

## Management of Adult Stroke Rehabilitation Care A Clinical Practice Guideline\*

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### I. Introduction

Stroke is a leading cause of disability in the United States.<sup>1</sup> The Veterans Health Administration (VHA) of the Department of Veterans Affairs (VA) estimates that 15 000 veterans are hospitalized for stroke each year (VA HSR&D, 1997).

Forty percent of stroke patients are left with moderate functional impairments and 15% to 30% with severe disability.<sup>2</sup> Effective rehabilitation interventions initiated early after stroke can enhance the recovery process and minimize functional disability. Improved functional outcomes for patients also contribute to patient satisfaction and reduce potential costly long-term care expenditures.

There are only 45 rehabilitation bed units (RBUs) in the VA today. Many veterans who have a stroke and are admitted to a VA Medical Center will find themselves in a facility that does not offer comprehensive, integrated, multidisciplinary care. In a VA rehabilitation field survey published in December 2000, more than half of the respondents reported that the “rehabilitative care of stroke patients was incomplete, fragmented, and not well coordinated” at sites lacking a RBU (VA Stroke Medical Rehabilitation Questionnaire Results, 2000).

In Department of Defense (DoD) medical treatment facilities, approximately 20 000 active-duty personnel and dependents were seen in 2002 for stroke and stroke-related diagnoses according to ICD-9 coding.<sup>3</sup> Comprehensive treatment for stroke patients in DoD medical facilities is given primarily at medical centers. Smaller DoD community hospitals may have limited resources to see both inpatients and outpatients, relying more on the TRICARE network for ongoing stroke rehabilitation services.

A growing body of evidence indicates that patients do better with a well-organized, multidisciplinary approach to post-acute rehabilitation after a stroke.<sup>4–6</sup> The VA/DoD Stroke Rehabilitation Working Group only focused on the post-acute stroke rehabilitation care.

Duncan and colleagues<sup>7</sup> found that greater adherence to post-acute stroke rehabilitation guidelines was associated with improved patient outcomes and concluded “compliance with guidelines may be viewed as a quality of care indicator with which to evaluate new organizational and funding changes involving post-acute stroke rehabilitation.” The VA developed an algorithm for the Stroke/Lower-Extremity Amputee Algorithms Guide 1996 (see Algorithms), and the results of implementation of this guideline demonstrated the utility of the algorithm as well as the feasibility of implementing a standard algorithm of rehabilitation care in a large healthcare system.<sup>8</sup>

The VA/DoD Stroke Rehabilitation Working Group built on the 1996 VA Stroke/Lower-Extremity Amputee Algorithms Guide and incorporated information from the following existing evidence-based guidelines/reports (see Appendix B, Guideline Development Process):

- Agency for Health Care Policy and Research (AHCPR) Post-Stroke Rehabilitation (1995)<sup>9</sup>
- Scottish Intercollegiate Guidelines Network (SIGN) Management of Patients with Stroke, No. 20 (1997)<sup>10</sup> (superseeded by No. 78, 2004)
- Royal College of Physicians (RCP) National Clinical Guidelines for Stroke (2000)<sup>11</sup>

The most important goal of the VA/DoD Clinical Practice Guideline for the Management of Stroke Rehabilitation is to

\*The Stroke Council of the American Heart Association has chosen to endorse the VA/DoD guideline for stroke rehabilitation. See: Management of Stroke Rehabilitation. Washington, DC: VA/DoD Clinical Practice Guideline Working Group, Veterans Health Administration, Department of Veterans Affairs and Health Affairs, Department of Defense, February 2003, Office of Quality and Performance publication 10Q CPG/STR-03. Participants in the VA/DoD Guideline Development Process can be found in Appendix A; please note that appendices have been renumbered in citation order and that 2 appendices from the original document are not included (abbreviations and bibliography).

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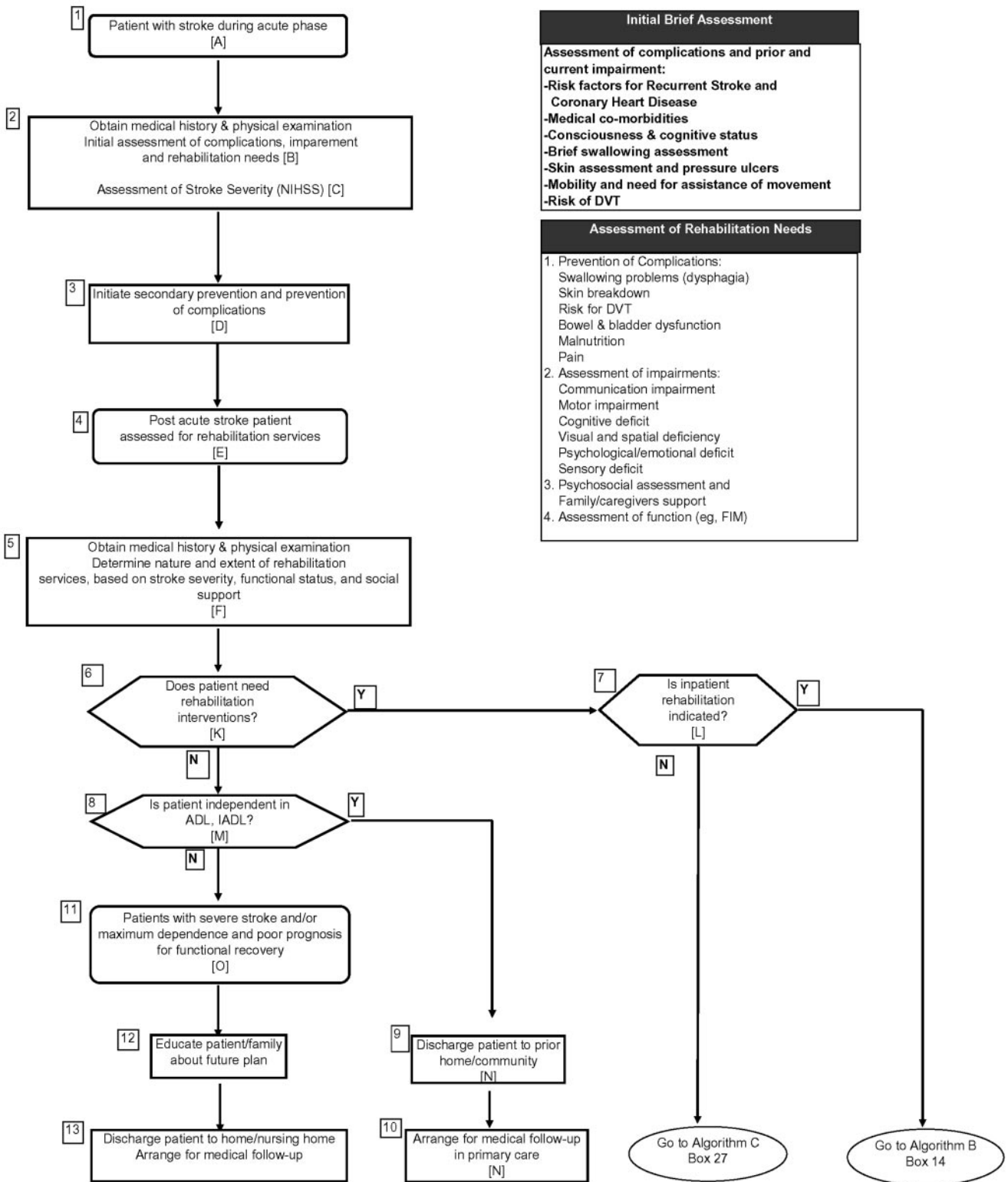
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Assessment

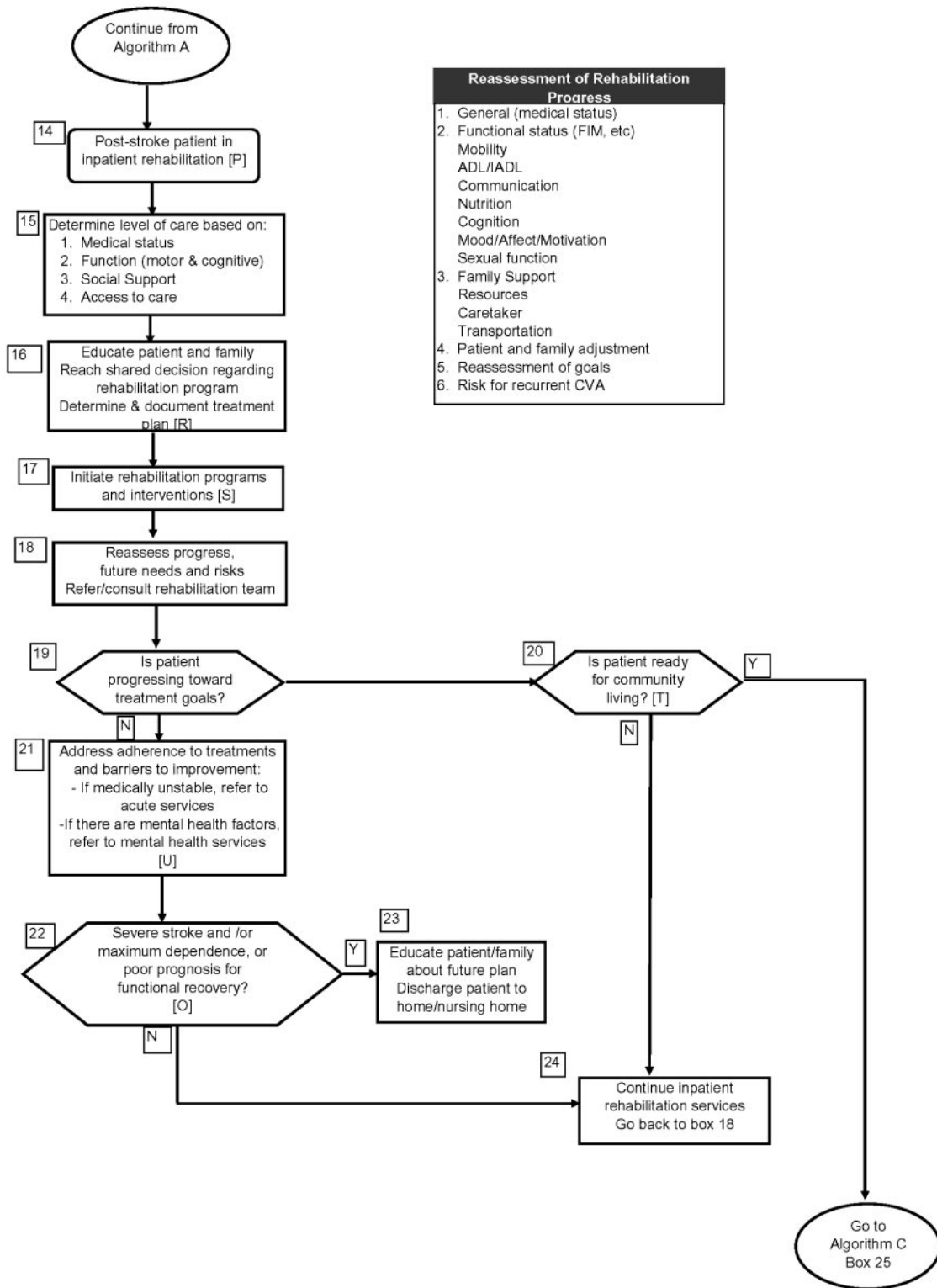


Algorithm A.

provide a scientific evidence base for practice interventions and evaluations. The guideline was developed to assist facilities to put in place processes of care that are evidence based and designed to achieve maximum functionality and

independence and improve patient/family quality of life. It will provide facilities lacking an organized RBU with a structured approach to stroke care and assure that veterans who suffer a stroke will have access to comparable care,

Inpatient Rehabilitation



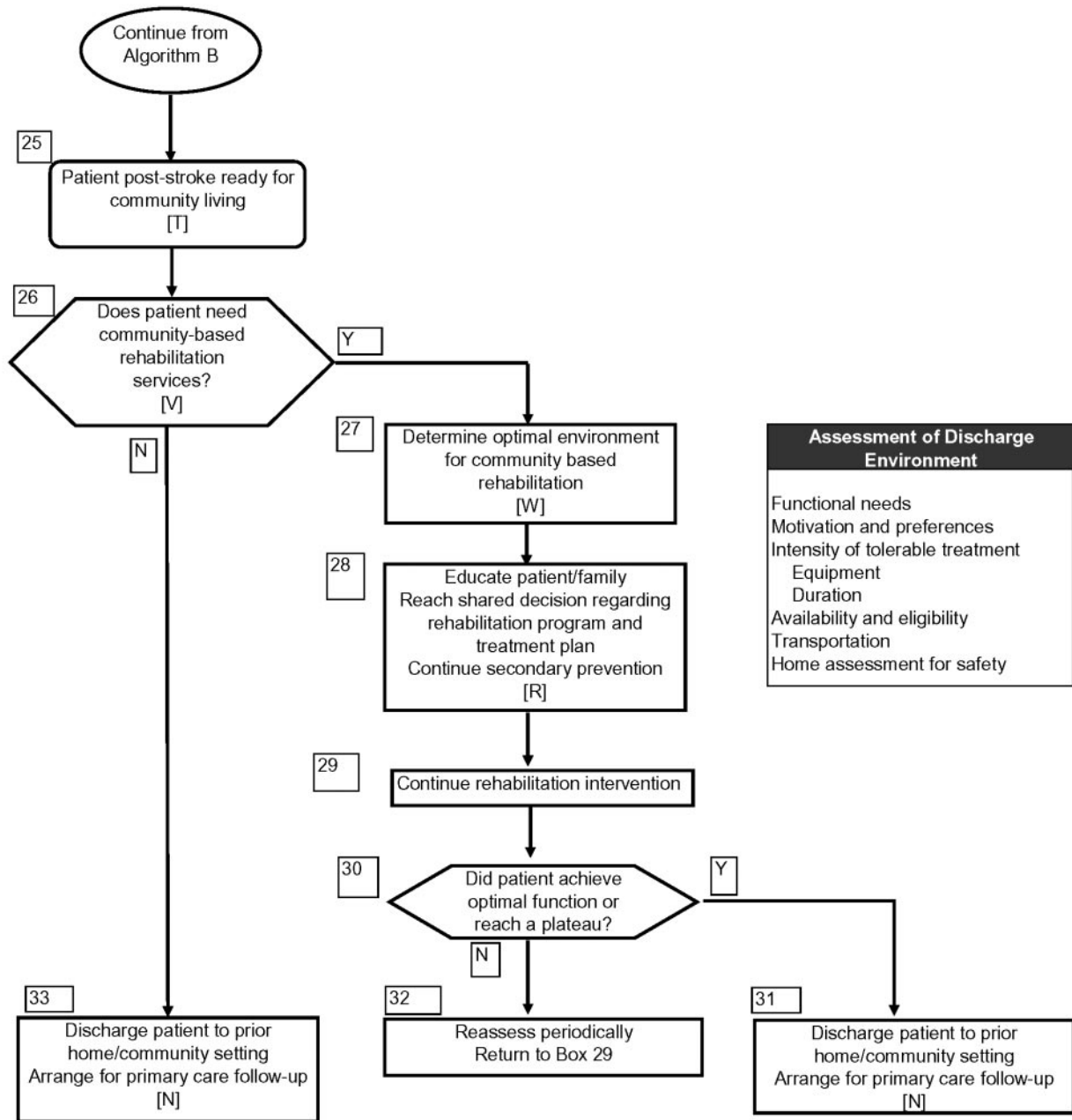
Algorithm B.

regardless of geographic location. The algorithm will serve as a guide that clinicians can use to determine best interventions and timing of care for their patients, better stratify stroke patients, reduce readmission, and optimize healthcare utilization.

If followed, the guideline is expected to have an impact on multiple measurable patient outcome domains.

Finally, new technology and more research will improve patient care in the future. The clinical practice guideline can

Community-Based Rehabilitation



Algorithm C.

assist in identifying priorities for research efforts and allocation of resources. As a result of implementing evidence-based practice, followed by data collection and assessment, new practice-based evidence may emerge.

**A. Key Points**

- The primary goals of rehabilitation are to prevent complications, minimize impairments, and maximize function.
- Secondary prevention is fundamental to preventing stroke recurrence, as well as coronary vascular events and coronary heart disease-mediated death.
- Early assessment and intervention are critical to optimize rehabilitation.

- Standardized evaluations and valid assessment tools are essential to development of a comprehensive treatment plan.
- Evidence-based interventions should be based on functional goals.
- Every patient should have access to an experienced multidisciplinary rehabilitation team to ensure optimal outcome.
- The patient and the patient’s family members and/or caregivers are essential members of the rehabilitation team.
- Patient and family education improves informed decision-making, social adjustment, and maintenance of rehabilitation gains.
- The multidisciplinary team should utilize community resources for community reintegration.

- Ongoing medical management of risk factors and comorbidities is essential to ensure survival.

## B. Outcome Measures

Effective rehabilitation improves functional outcome. An indicator for improvement is the positive change in the Functional Independence Measures (FIM; see Appendix C) score over a period of time in the post-acute care period. Within the Veterans Health Administration (VHA) this measure is captured in the Functional Status and Outcomes Database for rehabilitation. All stroke patients should be entered into the database, as directed by VHA Directive 2000-016 (dated June 5, 2000; Medical Rehabilitation Outcomes for Stroke, Traumatic Brain, and Lower-Extremity Amputee Patients).<sup>12</sup>

Additional indicators that should be measured at 3 months after the acute stroke episode may include the following:

- Functional status (including activities of daily living [ADLs] and instrumental activities of daily living [IADLs])
- Rehospitalizations
- Community dwelling status
- Mortality

The primary outcome measure for assessment of functional status is the FIM (see Appendix C).<sup>13</sup> The FIM has been tested extensively in rehabilitation for reliability, validity, and sensitivity and is by far the most commonly used outcome measure. A return to independent living requires not only the ability to perform basic ADLs but also the ability to carry out more complex activities (ie, IADLs), such as shopping, meal preparation, use of the phone, driving a car, and money management. These functions should be evaluated as the patient returns to the community. New stroke-specific outcome measures, such as the Stroke Impact Scale,<sup>14</sup> may be considered for a more comprehensive assessment of functional status and quality of life.

## II. The Provision of Rehabilitation Care

### A. Organization of Post-Acute Stroke Rehabilitation Care

#### Background

Stroke rehabilitation begins during the acute hospitalization, as soon as the diagnosis of stroke is established and life-threatening problems are under control. The highest priorities during this early phase are to prevent a recurrent stroke and complications, ensure proper management of general health functions, mobilize the patient, encourage resumption of self-care activities, and provide emotional support to the patient and family. After the "acute" phase of stroke care, the focus of care turns to assessment and recovery of any residual physical and cognitive deficits, as well as compensation for residual impairment.

Over the years, the organization and delivery of stroke care have taken many forms. With the growth of physical medicine, occupational therapy, and physical therapy, varying therapeutics and treatment settings have evolved. Assessment of the effect of stroke care organization and settings is difficult because of the extreme variability of organizational

settings. For example, on the one extreme, rehabilitation services can be provided in an outpatient setting, 1 hour per day, 3 days per week, by 1 therapist. At the other end of the structural continuum, rehabilitation services can be provided in a rehabilitation hospital setting, 5 hours per day, 7 days per week, by a team made up of several clinicians.

The Agency for Healthcare Policy and Research Guideline for Post-Stroke Rehabilitation (AHCPR, 1995) has concluded: "A considerable body of evidence, mainly from countries in Western Europe, indicates that better clinical outcomes are achieved when patients with acute stroke are treated in a setting that provides coordinated, multidisciplinary stroke-related evaluation and services. Skilled staff, better organization of services, and earlier implementation of rehabilitation interventions appear to be important components."

The VA/DoD Working Group reviewed several studies and trials addressing the question of organization of care. Although the reviews and trials make it clear that rehabilitation is a dominant component of organized services, it is not possible to specify precise standards and protocols for specific types of specialized units for stroke patients. Their limitations stem from imperfections in the way the reviews and trials controlled for differences in the structure and content of multidisciplinary/standard care programs, the period defined as post-acute stroke care, staff experience and staff mix, and patient need for rehabilitation therapy (ie, stroke severity and type).

#### Recommendations

1. Better clinical outcomes are achieved when post-acute stroke patients who are candidates for rehabilitation receive coordinated, multidisciplinary evaluation and intervention.
  - Post-acute stroke care should be delivered in a setting in which rehabilitation care is formally coordinated and organized.
  - Post-acute stroke care should be delivered by a variety of treatment disciplines, experienced in providing post-stroke care, to ensure consistency and reduce the risk of complications.
  - The multidisciplinary team may consist of a physician, nurse, physical therapist, occupational therapist, kinesiologist, speech and language pathologist (SLP), psychologist, recreational therapist, patient, and family/caregivers.
2. If an organized rehabilitation team is not available in the facility, patients with moderate or severe symptoms should be offered a referral to a facility with such a team, or a physician or rehabilitation specialist with some experience in stroke should be involved in the patient's care.
3. An organized team approach should also be continued in coordinating the outpatient or home-based rehabilitation care. Community resources for stroke rehabilitation services that include an organized team should be identified and provided to patients and families/caregivers.



### Discussion

The evidence for both acute and post-acute (rehabilitation) stroke care suggests that organized care for poststroke patients is worthwhile to achieve optimal outcomes, and the outcomes measured are substantial (ie, mortality and dependency and return to community living). In several randomized controlled trials (RCTs),<sup>16–20</sup> stroke unit care or organized inpatient multidisciplinary rehabilitation showed improved outcome compared with “standard” care (see Table 1).

#### *Studies of Care in the Acute and Post-Acute Stroke Rehabilitation Settings*

The Stroke Unit Trialists’ Collaboration review<sup>16</sup> (which was updated in 2001<sup>6</sup>) concluded, “Patients receiving organized inpatient stroke unit care were more likely to survive, regain independence, and return home than those receiving a less organized service.” The Cochrane review further concluded, “Acute stroke patients should be offered organized inpatient stroke unit care, typically provided by a coordinated multidisciplinary team operating within a discrete stroke ward that can offer a substantial period of rehabilitation, if required. There are no firm grounds for restricting access according to a patient’s age, sex, or stroke severity.” However, the reviewers also cautioned that there could be a wide range of results because of varying outcome rates and confidence intervals. The most recent update of this systematic review involved investigators from nearly all the trials,<sup>6</sup> to try to determine why stroke unit care was superior. They found little evidence of differences in staff numbers or mix, although a tendency was shown for assessment and therapy to begin earlier in organized settings.

Evans and colleagues<sup>5</sup> compared the effectiveness of multidisciplinary inpatient physical rehabilitation programs with standard medical care. On the basis of 11 studies, the researchers found that rehabilitation services improved short-term survival, functional ability, and most independent discharge location. However, they did not find long-term benefits. The authors suggested, “The lack of long-term benefits of short-term rehabilitation may suggest that therapy should be extended to home or subacute care settings, rather than being discontinued at discharge.”

