 association among the ICF dimensions[355,473]; that is, clinicians cannot use body structure and function tests to reliably predict patients' activity and participation status.[337,354,472] In particular, more activity and participation tests suitable for stroke survivors with language deficits are needed. Most existing tests for these ICF dimensions were created for patients with predominantly physical diagnoses; thus, the language demands of these tests often exceed the abilities of patients with linguistic disorders, and the test items tend to reflect activity and participation restrictions related to physical rather than communication limitations.[472,474]

Observation of patient functioning in a variety of contexts (eg, familiar versus unfamiliar conversational partners or topics; noisy versus quiet environments) is recommended given that variable behavior is pervasive after stroke.[356,475] Additionally, observations and unstructured interviews may serve as the primary information source when patients whose abilities fall at the extremes of the severity spectrum are being assessed. Severely impaired patients often perform at basal levels on formal tests, whereas mildly impaired patients often perform at ceiling levels[476–478]; such test outcomes provide nominal direction in terms of treatment planning. Collection and analysis of language samples are also recommended to characterize the effects of communication impairments on patients' interactions within everyday milieus, particularly given that performance on structured, formal language tests may share a weak relationship with performance in less structured discourse contexts.[356,357,479] Several language-elicitation tasks should be used (eg, picture description, story retelling, video narration) to reflect the diverse communication activities encountered on a daily basis. Scoring systems for analyzing language content, structure, and use have been described with adequate detail and acceptable levels of rater reliability within the empirical literature.[480]

d. Treatment

Most evidence regarding the effects of cognitive and communicative treatments on stroke patients' daily activities and social participation is anecdotal or from weak research designs.[298,327,332] There remains a tremendous need not only to examine the impact of existing treatments on daily activities and participation but also to develop new protocols specifically designed to affect change within these ICF dimensions. This dearth of treatment data reflects, at least in part, the limited number of outcome measures available to document activity and participation changes. In addition, treatments that target activities and participation are most frequently applied in outpatient versus inpatient settings within the research literature (eg, Sohlberg et al[332]).

An increasing database has documented that a variety of aphasia treatment approaches may facilitate improved resumption of daily communicative activities and interactions, including computerized training and devices,[481] group treatment,[383] and communication partner training.[388] Certain neglect treatments also positively impact certain ADLs and IADLs (eg, wheelchair driving, reading, posture control).[359,398] In terms of other attention disorders, treatments that target more complex attention functions, including metacognitive skills (eg, strategy training, self-monitoring), are most likely to evoke activity and participation changes.[331,482] Training with external memory devices (eg, Neuropage) has been shown to facilitate independence in completing ADLS and IADLs (eg, completing self-care and hygiene activities, using public transportation).[332,387,400] Most research to date, however, has focused on patients with memory impairments

subsequent to traumatic brain injury versus stroke. For other communicative and cognitive disorders related to stroke, there is minimal research documenting treatment outcomes in terms of performance on activity or participation measures.[364,373] See Tables 10 and 11 for specific assessment and treatment recommendations, respectively.

3. Return to Work

A significant number of stroke survivors do not return to work after rehabilitation.[483–488] Return to work is associated with a higher sense of well-being and life satisfaction.[489–491] Understanding the many factors associated with returning to work after stroke is difficult because (1) inconsistent study designs and methods prevent a clear picture of the variables related to return to work, (2) there is a paucity of research on how to facilitate return to work in this population, and (3) rehabilitation services typically overlook return to work.[483,489] Furthermore, there has been no investigation of employment maintenance. Despite the limited research, the severity of stroke sequelae frequently has been shown to modulate return to work, with more severe impairments reducing the chance that the stroke survivor will return to work[486,491–494]; accordingly, amelioration of these impairments with the rehabilitation methods discussed in previous sections of the present statement might facilitate vocational reintegration. However, Shaw and colleagues[495] found that individuals' perception of their impairment level was key to returning to work, and thus, it may be that absolute impairment is less important than stroke survivors' beliefs in their abilities (ie, a personal factor within the ICF model). Koch and colleagues[490] found that the individuals who returned to work in their study demonstrated greater patience, determination, and sense of humor than individuals who did not. In that study, vocational reentry was also associated with emotional support from caregivers, instrumental support from HCPs, and willingness of employers to make accommodations. More recently, Ownsworth and Shum[496] identified significant correlations between several executive function measures and employment productivity among stroke survivors. Flexible coworkers have also been found to be important in return to work,[497] and being capable of a white collar job was associated with a higher rate of return to work than being employable in blue collar jobs.[498] As Treger et al noted,[483] although many risk factors for inability to return to work have been identified, no models have yet been developed to help HCPs identify whether a particular stroke survivor will or will not regain employment.

Unfortunately, return to work rarely has been measured in poststroke intervention clinical trials. One exception, a study of constraint-induced movement therapy,[499] identified no change in vocational reintegration after therapy. Evidence is also lacking regarding the efficacy of interventions to support poststroke return to work. Findings from 1 study[500] suggested that retraining blue collar workers for white collar jobs may facilitate return to work, although the retrospective, single-group methodology of that study limits conclusions.

a. Inpatient Settings

On the basis of working group consensus and previously published stroke rehabilitation guidelines,[15] it is recommended that interest in returning to work and type of employment desired be ascertained as soon as possible. Initial determination of stroke symptoms that may limit job performance should be made, followed by implementation of interventions designed to address these limitations.

b. Outpatient Settings

Again on the basis of working group consensus and previously published stroke rehabilitation guidelines,[15] it is recommended that interest in returning to work and type of employment be reassessed, as well as job activity limitations and barriers to vocational reentry, with referral to vocational counseling/rehabilitation as needed. Job retraining, if needed, should be begun, along with interventions to remove or minimize barriers.

4. The Role of the Interdisciplinary Team in Implementing Recommendations for Addressing Activity and Participation Issues Across Care Settings

With a unified approach to the recommendations, the interdisciplinary rehabilitation team will assist patients and their families to optimize patients' performance of the functional tasks required for ultimate reintegration into their home and community. For many stroke survivors, mobility, social integration, and return to work are important elements that dramatically affect their quality of life, and thus, coordination of efforts by the respective disciplines is essential.

Although 30% of stroke patients recover almost completely or with minor impairments,[501] the role of nursing once again becomes important in addressing the ICF activity and participation dimensions. Nurses are pivotal in coordinating care, astutely observing actual or potential problems and monitoring their quick management, and advocating for patients and their families to adequately prepare them for present and future care needs. Another important element of nursing care is patient education, including ensuring that patients and their families are well informed regarding their strengths and available resources and that they recognize that many activities and strategies (eg, eating a balanced diet that meets their nutritional needs; fall prevention strategies) included in the rehabilitation process will need to be continued as patients move from 1 care setting to another.

In summary, a cohesive interdisciplinary approach to poststroke rehabilitation provided in inpatient, outpatient, and chronic care settings can facilitate positive change in the ICF dimensions of activities and participation, although clearly, further research is needed to establish a broader spectrum of assessment tools and treatment protocols to meet the diverse needs of individual stroke survivors and their families. Next, rehabilitation issues pertaining to the contextual factors dimension of the ICF model are reviewed via a discussion of some of the more influential personal and environmental factors that may influence poststroke recovery across care settings.

C. Approach to Personal and Environmental Contextual Factors

As indicated by the ICF framework, personal and environmental factors have a distinct influence on how patients

respond to stroke (Figure). It is essential that all interdisciplinary team members consider each patient's individual and environmental characteristics when developing, implementing, and evaluating stroke interventions.[10] Central to this assessment process is determining nonmodifiable and modifiable stroke risk factors along with personal factors such as the patient's compliance with prescribed medications and other treatment recommendations, learning capabilities, unique premorbid stroke condition, expectations, coping style, emotional state (eg, depression, anxiety, anger), body size, and sex. Family caregiver education and support represent key environmental factors that must be addressed to smooth the transition of care of the stroke patient to the home setting.

In rehabilitation settings, the nurse is traditionally the principal HCP with the primary responsibility of educating patients and their families regarding modifiable and nonmodifiable stroke risk factors,[502,503] emphasizing the 2006 AHA secondary prevention guidelines, and assisting the patient in developing a feasible action plan. Similarly, other interdisciplinary team members provide patient and caregiver education pertaining to stroke sequelae and treatments more specific to their area of practice.

1. Secondary Stroke Prevention

a. Inpatient Settings

One in 6 stroke survivors will have a recurrent stroke, with greatest prevalence within the first 6 months.[1] Therefore, HCPs must remain vigilant of the status of modifiable and treatable stroke risk factors. Comprehensive patient assessments and ongoing monitoring in conjunction with evidence-based and timely interventions are essential in inpatient rehabilitation settings (see Sacco et al[504] for nationally recognized, secondary stroke prevention standards). Preventive actions specifically targeted at modifiable stroke risk factors can reduce the likelihood of first stroke by almost 80%.[1] Modifiable stroke risk factors include smoking, alcohol consumption, obesity, and physical activity, and treatable vascular stroke risk factors include hypertension, diabetes, and cholesterol.[504] Nurses traditionally serve a central role in educating patients and their families regarding modifiable, treatable, and nonmodifiable stroke risk factors and in advocating creation of a feasible action plan, including adherence to prescribed medications and the periodic blood work that may be required. In addition, patient education is a performance standard for primary stroke centers and the Commission on Accreditation of Rehabilitation Facilities[10]; therefore, nurses must be well informed regarding evidence-based and best practices associated with effective lifestyle modification strategies for the diverse patient population (ie, age, sex, race, culture). Because of the evolving evidence pertaining to modifiable stroke risk factors and the prevention of recurrent stroke, nurses and other interdisciplinary team members need to remain informed of any recent empirical advances.

b. Outpatient and Chronic Care Settings

Actions to reduce modifiable and treatable stroke risk factors remain important in outpatient and chronic care settings, and the secondary prevention recommendations are the same as those described for inpatient settings.[504]

2. Compliance With Prescribed Medications and Treatment Plan

a. Inpatient Settings

The number 1 problem in treating illness is patients' failure to take prescription medicine correctly, regardless of age.[1,505] Two thirds of Americans fail to take any or all of their prescription medicines. With regard to high blood pressure, the major contributor to first and subsequent strokes, 72% are aware of their high blood pressure, and 61% are under current treatment, but only 35% have their high blood pressure under control.

Few RCTs have had compliance as an outcome measure, and even fewer examined multiple strategies to improve prescribed medication compliance. Some of the most promising strategies to increase compliance reflect a combination of interventions such as patient education, contracts, self-monitoring, social support, telephone follow-up, and tailoring of messages and interventions.[506–511] Outcomes from the Preventing Recurrence of Thromboembolic Events Through Coordinated Treatment Stroke Program indicated that interventions that combined exercise, diet instruction, medication guidelines, and tobacco cessation were maintained when 8 evidence-based medication and behavioral prevention measures were implemented.[512] The involvement of patients more consistently in developing, implementing, and refining their care plan to achieve a mutually established care objective by all interdisciplinary team members is also increasingly being demonstrated to positively affect adherence to lifestyle and medication recommendations.[513–515]

b. Outpatient and Chronic Care Settings

Given the comorbidities of the stroke survivor that contribute in most instances to the initial stroke, it is essential that secondary stroke prevention strategies remain in place within outpatient and chronic care settings. Furthermore, data indicate that approximately 14% of stroke survivors will experience another stroke within 1 year of their primary event.[516] A systematic review of the association between medication dose regimens and medication compliance revealed that as expected, the prescribed number of doses per day is inversely related to compliance,[517] with simpler, less frequent dosing regimens resulting in greater compliance. Once again, nurses have an essential role in educating patients and their families and identifying targeted and feasible interventions to maintain adherence to secondary prevention lifestyle changes and prescribed medical and other therapy recommendations.[518]

3. Poststroke Depression, Coping Style, Emotional State, and Sex

Inpatient, Outpatient, and Chronic Care Settings

The identification and treatment of poststroke depression are important because of the association of depression with quality of life and mortality.[401,402] In a 5-year prospective, community-based study, Paul et al[519] found nearly 20% of stroke survivors were depressed, with few taking antidepres-

sants. More frequent poststroke depression was identified by Clark and colleagues[520]; in their study, 74% of stroke caregivers indicated that their stroke survivors were feeling sad or depressed. Paradiso and Robinson[521] found a different pattern of poststroke depression in men than in women, which may have important implications for treatment and, consequently, mortality rates.[522] Additionally, stroke survivors often experience a variety of other emotional and behavioral changes after stroke (eg, feelings of worthlessness or being a burden on others, emotional lability, irritability, anger, frustration, indifference, emotional dependency, personality changes, inertia, and learned helplessness).

Research also suggests that an individual's coping style and emotional state may affect the incidence of stroke. In a study of 200 individuals hospitalized for stroke or transient ischemic attack, approximately 30 reported having extreme episodes of anger, fear, irritability, or nervousness as a result of a startling event within 2 hours before experiencing their stroke.[523] In addition, exposure to a potential trigger may increase stroke risk by as much as 14 times during the 2-hour period immediately after the exposure. Kuroda et al[524] found that women had a higher proportion of poststroke anxiety and depression than men, and although additional findings suggest that women have different coping styles than men after stroke, there remains a paucity of research to clarify sex differences and thus guide appropriate interventions.[402,525,526]

Coping and emotional state may also be influenced by poststroke dementia, which occurs initially in approximately 30% of survivors, increases by 7% at the end of the first year, and then rises to 48% of survivors after 25 years.[527] When drug and lifestyle strategies are planned with stroke survivors and their families, formal tests (eg, Short Portable Mental Examination) should be used by nurses or other qualified team members to screen for the presence of dementia. The assessment parameters identified in previous communication and cognition sections of the present statement should also be considered, with input from the collective and complementary expertise of all interdisciplinary team members included in comprehensive depression evaluation and treatment plans (for specific assessment and treatment recommendations, see "Depression" of the present statement and Table 12).

4. Stroke Survivors' Learning Capabilities

Inpatient, Outpatient, and Chronic Care Settings

When planning educational interventions, nurses and other HCPs must consider the importance of literacy and potential hearing, vision, language, and memory changes that may affect understanding, learning, and retaining information, as well as adherence to recommended medication and lifestyle interventions. HCPs should not make assumptions regarding the readability of drug and lifestyle educational materials or their appropriateness for the diverse stroke population. For example, in a recent survey of patient educational materials, only 20% were at the recommended 5th- to 6th-grade reading level,[528] with 80% exceeding this reading level. Furthermore, there remains a need for educational materials that accommodate the language deficits of stroke survivors with aphasia or that are appropriate for stroke patients or caregivers who speak languages other than English. Accordingly, HCPs should routinely assess patients' and their families' perceptions of the efficacy (ie, helpfulness and timing) of educational materials/strategies introduced throughout the entire caregiving process and make data-based changes as required. Although the literature is limited, emerging evidence suggests that acute stroke patients are able to recall and retain information presented, but performance is affected by the site of the brain lesion.[111]

Because the science pertaining to stroke care continues to evolve, HCPs must stay informed regarding distinctive sex, age, and ethnocultural responses to preventative interventions. For example, aspirin is not recommended to prevent first stroke in men, but it helps prevent first ischemic stroke and myocardial infarction in women 65 years and older.[529,530] Even though warfarin reduces stroke risk in patients with atrial fibrillation by 68% compared with 21% for full-dose aspirin, physicians still underprescribe warfarin to older adults.[531] This lower warfarin prescription rate is associated with physicians' fears of older adults (1) hemorrhaging; (2) falling; (3) having a greater predisposition to skin tearing; (4) refusing the medication; and (5) failing to adhere to dietary restrictions while taking the medication, failing to take the warfarin as prescribed, and failing to have the required routine blood work to monitor the drug's efficacy. Thus, creative interventions that address these concerns (eg, fall risk assessment, strategies to increase adherence to prescribed medication and laboratory schedules) are greatly needed, as is close monitoring of outcomes.

5. Family Caregiver Education and Support

Of all of the environmental factors listed in the ICF core sets for stroke, experts judged family support as most important.[532] Families care for approximately 74% of stroke survivors after discharge to the home setting.[533] Evidence is emerging about the vital role of family during the recovery trajectory, including the association of family support with improvements in stroke survivors' physical and overall functional status [534,535,] and psychosocial outcomes.[536,537] Moreover, stressed family caregivers may impede the rehabilitation process and are a leading reason for institutionalization of stroke survivors.[538] Thus, it is imperative to support family caregivers, because they provide care for stroke survivors during all phases of rehabilitation.

Family caregivers are at risk for depression, social isolation, declining health, and mortality as a result of providing care,[539] and they experience a considerable burden.[4] Depression prevalence in stroke caregivers has been estimated to range from 30% to 52%,[4,538,540] with higher depression rates in caregivers than in stroke survivors.[540–542] Stroke caregivers experience negative life changes such as less time for family and social activities, poorer relationships with friends, worse financial and emotional well-being, lower energy levels, and poorer physical health.[107,541,543] In a landmark prospective study, spousal caregivers of older persons with disabilities had a 63% higher mortality risk if they were experiencing strain than noncaregiving control subjects.[544] Thus, HCPs are strongly urged to respond to not only the needs of stroke survivors but also those of family caregivers throughout all phases of the rehabilitation process.[545]

a. Inpatient Settings

Recommendations from clinical practice guidelines and existing research have focused on family caregiver involvement in 6 main areas: (1) Caregivers as members of interdisciplinary teams; (2) assessment of needs and concerns from the caregiver's perspective; (3) the importance of follow-up contacts and referrals; (4) counseling focused on problem solving and social support; (5) the provision of stroke-related care information; and (6) attention to the emotional and physical health of caregivers. Table 13[16] provides a summary of recommendations in these areas. Generally, the research evidence in stroke caregiving is weak (level C or evidence based on working group consensus); however, recommendations based on available evidence are important to guide practice. The following sections describe recommendations regarding family involvement in all rehabilitation settings.

i. Caregivers as Members of Interdisciplinary Teams.

Current clinical practice guidelines recommend that family caregivers become active members of interdisciplinary teams, participating in the goal-setting and decision-making process for the care of stroke survivors to facilitate optimal recovery and community reintegration.[15,546] Family caregivers can be valuable contributors by providing information regarding the survivor's prestroke life and possible barriers and facilitators for rehabilitation. Caregivers should be viewed not only as respected colleagues in the care of stroke survivors, but also as clients.[545] Designated interdisciplinary team members must address family caregivers' needs and concerns and be prepared to provide support or referral when appropriate.

Despite the acknowledged importance of family caregivers in practice guidelines,[15,546] little evidence supports their inclusion on interdisciplinary teams. Smith et al[548] found no significant differences in knowledge of services, mood, or satisfaction in caregivers who participated on interdisciplinary teams compared with a usual-care group. Although Sulch and colleagues[547] reported greater attention to caregiver needs and a nonsignificant tendency toward lower caregiver strain in an interdisciplinary care group than a nurse-led stroke group, caregiver satisfaction was similar in both groups.

ii. Assessment of Caregiver Needs and Concerns.

The literature has increasingly acknowledged the importance of assessing caregivers' perspectives of needs and concerns after stroke across all care settings.[554] In their comprehensive review of 22 stroke caregiver intervention studies, Visser-Meily et al[555] concluded that many interventions were unsuccessful in reducing caregiver strain or improving caregiver well-being or emotional status because they focused on patient outcomes as the target goal. No RCTs have yet addressed the effectiveness of detailed caregiver assessments or individualized caregiver interventions in inpatient settings.

Despite this lack of evidence, the assessment of caregiver needs and concerns from the caregiver's perspective has been highly recommended in stroke patient care guidelines.[15,546] The consensus of 54 recognized experts in caregiving, leaders in health and long-term care issues, scholars, practitioners, and public officials was that caregiver assessment is fundamental to the care of persons with chronic and disabling conditions and to effective outcomes and quality of care.[556] Given the pivotal importance of the systematic and comprehensive multidimensional assessment of the primary family caregiver and of including this in the long-term goals and rehabilitation plan for the stroke survivor, Table 14 lists caregiver assessment tools that HCPs might use throughout the rehabilitation care process (for a more detailed review of stroke caregiver measures, see Visser-Meily et al[557]).

As stroke caregiver assessment becomes more widely accepted as a standard of care, so will evaluation of entire family systems. Researchers and clinicians are encouraged to go beyond the stroke survivor-caregiver dyad and examine entire families.[546,565] One study that focused on minor children of stroke survivors advocated the need to screen for children's functioning, spouse depression, and the quality of the marital relationship during rehabilitation for a more family-centered care approach.[557] Despite minimal research in this area, consideration of the entire family system, including young children and other family members, can be beneficial, with referral for treatment or counseling as appropriate.

iii. Follow-Up Contacts and Referrals.

Interventions, referrals, and follow-up care based on detailed caregiver assessments conducted during the survivor's inpatient stay are likely to smooth the transition of care to the home setting. Ski and O'Connell[568] found that the main concern expressed by stroke caregivers was poor follow-up procedures for initiating rehabilitation in the home. Caregivers reported a need for more information about stroke associations, support groups, home help, and rehabilitation options before discharge.

Current practice guidelines recommend that a designated HCP, preferably an interdisciplinary team member, arrange for follow-up care during the stroke survivor's inpatient stay and provide follow-up contacts with family caregivers after discharge (ie, 1, 4, 6, and 12 months after discharge).[546] Acute care hospitals and rehabilitation facilities should maintain current lists of community resources, support groups, volunteer agencies, respite and home care agencies, therapy services, and additional supportive resources to share with survivors and their families while survivors are inpatients.[549,569] Stroke organizations such as the American Stroke Association (www.strokeassociation.org) and the National Stroke Association (www.stroke.org) offer written materials, monthly stroke magazine subscriptions, World Wide Web sites for survivors and caregivers, and lists of stroke support groups.[554] General caregiving (eg, Family Caregiver Alliance, www.caregiver.org) and specific disorder (eg, National Aphasia Association, www.aphasia.org) associations may be helpful as well. Referral to a social worker is recommended to help family caregivers deal with financial problems, find appropriate community resources, and make decisions about nursing home placement when appropriate.[461]

iv. Counseling Focused on Problem Solving and Social Support.