In 1999, Cifu and Stewart<sup>4</sup> reviewed studies that investigated the type of inpatient rehabilitation (interdisciplinary versus multidisciplinary) as a predictor of outcome after a stroke. The authors concluded that an interdisciplinary setting (ie, services “provided by diverse professionals who constitute a team that communicates regularly and uses its varying expertise to work toward common goals”) is strongly related to improved outcome. A specialized multidisciplinary team (which usually includes similar professionals as an interdisciplinary team, but with less consistent “regular communication and common goal orientation”) appears to be less effective if it lacks the organizational structure provided by regular communication. Other predictors for improved outcome at hospital discharge and follow-up were increased functional skills on admission to rehabilitation and early initiation of rehabilitation services. Specialized therapy and a greater intensity of therapy services had “a weak relationship with improved functional outcome at hospital discharge and

follow-up,” and the authors observed that the “current literature is too limited to allow an assessment of the relationship of specific types of noninpatient rehabilitation services after stroke and functional outcome.”

Indredavik et al<sup>19–22</sup> examined the long-term benefits for a combined acute and rehabilitation stroke unit in Norway. Starting with 220 patients, the researchers compared outcomes for surviving patients at 5 years (n=77) and 10 years (n=31) after discharge. Differences in treatment were confined to the first 6 weeks of treatment. Reportedly, there were no differences in the severity of the strokes in the control and experimental groups. Quality of life was measured by the Frenchay Activities Index (FAI), Nottingham Health Profile (81% of patients), and a visual analog scale (86% of patients). Functional status was measured using the Barthel Index (BI).<sup>23,24</sup> More patients in the stroke unit group had an FAI score greater than 30 than did patients in the general ward. The FAI and visual analog scale scores favored stroke unit patients (34.2 versus 27.2;  $P=0.01$  for FAI and 72.8 versus 50.7 mm;  $P=0.002$  for the visual analog scale). Patients in both groups who had better functional status measured by the BI also had higher quality of life scores. Acute care in a stroke unit improved quality of life for patients at 5 years.<sup>20</sup> The researchers also studied survival, proportion of patients living at home, and functional status measured by the BI. Intention-to-treat analysis was used. At 5 years, the Kaplan-Meier survival curve analysis showed that survival was higher in the stroke unit group than in the ward care group (41% versus 29%;  $P=0.04$ ). More patients who received stroke unit care were living at home ( $P=0.006$ ), were independent (BI score  $>95$ ;  $P=0.004$ ), or were at least partly independent (BI score  $>60$ ;  $P=0.006$ ).<sup>22</sup> The groups did not differ for help or support received at home. Stroke unit care improved long-term survival and functional status and increased the number of patients living at home.

In a RCT,<sup>25</sup> 457 acute stroke patients were assigned to 3 different levels of treatment (stroke unit, general ward, and domiciliary care). Patients who survived without severe disability at 1 year after stroke in the 3 groups were as follows: 129 (85%), 99 (66%), and 102 (71%), respectively. Stroke unit care was significantly better than that at the 2 lower levels of care. The net effect of the stroke unit was profoundly different for approximately 30 patients (20% of sample).

#### *Studies of Care in the Post-Acute Stroke Rehabilitation Setting*

Langhorne and Duncan<sup>17</sup> conducted a systematic review of a subset of the studies identified by the Stroke Unit Trialists’ Collaboration, those that deal with post-acute rehabilitation stroke services. They defined intervention as “organized inpatient multidisciplinary rehabilitation commencing at least 1 week after stroke” and sought randomized trials that compared this model of care with an alternative. In a heterogeneous group of 9 trials (6 involving stroke rehabilitation units and 3 involving general rehabilitation wards) that recruited 1437 patients, organized inpatient multidisciplinary rehabilitation was associated with a reduced odds of death (OR=0.66; 95% CI, 0.49 to 0.88;  $P<0.01$ ), death or institu-

**TABLE 1. Evidence**

Recommendation	Source	QE	Overall		R
			Quality		
1. Better clinical outcomes are achieved when post-acute stroke patients receive coordinated, multidisciplinary evaluation and intervention.					
• Organized and coordinated post-acute inpatient rehabilitation care	Evans et al, 2001 <sup>26</sup> ; Langhorne and Duncan, 2001 (SR) <sup>17</sup>	I	Good		A
• Interdisciplinary team approach	AHCPR, 1995 <sup>15</sup> ; Cifu and Stewart, 1999 (SR) <sup>4</sup> ; Evans et al, 1995 (SR) <sup>5</sup> ; Evans et al, 2001 <sup>26</sup> ; Indredavik et al, 1997, <sup>21</sup> 1998, <sup>19</sup> and 1999 <sup>20, 22</sup> ; Kalra et al, 2000 <sup>25</sup> ; Langhorne and Duncan, 2001 (SR) <sup>17</sup> ; Stroke Unit Trialists, 2002 (SR) <sup>6</sup>	I	Fair		B
• Multidisciplinary rehabilitation programs coordinated with the patient and family members/caregivers	Working Group Consensus	III	Poor		I
2. Referral to a facility with an organized rehabilitation team, for patients with moderate or severe symptoms, or involvement of a rehabilitation specialist with some experience in stroke	Working Group Consensus	III	Poor		I
3. Organized team approach for outpatient or home-based rehabilitation care	Working Group Consensus	III	Poor		I

QE indicates quality of evidence; R, recommendation; and SR, systematic review (see Appendix B).

A table comparing all the studies can be found in the "Evidence Appraisal Report for the VA/DoD Clinical Practice Guideline for the Management of Stroke Rehabilitation."

tionalization (OR=0.70; 95% CI, 0.56 to 0.88;  $P<0.001$ ), and death or dependency (OR=0.65; 95% CI, 0.50 to 0.85;  $P<0.001$ ), which was consistent across a variety of trial subgroups. For every 100 patients receiving organized inpatient multidisciplinary rehabilitation, an extra 5 returned home in an independent state. This review of post-acute stroke care concluded that there can be substantial benefit from organized inpatient multidisciplinary rehabilitation in the post-acute period, which is both statistically significant and clinically important.

One RCT has been published<sup>26</sup> since the most recent update of the collaboration's work. This study, which deals with both acute and rehabilitative care, sought to quantify the

differences between staff interventions in a stroke unit versus staff interventions on a general ward supported by a stroke specialist team. Observations were made daily for the first week of acute care but only weekly during the post-acute phase. During the observation period, the stroke unit patients were monitored more frequently and received better supportive care, including early initiation of feeding.

Because of the heterogeneity of the literature with regard to patient samples, structural design, and outcome measures, it is difficult to identify a "best practice" that applies to all patients with stroke. The evidence does not indicate the specific nature of the intervention or provide explanation of the nature of the team approach or which factor has the greatest impact on patient outcome. The very nature of stroke and its multifaceted effects create the need for a flexible and multifaceted treatment approach.

### Evidence

See Table 1.

## B. The Use of Standardized Assessment Tools

### Background

Comprehensive assessment of patients with stroke is necessary for appropriate clinical management and evaluation of outcomes for quality management and research.<sup>27</sup> The AHCPR Post-Stroke Rehabilitation Guideline recommends the use of well-validated, standardized instruments in evaluating stroke patients. These instruments help to ensure reliable documentation of the patient's neurological conditions, levels of disability, functional independence, family support, quality of life, and progress over time.<sup>9</sup>

### Recommendations

1. Strongly recommend assessment of the stroke recovery using the National Institutes of Health Stroke Scale (NIHSS, <http://www.strokecenter.org/trials/scales/nihss.html>; see Appendix E) at the time of presentation/hospital admission, or at least within the first 24 hours after presentation.
2. Recommend that all patients be screened for depression and motor, sensory, cognitive, communication, and swallowing deficits by appropriately trained clinicians, using standardized and valid screening tools.
3. Recommend that if depression and motor, sensory, cognitive, communication, and swallowing deficits are found, all patients should be formally assessed by the appropriate clinician from the coordinated rehabilitation team.
4. Recommend that the clinician use standardized, valid assessments to evaluate the patient's stroke-related impairments and functional status and encourage patient's participation in community and social activities.
5. Recommend that the standardized assessment results be used to assess probability of outcome, determine the appropriate level of care, and develop interventions.
6. Recommend that the assessment findings be shared and the expected outcomes discussed with the patient and family members/caregivers.

### Discussion

The AHCPR guideline<sup>9</sup> recommends that "Screening for possible admission to a rehabilitation program should be performed as soon as the patient's neurological and medical

condition permits. The individual(s) performing the screening examination should be experienced in stroke rehabilitation and preferably should have no direct financial interest in the referral decision. All screening information should be summarized in the acute medical record and provided to the rehabilitation setting at the time of referral” (Research evidence=NA; Expert opinion=strong consensus).

The AHCPR guideline panel evaluated the strengths and weaknesses of a battery of standardized instruments for assessment of stroke patients. Appendix D includes a list of preferred standard instruments recommended by the AHCPR guideline panel for patient assessment in stroke. Certain tests have established protocol for credentialing that must be adhered to (eg, Functional Independence Measure [FIM], National Outcome Measure System [NOMS], and National Institutes of Health Stroke Scale [NIHSS]). However, only the FIM and the NIHSS are widely used.

A partial listing of standardized tools can be found at The University of Kansas Landon Center on Aging Web site at [www2.kumc.edu/coa/Pepper/pepper.htm](http://www2.kumc.edu/coa/Pepper/pepper.htm). Although the listing is not all-inclusive, it provides references, tools, and an Access database (toolbox) that may be useful to the coordinated rehabilitation team in completing formal assessments.

New stroke-specific outcome measures that may be useful for assessing functional status and quality of life are currently under development (see Appendix D).

*The NIHSS Score*

The NIHSS score (see also Section III-C “Assess Stroke Severity” below) strongly predicts the likelihood of a patient’s recovery after stroke. A score of greater than 16 forecasts a high probability of death or severe disability, whereas a score of less than 6 forecasts a good recovery.<sup>28</sup>

Patients with a severe neurological deficit after stroke, as measured by the NIHSS, have a poor prognosis. During the first week after acute ischemic stroke, it is possible to identify a subset of patients who are highly likely to have a poor outcome.<sup>29</sup>

The Veterans Health Administration has issued a directive that all individuals who have rehabilitation potential have a functional status outcome assessment, which includes the FIM.<sup>12</sup> These data are captured in a functional outcomes database maintained by the physical medicine and rehabilitation service.

**Evidence**

See Table 2.

**C. Intensity/Duration of Therapy**

**Background**

There has been controversy in the past about the timing of initiation of therapy and intensity of therapy required for the acute stroke patient to gain maximum functional outcome. Although patients who are medically unstable are considered not to be suitable for any rehabilitation program, studies generally support early mobilization of the patient with an acute stroke to prevent deep vein thrombosis (DVT), skin breakdown, contracture formation, constipation, and pneumonia. Early therapy initiation, including range-of-motion exercises and physiologically sound changes of bed position on

**TABLE 2. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Assess stroke severity using the NIHSS score.	Adams et al, 1999 <sup>28</sup> ; Frankel et al, 2000 <sup>29</sup>	I	Good	A
2. Screen for complications using standardized and valid screening tools.	AHCPR, 1995 <sup>15</sup> ; Working Group Consensus	III	Poor	C
3. Formal assessment by appropriately trained clinicians	RCP, 2000 <sup>11</sup> ; SIGN, 1997 <sup>10</sup> ; Working Group Consensus	III	Poor	C
4. Standardized assessment tools	Duncan et al, 1999 <sup>27</sup>	III	Poor	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

the day of admission, followed by a progressive increase in the level of activity, should be provided as soon as medically tolerated. Early mobilization should also include encouraging the patient to resume self-care activities and socialization.

The physical demands of rehabilitation are substantial. The patient’s tolerance for therapy will depend on several factors including the severity of the stroke, medical stability, mental status, and level of function.

**Recommendations**

1. Strongly recommend that rehabilitation therapy start as early as possible, once medical stability is reached.
2. Recommend that the patient receive as much therapy as “needed” to adapt, recover, and/or reestablish the pre-morbid or optimal level of functional independence.

**Discussion**

*Early Initiation of Therapy*

One conclusion of a systematic review of 38 RCTs dating back to 1965 is that early rehabilitation therapy “appears to have a strong relationship” to improved functional outcome at hospital discharge and follow-up.<sup>4</sup> However, the review does not present any quantitative information that indicates the differential gain associated with the provision of specific therapies at different times during the patient’s treatment. Nor is there any discussion of when therapy is early versus late/delayed or early relative to when it would be provided via standard care. Instead, the word “early” seems to have meant shortly after a stroke occurs, which could span a variable number of days.

Nine clinical trials focus with varying specificity on the early provision of rehabilitation therapy after a stroke. Importantly, using the word “early” as a search parameter did not ensure that an identified study would focus exclusively, primarily, or even secondarily on the scheduling of a service in its own right or compared with standard care. Instead, “early” often meant that the intervention began sometime shortly after a stroke, but with little empirical significance.<sup>30,31</sup> “Early after stroke” simply meant whenever the therapy began.

One exception is a study by Paolucci and colleagues,<sup>32</sup> which examined differences in outcomes for patients for whom therapy was initiated 20 days apart. The researchers



found a strong inverse relationship between the start date and functional outcome (albeit with wide confidence intervals and a greater dropout risk). In other words, the earliest starters had significantly higher effectiveness of treatment than did the medium or latest groups. Treatment initiated within the first 20 days was associated with a significantly high probability of excellent therapeutic response (OR=6.11; 95% CI, 2.03 to 18.36), and beginning later was associated with a poor response (OR=5.18; 95% CI, 1.07 to 25.00). On the other hand, early intervention was associated with a 5 times greater risk of dropout than that of patients with delayed treatment (OR=4.99; 95% CI, 1.38 to 18.03).

A second study involved a comparison of an experimental group of patients who received 3 months of physiotherapy at home, immediately after a stroke, with a control group of patients who received therapy after a 3-month delay.<sup>33</sup> The findings show that physiotherapy initiated early after stroke slightly improved gait speed (ie, a few seconds over 10 meters), but the improvement was not maintained 3 months after physiotherapy stopped.

#### *Intensity of Therapy*

The heterogeneity of the studies in all aspects—patients, designs, treatments, comparisons, outcome measures, and results—combined with the borderline results in many of the trials limits the specificity and strength of any conclusions that can be drawn from them. Overall, the trials support the general concept that rehabilitation can improve functional outcomes, particularly in patients with lesser degrees of impairment. Weak evidence exists for a dose-response relationship between the intensity of the rehabilitation intervention and the functional outcomes. However, the lack of definition of lower thresholds, below which the intervention is useless, and upper thresholds, above which the marginal improvement is minimal, for any treatment, makes it impossible to generate specific guidelines.

Comparisons in many studies are between a more intense but also slightly different service than the control—any difference in outcome could be related to the difference in the nature of the treatment rather than just its intensity.

Despite all of these limitations, the conclusions of the systematic reviews are fairly consistent: The 2 meta-analyses both concluded that greater intensity produces slightly better outcomes.<sup>34,35</sup> Langhorne et al concluded,<sup>34</sup> “more intensive physiotherapy input was associated with a reduction in the combined poor outcome of death or deterioration and may enhance the rate of recovery.” Kwakkel et al<sup>35</sup> reported a small but statistically significant intensity-effect relationship in the rehabilitation of stroke patients. The recent meta-analysis of trials studying exercise therapy for arm function concluded,<sup>36</sup> “the difference in results between studies with and without contrast in the amount or duration of exercise therapy between groups suggests that more exercise therapy may be beneficial.” In all the reviews, insufficient contrast in the amount of rehabilitation between experimental and control conditions, organizational setting of rehabilitation management, lack of blinding procedures, and heterogeneity of patient characteristics were major confounding factors.

With regard to general factors affecting the effectiveness of rehabilitation, Cifu and Stewart<sup>4</sup> concluded that greater intensity of therapy services has “a weak relationship with improved functional outcome.” Only the early meta-analysis by Ottenbacher and Jannell<sup>30</sup> has a neutral conclusion: “The improvement in performance appears related to early initiation of treatment, but not to the duration of intervention.”

Four trials addressed intensity of physiotherapy or general rehabilitation services. The earliest trial randomized 133 discharged patients among intensive, routine, and no outpatient therapy and found a dose-response relationship with greater intensity, producing better performance on an index of ADLs.<sup>37</sup> Sivenius et al<sup>38</sup> divided 95 patients into intensive and normal treatment groups. Functional recovery, measured by motor function and ADLs, was slightly better in the intensive treatment group. Rapoport and Eerd<sup>39</sup> found that adding weekend physiotherapy services reduced length of stay by comparing time periods during which 5-day-a-week or everyday therapy sessions were provided. Partridge et al<sup>40</sup> did not find any differences in functional and psychological scores at 6 weeks in 104 patients randomized between a standard of 30 and 60 minutes of physiotherapy. Subgroup analyses suggested some subgroups might benefit.

Four additional trials targeted more specific disabilities of extremity function or gait. Sunderland et al<sup>41</sup> assigned 132 consecutive stroke patients to routine or enhanced treatment for arm function, the latter including both increased duration and behavioral methods. At 6 months, the enhanced group showed a slight but statistically significant advantage, concentrated in those patients with milder impairment. Richards et al<sup>42</sup> did a pilot study of 27 patients randomized to intensive, gait-focused physical therapy; early, intensive, conventional therapy; and routine conventional therapy. At 6 weeks gait velocity was better for the intensive, gait-focused group, but this advantage was not sustained at 3 and 6 months. Lincoln et al<sup>43</sup> randomized 282 patients with impaired arm function to routine physiotherapy, additional treatment by a qualified physiotherapist, or additional treatment by the physiotherapy assistant. There were no differences among the groups on outcome measures of arm function and ADLs at baseline, 5 weeks, 3 months, or 6 months. Parry et al<sup>31</sup> performed subgroup analyses of the same study and noted that patients with severe impairment improved little, but patients with lesser impairment may have benefited. Kwakkel et al<sup>35</sup> randomized 101 middle-cerebral-artery stroke patients with arm and leg impairment to additional arm training emphasis, leg training emphasis, or arm and leg immobilization, each treatment lasting 30 minutes, 5 days a week, for 20 weeks. At 20 weeks the leg training group scored better for ADLs, walking, and dexterity than the control group, whereas the arm training group scored better only for dexterity.

The clinical trials provide weak evidence for a dose-response relationship of intensity to functional outcomes. Caution is called for in the interpretation of these studies because some patients may not be able to tolerate higher-than-normal levels of therapy. Other patients may not benefit because they do not belong to a subset of patients for whom benefit has been demonstrated. Because of the heterogeneity

**TABLE 3. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Early initiation of therapy	Cifu and Stewart, 1999 (SR) <sup>41</sup> ; Ottenbacher and Jannell, 1993 <sup>30</sup>	I	Good	A
2. Intensity of therapy	Kwakkel et al, 1999 <sup>35</sup> ; Langhorne et al, 1996 <sup>34</sup> ; Richards et al, 1993 <sup>42</sup> ; Sivenius et al, 1985 <sup>38</sup> ; Smith et al, 1981 <sup>37</sup> ; van der Lee and Snels, 2001 <sup>36</sup>	I	Fair	B

QE indicates quality of evidence; R, recommendation; and SR, systematic review (see Appendix B).

of the studies, no specific guidelines about intensity or duration of treatment are justified.

### Evidence

See Table 3.

## D. Patient's Family and Caregivers

### Background

With the changes that have occurred in healthcare in the last decade, family members have become an integral part of the long-term care picture. Provision of long-term care can place family members under significant emotional, financial, and physical stress. Although a number of services are available to families/caregivers, the dissemination of this information is sometimes poor. As a result, many families are not able to take advantage of the resources available for respite, support groups, and financial aid. The family member/caregiver's quality of life may be improved if he/she is educated about potential sources of stress and resources. However, education alone has not been found to be sufficient to improve the caregiver's quality of life. Research in this area is limited and of variable quality.

### Recommendations

1. Recommend that the family/caregiver of the stroke patient be involved in decision making and treatment planning as early as possible, if available, and throughout the duration of the rehabilitation process.
2. Recommend that the providers be alert to the stress on the family/caregiver, specifically recognizing the stress associated with impairments (eg, cognitive loss, urinary incontinence, and personality changes) and providing support, as indicated.
3. Recommend that acute care hospitals and rehabilitation facilities maintain up-to-date information on community resources at the local and national levels, provide this information to the stroke patient and families/caregivers, and offer assistance in obtaining needed services.
4. Recommend that the patient and caregivers have their psychosocial and support needs reviewed on a regular basis, by a social worker or appropriate healthcare worker, to minimize caregiver distress.

### Discussion

Clinicians need to be sensitive to potential adverse effects of caregiving on family functioning and the health of the

caregiver. They should work with the patient and caregiver to avoid negative effects, promote problem solving, and facilitate reintegration of the patient into valued family and social roles.<sup>9</sup> In general, caregivers cope with physical limitations better than cognitive or emotional ones.<sup>44</sup> Strong social support has been shown to improve outcomes, especially in patients with severe physical or cognitive deficits.<sup>45</sup>

Current evidence suggests that stroke caregivers have elevated levels of depression at both the acute stroke phase and the chronic stroke phase. However, major gaps are apparent in this literature, with few studies addressing such areas as caregiver physical health, caregiver ethnicity, and caregiver interventions. Given the increasing prevalence of stroke, as well as the increasing pressures on families to provide care, more research is needed to guide policy and practice in this understudied topic.<sup>46</sup>

## E. Patient and Family/Caregiver Education

### Background

The patient and family/caregivers should be given information and provided with an opportunity to learn about the causes and consequences of stroke, potential complications, and the goals, process, and prognosis of rehabilitation.

### Recommendations

1. Recommend that patient and family/caregiver education be provided in an interactive and written format.
2. Recommend that clinicians consider identifying a specific team member to be responsible for providing information to the patient and family/caregiver about the nature of the stroke, stroke management rehabilitation and outcome expectations, and their roles in the rehabilitation process.
3. Recognize that the family conference is a useful means of information dissemination.
4. Recommend that patient and family education be documented in the patient's medical record to prevent the occurrence of duplicate or conflicting information from different disciplines.

### Discussion

Information provision or educational interventions have not been shown to be sufficient, by themselves, to improve patient outcomes (3 systematic reviews, 7 clinical trials; see Table 4). Provision of information in a passive format (eg, giving pamphlets to patients) is not as effective as educational interventions that also include some form of personal support, such as home visits or classes.

Educational interventions have been successful in improving the patient's and caregiver's knowledge about stroke, and may assist patients and caregivers in making effective decisions about treatments (3 systematic reviews, 7 clinical trials; see Table 4).

Better knowledge about stroke does not necessarily translate into better overall health or well-being for either patients or caregivers (2 systematic reviews, 4 clinical trials; see Table 4). Likewise, better decision-making ability has not been shown to result in improved overall outcomes (1 systematic review, 1 clinical trial). Some small trials have claimed success in improving the patient's health habits through educational interventions. Although these results are promis-

ing, they must be seen as speculative at present (2 clinical trials).

#### Systematic Reviews

The systematic reviews (Cochrane) examined 3 types of educational interventions:

- Provision of decision aids to people facing medical decisions<sup>47</sup>
- Provision of educational material with or without additional educational sessions<sup>48</sup>
- Interventions of any sort intended to affect adherence with prescribed, self-administered medications<sup>49,50</sup>

O'Connor et al<sup>47</sup> reviewed 24 trials of decision aids, and concluded "they are superior to usual care interventions in improving knowledge and realistic expectations of the benefits and harms of options; reducing passivity in decision making; and lowering decisional conflict stemming from feeling uninformed." The advantages of decision aids, however, were considered to be mixed: "They have had little effect on anxiety or satisfaction with the decision-making process or satisfaction with the decision. Their effects on choices vary with the decision. The effects on persistence with chosen therapies and health outcomes require further evaluation."

Forster and colleagues<sup>48</sup> reviewed 9 studies of educational intervention. The authors excluded trials in which information giving was only 1 component of a more complex rehabilitation intervention (eg, family support worker trials). Forster et al found that in 2 good-quality trials, information-plus-education improved knowledge.<sup>51,52</sup> Information plus education, however, had no effect on perceived health status and quality of life or on the Caregiver Hassles scale. One of the 2 relevant trials found an association between education provision and 4 of 7 subscales of a family functioning scale. However, 58% of the patients in that study did not attend 3 or more of the 6 classes offered. Forster et al<sup>48</sup> noted, "There is a suggestion that information provided in an educational context is more effective than the simple provision of a booklet or leaflet. However, the success of such strategies is limited if they are unacceptable to the patient." The authors concluded, "The results of the review are limited by the variable quality of the trials and the wide range of outcome measures used. The general 'effectiveness' of information provision has not been conclusively demonstrated."

Haynes et al<sup>49</sup> reviewed 19 studies (not all conducted among patients with stroke) of interventions to affect adherence with prescribed, self-administered medications. Although 10 of the studies demonstrated a positive effect of the intervention on medication adherence, "almost all of the interventions that were effective for long-term care were complex, including combinations of more convenient care, information, counseling, reminders, self-monitoring, reinforcement, family therapy, and other forms of additional supervision or attention." It is likely that educational interventions alone would not have had a significant effect on these patients.

#### Clinical Trials

Each of the 7 clinical trials examined a different aspect of patient/caregiver education:

- 12-week health promotion intervention (1 study)
- Self-management program for chronic disease (1 study)
- Family support program (1 study)
- Audiobooklet decision aid (1 study)
- Small group educational sessions (1 study)
- Information pack (1 study)
- Training in social problem-solving skills (1 study)

In a small study of 35 patients, Rimmer et al<sup>53</sup> found improvements in the patient's physical, mental, and social health after a 12-week health promotion intervention. Investigators for a self-management program for chronic disease<sup>54</sup> found that "treatment subjects, when compared with control subjects, demonstrated improvements at 6 months in weekly minutes of exercise, frequency of cognitive symptom management, communication with physicians, self-reported health, health distress, fatigue, disability, and social/role activities limitations. They also had fewer hospitalizations and days in the hospital." Both of these studies included an educational component, but it is difficult to say how much of the patient's improvement was due to education rather than the social context of the education or other factors.

In the remaining 5 studies,<sup>52,55-58</sup> researchers did not find any significant effect of the various interventions on patient clinical outcomes. The interventions did provide some benefit to patients and caregivers, however, such as increased knowledge about stroke and improved caregiver mental health<sup>58</sup> and significantly increased social activities and improved quality of life for caregivers.<sup>57</sup>

Evans et al<sup>51</sup> examined the effects of caregiver education with and without additional counseling. Both counseling and education significantly improved family functioning and caregiver knowledge. Counseling was more effective than education alone and also resulted in better patient functioning. Neither intervention affected use of social resources.

Forster et al<sup>48</sup> provided evidence that passive education alone is not adequate to meet educational needs. Education should be interactive to be most beneficial to the patient and family/caregiver.

#### Evidence

See Table 4.

### III. Rehabilitation During the Acute Phase

#### A. Patients With Stroke During the Acute Phase

AHCPR<sup>9</sup> has defined "acute care" as "the period of time immediately following the onset of an acute stroke. A full-service hospital where patients with an acute stroke are treated either in a medical service or in a specialized stroke unit, and where rehabilitation interventions are normally begun during the acute phase."

Because of the nature of the neurological problems and the propensity for complications, most patients with acute ischemic stroke are admitted to a hospital. A recent meta-analysis demonstrates that outcome can be improved if a patient is admitted to a facility that specializes in the care of stroke. The

**TABLE 4. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Education of patient and caregiver in an interactive and written format	Forster et al, 2001 <sup>48</sup>	I	Fair	B
2. Identification of a specific team member to provide information to patient and caregiver	Working Group Consensus	III	Poor	C
3. Use of family conferences to disseminate information	Working Group Consensus	III	Poor	C
4. Documentation of patient and family education	Working Group Consensus	III	Poor	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

goals of early supportive care after admission to the hospital are as follows:

- Observe changes in the patient’s condition that might prompt different medical or surgical interventions.
- Facilitate medical and surgical measures aimed at improving outcome after stroke.
- Institute measures to prevent subacute complications.
- Begin planning for therapies to prevent recurrent stroke.
- Begin efforts to restore neurological function through rehabilitation or other techniques.

After stabilization of the patient’s condition the following can be initiated, when appropriate: rehabilitation, measures to prevent long-term complications, chronic therapies to lessen the likelihood of recurrent stroke, family support, and treatment of depression.<sup>59</sup>

**B. Obtain Medical History and Do Physical Examination**

*Objective*

Obtain clinical data required to manage the stroke rehabilitation.

*Background*

Stroke rehabilitation begins during the acute hospitalization, as soon as the diagnosis of stroke is established and life-threatening problems are controlled. The highest priorities are to prevent recurrence of stroke and complications and begin mobilization.

*Recommendations*

1. Recommend that the NIHSS be used to assess severity of stroke in the initial stages as a predictor of mortality and long-term outcome (see Section III-C, “Assess Stroke Severity [NIHSS]” below).
2. Recommend that the initial assessment include a complete history and physical examination, with special emphasis on the following:
  - Risk factors for stroke recurrence
  - Medical comorbidities
  - Level of consciousness and cognitive status
  - Brief swallowing assessment

**TABLE 5. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Assessment of skin integrity	AHCP, 1995 <sup>15</sup> ; Sussman and Bates-Jensen, 1998 <sup>63</sup>	III	Poor	C
2. Interventions for prevention of skin breakdown	AHCP, 1995 <sup>15</sup> ; Working Group Consensus	III	Poor	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

- Skin assessment and risk for pressure ulcers (see Section III, B-1, “Risk for Skin Breakdown” below)
- Bowel and bladder function
- Mobility, with respect to the patient’s needs for assistance in movement
- Risk of DVT (see Section III, B-2, “Risk for Deep Vein Thrombosis” below)
- History of previous antiplatelet or anticoagulation use, especially at the time of stroke
- Emotional support for the family and caregiver

**B-1. Risk for Skin Breakdown**

*Background*

Pressure ulcers affect approximately 9% of all hospitalized patients and 23% of all nursing home patients. This condition can be difficult and costly to treat and often results in pain, disfigurement, and prolonged hospitalization.<sup>9</sup> It is crucial that healthcare personnel work collaboratively to prevent skin breakdown. Patients at highest risk for skin breakdown may have (1) dependence in mobility, (2) diabetes, (3) peripheral vascular disease, (4) urinary incontinence, (5) lower body mass index, and (6) end-stage disease.<sup>60,61</sup>

*Recommendations*

1. Recommend that a thorough assessment of skin integrity be completed on admission and monitored at least daily thereafter.
2. Recommend the use of proper positioning, turning, and transferring techniques and judicious use of barrier sprays, lubricants, special mattresses, and protective dressings and padding to avoid skin injury due to friction or excessive pressure.

*Discussion*

A valid and reliable pressure ulcer risk assessment tool, such as the Braden Scale,<sup>62</sup> can help predict the risk of pressure ulcer development and thus help the rehabilitation team to implement interventions to prevent skin breakdown. Such interventions may include, but are not limited to, the following: repositioning, mobilization, turning, proper transfer techniques, and the use of skin care/incontinence products and surface-pressure-reducing devices. Treatment of any skin breakdown should begin promptly and be monitored daily.<sup>9,63</sup>

*Evidence*

See Table 5.



**B-2. Risk for Deep Vein Thrombosis***Background*

There are several approaches to preventing DVT in stroke patients. Current practices include anticoagulation, intermittent pneumatic compression, compression stockings, and early mobilization. Walking as little as 50 feet per day, with or without assistance, significantly decreases the incidence of DVT after stroke.<sup>64</sup>

*Recommendations*

1. Recommend that all patients be mobilized as soon as possible (the act of getting a patient to move in the bed, sit up, stand, and eventually walk).
2. Recommend the use of subcutaneous low-dose unfractionated heparin (LDUH) (5000 U BID, unless contraindicated) to prevent DVT/pulmonary embolism (PE) for patients with ischemic stroke and impaired mobility. Low-molecular-weight heparin (LMWH) or heparinoids may be used as an alternative to LDUH, especially in patients with a history of heparin-related side effects (such as thrombocytopenia).
3. Recommend that clinicians consider using graduated compression stockings or an intermittent pneumatic compression machine as an adjunct to anticoagulation, as an alternative to anticoagulation for patients with intracerebral hemorrhage, or for patients in whom anticoagulation is contraindicated.

*Discussion*

The largest study for subcutaneous unfractionated heparin, the International Stroke Trial (IST),<sup>65</sup> established that LDUH is safe in ischemic stroke. This trial also demonstrated a dose-response rate for hemorrhagic complications.

Comparative trials for DVT/PE prevention in a stroke population have not been performed; however, randomized trials of several LMWH and heparinoid products in ischemic stroke patients and other patient populations suggest an efficacy and safety superior to those of unfractionated heparin for DVT prevention. The Trial of ORG 10172 in Acute Stroke Treatment (TOAST) study<sup>66</sup> demonstrated the safety of danaparoid in acute ischemic stroke patients, but the intravenous route, anticoagulation monitoring, and continuous dosing limit extrapolation to prophylactic use. Two meta-analyses found that LMWH reduced DVT and PE but increased bleeding in ischemic stroke victims.<sup>67,68</sup> Another LMWH trial found a dose-response effect for DVT prevention and intracranial hemorrhage rate, both increasing at higher doses.<sup>69</sup> Specific treatment recommendations about optimal LMWH agent and dosing cannot be made from the existing data.

The use of nonpharmacological approaches to DVT/PE prevention, such as intermittent pneumatic compression, graduated compression stockings, and early mobilization, appears to have some beneficial effect, although they were not tested in fully randomized controlled trials. Graded compression stockings produced a reduction in DVT incidence comparable to that in other patient groups (OR=0.43, 95% CI, 0.14 to 1.36), but the reduction was not statistically significant, and the magnitude of the effect size requires confirmation.<sup>70</sup> Use of pneumatic compression devices com-

**TABLE 6. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Early mobilization	Working Group Consensus	III	Poor	C
2. LDUH in ischemic stroke patients for DVT prevention	IST, 1997 <sup>65</sup>	I	Good	A
3. LMWH and heparinoids in ischemic stroke patients for DVT prevention	Bath et al, 2000 <sup>67</sup> and 2000b <sup>69</sup> (SR); Bijsterveld et al, 1999 <sup>68</sup>	I	Poor	C
4. Alternating compression machines in stroke patients for DVT prevention	Kamran et al, 1998 <sup>71</sup>	II-3	Fair	B
5. Graduated compression stockings in stroke patients for DVT prevention	Muir et al, 2000 <sup>70</sup>	I	Fair	B

QE indicates quality of evidence; R, recommendation; and SR, systematic review (see Appendix B).

bined with subcutaneous heparin and compression stockings reduce the risk of DVT and PE in stroke patients.<sup>71</sup> The morbidity and mortality associated with DVT/PE is a sufficient reason to continue these clinical practices. These interventions can be used in combination with or as alternatives to anticoagulation.

There are no data from clinical trials on DVT/PE prophylaxis in intracerebral hemorrhage or hemorrhagic strokes. Because the risk of worsening brain hemorrhage is uncertain if LDUH or LMWH is used, graduated compression stockings or sequential compression devices are recommended.

*Evidence*

See Table 6.

**C. Assess Stroke Severity (NIHSS)***Objective*

Stratify patients according to severity and likely outcome.

*Background*

The National Institutes of Health Stroke Scale (NIHSS) is a standardized, validated instrument that assesses severity of neurological impairment after stroke (see Appendix E). It is designed so that virtually any stroke will register some abnormality on the scale. The scale has an administration time of 5 to 10 minutes. The NIHSS score is based solely on examination and requires no historical information or contributions from surrogates. It can be administered at any stage by any trained clinician.

The original 11 items of the NIHSS do not test distal upper extremity weakness, which is more common in stroke patients than proximal arm weakness. An additional item examining finger extension is often added to the NIHSS. Although not contributing to the total NIHSS score, this item should be recorded as part of the NIHSS assessment.

**Recommendations**

1. Strongly recommend that the patient be assessed for stroke severity using the NIHSS at the time of presentation/hospital admission, or at least within the first 24 hours after presentation.
2. Strongly recommend that all professionals involved in any aspect of the stroke care be trained and certified to assess stroke severity using the NIHSS.
3. Recommend that patients be reassessed using the NIHSS at the time of acute care discharge.
4. Recommend that if the patient is transferred to rehabilitation and there are no NIHSS scores in the record, the rehabilitation team should complete an NIHSS assessment.

**Discussion**

The NIHSS is used to guide decisions concerning acute stroke therapy.<sup>72</sup> Initial scores have been used to stratify patients according to severity and likely outcome. The presentation NIHSS score was highly correlated with outcome in retrospective analyses of 2 randomized clinical trials.<sup>28,29</sup> A second assessment serves as a recheck of the initial measurement and may be more accurate, because the patient will have been stabilized and may be better able to cooperate with the examiner, thus improving the accuracy of scoring.

Because the severity of stroke as assessed using the NIHSS may influence decisions concerning the acute treatment of stroke patients (such as the use of thrombolytic therapy), application of this scale in clinical settings is becoming more common.<sup>73</sup>

The NIHSS score strongly predicts the likelihood of the patient’s recovery after stroke. A score of greater than 16 forecasts a high probability of death or severe disability, whereas a score of less than 6 forecasts a good recovery.<sup>28</sup> Patients with a severe neurological deficit after stroke, as measured using the NIHSS, have a poor prognosis. During the first week after acute ischemic stroke, it is possible to identify a subset of patients who are highly likely to have a poor outcome.<sup>29</sup>

Potential examiners become certified in the NIHSS by watching a training videotape and passing an examination that involves scoring patients shown on a test tape.<sup>72</sup> Certified examiners may be of any background (eg, physician, nurse, therapist, or social worker).<sup>74–76</sup> Inter-rater reliability between examiners for most items of the NIHSS is high,<sup>77</sup> making the scale highly reproducible. Retrospective estimation of the initial NIHSS score from the admission neurological examination is possible and fairly accurate,<sup>78–80</sup> although actual testing is preferable.

Continuing validation of the predictive value of the NIHSS within the VA/DoD healthcare system through ongoing prospective data collection is encouraged.

**Evidence**

See Table 7.

**D. Initiation of Secondary Prevention of Stroke and Atherosclerotic Vascular Disease**

**Objective**

Reduce the risk for recurrence of stroke.

**TABLE 7. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Assess stroke severity using the NIHSS score.	Adams et al, 1999 <sup>28</sup> ; Frankel et al, 2000 <sup>29</sup>	I	Good	A

QE indicates quality of evidence; R, recommendation (see Appendix B).

**Background**

After a stroke, patients are at increased risk for additional cerebrovascular events. Patients with ischemic stroke or nonischemic stroke in the setting of CHD risk equivalents (ie, coronary artery disease, peripheral vascular disease, diabetes) are also at increased risk for myocardial infarction and coronary heart disease–mediated death.

**Recommendations**

The need for secondary prevention of stroke is lifelong and is a critical component of rehabilitation with clear data on hypertension treatment, warfarin use in atrial fibrillation, and antiplatelet therapy use in cerebral ischemia.<sup>81</sup> In patients with ischemic stroke or nonischemic stroke in the setting of CHD risk equivalents, the need for secondary prevention of coronary heart disease is also a critical component with clear data on antiplatelet therapy, hypertension control, consideration of ACE inhibitors, lipid-lowering therapy even in the setting of normal LDL cholesterol, exercise, and smoking cessation.

**IV. Poststroke Rehabilitation**

**A. Assess Post–Acute Stroke Patients for Rehabilitation Services**

Post-acute stroke is defined as “the period of time immediately after discharge from acute care.” At that point the stroke patient has achieved medical stability and the focus of care becomes rehabilitation. Stroke rehabilitation after discharge from acute care can be conducted in inpatient rehabilitation hospitals or rehabilitation units in acute care hospitals, nursing facilities, the patient’s home, or outpatient facilities. Some patients may recover from the acute phase with no need for rehabilitation services.

*Inpatient rehabilitation* is defined as “rehabilitation performed during an inpatient stay in a freestanding rehabilitation hospital or a rehabilitation unit of an acute care hospital. The term inpatient is also used to refer generically to programs where the patient is in residence during treatment, whether in an acute care hospital, a rehabilitation hospital, or a nursing facility.”

*Nursing facility rehabilitation* is defined as “rehabilitation performed during a stay in a nursing facility. Nursing facilities vary widely in their rehabilitation capabilities, ranging from maintenance care to comprehensive and intense rehabilitation programs.”

*Outpatient rehabilitation* is defined as “rehabilitation performed in an outpatient facility that is either freestanding or attached to an acute care or rehabilitation hospital. Day hospital care is a subset of outpatient rehabilitation in which the patient spends a major part of the day in an outpatient rehabilitation facility.”

*Home-based rehabilitation* is defined as a “rehabilitation program provided in the patient’s place of residence.”<sup>9</sup>

## **B. Obtain Medical History and Do Physical Examination**

Determine nature and extent of rehabilitation services needed on the basis of stroke severity, functional status, and social support.

### *Objective*

Obtain clinical data to determine the patient’s need for rehabilitation services.

### *Annotations*

A thorough history and physical should be performed by the rehabilitation physician. The NIHSS score should be obtained at this time, if not previously determined by the referring team. The history, physical, and NIHSS score provide the framework to begin to determine the nature and extent of needed rehabilitation services.

The history and physical should cover the following areas:

- Risk of complications (skin breakdown, risk for DVT, swallowing problems, bowel and bladder dysfunction, malnutrition, falls, and pain) (See Sections III-B and IV-C.)
- Determination of impairment (swallowing, cognition, communication, motor, psychological, and safety awareness) (See Sections IV-D and -O.)
- Psychosocial assessment (family and caregivers, social support, financial, and cultural support) (See Section IV-E, “Psychosocial Assessment.”)
- Assessment of prior and current functional status (eg, FIM) (See Section IV-F.)

## **C. Assess Risk for Complications**

### *C-1. Assessment of Swallowing (Dysphagia)*

#### *Background*

Dysphagia, an abnormality in swallowing fluids or food, is common, occurring in about 45% of all stroke patients admitted to the hospital. It can seriously affect the patient’s quality of life and potentially lead to death. It is associated with severe strokes and with worse outcome. The presence of aspiration may be associated with an increased risk of developing pneumonia after stroke. Malnutrition is also common, being present in about 15% of all patients admitted to the hospital, and increasing to about 30% over the first week after stroke. Malnutrition is associated with a worse outcome and a slower rate of recovery.<sup>11</sup>

Assessment of dysphagia by personnel who are not adequately trained in the anatomy and physiology of swallowing is oftentimes problematic. Traditionally, SLPs receive formal training in oropharyngeal anatomy and physiology. However, many medical centers may not have the availability of the SLP but may have other health professionals (eg, occupational therapists and nurses) with training in assessment and treatment of dysphagia. The availability of the SLP and education of other health professionals in dysphagia are essential to ensure that the rates of malnutrition and aspiration pneumonia are kept to a minimum.

### *Recommendations*

1. Recommend that all patients have their swallow screened before initiating oral intake of fluids or food, utilizing a simple valid bedside testing protocol.
2. Recommend that the swallow screening be performed by the SLP or other trained personnel (eg, nurse or occupational therapist) if the SLP is not available.
3. If the patient’s swallow screening is abnormal, a complete bedside swallow examination is recommended. The examination should be performed by the SLP, who will define swallow physiology and make recommendations about management and treatment.
4. Recommend that all patients who have a positive bedside screening be tested using a videofluoroscopy swallowing study (VFSS)/modified barium swallow. Patients with a high risk for aspiration and/or dysphagia (eg, brain stem stroke, pseudobulbar palsy, and multiple strokes), regardless of screening results, should undergo VFSS.
5. Recommend considering fiberoptic endoscopic examination of swallowing (FEES) as an alternative to VFSS.
6. There is insufficient evidence to recommend for or against fiberoptic endoscopic examination of swallowing with sensory testing (FEESST) for the assessment of dysphagia.
7. Recommend that the diagnostic assessment, whether VFSS or another modality, include a definition of swallow physiology with identification of the physiological abnormality and treatment strategies to directly assess their effectiveness.
8. Recommend discussing food consistency with dietetics to ensure standardization, consistency, and palatability.

### *Discussion*

No controlled trials were found that compared the effectiveness of a screening program versus no screening for identifying patients who are at increased risk of pneumonia and nutrition problems. Two systematic reviews that included case series showed that patients who have abnormal screening tests are at increased risk of pneumonia and nutrition problems compared with patients who have normal screening tests.<sup>82,83</sup>

The only 2 signs that seem predictive of aspiration are severe dysphagia and abnormal pharyngeal sensation.<sup>82,83</sup> The ECRI<sup>82</sup> has reported that individual signs and symptoms do not adequately predict pneumonia or detect aspiration during a bedside evaluation.