During inpatient rehabilitation, caregiver counseling focused on problem-solving behaviors and social support has been recommended.[558,573] On the basis of their comprehensive review of stroke caregiver intervention studies, Visser-Meily

Table 13. Recommendations and Levels of Evidence Across Patient Care Settings According to ICF Environmental Factor Issues: Family Caregiver Education and Support

Family Caregiver Recommendations	Care in the Inpatient Setting	Care in the Outpatient Setting	Care in Chronic Care Settings
Caregivers as members of interdisciplinary teams			
Caregivers should be active members of the interdisciplinary team with common shared goals for recovery and community reintegration.	Sources:[15,546–548] Class I; Level of Evidence C	Sources:[15,546–553] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Assessment of caregiver needs and concerns			
Detailed assessment of caregiver needs from the caregiver's perspective is recommended in inpatient and outpatient settings; it is reasonable to perform such assessments in chronic care settings. See Table 14 for caregiver assessment tools.	Sources:[15,107,514,545,546,554–559] Class I; Level of Evidence C	Sources:[15,107,514,545,546,554–564] Class I; Level of Evidence C	Source: Working Group Consensus Class IIa; Level of Evidence C
It is reasonable to consider the entire family system, with appropriate referral for treatment or counseling.	Sources:[546,554,565–567] Class IIa; Level of Evidence C	Sources:[546,554,565–567] Class IIa; Level of Evidence C	Source: Working Group Consensus Class IIb; Level of Evidence C
Follow-up contacts and referrals			
Follow-up contacts with family caregivers should be arranged and performed after discharge by a designated HCP in inpatient and outpatient settings; it is reasonable to do this in chronic care settings.	Sources:[546,549,568,569,570] Class I; Level of Evidence A	Sources:[546,549,568–571] Class I; Level of Evidence A	Sources: Working Group Consensus Class IIb; Level of Evidence C
Social work referral is recommended to assist family caregivers in dealing with financial problems, locating appropriate community resources, and finding long-term care when needed.	Sources:[15,461,514,545,554,558,569] Class I; Level of Evidence C	Sources:[15,461,514,545,554,558,569,570] Class I; Level of Evidence C	Sources:[461], Working Group Consensus Class I; Level of Evidence C
Acute-care and rehabilitation facilities should maintain current lists of community resources, support groups (face-to-face and online), and volunteer agencies to provide to both survivors and their family caregivers in inpatient and outpatient settings; it is reasonable to do so in chronic care settings.	Sources:[15,554,568] Class I; Level of Evidence C	Sources:[15,554,568,572] Class I; Level of Evidence C	Source: Working Group Consensus Class IIa; Level of Evidence C
Counseling focused on problem solving and social support			
Caregiver counseling should focus on problem-solving behaviors and social support in inpatient and outpatient settings; it is reasonable to do so in chronic care settings.	Sources:[513,546,548,554, 555,567,573–576] Class I; Level of Evidence A	Sources:[513,546,548,554,555,568, 569,573–576,577–580] Class I; Level of Evidence A	Sources:[546], Working Group Consensus Class IIa; Level of Evidence C
Information on stroke-related care			
A designated HCP should provide information in a variety of formats as appropriate (eg, written information, individual face-to-face education, family conferences, World Wide Web sites, stroke organizations) in inpatient and outpatient settings; it is reasonable to do so in chronic care settings.	Sources:[15,545,546] Class I; Level of Evidence C	Sources:[15,112,545,546,581–583] Class I; Level of Evidence C	Source: Working Group Consensus Class IIa; Level of Evidence C
Caregivers should be encouraged to ask questions about the survivor's care.	Sources:[15,545,546] Class I; Level of Evidence C	Sources:[15,545,546] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Caregivers should be encouraged to attend therapy sessions so they can provide support and promote the survivor's self-care while avoiding overdependence in inpatient and outpatient settings; it is reasonable to do so in chronic care settings.	Sources:[15,545,546] Class I; Level of Evidence C	Sources:[15,545,546] Class I; Level of Evidence C	Source: Working Group Consensus Class IIa; Level of Evidence C
Assessment and reinforcement of caregiver knowledge of stroke warning signs, lifestyle changes, and risk factors for secondary stroke prevention is recommended in inpatient and outpatient settings; it is reasonable to do so in chronic care settings.	Sources:[15,108,119,504,514,515, 545,546,548,554,584,585] Class I; Level of Evidence B	Sources:[15,112,504,513–515, 545,546,554,581–586] Class I; Level of Evidence B	Source: Working Group Consensus Class IIa; Level of Evidence C
Additional areas for caregiver education and training should include medication management, the survivor's condition and treatment plans, and poststroke complications.	Sources:[15,514,545,546,554,558, 567,584,587] Class I; Level of Evidence B	Sources:[15,514,545,546,554,558, 567,584,587] Class I; Level of Evidence B	Source: Working Group Consensus Class I; Level of Evidence C

(*Continued*)

Table 13. Continued

Family Caregiver Recommendations	Care in the Inpatient Setting	Care in the Outpatient Setting	Care in Chronic Care Settings
Provision of family education regarding communication techniques for survivors with communication disorders is recommended.	Sources:[15,107,109,110,546,570] Class I; Level of Evidence C	Sources:[15,107,109,110,546,570,588] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Discussing sexuality and intimacy after stroke, with professional support provided as necessary, is recommended in outpatient settings; it is reasonable to do so in inpatient and chronic care settings.	Sources:[546] Working Group Consensus Class IIa; Level of Evidence C	Sources:[546] Working Group Consensus Class I; Level of Evidence C	Source: Working Group Consensus Class IIa; Level of Evidence C
Caregivers should be asked about survivors' depressive symptoms, emotions, and difficult behaviors so that strategies can be provided for caregivers and treatment or counseling can be sought for the survivor.	Sources:[15,520,543,545,554,558,589] Class I; Level of Evidence C	Sources:[15,520,543,545,554,558,589,590] Class I; Level of Evidence C	Sources:[15,110] Class I; Level of Evidence C
Attention to caregivers' emotional and physical health			
Caregiver depression should be assessed and receive prompt treatment and/or referral. See Table 12 for suggested screening tools.	Sources:[15,119,520,546,548,554,570,574,576,578,591–593] Class I; Level of Evidence C	Sources:[15,119,520,546,548,551,552,554,562,570–572,574,576,578,580,591–594] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C
Caregivers should be asked about their own health and encouraged to seek regular health checkups.	Sources:[15,119,545,546,551,554,570,574,575,581,582,585,592] Class I; Level of Evidence C	Sources:[15,119,545,546,551,554,570,574,575,581,582,585,592] Class I; Level of Evidence C	Source: Working Group Consensus Class I; Level of Evidence C

et al[555] concluded that although time consuming, counseling that promotes problem-solving, coping, and support-seeking behaviors should be provided. Another review revealed that providing information alone had no effect on stroke patient or caregiver mood, perceived health status, or quality of life.[573] However, education combined with targeted problem-solving strategies improved caregiver knowledge, family functioning, problem-solving skills, preparedness, depression, and health-related quality of life.[513,574,576] These types of interventions empower family caregivers to identify, solve, and evaluate their own problems in providing care.

v. Information on Stroke-Related Care.

A study asking stroke caregivers about the advice they would offer to fellow stroke caregivers generated a number of recommendations, such as (1) getting more information before discharge, (2) attending classes and support groups, (3) finding books or written materials about stroke, (4) keeping a running list of questions to ask, and (5) attending and participating in therapy sessions to learn what the survivor can do.[545] These findings are consistent with recommendations from current clinical practice guidelines,[15,546] which include recommendations that patient and family caregiver education be provided in an interactive and written format by a designated member of the interdisciplinary team and that family conferences be held for further information sharing. Although the effectiveness and amount of education required to effect positive stroke outcomes are unclear, stroke caregivers continue to express the need for information about all aspects of stroke care, particularly during inpatient and early discharge phases of stroke rehabilitation.[554]

Information about stroke. Stroke caregivers are commonly concerned about recognizing the warning signs of a second stroke, as well as about recommended lifestyle changes and risk factors for secondary stroke prevention.[545] King and Semik[514] reported that only 40% of stroke caregivers remembered receiving any information about secondary stroke prevention. Current guidelines recommend that stroke survivors visit with their HCPs about modifying stroke risk factors (eg, controlling blood pressure, smoking cessation, increasing physical activity via a supervised therapeutic exercise regimen) to reduce secondary stroke risk.[504,584] Family caregiver education is needed in these areas so that they can assist and support the survivor. Unfortunately, research regarding family education in these areas is limited. One RCT was unable to demonstrate improvements in caregiver knowledge, satisfaction, or mood after an educational program initiated within a stroke unit.[548] Two other trials found that caregiver knowledge about stroke and satisfaction improved significantly after an inpatient caregiver educational program[515,585]; however, there were no significant improvements in caregiver emotional state, burden, or perceived health. Another study found that transitional care initiated during inpatient rehabilitation that covered information about stroke for caregivers resulted in decreased patient institutionalization and mortality but did not significantly change caregiver physical or emotional health.[108] Despite limited evidence from RCTs, family caregiver education of stroke warning signs, risk factors, and lifestyle changes is highly recommended in current practice guidelines.[108]

Other stroke-related care issues. Other areas for family caregiver education and support include medication management, the survivor's condition and treatment plans, and poststroke complications (eg, physical impairments, bowel or bladder incontinence, contractures, cognitive deficits). Depressive patient symptoms are common after stroke, and dealing with poststroke depression is a primary family caregiver concern. Managing stroke survivors' emotions and behaviors is regarded as one of the most difficult aspects of providing care.[543] Because family caregivers of aphasic survivors have been found to experience greater difficulty with tasks and worse life changes than caregivers of nonaphasic survivors,[543] family education regarding communication techniques for survivors with communication disorders should be provided.[15,109,110,546] Although commonly neglected, sexuality and intimacy after stroke should be discussed as needed.[546]

Table 14. Examples of Tools for the Assessment of Stroke Caregivers

Tool	Domain	Time to Administer, min	Comments
Caregiver Needs and Concerns Checklist[545,554,560,561]	Environment: caregiver needs and concerns	<10	A 32-item checklist to identify needs and concerns from the caregiver's perspective. Items based on qualitative interviews from stroke caregivers. Relevance and feasibility documented by experts and caregivers. Used to guide stroke caregiver interventions in an RCT.
Oberst Caregiving Burden Scale[557,558]	Environment: caregiver tasks	<5	A 15-item scale to measure time and difficulty with caregiver tasks (eg providing personal care, dealing with finances, interacting with health professionals). Evidence of reliability and validity in stroke caregivers.
Bakas Caregiving Outcomes Scale[107,541,554,557]	Environment: caregiver life changes	<5	A 15-item scale to measure life changes specifically as a result of caring for a stroke survivor. Includes both positive and negative aspects of providing care. Strong psychometric properties in stroke caregivers.
Caregiver Strain Index[557,601,602]	Environment: caregiver strain	<5	A 13-item scale of caregiver strain with yes/no answers, originally developed for caregivers of hospitalized hip surgery or heart patients. Validated in stroke caregivers.
Family Caregiver Conflict Scale[559]	Environment: family caregiver conflict	<5	Easy to administer 15-item scale that measures family conflict surrounding stroke recovery (ie, disagreements regarding care). Relatively new instrument with preliminary evidence of reliability and validity.
Self-Rated Burden[601]	Environment: caregiver strain	<2	One item that measures burden using a visual analogue scale ranging from 0 (not at all straining) to 100 (much too straining). Evidence of feasibility and validity in stroke caregivers.

Obviously, education and support in these areas depend on the stroke survivor's condition, as well as the needs and concerns expressed by individual caregivers.[554]

vi. Attention to Caregivers' Emotional and Physical Health.

Depressive symptoms in the caregiver. Treatment of caregiver depressive symptoms is paramount. Caregiver stress and strain can impede the rehabilitation process for stroke survivors, are leading causes of long-term stroke survivor institutionalization, and are risk factors for increased caregiver mortality.[538] RCTs that have tested interventions to reduce caregiver depressive symptoms have yielded inconsistent results: Although some have shown that caregiver problem-solving interventions initiated during inpatient care can reduce depressive symptoms,[575,591] others yielded insufficient evidence.[110,548] Despite these variable findings, it remains important to identify and treat caregivers' depressive symptoms. Although not currently implemented widely in practice, the use of depression screening tools listed in Table 12 might help identify caregivers in need of referral for further evaluation.[554] Screening for caregiver depressive symptoms and identifying factors that may contribute to depressive symptoms are recommended so that support, interventions, and referrals can be made.

Caregiver health. Descriptive and intervention research regarding stroke caregivers' health status and health-promotion activities is lacking and inconclusive. Some researchers have reported mental and physical component scores on the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) for stroke caregivers that are close to published norms,[109,111,550] whereas others have reported lower scores.[539] Most stroke caregiver intervention studies have not found significant improvements in general health perceptions, although most used the SF-36, which is considered a more global measure.[109]

Even with inconclusive evidence regarding the health status of stroke family caregivers, current practice guidelines recommend that all members of the survivor's interdisciplinary team attend to the health status of family caregivers throughout all phases of rehabilitation.[546] Simply asking stroke caregivers about their own health and encouraging regular checkups not only shows caregivers that HCPs are concerned about them but may also remind caregivers of the importance of taking care of themselves and seeking assistance when needed. Financial concerns may indicate a social work referral is necessary to assist the caregiver in obtaining healthcare benefits, because some caregivers reduce work time or quit jobs to care for stroke survivors.[593]

b. Outpatient Settings

Family caregivers are integral partners in the community reintegration of stroke survivors in outpatient and chronic care settings. Most stroke caregiver research has taken place in outpatient settings, although most studies were initiated within inpatient settings. The recommendations for supporting family caregivers in inpatient settings are even more important in outpatient settings as families and survivors adjust to the home

care environment. For instance, once the stroke survivor is out of inpatient settings and the family is reestablishing a routine, the family caregiver may detect cognitive, communicative, and/or behavior changes that were unnoticed previously. Learning how to identify such changes and to notify the survivor's HCPs is important. Even more important is helping family caregivers manage survivors' emotions and behaviors, one of the most stressful aspects of providing care.[520,543,545,558] Referral to a social worker for community resources or for follow-up neuropsychological testing of the stroke survivor may be indicated after discharge. Counseling focused on problem solving, social support, role changes, and dealing with grief or loss, as well as information on stroke-related knowledge and care (eg, stroke warning signs, lifestyle changes), should be ongoing throughout the rehabilitation process. Attention to family caregivers' emotional and physical health remains critical, because caregiver stress can impede stroke recovery and place survivors at risk for long-term institutionalization. As mentioned previously, family caregivers of stroke survivors are commonly neglected by HCPs[113,514,545] and frequently experience poor follow-up care after discharge.[568] With attention to the recommendations in Table 13, improvements in the comprehensive care of stroke survivors and their family caregivers can be realized.

c. Chronic Care Settings

In chronic care settings, families have an oversight role to play to ensure that stroke survivors' needs are met. Families play a supportive role in keeping stroke survivors connected with their past, integrating them into the new setting, and facilitating their completion of activities and exercise. In addition, making sure families have the appropriate documents in place (eg, living will, healthcare power of attorney) is helpful for the future.

Although evidence is limited with regard to family caregivers of stroke survivors in chronic care settings, the recommendations in Table 13 still apply. Family caregivers must be active members of interdisciplinary teams and involved in the decision-making process for the survivor's care. Although rarely addressed in this setting, detailed assessment of family caregiver needs and concerns from the caregiver's perspective would help identify areas in which caregivers can continue to contribute to the survivor's care. It may be beneficial to ask about family caregivers' needs and encourage them to take care of themselves. Consideration of the entire family is also important. Follow-up contracts with family caregivers after discharge, even though the survivor is in extended care, may help reveal critical care issues that might be missed otherwise. Counseling aimed at the same areas as discussed for outpatient settings may assist family caregivers, including in easing stress related to nursing home placement. Information about stroke-related care issues should be provided so that family members can continue to assist with care and potentially recognize warning signs of another stroke or complications that may require medical attention. Caregivers must be encouraged to ask questions and participate in survivors' therapy sessions. Support of family members of stroke survivors who are in chronic care settings is integral to comprehensive stroke care programs.

In summary, the importance of family in the care of stroke survivors across inpatient, outpatient, and chronic care settings cannot be overemphasized. Table 13 summarizes stroke caregiver recommendations across these settings. Family education and support is the most important environmental factor listed in the ICF Core Sets for Stroke and cannot be overlooked in stroke rehabilitation programs.

6. The Role of the Interdisciplinary Team in Implementing Recommendations for Addressing Personal and Environmental Contextual Factors

Throughout the rehabilitation process, the interdisciplinary team needs to be cognizant of the contextual factors that make stroke survivors unique, and then use this information to design and execute an individualized rehabilitation plan. With specific attention paid to personal and environmental attributes, the interdisciplinary team can become more adept at partnering with patients and their families and implementing the recommendations described as they pertain to the ICF dimension of contextual factors.

Once again, nurses are most inclined to have a more complete picture of patients and their families in the present and before the stroke. Because nurses are with patients during all times of the day and work with patients as they learn new activities, assist in dressing and toileting as needed, and observe first-hand patients' frustrations and successes, they develop a greater understanding and appreciation of patients' strengths and limitations. Given this rather extensive knowledge of the patient, nurses are more inclined to see the entire picture and are able to serve most effectively as the patient's advocate to make sure that the recommendations identified in this section are implemented as designed.

In summary, consideration of contextual factors is advocated when stroke rehabilitation is provided across inpatient, outpatient, and chronic care settings. In the final section of the present statement, we review key components to addressing stroke care management in end-of-life and palliative care settings.

III. End-of-Life and Palliative Care Settings After Stroke

The delivery of end-of-life clinical care comprises a number of principles that are relevant to stroke.[595] Elements such as race, ethnicity, and culture, as well as stroke severity and its prognosis, may influence how an end-of-life plan is organized. Other aspects of the end-of-life experience are often more fluid and need to be addressed as they evolve (eg, pain and physical discomfort; social relationships and support; economic demands; caregiving needs; hopes and expectations). Appropriate care must be provided not only by HCPs but also by family, friends, communities, and institutions. Each component of this support system should be evaluated through formal measures, with a focus on the satisfaction of the provider and stroke patient or other aspects of quality of life. Although there is little research regarding end-of-life care specifically focused on stroke, such end-of-life care and decisions may need to be considered clinically at any point along the stroke continuum and thus are appropriate to include in this comprehensive review of stroke care.

In 1999, The Project to Educate Physicians on End-of-Life Care was published.[596] Its objectives were to define palliative care and describe concepts of suffering, elements of end-of-life care, and hospice and palliative care program standards. The principles of The Project to Educate Physicians on End-of-Life Care form the recommendations for delivering end-of-life clinical care, and accordingly, these recommendations form the basis of the guidelines for end-of-life care after stroke.

Assessment

An end-of-life plan of care should be based on a comprehensive assessment of the whole patient.[596] Patient self-report is the gold standard for assessment, but when this is not possible (eg, aphasic stroke survivors), a history should be obtained from the caregivers closest to the patient. Pain should be used as a portal of entry into other aspects of the assessment, including a determination of the location, quality, severity, and modifying factors of physical symptoms, as well as their impact on function, the effect of current treatments, and the patient's perspectives of these symptoms. Physical symptoms should correlate with the primary illness, current or past medical therapy, or other comorbid conditions for stroke survivors. A history of previous treatments must correspond to the treatments available and desired by the stroke survivor. The assessment should also consider any functional and safety issues, hydration, and nutritional status, as well as psychological, communicative, social, and spiritual factors in the expression of physical symptoms.

Besides physical factors, emotion, cognition, communication, mood, coping responses, fears, and unresolved issues should be evaluated, because there may be an emotional response to serious illness. In addition, HCPs must screen the stroke survivor for psychiatric conditions (eg, anxiety, depression, delirium) using validated tools when necessary (see Table 12 for a list of depression screening measures). Because coping mechanisms vary widely, HCPs must always inquire about the potential for self-harm and suicidal ideation. Moreover, patients should be encouraged to express fears about the future and discuss unresolved issues in personal matters, especially in relationships, that often are a prominent part of the end-of-life experience.

Treatment

Patient symptoms should be managed with a palliative care paradigm.[596] The WHO[597] defined palliative care as all active care provided to patients whose disease fails to respond to curative treatments. Although the details of palliative care are beyond the scope of the present statement, the overall goal of palliative care is achievement of the best quality of life for stroke survivors and their families by preventing and relieving pain and other distressful physical, psychological, social, and spiritual symptoms.[596] Palliative care neither hastens nor postpones death but rather offers an interdisciplinary team to integrate psychological and spiritual aspects of care and consequently not only help patients live as actively as possible until death but also support families during the patients' illness and the bereavement period. Additionally, for patients with communicative symptoms (eg, aphasia, dysarthria), the care plan should include identifying and maintaining a communication modality or assistive device that will allow patients to continue to communicate with family and caregivers.

Hospices are institutions in which interdisciplinary teams integrate medical, emotional, social, cultural, and spiritual care of end-of-life patients and their families. In the United States, hospice includes (1) a free-standing facility or a dedicated unit within a hospital or nursing home, (2) an agency that provides care in a variety of settings but usually in the patient's home, (3) integrated care similar to palliative care that may be delivered into any setting, including intensive care units, and (4) a Medicare benefit subject to Center for Medicare and Medicaid Services rules and regulations, as well as accreditation by The Joint Commission. In 2007, the National Hospice and Palliative Care Organization estimated that 39% of all deaths in the United States occurred under the care of a hospice program.[598]

In the United States, Medicare recipients may receive hospice care in several environments. For example, patients may receive routine home care, as well as hospital care for a condition unrelated to the terminal condition. Despite the environment, a multitude of services are available when justified.[599] A registered nurse with special training and expertise in end-of-life care can visit the patient as needed and be on call, with other hospice nurses, 24 hours every day. Medical social services are provided by a social worker and consultation and oversight by the hospice medical director. Counseling services include dietary recommendations, bereavement counseling for the terminally ill patient, and adjustment-to-death support for the patient's family and friends. Bereavement services are provided up to 1 year after the patient's death. Sometimes peer visits or trained hospice volunteers provide friendly visits, compassionate listening, and companionship for patients and families. OT, PT, SLP, home health aide, and homemaker services may be available by special arrangement between the hospice and other agencies. The hospice may supply medications and medical supplies for palliation and management of both terminal and comorbid conditions. Finally, clergy may offer spiritual support as needed to foster communication between terminally ill patients and their congregation of worship.

The following end-of-life assessment and treatment recommendations, based on The Project to Educate Physicians on End-of-Life Care consensus,[599] are applicable to stroke care (Class I, Level of Evidence C):

1. HCPs should (a) respect the dignity of both patients and caregivers, (b) be sensitive to and respectful of patients' and families' wishes, (c) use the most appropriate measures that are consistent with patients' choices, and (d) respect patients' rights to refuse treatment.
2. End-of-life care plans should (a) encompass alleviation of pain and other physical symptoms, (b) address psychological, social, cultural, and spiritual/religious problems, (c) offer continuity of care by patients' primary care and specialist providers, (d) provide access to any therapy (including alternative and nontraditional treatments) that may realistically be expected to improve patients' quality of life, (e) provide access to palliative and hospice care, (f) respect the physician's professional judgment to dis-

continue treatments when appropriate, with the consideration of both patient and family preferences, and (g) be based on and promote clinical and evidence-based research on end-of-life care.

IV. Conclusions

Healthcare advances have contributed greatly to improved stroke survival. Although progress in stroke care has been made, a majority of stroke survivors continue to cope with residual physical, cognitive, communicative, and/or emotional deficits. As indicated, there is strong evidence that stroke rehabilitation initiated at the time of admission and sustained across the healthcare continuum significantly reduces the likelihood of death and disability within the first year. Increasingly, the WHO ICF model of disease is being used to provide a common framework to deliver and study the efficacy of rehabilitation outcomes across rehabilitation settings. In addition, the ICF can be used to facilitate professional decision-making, communication, and collaborative efforts among nursing and other interdisciplinary team members and professional colleagues across the globe, as well as provide a uniform structure to educate staff, patients, families, and referral agencies. Moreover, the US Centers for Medicare and Medicaid Services also are looking more closely at adopting the ICF as a framework for documenting care and determining payment for services. In closing, the present statement serves as an initial effort to reframe the complexities of interdisciplinary, postacute care of stroke survivors into a format that optimizes the potential for the highest achievable outcomes and quality care.

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*Modest.

†Significant.

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*Significant.

References

1. Lloyd-Jones D, Adams R, Carnethon M, De Simone G, Ferguson TB, Flegal K, Ford E, Furie K, Go A, Greenlund K, Haase N, Hailpern S, Ho M, Howard V, Kissela B, Kittner S, Lackland D, Lisabeth L, Marelli A, McDermott M, Meigs J, Mozaffarian D, Nichol G, O'Donnell C, Roger V, Rosamond W, Sacco R, Sorlie P, Stafford R, Steinberger J, Thom T, Wasserthiel-Smoller S, Wong N, Wylie-Rosett J, Hong Y. Heart disease and stroke statistics–2009: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee [published correction appears in *Circulation*. 2009;119:e182]. *Circulation*. 2009;119:e21–e181.
2. Briggs DE, Felberg R, Malkoff M, Bratina P, Grotta JC. Should mild or moderate stroke patients be admitted to an intensive care unit? *Stroke*. 2001;32:871–876.
3. Evans A, Harraf F, Donaldson N, Kalra L. Randomized controlled study of stroke unit care versus stroke team care in different stroke subtypes. *Stroke*. 2002;33:449–455.
4. Anderson CS, Linto J, Stewart-Wynne EG. A population-based assessment of the impact and burden of caregiving for long-term stroke survivors. *Stroke*. 1995;26:843–849.
5. Kalra L, Langhorne P. Facilitating recovery: evidence for organized stroke care. *J Rehabil Med*. 2007;39:97–102.
6. Kleim JA, Jones TA. Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. *J Speech Lang Hear Res*. 2008;51:S225–S329.
7. ACCF/AHA Task Force on Practice Guidelines. *Methodology Manual for ACCF/AHA Guideline Writing Committees: Methodologies and Policies From the ACCF/AHA Task Force on Practice Guidelines.* Available at: http://www.americanheart.org/downloadable/heart/1260477059730120 9Methodology_Manual_for_ACC_AHA_Writing_Committees.pdf. Accessed February 1, 2010.
8. World Health Organization. *International Classification of Functioning, Disability and Health (ICF)*. Geneva, Switzerland: World Health Organization; 2008.
9. American Speech-Language-Hearing Association, Ad Hoc Committee on Scope of Practice in Speech-Language Pathology. *Scope of Practice in Speech-Language Pathology.* Rockville, Md: American Speech-Language-Hearing Association; 2001.
10. Commission on Accreditation of Rehabilitation Facilities. *Medical Rehabilitation Standards Manual.* Tucson, Ariz: CARF International; 2009.
11. Duncan PW, Jorgensen HS, Wade DT. Outcome measures in acute stroke trials: a systematic review and some recommendations to improve practice. *Stroke*. 2000;31:1429–1438.
12. Keith RA. The comprehensive treatment team in rehabilitation. *Arch Phys Med Rehabil*. 1991;72:269–274.
13. Nelson A, Powell-Cope G, Palacios P, Luther SL, Black T, Hillman T, Christiansen B, Nathenson P, Gross JC. Nurse staffing and patient outcomes in inpatient rehabilitation settings. *Rehabil Nurs*. 2007;32:179–202.
14. Duncan PW, Horner RD, Reker DM, Samsa GP, Hoenig H, Hamilton B, LaClair BJ, Dudley TK. Adherence to postacute rehabilitation guidelines is associated with functional recovery in stroke. *Stroke*. 2002;33:167–178.
15. Duncan PW, Zorowitz R, Bates B, Choi JY, Glasberg JJ, Graham GD, Katz RC, Lamberty K, Reker D. Management of adult stroke rehabilitation care: a clinical practice guideline. *Stroke*. 2005;36:e100–e143.
16. Duncan PW, Wallace D, Lai SM, Johnson D, Embretson S, Laster LJ. The stroke impact scale version 2.0: evaluation of reliability, validity, and sensitivity to change. *Stroke*. 1999;30:2131–2140.
17. Langhorne P. Developing comprehensive stroke services: an evidence-based approach. *Postgrad Med J*. 1995;71:733–737.
18. Langhorne P, Duncan P. Does the organization of postacute stroke care really matter? *Stroke*. 2001;32:268–274.
19. Maulden SA, Gassaway J, Horn SD, Smout RJ, DeJong G. Timing of initiation of rehabilitation after stroke. *Arch Phys Med Rehabil*. 2005;86:S34–S40.
20. Langhorne P, Taylor G, Murray G, Dennis M, Anderson C, Bautz-Holter E, Dey P, Indredavik B, Mayo N, Power M, Rodgers H, Ronning OM, Rudd A, Suwanwela N, Widen-Holmqvist L, Wolfe C. Early supported discharge services for stroke patients: a meta-analysis of individual patients' data. *Lancet*. 2005;365:501–506.
21. Lee WC, Christensen MC, Joshi AV, Pashos CL. Long-term cost of stroke subtypes among Medicare beneficiaries. *Cerebrovasc Dis*. 2007;23:57–65.
22. Wodchis WP, Teare GF, Naglie G, Bronskill SE, Gill SS, Hillmer MP, Anderson GM, Rochon PA, Fries BE. Skilled nursing facility rehabilitation and discharge to home after stroke. *Arch Phys Med Rehabil*. 2005;86:442–448.
23. Worsowicz G, Deutsch A, Heinemann A. Integrating financial data into inpatient rehabilitation health services research. *Arch Phys Med Rehabil*. 2008;89:e27.
24. Department of Health & Human Services, Centers for Medicare & Medicaid Services. *Health Insurance for the Aged, Publication 10: The Hospital Manual* (Revision 789). Chapter 211: inpatient hospital stays for rehabilitation care. Available at: http://www.cms.hhs.gov/Manuals/PBM/list.asp. Accessed October 19, 2008.
25. Department of Health & Human Services, Centers for Medicare & Medicaid Services. *Health Insurance for the Aged, Publication 12: Skilled Nursing Facility Manual* (Revision 166). Chapter 2001: skilled nursing facility (SNF) defined. Available at: http://www.cms.hhs.gov/Manuals/PBM/list.asp. Accessed October 19, 2008.
26. Department of Health & Human Services, Centers for Medicare & Medicaid Services. *Medicare Program: Prospective Payment System for Long-Term Care Hospitals: Implementation and FY2003 Rates; Final Rule.* Available at: http://www.ncbi.nlm.nih.gov/pubmed/12211257. Accessed June 15, 2010.
27. Department of Health & Human Services, Centers for Medicare & Medicaid Services. *Health Insurance for the Aged, Publication 11: The Home Health Agency Manual* (Revision 303). Available at: http://www.cms.hhs.gov/Manuals/PBM/list.asp. Accessed October 19, 2008.
28. Department of Health and Human Services, Centers for Medicare & Medicaid Services. *Health Insurance for the Aged, Publication 9: The Outpatient Physical Therapy/CORF Manual.* Available at: http://www.cms.hhs.gov/Manuals/PBM/list.asp. Accessed October 19, 2008.
29. Social Security Administration. Arrangements for certain services. In: *Compilation of the Social Security Laws: Part E–Miscellaneous Provisions: Definitions of Services, Institutions, Etc.* Available at: www.socialsecurity.gov/OP_Home/ssact/title18/1861.htm#ACT-1861-w-2. Accessed June 15, 2010.
30. Commission on Accreditation of Rehabilitation Facilities. *Medical Rehabilitation Standards Manual.* Tucson, Ariz: CARF International; 2010.
31. Taub E, Uswatte G, King DK, Morris D, Crago JE, Chatterjee A. A placebo-controlled trial of constraint-induced movement therapy for upper extremity after stroke. *Stroke*. 2006;37:1045–1049.
32. Macko RF, Ivey FM, Forrester LW, Hanley D, Sorkin JD, Katzel LI, Silver KH, Goldberg AP. Treadmill exercise rehabilitation improves ambulatory function and cardiovascular fitness in patients with chronic stroke: a randomized, controlled trial. *Stroke*. 2005;36:2206–2211.
33. Silver KH, Macko RF, Forrester LW, Goldberg AP Smith GV. Effects of aerobic treadmill training on gait velocity, cadence, and gait symmetry in chronic hemiparetic stroke: a preliminary report. *Neurorehabil Neural Repair*. 2000;14:65–71.
34. Macko RF, DeSouze CA, Tretter LD, Silver KH, Smith GV, Anderson PA, Tomoyasu N, Gorman P, Dengel DR. Treadmill aerobic exercise training reduces the energy expenditure and cardiovascular demands of hemiparetic gait in chronic stroke patients: a preliminary report. *Stroke*. 1997;28:326–330.
35. Kerse N, Parag V, Feigin VL, McNaughton H, Hackett ML, Bennett DA, Anderson CS; Auckland Regional Community Stroke (ARCOS) Study Group. Falls after stroke: results from the Auckland Regional Community Stroke (ARCOS) study, 2002 to 2003. *Stroke*. 2008;39:1890–1893.
36. Ashburn A, Hyndman D, Pickering R, Yardley L, Harris S. Predicting people with stroke at risk of falls. *Age Ageing*. 2008;37:270–276.
37. Andersson A, Kamwendo K, Seiger A, Appelros P. How to identify potential fallers in a stroke unit: validity indexes of 4 test methods. *J Rehabil Med*. 2006;38:186–191.
38. Mathiowetz V, Kashman N, Volland G, Weber K, Dowe M, Rogers S. Grip and pinch strength: normative data for adults. *Arch Phys Med Rehabil*. 1985;66:69–74.
39. Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of grip and pinch strength evaluations. *J Hand Surg Am*. 1984;9:222–226.
40. Andrews AW, Thomas MW, Bohannon RW. Normative values for isometric muscle force measurements obtained with hand-held dynamometers. *Phys Ther*. 1996;76:248–259.

41. Bohannon RW. Muscle strength changes in hemiparetic stroke patients during inpatient rehabilitation. *Neurorehabil Neural Repair*. 1988;2: 163–166.
42. Bohannon RW, Andrews AW. Interrater reliability of hand-held dynamometry. *Phys Ther*. 1987;67:931–933.
43. Woodbury ML, Velozo CA, Richards LG, Duncan PW, Studenski S, Lai SM. Longitudinal stability of the Fugl-Meyer Assessment of the upper extremity. *Arch Phys Med Rehabil*. 2008;89:1563–1569.
44. Woodbury ML, Velozo CA, Richards LG, Duncan PW, Studenski S, Lai SM. Dimensionality and construct validity of the Fugl-Meyer Assessment of the upper extremity. *Arch Phys Med Rehabil*. 2007;88: 715–723.
45. Gladstone DJ, Danells CJ, Black SE. The Fugl-Meyer assessment of motor recovery after stroke: a critical review of its measurement properties. *Neurorehabil Neural Repair*. 2002;16:232–240.
46. Fugl-Meyer AR, Jääskö L, Leyman I, Olsson S, Steglind S. The post-stroke hemiplegic patient, I: a method for evaluation of physical performance. *Scand J Rehabil Med*. 1975;7:13–31.
47. Duncan PW, Propst M, Nelson SG. Reliability of the Fugl-Meyer assessment of sensorimotor recovery following cerebrovascular accident. *Phys Ther*. 1983;63:1606–1610.
48. van der Lee JH, Beckerman H, Lankhorst GJ, Bouter LM. The responsiveness of the Action Research Arm Test and the Fugl-Meyer Assessment Scale in chronic stroke patients. *J Rehabil Med*. 2001;33: 110–113.
49. Hsieh CL, Hsueh IP, Chiang FM, Lin PH. Inter-rater reliability and validity of the action research arm test in stroke patients. *Age Ageing*. 1998;27:107–113.
50. Koh CL, Hsueh IP, Wang WC, Sheu CF, Yu TY, Wang CH, Hsieh CL. Validation of the action research arm test using item response theory in patients after stroke. *J Rehabil Med*. 2006;38:375–380.
51. Lang CE, Wagner JM, Dromerick AW, Edwards DF. Measurement of upper-extremity function early after stroke: properties of the action research arm test. *Arch Phys Med Rehabil*. 2006;87:1605–1610.
52. Lyle RC. A performance test for assessment of upper limb function in physical rehabilitation treatment and research. *Int J Rehabil Res*. 1981; 4:483–492.
53. Yozbatiran N, Der-Yeghiaian L, Cramer SC. A standardized approach to performing the action research arm test. *Neurorehabil Neural Repair*. 2008;22:78–90.
54. Mathiowetz V, Volland G, Kashman N, Weber K. Adult norms for the Box and Block Test of manual dexterity. *Am J Occup Ther*. 1985;39: 386–391.
55. Chen HM, Chen CC, Hsueh IP, Huang SL, Hsieh CL. Test-retest reproducibility and the smallest real difference of 5 hand function tests in patients with stroke. *Neurorehabil Neural Repair*. 2009;23:435–440.
56. Carr JH, Shepherd RB, Nordholm L, Lynne D. Investigation of a new motor assessment scale for stroke patients. *Phys Ther*. 1985;65:175–180.
57. Poole JL, Whitney SL. Motor assessment scale for stroke patients: concurrent validity and interrater reliability. *Arch Phys Med Rehabil*. 1988;69:195–197.
58. Malouin F, Pichard L, Bonneau C, Durand A, Corriveau D. Evaluating motor recovery early after stroke: comparison of the Fugl-Meyer Assessment and the Motor Assessment Scale. *Arch Phys Med Rehabil*. 1994;75:1206–1212.
59. Gowland C, Stratford P, Ward M, Moreland J, Torresin W, Van Hullenaar S, Sanford J, Barreca S, Vanspall B, Plews N. Measuring physical impairment and disability with the Chedoke-McMaster Stroke Assessment. *Stroke*. 1993;24:58–63.
60. Whitall J, Savin DN Jr, Harris-Love M, Waller SM. Psychometric properties of a modified Wolf Motor Function test for people with mild and moderate upper-extremity hemiparesis. *Arch Phys Med Rehabil*. 2006;87:656–660.
61. Wolf SL, Catlin PA, Ellis M, Archer AL, Morgan B, Piacentino A. Assessing the Wolf Motor Function Test as outcome measure for research in patients after stroke. *Stroke*. 32:1635–1639.
62. Wolf SL, McJunkin JP, Swanson ML, Weiss PS. Pilot normative database for the Wolf Motor Function Test. *Arch Phys Med Rehabil*. 2006;87:443–445.
63. Daley K, Mayo N, Wood-Dauphinée S. Reliability of scores on the Stroke Rehabilitation Assessment of Movement (STREAM) measure. *Phys Ther*. 1999;79:8–19.
64. Daley K, Mayo N, Danys I, Cabot R, Wood DS. The Stroke Rehabilitation Assessment of Movement (STREAM): refining and validating the content. *Physiother Can*. 1997;49:269–278.
65. Hsieh YW, Wang CH, Sheu CF, Hseuh IP, Hsieh CL. Estimating the minimal clinically important difference of the Stroke Rehabilitation Assessment of Movement measure. *Neurorehabil Neural Repair*. 2008; 22:723–727.
66. Jebsen RH, Taylor N, Trieschmann RB, Trotter MJ, Howard LA. An objective and standardized test of hand function. *Arch Phys Med Rehabil*. 1969;50:311–319.
67. Stern EB. Stability of the Jebsen-Taylor Hand Function Test across three test sessions. *Am J Occup Ther*. 1992;46:647–649.
68. Barreca S, Gowland CK, Stratford P, Huijbregts M, Griffiths J, Torresin W, Dunkley M, Miller P, Masters L. Development of the Chedoke Arm and Hand Activity Inventory: theoretical constructs, item generation, and selection. *Top Stroke Rehabil*. 2004;11:31–42.
69. Barreca SR, Stratford PW, Lambert CL, Masters LM, Streiner DL. Test-retest reliability, validity, and sensitivity of the Chedoke Arm and Hand Activity Inventory: a new measure of upper-limb function for survivors of stroke. *Arch Phys Med Rehabil*. 2005;86:1616–1622.
70. Barreca SR, Stratford PW, Masters LM, Lambert CL, Griffiths J. Comparing 2 versions of the Chedoke Arm and Hand Activity Inventory with the Action Research Arm Test. *Phys Ther*. 2006;86:245–253.
71. Uswatte G, Taub E, Morris D, Light K, Thompson PA. The Motor Activity Log-28: assessing daily use of the hemiparetic arm after stroke. *Neurology*. 2006;67:1189–1194.
72. Uswatte G, Taub E, Morris D, Vignolo M, McCulloch K. Reliability and validity of the upper-extremity Motor Activity Log-14 for measuring real-world arm use. *Stroke*. 2005;36:2493–2496.
73. Collen FM, Wade DT, Robb GF, Bradshaw CM. The Rivermead Mobility Index: a further development of the Rivermead Motor Assessment. *Int Disabil Stud*. 1991;13:50–54.
74. Wade DT, Collen FM, Robb GF, Warlow CP. Physiotherapy intervention late after stroke and mobility. *BMJ*. 1992;304:609–613.
75. Ada L, O'Dwyer N, O'Neill E. Relation between spasticity, weakness and contracture of the elbow flexors and upper limb activity after stroke: an observational study. *Disabil Rehabil*. 2006;28:891–897.
76. Canning CG, Ada L, Adams R, O'Dwyer NJ. Loss of strength contributes more to physical disability after stroke than loss of dexterity. *Clin Rehabil*. 2004;18:300–308.
77. Kamper DG, Fischer HC, Cruz EZ, Rymer WZ. Weakness is the primary contributor to finger impairment in chronic stroke. *Arch Phys Med Rehabil*. 2006;87:1262–1269.
78. McDonnell MN, Hillier SL, Ridding MC, Miles TS. Impairments in precision grip correlate with functional measures in adult hemiplegia. *Clin Neurophysiol*. 2006;117:1474–1480.
79. Kusoffsky A, Wadell I, Nilsson BY. The relationship between sensory impairment and motor recovery in patients with hemiplegia. *Scand J Rehabil Med*. 1982;14:27–32.
80. La Joie WJ, Reddy NM, Melvin JL. Somatosensory evoked potentials: their predictive value in right hemiplegia. *Arch Phys Med Rehabil*. 1982;63:223–226.
81. Wade DT, Langton-Hewer R, Wood VA, Skilbeck CE, Ismail HM. The hemiplegic arm after stroke: measurement and recovery. *J Neurol Neurosurg Psychiatry*. 1983;46:521–524.
82. de Weerdt W, Lincoln NB, Harrison MA. Prediction of arm and hand function recovery in stroke patients. *Int J Rehabil Res*. 1987;10(suppl 5):110–112.
83. Bohannon RW, Smith MB. Assessment of strength deficits in eight paretic upper extremity muscle groups of stroke patients with hemiplegia. *Phys Ther*. 1987;67:522–525.
84. Duncan PW, Goldstein LB, Horner RD, Landsman PB, Samsa GP, Matchar DB. Similar motor recovery of upper and lower extremities after stroke. *Stroke*. 1994;25:1181–1188.
85. Duncan PW, Goldstein LB, Matchar D, Divine GW, Feussner J. Measurement of motor recovery after stroke: outcome assessment and sample size requirements. *Stroke*. 1992;23:1084–1089.
86. Jørgensen HS, Nakayama H, Raaschou HO, Vive-Larsen J, Støier M, Olsen TS. Outcome and time course of recovery in stroke, part I: outcome: the Copenhagen Stroke Study. *Arch Phys Med Rehabil*. 1995; 76:399–405.
87. Kalra L, Crome P. The role of prognostic scores in targeting stroke rehabilitation in elderly patients. *J Am Geriatr Soc*. 1993;41:396–400.
88. Patel AT, Duncan PW, Lai SM, Studenski S. The relation between impairments and functional outcomes poststroke. *Arch Phys Med Rehabil*. 2000;81:1357–1363.
89. Salter K, Jutai J, Zettler L, Moses M, Foley N, Teasell R. Outcome measures. In: *Evidence-Based Review of Stroke Rehabilitation.* 12th ed.