The same 2 systematic reviews,<sup>82,83</sup> along with a third,<sup>84</sup> showed that routine screening compared with no screening may decrease the risk of pneumonia, but this is based on very limited data from case series, cohort studies, and a single historical-controlled trial. One systematic review included cost-effectiveness analyses, which suggested that routine screening with a preliminary bedside evaluation followed by either a full bedside evaluation or VFSS when the preliminary study is abnormal may be cost-effective—if the assumptions used in the analyses are correct.<sup>82</sup>

**BEDSIDE EXAMS.** Cohort studies have shown that full bedside evaluations can detect patients who are at risk for pneumonia and nutrition problems, but the magnitude of the increased risk for patients with abnormal tests is not clear. Water swallow tests alone do not seem to be as accurate as full

TABLE 8. Evidence

Recommendation	Source	QE	Overall Quality	R
1. Simple valid bedside swallow screening completed before initiating oral intake of fluids or foods	ECRI, 1999 <sup>82</sup> ; Martino et al, 2000 <sup>84</sup> ; Perry and Love, 2001 <sup>83</sup>	II-2	Fair	B
2. Swallow screening performed by the SLP or other appropriately trained personnel	Working Group Consensus	III	Poor	I
3. A complete bedside swallow examination, performed by the SLP, for all patients with abnormal swallow screenings	Working Group Consensus	III	Poor	I
4. Use VFSS for all positive bedside swallow screenings; patients at high risk for aspiration/dysphagia should undergo VFSS.	Perry and Love, 2001 <sup>83</sup>	II-2	Fair	B
5. FEES as an alternative to videofluoroscopy	ECRI, 1999 <sup>82</sup>	II-2	Fair	C
6. FEESST may be considered.	Aviv et al, 2000 <sup>87</sup>	II-3	Poor	I
7. VFSS and other diagnostic procedures for swallow should include assessment of treatment strategies.	Martin-Harris et al, 2000 <sup>88</sup>	II-2	Fair	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

bedside exams. Limited data suggest that the accuracy of water swallow tests or full bedside evaluations may be increased by combining these with an oxygen desaturation test.<sup>85</sup>

**VIDEOFLUOROSCOPY/MODIFIED BARIUM SWALLOW.** Cohort studies have shown that patients who aspirate on VFSS are at higher risk of developing pneumonia and nutrition problems than are patients with normal tests. There is no good evidence that VFSS is more or less accurate than bedside exams in predicting pneumonia or other complications.<sup>82</sup>

**FIBEROPTIC ENDOSCOPIC EXAMINATION OF SWALLOWING (FEES).** Case series comparing FEES and VFSS have shown that each test detects some patients who aspirate that the other test does not, and that neither test is clearly better than the other. One small cohort study showed that FEES was very sensitive, but not specific in predicting pneumonia.<sup>86</sup>

One cohort study (20 subjects) showed that FEESST with VFSS improved prognostication for pneumonia over VFSS alone.<sup>87</sup> Additional research is needed.

Examination of treatment strategies by x-ray can impact diet and recovery from dysphagia. About 83% of patients receiving VFSS may receive changes in at least 1 of 5 important clinical variables: referrals to other specialists, swallowing therapy, compensatory strategies that improve swallowing, changes in mode of nutritional intake, and diet.<sup>88</sup>

#### Evidence

See Table 8.

## C-2. Treatment of Bowel and Bladder Incontinence

### Background

Urinary incontinence is a common problem after stroke. Approximately 50% of stroke patients have incontinence during their acute admission for stroke.<sup>89</sup> However, that number decreases to 20% by 6 months after stroke. Increased age, increased stroke severity, the presence of diabetes, and the occurrence of other disabling diseases increase the risk of urinary incontinence in stroke.

Most patients with moderate-to-severe stroke are incontinent at presentation, and many are discharged incontinent. Urinary and fecal incontinence are both common in the early stages. Incontinence is a major burden on caregivers once the patient is discharged home. Management of both bladder and bowel problems should be seen as an essential part of the patient's rehabilitation, because they can seriously hamper progress in other areas. Acute use of an indwelling catheter may facilitate management of fluids, prevent urinary retention, and reduce skin breakdown in patients with stroke; however, the use of a Foley catheter for more than 48 hours after stroke increases the risk of urinary tract infection.

Fecal incontinence occurs in a substantial proportion of patients after a stroke, but clears within 2 weeks in the majority of patients.<sup>90</sup> Continued fecal incontinence signals a poor prognosis. Diarrhea, when it occurs, may be due to medications, initiation of tube feedings, or infections; it can also be due to leakage around a fecal impaction. Treatment should be cause-specific.<sup>9</sup>

Constipation and fecal impaction are more common after stroke than incontinence. Immobility and inactivity, inadequate fluid or food intake, depression or anxiety, a neurogenic bowel or the inability to perceive bowel signals, lack of transfer ability, and cognitive deficits may each contribute to this problem. Goals of management are to ensure adequate intake of fluid, bulk, and fiber and to help the patient establish a regular toileting schedule. Bowel training is more effective if the schedule is consistent with the patient's previous bowel habits.<sup>91</sup> Stool softeners and judicious use of laxatives may be helpful.

### Recommendations

1. Recommend assessment of bladder function in acute stroke patients, as indicated. Assessment should include the following:
  - Assessment of urinary retention through the use of a bladder scanner or an in-and-out catheterization
  - Measurement of urinary frequency, volume, and control
  - Assessment for the presence of dysuria
2. Recommend considering removal of the Foley catheter within 48 hours to avoid increased risk of urinary tract infection; however, if used, it should be removed as soon as possible.
3. Recommend the use of silver alloy-coated urinary catheters, if a catheter is required.
4. There is insufficient evidence to recommend for or against the use of urodynamics over other methods of assessing bladder function.



5. Recommend considering an individualized bladder-training program be developed and implemented for patients who are incontinent of urine.
6. Recommend the use of prompted voiding in stroke patients with urinary incontinence.
7. Recommend that a bowel management program be implemented in patients with persistent constipation or bowel incontinence.

### Discussion

There are no systematic reviews evaluating the usefulness of urodynamics in the setting of poststroke incontinence. Weak trial data (ie, low-quality RCT in the nonstroke setting and prospective and retrospective cohort studies of patients after stroke) suggest that urodynamic evaluation may be important in males if empiric anticholinergic therapy is planned or if urinary incontinence does not resolve within the expected time frame.<sup>92</sup> Retrospective cohort data suggest that in males with stroke symptoms do not reliably predict the presence of obstructive findings on urodynamic testing.<sup>93</sup>

A systematic review of diagnostic test studies did not conclusively recommend bladder scanning as an adjunct to bedside clinical evaluation for incontinence over other methods of assessing urinary retention, such as in-and-out catheterization.

Use of an indwelling catheter should be limited to patients with incontinence who cannot be managed any other way. Studies performed in nonstroke populations have clearly demonstrated the increased risk of bacteriuria and urinary tract infections.<sup>94–96</sup>

A meta-analysis study published in 1998<sup>97</sup> concluded, “Silver alloy–coated urinary catheters are significantly more effective in preventing urinary tract infections than are silver oxide catheters. They are more expensive but may reduce overall costs of care, because catheter-related infection is a common cause of nosocomial infection and bacteremia.” This analysis covered a diverse patient population and was not specific to stroke.

There is systematic review evidence of low- to medium-quality studies that weakly supports bladder training in the short-term management of urge urinary incontinence in a general population with this disorder.<sup>98</sup> There is systematic review evidence of medium-quality studies that weakly supports prompted voiding for short-term improvement in incontinence symptoms.<sup>99</sup> These studies may not be generalizable to stroke patients because of a high prevalence of dementia in the population studied and the fact that the interventions were conducted by research assistants rather than nursing staff.

There is no pertinent evidence for or against scheduled voiding for stroke patients, nor is there evidence supporting a bowel program.

### Evidence

See Table 9.

### C-3. Assessment of Malnutrition

#### Background

Adequate nutrition and hydration can be compromised by altered consciousness, swallowing difficulties (dysphagia),

**TABLE 9. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Bladder assessment/scanning	Nwosu et al, 1998 <sup>100</sup>	II-2	Poor	C
	Working Group Consensus	III	Fair	B
2. Indwelling catheter	Bjork et al, 1984 <sup>94</sup> ; Sabanathan et al, 1985 <sup>95</sup> ; Warren et al, 1982 <sup>96</sup>	II-2	Fair	B
3. Silver alloy–coated catheters	Saint et al, 1998 <sup>97</sup>	I	Fair	B
4. Urodynamics	Ramsay et al, 1995 <sup>101</sup>	III	Poor	I
5. Bladder training program	Roe et al, 2000 <sup>102</sup> ; Berghmans et al, 2000 <sup>98</sup>	III	Poor	C
6. Prompted voiding	Eustice et al, 2000 <sup>99</sup>	I	Fair	B
7. Bowel program	Venn et al, 1992 <sup>91</sup>	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

sensory or perceptual deficits, reduced mobility, or depression, which can cause a decreased interest in eating. Assessment of nutrition and hydration includes monitoring intake, body weight, urinary and fecal outputs, caloric counts, and levels of serum proteins, electrolytes, and blood counts.

### Recommendations

1. Recommend that all patients receive evaluation of nutrition and hydration as soon as possible after admission. Food and fluid intake should be monitored daily in all patients, and body weight should be determined regularly.
2. Recommend that a variety of methods be used to maintain and improve intake of food and fluids. This will require treating the specific problems that interfere with intake; providing assistance in feeding, if needed; consistently offering fluid by mouth to dysphagic patients; and catering to the patient's food preferences. If intake is not maintained, feeding by a feeding gastrostomy may be necessary.

### Evidence

See Table 10.

### C-4. Assessment and Treatment of Pain

#### Background

Patients may have preexisting pain or acute pain after stroke. Pain occurring after stroke may include joint pain from spasticity, immobility, muscle weakness, headache, centrally mediated pain, and shoulder pain. Prevention, assessment,

**TABLE 10. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Nutrition and hydration evaluation should be completed as soon as possible after admission, using a valid nutritional screening method.	Working Group Consensus	III	Poor	I
2. Use a variety of methods to maintain and improve intake of food and fluids.	Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

**TABLE 11. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Standardized pain assessment	Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

and treatment of pain should continue throughout rehabilitation care.

*Recommendations*

1. Recommend pain assessment using the 0 to 10 scale.<sup>103</sup>
2. Recommend a pain management plan that includes assessment of the following: likely etiology (ie, musculoskeletal and neuropathic); pain location; pain quality, quantity, duration, and intensity; and what aggravates or relieves the pain.
3. Control pain that interferes with therapy.
4. Recommend the use of lower doses of centrally acting analgesics, which may cause confusion and deterioration of cognitive performance and interfere with the rehabilitation process.

*Discussion*

For pain assessment scales see the following book: VHA. Pain as the 5th Vital Sign Toolkit. Washington, DC: National Pain Management Coordinating Committee; October 2000.

*Evidence*

See Table 11.

**D. Assessment of Cognition and Communication**

*Objective*

Identify areas of cognitive and communication impairment.

*Background*

Assessment of cognition and arousal is important for determining the patient’s capabilities and limitations for coping with their stroke and assuring success of the rehabilitation process. The results of the assessment may impact the choice of treatment and disposition.

Assessment of communication ability is important for determining the patient’s capabilities and limitations in expressing their wants, needs, and understanding; their ability to contribute to their plan of care (including consent forms and advanced directives), and their ability to comprehend instructions affecting the success of the rehabilitation process. The results of the assessment may impact the choice of treatment and disposition.

*Recommendations*

1. Recommend that assessment of cognition, arousal, and attention address the following areas: learning and memory, visual neglect, attention, apraxia, and problem solving.
2. The Working Group does not recommend for or against the use of any specific tools to assess cognition. Several screening and assessment tools exist. Appendix D includes standard instruments for assessment of cognition.

3. Recommend that the assessment of communication ability address the following areas: listening, speaking, reading, writing, and pragmatics.
4. The Working Group does not recommend for or against the use of any specific tools to assess communication. Several screening and assessment tools exist. Appendix D includes standard instruments for assessment of communication.

**E. Psychosocial Assessment**

*Objective*

Provide comprehensive understanding of patient/caregiver psychosocial functioning, environment, resources, goals, and expectations for community integration.

*Background*

A comprehensive understanding and involvement of the whole person, family/caregiver, and environmental system are required for stroke rehabilitation. Without adequate resources and support it is difficult for patients to sustain the gains made during inpatient care or to make further progress in the community. It is essential that the treatment team know the patient (including history, expectations, coping style, resources, and emotional support system) in order to fully engage him/her in the treatment process. Motivation and hope for improvement are critical to functional improvement.

*Recommendations*

1. Recommend that all stroke patients receive a psychosocial assessment, psychosocial intervention, and referrals.
2. Recommend that families, significant others, and caregivers be included in the assessment process.
3. Recommend that all stroke patients be referred to a social worker for a comprehensive psychosocial assessment and intervention.
4. Recommend that the psychosocial assessment include the following areas:
  - History of prestroke functioning (eg, demographic information, past physical conditions and response to treatment, substance use and abuse, psychiatric, emotional and mental status and history, education and employment, and military, legal, and coping strategies)
  - Family/caregiver situation and relationships
  - Resources (eg, income and benefits, housing, and social network)
  - Spiritual and cultural activities
  - Leisure time and preferred activities
  - Patient/family/caregiver understanding of the condition, treatment, and prognosis, as well as hopes and expectations for care

*Discussion*

The assessment should provide information about the significance of the history and situation to the patient/family now, as well as documentation of facts and events. Family/caregiver involvement is also essential to obtain a complete psychosocial assessment, encourage motivation, learn proper way of assisting patient with ADLs and mobility function, and plan for successful follow-up care. Research suggests that the prevention of social deterioration and impairment should be part of the multidisciplinary efforts to care for poststroke patients.<sup>104</sup> High levels of family support have been found to be associated with improved functional status in poststroke

**TABLE 12. Evidence**

Recommendation	Source	QE	Overall		R
			Quality		
1. All stroke patients receive a psychosocial assessment and intervention and referrals.	Tsouana-Hadjis et al, 2000 <sup>105</sup>	II-3	Fair		B
2. Include families, significant others, and caregivers in the assessment process.	Tsouana-Hadjis et al, 2000 <sup>105</sup>	II-3	Fair		B
3. Comprehensive psychosocial assessment and intervention by a social worker	Working Group Consensus	III	Poor		I

QE indicates quality of evidence; R, recommendation (see Appendix B).

patients,<sup>105</sup> emphasizing the importance of family involvement in care and planning issues.

In one study, patients receiving early, systematic discharge planning on the basis of psychosocial assessment experienced an increased likelihood of successful return to home after hospital admission and a decreased chance of unscheduled readmission.<sup>106</sup> Unmet needs and gaps in resources should be addressed as soon as possible, not only to plan for discharge but also to relieve anxiety and encourage planning for the future during the rehabilitation process.

#### **Evidence**

See Table 12.

### **F. Assessment of Function**

#### **Objective**

Provide baseline assessment of overall functional status.

#### **Background**

Analysis of function focuses on the measurement of task-specific activities that are essential to support the well-being of an individual. The assessment of function is accomplished via a test or battery of tests in which the results can be used as (1) an information base for setting realistic goals, (2) an indicator to the patient of current abilities that documents progression toward more complex functional levels, (3) an index for decisions on admission and discharge from a rehabilitation or extended care facility, and (4) a guide for determining the safety of an individual in performing a particular task and the risk of injury with continued performance. The discharge environment has to support the functional abilities of the patient.

#### **Recommendations**

1. Recommend that a standardized assessment tool be used to assess functional status of stroke patients.
2. Recommend considering the use of the Functional Independence Measure (FIM) as the standardized functional assessment (see Appendix C: Functional Independence Measure [FIM] Instrument). Appendix D includes the list of other standard instruments for assessment of function and impact of stroke.

#### **Discussion**

Standard measurement tools may be used to objectively document the overall functional status of a patient who

**TABLE 13. Evidence**

Recommendation	Source	QE	Overall		R
			Quality		
1. Standardized functional assessment tool (eg, FIM)	Lin, 2001 <sup>108</sup> ; Ottenbacher et al, 1996 <sup>109</sup> (meta-analysis)	II-2	Fair		B

QE indicates quality of evidence; R, recommendation (see Appendix B).

survived a stroke. The most widely used tool for measuring functional status is the FIM, although others exist (eg, Barthel and Lawton<sup>107</sup>). VHA Directive 2000–16 June 2001 states that all VA facilities will complete a FIM assessment on all stroke patients with rehabilitation needs.<sup>12</sup>

Assessment of function may include, but is not limited to, the following:

- Aerobic capacity and endurance
- Arousal, attention, and cognition
- Assistive and adaptive devices
- Balance
- Circulation (ie, cardiovascular signs/symptoms and response to position change)
- Continence
- Gait
- Locomotion
- Joint integrity and mobility
- Motor function (ie, movement patterns, coordination, dexterity, and agility)
- Muscle performance (strength, power, and endurance)
- Orthotic, protective, and supportive devices
- Pain
- Posture
- Range of motion
- Reflex integrity
- Sexual activity
- Self-care (ADLs and IADLs)

#### **Evidence**

See Table 13.

### **G. Does Patient Need Rehabilitation Interventions?**

#### **Objective**

Identify the patient who requires rehabilitation intervention.

#### **Background**

Patients who have sustained an acute stroke should receive rehabilitation services if their poststroke functional status is below their prestroke status, and if there is a potential for improvement. If pre- and poststroke functional status is equivalent, or if the prognosis is judged to be poor, rehabilitation services may not be appropriate for the patient at the present time.

Patients who have had an ischemic or hemorrhagic stroke with resultant impairments and limitations in activities, as identified on the brief assessment, should be referred to rehabilitation services for an assessment of rehabilitation needs.

### Recommendations

1. Strongly recommend that once the patient is medically stable, the primary physician consult rehabilitation services (ie, physical therapy, occupational therapy, speech and language pathology, kinesiotherapy, and physical medicine), as indicated, to assess the patient's rehabilitation needs and to recommend the most appropriate setting to meet those needs.
2. Recommend that a multidisciplinary assessment, using a standard procedure, be undertaken and documented for all patients. Patients with need of rehabilitation intervention should be referred to a specialist stroke rehabilitation team, as soon as possible.

### Discussion

Assessment of rehabilitation needs should include the following:

- Medical workup and treatment plan
- Stable vital signs for 24 hours
- No chest pain within the previous 24 hours, with the exception of stable angina or a documented noncardiac condition
- No significant arrhythmia
- No evidence of DVT
- Cognitive capability of participating in rehabilitation
- Willingness to participate in rehabilitation services
- Prior functional status
- Capacity for improvement
- Functional deficits: See Sections IV-C, -D, -E, and -F.
- Assessment of training needs: family, major equipment, and vocation/leisure

## H. Is Inpatient Rehabilitation Indicated?

### Objective

Identify the optimal environment for providing rehabilitation interventions.

### Background

No study has demonstrated the superiority of 1 type of rehabilitation setting over another. The decision to provide rehabilitation services in an inpatient setting, either in the general inpatient ward, rehabilitation unit, or long-term care unit, is based on the patient's needs and availability of resources. Regardless of the setting, the patient should be cared for by a coordinated multidisciplinary team.

### Recommendations

1. Strongly recommend that patients in need of rehabilitation services have access to a setting with a coordinated and organized rehabilitation care team that is experienced in providing stroke services. The coordination and organization of inpatient post-acute stroke care will improve patient outcome.
2. No recommendation can be made for the use of 1 type of rehabilitation setting over another because no conclusive evidence demonstrates that superiority exists.
3. Recommend that the severity of the patient's impairment, the availability of family/social support, and patient/family preferences determine the optimal environment for care.

4. Recommend that patients remain in an inpatient setting for their rehabilitation care if they are in need of skilled nursing services, regular physician care, and multiple therapeutic interventions.

### Discussion

The Early Supported Discharge Trialists study<sup>110</sup> has shown that if a multidisciplinary team exists in the community, rehabilitation services may be successfully provided in outpatient settings and patients can be discharged from the inpatient setting early. Cifu and Stewart<sup>4</sup> observed that "current literature is too limited to allow an assessment of the relationship of specific types of noninpatient rehabilitation services after stroke and functional outcome." Evans,<sup>5</sup> in another review of the literature, noted that "[inpatient] rehabilitation services are effective in improving short-term survival, functional ability, and the most independent discharge location"; however, Evans found a lack of long-term benefits and suggested that therapy be extended to home or other settings, rather than being discontinued at discharge.

Rudd and colleagues<sup>111</sup> have attempted to address the issue by studying whether early discharge with intensive community-based therapy is as effective as continued inpatient rehabilitation care. The authors controlled for the medical stability of patients and for therapeutic intensity, thereby testing whether patients and caregivers could competently function at home after a shorter period of inpatient care. The groups did not differ for any of the standardized measures. More patients in the community-care group were satisfied with their hospital care than were patients in the conventional-care group (79% versus 65%;  $P=0.03$ ). Mean length of stay after randomization was shorter in the community-care group than in the conventional-care group (12 versus 18 days;  $P<0.001$ ). Patients with stroke who were discharged early to a community-based rehabilitation team did not differ in impairment and disability compared with patients who received conventional care. Details were not provided about qualitative differences between the community-based and inpatient multidisciplinary therapy programs.

The Working Group consensus is that patients should remain in an inpatient setting for their rehabilitation care if they are in need of skilled nursing services, regular contact by a physician, and multiple therapeutic interventions.

Examples for "need of skilled nursing services" include (but are not limited to) the following:

- Bowel and bladder impairment
- Skin breakdown or high risk for skin breakdown
- Impaired bed mobility
- Dependence for ADLs
- Inability to manage medications
- High risk for nutritional deficits

Examples for "need of regular contact by a physician" include (but are not limited to) the following:

- Medical comorbidities not optimally managed (eg, diabetes and hypertension)



**TABLE 14. Evidence**

Recommendation	Source	QE	Overall	
			Quality	R
1. Organized and coordinated post-acute inpatient rehabilitation care improves outcome.	See Section II, "The Provision of Rehabilitation Care"	I	Good	A
2. Inpatient vs outpatient settings	Cifu and Stewart, 1999 <sup>4</sup> ; Early Supported Discharge Trialists, 2000 <sup>10</sup> ; Evans et al, 1995 <sup>5</sup> ; Rudd et al, 1997 <sup>11</sup>	I	Fair	B
3. Patient's impairments, availability of family/social support, and patient/family preferences determine the optimal environment for care.	Working Group Consensus	III	Fair	I
4. Patients requiring skilled nursing services, regular physician contact, and multiple therapeutic interventions should remain in an inpatient setting for rehabilitation care.	Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

- Complex rehabilitation issues (eg, orthotics, spasticity, and bowel/bladder)
- Acute illness (but not severe enough to prevent rehabilitation care)
- Pain management issues

An example for "need of multiple therapeutic interventions" includes (but is not limited to) the following:

- Moderate-to-severe motor/sensory deficits, and/or
- Cognitive deficits, and/or
- Communication deficits

### **Evidence**

See Table 14.

## **I. Is Patient Independent in ADLs and IADLs?**

### **Objective**

Determine appropriate discharge environment.

### **Background**

Instrumental activities of daily living (IADLs) are skills beyond basic self-care skills needed to function independently at home and in the community. Successful performance of complex ADL tasks (ie, cooking, cleaning, shopping, and housekeeping) requires higher-level neurophysiological organization than is required for performance of self-maintenance tasks (ie, bathing and dressing). For a patient planning to return to an assisted-living situation, further independence may not be required or expected. For many patients, however, IADLs are central to independent living. Cognitive functioning and comprehension are also necessary factors for independent living.