2008. EBRSR Web site. Available at: http://www.ebrsr.com/reviews_details.php?Outcome-Measures-9. Accessed June 15, 2010.
90. Studenski SA, Lai SM, Duncan PW, Rigler SK. The impact of self-reported cumulative comorbidity on stroke recovery. *Age Ageing*. 2004; 33:195–198.
91. Studenski SA, Wallace D, Duncan PW, Rymer M, Lai SM. Predicting stroke recovery: three- and six-month rates of patient-centered functional outcomes based on the Orpington Prognostic Scale. *J Am Geriatr Soc*. 2001;49:308–312.
92. Boissy P, Bourbonnais D, Carlotti MM, Gravel D, Arsenault BA. Maximal grip force in chronic stroke subjects and its relationship to global upper extremity function. *Clin Rehabil*. 1999;13:354–362.
93. Smithard DG, O'Neill PA, Parks C, Morris J. Complications and outcome after acute stroke: does dysphagia matter? [published correction appears in *Stroke*. 1998;29:1480–1481]. *Stroke*. 1996;27: 1200–1204.
94. Aviv JE. Prospective, randomized outcome study of endoscopy versus modified barium swallow in patients with dysphagia. *Laryngoscope*. 2000;110:563–574.
95. Chong MS, Lieu PK, Sitoh YY, Meng YY, Leow LP. Bedside clinical methods useful as screening test for aspiration in elderly patients with recent and previous strokes. *Ann Acad Med Singapore*. 2003;32: 790–794.
96. Leder SB, Espinosa JF. Aspiration risk after acute stroke: comparison of clinical examination and fiberoptic endoscopic evaluation of swallowing. *Dysphagia*. 2002;17:214–218.
97. Perry L, Love CP. Screening for dysphagia and aspiration in acute stroke: a systematic review. *Dysphagia*. 2001;16:7–18.
98. Teasell R, Foley N, Martino R, Bhogal S, Speechley M. Dysphagia and aspiration post stroke. *Evidence-Based Review of Stroke Rehabilitation.* 12th ed. 2008. EBRSR Web site. Available at: http://www.ebrsr.com/reviews_details.php?Dysphagia-and-Aspiration-Post-Stroke-29. Accessed July 25, 2009.
99. Nwosu CR, Khan KS, Chien PF, Honest MR. Is real-time ultrasonic bladder volume estimation reliable and valid? A systematic review. *Scand J Urol Nephrol*. 1998;32:325–330.
100. Teasell R, Foley N, Salter K, Bhogal S. Medical complications post stroke. *Evidence-Based Review of Stroke Rehabilitation.* 12th ed. 2008. EBRSR Web site. Available at: http://www.ebrsr.com/reviews_details.php?Medical-Complications-Post-Stroke-17. Accessed June 1, 2009.
101. Jacobs BS, Baker PL, Roychoudhury C, Mehta RH, Levine SR. Improved quality of stroke care for hospitalized Medicare beneficiaries in Michigan. *Stroke*. 2005;36:1227–1231.
102. Sherman DG, Albers GW, Bladin C, Fieschi C, Gabbai AA, Kase CS, O'Riordan W, Pineo GF; PREVAIL Investigators. The efficacy and safety of enoxaparin versus unfractionated heparin for the prevention of venous thromboembolism after acute ischaemic stroke (PREVAIL Study): an open-label randomised comparison. *Lancet*. 2007;369: 1347–1355.
103. Brandstater ME, Shutter LA. Rehabilitation interventions during acute care of stroke patients. *Top Stroke Rehabil*. 2002;9:48–56.
104. Singh S, Hamdy S. Dysphagia in stroke patients. *Postgrad Med J*. 2006;82:383–391.
105. Massey R, Jedlicka D. The Massey Bedside Swallowing screen. *J Neurosci Nurs*. 2002;34:252–253, 257–260.
106. Yoo SH, Kim JS, Kwon SU, Yun SC, Koh JY, Kang DW. Undernutrition as a predictor of poor clinical outcomes in acute ischemic stroke patients. *Arch Neurol*. 2008;65:39–43.
107. Bakas T, Champion V, Perkins SM, Farran CJ, Williams LS. Psychometric testing of the revised 15-item Bakas Caregiving Outcomes Scale. *Nurs Res*. 2006;55:346–355.
108. Gräsel E, Schmidt R, Biehler J, Schupp W. Long-term effects of the intensification of the transition between inpatient neurological rehabilitation and home care of stroke patients. *Clin Rehabil*. 2006;20:577–583.
109. Booth S, Swabey D. Group training in communication skills for carers of adults with aphasia. *Int J Lang Commun Disord*. 1999;34:291–309.
110. Kagan A, Winckel J, Black S, Duchan JF, Simmons-Mackie N, Square P. A set of observational measures for rating support and participation in conversation between adults with aphasia and their conversation partners. *Top Stroke Rehabil*. 2004;11:67–83.
111. Rettke H, Lyrer P. Learning capacity of acute stroke patients: a pilot study [in German]. *Pflege*. 2002;15:53–60.
112. Mant J, Carter J, Wade DT, Winner S. The impact of an information pack on patients with stroke and their carers: a randomized controlled trial. *Clin Rehabil*. 1998;12:465–476.
113. Low JT, Payne S, Roderick P. The impact of stroke on informal carers: a literature review. *Soc Sci Med*. 1999;49:711–725.
114. Booth J, Kumlien S, Zang Y, Gustafsson B, Tolson D. Rehabilitation nurses practices in relation to urinary incontinence following stroke: a cross-cultural comparison. *J Clin Nurs*. 2009;18:1049–1058.
115. Rasquin SM, Lodder J, Ponds RW, Winkens I, Jolles J, Verhey FR. Cognitive functioning after stroke: a one year follow-up study. *Dement Geriatr Cogn Disord*. 2004;18:138–144.
116. Law M, Baptiste S, McColl M, Opzoomer A, Polatajko H, Pollock N. The Canadian Occupational Performance Measure: an outcome measure for occupational therapy. *Can J Occup Ther*. 1990;57:82–87.
117. Külzer AM, Scolari C, Gus M. Relationship between usual physical, cognitive and social activities and functional recovery at hospital discharge after acute stroke. *J Rehabil Med*. 2008;40:195–199.
118. Bode RK, Rychlik K, Heinemann AW, Lovell L, Modla L. Reconceptualizing poststroke activity level using the Frenchay Activities Index. *Top Stroke Rehabil*. 2003;9:82–91.
119. Gräsel E, Biehler J, Schmidt R, Schupp W. Intensification of the transition between inpatient neurological rehabilitation and home care of stroke patients: controlled clinical trial with follow-up assessment six months after discharge. *Clin Rehabil*. 2005;19:725–736.
120. Beninato M, Gill-Body KM, Salles S, Stark PC, Black-Schaffer RM, Stein J. Determination of the minimal clinically important difference in the FIM instrument in patients with stroke. *Arch Phys Med Rehabil*. 2006;87:32–39.
121. Hamilton BB, Granger CV, Sherwin FS, Zielezny M, Tashman J, Fuhrer MA. A uniform national data system for medical rehabilitation. In: Fuhrer MJ, ed. *Rehabilitation Outcomes: Analysis and Measurement.* Baltimore, Md: PH Brooks; 1987.
122. Hamilton BB, Laughlin JA, Fiedler RC, Granger CV. Interrater reliability of the 7-level Functional Independence Measure (FIM). *Scand J Rehabil Med*. 1994;26:115–119.
123. van der Putten JJ, Hobart JC, Freeman JA, Thompson AJ. Measuring change in disability after inpatient rehabilitation: comparison of the responsiveness of the Barthel Index and the Functional Independence Measure. *J Neurol Neurosurg Psychiatry*. 1999;66:480–484.
124. Berg K, Wood-Dauphinee S, Williams JI. The Balance Scale: reliability assessment with elderly residents and patients with an acute stroke. *Scand J Rehabil Med*. 1995;27:27–36.
125. Holden MK, Gill KM, Magliozzi MR. Gait assessment for neurologically impaired patients: standards for outcome assessment. *Phys Ther*. 1986;66:1530–1539.
126. Perry J, Garrett M, Gronley JK, Mulroy SJ. Classification of walking handicap in the stroke population. *Stroke*. 1995;26:982–989.
127. Richards CL, Olney SJ. Hemiparetic gait following stroke: part II: recovery and physical therapy. *Gait Posture*. 1996;4:149–162.
128. Salbach NM, Mayo NE, Higgins J, Ahmed S, Finch LE, Richards CL. Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Arch Phys Med Rehabil*. 2001;82:1204–1212.
129. Schmid A, Duncan PW, Studenski S, Lai SM, Richards L, Perera S, Wu SS. Improvements in speed-based gait classifications are meaningful. *Stroke*. 2007;38:2096–2100.
130. Wee JY, Bagg SD, Palepu A. The Berg Balance Scale as a predictor of length of stay and discharge destination in an acute stroke rehabilitation setting. *Arch Phys Med Rehabil*. 1999;80:448–452.
131. van Wijck FM, Pandyan AD, Johnson GR, Barnes MP. Assessing motor deficits in neurological rehabilitation: patterns of instrument usage. *Neurorehabil Neural Repair*. 2001;15:23–30.
132. Bohannon RW, Smith MB. Interrater reliability of a modified Ashworth scale of muscle spasticity. *Phys Ther*. 1987;67:206–207.
133. Condliffe EG, Clark DJ, Patten C. Reliability of elbow stretch reflex assessment in chronic post-stroke hemiparesis. *Clin Neurophysiol*. 2005; 116:1870–1878.
134. Sabari JS, Lim AL, Velozo CA, Lehman L, Kieran O, Lai JS. Assessing arm and hand function after stroke: a validity test of the hierarchical scoring system used in the Motor Assessment Scale for stroke. *Arch Phys Med Rehabil*. 2005;86:1609–1615.
135. Nadeau SE, Behrman AL, Davis SE, Reid K, Wu SS, Stidham BS, Helms KM, Gonzalez Rothi LJ. Donepezil as an adjuvant to constraint-induced therapy for upper-limb dysfunction after stroke: an exploratory randomized clinical trial. *J Rehabil Res Dev*. 2004;41:525–534.

136. Page SJ, Levine P, Leonard A. Mental practice in chronic stroke: results of a randomized, placebo-controlled trial. *Stroke*. 2007;38:1293–1297.
137. van de Port IG, Wood-Dauphinee S, Lindeman E, Kwakkel G. Effects of exercise training programs on walking competency after stroke: a systematic review. *Am J Phys Med Rehabil*. 2007;86:935–951.
138. Wolf SL, Winstein CJ, Miller JP, Taub E, Uswatte G, Morris D, Giuliani C, Light KE, Nichols-Larsen D; EXCITE Investigators. Effect of constraint-induced movement therapy on upper extremity function 3 to 9 months after stroke: the EXCITE randomized clinical trial. *JAMA*. 2006;296:2095–2104.
139. Page SJ, Levine P, Leonard AC. Modified constraint-induced therapy in acute stroke: a randomized controlled pilot study. *Neurorehabil Neural Repair*. 2005;19:27–32.
140. Dromerick AW, Lang CE, Birkenmeier RL, Wagner JM, Miller JP, Videen TO, Powers WJ, Wolf SL, Edwards DF. Very Early Constraint-Induced Movement during Stroke Rehabilitation (VECTORS): a single-center RCT. *Neurology*. 2009;73:195–201.
141. Masiero S, Celia A, Rosati G, Armani M. Robotic-assisted rehabilitation of the upper limb after acute stroke. *Arch Phys Med Rehabil*. 2007;88:142–149.
142. Page SJ, Levine P, Leonard A, Szaflarski JP, Kissela BM. Modified constraint-induced therapy in chronic stroke: results of a single-blinded randomized controlled trial. *Phys Ther*. 2008;88:333–340.
143. Volpe BT, Lynch D, Rykman-Berland A, Ferraro M, Galgano M, Hogan N, Krebs HI. Intensive sensorimotor arm training mediated by therapist or robot improves hemiparesis in patients with chronic stroke. *Neurorehabil Neural Repair*. 2008;22:305–310.
144. Wu CY, Chen CL, Tsai WC, Lin KC, Chou SH. A randomized controlled trial of modified constraint-induced movement therapy for stroke survivors: changes in motor impairment, daily functioning, and quality of life. *Arch Phys Med Rehabil*. 2007;88:273–278.
145. Kahn LE, Zygman ML, Rymer WZ, Reinkensmeyer DJ. Robot-assisted reaching exercise promotes arm movement recovery in chronic hemiparetic stroke: a randomized controlled pilot study. *J Neuroeng Rehabil*. 2006;3:12.
146. Turton AJ, Butler SR. A multiple case design experiment to investigate the performance and neural effects of a programme for training hand function after stroke. *Clin Rehabil*. 2004;18:754–763.
147. Carey JR, Kimberely TJ, Lewis SM, Auerbach EJ, Dorsey L, Rundquist P, Ugurbil K. Analysis of fMRI and finger tracking training in subjects with chronic stroke. *Brain*. 2002;125:773–788.
148. Church C, Price C, Pandyan AD, Huntley S, Curless R, Rodgers H. Randomized controlled trial to evaluate the effect of surface neuromuscular electrical stimulation to the shoulder after acute stroke. *Stroke*. 2007;37:2995–3001.
149. Meilink A, Hemmen B, Seelen H, Kwakkel G. Impact of EMG-triggered neuromuscular stimulation of the wrist and finger extensors of the paretic hand after stroke: a systematic review of the literature. *Clin Rehabil*. 2008;22:291–305.
150. Chae J, Ng A, Yu DT, Kirsteins A, Elovic EP, Flanagan SR, Harvey RL, Zorowitz RD, Fang ZP. Intramuscular electrical stimulation for shoulder pain in hemiplegia: does time from stroke onset predict treatment success? *Neurorehabil Neural Repair*. 2007;21:561–567.
151. Page SJ, Levine P. Back from the brink: electromyography-triggered stimulation combined with modified constraint-induced movement therapy in chronic stroke [published correction appears in *Arch Phys Med Rehabil*. 2006;87:447]. *Arch Phys Med Rehabil*. 2006;87:27–31.
152. Sullivan JE, Hedman LD. Effects of home-based sensory and motor amplitude electrical stimulation on arm dysfunction in chronic stroke. *Clin Rehabil*. 2007;21:142–150.
153. Barker RN, Brauer SG, Carson RG. Training of reaching in stroke survivors with severe and chronic upper limb paresis using a novel nonrobotic device: a randomized clinical trial. *Stroke*. 2008;39:1800–1807.
154. Hara Y, Ogawa S, Muraoka Y. Hybrid power-assisted functional electrical stimulation to improve hemiparetic upper-extremity function. *Am J Phys Med Rehabil*. 2006;85:977–985.
155. Hara Y, Ogawa S, Tsujiuchi K, Muraoka Y. A home-based rehabilitation program for the hemiplegic upper extremity by power-assisted functional electrical stimulation. *Disabil Rehabil*. 2008;30:296–304.
156. Lannin NA, Cusick A, McCluskey A, Herbert RD. Effects of splinting on wrist contracture after stroke: a randomized controlled trial. *Stroke*. 2007;38:111–116.
157. Lynch D, Ferraro M, Krol J, Trudell CM, Christos P, Volpe BT. Continuous passive motion improves shoulder joint integrity following stroke. *Clin Rehabil*. 2005;19:594–599.
158. Griffin A, Bernhardt J. Strapping the hemiplegic shoulder prevents development of pain during rehabilitation: a randomized controlled trial. *Clin Rehabil*. 2006;20:287–295.
159. Lannin NA, Horsley SA, Herbert R, McCluskey A, Cusick A. Splinting the hand in the functional position after brain impairment: a randomized, controlled trial. *Arch Phys Med Rehabil*. 2003;84:297–302.
160. Rose V, Shah S. A comparative study on the immediate effects of orthoses in reduction of hypertonus. *Aust Occup Ther J*. 1987;34:59–64.
161. Hanger HC, Whitewood P, Brown G, Ball MC, Harper J, Cox R, Sainsbury R. A randomized controlled trial of strapping to prevent post-stroke shoulder pain. *Clin Rehabil*. 2000;14:370–380.
162. Ada L, Goddard E, McCully J, Stavrinos T, Bampton J. Thirty minutes of positioning reduces the development of shoulder external rotation contracture after stroke: a randomized controlled trial. *Arch Phys Med Rehabil*. 2005;86:230–234.
163. Dean CM, Mackey FH, Katrak P. Examination of shoulder positioning after stroke: a randomized controlled pilot trial. *Aust J Physiother*. 2000;46:35–40.
164. de Jong LD, Nieuwboer A, Aufdemkampe G. Contracture preventive positioning of the hemiplegic arm in subacute stroke patients: a pilot randomized controlled trial. *Clin Rehabil*. 2006;20:656–667.
165. Tseng C, Chen C, Wu S, Lin L. Effects of a range-of-motion exercise programme. *J Adv Nurs*. 2007;57:181–191.
166. Bülow M, Speyer R, Baijens L, Woisard V, Ekberg O. Neuromuscular electrical stimulation (NMES) in stroke patients with oral and pharyngeal dysfunction. *Dysphagia*. 2008;23:302–309.
167. Landi F, Cesari M, Onder G, Tafani A, Zamboni V, Cocchi A. Effects of an occupational therapy program on functional outcomes in older stroke patients. *Gerontology*. 2006;52:85–91.
168. Trombly CA, Ma HI. A synthesis of the effects of occupational therapy for persons with stroke, part I: restoration of roles, tasks, and activities. *Am J Occup Ther*. 2002;56:250–259.
169. Legg LA, Drummond AE, Langhorne P. Occupational therapy for patients with problems in activities of daily living after stroke. *Cochrane Database Syst Rev*. 2006 Oct 18;(4);CD003585.
170. Söderström ST, Pettersson RP, Leppert J. Prediction of driving ability after stroke and the effect of behind-the-wheel training. *Scand J Psychol*. 2006;47:419–429.
171. Akinwuntan AE, De Weerdt W, Feys H, Pauwels J, Baten G, Arno P, Kiekens C. Effect of simulator training on driving after stroke: a randomized controlled trial. *Neurology*. 2005;65:843–850.
172. Latham NK, Jette DU, Slavin M, Richards LG, Procino A, Smout RJ, Horn SD. Physical therapy during stroke rehabilitation for people with different walking abilities. *Arch Phys Med Rehabil*. 2005;86:S41–S50.
173. Richards LG, Latham NK, Jette DU, Rosenberg L, Smout RJ, DeJong G. Characterizing occupational therapy practice in stroke rehabilitation. *Arch Phys Med Rehabil*. 2005;86:S51–S60.
174. Volpe BT, Krebs HI, Hogan N, Edelsteinn L, Diels CM, Aisen ML. Robot training enhanced motor outcome in patients with stroke maintained over 3 years. *Neurology*. 1999;53:1874–1876.
175. Fasoli SE, Krebs HI, Ferraro M, Hogan N, Volpe BT. Does shorter rehabilitation limit potential recovery poststroke? *Neurorehabil Neural Repair*. 2004;18:88–94.
176. Aisen ML, Krebs HI, Hogan N, McDowell F, Volpe BT. The effect of robot-assisted therapy and rehabilitative training on motor recovery following stroke. *Arch Neurology*. 1997;54:443–446.
177. Howle JM. *Neuro-Developmental Treatment Approach: Theoretical Foundations and Principles*. Laguna Beach, Calif: Osseum Entertainment; 2002.
178. Hafsteinsdóttir TB, Algra A, Kappelle LJ, Grypdonck MH; Dutch NDT Study Group. Neurodevelopmental treatment after stroke: a comparative study [republished in *Ned Tijdschr Geneeskd*. 2007;151:2045–2049]. *J Neurol Neurosurg Psychiatry*. 2005;76:788–792.
179. Luke C, Dodd K, Brock K. Outcomes of the Bobath concept on upper limb recovery following stroke. *Clin Rehabil*. 2004;18:888–898.
180. van Vliet PM, Lincoln NB, Foxall A. Comparison of Bobath based and movement science based treatment for stroke: a randomised controlled trial. *J Neurol Neurosurg Psychiatry*. 2005;76:503–508.
181. Wang RY. Neuromodulation of effects of upper limb motor function and shoulder range of motion by functional electric stimulation (FES). *Acta Neurochir Suppl*. 2007;97(part 1):381–385.

182. Alon G, Levitt AF, McCarthy PA. Functional electrical stimulation enhancement of upper extremity functional recovery during stroke rehabilitation: a pilot study. *Neurorehabil Neural Repair*. 2007;21:207–215.
183. Chae J, Zorowitz R. Functional status of cortical and subcortical nonhemorrhagic stroke survivors and the effect of lesion laterality. *Am J Phys Med Rehabil*. 1998;77:415–420.
184. Faghri PD, Rodgers MM, Galser RM, Bors JG, Ho C, Akuthota P. The effects of functional electrical stimulation on shoulder subluxation, arm function recovery, and shoulder pain in hemiplegic stroke patients. *Arch Phys Med Rehabil*. 1994;75:73–79.
185. Francisco G, Chae J, Chawla H, Kirshblum S, Zorowitz R, Lewis G, Pang S. Electromyogram-triggered neuromuscular stimulation for improving the arm function of acute stroke survivors: a randomized pilot study. *Arch Phys Med Rehabil*. 1998;79:570–575.
186. Newsam CJ, Baker LL. Effect of an electric stimulation facilitation program on quadriceps motor unit recruitment after stroke. *Arch Phys Med Rehabil*. 2004;85:2040–2045.
187. Popovic MB, Popovic DB, Sinkjaer T, Stefanovic A, Schwirtlich L. Clinical evaluation of functional electrical therapy in acute hemiplegic subjects. *J Rehabil Res Dev*. 2003;40:443–453.
188. Tong RK, Ng MF, Li LS. Effectiveness of gait training using an electromechanical gait trainer, with and without functional electric stimulation, in subacute stroke: a randomized controlled trial. *Arch Phys Med Rehabil*. 2006;87:1298–1304.
189. Kowalczewski J, Gritsenko V, Ashworth N, Ellaway P, Prochazka A. Upper-extremity functional electrical stimulation-assisted exercises on a workstation in the subacute phase of stroke recovery. *Arch Phys Med Rehabil*. 2007;88:833–839.
190. Yan T, Hui-Chan CW, Li LS. Functional electrical stimulation improves motor recovery of the lower extremity and walking ability of subjects with first acute stroke: a randomized placebo-controlled trial. *Stroke*. 2005;36:80–85.
191. Shah RR, Haghpanah S, Elovic EP, Flanagan SR, Behnegar A, Nguyen V, Page SJ, Fang ZP, Chae J. MRI findings in the painful poststroke shoulder. *Stroke*. 2008;39:1808–1813.
192. Vuagnat H, Chantraine A. Shoulder pain in hemiplegia revisited: contribution of functional electrical stimulation and other therapies. *J Rehabil Med*. 2003;35:49–54.
193. Teasell R, Foley N, Bhogal S. Painful hemiplegic shoulder. *Evidence-Based Review of Stroke Rehabilitation.* 12th ed. 2008. EBRSR Web site. Available at: http://www.ebrsr.com/reviews_details.php?Painful-Hemiplegic-Shoulder-16. Accessed February 25, 2009.
194. Zorowitz RD, Idank D, Ikai T, Hughes MB, Johnston MV. Shoulder subluxation after stroke: a comparison of four supports. *Arch Phys Med Rehabil*. 1995;76:763–771.
195. Williams R, Taffs L, Minuk T. Evaluation of two support methods for the subluxated shoulder of hemiplegic patients [published correction appears in *Phys Ther*. 1988;68:1969]. *Phys Ther*. 1988;68:1209–1214.
196. Chantraine A, Baribeault A, Uebelhart D, Gremion G. Shoulder pain and dysfunction in hemiplegia: effects of functional electrical stimulation. *Arch Phys Med Rehabil*. 1999;80:328–331.
197. Yu DT, Chae J, Walker ME, Kirsteins A, Elovic EP, Flanagan SR, Harvey RL, Zorowitz RD, Frost FS, Grill JH, Feldstein M, Fang ZP. Intramuscular neuromuscular electric stimulation for poststroke shoulder pain: a multicenter randomized clinical trial. *Arch Phys Med Rehabil*. 2004;85:695–704.
198. Faghri PD. The effects of neuromuscular stimulation-induced muscle contraction versus elevation on hand edema in CVA patients. *J Hand Ther*. 1997;10:29–34.
199. Chae J, Yu DT, Walker ME, Kirsteins A, Elovic EP, Flanagan SR, Harvey RL, Zorowitz RD, Frost FS, Grill JH, Fang ZP. Intramuscular electrical stimulation for hemiplegic shoulder pain: a 12-month follow-up of a multiple-center, randomized clinical trial. *Am J Phys Med Rehabil*. 2005;84:832–842.
200. Linn SL, Granat MH, Lees KR. Prevention of shoulder subluxation after stroke with electrical stimulation. *Stroke*. 1999;30:963–968.
201. Wang RY, Chan RC, Tsai MW. Functional electrical stimulation on chronic and acute hemiplegic shoulder subluxation. *Am J Phys Med Rehabil*. 2000;79:385–390.
202. Bütefisch C, Hummelsheim H, Denzler P, Mauritz KH. Repetitive training of isolated movements improves the outcome of motor rehabilitation of the centrally paretic hand. *J Neurol Sci*. 1995;130:59–68.
203. Carey JR, Durfee WK, Bhatt E, Nagpal A, Weinstein SA, Anderson KM, Lewis SM. Comparison of finger tracking versus simple movement training via telerehabilitation to alter hand function and cortical reorganization after stroke. *Neurorehabil Neural Repair*. 2007;21:216–232.
204. Foley N, Teasell R, Jutai J, Bhogal S, Kruger E. Upper extremity interventions. *Evidence-Based Review of Stroke Rehabilitation.* 2007. EBRSR Web site. Available at: http://www.ebrsr.com/reviews_details.php?Upper-Extremity-Interventions-31. Accessed April 24, 2009.
205. Maulucci RA, Eckhouse RH. Retraining reaching in chronic stroke with real-time auditory feedback. *NeuroRehabilitation*. 2001;16:171–182.
206. Woldag H, Waldmann G, Heuschkel G, Hummelsheim H. Is the repetitive training of complex hand and arm movements beneficial for motor recovery in stroke patients? *Clin Rehabil*. 2003;17:723–730.
207. Byblow WD, Lewis GN, Stinear JW, Carson RG. The modulation of excitability in corticospinal pathways during rhythmic movement. In: Swinnen SP, Duysens J, eds. *Neurobehavioral Determinants of Interlimb Coordination: A Multidisciplinary Approach.* Boston, Mass: Kluwer Academic Publishers; 2004:155–185.
208. Cauraugh JH, Kim S. Two coupled motor recovery protocols are better than one: electromyogram-triggered neuromuscular stimulation and bilateral movements. *Stroke*. 2002;33:1589–1594.
209. Lewis GN, Byblow WD. Neurophysiological and behavioural adaptations to a bilateral training intervention in individuals following stroke. *Clin Rehabil*. 2004;18:48–59.
210. Mudie MH, Matyas TA. Responses of the densely hemiplegic upper extremity to bilateral training. *Neurorehabil Neural Repair*. 2001;15:129–140.
211. Mudie MH, Matyas TA. Can simultaneous bilateral movement involve the undamaged hemisphere in reconstruction of neural networks damaged by stroke? *Disabil Rehabil*. 2000;22:23–37.
212. Platz T, Bock S, Prass K. Reduced skillfulness of arm motor behavior among motor stroke patients with good clinical recovery: does it indicate reduced automaticity? Can it be improved by unilateral or bilateral training? A kinematic motion analysis study. *Neuropsychologia*. 2001;39:687–698.
213. Whitall J, McCombe Waller S, Silver KH, Macko RF. Repetitive bilateral arm training with rhythmic auditory cueing improves motor function in chronic hemiparetic stroke [published correction appears in *Stroke*. 2007;38:e22]. *Stroke*. 2000;31:2390–2395.
214. Duncan P, Studenski S, Richards L, Gollub S, Lai SM, Reker D, Perera S, Yates J, Koch V, Rigler S, Johnson D. Randomized clinical trial of therapeutic exercise in subacute stroke. *Stroke*. 2003;34:2173–2180.
215. Winstein CJ, Rose DK, Tan SM, Lewthwaite R, Chui HC, Azen SP. A randomized controlled comparison of upper extremity rehabilitation strategies in acute stroke: a pilot study of immediate and long-term outcomes. *Arch Phys Med Rehabil*. 2004;85:620–628.
216. van der Lee JH, Wagenaar RC, Lankhorst GJ, Vogelaar TW, Devillé WL, Bouter LM. Forced use of the upper extremity in chronic stroke patients: results from a single-blind randomized clinical trial. *Stroke*. 1999;30:2369–2375.
217. Fritz SL, Light KE, Patterson TS, Behrman AL, Davis SB. Active finger extension predicts outcomes after constraint-induced movement therapy for individuals with hemiparesis after stroke. *Stroke*. 2005;36:1172–1177.
218. Page SJ, Levine P. Modified constraint-induced therapy in patients with chronic stroke exhibiting minimal movement ability in the affected arm. *Phys Ther*. 2007;87:872–878.
219. Hesse S, Werner C, von Frankenberg S, Bardeleben A. Treadmill training with partial body weight support after stroke. *Phys Med Rehabil Clin N Am*. 2003;14:S111–S123.
220. Harris-Love ML, Forrester LW, Macko RF, Silver KH, Smith GV. Hemiparetic gait parameters in overground versus treadmill walking. *Neurorehabil Neural Repair*. 2001;15:105–112.
221. Patterson SL, Rodgers MM, Macko RF, Forrester LW. Effect of treadmill exercise training on spatial and temporal gait parameters in subjects with chronic stroke: a preliminary report. *J Rehabil Res Dev*. 2008;45:221–228.
222. Smith GV, Silver KH, Goldberg AP, Macko RF. "Task-oriented" exercise improves hamstring strength and spastic reflexes in chronic stroke patients. *Stroke*. 1999;30:2112–2118.
223. Enzinger C, Dawes H, Johansen-Berg H, Wade D, Bogdanovic M, Collett J, Guy C, Kischka U, Ropele S, Fazekas F, Matthews PM. Brain activity changes associated with treadmill training after stroke. *Stroke*. 2009;40:2460–2467.
224. Luft AR, Macko RF, Forrester LW, Villagra F, Ivey F, Sorkin JD, Whitall J, McCombe-Waller S, Katzel L, Goldberg AP, Hanley DF. Treadmill exercise activates subcortical neural networks and improves