**TABLE 15. Activities of Daily Living and Instrumental Activities of Daily Living\***

ADLs	IADLs
<b>Mobility</b>	<b>Home management</b>
Bed mobility	Shopping
Wheelchair mobility	Meal planning
Transfers	Meal preparation
Ambulation	Cleaning
Stair climbing	Laundry
	Child care
<b>Self-care</b>	<b>Community living skills</b>
Dressing	Money/financial management
Self-feeding	Use of public transportation
Toileting	Driving
Bathing	Shopping
Grooming	Access to recreation activities
<b>Communication</b>	<b>Health management</b>
Writing	Handling medication
Typing/computer use	Knowing health risks
Telephoning	Making medical appointments
Use of special communication devices	
<b>Environmental hardware</b>	<b>Safety management</b>
Keys	Fire safety awareness
Faucets	Ability to call 9-1-1
Light switches	Response to smoke detector
Windows/doors	Identification of dangerous situations

\*Modified from: Pedretti LW. *Occupational Therapy: Practice Skills for Physical Dysfunction*. 4th ed. St Louis: Mosby; 1996.

### **Recommendations**

1. Recommend that all poststroke patients be reassessed for ADLs before discharge.
2. Recommend that all patients planning to return to independent community living be assessed for IADLs before discharge (including community skills evaluation and home assessment).
3. Recommend that minimal IADL skills required to stay at home alone include the ability to (1) prepare or retrieve a simple meal, (2) use safety precautions and exhibit good judgment, (3) take medication, and (4) get emergency aid, if needed. Refer to Table 15 as a guide to differentiate between ADLs and IADLs.

### **Discussion**

See Table 15.

### **Evidence**

See Table 16.

## **J. Discharge Patient to Prior Home/Community and Arrange for Medical Follow-Up in Primary Care**

### **Objective**

Ensure that the patient's continued medical and functional needs are addressed after discharge from rehabilitation services.

**TABLE 16. Evidence**

Recommendation	Source	QE	Overall	
			Quality	R
1. Reassess the patient's ADLs before discharge.	Nourhashemi et al, 2001 <sup>112</sup>	II-2	Fair	B
2. Assess the patient's IADLs before discharge if the patient is returning to independent community living.	Ginsberg et al, 1999 <sup>113</sup>	II-3	Fair	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

**Recommendations**

1. Recommend that every patient participate in a secondary prevention program (see Section III-D, "Initiation of Secondary Prevention of Stroke and Atherosclerotic Vascular Disease").
2. Recommend that post-acute stroke patients be followed up by a primary care provider to address stroke risk factors and continue treatment of comorbidities.
3. Recommend that patient and family be educated about pertinent risk factors for stroke.

**Discussion**

Patients who do not require any type of rehabilitation services and are discharged from acute care to home (or in the case of profoundly disabled patients, to a nursing home) require follow-up with their primary care provider within 1 month of discharge.

Patients who receive rehabilitation services require follow-up with their primary care provider within 1 month of discharge. They also require follow-up with the rehabilitation professional at a point in time 3 to 6 months after discharge.

**J-1. Exercise Program**

*Background*

Ensure that the patient is given a home exercise program or is referred to an appropriate community exercise program, as indicated.

*Recommendations*

Recommend that the patient participate in a regular strengthening and aerobic exercise program at home or in an appropriate community program that is designed with consideration of the patient's comorbidities and functional limitations.

*Discussion*

After discharge from rehabilitation services, patients may have continued medical or functional needs. Muscle weakness and decreased endurance are common impairments after stroke, which may persist after completion of formal rehabilitation. Stroke patients can make improvements in strength and endurance after formal rehabilitation is completed, which may improve function and decrease risk of further disease and disability. Additionally, management of stroke risk factors and comorbid disease should occur through follow-up with a primary care provider.

**TABLE 17. Evidence**

Recommendation	Source	QE	Overall	
			Quality	R
1. Regular strengthening and aerobic exercise program at home or in an appropriate community program	Macko et al, 1997 <sup>114</sup> ; Potempa et al, 1996 <sup>115</sup> ; Rimmer et al, 2000b <sup>116</sup> ; Teixeira-Salmela et al, 1999 <sup>117</sup>	II-2	Fair	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

*Evidence*

See Table 17.

**J-2. Adaptive Equipment, Durable Medical Equipment Devices, Orthotics, and Wheelchairs**

*Background*

Many patients require assistive devices, adaptive equipment, mobility aids, wheelchairs, and orthoses to maximize independent functioning after stroke. Many types of adaptive devices and durable medical equipment devices are available. Type and level of functional deficit, degree of achieved adaptation, and the structural characteristics of the living environment determine the need for a particular item.

*Recommendations*

1. Recommend that adaptive devices be used for safety and function if other methods of performing the task are not available or cannot be learned or if the patient's safety is a concern.
2. Recommend that lower-extremity orthotic devices be considered if ankle or knee stabilization is needed to improve the patient's gait and prevent falls.
3. Recommend that a prefabricated brace be initially used and that only patients who demonstrate long-term need for bracing have customized orthoses made.
4. Recommend that wheelchair prescriptions be based on careful assessment of the patient and the environment in which the wheelchair will be used.
5. Recommend that walking assistive devices be used to help with mobility efficiency and safety, when needed.

*Discussion*

A vast array of adaptive devices is available, including devices to make eating, bathing, grooming, and dressing easier for patients with functional limitations. These devices should only serve as a supplement and should not be expected to take the place of the patient mastering the task in question. Additionally, many patients may need to use adaptive devices early during the rehabilitation after a stroke, but will not require long-term use. This should be taken into account when considering providing a device. Examples of adaptive devices include (but are not limited to) eating utensils with built-up handles, rocker knives, plate guards, nonskid place mats, long handled sponges for bathing, hand-held showers, tub and shower chairs, grab bars for bathrooms, and elevated toilet seats.

Lower-extremity orthoses, such as ankle-foot-orthoses and knee-ankle foot-orthoses, may be required if the patient has persistent weakness and instability at the ankle and/or knee joint after a stroke. Proper timing for using an orthosis can

**TABLE 18. Evidence**

Recommendation	Source	QE	Overall	
			Quality	R
1. Use of adaptive equipment	AHCPR, 1995 <sup>15</sup> ; Working Group Consensus	III	Poor	C
2. Use of lower-extremity orthotic devices	AHCPR, 1995 <sup>15</sup> ; Working Group Consensus	III	Poor	C
3. Use of prefabricated braces	AHCPR, 1995 <sup>15</sup> ; Working Group Consensus	III	Poor	C
4. Wheelchair prescriptions	AHCPR, 1995 <sup>15</sup> ; Working Group Consensus	III	Poor	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

facilitate gait training and should be considered early on in the rehabilitation process to permit gait training to occur as early as possible. An orthosis should not be used as a substitute for functional exercise directed at regaining muscle strength and control, particularly if the prognosis for motor recovery is good. Prefabricated orthoses can be used in the early stages of gait training, but a custom-fit device should be provided if it is determined that the patient may require long-term use of the orthosis.

Walking devices are helpful for patients with mild gait impairments. These devices increase the base of support around a patient's center of gravity and reduce the balance and effort needed to walk. Walking aids include (but are not limited to) the following:

- Single point canes: Need to be fitted to the patient and have rubber tips to improve traction.
- Tripod or quad canes: Have 3 to 4 points of contact and offer more stability than a single point cane; however, they are heavier, bulkier, and more awkward to use.
- Walkers: Support more body weight than canes; should be lightweight and foldable if the patient is planning to use it outside the home.
- Rolling walkers: Allow for more energy-efficient ambulation. The 2-wheeled walker is the most commonly used walker, because 4-wheeled walkers are less stable and require greater coordination.

Wheelchairs should be provided for patients with severe motor weakness or those who easily fatigue. Wheelchair designs vary greatly; therefore, a wheelchair prescription should be specific to the patient's needs and environment and patient and family/caregiver preferences.

#### Evidence

See Table 18.

### J-3. Return to Work

#### Background

The AHCPR<sup>9</sup> has stated, "Stroke survivors who worked prior to their strokes should, if their condition permits, be encouraged to be evaluated for the potential to return to work. Vocational counseling should be offered when appropriate." A meeting report by the American Stroke Association's 26th International Stroke Conference (2001) stated, "...the risk of stroke increases dramatically with age and the average age of

**TABLE 19. Evidence**

Recommendation	Source	QE	Overall	
			Quality	R
1. Evaluate for the potential of returning to work.	AHCPR, 1995 <sup>15</sup>	III	Poor	C
2. Refer previously employed patients to vocational counseling.	AHCPR, 1995 <sup>15</sup> ; American Stroke Association	III	Poor	C
3. Refer patients with psychosocial barriers who are considering returning to work to supportive services.	AHCPR, 1995 <sup>15</sup> ; American Stroke Association	III	Poor	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

workers is increasing." Because of the Social Security Administration's change in mandatory retirement age "...more people will be working at the time of stroke and as more treatments are developed, more survivors will be facing the possibility of reemployment."

#### Recommendations

1. Recommend that all patients, if their condition permits, be encouraged to be evaluated for the potential of returning to work.
2. Recommend that all patients who were previously employed be referred to vocational counseling for assistance in returning to work.
3. Recommend that all patients who are considering a return to work but who may have psychosocial barriers (eg, motivation, emotional, and psychological concerns) be referred for supportive services, such as vocational counseling or psychological services.

#### Discussion

There are many barriers to vocational reintegration that must be addressed if the stroke patient is to return to work. The type of work to which the patient is considering returning may be the single most significant determinant to successful reemployment (eg, labor versus managerial or clerical). Retraining or returning to school for alternative employment requires a high level of motivation. Studies have indicated that successful reemployment may be dependent on support from family, return to work specialists, and employers.

#### Evidence

See Table 19.

### J-4. Return to Driving

#### Background

The question of if or when a person can resume driving after a stroke can be difficult to answer. The family and medical staff will need to balance the patient's desire for independence with safety concerns. Safe operation of a vehicle requires multilevel functions (eg, physical, cognitive, psychomotor, perceptual motor, and behavioral). Legal requirements vary from state to state.

#### Recommendations

1. Recommend that all patients be given a clinical assessment of their physical, cognitive, and behavioral functions to determine their readiness to resume driving. In individual

**TABLE 20. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Clinical assessment of the patient's physical, cognitive, and behavioral functions to determine readiness for return to driving	Working Group Consensus	III	Poor	I
2. Referral to an adaptive driving program for individuals with residual deficits	Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

cases, where concerns are identified by the family or medical staff, the patient should be required to pass the state road test as administered by the licensing department. Each medical facility should be familiar with their state laws with regard to driving after a stroke.

2. Recommend that medical staff consider referring patients with residual deficits to adaptive driving instruction programs to minimize the deficits, eliminate safety concerns, and ensure that patients will be able to pass the state's driving test.

*Discussion*

There are no incidence rates for motor vehicle accidents for poststroke patients as a group. However, because most stroke patients are older drivers with possible residual deficits, they should be considered at greater risk for motor vehicle accidents because older drivers (without stroke) are involved in more fatal motor vehicle accidents per miles driven.<sup>118</sup> Many factors contribute to this statistic; therefore, caution should be exercised not to overgeneralize. Currently, there is only a mild-to-moderate correlation of clinical exams to the pass/failure rate of poststroke patients on state driving road tests.

*Evidence*

See Table 20.

**J-5. Sexual Function**

*Background*

Sexual issues relate both to sexual function and to changes in body image as a result of the stroke. Sexual activity usually diminishes and sometimes ceases after stroke, but sex remains an important issue to the majority of poststroke patients. Sexual issues are often not adequately addressed, despite evidence that patients and their partners welcome frank discussions.<sup>119</sup>

*Recommendations*

Recommend that sexual issues be discussed during rehabilitation and addressed again after transition to the community when the poststroke patient and partner are ready.

*Discussion*

The most important message is that sexual activity is not contraindicated after stroke. However, both parties need to recognize and adjust for the potential effects of motor, sensory, and self-esteem difficulties. Interventions that stress the importance of effective communication, sharing

of concerns, and development of adaptive strategies to avoid fatigue (such as positioning, foreplay, and timing) are often helpful.

**K. Patients With Severe Stroke and/or Maximum Dependence and Poor Prognosis for Functional Recovery**

Patients who have had a severe stroke or who are maximally dependent in ADLs and have a poor prognosis for functional recovery are not candidates for rehabilitation intervention. Families and caregivers should be educated in the care of these patients, which may include the following: prevention of recurrent stroke, signs and symptoms of potential complications and psychological dysfunction, medication administration, assisted ADL tasks (eg, transfers, bathing, positioning, dressing, feeding, toileting, and grooming), swallowing techniques, nutrition and hydration, care of indwelling bladder catheter, skin care, contractures, use of a feeding tube, home exercises (range of motion), and sexual functioning. Families should receive counseling on the benefits of nursing home placement for long-term care.

**L. Inpatient Rehabilitation of the Poststroke Patient**

Inpatient rehabilitation is defined as “rehabilitation performed during an inpatient stay in a freestanding rehabilitation hospital or a rehabilitation unit of an acute care hospital.” The term “inpatient” is also used to refer generically to programs in which the patient is in residence during treatment, whether in an acute care hospital, a rehabilitation hospital, or a nursing facility.

**M. Determine Optimal Level of Care**

*Objective*

Provide the optimal environment for rehabilitation care.

*Background*

The clinician determines the optimal environment in which inpatient rehabilitation services should be provided. Outcomes are better with the presence of a multidisciplinary team specializing in stroke rehabilitation. The primary determinants of the level of care should be the patient's medical and functional status (ie, motor and cognition). See Sections IV-D and -F. The decision should be made in the context of social support and access to care.

*Recommendations*

1. Strongly recommend that rehabilitation services be provided in an environment with organized and coordinated post-acute stroke rehabilitation care.

*Discussion*

Evidence for the need to assess medical status for appropriate level of rehabilitation intervention is present and well established (see Section II, “The Provision of Rehabilitation Care”). Evidence-based rehabilitation clinical practice has used validated instrument scales with regard to functional status. Organized and coordinated rehabilitation care has demonstrated optimal stroke outcomes.<sup>17</sup>



**TABLE 21. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Organized and coordinated post-acute inpatient rehabilitation care improves outcome.	See Section II, "The Provision of Rehabilitation Care"	I	Good	A

QE indicates quality of evidence; R, recommendation (see Appendix B).

### Evidence

See Table 21.

## N. Educate Patient/Family, Reach Shared Decision About Rehabilitation Program, and Determine Treatment Plan

### Objective

Ensure the understanding of common goals among staff, family, and caregivers in the stroke rehabilitation process and, therefore, optimize the patient's functional recovery and community reintegration.

### Background

Goals are central to the process of rehabilitation because rehabilitation involves behavioral change.<sup>120</sup> The use of patient goals that transcend treating disciplines is a common method of creating consistency in the delivery of rehabilitation services; however, not all rehabilitation settings subscribe to their use. The setting of goals is a mechanism for active patient involvement and co-optation of the patient into the "rehabilitation team." Goal setting should use both short-term and long-term perspectives.

### Recommendations

1. Recommend that the clinical team and family/caregiver reach a shared decision about the rehabilitation program.
  - The clinical team should propose the preferred environment for rehabilitation and treatments on the basis of expectations for recovery.
  - Describe to the patient and family the treatment options, including the rehabilitation and recovery process, prognosis, estimated length of stay, frequency of therapy, and discharge criteria.
  - The patient, family, caregiver, and rehabilitation team should determine the optimal environment for rehabilitation and preferred treatment.
2. Recommend that the rehabilitation program be guided by specific goals developed in consensus with the patient, family, and rehabilitation team.
3. Recommend that the patient's family/caregiver participate in the rehabilitation sessions and be trained to assist patient with functional activities, when needed.
4. Recommend that patient and caregiver education be provided in an interactive and written format. Provide the patient and family with an information packet that may include printed material on subjects such as the resumption of driving, patient rights/responsibilities, support group information, and audiovisual programs on stroke.

**TABLE 22. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Determining therapy goals	Working Group Consensus	III	Poor	I
2. Patient/family education	See Section II, "The Provision of Rehabilitation Care"	I	Fair	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

5. Recommend that the detailed treatment plan be documented in the patient's record to provide integrated rehabilitation care.

### Discussion

#### Shared Decision Making

The patient and family are presented with information about the rehabilitation process and the alternatives available to achieve their rehabilitation goals. Although the team may make recommendations about rehabilitation in the safest and least restrictive environment, the patient and family are ultimately the ones to make the decisions about the treatment setting. Alternatives include nursing home placement, lower intensity therapy in another facility, discharge home with homecare services, outpatient therapy, or refusal of all services.

#### Goal of Therapy

The poststroke rehabilitation guideline published by the AHCPR does not address whether or not goals should be used, but rather "how" goals should be used.<sup>9</sup> There is insufficient evidence to evaluate the value of consensus goal development in stroke rehabilitation. However, it is best common practice to develop comprehensive goals that cover the level of disability and include psychosocial goals. The guideline recommends the following: "Both short-term and longer term goals need to be realistic in terms of current levels of disability and the potential for recovery."

The use of goal setting as a targeted outcome and subsequent outcome measure (eg, goal attainment scaling) has exhibited positive results in several clinical trials involving geriatric rehabilitation, brain injury rehabilitation, and mixed rehabilitation patients.<sup>121-124</sup>

Setting patient goals has multiple utilities. Goals should be realistic targets for use by the patient, family, and staff. Goals can serve in the capacity of a "self-fulfilling prophecy." Goals can create an environment of treatment consistency among treating disciplines, serve as benchmarks for response and recovery, and provide a basis for team meetings.

#### Treatment Plan

The treatment plan is determined on an individual basis for each patient, taking into account the patient/family's discharge goals and needs. The patient and family ultimately determine the treatment plan and establish short- and long-term goals.

### Evidence

See Table 22.

**O. Initiate Rehabilitation Programs and Interventions**

**Objective**

Provide the most appropriate interventions to optimize patient function and quality of life after an acute stroke.

**Background**

Patients who have had an ischemic or hemorrhagic stroke with resultant impairments and limitations in activities, as identified on the brief assessment, should be referred to rehabilitation services for an assessment of rehabilitation needs.

Stroke rehabilitation involves programs to reduce impairment, enhance recovery, and adapt to the persisting disability. Adaptation to the disability includes programs to teach mobility, ADLs, and community reintegration. These programs also include provision of assistive devices and technology. Mobility and training in ADLs have not been, nor are likely to be in the future, subjected to randomized, controlled studies. The treatment plan involves a multidisciplinary team that may include physical therapy, occupational therapy, speech and language pathology, kinesiotherapy, physical medicine or stroke rehabilitation physician. The following recommendations address those areas in which high-quality evidence has been identified.

**Discussion**

Assessment of rehabilitation needs should include the following:

- Medical workup and treatment plan
- Stable vital signs for 24 hours
- No chest pain within the previous 24 hours, with the exception of stable angina or a documented noncardiac condition
- No significant arrhythmia
- No evidence of DVT
- Cognitive capability of participating in rehabilitation
- Willingness to participate in rehabilitation services
- Prior functional status
- Capacity for improvement
- Functional deficits: See Sections IV-C, -D, -E, -F, and -G.
- Assessment of training needs: family, major equipment, and vocation/leisure

**Swallowing: Dysphagia Treatment**

**Background**

Dysphagia treatment may involve compensatory strategies, including posture changes, heightening sensory input, swallow maneuvers (voluntary control of selected aspects of the swallow), active exercise programs, or diet modifications. Dysphagia management may include, for example, nonoral feeding, psychological support, nursing intervention. At this time, it is unclear how dysphagic patients should be fed and treated after acute stroke.<sup>125</sup>

**Recommendations**

1. Recommend considering enteral feeding for the stroke patient who is unable to orally maintain adequate nutrition or hydration.

**TABLE 23. Evidence**

Recommendation	Source	Overall QE	Quality	R
1. Enteral feeding for patients who are unable to orally maintain adequate nutrition	Finestone et al, 2001 <sup>126</sup>	II-2	Fair	B
2. Initiate swallowing treatment and management once SLP identifies a treatable disorder in swallow anatomy or physiology.	Hinds and Wiles, 1998 <sup>128</sup> ; Martin-Harris et al, 2000 <sup>88</sup> ; Perry and McLaren, 2000 <sup>129</sup>	II-3	Fair	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

2. Recommend considering the use of a feeding tube; however, there is no evidence to recommend the use of one feeding route over another.
3. Recommend that the dysphagic stroke patient receive both direct swallowing treatment and management by the SLP, when available, when a treatable disorder in swallow anatomy or physiology is identified.

**Discussion**

The relevant systematic review and the existing guidelines generally support the use of tube feedings for patients who cannot sustain oral caloric and/or fluid intake in order to meet nutritional needs, but do not provide evidence with regard to timing and route. Very limited evidence suggests that percutaneous enteral gastrostomy feeding may compare favorably with nasogastric tube feeding.<sup>126</sup>

Because of the limited number of studies and the small numbers of patients, it is difficult to make specific recommendations about the various feeding interventions. Data from 2 ongoing studies may provide evidence about the appropriate use of feeding interventions to improve survival and quality of life for the dysphagic patient.

Data from several studies show swallow improvement with treatment provided during the video fluoroscopy swallowing study.<sup>88,127</sup>

**Evidence**

See Table 23.

**Communication**

**Acute Communication Disorders**

BACKGROUND. Disorders of communication (ie, problems with speaking, listening, reading, writing, gesturing, and/or pragmatics) and related cognitive impairments may occur in as many as 40% of poststroke patients. The most common communication disorders occurring after stroke are aphasia and dysarthria. Rapid spontaneous improvement is common, but early evaluation can identify communication problems and monitor change. If indicated, intervention can help maximize recovery of communication abilities and prevent learning of ineffective or inappropriate compensatory behaviors. Goals of speech and language treatment are to (1) facilitate the recovery of communication, (2) assist patients in developing strategies to compensate for communication disorders, and (3) counsel and educate people in the patient's environment to facilitate communication, decrease isolation,

**TABLE 24. Evidence**

Recommendation	Source	Overall		
		QE	Quality	R
1. Early treatment for patients with communication disorders by an SLP	ASHA, 2001 <sup>130</sup> and 2002 <sup>131</sup> ; Robey, 1994 <sup>132</sup> ; Robey, 1998 <sup>133</sup>	II-2	Fair	B
2. Staff and family/caregiver education in communication techniques	ASHA, 2001 <sup>130</sup> ; Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

and meet the patient's desires and needs.

#### RECOMMENDATIONS

1. Recommend that patients with communication disorders receive early treatment and monitoring of change in communication abilities in order to optimize recovery of communication skills, develop useful compensatory strategies, when needed, and facilitate improvements in functional communication.
2. Recommend that the SLP educate the rehabilitation staff and family/caregivers in techniques to enhance communication with patients who have communication disorders.