walking after stroke: a randomized controlled trial. *Stroke*. 2008;39: 3341–3350.
225. Barbeau H, Visintin M. Optimal outcomes obtained with body-weight support combined with treadmill training in stroke subjects. *Arch Phys Med Rehabil*. 2003;84:1458–1465.
226. Hesse S, Bertelt C, Jahnke MT, Schaffrin A, Baake P, Malezic M, Mauritz KH. Treadmill training with partial body weight support compared with physiotherapy in nonambulatory hemiparetic patients. *Stroke*. 1995;26:976–981.
227. Hesse S, Konrad M, Uhlenbrock D. Treadmill walking with partial body weight support versus floor walking in hemiparetic subjects. *Arch Phys Med Rehabil*. 1999;80:421–427.
228. McCain KJ, Pollo FE, Baum BS, Coleman SC, Baker S, Smith PS. Locomotor treadmill training with partial body-weight support before overground gait in adults with acute stroke: a pilot study. *Arch Phys Med Rehabil*. 2008;89:684–691.
229. Miller EW, Quinn ME, Seddon PG. Body weight support treadmill and overground ambulation training for two patients with chronic disability secondary to stroke. *Phys Ther*. 2002;82:53–61.
230. Sullivan KJ, Brown DA, Klassen T, Mulroy S, Ge T, Azen SP, Winstein CJ; Physical Therapy Clinical Research Network (PTClinResNet). Effects of task-specific locomotor and strength training in adults who were ambulatory after stroke: results of the STEPS randomized clinical trial. *Phys Ther*. 2007;87:1580–1602.
231. Trueblood PR. Partial body weight treadmill training in persons with chronic stroke. *NeuroRehabilitation*. 2001;16:141–153.
232. Moseley AM, Stark A, Cameron ID, Pollock A. Treadmill training and body weight support for walking after stroke. *Cochrane Database Syst Rev*. 2005;(4):CD002840.
233. Kosak MC, Reding MJ. Comparison of partial body weight-supported treadmill gait training versus aggressive bracing assisted walking post stroke. *Neurorehabil Neural Repair*. 2000;14:13–19.
234. Fischer HC, Stubblefield K, Kline T, Luo X, Kenyon RV, Kamper DG. Hand rehabilitation following stroke: a pilot study of assisted finger extension training in virtual environment. *Top Stroke Rehabil*. 2007; 14:1–12.
235. Lo AC, Guarino P, Krebs HI, Volpe BT, Bever CT, Duncan PW, Ringer RJ, Wagner TH, Richards LG, Bravata DM, Haselkorn JK, Wittenberg GF, Federman DG, Corn BH, Maffucci AD, Peduzzi P. Multicenter randomized trial of robot-assisted rehabilitation for chronic stroke: methods and entry characteristics for VA ROBOTICS. *Neurorehabil Neural Repair*. 2009;23:775–783.
236. Broeren J, Rydmark M, Björkdahl A, Sunnerhagen KS. Assessment and training in a 3-dimensional virtual environment with haptics: a report on 5 cases of motor rehabilitation in the chronic stage after stroke. *Neurorehabil Neural Repair*. 2007;21:180–189.
237. Jang SH, You SH, Hallett M, Cho YW, Park CM, Cho SH, Lee HY, Kim TH. Cortical reorganization and associated functional motor recovery after virtual reality in patients with chronic stroke: an experimenter-blind preliminary study. *Arch Phys Med Rehabil*. 2005; 86:2218–2223.
238. Kuttuva M, Boian R, Merians A, Burdea G, Bouzit M, Lewis J, Fensterheim D. The Rutgers Arm, a rehabilitation system in virtual reality: a pilot study. *Cyberpsychol Behav*. 2006;9:148–151.
239. Merians AS, Poizner H, Boian R, Burdea G, Adamovich S. Sensorimotor training in a virtual reality environment: does it improve functional recovery poststroke? *Neurorehabil Neural Repair*. 2006;20: 252–267.
240. Stewart JC, Yeh SC, Jung Y, Yoon H, Whitford M, Chen SY, Li L, McLaughlin M, Rizzo A, Winstein CJ. Intervention to enhance skilled arm and hand movements after stroke: a feasibility study using a new virtual reality system. *J Neuroeng Rehabil*. 2007;4:21.
241. Yang YR, Wang RY, Lin KH, Chu MY, Chan RC. Task-oriented progressive resistance strength training improves muscle strength and functional performance in individuals with stroke. *Clin Rehabil*. 2006; 20:860–870.
242. Flansbjer UB, Miller M, Downham D, Lexell J. Progressive resistance training after stroke: effects on muscle strength, muscle tone, gait performance and perceived participation. *J Rehabil Med*. 2008;40:42–48.
243. Teixeira-Salmela LF, Olney SJ, Nadeau S, Brouwer B. Muscle strengthening and physical conditioning to reduce impairment and disability in chronic stroke survivors. *Arch Phys Med Rehabil*. 1999;80: 1211–1218.
244. Kim CM, Eng JJ, MacIntyre DL, Dawson AS. Effects of isokinetic strength training on walking in persons with stroke: a double-blind controlled pilot study. *J Stroke Cerebrovasc Dis*. 2001;10:265–273.
245. Bale M, Strand LI. Does functional strength training of the leg in subacute stroke improve physical performance? A pilot randomized controlled trial. *Clin Rehabil*. 2008;22:911–921.
246. Ouellette MM, LeBrasseur NK, Bean JF, Phillips E, Stein J, Frontera WR, Fielding RA. High-intensity resistance training improves muscle strength, self-reported function, and disability in long-term stroke survivors. *Stroke*. 2004;35:1404–1409.
247. Nasciutti-Prudente C, Oliveira FG, Houri SF, de Paula Goulart FR, Neto MH, Teixeira-Salmela LF. Relationships between muscular torque and gait speed in chronic hemiparetic subjects. *Disabil Rehabil*. 2009;31: 103–108.
248. Pak S, Patten C. Strengthening to promote functional recovery post-stroke: an evidence-based review. *Top Stroke Rehabil*. 2008;15: 177–199.
249. Ada L, Dorsch S, Canning CG. Strengthening interventions increase strength and improve activity after stroke: a systematic review. *Aust J Physiother*. 2006;52:241–248.
250. Stein J, Krebs HI, Frontera WR, Fasoli SE, Hughes R, Hogan N. Comparison of two techniques of robot-aided upper limb exercise training after stroke. *Am J Phys Med Rehabil*. 2004;83:720–728.
251. Butler AJ, Page SJ. Mental practice with motor imagery: evidence for motor recovery and cortical reorganization after stroke. *Arch Phys Med Rehabil*. 2006;87(suppl 2):S2–S11.
252. Müller K, Bütefisch CM, Seitz RJ, Hörnberg V. Mental practice improves hand function after hemiparetic stroke. *Restor Neurol Neurosci.* 2007;25:501–511.
253. Kimberley TJ, Lewis SM, Auerbach EJ, Dorsey LL, Lojovich JM, Carey JR. Electrical stimulation driving functional improvements and cortical changes in subjects with stroke. *Exp Brain Res*. 2004;154:450–460.
254. Ring H, Rosenthal N. Controlled study of neuroprosthetic functional electrical stimulation in sub-acute post-stroke rehabilitation. *J Rehabil Med*. 2005;37:32–36.
255. Cozean CD, Pease WS, Hubbell SL. Biofeedback and functional electrical stimulation in stroke rehabilitation. *Arch Phys Med Rehabil*. 1988; 69:401–405.
256. Burridge JH, Taylor PN, Hagan SA, Wood DE, Swain ID. The effects of common peroneal stimulation on the effort and speed of walking: a randomized controlled trial with chronic hemiplegic patients. *Clin Rehabil*. 1997;11:201–210.
257. Burridge JH, Haugland M, Larsen B, Pickering RM, Svaneborg N, Iversen HK, Christensen PB, Haase J, Brennum J, Sinkjaer T. Phase II trial to evaluate the ActiGait implanted drop-foot stimulator in established hemiplegia. *J Rehabil Med*. 2007;39:212–218.
258. Kottink AI, Hermens HJ, Nene AV, Tenniglo MJ, van der Aa HE, Buschman HP, IJzerman MJ. A randomized controlled trial of an implantable 2-channel peroneal nerve stimulator on walking speed and activity in poststroke hemiplegia. *Arch Phys Med Rehabil*. 2007;88: 971–978.
259. Kottink AI, Hermens HJ, Nene AV, Tenniglo MJ, Groothuis-Oudshoorn CG, IJzerman MJ. Therapeutic effect of an implantable peroneal nerve stimulator in subjects with chronic stroke and footdrop: a randomized controlled trial. *Phys Ther*. 2008;88:437–448.
260. Woodford H, Price C. EMG biofeedback for the recovery of motor function after stroke. *Cochrane Database Syst Rev*. 2007 April 18;(2): CD004585.
261. Aiello E, Gates DH, Patritti BL, Cairns KD, Meister M, Clancy EA, Bonato P. Visual EMG biofeedback to improve ankle function in hemiparetic gait. *Conf Proc IEEE Eng Med Biol Soc*. 2005;7:7703–7706.
262. Cho SH, Shin HK, Kwon YH, Lee MY, Lee YH, Lee CH, Yang DS, Jang SH. Cortical activation changes induced by visual biofeedback tracking training in chronic stroke patients. *NeuroRehabilitation*. 2007; 22:77–84.
263. Lourençcão MI, Battistella LR, de Brito CM, Tsukimoto GR, Miyazaki MH. Effect of biofeedback accompanying occupational therapy and functional electrical stimulation in hemiplegic patients. *Int J Rehabil Res*. 2008;31:33–41.
264. Hemmen B, Seelen H. Effects of movement imagery and electromyography-triggered feedback on arm hand function in stroke patients in the subacute phase. *Clin Rehabil*. 2007;21:587–594.
265. Barclay-Goddard R, Stevenson T, Poluha W, Moffatt ME, Taback SP. Force platform feedback for standing balance training after stroke. *Cochrane Database Syst Rev*. 2004 Oct 18;(4):CD004129.

266. Geiger RA, Allen JB, O'Keefe J, Hicks RR. Balance and mobility following stroke: effects of physical therapy interventions with and without biofeedback/forceplate training. *Phys Ther*. 2001;81:995–1005.
267. Bonan IV, Yelnik AP, Colle FM, Michaud C, Normand E, Panigot B, Roth P, Guichard JP, Vicaut E. Reliance on visual information after stroke: part II: effectiveness of a balance rehabilitation program with visual cue deprivation after stroke: a randomized controlled trial. *Arch Phys Med Rehabil*. 2004;85:274–278.
268. Katz-Leurer M, Sender I, Keren O, Dvir Z. The influence of early cycling training on balance in stroke patients at the subacute stage: results of a preliminary trial. *Clin Rehabil*. 2006;20:398–405.
269. Cheng PT, Wang CM, Chung CY, Chen CL. Effects of visual feedback rhythmic weight-shift training on hemiplegic stroke patients. *Clin Rehabil*. 2004;18:747–753.
270. Pollock AS, Durward BR, Rowe PJ, Paul JP. The effect of independent practice of motor tasks by stroke patients: a pilot randomized control trial. *Clin Rehabil*. 2002;16:473–480.
271. Eser F, Yavuzer G, Karakus D, Karaoglan B. The effect of balance training on motor recovery and ambulation after stroke: a randomized controlled trial. *Eur J Phys Rehabil Med*. 2008;44:19–25.
272. Smithard DG, O'Neill PA, England RE, Park CL, Wyatt R, Martin DF, Morris J. The natural history of dysphagia following a stroke. *Dysphagia*. 1997;12:188–193.
273. Mann G, Hankey GJ, Cameron D. Swallowing function after stroke: prognosis and prognostic factors at 6 months. *Stroke*. 1999;30:744–748.
274. Martino R, Foley N, Bhogal S, Diamant N, Speechley M, Teasell R. Dysphagia after stroke: incidence, diagnosis, and pulmonary complications. *Stroke*. 2005;36:2756–2763.
275. American Speech-Language-Hearing Association Web site. National Outcomes Measurement System (NOMS) Data and Research: Data outcomes 2008. Available at: http://www.asha.org/members/research/NOMS/. Accessed June 15, 2009.
276. Katzan IL, Cebul RD, Husak SH, Dawson NV, Baker DW. The effect of pneumonia on mortality among patients hospitalized for acute stroke. *Neurology*. 2003;60:620–625.
277. Teasell RW, Bach D, McRae M. Prevalence and recovery of aspiration poststroke: a retrospective analysis. *Dysphagia*. 1994;9:35–39.
278. Suiter DM, Leder SB. Clinical utility of the 3-ounce water swallow test. *Dysphagia*. 2008;23:244–250.
279. *Improving Recognition and Management of Dysphagia in Acute Care of Stroke: A Vision for Ontario.* Ontario, Canada: Heart and Stroke Foundation of Ontario; 2002.
280. Ashford J, McCabe D, Wheeler-Hegland K, Frymark T, Mullen R, Musson N, Schooling T, Hammond CS. Evidence-based systematic review: oropharyngeal dysphagia behavioral treatments: part III: impact of dysphagia treatments on populations with neurological disorders. *J Rehabil Res Dev*. 2009;46:195–204.
281. Logemann JA, Gensler G, Robbins J, Lindblad AS, Brandt D, Hind JA, Kosek S, Dikeman K, Kazandjian M, Gramigna GD, Lundy D, McGarvey-Toler S, Miller Gardner PJ. A randomized study of three interventions for aspiration of thin liquids in patients with dementia or Parkinson's disease. *J Speech Lang Hear Res*. 2008;51:173–183.
282. Robbins J, Gensler G, Hind J, Logemann JA, Lindblad AS, Brandt D, Baum H, Lilienfeld D, Kosek S, Lundy D, Dikeman K, Kazandjian M, Gramigna GD, McGarvey-Toler S, Miller Gardner PJ. Comparison of 2 interventions for liquid aspiration on pneumonia incidence: a randomized trial [published correction appears in *Ann Intern Med*. 2008;148:715]. *Ann Intern Med*. 2008;148:509–518.
283. The Management of Stroke Rehabilitation Working Group. *VA/DoD Clinical Practice Guideline for the Management of Stroke Rehabilitation.* Available at: http://www.healthquality.va.gov/Management_of_Stroke_Rehabilitation.asp. Accessed May 17, 2007.
284. Huang JY, Zhang DY, Yao Y, Xia QX, Fan QQ. Training in swallowing prevents aspiration pneumonia in stroke patients with dysphagia. *J Int Med Res*. 2006;34:303–306.
285. Crary MA, Carnaby Mann GD, Groher ME, Helseth E. Functional benefits of dysphagia therapy using adjunctive sEMG biofeedback. *Dysphagia*. 2004;19:160–164.
286. Power ML, Fraser CH, Hobson A, Singh S, Tyrrell P, Nicholson DA, Turnbull I, Thompson DG, Hamdy S. Evaluating oral stimulation as a treatment for dysphagia after stroke. *Dysphagia*. 2006;21:49–55.
287. Doshi VS, Say JH, Young SH, Doraisamy P. Complications in stroke patients: a study carried out at the Rehabilitation Medicine Service, Changi General Hospital. *Singapore Med J*. 2003;44:643–652.
288. Barrett JA. Bladder and bowel problems after stroke. *Rev Clin Gerontol*. 2002;12:253–267.
289. Brittain K, Perry S, Shaw C, Matthews R, Jagger C, Potter J. Isolated urinary, fecal, and double incontinence: prevalence and degree of soiling in stroke survivors. *J Am Geriatr Soc*. 2006;54:1915–1919.
290. Kolominsky-Rabas PL, Hilz MJ, Neundoerfer B, Heuschmann PU. Impact of urinary incontinence after stroke: results from a prospective population-based stroke register. *Neurourol Urodyn*. 2003;22:322–327.
291. Pettersen R, Wyller TB. Prognostic significance of micturition disturbances after acute stroke. *J Am Geriatr Soc*. 2006;54:1878–1884.
292. Borrie MJ, Bawden M, Speechley M, Kloseck M. Interventions led by nurse continence advisers in the management of urinary incontinence: a randomized controlled trial. *CMAJ*. 2002;166:1267–1273.
293. Harari D, Coshall C, Rudd AG, Wolfe CD. New-onset fecal incontinence after stroke: prevalence, natural history, risk factors, and impact. *Stroke*. 2003;34:144–150.
294. Winge K, Rasmussen D, Werdelin LM. Constipation in neurological diseases. *J Neurol Neurosurg Psychiatry*. 2003;74:13–19.
295. American Speech-Language-Hearing Association (2010). 2010 Medicare Fee Schedule for Speech-Language Pathologists. Available at: http://www.asha.org/Practice/reimbursement/medicare/feeschedule/. Accessed June 16, 2010.
296. Zipoli R Jr, Kennedy M. Evidence-based practice among speech-language pathologists: attitudes, utilization, and barriers. *Am J Speech Lang Pathol*. 2005;14:208–220.
297. Lezak MD. *Neuropsychological Assessment.* New York, NY: Oxford University Press; 1995.
298. Murray LL, Clark HM. *Neurogenic Disorders of Language: Theory Driven Clinical Practice.* Clifton Park, NJ: Thomas Delmar Learning; 2006.
299. Kertesz A. *Western Aphasia Battery-Enhanced.* San Antonio, Tex: PsychCorp; 2006.
300. Pimental P, Knight J. *MIRBI-2: The Mini Inventory of Right Brain Injury.* Austin, Tex: Pro-Ed; 2000.
301. Dabul B. *ABA-2: Apraxia Battery for Adults-Second Edition.* Austin, Tex: Pro-Ed; 2000.
302. Drummond S. *Dysarthria Examination Battery.* San Antonio, Tex: PsychCorp; 1993.
303. Biddle AK, Watson LR, Hooper CR, Lohr KN, Sutton SF. *Criteria for Determining Disability in Speech-Language Disorders.* Rockville, Md: Agency for Healthcare Research and Quality; 2002. AHRQ publication No. 02-E010.
304. LaPointe L, Horner J. *RCBA-2: Reading Comprehension Battery for Aphasia-2.* Austin, Tex: Pro-Ed. 1998.
305. Hawkins KA, Bender S. Norms and the relationship of Boston Naming Test performance to vocabulary and education: a review. *Aphasiology*. 2002;16:1143–1153.
306. Kaplan E, Goodglass H, Weintraub S. *Boston Naming Test.* Philadelphia, Pa: Lippincott Williams & Wilkins; 2001.
307. Rami L, Serradell M, Bosch B, Caprile C, Sekler A, Villar A, Canal R, Molinuevo JL. Normative data for the Boston Naming Test and the Pyramids and Palm Trees Test in the elderly Spanish population. *J Clin Exp Neuropsychol*. 2008;30:1–6.
308. Tallberg IM. The Boston Naming Test in Swedish: normative data. *Brain Lang*. 2005;94:19–31.
309. Baines K, Martin A, Heeringa H. *ALFA: Assessment of Language-Related Functional Activities.* Austin, Tex: Pro-Ed; 1999.
310. Frattali C. *Functional Assessment of Communication Skills for the Adult.* Rockville, Md: American Speech-Language-Hearing Association; 1995.
311. Paul DR, Frattali CM, Holland AL, Thompson CK, Caperton CJ, Slater SC. *Quality of Communication Life Scale.* Rockville, Md: American Speech-Language-Hearing Association; 2004.
312. Helm-Estabrooks N. *Cognitive Linguistic Quick Test.* San Antonio, Tex: PsychCorp; 2001.
313. Robertson IJ, Ward T, Ridgeway V, Nimmo-Smith I. *The Test of Everyday Attention.* San Antonio, Tex: PsychCorp; 1994.
314. D'Elia L, Satz P, Uchiyama C, White T. *Color Trails Test.* Odessa, Fla: Psychological Assessment Resources; 1996.
315. Wilson B, Cockburn J, Halligan P. *The Behavioral Inattention Test.* Bury St. Edmunds, Suffolk, England: Thames Valley Test Co; 1987.
316. Wechsler D. *Wechsler Memory Scale-IV.* San Antonio, Tex: Pearson; 2009.
317. Bucks RS, Willison JR, Byrne LMT. *Location Learning Test.* Bury St. Edmunds, Suffolk, England: Thames Valley Test Co; 2000.

318. Delis DC, Kaplan E, Kramer JH. *Delis-Kaplan Executive Function System: Examiner's Manual.* San Antonio, Tex: PsychCorp; 2001.
319. Wilson B, Cockburn J, Baddeley AD. *The Rivermead Behavioural Memory Test.* Bury St. Edmunds, Suffolk, England: Thames Valley Test Co; 1996.
320. Wilson BA, Alderman N, Burgess PW, Emslie H, Evans JJ. *Behavioural Assessment of the Dysexecutive Syndrome.* Bury St. Edmunds, Suffolk, England: Thames Valley Test Co; 1996.
321. Code C, Müller DJ, Herrmann M. Perceptions of psychosocial adjustment to aphasia: applications of the Code-Müller protocols. *Semin Speech Lang*. 1999;20:51–62.
322. Olsson E, Wik K, Ostling AK, Johannson M, Andersson G. Everyday memory self-assessed by adult patients with acquired brain damage and their significant others. *Neuropsychol Rehabil*. 2006;16:257–271.
323. Barrett AM, Buxbaum LJ, Coslett HB, Edwards E, Heilman KM, Hillis AE, Milberg WP, Robertson IH. Cognitive rehabilitation interventions for neglect and related disorders: moving from bench to bedside in stroke patients. *J Cogn Neurosci*. 2006;18:1223–1236.
324. Berthier ML. Poststroke aphasia: epidemiology, pathophysiology and treatment. *Drugs Aging*. 2005;22:163–182.
325. Nickels L. Therapy for naming disorders: revisiting, revising, and reviewing. *Aphasiology*. 2002;16:935–979.
326. Mullen R. The state of the evidence: ASHA develops levels of evidence for communication sciences and disorders. *The ASHA Leader.* March 6, 2007.
327. Togher L, Schultz R, Tate R, McDonald S, Perdices M, Smith K, Winders K, Savage S. The methodological quality of aphasia therapy research: an investigation of group studies using the PsycBITE evidence-based practice database. *Aphasiology*. 2009;23:694–706.
328. Bhogal S, Teasell R, Speechley M. Intensity of aphasia therapy, impact on recovery. *Stroke*. 2003;34:987–993.
329. Aftonomos LB, Appelbaum JS, Steele RD. Improving outcomes for persons with aphasia in advanced community-based treatment programs. *Stroke*. 1999;30:1370–1379.
330. Holland AL, Fromm DS, DeRuyter F, Stein M. Treatment efficacy: aphasia. *J Speech Hear Res*. 1996;39:S27–S36.
331. Sohlberg MM, Avery J, Kennedy M, Ylvisaker M, Coelho C, Turkstra L, Yorkston K. Practice guidelines for direct attention training. *J Med Speech Lang Pathol*. 2003;11:xix–xxxix.
332. Sohlberg MM, Kennedy M, Avery J, Coelho C, Turkstra L, Ylvisaker M, Yorkston K. Evidence based practice for the use of external aids as a memory compensation technique. *J Med Speech Lang Pathol*. 2007; 15:xv–li.
333. Odell K, Wollack J, Flynn M. Functional outcomes in patients with right hemisphere brain damage. *Aphasiology*. 2005;19:807–830.
334. Katz RC, Hallowell B, Code C, Armstrong E, Roberts P, Pound C, Katz L. A multinational comparison of aphasia management practices. *Int J Lang Commun Disord*. 2000;35:303–314.
335. Edwards DF, Hahn MG, Baum CM, Perlmutter MS, Sheedy C, Dromerick AW. Screening patients with stroke for rehabilitation needs: validation of the post-stroke rehabilitation guidelines. *Neurorehabil Neural Repair*. 2006;20:42–48.
336. Miyake A, Emerson M, Friedman NP. Assessment of executive functions in clinical settings: problems and recommendations. *Semin Speech Lang*. 2000;21:169–183.
337. Cicerone K, Levin H, Malec J, Stuss D, Whyte J. Cognitive rehabilitation interventions for executive function: moving from bench to bedside in patients with traumatic brain injury. *J Cogn Neurosci*. 2006; 18:1212–1222.
338. Ross-Swain D, Fogle P. *Ross Information Processing Assessment–Geriatric.* Austin, Tex: Pro-Ed; 1996.
339. Croot K. Diagnosis of AOS: definition and criteria. *Semin Speech Lang*. 2002;23:267–280.
340. Kent RD, Kent JF, Duffy J, Weismer G. The dysarthrias: speech-voice profiles, related dysfunctions, and neuropathology. *J Med Speech Lang Pathol*. 1998;6:165–211.
341. Vogel D, Cannito MP. *Treating Disordered Speech Motor Control.* Austin, Tex: Pro-Ed; 2001.
342. Raymer A, Gonzalez L, Greenwald M. The role of cognitive models in language rehabilitation. *NeuroRehabilitation*. 1995;5:183–193.
343. Turkstra L, Coelho C, Ylvisaker M. The use of standardized tests for individuals with cognitive-communication disorders. *Semin Speech Lang*. 2005;26:215–222.
344. Mahendra N. A multicultural perspective on assessing TW, a bilingual client with aphasia. *Perspect Neurophysiol Neurogenic Speech Lang Disord*. 2006;16:9–18.
345. Muñoz ML, Marquardt TP. Picture naming and identification in bilingual speakers of Spanish and English with and without aphasia. *Aphasiology*. 2003;17:1115–1132.
346. ASHA's Multicultural Issues Board. *Knowledge and Skills Needed by Speech-Language Pathologists and Audiologists to Provide Culturally and Linguistically Appropriate Services.* Rockville, Md: American Speech and Language Association; 2004.
347. Neils-Strunjas J. Clinical assessment strategies: evaluation of language comprehension and production by formal test batteries. In: Stemmer B, Whitaker HA, eds. *Handbook of Neurolinguistics.* San Diego, Calif: Academic Press; 1998.
348. Duffy JR. *Motor Speech Disorders: Substrates, Differential Diagnosis, and Management.* St Louis, Mo: Mosby; 1995.
349. Hoit JD, Hixon TJ. Age and laryngeal airway resistance during vowel production in women. *J Speech Hear Res*. 1992;35:309–313.
350. American Speech-Language-Hearing Association (2005). *Roles of Speech-Language Pathologists in the Identification, Diagnosis, and Treatment of Individuals With Cognitive-Communicative Disorders: Position Statement.* Available at: www.asha.org/policy.
351. Roberts P. Aphasia assessment and treatment for bilingual and culturally diverse patients. In: *Language Intervention Strategies in Aphasia and Related Neurogenic Communication Disorders*. Philadelphia, Pa: Lippincott Williams & Wilkins; 2001.
352. Schubert F, Spatt J. Double dissociations between neglect tests: possible relation to lesion site. *Eur Neurol*. 2001;45:160–164.
353. Agrell BM, Dehlin OI, Dahlgren CJ. Neglect in elderly stroke patients: a comparison of five tests. *Psychiatry Clin Neurosci*. 1997;51:295–300.
354. Simmons-Mackie N, Threats TT, Kagan A. Outcome assessment in aphasia: a survey. *J Commun Disord*. 2005;38:1–27.
355. Ross KB, Wertz RT. Comparison of impairment and disability measures for assessing severity of, and improvement in, aphasia. *Aphasiology*. 1999;13:113–124.
356. Mayer JF, Murray LL. Functional measures of naming in aphasia: word retrieval in confrontation naming versus connected speech. *Aphasiology*. 2003;17:481–497.
357. Tingley S, Kyte CS, Johnson CK, Beitchman JH. Single-word and conversational measures of word-finding proficiency. *Am J Speech Lang Pathol*. 2003;12:359–368.
358. Golper L. Language assessment. In: Wallace GL, ed. *Adult Aphasia Rehabilitation.* Boston, Mass: Butterworth-Heinemann; 1996:57–86.
359. Arene NU, Hillis AE. Rehabilitation of unilateral spatial neglect and neuroimaging. *Eura Medicophys*. 2007;43:255–269.
360. Robey RR. The efficacy of treatment for aphasic persons: a meta-analysis. *Brain Lang*. 1994;47:582–608.
361. Robey RR. A meta-analysis of clinical outcomes in the treatment of aphasia. *J Speech Lang Hear Res*. 1998;41:172–187.
362. Whurr R, Lorch MP, Nye C. A meta-analysis of studies carried out between 1946 and 1988 concerned with the efficacy of speech and language therapy treatment for aphasic patients. *Eur J Disord Commun*. 1992;27:1–17.
363. Patterson J, Raymer A, Cherney L, Frymark T, Schooling T, Mullen R. Effect of intensity and CILT in aphasia: a systematic review. Paper presented at: American Speech-Language-Hearing Association Convention; November 15–17, 2007; Boston, Mass.
364. Basso A. How intensive/prolonged should an intensive/prolonged treatment be? *Aphasiology*. 2005;19:975–984.
365. Bhogal SK, Teasell RW, Foley NC, Speechley MR. Rehabilitation of aphasia: more is better. *Top Stroke Rehabil*. 2003;10:66–76.
366. Klonoff PS, Sheper JC, O'Brien KP, Chiapelo DA, Hodak JA. Rehabilitation and outcome of right-hemisphere stroke patients: challenges to traditional diagnostic and treatment methods. *Neuropsychology*. 1990; 4:147–163.
367. Blake ML, Tompkins CA. *Treatment Efficacy Summary: Cognitive-Communication Disorders Resulting From Right Hemisphere Brain Damage.* Rockville, Md: ASHA; 2007.
368. Wambaugh JL. A summary of treatments for apraxia of speech and review of replicated approaches. *Semin Speech Lang*. 2002;23:293–308.
369. Sellars C, Hughes T, Langhorne P. Speech and language therapy for dysarthria due to non-progressive brain damage. *Cochrane Database Syst Rev*. 2005 Jul 20;(3):CD002088.

370. Hanson E, Yorkston K, Beukelman D. Speech supplementation techniques for dysarthria: a systematic review. *J Med Speech Lang Pathol*. 2004;12:161–166.
371. Spencer KA, Yorkston KM. Evidence for the treatment of respiratory/phonatory dysfunction from dysarthria. *Perspect Neurophysiol Neurogenic Speech Lang Disord*. 2002;12:4–16.
372. Yorkston KM, Spencer K, Duffy J, Beukelman D, Golper LA, Miller R, Strand E, Sullivan M. Evidence-based practice guidelines for dysarthria: management of velopharyngeal function. *J Med Speech Lang Pathol*. 2001;9:257–274.
373. Cicerone KD, Dahlberg C, Kalmar K, Langenbahn DM, Malec JF, Bergquist TF, Felicetti T, Giacino JT, Harley JP, Harrington DE, Herzog J, Kneipp S, Laatsch L, Morse PA. Evidence-based cognitive rehabilitation: recommendations for clinical practice. *Arch Phys Med Rehabil*. 2000;81:1596–1615.
374. Lincoln NB, Majid MJ, Weyman N. Cognitive rehabilitation for attention deficits following stroke. *Cochrane Database Syst Rev*. 2000;(4):CD002842.
375. Bowen A, Lincoln NB, Dewey M. Cognitive rehabilitation for spatial neglect following stroke. *Cochrane Database Syst Rev*. 2002;(2):CD003586.
376. Johannsen L, Ackermann H, Karnath HO. Lasting amelioration of spatial neglect by treatment with neck muscle vibration even without concurrent training. *J Rehabil Med*. 2003;35:249–253.
377. Paolucci S, Antonucci G, Guariglia C, Magnotti L, Pizzamiglio L, Zoccolotti P. Facilitatory effect of neglect rehabilitation on the recovery of left hemiplegic stroke patients: a cross-over study. *J Neurol*. 1996;243:308–314.
378. Wiart L, Côme AB, Debelleix X, Petit H, Joseph PA, Mazaux JM, Barat M. Unilateral neglect syndrome rehabilitation by trunk rotation and scanning training. *Arch Phys Med Rehabil*. 1997;78:424–429.
379. Majid MJ, Lincoln NB, Weyman N. Cognitive rehabilitation for memory deficits following stroke. *Cochrane Database Syst Rev*. 2000;(3):CD002293.
380. Cappa SF, Benke T, Clarke S, Rossi B, Stemmer B, van Heugten CM; Task Force on Cognitive Rehabilitation; European Federation of Neurological Societies. EFNS guidelines on cognitive rehabilitation: report of an EFNS task force. *Eur J Neurol*. 2005;12:665–680.
381. Pohjasvaara T, Leskelä M, Vataja R, Kalska H, Ylikoski R, Hietanen M, Leppävuori A, Kaste M, Erkinjuntti T. Post-stroke depression, executive dysfunction and functional outcome. *Eur J Neurol*. 2002;9:269–275.
382. Fridriksson J, Frank E, Vesselinov R. Utilization of speech-language pathology and audiology services in stroke patients. *J Med Speech-Lang Pathol*. 2005;13:223–231.
383. Elman RJ, Bernstein-Ellis E. The efficacy of group communication treatment in adults with chronic aphasia. *J Speech Lang Hear Res*. 1999;42:411–419.
384. von Cramon DY, Matthes-von Cramon G, Mai N. Problem-solving deficits in brain-injured patients: a therapeutic approach. *Neuropsychol Rehabil*. 1991;1:45–64.
385. Fink R, Brecher A, Schwartz M, Robey R. A computer-implemented protocol for the treatment of naming disorders: Evaluation of clinician-guided and partially self-guided instruction. *Aphasiology*. 2002;16:1061–1086.
386. Katz RC, Wertz RT. The efficacy of computer-provided reading treatment of chronic aphasic adults. *J Speech Lang Hear Res*. 1997;40:493–507.
387. Wilson BA, Emslie HC, Quirk K, Evans JJ. Reducing everyday memory and planning problems by means of a paging system: a randomised control crossover study. *J Neurol Neurosurg Psychiatry*. 2001;70:477–482.
388. Kagan A, Black SE, Duchan FJ, Simmons-Mackie N, Square P. Training volunteers as conversation partners using "Supported Conversation for Adults with Aphasia" (SCA): a controlled trial. *J Speech Lang Hear Res*. 2001;44:624–638.
389. Purdya M, Hindenlanga J. Educating and training caregivers of persons with aphasia. *Aphasiology*. 2005;19:377–388.
390. Marshall RC, Wertz RT, Weiss DG, Aten JL, Brookshire RH, Garcia-Bunuel L, Holland AL, Kurtzke JF, LaPointe LL, Milianti FJ, Brannegan R, Greenbaum H, Vogel D, Carter J, Barnes NS, Goodman R. Home treatment for aphasic patients by trained nonprofessionals. *J Speech Hear Disord*. 1989;54:462–470.
391. Hickey EM, Bourgeois MS, Olswang LB. Effects of training volunteers to converse with nursing home residents with aphasia. *Aphasiology*. 2004;18:625–637.
392. Hoerster L, Hickey EM, Bourgeois MS. Effects of memory aids on conversations between nursing home residents with dementia and nursing assistants. *Neuropsychol Rehabil*. 2001;11:399–427.
393. Kennedy MRT, Coelho C, Turkstra L, Ylvisaker M, Sohlberg MM, Yorkston K, Chiou H-H, Kan P-F. Intervention for executive functions after traumatic brain injury: a systematic review, meta-analysis and clinical recommendations. *Neuropsychol Rehabil*. 2008;18:257–299.
394. Cherney LR, Patterson JP, Raymer A, Frymark T, Schooling T. Evidence-based systematic review: effects of intensity of treatment and constraint-induced language therapy for individuals with stroke-induced aphasia. *J Speech Lang Hear Res*. 2008;51:1282–1299.
395. Lundgren K, Brownell H, Roy S, Cayer-Meade C. A metaphor comprehension intervention for patients with right hemisphere brain damage: a pilot study. *Brain Lang*. 2006;99:69–70.
396. Stablum F, Umiltà C, Mogentale C, Carlan M, Guerrini C. Rehabilitation of executive deficits in closed head injury and anterior communicating artery aneurysm patients. *Psychol Res*. 2000;63:265–278.
397. van der Gaag A, Smith L, Davis S, Moss B, Cornelius V, Laing S, Mowles C. Therapy and support services for people with long-term stroke and aphasia and their relatives: a six-month follow-up study. *Clin Rehabil*. 2005;19:372–380.
398. Rode G, Pisella L, Rosetti Y, Farnè A, Boisson D. Bottom-up transfer of sensory-motor plasticity to recovery of spatial cognition: visuomotor adaptation and spatial neglect. *Prog Brain Res*. 2003;142:273–287.
399. Kaschel R, Della Sala S, Cantagallo A, Fahlböck A, Laaksonen R, Kazen M. Imagery mnemonics for the rehabilitation of memory: a randomised group controlled trial. *Neuropsychol Rehabil*. 2002;12:127–153.
400. Yasuda K, Misu T, Beckman B, Watanabe O, Ozawa Y, Nakamura T. Use of an IC recorder as voice output memory aid for patients with prospective memory impairment. *Neuropsychol Rehabil*. 2002;12:155–166.
401. House A, Knapp P, Bamford J, Vail A. Mortality at 12 and 24 months after stroke may be associated with depressive symptoms at 1 month. *Stroke*. 2001;32:696–701.
402. Sturm JW, Donnan GA, Dewey HM, Macdonell RA, Gilligan AK, Srikanth V, Thrift AG. Quality of life after stroke: the North East Melbourne Stroke Incidence Study (NEMESIS). *Stroke*. 2004;35:2340–2345.
403. Angeleri F, Angeleri VA, Foschi N, Giaquinto S, Nolfe G, Saginario A, Signorino M. Depression after stroke: an investigation through catamnesis. *J Clin Psychiatry*. 1997;58:261–265.
404. Aström M, Adolfsson R, Asplund K. Major depression in stroke patients: a 3-year longitudinal study. *Stroke*. 1993;24:976–982.
405. Gordon WA, Hibbard MR. Poststroke depression: an examination of the literature. *Arch Phys Med Rehabil*. 1997;78:658–663.
406. Berg A, Palomäki H, Lehtihalmes M, Lönnqvist J, Kaste M. Poststroke depression: an 18-month follow-up. *Stroke*. 2003;34:138–143.
407. Salter K, Bhogal S, Teasell R, Foley N, Speechley M. Post-stroke depression. *Evidence-Based Review of Stroke Rehabilitation.* 12th ed. 2008. EBRSR Web site. Available at: http://www.ebrsr.com/reviews_details.php?Post-Stroke-Depression-8. Accessed February 23, 2009.
408. Carota A, Berney A, Aybek S, Iaria G, Staub F, Ghika-Schmid F, Annable L, Guex P, Bogousslavsky J. A prospective study of predictors of poststroke depression. *Neurology*. 2005;64:428–433.
409. Nannetti L, Paci M, Pasquini J, Lombardi B, Taiti PG. Motor and functional recovery in patients with post-stroke depression. *Disabil Rehabil*. 2005;27:170–175.
410. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry*. 1961;4:561–571.
411. Radloff LS. The CES-D Scale. *Appl Psychol Meas*. 1977;1:385–401.
412. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, Leirer VO. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res*. 1982–1983;17:37–49.
413. Hamilton M. Development of a rating scale for primary depressive illness. *Br J Soc Clin Psychol*. 1967;6:278–296.
414. Williams LS, Brizendine EJ, Plue L, Bakas T, Tu W, Hendrie H, Kroenke K. Performance of the PHQ-9 as a screening tool for depression after stroke. *Stroke*. 2005;36:635–638.
415. Schmitz N, Wang J, Malla A, Lesage A. Joint effect of depression and chronic conditions in disability: results from a population-based study. *Psychosom Med*. 2007;69:332–338.