**DISCUSSION.** The American Speech-Language-Hearing Association (ASHA) requires that evaluation and treatment of communication disorders be performed by a certified SLP (ie, an individual who holds the Certificate of Clinical Competence in Speech-Language Pathology [CCC-SLP]).<sup>130,131</sup>

Two meta-analyses that included observational and quasi-experimental studies addressing treatment outcomes of aphasic patients at different recovery periods concluded the following:

- The recovery of treated individuals was nearly 2 times that of untreated individuals when treatment was begun in the acute stage (less than 4 months from insult). Furthermore, treatment brought about an appreciable, but smaller, improvement when begun after the acute period.<sup>132</sup>
- Outcomes for treated individuals are superior to those for untreated individuals in all stages of recovery. Outcomes are greater when begun in the acute stage of recovery.<sup>133</sup>

**EVIDENCE.** See Table 24.

#### *Long-Term Communication Difficulties*

**BACKGROUND.** Disorders of communication (ie, problems with speaking, listening, reading, writing, gesturing, and/or pragmatics) and related cognitive impairments may occur in as many as 40% of poststroke patients. The most common communication disorders occurring after stroke are aphasia and dysarthria. Rate of improvement decreases with time after stroke, making the evaluation and, if indicated, treatment of residual communication disorders an important step toward achieving independence and improving quality of life for stroke patients. Goals of speech-language treatment are to (1) facilitate recovery from the communication difficulties; (2) assist patients in developing strategies to compensate for communication disorders; and (3) counsel and educate people in the patient's environment to facilitate communication,

**TABLE 25. Evidence**

Recommendation	Source	Overall		
		QE	Quality	R
1. Follow-up evaluation and treatment by the SLP for residual communication difficulties	Elman and Bernstein-Ellis, 1999 <sup>134</sup> ; Katz and Wertz, 1997 <sup>135</sup> ; Robey, 1994 <sup>132</sup> and 1998 <sup>133</sup> ; Wertz et al, 1986 <sup>136</sup> ; Whurr et al, 1992 <sup>138</sup> and 1997 <sup>139</sup>	I	Good	A

QE indicates quality of evidence; R, recommendation (see Appendix B).

decrease isolation, and meet the patient's wants and needs.

**RECOMMENDATIONS.** Recommend that all patients be evaluated and treated by the SLP for residual communication difficulties (ie, speaking, listening, reading, writing, and pragmatics).

**DISCUSSION.** Three RCTs (1 individual, 1 group, and 1 computer-provided) demonstrated statistically significant improvement of long-term language difficulties in treated stroke patients when compared with untreated stroke patients.<sup>134–136</sup>

One RCT treatment study (individual) did not find a significant difference in long-term language difficulties between treated and untreated stroke patients. However, only one third of the treatment subjects received the prescribed treatment (2 hour/wk × 24 weeks).<sup>137</sup> Four meta-analyses indicated that treatment is generally efficacious.<sup>132,133,138,139</sup>

**EVIDENCE.** See Table 25.

#### **Motor**

##### *Motor Functioning—Strengthening*

**BACKGROUND.** Muscle weakness is a common impairment after stroke. However, facilitation treatment models have often emphasized the management of spasticity without addressing underlying muscle weakness. Another common intervention focus is functional training, sometimes without addressing the contributing impairments. Lower-extremity muscle strength has been correlated with gait speed in stroke patients.<sup>140</sup> Additionally, lower-extremity muscle strength on admission to rehabilitation is a predictor of function at discharge.<sup>141</sup> Lower-extremity strength has also been inversely correlated with a risk of falling in elderly individuals.

**RECOMMENDATIONS.** Recommend that strengthening be included in the acute rehabilitation of patients with muscle weakness after stroke.

**DISCUSSION.** The recommendation for including strengthening in the acute rehabilitation of patients with muscle weakness after stroke is based on Working Group Consensus, considering the positive relationship between muscle strength, function, and prevention of falls. Researchers in strength training of poststroke patients have studied subjects after acute rehabilitation had been completed (greater than 6 months after stroke) and demonstrated improvement in muscle strength and function with training.<sup>116,117</sup> There is a lack of research on specific strength training during acute rehabilitation.

**EVIDENCE.** See Table 26.

**TABLE 26. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Strengthening for patients with muscle weakness after stroke	Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

*Partial Body Weight Support for Treadmill Training*

**BACKGROUND.** More than one half of stroke patients who survive the acute phase of stroke are not able to walk and will require a period of rehabilitation to achieve a functional level of ambulation.<sup>142</sup> Recent studies reported that the type of training strategy implemented in rehabilitation can affect the patient’s locomotor recovery (see Table 27). A recently proposed gait training strategy involves unloading the lower extremities by supporting a percentage of body weight. Body weight support provides symmetrical removal of weight from the lower extremities, thereby facilitating walking in patients with neurological conditions. This specific gait training strategy has been used to enhance/facilitate locomotor abilities after stroke.

**RECOMMENDATIONS**

1. Recommend that treadmill training with partial body weight support be used as an adjunct to conventional therapy in patients with mild-to-moderate dysfunction resulting in impaired gait.

**DISCUSSION.** Treadmill training with partial body weight support is superior to non-body weight-supported treadmill training and is, therefore, recommended as an adjunct to conventional therapy in patients with mild-to-moderate dysfunction resulting in impaired gait.<sup>142</sup>

The RCP guideline<sup>11</sup> recommends the use of this modality for patients who are not walking 3 months after an acute stroke. One subsequent RCT found equivalent results for most patients from a program that included aggressive bracing and assisted walking.<sup>143</sup> One very small RCT found no benefit from partial body weight-supported treadmill training initiated within 6 weeks after the stroke.<sup>144</sup>

**EVIDENCE.** See Table 27.

*Constraint-Induced Movement Therapy*

**BACKGROUND.** Substantial loss of motor function may persist after sustaining a stroke. Persistent loss of upper extremity function is common among these individuals. Several different therapeutic approaches aimed at resolving upper-extremity dysfunction after stroke have been postulated. One

**TABLE 27. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Partial body weight support for treadmill training	Kosak and Reding, 2000 <sup>143</sup> ; Teixeira da Cunha Filho et al, 2001 <sup>144</sup> ; Visintin et al, 1998 <sup>142</sup>	I	Fair	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

**TABLE 28. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Constraint-induced therapy	Kunkel et al, 1999 <sup>145</sup> ; van der Lee et al, 1999 <sup>148</sup>	I	Poor	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

such approach has been termed “constraint-induced (CI) movement therapy,” and involves forced use of the involved upper extremity and discourages the use of the unaffected extremity. This approach requires substantial exercises (eg, 6 to 8 hours per day for 2 weeks).

**RECOMMENDATIONS**

1. Recommend considering the use of CI therapy for a select group of patients—that is, patients with 20 degrees of wrist extension and 10 degrees of finger extension, who have no sensory and cognitive deficits. To date the only demonstrated benefit occurs in individuals who received 6 to 8 hours of daily training for at least 2 weeks.<sup>145</sup>

**DISCUSSION.** The AHCPR<sup>9</sup> and RCP guidelines<sup>11</sup> do not make recommendations about the use of CI movement therapy. The study by Dromerick et al (n=23) is the only RCT that has looked at the results of CI therapy in an acute care setting. This clinical trial demonstrated the feasibility and safety of performing trials in the acute care setting. The results of the study showed a trend toward improved function among the CI group; however, conclusions are difficult to draw because of the small sample size and significant demographic differences between the study groups.<sup>146</sup>

CI movement therapy may prove beneficial for a small subset of stroke patients. Benefit has only been shown in patients with specific degrees of active wrist and finger extension on the involved upper extremity. Candidates for CI movement therapy must meet or exceed minimum motor criteria: 20-degree extension of the affected wrist and 10 degrees for each finger and who have no sensory or cognitive deficits.<sup>145</sup> The Working Group cannot recommend CI therapy as a preferred treatment for every patient.

The ongoing EXCITE (Extremity Constraint-Induced Therapy Evaluation) clinical trial, funded by the National Center for Medical Rehabilitation Research, may support the use of CI movement therapy in other populations.<sup>147</sup>

**EVIDENCE.** See Table 28.

*Functional Electrical Stimulation*

**BACKGROUND.** Functional electrical stimulation (FES) is electrical stimulation applied to a muscle, causing it to contract. FES has been used for several years as a therapy modality for poststroke patients, but has not been a routine standard of care. FES is a time-limited intervention, generally used during the first several weeks after the acute stroke.

**RECOMMENDATIONS**

1. Recommend treatment with FES for patients who have demonstrated impaired muscle contraction, specifically with patients with ankle/knee/wrist motor impairment.



2. Recommend FES for patients who have shoulder subluxation.
3. There is insufficient evidence to recommend for or against using multichannel FES for severe hemiplegic patients with gait impairment.
4. Recommend FES for gait training after stroke.

DISCUSSION. There is evidence of short-term increases in motor strength and motor control and a reduction in impairment severity, but there is no evidence of an increase in the patient's function.<sup>149</sup>

The total number of studies evaluating FES appears to be very small. A Cochrane review, a meta-analysis based on 2 RCTs, concluded that FES leads to improvements in glenohumeral subluxation.<sup>150</sup> A meta-analysis of 4 RCTs using FES for wrist extension, knee extension, or ankle dorsiflexion reported improved muscle force in the muscle groups receiving FES; no functional outcomes were reported.<sup>149</sup> One additional trial demonstrated short-term improvements in gait parameters when multichannel FES was used for 3 weeks in patients with severe hemiplegia.<sup>151</sup> These studies did not address the persistence of the effect or functional status change.

From the 1970s through the early 1990s a number of studies were performed that investigated the possibilities of FES as a treatment modality for patients with stroke.<sup>150</sup> Many of the studies reported favorable results and gains in motor strength, coordination, spasticity control, gait speed, and gait endurance. These studies were not RCTs.

The number of recent FES studies is small. A Cochrane review, a meta-analysis based on 2 RCTs, concluded that FES leads to improvement in glenohumeral subluxation.<sup>150</sup> More recently, Daly and colleagues<sup>152–154</sup> investigated the potential for FES to restore gait components in the stance and swing phases of gait. They reported that in the small numbers of patients they studied, there were dramatic gains in gait components, along with functional and quality of life changes. No RCTs were reported by this group, nor was there a description of the persistence of the effect.

EVIDENCE. See Table 29.

#### *Neurodevelopmental Training for Motor Retraining*

BACKGROUND. Several theoretical models of motor behavior exist. These models serve as the foundation for treatment approaches for central nervous system (CNS) dysfunction. Traditional approaches to CNS dysfunction are based on reflex or hierarchical models of motor control. These models of motor control have influenced neurodevelopmental training (NDT). NDT approaches focus on a progression of movement through the developmental sequence, inhibition of primitive reflexes/spasticity, and facilitation of higher-level control.<sup>156</sup> In the NDT model of motor control, higher centers control lower centers in the CNS.

On the contrary, contemporary models of motor control and learning focus on the interaction of higher and lower centers of control and view the nervous system as 1 system among many that influence motor behavior. Contemporary task-oriented approaches focus on the interaction of multiple systems and assume that motor control and behavior are

**TABLE 29. Evidence**

Recommendation	Source	Overall		
		QE	Quality	R
1. FES for patients with impaired muscle contraction, specifically patients with ankle/knee/wrist motor impairment	Glanz et al, 1996 <sup>149</sup>	I	Fair	B
2. FES for patients who have shoulder subluxation	Price and Pandyan, 2001 <sup>150</sup>	I	Fair	B
3. Multichannel FES for severely hemiplegic patients with gait impairment	Bogataj et al, 1995 <sup>151</sup>	I	Fair	B
4. FES for gait training after stroke	Daly et al, 1993 <sup>152</sup> ; Daly et al, 2000a, <sup>153</sup> 2000b <sup>154</sup> , 2001 <sup>155</sup>	II-2	Fair	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

organized around goal-directed and functional activities, rather than on muscles or movement patterns.

#### RECOMMENDATIONS

1. There is insufficient evidence to recommend for or against using NDT in comparison to other treatment approaches for motor retraining after an acute stroke.

DISCUSSION. Three RCTs were found from the literature review<sup>157–159</sup>; however, the studies were too small or too poorly designed to serve as models for the use of NDT for motor retraining after stroke. These studies have also produced conflicting results. Brunham and Snow<sup>157</sup> compared NDT to “conventional physiotherapy” and found “the results favored conventional therapy over NDT, although all patients attained their goals regardless of treatment type.” Mulder and colleagues<sup>158</sup> compared “electromyographic (EMG) feedback in the (re)learning of motor control to the effects of a conventional physical therapy procedure (ie, NDT)” and results of the study showed no significant differences. Wagenaar and colleagues<sup>159</sup> found that there were no significant differences between patients treated with NDT versus the Brunstrom method.

There is insufficient evidence to support the recommendation of NDT versus conventional treatment approaches to promote motor retraining. The 3 RCTs were too small and poorly designed to serve as models for the use of NDT.

EVIDENCE. See Table 30.

**TABLE 30. Evidence**

Recommendation	Source	Overall		
		QE	Quality	R
1. NDT for motor retraining after acute stroke as compared with other treatment approaches	Brunham and Snow, 1992 <sup>157</sup> ; Mulder et al, 1986 <sup>158</sup> ; Wagenaar et al, 1990 <sup>159</sup>	I	Fair	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

Spasticity

**BACKGROUND.** Contractures that restrict movement of the involved joint or are painful will impede rehabilitation and may limit a patient’s potential for recovery. Patients with paretic limbs with muscle spasticity are at high risk of developing contractures. Early treatment is key to preventing this disabling complication.

**RECOMMENDATIONS**

1. Recommend that spasticity and contractures be treated with antispastic positioning, range of motion exercises, stretching, splinting, serial casting, or surgical correction.
2. Consider use of tizanidine, dantrolene, and oral baclofen for spasticity resulting in pain, poor skin hygiene, or decreased function. Tizanidine should be used specifically for chronic stroke patients (refer to Section IV-O).
3. Recommend against diazepam or other benzodiazepines during the stroke recovery period due to possible deleterious effects on recovery (refer to Section IV-O), in addition to deleterious sedation side effects.
4. Consider use of botulinum toxin or phenol/alcohol for selected patients with disabling or painful spasticity or spasticity resulting in poor skin hygiene or decreased function.
5. Consider intrathecal baclofen for chronic stroke patients for spasticity resulting in pain, poor skin hygiene, or decreased function.
6. Consider neurosurgical procedures, such as selective dorsal rhizotomy or dorsal root entry zone lesion, for spasticity resulting in pain, poor skin hygiene, or decreased function.

**DISCUSSION.** Spasticity is defined as velocity-dependent hyperactivity of tonic stretch reflexes. It is 1 of the most important impairments for patients after stroke, and can result in significant pain and functional disturbances. The most impairing state from spasticity may be contractures, rendering the affected limb functionless. Skin hygiene may also be a problem with spasticity.

Spasticity is typically treated in a stepwise approach, beginning with the least-invasive modalities and progressing to more invasive. Positioning, passive stretching, and range of motion exercise may provide relief, and should be done several times daily in persons with spasticity. Corrective measures for contractures that interfere with function include splinting, serial casting, or surgical correction. No reliable data exist comparing different physical therapy interventions, with or without antispastic medications.

Tizanidine, baclofen, dantrolene, and diazepam are FDA-approved oral medications in the United States for the treatment of spasticity. There is limited evidence from controlled trials of spasticity treatment in stroke patients, and the conclusions of the majority of these trials were that spasticity and pain may be reduced but that no significant functional gains were made. Tizanidine has been shown to have efficacy in chronic stroke patients with improvement in spasticity and pain without loss of motor strength, in an open-label dose titration study.<sup>160</sup> Dantrolene has limited trial data to support its use in stroke and cited benefits of no cognitive side effects.<sup>161</sup> Katrak et al<sup>162</sup> found that starting patients on Dantrolene Sodium early after a stroke, before the onset of disabling spasticity, produced no change in clinical tone or

**TABLE 31. Evidence**

Recommendation	Source	Overall		
		QE	Quality	R
1. Use of antispastic positioning, range-of-motion exercises, stretching, splinting, serial casting, or surgical correction for spasticity	AHCPR, 1995 <sup>15</sup> ; RCP, 2000 <sup>11</sup> ; Working Group Consensus	III	Poor	C
2. Use of tizanidine (in chronic stroke patients), dantrolene, and oral baclofen for spasticity	Gelber et al, 2001, <sup>160</sup> ; Ketel and Kolb, 1984 <sup>161</sup> ; Milanov, 1992 <sup>163</sup>	II-1	Fair	B
3. Use of drugs with central nervous system effects may deteriorate recovery	Goldstein, 1995 <sup>172</sup> and 1998 <sup>173</sup> ; Graham, 1999 <sup>174</sup> ; Troisi et al, 2002 <sup>175</sup>	II-2	Fair	D
4. Use of botulinum toxin and phenol/alcohol to treat spasticity	Bakheit et al, 2000 <sup>176</sup> ; Kirazli et al, 1998 <sup>165</sup> ; Kong and Chua, 1999 <sup>166</sup> ; On et al, 1999 <sup>167</sup> ; Richardson et al, 2000 <sup>177</sup> ; Simpson, 1996 <sup>171</sup>	I	Fair	B
5. Use of intrathecal baclofen for chronic stroke patients	Meythaler et al, 2001 <sup>178</sup>	II-1	Fair	C
6. Use of certain neurosurgical procedures	Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

functional outcome. Oral baclofen has some data to support its use in stroke.<sup>163</sup> Reportedly, oral baclofen may cause significant sedation and have less impact on spasticity in stroke victims, in comparison to other disease conditions.<sup>164</sup> Diazepam is relatively contraindicated in stroke patients, at least in the stroke recovery period, as reviewed in Section IV-O.

Several procedures exist for the treatment of spasticity. Phenol/alcohol neurolysis has been effective in reducing spasticity,<sup>165–167</sup> but is an invasive procedure with an irreversible therapeutic action and potential notable side effects. Both the AHCPR<sup>9</sup> and RCP guidelines<sup>11</sup> support the use of botulinum toxin injections for selected patients with spasticity due to stroke. A number of double-blind placebo-controlled, randomized trials of high quality have been published since the guideline reports. These trials confirm the effectiveness of botulinum toxin injections in producing short-term improvements as noted by patients and their caregivers and in decreasing spasticity in a small select group of patients. However, no evidence was found to suggest that the use of EMG guidance improves outcomes from the botulinum toxin injection therapy.<sup>168</sup> Botulinum toxin has several evidence-based indications with regard to effective treatment of spasticity and functional benefits in nonstroke conditions.<sup>169–171</sup> No additional RCTs have been published since the RCP guideline that addressed the addition of electrostimulation to botulinum injections.

**TABLE 32. Evidence**

Recommendation	Source	QE	Overall	
			Quality	R
1. Biofeedback for poststroke patients	Schleenbaker and Mainous, 1993 <sup>182</sup> ; Glanz et al, 1995 <sup>179</sup> ; Moreland et al, 1998 <sup>181</sup>	I	Poor	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

Intrathecal baclofen has been demonstrated to reduce spasticity in a small trial of chronic stroke patients (with stroke onset >6 months previous). There are several neurosurgical procedures for the treatment of spasticity, but they lack any clinical trial evidence. Of these, the most common are selective dorsal rhizotomy or dorsal root entry zone lesions. Significant risks are involved with these invasive procedures, to include operative complications and unintended spinal cord damage.

EVIDENCE. See Table 31.

### Biofeedback

**BACKGROUND.** Surface and computerized EMG biofeedback have been used and documented in the treatment of stroke patients since the 1970s for improvement of arm function, gait, and swallowing. Biofeedback has been used primarily as an adjunct to conventional therapies.

**RECOMMENDATIONS.** The Working Group makes no recommendation for or against routine use of biofeedback for poststroke patients. The use of biofeedback is left to the consideration of the individual provider.

**DISCUSSION.** Four meta-analyses have addressed biofeedback.<sup>179–182</sup> All 4 reviews showed trends toward improvements with biofeedback, but only 2 showed any statistically significant differences.<sup>181,182</sup> The limited number of studies and small sample sizes may have led to a type II error. One small RCT, published since these meta-analyses, found no improvements in gait with the use of EMG biofeedback for poststroke patients.<sup>183</sup> In addition, 2 small RCTs, published since the meta-analyses, showed no benefit when patients received balance training with a biofeedback apparatus that provided cues with regard to their center of gravity.<sup>184,185</sup>

Because of methodological flaws in current studies, additional research is indicated to assess the efficacy of biofeedback as an adjunct to conventional therapy for poststroke patients.

EVIDENCE. See Table 32.

### Shoulder Pain

**BACKGROUND.** Shoulder pain resulting from sensorimotor dysfunction of the upper extremity is a common problem after stroke. As many as 72% of stroke patients will experience at least 1 episode of shoulder pain during the first year after the stroke.<sup>186</sup> Shoulder pain can delay rehabilitation and functional recuperation, because the painful joint may mask improvement of motor function<sup>186</sup> or may inhibit rehabilitation because it limits the use of a cane or wheelchair for ambulation. The incidence of shoulder-hand-pain syndrome has been reported to be as high as 67% in patients with a combination of motor, sensory, and visuoperceptual deficits.<sup>64</sup>

### RECOMMENDATIONS

1. Recommend considering the following interventions to prevent shoulder pain in the involved upper extremity, after a stroke:
  - Electrical stimulation to improve shoulder lateral rotation
  - Shoulder strapping (sling)
  - Staff education to prevent trauma to the hemiplegic shoulder
2. Recommend avoiding the use of overhead pulleys, which encourage uncontrolled abduction
3. Recommend considering the following interventions to treat shoulder pain:
  - Intra-articular injections (Triamcinolone)
  - Shoulder strapping
  - Improve range of motion (ROM) through stretching and mobilization techniques focusing especially on external rotation and abduction, as a means of preventing frozen shoulder and shoulder-hand-pain syndrome
  - Modalities: ice, heat, and soft tissue massage
  - Functional electrical stimulation (FES)
  - Strengthening

**DISCUSSION.** There are several causes of poststroke shoulder pain. The following list of common causes of shoulder pain does not include shoulder subluxation, because its association with shoulder pain remains controversial<sup>187</sup>:

- Adhesive capsulitis
- Traction/compression neuropathy
- Complex regional pain syndrome
- Shoulder trauma
- Bursitis/tendonitis
- Rotator cuff tear
- Heterotrophic ossification

Treatment of shoulder pain includes the following interventions:

- Electrical stimulation
- Treatment with steroid injections/medication
- Exercise
- Shoulder positioning protocols
- Strapping the involved upper extremity
- Modalities including ice, heat, soft tissue massage, and mobilization

Price and Pandyan<sup>150</sup> found that patients who received electrical stimulation had no change in pain intensity, compared with the control group; however, there was a significant treatment effect in favor of pain-free lateral rotation.

Intra-articular injections (Triamcinolone) have been found to have significant effects on pain. ROM improved with the injections; however, the improvements were not significant.<sup>188</sup>

Bohannon et al<sup>189</sup> considered range of lateral rotation the factor that related most significantly to the onset/occurrence of shoulder pain.

**TABLE 33. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Electrical stimulation	Price and Pandyan, 2001 <sup>150</sup>	I	Good	B
2. Intra-articular injections	Dekker et al, 1997 <sup>188</sup>	I	Poor	B
3. ROM: lateral rotation	Bohannon et al, 1986 <sup>189</sup>	II-2	Fair	B
4. Exercise: pulleys encourage uncontrolled abduction	Kumar et al, 1990 <sup>190</sup>	I	Fair	D
5. Positioning protocol	Dean et al, 2000 <sup>191</sup>	I	Fair	B
6. Strapping	Ancliffe, 1992 <sup>193</sup> Hanger et al, 2000 <sup>194</sup>	II-2 I	Fair	C

QE indicates quality of evidence; R, recommendation (see Appendix B).

The highest incidence of developing hemiplegic shoulder pain occurred with patients who used an overhead pulley.<sup>190</sup>

There is no significant difference in the effect of reducing shoulder pain with shoulder positioning protocols versus no prolonged positioning.<sup>191</sup> However, protecting the hemiplegic limb from trauma and injuries has been shown to reduce the frequency of shoulder-hand syndrome.<sup>192</sup>

Strapping the hemiplegic limb prolongs the incidence of shoulder pain compared with a nonstrapped group.<sup>193</sup> Hanger et al<sup>194</sup> reported no significant difference in the presence of pain, ROM, or functional outcomes; however, there were trends for less pain in 6 weeks and better upper limb function in strapped patients.

There is no evidence to support the efficacy of therapeutic modalities used to treat hemiplegic shoulder pain; however, these modalities are commonly used to reduce pain/swelling and improve circulation, tissue elasticity, and ROM.

EVIDENCE. See Table 33.

**Psychological Assessment**

*Cognitive Remediation*

BACKGROUND. Impairments in cognitive functioning are common after a stroke. In particular, impairments in attention, memory, and executive functioning (ie, integrating multiple and complex processes) can be especially disabling. The treatment of cognitive deficits through cognitive remediation designed to reduce deficits can be approached in a variety of ways. Cicerone and colleagues<sup>195</sup> completed a comprehensive review of the evidence-based literature for cognitive remediation for both traumatic brain injury (TBI) and stroke. The review revealed a large number of RCTs in a variety of areas of cognitive functioning and provided comprehensive guidelines for cognitive rehabilitation specific to these populations. There is support for cognitive remediation of deficits in both the acute and post-acute phases of recovery from stroke and TBI, although some of the improvements were relatively small and task specific. Some benefits were specific to the TBI population, although it seems reasonable to extend some of these results to the stroke population.

RECOMMENDATIONS

1. Recommend that patients be assessed for cognitive deficits and be given cognitive retraining, if any of the following conditions are present:

- Attention deficits
  - Visual neglect
  - Memory deficits
  - Executive function and problem-solving difficulties
2. Patients with multiple areas of cognitive impairment may benefit from a variety of cognitive retraining approaches that may involve multiple disciplines.
  3. Recommend the use of training to develop compensatory strategies for memory deficits in poststroke patients who have mild short-term memory deficits.

DISCUSSION. Two RCTs and 2 Level II studies demonstrated improved attention in post-acute stroke rehabilitation patients through utilization of a variety of treatment approaches with differing levels of complexity and response demands (see Table 34).<sup>196</sup> The interaction and monitoring of activities by therapists were also considered important aspects of these treatments. The results seen were fairly small and task specific, and the ability to generalize these to stroke patients is unclear. There was insufficient evidence to distinguish between spontaneous recovery and interventions in moderate-to-severely impaired patients in the acute recovery phase.

Evidence from 6 Level I studies and 8 Level II studies exists to support the utilization of visual-spatial rehabilitation for visual neglect after a right cerebrovascular accident (CVA).<sup>197</sup>

Four RCTs utilizing TBI patients demonstrated some benefit for memory functioning.<sup>198</sup> Three of these studies reported an increase in memory function based on neuropsychological measures and decreased subjective complaints of memory. The fourth study showed similar benefits when patients were stratified by severity of initial memory impairments. The use of training to develop compensatory strategies for memory deficits has been found to be beneficial in stroke patients who have mild impairments and who are fairly independent in daily function, who are actively involved in identifying their memory problems, and who are capable and motivated to incorporate use of the strategy. No data specifically utilizing stroke patients were identified.

A Cochrane review<sup>195</sup> with 1 RCT (n=12) showed no significant improvement for memory functioning or subjective memory complaints.

Three studies with various non-RCT designs and relatively small sample sizes (n=43) looked at executive functioning in stroke and TBI patients.<sup>199</sup> Benefit from formal problem-solving strategies and the ability to apply these strategies to everyday situations and functional activities was found for patients with executive function and problem-solving dysfunction. Some evidence exists that the promotion of awareness and self-regulation through verbal instruction, questioning, and monitoring can improve problem-solving skills.

EVIDENCE. See Table 34.

*Mood Disturbance: Depression and Emotionalism*

BACKGROUND.

ASSESSMENT

All patients should be screened for emotional disorders given the high incidence after a stroke. Poststroke depression (PSD) often manifests with subtle signs, such as refusal to partici-



TABLE 34. Evidence

Recommendation	Source	Overall		
		QE	Quality	R
1. Use of training to improve attention in post-acute stroke	Cicerone et al, 2000 <sup>195</sup>	I	Good	A
	Gray et al, 1992 <sup>200</sup>	I		
	Niemann et al, 1990 <sup>201</sup>	I		
	Sohlberg et al, 1987 <sup>202</sup>	II		
	Strache, 1987 <sup>203</sup>	II		
2. Use of training to compensate for visual neglect after a right CVA	Cicerone et al, 2000 <sup>195</sup>	I	Good	B
3. Use of formal problem-solving strategies	Cicerone et al, 2000 <sup>195</sup>	II	Fair	C
4. Multimodal intervention for multiple cognitive deficits	Cicerone et al, 2000 <sup>195</sup>	III	Fair	C
5. Use of training to develop compensatory strategies for a mild short-term memory deficit	Cicerone et al, 2000 <sup>195</sup> ; Ryan and Ruff, 1988 <sup>204</sup>	I	Good	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

pate in therapy. High index of suspicion is necessary in order to recognize depression before it interferes too much with therapy and with the patient's well-being. The assessment of the poststroke patient can be complicated by cognitive deficits that prevent the patient from recognizing or being able to report symptoms of depression. The patient may present with flat affect or aprosodic speech caused by organic changes related to stroke that may be misinterpreted as sadness or indifference to their situation. In addition, the aphasic patient with receptive and/or expressive language difficulties poses a unique challenge for the diagnostician. There is not a single universally accepted tool for the assessment of PSD. In fact, most screening instruments used to assess depression were not established for patients with cognitive and/or physical impairments.

Various studies have used different criteria for the diagnosis of PSD. Given the limitations of the research and the problems unique to this patient population, assessment that involves a variety of information from multiple sources may be most beneficial. Therefore, a psychiatric illness may be best diagnosed using clearly delineated criteria for major depression, as well as other categories of psychiatric symptoms (eg, mania and anxiety) along with patient self-report, observation of patient behavior, information from family members familiar with the patient's premorbid condition, and staff reports of changes in behavior, motivation, effort, and emotional reactivity.

#### TREATMENT

A variety of neuropsychiatric sequelae can be seen after a stroke, with depressive symptoms being most common. In fact, PSD is

TABLE 35. Evidence

Recommendation	Source	Overall		
		QE	Quality	R
1. Pharmacotherapy for depression	Andersen, 1995 <sup>211</sup> ; Cole et al, 2001 <sup>212</sup> ; Hackett et al, 2004 <sup>209</sup> ; House, 2004 <sup>210</sup> ; Kimura et al, 2000 <sup>213</sup> ; Miyai and Reeding, 1998 <sup>214</sup> ; RCP, 2000 <sup>11</sup> ; Robinson et al, 2000 <sup>215</sup> ; Wiart et al, 2000 <sup>216</sup>	I	Good	A
2. Pharmacotherapy for emotional lability	Brown et al, 1998 <sup>217</sup> ; Burns et al, 1999 <sup>218</sup> ; Cole et al, 2001 <sup>212</sup> ; Hackett et al, 2004 <sup>209</sup> ; House, 2004 <sup>210</sup> ; RCP, 2000 <sup>11</sup> ; Robinson et al, 1993 <sup>219</sup>	I	Good	A
3. Psychotherapy	Grober et al, 1993 <sup>220</sup> ; Lincoln et al, 1997 <sup>206</sup>	II	Fair	C
4. Information/advice	RCP, 2000 <sup>11</sup>	I	Fair	B
5. Routine use of prophylactic antidepressants	Dam et al, 1996 <sup>221</sup> ; Palomaki et al, 1999 <sup>222</sup> ; Raffaele et al, 1996 <sup>223</sup> ; Robinson et al, 2000 <sup>215</sup>	I	Good	D

QE indicates quality of evidence; R, recommendation (see Appendix B).

estimated to occur in between 25% and 75% of poststroke patients (depending on diagnostic criteria utilized)<sup>205</sup> and is underdiagnosed by nonpsychiatric physicians. PSD is frequently untreated because the neurovegetative symptoms of depression, including sleep disturbance, decreased appetite, fatigue, and feelings of hopelessness, are similar to common poststroke symptoms. Speech and cognitive difficulties can also make the assessment of PSD very difficult. Because the consequences of depression can impact a patient's ability to actively participate in therapies and lengthen recovery, it is important to address the symptoms early on in the rehabilitation process. Literature suggests that PSD is treatable with a variety of medications, with selective serotonin reuptake inhibitors (SSRI) and tricyclic antidepressants being the most frequently studied medications (see Table 35). Although the data on the efficacy of individual psychotherapy during rehabilitation are limited, there are some studies that suggest adaptations of cognitive-behavioral therapy techniques and brief supportive therapy may be beneficial.<sup>206</sup>

It is extremely common for poststroke patients to experience periods of emotionalism. The symptoms generally decline over time with no need for treatment with medication or therapeutic intervention, which is mistakenly interpreted by many family and staff as depression. Although these symptoms are frequently unrelated to mood, they can be a cause for frustration and concern for the patient and family. However, as many as 15% of patients experience a more extreme form of emotional change referred to as "pathological affect" or "pseudo-bulbar affect" (uncontrollable laughing/crying),<sup>205</sup> and if not treated can develop into clinical depression. Therefore, patient and family education is very important. When this lability interferes with the patient rehabilitation or complicates the patient's relationship with family members, pharmacotherapy may be considered. These extreme symptoms have also been found to respond to antidepressant medication.

Depression frequently coexists with other psychiatric syndromes and “the presence of depressive symptoms should lead to consideration of other types of mood disturbance.”<sup>11</sup> Anxiety in particular is found to coexist with depression in the poststroke patient population, but frequently goes undiagnosed.<sup>207</sup> Anxiety can create uncomfortable or disabling feelings of worry/fear accompanied by physical symptoms that make participation in therapy more difficult. Shimoda and Robinson<sup>208</sup> reported that generalized anxiety disorder (GAD) accompanied by PSD delayed recovery from depression, delayed ADL recovery, and reduced overall social functioning. Unfortunately, few studies have been conducted to address the treatment and recovery from poststroke GAD.

#### RECOMMENDATIONS.

##### ASSESSMENT

1. The Working Group makes no recommendation for the use of any specific diagnostic tool over another.
2. Recommend using a structured inventory to assess specific psychiatric symptoms and monitor symptom change over time (refer to the VA/DoD Guideline for Management of Major Depressive Disorder at [http://www.oqp.med.va.gov/cpg/MDD/MDD\\_Base.htm](http://www.oqp.med.va.gov/cpg/MDD/MDD_Base.htm)).
3. Recommend assessing poststroke patients for other psychiatric illnesses, including anxiety, bipolar illness, and pathological affect.

##### TREATMENT

4. Strongly recommend that patients with a diagnosed depressive disorder be given a trial of antidepressant medication, if no contraindication exists.
5. The Working Group makes no recommendation for the use of 1 class of antidepressants over another; however, side effect profiles suggest that SSRIs may be favored in this patient population.
6. Recommend patients with severe, persistent, or troublesome tearfulness be given a trial on antidepressant medications.
7. Recommend SSRIs as the antidepressant of choice in patients with severe, persistent, or troublesome tearfulness.
8. There is insufficient evidence to recommend for or against the use of individual psychotherapy alone in the treatment of PSD.
9. Recommend patients be given information, advice, and the opportunity to talk about the impact of the illness on their lives.
10. Routine use of prophylactic antidepressants is not recommended in poststroke patients.
11. Recommend that mood disorders causing persistent distress or worsening disability be managed by, or with the advice of, an experienced clinical psychologist or psychiatrist.

**DISCUSSION.** Given the high rate of cognitive impairments (in particular aphasia) after a stroke, the utilization of formal assessment instruments is often difficult.

There is insufficient evidence at present to recommend the routine use of antidepressants after stroke.

Level I evidence from existing guidelines, plus data from 2 systematic reviews and 4 additional clinical trials, support the use of antidepressants in poststroke patients with depression to improve mood, if no contraindications (see Table 35)<sup>209</sup>; the benefit of this intervention on other clinical outcomes is not fully proven; evidence is lacking to fully suggest which category of antidepressants be used as first-line.

Anxiety symptoms in poststroke patients should be assessed and treated, particularly in those patients with a diagnosed depressive disorder. Any patient diagnosed with 1 form of mood disorder should be assessed for others.

There is insufficient evidence to support the use of behavioral/cognitive therapy alone for poststroke depression; however, the utilization of an adapted form of cognitive behavioral therapy has been found to have some usefulness and the utilization of therapy in conjunction with antidepressant medication may be beneficial.

Data from several small controlled trials support the benefit of antidepressant therapy in poststroke mood lability, but the clinical impact is difficult to determine.<sup>210</sup>

**EVIDENCE.** See Table 35.

##### *Visual and Spatial Neglect*

**BACKGROUND.** A multitude of stroke presentations with various combinations of visual-perceptual impairments are seen in the poststroke population. When present, visual and spatial neglect can have a substantial negative impact on an individual's ability to function safely within his or her environment and is a significant contributor to poor prognosis after stroke.<sup>224</sup> Unilateral neglect is the lack of awareness of a specific body part or external environment contralateral to the site of the brain lesion and usually occurs in patients with right (nondominant) cortical strokes.<sup>225</sup> Unilateral body neglect may occur independently of visual field cuts or visual inattention or may be compounded by these deficits.<sup>226</sup> Testing and observation by a trained professional are necessary to recognize neglect and to distinguish it from visual field cuts, impaired attention, and planning or visuospatial abilities, thereby allowing the professional to properly treat the deficit.

It is important to note that with neglect, the patient does not realize that he/she is failing to attend to 1 side of their world. Because of safety concerns related to this, such as the risk of sustaining burns or injury to the affected limb, neglect should be addressed early in the rehabilitation process. The clinician may observe neglect when a patient dons his/her shirt on only 1 arm, shaves only half of his face, or fails to notice food on half of his/her lunch tray. Reading, writing, drawing, and mobility may also be negatively impacted by the presence of neglect.

Many patients with mild neglect have spontaneous improvement of their symptoms within weeks of onset. Those with profound neglect may improve over a period of many months. The literature does not reveal a single intervention best suited for addressing neglect. A multifaceted approach can be helpful. Patient education is an important element within these interventions. Patient education is often a long-term process, and the goal is to teach the patient to acknowledge the neglect (to some degree).

**TABLE 36. Evidence**

Recommendation	Source	QE	Overall	
			Quality	R
1. Assessment for visual and spatial neglect	Agrell et al, 1997 <sup>227</sup> ; Halligan et al, 1989 <sup>228</sup> ; Jehkonen et al, 1998 <sup>229</sup> ; Schubert and Spatt, 2001 <sup>230</sup> ; Stone et al, 1991 <sup>231</sup> ; Wilson et al, 1987 <sup>232</sup> ; Working Group Consensus	III	Poor	C
2. Treatment that focuses on functional adaptation	Antonucci et al, 1995 <sup>233</sup> ; Beis et al, 1999 <sup>234</sup> ; Fanthome et al, 1995 <sup>235</sup> ; Paolucci et al, 1996 <sup>236</sup> ; Rossetti et al, 1998 <sup>237</sup> ; Wiart et al, 1997 <sup>238</sup>	I	Poor	B

QE indicates quality of evidence; R, recommendation (see Appendix B).

#### RECOMMENDATIONS.

1. Recommend that stroke patients be assessed for visual and spatial neglect, as indicated.
2. Recommend treatment for stroke patients with visual/spatial neglect that focuses on functional adaptation (eg, visual scanning, environmental adaptation, environmental cues, and patient/family education).

**DISCUSSION.** No systematic reviews were found that addressed screening of patients for poststroke neglect. No randomized trials were found that compared a strategy of screening for neglect with a strategy that did not include screening. In addition, no studies were found that calculated sensitivity or specificity of screening tests for neglect by comparing them to a reference standard. There does not appear to be a reference standard that could be used in such an analysis.

When a battery of different neglect tests is given to patients without comparison to any reference standard, each of the tests misses “cases” identified by other tests. Conversely, some healthy individuals with no history of stroke or other neurological problem may score very poorly on some of these tests. The only study that compared a series of tests for neglect with clinical impressions found that clinicians identified more patients as neglected during the routine course of care than showed up as positives on the test. Only 1 of the studies addressed the issue of testing for neglect during the “early” stages of stroke recovery.

No systematic reviews or meta-analyses were found that addressed therapy for visual and spatial neglect. Six small RCTs addressed interventions for neglect (see Table 36). With 1 exception, only a single trial assessed each intervention. The trials were small and exploratory in nature. A multifaceted approach to visual-spatial neglect can be helpful as there is no compelling evidence that a single approach is sufficient.

**EVIDENCE.** See Table 36.

#### Pharmacological

##### *Use of Pharmacological Agents*

**BACKGROUND.** While undergoing rehabilitation for stroke, patients frequently receive a variety of medications to treat complications of stroke or other unrelated chronic medical conditions. Although many of these concomitant medications cross the blood-brain barrier and have CNS effects, relatively little is known about the potentially deleterious or beneficial

effects of these drugs on stroke recovery. Providers often do not consider their potential impact on stroke outcomes. Limited data exist for certain pharmaceutical agents with regard to beneficial or deleterious influences on recovery from stroke, but further study is needed before definitive recommendations can be made.

#### RECOMMENDATIONS.

1. Recommend against the use of neuroleptics, benzodiazepines, phenobarbital, and phenytoin during the stroke recovery period. These pharmaceutical agents should be used cautiously in stroke patients, weighing the likely benefit of these drugs against the potential for adverse effects on patient outcome.
2. Recommend against centrally acting  $\alpha$ 2-adrenergic receptor agonists (such as clonidine and others) and  $\alpha$ 1-receptor antagonists (such as prazosin and others) as antihypertensive medications for stroke patients because of their potential to impair recovery (see Section III-D, “Initiation of Secondary Prevention of Stroke and Atherosclerotic Vascular Disease”).
3. There is insufficient evidence on the optimal dose and safe use of neurotransmitter-releasing agents and central nervous system stimulants. Consider stimulants/neurotransmitter-releasing agents in selected patients to improve participation in stroke rehabilitation or to enhance motor recovery. Dextroamphetamine has been the most tested stimulant at 10 mg per day, but insufficient evidence is available with regard to optimal dosing and safety to support the routine use of CNS stimulants during rehabilitation. Data remain sparse to consider routine use of neurotransmitter-releasing agents in stroke recovery.

**DISCUSSION.** Several small controlled trials have found a benefit of using the CNS stimulant dextroamphetamine in patients during active rehabilitation for hemiparesis<sup>239,240</sup> and aphasia,<sup>241</sup> although other trials have failed to document a benefit.<sup>242,243</sup> The safety of dextroamphetamine in a stroke population has been tested in a small series.<sup>244</sup> Limited data support the use of other neurotransmitter-releasing agents to promote stroke recovery, including methylphenidate,<sup>245</sup> levodopa,<sup>246</sup> and L-threo-3,4-dihydroxyphenyl serine (L-DOPS).<sup>247</sup>

Fluoxetine in nondepressed patients in a small RCT appeared to have a small benefit in motor recovery independent of the treatment of depression.<sup>221</sup> A functional MRI prospective double-blind crossover, placebo-controlled study on 8 pure motor hemiparetic patients demonstrated motor cortex modulation by a single dose of fluoxetine.<sup>248</sup> Data do not permit discrimination among these agents or identification of an optimal dosing and administration protocol for any of these medications. The preferred time of initiation of pharmacotherapy after stroke and duration of treatment also remain uncertain.

A Cochrane Review evaluated pharmacological treatment after stroke with aphasia.<sup>249</sup> A total of 10 trials were identified as suitable for review. The drugs reviewed included piracetam, bifemalane, piribedil, bromocriptine, idebenone, and Dextran 40. Weak evidence supported piracetam, a drug currently not available in the United States, for use in aphasia recovery. Insufficient safety data and the lack of adequately designed clinical trials to fully evaluate the efficacy of the listed pharmaceutical agents were noted. Recently, dextroam-

TABLE 37. Evidence

Recommendation	Source	QE	Overall Quality	R
1. Use of drugs to enhance stroke recovery	Crisostomo et al, 1988 <sup>239</sup> ; Dam et al, 1996 <sup>221</sup> ; Grade et al, 1998 <sup>245</sup> ; Nishino et al, 2001 <sup>247</sup> ; Scheidtmann et al, 2001 <sup>246</sup> ; Walker-Batson, 1995 <sup>240</sup> and 2001 <sup>241</sup>	I	Fair	B
2. Avoidance of certain drugs with central effects	Goldstein, 1995 <sup>172</sup> and 1998 <sup>173</sup> ; Graham et al, 1999 <sup>174</sup>	II-2	Fair	D
3. Avoidance of certain antihypertensive agents	Goldstein, 1995 <sup>172</sup> and 1998 <sup>173</sup>	II-2	Fair	D

QE indicates quality of evidence; R, recommendation (see Appendix B).

phedamine was tested in a small, randomized trial in aphasia, which was not evaluated in the Cochrane review.<sup>241</sup> The drug was beneficial for aphasic patients, but the beneficial effects did not appear to be sustained at 6 months.

In retrospective analyses of data collected during stroke clinical trials,<sup>172,174,175</sup> and in animal studies of recovery from brain injury,<sup>173</sup> CNS depressants such as neuroleptics, barbiturates, benzodiazepines, and anticonvulsants have been associated with poorer outcomes. In the human studies, it is difficult to separate cause and effect, because the conditions treated by these medications, when occurring after stroke, may themselves be associated with more severe brain injury and worse outcome. In the absence of additional data, clinicians should limit the use of these medications in patients recovering from stroke as much as is practical. Routine use of these medications for minor indications (eg, use of benzodiazepines for mild insomnia during inpatient rehabilitation) is discouraged.