416. Hackett ML, Anderson CS, House AO, Xia J. Interventions for treating depression after stroke. *Cochrane Database Syst Rev*. 2008 Oct 8;(4); CD003437.
417. Brown SL, Salive ME, Guralnik JM, Pahor M, Chapman DP, Blazer D. Antidepressant use in the elderly: association with demographic characteristics, health-related factors and health care utilization. *J Clin Epidemiol*. 1995;48:445–453.
418. Lipsey JR, Robinson RG, Pearlson GD, Rao K, Price TR. Nortriptyline treatment of post-stroke depression: a double-blind study. *Lancet*. 1984; 1:297–300.
419. Robinson RG, Schultz SK, Castillo C, Kopel T, Kosier JT, Newman RM, Curdue K, Petracca G, Starkstein SE. Nortriptyline versus fluoxetine in the treatment of depression and in short-term recovery after stroke: a placebo-controlled, double-blind study. *Am J Psychiatry*. 2000; 157:351–359.
420. Williams LS, Kroenke K, Bakas T, Plue LD, Brizendine E, Tu W, Hendrie H. Care management of poststroke depression: a randomized, controlled trial. *Stroke*. 2007;38:998–1003.
421. Turner-Stokes L, MacWalter R; Guideline Development Group of the British Society of Rehabilitation Medicine; British Geriatrics Society; Royal College of Physicians London. Use of antidepressant medication following acquired brain injury: concise guidance. *Clin Med*. 2005;5: 268–274.
422. Wijdicks EF, Scott JP. Pulmonary embolism associated with acute stroke. *Mayo Clin Proc*. 1997;72:297–300.
423. Bernhardt J, Dewey H, Thrift A, Collier J, Donnan G. A Very Early Rehabilitation Trial for Stroke (AVERT): phase II safety and feasibility. *Stroke*. 2008;36:1390–1396.
424. Kamran SI, Downey D, Ruff RL. Pneumatic sequential compression reduces the risk of deep vein thrombosis in stroke patients. *Neurology*. 1998;50:1683–1688.
425. Braden BJ, Bergstrom N. Clinical utility of the Braden scale for predicting pressure sore risk. *Decubitus*. 1989;2:44–46, 50–51.
426. Bergstrom N, Braden B, Kemp M, Champagne M, Ruby E. Predicting pressure ulcer risk: a multisite study of the predictive validity of the Braden Scale. *Nurs Res*. 1998;47:261–269.
427. Watkins CL, Leathley MJ, Gegson JM, Moore AP, Smith TL, Sharma AK. Prevalence of spasticity post stroke. *Clin Rehabil*. 2002;16: 515–522.
428. Brashear A, Gordon MF, Elovic E, Kassicieh VD, Marciniak C, Do M, Lee CH, Jenkins S, Turkel C; Botox Post-Stroke Spasticity Study Group. Intramuscular injection of botulinum toxin for the treatment of wrist and finger spasticity after a stroke. *N Engl J Med*. 2002;347:395–400.
429. Childers MK. Targeting the neuromuscular junction in skeletal muscles. *Am J Phys Med Rehabil*. 2004;83:S38–S44.
430. Meythaler JM, Guin-Renfroe S, Brunner RC, Hadley MN. Intrathecal baclofen for spastic hypertonia from stroke. *Stroke*. 2001;32: 2099–2109.
431. Galvan TJ. Dysphagia: going down and staying down. *Am J Nurs*. 2001;101:37–42.
432. Iwamoto T, Fukuda S, Kikawada M, Takasaki M, Imamura T. Prognostic implications of swallowing ability in elderly patients after initial recovery from stroke. *J Gerontol A Biol Sci Med Sci*. 2005;60:120–124.
433. Finestone HM, Greene-Finestone LS, Wilson ES, Teasell RW. Malnutrition in stroke patients on the rehabilitation service and at follow up: prevalence and predictors. *Arch Phys Med Rehabil*. 1995;76:310–316.
434. Westergren A, Ohlsson O, Rahm Hallberg I. Eating difficulties, complications and nursing interventions during a period of three months after a stroke. *J Adv Nurs*. 2001;35:416–426.
435. Jönsson AC, Lindgren L, Norrving B, Lindgren A. Weight loss after stroke: a population-based study from the Lund Stroke Register. *Stroke*. 2008;39:918–923.
436. Munoz R, Duran-Cantolla J, Martínez-Vila E, Gallego J, Rubio R, Aizpuru F, De La Torre G. Severe sleep apnea and risk of ischemic stroke in the elderly. *Stroke*. 2006;37:2317–2321.
437. Arzt M, Young T, Finn L, Skatrud JB, Ryan CM, Newton GE, Mak S, Parker JD, Floras JS, Bradley TD. Sleepiness and sleep in patients with both systolic heart failure and obstructive sleep apnea. *Arch Intern Med*. 2006;166:1716–1722.
438. Lavie P, Lavie L. Is the severity of sleep apnea associated with ischemic stroke in the elderly? *Stroke*. 2007;38:249; author reply 250.
439. Marin JM, Carrizo SJ, Vicente E, Agusti AG. Long-term cardiovascular outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study. *Lancet*. 2005;365:1046–1053.
440. Bladin CF, Alexandrov AV, Bellavance A, Bornstein N, Chambers B, Coté R, Lebrun L, Pirisi A, Norris JW. Seizures after stroke: a prospective multicenter study. *Arch Neurol*. 2000;57:1617–1622.
441. Szaflarski JP, Rackley AY, Kleindorfer DO, Khoury J, Woo D, Miller R, Alwell K, Broderick JP, Kissela BM. Incidence of seizures in the acute phase of stroke: a population based study. *Epilepsia*. 2008;49: 974–981.
442. Thanvi B, Treadwell S, Robinson T. Early neurological deterioration in acute ischaemic stroke: predictors, mechanisms and management. *Postgrad Med J*. 2008;84:412–417.
443. Alberti A, Paciaroni M, Caso V, Venti M, Palmerini F, Agnelli G. Early seizures in patients with acute stroke: frequency, predictive factors, and effect on clinical outcome. *Vasc Health Risk Manag*. 2008;4:715–720.
444. Garrett MC, Komotar RJ, Starke RM, Merkow MB, Otten ML, Connolly ES. Predictors of seizure onset after intracerebral hemorrhage and the role of long-term antiepileptic therapy. *J Crit Care*. 2009;24:335–339.
445. Secrest J. Rehabilitation and rehabilitative nursing. In: Mauk KL, ed. *The Specialty Practice of Rehabilitation Nursing: A Core Curriculum*. Chicago, Ill: Association of Rehabilitation Nursing; 2007:2–12. Accessed March 15, 2009.
446. American Association of Colleges of Nursing. *The Essentials of Baccalaureate Education for Professional Nursing Practice*. Washington, DC: American Association of Colleges of Nursing; 2008.
447. Teasell R, Foley N, Bhogal SK, Speechley M. Outpatient stroke rehabilitation. *Evidence-Based Review of Stroke Rehabilitation*. 12th ed. 2008. EBRSR Web site. Available at: http://www.ebrsr.com/reviews_details.php?Outpatient-Stroke-Rehabilitation-32.
448. Korner-Bitensky N, Desrosiers J, Rochette A. A national survey of occupational therapists' practices related to participation post-stroke. *J Rehabil Med*. 2008;40:291–297.
449. Ekstam L, Uppgard B, von Koch L, Tham K. Functioning in everyday life after stroke: a longitudinal study of elderly people receiving rehabilitation at home. *Scand J Caring Sci*. 2007;21:434–446.
450. Poulin V, Desrosiers J. Participation after stroke: comparing proxies' and patients' perceptions. *J Rehabil Med*. 2008;40:28–35.
451. Burton CR. Living with stroke: a phenomenological study. *J Adv Nurs*. 2000;32:301–309.
452. Studenski S, Duncan PW, Perera S, Reker D, Lai SM, Richards L. Daily functioning and quality of life in a randomized controlled trial of therapeutic exercise for subacute stroke survivors. *Stroke*. 2005;36: 1764–1770.
453. Pohl M, Werner C, Holzgraefe M, Kroczek G, Mehrholz J, Wingendorf I, Hoölig G, Koch R, Hesse S. Repetitive locomotor training and physiotherapy improve walking and basic activities of daily living after stroke: a single-blind, randomized multicentre trial (DEutsche GAngtrainerStudie, DEGAS). *Clin Rehabil*. 2007;21:17–27.
454. Donkervoort M, Dekker J, Deelman B. The course of apraxia and ADL functioning in left hemisphere stroke patients treated in rehabilitation centres and nursing homes. *Clin Rehabil*. 2006;20:1085–1093.
455. Desrosiers J, Bourbonnais D, Corriveau H, Gosselin S, Bravo G. Effectiveness of unilateral and symmetrical bilateral task training for arm during the subacute phase after stroke: a randomized controlled trial. *Clin Rehabil*. 2005;19:581–593.
456. Mead GE, Greig CA, Cunningham I, Lewis SJ, Dinan S, Saunders DH, Fitzsimons C, Young A. Stroke: a randomized trial of exercise or relaxation. *J Am Geriatr Soc*. 2007;55:892–899.
457. Ng YS, Jung H, Tay SS, Bok CW, Chiong Y, Lim PA. Results from a prospective acute inpatient rehabilitation database: clinical characteristics and functional outcomes using the Functional Independence Measure. *Ann Acad Med Singapore*. 2007;36:3–10.
458. Ng YS, Stein J, Ning M, Black-Schaffer RM. Comparison of clinical characteristics and functional outcomes of ischemic stroke in different vascular territories. *Stroke*. 2007;38:2309–2314.
459. Gagnon D, Nadeau S, Tam V. Clinical and administrative outcomes during publicly-funded inpatient stroke rehabilitation based on a case-mix group classification model. *J Rehabil Med*. 2005;37:45–52.
460. Lipson DM, Sangha H, Foley NC, Bhogal S, Pohani G, Teasell RW. Recovery from stroke: differences between subtypes. *Int J Rehabil Res*. 2005;28:303–308.
461. Teasell R, Foley N, Bhogal S, Bagg S, Jutai J. Evidence-based practice and setting basic standards for stroke rehabilitation in Canada. *Top Stroke Rehabil*. 2006;13:59–65.
462. Suzuki M, Omori M, Hatakeyama M, Yamada S, Matsushita K, Iijima S. Predicting recovery of upper-body dressing ability after stroke. *Arch Phys Med Rehabil*. 2006;87:1496–1502.

463. Lai SM, Duncan PW, Keighley J, Johnson D. Depressive symptoms and independence in BADL and IADL. *J Rehabil Res Dev*. 2002;39:589–596.
464. Teasell RW, Foley NC, Bhogal SK, Chakravertty R, Bluvol A. A rehabilitation program for patients recovering from severe stroke. *Can J Neurol Sci*. 2005;32:512–517.
465. Logan PA, Gladman JR, Drummond AE, Radford KA; TOTAL Study Group. A study of interventions and related outcomes in a randomized controlled trial of occupational therapy and leisure therapy for community stroke patients. *Clin Rehabil*. 2003;17:249–255.
466. Liu KP, Chan CC, Lee TM, Hui-Chan CW. Mental imagery for promoting relearning for people after stroke: a randomized controlled trial. *Arch Phys Med Rehabil*. 2004;85:1403–1408.
467. Grimby G, Andrén E, Daving Y, Wright B. Dependence and perceived difficulty in daily activities in community-living stroke survivors 2 years after stroke: a study of instrumental structures. *Stroke*. 1998;29:1843–1849.
468. Gillen R, Tennen H, McKee T. The impact of the inpatient rehabilitation facility prospective payment system on stroke program outcomes. *Am J Phys Med Rehabil*. 2007;86:356–363.
469. De Wit L, Putman K, Schuback B, Komárek A, Angst F, Baert I, Berman P, Bogaerts K, Brinkmann N, Connell L, Dejaeger E, Feys H, Jenni W, Kaske C, Lesaffre E, Leys M, Lincoln N, Louckx F, Schupp W, Smith B, De Weerdt W. Motor and functional recovery after stroke: a comparison of 4 European rehabilitation centers. *Stroke*. 2007;38:2101–2107.
470. Hartman-Maeir A, Soroker N, Ring H, Avni N, Katz N. Activities, participation and satisfaction one-year post stroke. *Disabil Rehabil*. 2007;29:559–566.
471. Sackley C, Wade DT, Mant D, Atkinson JC, Yudkin P, Cardoso K, Levin S, Lee VB, Reel K. Cluster randomized pilot controlled trial of an occupational therapy intervention for residents with stroke in UK care homes. *Stroke*. 2006;37:2336–2341.
472. Tompkins CA, Lehman MT, Wyatt AD, Schulz R. Functional outcome assessment of adults with right hemisphere brain damage. *Semin Speech Lang*. 1998;19:303–321.
473. Samsa GP, Matchar DB. How strong is the relationship between functional status and quality of life among persons with stroke? *J Rehabil Res Dev*. 2004;41:279–282.
474. Hirsch F, Holland A. Beyond activity: measuring participation in society and quality of life. In: Worrall LE, Frattali CM, eds. *Neurogenic Communication Disorders: A Functional Approach.* New York, NY: Thieme; 2000.
475. Stuss DT, Murphy KJ, Binns MA, Alexander MP. Staying on the job: the frontal lobes control individual performance variability. *Brain*. 2003;126:2363–2380.
476. Beaumont JG, Marjoribanks J, Flury S, Lintern T. A screening test of auditory comprehension for individuals with severe physical disability (PACST). *Br J Clin Psychol*. 1999;38(part 1):1–4.
477. Ross KB, Wertz RT. Accuracy of formal tests for diagnosing mild aphasia: an application of evidence-based medicine. *Aphasiology*. 2004;18:337–355.
478. Bernicot J, Dardier V. Communication deficits: assessment of subjects with frontal lobe damage in an interview setting. *Int J Lang Commun Disord*. 2001;36:245–263.
479. Li E, Ritterman S, Della Volpe A, Williams S. Variation in grammatic complexity across three types of discourse. *J Speech Lang Pathol Audiol*. 1996;20:180–186.
480. Prins R, Bastiaanse R. Analyzing the spontaneous speech of aphasic speakers. *Aphasiology*. 2004;18:1075–1091.
481. van de Sandt-Koenderman M. High-tech AAC and aphasia: widening horizons? *Aphasiology*. 2004;18:245–263.
482. Mazer B, Sofer S, Korner-Bitensky N, Gelinas I, Hanley J, Wood-Dauphinee S. Effectiveness of a visual attention retraining program on the driving performance of clients with stroke. *Arch Phys Med Rehabil*. 2003;84:541–550.
483. Treger I, Shames J, Giaquinto S, Ring H. Return to work in stroke patients. *Disabil Rehabil*. 2007;29:1397–1403.
484. Teasell RW, McRae MP, Finestone HM. Social issues in the rehabilitation of younger stroke patients. *Arch Phys Med Rehabil*. 2000;81:205–209.
485. Varona JF, Bermejo F, Guerra JM, Molina JA. Long-term prognosis of ischemic stroke in young adults: study of 272 cases. *J Neurol.* 2004;251:1507–1514.
486. Hsieh CL, Lee MH. Factors influencing vocational outcomes following stroke in Taiwan: a medical centre-based study. *Scand J Rehabil Med*. 1997;29:113–120.
487. Wozniak MA, Kittner SJ. Return to work after ischemic stroke: a methodological review. *Neuroepidemiology*. 2002;21:159–166.
488. Yap EC, Chua KS. Rehabilitation outcome after primary subarachnoid haemorrhage. *Brain Inj*. 2002;16:491–499.
489. Medin J, Barajas J, Ekberg K. Stroke patients' experiences of return to work. *Disabil Rehabil*. 2006;28:1051–1060.
490. Koch L, Egbert N, Coeling H, Ayers D. Returning to work after the onset of illness: experiences of right hemisphere stroke survivors. *Rehabil Counsel Bull*. 2005;48:209–218.
491. Vestling M, Tufvesson B, Iwarsson S. Indicators for return to work after stroke and the importance of work for subjective well-being and life satisfaction. *J Rehabil Med*. 2003;35:127–131.
492. Saeki S, Ogata H, Okubo T, Takahashi K, Hoshuyama T. Return to work after stroke: a follow-up study. *Stroke*. 1995;26:399–401.
493. Hinckley JJ. Vocational and social outcomes of adults with chronic aphasia. *J Commun Disord*. 2002;35:543–560.
494. Black-Schaffer RM, Osberg JS. Return to work after stroke: development of a predictive model. *Arch Phys Med Rehabil*. 1990;71:285–290.
495. Shaw L, Segal R, Polatajko H, Harburn K. Understanding return to work behaviours: promoting the importance of individual perceptions in the study of return to work. *Disabil Rehabil*. 2002;24:185–195.
496. Ownsworth T, Shum D. Relationship between executive functions and productivity outcomes following stroke. *Disabil Rehabil*. 2008;30:531–540.
497. Alaszewski A, Alaszewski H, Potter J, Penhale B. Working after a stroke: survivors' experiences and perceptions of barriers to and facilitators of the return to paid employment. *Disabil Rehabil*. 2007;29:1858–1869.
498. Gabriele W, Renate S. Work loss following stroke. *Disabil Rehabil.* 2009;31:1487–1493.
499. Mennemeyer ST, Taub E, Uswatte G, Pearson S. Employment in households with stroke after Constraint-Induced Movement therapy. *NeuroRehabilitation*. 2006;21:157–165.
500. Chan ML. Description of a return-to-work occupational therapy programme for stroke rehabilitation in Singapore. *Occup Ther Int.* 2008;15:87–99.
501. National Institute of Neurological Disorders Stroke rt-PA Stroke Study Group. Recombinant tissue plasminogen activator for minor strokes: the National Institute of Neurological Disorders and Stroke rt-PA Stroke Study experience. *Ann Emerg Med.* 2005;46:243–252.
502. American Nurses Association. *Nursing: Scope and Standards of Practice.* Silver Spring, Md: American Nurses Association; 2004.
503. Association of Rehabilitation Nursing. *Standards and Scope of Rehabilitation Nursing Practice.* Glenview, Ill: Association of Rehabilitation Nursing; 2008.
504. Sacco RL, Adams R, Albers G, Alberts MJ, Benavente O, Furie K, Goldstein LB, Gorelick P, Halperin J, Harbaugh R, Johnston SC, Katzan I, Kelly-Hayes M, Kenton EJ, Marks M, Schwamm LH, Tomsick T; American Heart Association; American Stroke Association Council on Stroke; Council on Cardiovascular Radiology and Intervention; American Academy of Neurology. Guidelines for prevention of stroke in patients with ischemic stroke or transient ischemic attack: a statement for healthcare professionals from the American Heart Association/American Stroke Association Council on Stroke: co-sponsored by the Council on Cardiovascular Radiology and Intervention: the American Academy of Neurology affirms the value of this guideline. *Stroke*. 2006;37:577–617.
505. Adams RJ, Albers G, Alberts MJ, Benavente O, Furie K, Goldstein LB, Gorelick P, Halperin J, Harbaugh R, Johnston SC, Katzan I, Kelly-Hayes M, Kenton EJ, Marks M, Sacco RL, Schwamm LH; American Heart Association; American Stroke Association. Update to the AHA/ASA recommendations for the prevention of stroke in patient with stroke and transient ischemic attack. *Stroke*. 2008;39:1647–1652.
506. Swain MA, Steckel SB. Influencing adherence among hypertensives. *Res Nurs Health*. 1981;4:213–222.
507. Daltroy LH, Godin G. The influence of spousal approval and patient perception of spousal approval on cardiac participation in exercise programs. *J Cardiopulm Rehabil Prev*. 1989;9:363–367.
508. Edmonds D, Foerster E, Groth H, Greminger P, Siegenthaler W, Vetter W. Does self-measurement of blood pressure improve patient compliance in hypertension? *J Hypertens Suppl*. 1985;3:S31–S34.

509. Morisky DE, Levine DM, Green LW, Shapiro S, Russell RP, Smith CR. Five-year blood pressure control and mortality following health education for hypertensive patients. *Am J Public Health*. 1983;73:153–162.
510. Oldridge NB, Jones NL. Improving patient compliance in cardiac rehabilitation: effects of written agreement and self-monitoring. *J Cardiopulm Rehabil*. 1983;3:257–262.
511. Taylor CB, Houston-Miller N, Killen JD, DeBusk RF. Smoking cessation after acute myocardial infarction: effects of a nurse-managed intervention. *Ann Intern Med*. 1990;113:118–123.
512. Ovbiagele B, Kidwell CS, Selco S, Razinia T, Saver JL. Treatment adherence rates one year after initiation of a systematic hospital-based stroke prevention program. *Cerebrovasc Dis*. 2005;20:280–282.
513. van den Heuvel ET, de Witte LP, Nooyen-Haazen I, Sanderman R, Meyboom-de Jong B. Short-term effects of a group support program and an individual support program for caregivers of stroke patients. *Patient Educ Couns*. 2000;40:109–120.
514. King RB, Semik PE. Stroke caregiving: difficult times, resource use, and needs during the first 2 years. *J Gerontol Nurs*. 2006;32:37–44.
515. Lincoln NB, Francis VM, Lilley SA, Sharma JC, Summerfield M. Evaluation of a stroke family support organiser: a randomized controlled trial. *Stroke*. 2003;34:116–121.
516. Broderick J, Brott T, Kothari R, Miller R, Khoury J, Pancioli A, Gebel J, Mills D, Minneci L, Shukla R. The Greater Cincinnati/Northern Kentucky Stroke Study: preliminary first-ever and total incidence rates of stroke among blacks. *Stroke*. 1998;29:415–421.
517. Claxton AJ, Cramer J, Pierce C. A systematic review of the associations between dose regimens and medication compliance. *Clin Ther*. 2001; 23:1296–1310.
518. Miller E. Prevention of transient ischemic attack and stroke in older adults: implementing evidence-based interventions. *J Gerontol Nurs*. 2007;33:26–37.
519. Paul SL, Dewey HM, Sturm JW, Macdonell RA, Thrift AG. Prevalence of depression and use of antidepressant medication at 5-years poststroke in the North East Melbourne Stroke Incidence Study. *Stroke*. 2006;37: 2854–2855.
520. Clark PC, Dunbar SB, Aycock DM, Courtney E, Wolf SL. Caregiver perspectives of memory and behavior changes in stroke survivors. *Rehabil Nurs*. 2006;31:26–32.
521. Paradiso S, Robinson RG. Gender differences in poststroke depression. *J Neuropsychiatry Clin Neurosci*. 1998;10:41–47.
522. Reynolds SL, Haley WE, Kozlenko N. The impact of depressive symptoms and chronic diseases on active life expectancy in older Americans. *Am J Geriatr Psychiatry*. 2008;16:425–432.
523. Koton S, Tanne D, Bornstein NM, Green MS. Triggering risk factors for ischemic stroke: a case-crossover study. *Neurology*. 2004;63: 2006–2010.
524. Kuroda A, Kanda T, Sakai F. Gender differences in health-related quality of life among stroke patients. *Geriatr Gerontol Int*. 2006;6: 165–173.
525. Wilz G. Predictors of subjective impairment after stroke: influence of depression, gender, and severity of stroke. *Brain Inj*. 2007;21:39–45.
526. Cronqvist A, Klang B, Björvell H. The use and efficacy of coping strategies and coping styles in a Swedish sample. *Qual Life Res*. 1997; 6:87–96.
527. Leys D, Hénon H, Mackowiak-Cordoliani MA, Pasquier F. Poststroke dementia. *Lancet*. 2005;4:752–759.
528. Cotugna N, Vickery CE, Carpenter-Haefele KM. Evaluation of literacy level of patient education pages in health-related journals. *J Community Health*. 2005;30:213–219.
529. Maclean N, Pound P, Wolfe C, Rudd A. The concept of patient motivation: a qualitative analysis of stroke professionals' attitudes. *Stroke*. 2002;33:444–448.
530. Mosca L, Banka CL, Benjamin EJ, Berra K, Bushnell C, Dolor RJ, Ganiats TG, Gomes AS, Gornik HL, Gracia C, Gulati M, Haan CK, Judelson DR, Keenan N, Kelepouris E, Michos ED, Newby LK, Oparil S, Ouyang P, Oz MC, Petitti D, Pinn VW, Redberg RF, Scott R, Sherif K, Smith SC Jr, Sopko G, Steinhorn RH, Stone NJ, Taubert KA, Todd BA, Urbina E, Wenger NK; Expert Panel/Writing Group; American Heart Association; American Academy of Family Physicians; American College of Obstetricians and Gynecologists; American College of Cardiology Foundation; Society of Thoracic Surgeons; American Medical Women's Association; Centers for Disease Control and Prevention; Office of Research on Women's Health; Association of Black Cardiologists; American College of Physicians; World Heart Federation; National Heart, Lung, and Blood Institute; American College of Nurse Practitioners. Evidence-based guidelines for cardiovascular disease prevention in women: 2007 update [published correction appears in *Circulation*. 2007;115:e407]. *Circulation*. 2007;115: 1481–1501.
531. Hylek E, D'Antonio J, Evans-Molina C, Shea C, Henault LE, Regan S. Translating the results of randomized trials into clinical practice: the challenge of warfarin candidacy among hospitalized elderly patients with atrial fibrillation. *Stroke*. 2006;37:1075–1080.
532. Geyh S, Cieza A, Schouten J, Dickson H, Frommelt P, Omar Z, Kostanjsek N, Ring H, Stucki G. ICF Core Sets for stroke. *J Rehabil Med.* 2004 Jul;(44 suppl):135–141.
533. Dewey HM, Thrift AG, Mihalopoulos C, Carter R, Macdonell RA, McNeil JJ, Donnan GA. Informal care for stroke survivors: results from the North East Melbourne Stroke Incidence Study (NEMESIS). *Stroke*. 2002;33:1028–1033.
534. Maeshima S, Ueyoshi A, Osawa A, Ishida K, Kunimoto K, Shimamoto Y, Matsumoto T, Yoshida M. Mobility and muscle strength contralateral to hemiplegia from stroke: benefit from self-training with family support. *Am J Phys Med Rehabil*. 2003;82:456–462.
535. Tsouna-Hadjis E, Vemmos K, Zakopoulos N, Stamatelopoulos S. First-stroke recovery process: the role of family social support. *Arch Phys Med Rehabil*. 2000;81:881–887.
536. King RB, Shade-Zeldow Y, Carlson CE, Feldman JL, Philip M. Adaptation to stroke: a longitudinal study of depressive symptoms, physical health, and coping process. *Top Stroke Rehabil*. 2002;9:46–66.
537. Glass TA, Matchar DB, Belyea M, Feussner JR. Impact of social support on outcome in first stroke. *Stroke*. 1993;24:64–70.
538. Han B, Haley WE. Family caregiving for patients with stroke: review and analysis. *Stroke*. 1999;30:1478–1485.
539. Tooth L, McKenna K, Barnett A, Prescott C, Murphy S. Caregiver burden, time spent caring and health status in the first 12 months following stroke. *Brain Inj*. 2005;19:963–974.
540. Berg A, Palomäki H, Lönnqvist J, Lehtihalmes M, Kaste M. Depression among caregivers of stroke survivors. *Stroke*. 2005;36:639–643.
541. Bakas T, Champion V. Development and psychometric testing of the Bakas Caregiving Outcomes Scale. *Nurs Res*. 1999;48:250–259.
542. King R, Shade-Zeldow Y, Carlson C, Knafl K, Roth E. Early adaptation to stroke: patient and primary support person. *Rehabil Nurs Res*. 1995; 4:82–89.
543. Bakas T, Kroenke K, Plue LD, Perkins SM, Williams LS. Outcomes among family caregivers of aphasic versus nonaphasic stroke survivors. *Rehabil Nurs*. 2006;31:33–42.
544. Schulz R, Beach SR. Caregiving as a risk factor for mortality: the Caregiver Health Effects Study. *JAMA*. 1999;282:2215–2219.
545. Bakas T, Austin JK, Okonkwo KF, Lewis RR, Chadwick L. Needs, concerns, strategies, and advice of stroke caregivers the first 6 months after discharge. *J Neurosci Nurs*. 2002;34:242–251.
546. van Heugten C, Visser-Meily A, Post M, Lindeman E. Care for carers of stroke patients: evidence-based clinical practice guidelines. *J Rehabil Med*. 2006;38:153–158.
547. Sulch D, Melbourn A, Perez I, Kalra L. Integrated care pathways and quality of life on a stroke rehabilitation unit. *Stroke*. 2002;33: 1600–1604.
548. Smith J, Forster A, Young J. A randomized trial to evaluate an education programme for patients and carers after stroke. *Clin Rehabil*. 2004;18: 726–736.
549. Teng J, Mayo NE, Latimer E, Hanley J, Wood-Dauphinee S, Côté R, Scott S. Costs and caregiver consequences of early supported discharge for stroke patients. *Stroke*. 2003;34:528–536.
550. Anderson C, Rubenach S, Mhurchu CN, Clark M, Spencer C, Winsor A. Home or hospital for stroke rehabilitation? Results of a randomized controlled trial, I: health outcomes at 6 months. *Stroke*. 2000;31: 1024–1031.
551. Holmqvist LW, von Koch L, de Pedro-Cuesta J. Use of healthcare, impact on family caregivers and patient satisfaction of rehabilitation at home after stroke in southwest Stockholm. *Scand J Rehabil Med*. 2000; 32:173–179.
552. Jones AL, Charlesworth JF, Hendra TJ. Patient mood and carer strain during stroke rehabilitation in the community following early hospital discharge. *Disabil Rehabil*. 2000;22:490–494.
553. Rudd AG, Wolfe CD, Tilling K, Beech R. Randomised controlled trial to evaluate early discharge scheme for patients with stroke [published correction appears in *BMJ*. 1998;316:435]. *BMJ*. 1997;315:1039–1044.

554. Bakas T. Stroke and the family. In: Stein J, Harvey R, Macko R, Winstein C, Zorowitz R, eds. *Stroke Recovery and Rehabilitation.* New York, NY: Demos Medical Publishing; 2009.
555. Visser-Meily A, van Heugten C, Post M, Schepers V, Lindeman E. Intervention studies for caregivers of stroke survivors: a critical review. *Patient Educ Couns*. 2005;56:257–267.
556. Family Caregiver Alliance. *Caregiver Assessment: Principle, Guidelines and Strategies for Change.* Report from a National Consensus Development Conference (Vol. 1). San Francisco, Calif: Family Caregiver Alliance; 2006.
557. Visser-Meily JM, Post MW, Riphagen II, Lindeman E. Measures used to assess burden among caregivers of stroke patients: a review. *Clin Rehabil*. 2004;18:601–623.
558. Bakas T, Austin JK, Jessup SL, Williams LS, Oberst MT. Time and difficulty of tasks provided by family caregivers of stroke survivors. *J Neurosci Nurs*. 2004;36:95–106.
559. Clark PC, Shields CG, Aycock D, Wolf SL. Preliminary reliability and validity of a family caregiver conflict scale for stroke. *Prog Cardiovasc Nurs*. 2003;18:77–82, 92.
560. Bakas T, Farran CJ, Austin JK, Given BA, Johnson EA, Williams LS. Content validity and satisfaction with a stroke caregiver intervention program. *J Nurs Scholarsh*. 2009;41:368–375.
561. Bakas T, Farran CJ, Austin JK, Given BA, Johnson EA, Williams LS. Stroke caregiver outcomes from the Telephone Assessment and Skill-Building Kit (TASK). *Top Stroke Rehabil*. 2009;16:105–121.
562. Dennis M, O'Rourke S, Slattery J, Staniforth T, Warlow C. Evaluation of a stroke family care worker: results of a randomized controlled trial. *BMJ*. 1997;314:1071–1076.
563. Murray J, Young J, Forster A, Herbert G, Ashworth R. Feasibility study of a primary care-based model for stroke aftercare. *Br J Gen Pract*. 2006;56:775–780.
564. Pierce LL, Steiner V, Hicks B, Holzaepfel AL. Problems of new caregivers of persons with stroke. *Rehabil Nurs*. 2006;31:166–172.
565. Palmer S, Glass TA. Family function and stroke recovery: a review. *Rehabil Psychol*. 2003;48:255–265.
566. Visser-Meily A, Post M, Meijer AM, van de Port I, Maas C, Lindeman E. When a parent has a stroke: clinical course and prediction of mood, behavior problems, and health status of their young children. *Stroke*. 2005;36:2436–2440.
567. Harlow A, Murray LL. Addressing the needs of adolescent children when a parent becomes aphasic: one family's experiences. *Top Stroke Rehabil*. 2001;7:46–51.
568. Ski C, O'Connell B. Stroke: the increasing complexity of carer needs. *J Neurosci Nurs*. 2007;39:172–179.
569. Evans RL, Matlock AL, Bishop DS, Stranahan S, Pederson C. Family intervention after stroke: does counseling or education help? *Stroke*. 1988;19:1243–1249.
570. Kalra L, Evans A, Perez I, Melbourn A, Patel A, Knapp M, Donaldson N. Training carers of stroke patients: randomised controlled trial. *BMJ*. 2004;328:1099–1103.
571. Goldberg G, Segal ME, Berk SN, Schall RR, Gershkoff AM. Stroke transition after inpatient rehabilitation. *Top Stroke Rehabil*. 1997;4:64–479.
572. Printz-Feddersen V. Group process effect on caregiver burden. *J Neurosci Nurs*. 1990;22:164–168.
573. Smith J, Forster A, House A, Knapp P, Wright J, Young J. Information provision for stroke patients and their caregivers. *Cochrane Database Syst Rev.* 2008 Apr 16;(2):CD001919.
574. Grant JS. Social problem-solving partnerships with family caregivers. *Rehabil Nurs*. 1999;24:254–260.
575. Grant JS, Elliott TR, Giger JN, Bartolucci AA. Social problem-solving telephone partnerships with family caregivers of persons with stroke. *Int J Rehabil Res*. 2001;24:181–189.
576. King RB, Hartke RJ, Denby F. Problem-solving early intervention: a pilot study of stroke caregivers. *Rehabil Nurs*. 2007;32:68–76, 84.
577. Forster A, Young J. Specialist nurse support for patients with stroke in the community: a randomised controlled trial. *BMJ*. 1996;312:1642–1646.
578. Kotila M, Numminen H, Waltimo O, Kaste M. Depression after stroke: results of the FINNSTROKE Study. *Stroke*. 1998;29:368–372.
579. Larson J, Franzén-Dahlin A, Billing E, Arbin M, Murray V, Wredling R. The impact of a nurse-led support and education programme for spouses of stroke patients: a randomized controlled trial. *J Clin Nurs*. 2005;14:995–1003.
580. Lee J, Soeken K, Picot SJ. A meta-analysis of interventions for informal stroke caregivers. *West J Nurs Res*. 2007;29:344–356.
581. Mant J, Carter J, Wade DT, Winner S. Family support for stroke: a randomised controlled trial. *Lancet*. 2000;356:808–813.
582. Mant J, Winner S, Roche J, Wade DT. Family support for stroke: one year follow up of a randomised controlled trial. *J Neurol Neurosurg Psychiatry*. 2005;76:1006–1008.
583. Pain H, McLellan D. The use of individualized booklets after a stroke. *Clin Rehabil*. 1990;4:265–272.
584. Gordon NF, Gulanick M, Costa F, Fletcher G, Franklin BA, Roth EJ, Shephard T; American Heart Association Council on Clinical Cardiology, Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascular Nursing; the Council on Nutrition, Physical Activity, and Metabolism; and the Stroke Council. Physical activity and exercise recommendations for stroke survivors: an American Heart Association scientific statement from the Council on Clinical Cardiology, Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascular Nursing; the Council on Nutrition, Physical Activity, and Metabolism; and the Stroke Council. *Stroke*. 2004;35:1230–1240.
585. Rodgers H, Atkinson C, Bond S, Suddes M, Dobson R, Curless R. Randomized controlled trial of a comprehensive stroke education program for patients and caregivers. *Stroke*. 1999;30:2585–2591.
586. Braithwaite V, McGown A. Caregivers' emotional well-being and their capacity to learn about stroke. *J Adv Nurs*. 1993;18:195–202.
587. Ostwald SK, Wasserman J, Davis S. Medications, comorbidities, and medical complications in stroke survivors: the CAReS Study. *Rehabil Nurs*. 2006;31:10–14.
588. Draper B, Bowring G, Thompson C, Van Heyst J, Conroy P, Thompson J. Stress in caregivers of aphasic stroke patients: a randomized controlled trial. *Clin Rehabil*. 2007;21:122–130.
589. Cameron JI, Cheung AM, Streiner DL, Coyte PC, Stewart DE. Stroke survivors' behavioral and psychologic symptoms are associated with informal caregivers' experiences of depression. *Arch Phys Med Rehabil*. 2006;87:177–183.
590. McKinney M, Blake H, Treece KA, Lincoln NB, Playford EE, Gladman JR. Evaluation of cognitive assessment in stroke rehabilitation. *Clin Rehabil*. 2002;16:129–136.
591. Grant JS, Elliott TR, Weaver M, Bartolucci AA, Giger JN. Telephone intervention with family caregivers of stroke survivors after rehabilitation. *Stroke*. 2002;33:2060–2065.
592. Clark PC, Dunbar SB, Shields CG, Viswanathan B, Aycock DM, Wolf SL. Influence of stroke survivor characteristics and family conflict surrounding recovery on caregivers' mental and physical health. *Nurs Res*. 2004;53:406–413.
593. Ko JY, Aycock DM, Clark PC. A comparison of working versus nonworking family caregivers of stroke survivors. *J Neurosci Nurs*. 2007;39:217–225.
594. Lincoln NB, Flannaghan T. Cognitive behavioral psychotherapy for depression following stroke: a randomized controlled trial. *Stroke*. 2003;34:111–115.
595. Cassel CK, Foley KM. *Principles for Care of Patients at the End of Life: An Emerging Consensus Among Specialties of Medicine.* New York, NY: Milbank Memorial Fund; 1999.
596. Emanuel LL, von Guten CJ, Ferris FD. *Education for Physicians on End-of-Life Care.* Chicago, Ill: Robert Wood Johnson Foundation; 1999.
597. World Health Organization Web site. WHO definition of palliative care. Available at: http://www.who.int/cancer/palliative/definition/en/. Accessed July 11, 2008.
598. National Hospice and Palliative Care Organization. *NHPCO Facts and Figures: Hospice Care in America.* Alexandria Va: National Hospice and Palliative Care Organization; 2008.
599. US Department of Health and Human Services, Centers for Medicare and Medicaid Services. *Health Insurance for the Aged, Publication 21: The Hospice Manual (Revision 62), Chapter 2000: eligibility and coverage.* Available at: http://www.cms.hhs.gov/Manuals/PBM/list.asp. Accessed October 19, 2008.
600. Deleted in proof.
601. van Exel NJ, Scholte op Reimer WJ, Brouwer WB, van den Berg B, Koopmanschap MA, van den Bos GA. Instruments for assessing the burden of informal caregiving for stroke patients in clinical practice: a comparison of CSI, CRA, SCQ, and self-rated burden. *Clin Rehabil*. 2004;18:203–214.
602. Robinson BC. Validation of a Caregiver Strain Index. *J Gerontol*. 1983;38:344–348.

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Comprehensive Overview of Nursing and Interdisciplinary Rehabilitation Care of the Stroke Patient: A Scientific Statement From the American Heart Association

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AHA Scientific Statement

脳卒中患者の看護と集学的リハビリテーション

Comprehensive Overview of Nursing and Interdisciplinary Rehabilitation Care of the Stroke Patient

— A Scientific Statement From the American Heart Association

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はじめに

この声明書は，脳卒中後の急性期から慢性期に現在米国で行われている看護とリハビリテーションを含めた集学的ケアの科学的エビデンスを含めた声明書で，米国の脳卒中に対する集学的治療の現状を知るうえで非常に参考になるオーバービューである。内容的には世界保健機関（WHO）の国際生活機能分類［*International Classification for Functioning, Disability, and Health (ICF).* World Health Organization; 2008］を基盤として，急性期病院への入院から慢性期に至る各ステージでの身体および機能面のケア，日常生活と社会的活動を目指すケア，個人的および環境因子への対応が紹介され，終末期ケアについても触れている。

I. 序　文

米国においては発病後 30 日以内の死亡率が救急医療と急性脳卒中医療の進歩により低下しており，発症後 4 週間の集学的医療チームによる入院治療により死亡数が減少したというエビデンスがある。このような勇気づけられる面がある一方，脳卒中は慢性身体障害の最大の原因である。このため本声明書では，脳卒中患者とその家族に対する入院および外来リハビリテーション期，慢性期，終末期の集学的管理について，現在得られているエビデンスとそれに基づいた推奨を，WHO による ICF の次元（領域）に従って述べる。

A. WHO の国際生活機能分類モデル

WHO の ICF では脳卒中後の機能回復を，脳卒中および併存症，その状態が個々の患者に与える影響，個々の患者の個人的および環境的要素を含む背景因子（contextual factor）が互いに作用しあう多面的な過程として認識しており，**図**に示されているように，脳卒中の影響を次の 4 つの次元（dimension）に分けている。1）身体機能と身体構造の喪失は脳卒中の一次的（片麻痺や認知機能障害）または二次的（拘縮や褥瘡）結果として起こる身体構造と生理学的・心理学的障害を含む。2）活動の制限は ADL（日常生活動作）と器具の操作についての手段的 ADL（Instrumental ADL：IADL）を含む機能の障害を指す。3）参加の制限は脳卒中患者の日常生活への復帰，新しい生活の開始，社会的活動への復帰に際して遭遇する障害を指す。4）背景因子には，個々の脳卒中患者に特有な障害の認識や，ヘルスケアに影響を与える個人的または環境的因子が含まれる。個人的因子には性別，併存症，民族文化的背景など内的な特異性が含まれ，環境因子には家族のサポート，社会的風潮，建物の設計上の制限，ヘルスケアの資源など外的な特異性が含まれる。ICF では活動と参加の制限を分けているが，これらの次元は，臨床的に評価する場合には 1 つの概念として用いられている。従ってこの声明書でも活動と参加の制限を 1 つの次元として考える。個人的因子としては脳卒中二次予防に対する積極性，服薬上のコンプライアンス，適応能力，学習能力，うつ状態などがあげられ，主な環境因子としては家族内介護者の理解と支援があげられる。

B. 脳卒中患者の集学的ケア

脳卒中は複雑な疾患であり，集学的チームによる専門知識が要求される。組織だった集学的脳卒中ケアは死亡率を低下させ，施設入所者数と長期障害者数を減少させるのみか，機能回復と独立した ADL を促進する可能性があるとされる。しかし大半の研究は脳卒中の急性期とその直後に注目し，慢性期の回復はあまり注目されていない。急性期初期には身体構造と機能レベルに焦点がおか

れるが，亜急性期・慢性期のケアは活動に必要な機能の遂行能力を改善させ，地域活動への参加を促進させ，職業上または職業外でのニーズに対応することに焦点が移される。**表 4** には米国における脳卒中後のヘルスケアの典型的なパターンがステージごとにまとめられている。この表で明らかなように，急性期病院での入院期間は極めて短く，入院リハビリテーションも短期であり，外来または在宅での治療とリハビリテーションが強調されている。入院・入所ケアとしては高度の集学的リハビリテーションを必要とする患者に，リハビリテーションに精通した医師と看護師の 24 時間体制のケアを提供する入院リハビリテーション施設（病院）がある。もう 1 つは，医療または看護を必要とする入居者にリハビリテーションまたは熟練した看護や関連したサービスを提供する熟練看護施設がある。また療養型病院で複数の急性または慢性併存症をもつ複雑な患者にリハビリテーションの一環としてより長期間（老年社会保険で平均 25 日）入所リハビリテーションが提供される。外来ケアには 2 種類ある。1 つは在宅ヘルスサービスで，熟練した看護，理学療法（PT），作業療法（OT），言語療法（SLP），医療，介護などが提供される。もう 1 つは病院または施設で医師の監督のもと PT，OT，SLP の治療が受けられる。総合的な外来リハビリテーション施設では上記のサービス以外に臨床心理学やソーシャルサービスが提供される。慢性期ケアでは脳卒中患者の健康の維持に必要なカウンセリングと教育を含む診断，治療，再発予防に関するサービスを提供し，長期ケアやホスピスを含む計画をたてる。脳卒中後に生存期間が短いと判断された患者には，適切な終末期ケアのプランがたてられるが，入院，外来，慢性期患者に適応がある脳卒中のケアは終末期の患者にも必要である。

II. ICF の各次元の障害に対するリハビリテーション

A. 身体構造と機能の障害

入院を必要とする急性期から在宅または施設でのケアを必要とする慢性期まで，運動機能，言語機能，認知機能の障害に対するリハビリテーションが PT，OT，SLP を含む集学的チームにより施行される。この声明書には，それぞれの機能障害の検査法とリハビリテーション療法の評価がエビデンスに基づいて詳細に記載されている。感情または心理学的障害では脳卒中後のうつ状態が重要であり，看護師の役割と薬物治療による転帰の改善が強調されている。脳卒中後の重篤な合併症としては肺塞栓症・深部静脈血栓症，褥瘡，痙縮，誤嚥，栄養不良，転倒などについて予防法・治療法が検討されている。これらの障害に対する集学的チームの役割は非常に重要であり，チームワークとエビデンスに基づいた対応により短期と長期のゴール達成が促進される。集学的チームにおいては，看護師はケア全体を把握して患者および家族とリハビリテーションの連携をとり，他のメンバーが個々の ICF 機能障害の治療を担当する。

B. 活動と参加の障害

四肢の機能改善に関しては，移動，ADL，IADL における障害および必要とされる介助を評価し，最大限の機能的自立を得るために必要なリハビリテーション法を入院中から開始し，外来ケアと慢性期に継続させるべきである。現在使われているコミュニケーションと認知機能の評価法は急性期の入院患者が対象とされており，日常生活や社会復帰への障害を評価するテストが少ないが，外来ケアと慢性期ケアにおいてもコミュニケーションと認知機能の評価が必須であり，治療の目標も日常生活，社会復帰，職場復帰に焦点をあわせるべきである。集学的チームによる入院，外来，慢性期のリハビリテーションが ICF の「活動と参加」次元の改善を促進させることが示されているが，個々の脳卒中患者と家族の多様なニーズに対応するため，より広範な評価法と治療法が必要とされている。

C. 個人的および環境的な背景因子

個人的および環境因子は患者の脳卒中後の経過に影響を与えるため，集学的チームは個々の患者の個人的および環境面の特徴を考慮して治療計画をたて実践することが必要である。評価に際しては患者の服薬や他の治療へのコンプライアンス，学習能力，適応能力，情動などとともに，修正可能とそうでない危険因子を識別することが重要である。家族の教育と家族への支援は，円滑な在宅ケアへの移行のために重要な環境因子である。急性期から慢性期のリハビリテーションを通して，集学的チームは個々の患者の特異的な背景因子を認識し，その情報をリハビリテーション計画に入れる必要がある。そうすることにより，集学的チームは患者およびその家族と一体となり，リハビリテーション計画の実行が容易になる。

III. 終末期および緩和ケア

終末期ケアの計画には，民族，文化，脳卒中の重症度と予後などが影響を与える。その他の要素は流動的であり，疼痛，身体的症状，社会的関係，介護，支援，経済的不安など，それらが起こった際に対応する必要がある。適切な終末期ケアはヘルスケア関係者のみならず，家族，友人，施設，地域の参加によって行われるべきである。これまで脳卒中に焦点をあわせた終末期ケアの研究は乏しいが，終末期ケアの評価には疼痛，身体的症状，認知

機能，言語機能，対処能力，感情，気分，恐怖心などが含まれるべきであり，緩和治療の全体的な目標はこれらの疼痛や苦痛を予防または治療することにより，脳卒中患者とその家族に最善の生活を提供することである。

IV. 結　語

ヘルスケアの進歩は脳卒中患者の生存率の改善に大きく貢献してきた。しかし大半の患者は後遺症として残る身体機能，認知機能，コミュニケーション，情動の障害と向き合わねばならない。WHO の ICF 疾患モデルがリハビリテーションの研究において共通の基盤として用いられつつあり，専門的な意思決定，コミュニケーション，集学的チームメンバーあるいは世界中の同じ専門領域の人々の協力関係を促進させている。この声明書は，脳卒中後の複雑な集学的ケアを，高質なケアと最良の転帰が得られる最適なかたちに再構成する第一歩である。

（文責：柳原　武彦）

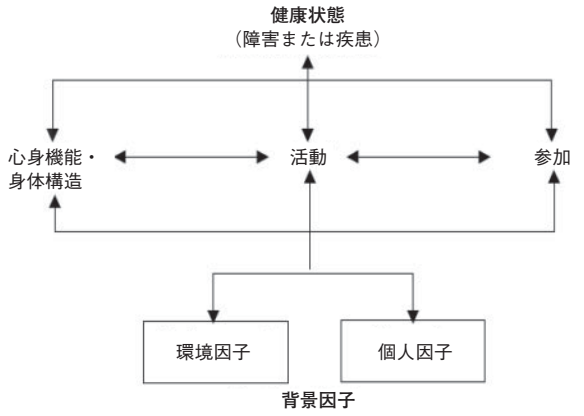

図　世界保健機関（WHO）の国際生活機能分類（ICF）の図。疾患の帰結と背景因子の相互作用を表す。

表 4　脳卒中後のケアにおける入院および退院に関する推定値と集学的医療チームの特徴 *

時期	入院・入所	期間（平均± SD）	集学的医療チームの特徴
病院治療			
急性期集中治療	発症から数時間	くも膜下出血：9.2 ± 12.3 時間 脳内出血：5.1 ± 9.2 時間 虚血性脳卒中：1.8 ± 12.3 時間	医師の治療が必要 看護スタッフが充実 生命維持 医学的に安定している場合は OT/PT/SLP も可
急性期治療	2 ～ 3 日後	くも膜下出血：11.3 ± 11.6 日 脳内出血：8.0 ± 9.2 日 虚血性脳卒中：6.3 ± 6.8 日	医師の治療が必要 看護スタッフが充実 綿密な生理学的モニタリング 限定的な OT，PT，SLP SW による退院計画
入院リハビリテーション	5 ～ 7 日後	平均 8 ～ 30 日，中央値は 15 日	医師の治療が必要 看護スタッフは減少 最低 3 時間の OT/PT/SLP が必要 SW による退院計画 必要に応じて精神医療
熟練看護施設でのケア			
SNF 入院リハビリテーション	脳卒中発症から 5 ～ 7 日後	個々の脳卒中の重症度によって異なる（最長 100 日）	月に一度は医師の診察が必要 看護スタッフは減少 必要に応じて OT/PT/SLP
長期ケア	脳卒中の重症度，個々の資源・資力，種々の併存疾患によって異なる	ケアの必要性によって異なる（長期治療か緩和 / 終末期医療かなど）	看護スタッフは比較的少ない 主に熟練看護助手によるケア 治療相談に応じて治療
地域リハビリテーション（在宅療養を含む）			
早期退院支援サービス	20 ～ 30 日後	1 ～ 44 カ月	医師または看護師による来診 可動性，ADL，コミュニケーションの目標に応じた OT/PT/SLP 必要に応じて精神医療
長期外来リハビリテーション	4 ～ 6 カ月後 個々の資源・資力および機能的ニーズによって異なる	個々の資源・資力および機能的ニーズによって終了時期は異なる	一次医療者（医師，nurse practitioner）への引き継ぎのための調整 / 紹介 必要に応じて集学的治療または精神医療

SD：標準偏差，SW：ソーシャルワーク，SNF：熟練看護施設，OT：作業療法，PT：理学療法，SLP：言語療法，ADL：日常生活動作。
* 表は，米国における脳卒中医療の代表的な傾向を示している。実際に行われている医療は地域や医療費支払機関によって異なる。