Centrally acting  $\alpha_2$ -adrenergic receptor agonists (such as clonidine and others) and  $\alpha_1$ -receptor antagonists (such as prazosin and others) have been associated with poorer outcomes in at least 1 retrospective analysis. Model studies found poorer recovery in animals treated with clonidine and prazosin.<sup>173</sup> Data support the beneficial effects of other classes of antihypertensives (angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and diuretics) for secondary stroke prevention, and these drugs are generally preferred as first-line agents for hypertension control in patients after stroke.<sup>250</sup>

Consider bromocriptine or dextroamphetamine in selected aphasic patients. There are insufficient data on optimal dosing, and safety precludes the routine use of these medications for aphasia.

EVIDENCE. See Table 37.

## P. Is Patient Ready for Community Living?

### Objective

Provide smooth transition back to community living after stroke.

### Background

The majority of patients who have had a stroke will be managed initially in a hospital. The time of discharge from inpatient care to home (or to residential living or nursing home) constitutes an important watershed. There is much anecdotal and some research-based evidence that discharge could be better managed. Living with disabilities after a stroke is a lifelong challenge during which people continue to seek and find ways to compensate for or adapt to persisting neurological deficits. For many stroke patients and their families, the real work of recovery begins after formal rehabilitation.

### Recommendations

1. Recommend that the patient, family, and caregivers be fully informed about, prepared for, and involved in all aspects of healthcare and safety needs.
2. Recommend that the family and caregivers receive all necessary equipment and training in moving and handling, in order to position and transfer the patient safely in the home environment.
3. Recommend that the patient have appropriate vocational and income support opportunities. Stroke patients who worked before their strokes should be encouraged to be evaluated for the potential to return to work, if their condition permits. Vocational counseling should be offered when appropriate.
4. Recommend that leisure activities be identified and encouraged and that the patient be enabled to participate in these activities.
5. Recommend that case management be put in place for complex patient and family situations.
6. Recommend that acute care hospitals and rehabilitation facilities maintain up-to-date inventories of community resources, provide this information to stroke patients and their families and caregivers, and offer assistance in obtaining needed services. Patients should be given information about, and offered contact with, appropriate local statutory and voluntary agencies.

### Discussion

The first few weeks after discharge from an inpatient stay after a stroke are difficult as the patient attempts to use newly learned skills without the support of the rehabilitation environment or team. The full impact of the stroke may not become apparent until the patient has been home a few weeks and tries to get on with his/her life. Adequate support from family and caregivers is critical to a successful outcome. It is also important to ensure that all necessary equipment and support services are in place.

Evans et al,<sup>5</sup> after noting that rehabilitation services are effective in improving short-term survival, functional ability, and the most independent discharge location, have suggested that “the lack of long-term benefits of short-term rehabilitation may suggest that therapy should be extended to home or sub-acute care settings, rather than being discontinued at discharge. These services should be organized and in place at the time of discharge.”

Caregiving can be extremely taxing, both physically and emotionally. Adverse health effects on caregivers include increased risk of depression,<sup>251–254</sup> increased use of health



services, and the self-administration of medications prescribed originally for the stroke patient.<sup>255</sup> Depression has been associated with physical abuse of the patient<sup>256</sup> and a greater likelihood of nursing home placement.<sup>257</sup> Clinicians need to be sensitive to the potential adverse effects of caregiving on family functioning and the health of the caregiver. Opportunities for respites may be extremely important.

Clinicians should work with the patient and caregivers to avoid negative effects, promote problem solving, and facilitate reintegration of the patient into valued family and social roles. Preexisting organizational and functional characteristics of the family may have important effects on a successful transition to community living. A caregiver is more likely to give adequate support if he/she is a spouse who is knowledgeable about stroke and its disabilities, is not depressed, and lives in an otherwise well-functioning family unit.<sup>258</sup>

Community support can help buffer the effects of disabilities on the patient, family, and caregivers. Educational support can be provided through printed materials, videotapes, computer programs, and information on support groups. The availability of emotional support and physical services such as homemaker home health, Meals-on-Wheels, devices (eg, ramps), and equipment may also be crucial to a successful outcome.

Participation in leisure activities is closely related to both health status and quality of life.<sup>259–263</sup> Interest in leisure and recreational activities may provide motivation to resume an active lifestyle.

A patient is ready for discharge from an inpatient setting when

- he/she has no skilled nursing needs or if needs are present (eg, wound care) those needs can be met by caregiver or community support services.
- he/she does not require regular physician care.
- he/she has an environment available that is supportive of or can be modified to support the individual's specific functional deficits.
- he/she is functionally independent or, if assistance is required, the patient can be assisted by family or caregiver
- additional rehabilitation services, if required, are available and accessible in the community.

#### **Evidence**

See Table 38.

### **Q. Address Adherence to Treatments and Barriers to Improvement**

If medically unstable, refer to acute services. If there are mental health factors, refer to mental health services.

During the rehabilitation process, patients will occasionally come up against unexpected barriers to their continued progress or to their ability to adhere to the treatment plan. These include medical complications and mental health factors that make it difficult to participate/adhere to treatment goals. Lack of, or incorrect information about, diagnosis, prognosis, treatment rationale, and need for behavioral change may also become a barrier to improvement.

**TABLE 38. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Patient and family/caregiver:	Working Group	III	Poor	I
• Education and information	Consensus			
• Equipment and training				
• Vocational counseling				
• Encourage leisure activities				
2. Assign case management in complex situations	Working Group Consensus	III	Poor	I
3. Maintain resource listing	Working Group Consensus	III	Poor	I

QE indicates quality of evidence; R, recommendation (see Appendix B).

Most times, this assessment and treatment can occur in the rehabilitation setting and will not require a transfer to another service. Once the barriers have been successfully addressed, reexamination of treatment goals may be helpful.

- When the encountered barrier is medical illness that makes participation difficult, referral to the appropriate service for treatment is warranted.
- When the issue is related to mental health factors, assessment of these factors by a psychiatrist/psychologist and intervention/treatment are appropriate.

### **R. Assess Patient's Need for Community-Based Rehabilitation Services**

Determine optimal environment for patient's rehabilitation: outpatient versus community-based services.

1. *Nursing facility rehabilitation* is defined as "rehabilitation performed during a stay in a nursing facility. Nursing facilities vary widely in their rehabilitation capabilities, ranging from maintenance care to comprehensive and intense rehabilitation programs."
2. *Outpatient rehabilitation* is defined as "rehabilitation performed in an outpatient facility that is either freestanding or attached to an acute care or rehabilitation hospital. Day hospital care is a subset of outpatient rehabilitation in which the patient spends a major part of the day in an outpatient rehabilitation facility."
3. *Home-based rehabilitation* is defined as "a rehabilitation program provided in the patient's place of residence (AHCPR, 1995)."<sup>9</sup>

### **S. Determine Optimal Environment for Community-Based Rehabilitation Services**

#### **Objective**

Determine if therapy after hospital discharge should be provided on an outpatient basis or in the home environment by home health services.

#### **Background**

Patients referred for outpatient or home care services are those who have rehabilitation needs but do not meet the criteria for continued inpatient stay. These patients do not have skilled nursing needs or require regular physician contact; however, they may have multiple therapy needs. Outpatient rehabilitation can occur in different settings, including the patient's home.

**Recommendations**

Strongly recommend continuing outpatient rehabilitation services in the setting in which they can most appropriately and effectively be carried out. This is based on medical status, function, social support, and access to care.

**Discussion**

In determining where continued rehabilitation should take place after hospital discharge, the following factors must be considered. The discharge plan is developed within the coordinated team. Traditionally, this process is led by the social worker on the team.

1. *Can the patient tolerate treatment provided in the outpatient setting?* Some patients who are appropriate for discharge, those who still require continued therapy, may not be able to tolerate a full outpatient program. They may be too frail or debilitated to tolerate traveling to an outpatient clinic setting. The distance to be traveled should not be prohibitive, and the patient must be able to safely travel by the available means (ie, transfers and sitting balance) and tolerate the travel, in addition to the therapy sessions. Patients may require inter-

**TABLE 39. Evidence**

Recommendation	Source	QE	Overall Quality	R
1. Community rehabilitation setting	Weir, 1999 <sup>264</sup>	I	Good	A

QE indicates quality of evidence; R, recommendation (see Appendix B).

- ventions specific to their home environment. For these patients, the therapeutic interventions may be better provided in the environment in which they will be used (eg, homemaking activities or mobility in the discharge environment).
2. *Can the required therapeutic interventions only be provided in a clinic setting?* The equipment available for home health rehabilitation is limited. Specialized exercise equipment is usually not available in the home setting. In addition, there is greater access to coordinated programs and physician support in the outpatient setting. Depending on the patient's community setting, certain necessary services may not be available through home health (eg, SLP and driver's training).
  3. *Is the patient eligible for home health services?* The patient's eligibility for home health services must be determined.

**Evidence**

See Table 39.

**Disclosure**

**TABLE 40. Disclosures**

Writing Group Member Name	Research Grant	Speakers Bureau/Honoraria	Stock Ownership	Consultant/Advisory Board	Other
Bates	None	None	None	None	None
Choi	None	None	None	None	None
Duncan	None	None	None	None	None
Glasberg	None	None	None	None	None
Graham	Allergan Pfizer	None	None	None	None
Katz	None	None	None	None	None
Lamberty	None	None	None	None	None
Reker	None	None	None	None	None
Zorowitz	None	None	None	None	None

**Appendix A**

See <http://stroke.ahajournals.org/cgi/content/full/36/9/e100/DC1>.

**Appendix B**

See <http://stroke.ahajournals.org/cgi/content/full/36/9/e100/DC2>.

**Appendix C**

See <http://stroke.ahajournals.org/cgi/content/full/36/9/e100/DC3>.

**Appendix D**

See <http://stroke.ahajournals.org/cgi/content/full/36/9/e100/DC4>.

**Appendix E**

See <http://stroke.ahajournals.org/cgi/content/full/36/9/e100/DC5>.

**Bibliography**

Items in the bibliography are reference materials that were not cited within the original VA/DoD article.

Agency for Health Care Policy and Research (AHCPR). *Manual for Conducting Systematic Review*. Draft. August 1996. Prepared by Steven H. Woolf.

Aviv JE, Martin JH, Kim T, Sacco RL, Thomson JE, Diamond B, Close LG. Laryngopharyngeal sensory discrimination testing and the laryngeal adductor reflex. *Ann Otol Rhinol Laryngol*. 1999;108:725-730.

Bhakta BB, Cozens JA, Chamberlain MA, Bamford JM. Impact of botulinum toxin type A on disability and carer burden due to arm spasticity after stroke: a randomised double blind placebo controlled trial. *J Neurol Neurosurg Psychiatry*. 2000;69:217-221. [Erratum in: *J Neurol Neurosurg Psychiatry*. 2001;70:821.]

Chemerinski E, Robinson RG. The neuropsychiatry of stroke. *Psychosomatics*. 2000;41:5-14. Review.

Collins MJ, Bakheit AM. Does pulse oximetry reliably detect aspiration in dysphagic stroke patients? *Stroke*. 1997;28:1773-1775.

Ding R, Logemann JA. Pneumonia in stroke patients: a retrospective study. *Dysphagia*. 2000;15:51-57.

Gottlieb D, Kipnis M, Sister E, Vardi Y, Brill S. Validation of the 50 ml3 drinking test for evaluation of post-stroke dysphagia. *Disabil Rehabil*. 1996;18:529-532.

Inoue M. Predicting outcomes of patients in Japan after first acute stroke using a simple model. *Am J Phys Med Rehabil*. 2001;80:645-649.

Lawton MP. Assessing the competence of older people. In: Kent D, Kastenbaum R, Sherwood S, eds. *Research Planning and Action for the Elderly*. New York: Behavioral Publications; 1972.

Lyden PD, Lu M, Levine SR, Brott TG, Broderick J; NINDS rtPA Stroke Study Group. A modified National Institutes of Health Stroke Scale for use in stroke clinical trials: preliminary reliability and validity. *Stroke*. 2001;32:1310–1317.

*Management of Substance Use Disorder in the Primary Care Setting*. Washington, DC: VA/DoD Evidence-Based Clinical Practice Guideline Working Group, Veterans Health Administration, Department of Veterans Affairs, and Health Affairs, Department of Defense, September 2001. Office of Quality and Performance publication 10Q-CPG/SUD-01.

McCullough GH, Wertz RT, Rosenbek JC, Mills RH, Ross KB, Ashford JR. Inter- and intrajudge reliability of a clinical examination of swallowing in adults. *Dysphagia*. 2000;15:58–67.

Odderson IR, Keaton JC, McKenna BS. Swallow management in patients on an acute stroke pathway: quality is cost effective. *Arch Phys Med Rehabil*. 1995;76:1130–1133.

Ronning OM, Guldvog B. Outcome of subacute stroke rehabilitation: a randomized controlled trial. *Stroke*. 1998;29:779–784.

Saint S, Veenstra DL, Sullivan SD, Chenoweth C, Fendrick AM. The potential clinical and economic benefits of silver alloy urinary catheters in preventing urinary tract infection. *Arch Intern Med*. 2000;160:2670–2675.

Shank J. *The Role of Therapeutic Recreation in Rehabilitation Research*. The National Center for Medical Rehabilitation Research; March 6, 1992.

Smith HA, Lee SH, O'Neill PA, Connolly MJ. The combination of bedside swallowing assessment and oxygen saturation monitoring of swallowing in acute stroke: a safe and humane screening tool. *Age Ageing*. 2000;29:495–499.

VA 1996 External Peer Review Program. Contract No. V101(93) P-1369.

Wallace JD. Summary of combined clinical analysis of controlled clinical trials with tizanidine. *Neurology*. 1994;44(11 suppl 9):S60–S68; discussion S68–S69.

Williams LS, Weinberger M, Harris LE, Clark DO, Biller J. Development of a stroke-specific quality of life scale. *Stroke*. 1999;30:1362–1369.

## References

- American Heart Association. *Heart and Stroke Statistical Update—2000*. Dallas, Tex: American Heart Association; 1999.
- American Heart Association. *Heart and Stroke Statistical Update—2005*. Dallas, Tex: American Heart Association; 2004.
- Health Care Financing Administration. *The International Classification of Diseases, Ninth Revision, Clinical Modification*. 3rd ed. Washington, DC: US Department of Health and Human Services, Public Health Service, 1989. DHHS Publication No. (PHS)89-1260.
- Cifu DX, Stewart DG. Factors affecting functional outcome after stroke: a critical review of rehabilitation interventions. *Arch Phys Med Rehabil*. 1999;80(5 suppl 1):S35–S39.
- Evans RL, Connis RT, Hendricks RD, Haselkorn JK. Multidisciplinary rehabilitation versus medical care: a meta-analysis. *Soc Sci Med*. 1995; 40:1699–1706.
- Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. *Cochrane Database Syst Rev*. 2002(1):CD000197.
- Reker DM, Duncan PW, Horner RD, Hoenig H, Samsa GP, Hamilton BB, Dudley TK. Postacute stroke guideline compliance is associated with greater patient satisfaction. *Arch Phys Med Rehabil*. 2002;83: 750–756.
- Bates BE, Stineman MG. Outcome indicators for stroke: application of an algorithm treatment across the continuum of postacute rehabilitation services. *Arch Phys Med Rehabil*. 2000;81:1468–1478.
- Gresham GE, Duncan PW, Stason WB, et al. *Post-Stroke Rehabilitation. Clinical Practice Guideline, No. 16*. Rockville, Md: US Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research; May 1995. AHCPR Publication No. 95-0662.
- Scottish Intercollegiate Guidelines Network (SIGN). *Management of Patients with Stroke Part III: Identification and Management of Dysphagia, No. 20*. Edinburgh, Scotland: Scottish Intercollegiate Guidelines Network; 1997. [Superseded by *Management of Patients with Stroke: Identification and Management of Dysphagia, No. 78*; 2004.]
- Royal College of Physicians. *National Clinical Guidelines for Stroke*. 2nd ed. Prepared by the Intercollegiate Stroke Working Party. London: RCP; 2004. Available at: <http://www.rcplondon.ac.uk/pubs/books/stroke/index.htm>. Accessed July 20, 2005.

- Veterans Health Administration. *Medical Rehabilitation Outcomes for Stroke, Traumatic Brain, and Lower-Extremity Amputee Patients*. VHA Directive 2000-016. Washington, DC: Department of Veterans Affairs, Veterans Health Administration; June 5, 2000. Available at: [http://www1.va.gov/vhapublications/ViewPublication.asp?pub\\_ID=82](http://www1.va.gov/vhapublications/ViewPublication.asp?pub_ID=82). Accessed July 27, 2005.
- Uniform Data System for Medical Rehabilitation. FIM Instrument. Buffalo, NY: University of Buffalo; 1997.
- Duncan PW, Lai SM, Bode RK, Perera S, DeRosa J. Stroke Impact Scale-16: a brief assessment of physical function. *Neurology*. 2003;60: 291–296.
- Deleted in proof.
- Organised inpatient (stroke unit) care for stroke. Stroke Unit Trialists' Collaboration. *Cochrane Database Syst Rev*. 2000;(2):CD000197. [Update in: *Cochrane Database Syst Rev*. 2002;(1):CD000197.]
- Langhorne P, Duncan P. Does the organization of postacute stroke care really matter? *Stroke*. 2001;32:268–274.
- Indredavik B, Bakke F, Solberg R, Rokseth R, Haaheim LL, Holme I. Benefit of a stroke unit: a randomized controlled trial. *Stroke*. 1991;22: 1026–1031.
- Indredavik B, Bakke F, Slordahl SA, Rokseth R, Haheim LL. Stroke unit treatment improves long-term quality of life: a randomized controlled trial. *Stroke*. 1998;29:895–899.
- Indredavik B, Bakke F, Slordahl SA, Rokseth R, Haheim LL. Stroke unit treatment: 10-year follow-up. *Stroke*. 1999;30:1524–1527.
- Indredavik B, Slordahl SA, Bakke F, Rokseth R, Haheim LL. Stroke unit treatment. Long-term effects. *Stroke*. 1997;28:1861–1866.
- Indredavik B, Bakke F, Slordahl SA, Rokseth R, Haheim LL. Treatment in a combined acute and rehabilitation stroke unit: which aspects are most important? *Stroke*. 1999;30:917–923.
- Mahoney FI, Barthel DW. Functional evaluation: the Barthel index. *Md State Med J*. 1965;14:61–65.
- Wade DT, Collin C. The Barthel ADL Index: a standard measure of physical disability? *Int Disabil Stud*. 1988;10:64–67. Review.
- Kalra L, Evans A, Perez I, Knapp M, Donaldson N, Swift CG. Alternative strategies for stroke care: a prospective randomised controlled trial. *Lancet*. 2000;356:894–899.
- Evans A, Perez I, Harraf F, Melbourne A, Steadman J, Donaldson N, Kalra L. Can differences in management processes explain different outcomes between stroke unit and stroke-team care? *Lancet*. 2001;358: 1586–1592.
- Duncan PW, Lai SM, van Culin V, Huang L, Clausen D, Wallace D. Development of a comprehensive assessment toolbox for stroke. *Clin Geriatr Med*. 1999;15:885–915.
- Adams HP Jr, Davis PH, Leira EC, Chang KC, Bendixen BH, Clarke WR, Woolson RF, Hansen MD. Baseline NIH Stroke Scale score strongly predicts outcome after stroke: a report of the Trial of Org 10172 in Acute Stroke Treatment (TOAST). *Neurology*. 1999;53:126–131.
- Frankel MR, Morgenstern LB, Kwiatkowski T, Lu M, Tilley BC, Broderick JP, Libman R, Levine SR, Brott T. Predicting prognosis after stroke: a placebo group analysis from the National Institute of Neurological Disorders and Stroke rt-PA Stroke Trial. *Neurology*. 2000;55: 952–959.
- Ottenbacher KJ, Jannell S. The results of clinical trials in stroke rehabilitation research. *Arch Neurol*. 1993;50:37–44.
- Parry RH, Lincoln NB, Vass DC. Effect of severity of arm impairment on response to additional physiotherapy early after stroke. *Clin Rehabil*. 1999;13:187–198.
- Paolucci S, Antonucci G, Grasso MG, Morelli D, Troisi E, Coiro P, Bragoni M. Early versus delayed inpatient stroke rehabilitation: a matched comparison conducted in Italy. *Arch Phys Med Rehabil*. 2000; 81:695–700.
- Wade DT, Collen FM, Robb GF, Warlow CP. Physiotherapy intervention late after stroke and mobility. *BMJ*. 1992;304:609–613.
- Langhorne P, Wagenaar R, Partridge C. Physiotherapy after stroke: more is better? *Physiother Res Int*. 1996;1:75–88.
- Kwakkel G, Wagenaar RC, Twisk JW, Lankhorst GJ, Koetsier JC. Intensity of leg and arm training after primary middle-cerebral-artery stroke: a randomised trial. *Lancet*. 1999;354:191–196.
- van der Lee JH, Snels IA, Beckerman H, Lankhorst GJ, Wagenaar RC, Bouter LM. Exercise therapy for arm function in stroke patients: a systematic review of randomized controlled trials. *Clin Rehabil*. 2001; 15:20–31. Review.
- Smith DS, Goldenberg E, Ashburn A, Kinsella G, Sheikh K, Brennan PJ, Meade TW, Zutshi DW, Perry JD, Reeback JS. Remedial therapy



- after stroke: a randomised controlled trial. *Br Med J (Clin Res Ed)*. 1981;282:517-520.
38. Sivenius J, Pyorala K, Heinonen OP, Salonen JT, Riekkinen P. The significance of intensity of rehabilitation of stroke—a controlled trial. *Stroke*. 1985;16:928-931.
  39. Rapoport J, Judd-Van Eerd M. Impact of physical therapy weekend coverage on length of stay in an acute care community hospital. *Phys Ther*. 1989;69:32-37.
  40. Partridge C, Mackenzie M, Edwards S, Reid A, Jayawardena S, Guck N, Potter J. Is dosage of physiotherapy a critical factor in deciding patterns of recovery from stroke: a pragmatic randomized controlled trial. *Physiother Res Int*. 2000;5:230-240.
  41. Sunderland A, Tinson DJ, Bradley EL, Fletcher D, Langton Hewer R, Wade DT. Enhanced physical therapy improves recovery of arm function after stroke: a randomised controlled trial. *J Neurol Neurosurg Psychiatry*. 1992;55:530-535.
  42. Richards CL, Malouin F, Wood-Dauphinee S, Williams JI, Bouchard JP, Brunet D. Task-specific physical therapy for optimization of gait recovery in acute stroke patients. *Arch Phys Med Rehabil*. 1993;74:612-620.
  43. Lincoln NB, Parry RH, Vass CD. Randomized, controlled trial to evaluate increased intensity of physiotherapy treatment of arm function after stroke. *Stroke*. 1999;30:573-579.
  44. Evans RL. Caregiver compliance and feelings of burden in poststroke home care. *Psychol Rep*. 1986;59(2 pt 2):1013-1014.
  45. Glass TA, Matchar DB, Belyea M, Feussner JR. Impact of social support on outcome in first stroke. *Stroke*. 1993;24:64-70.
  46. Han B, Haley WE. Family caregiving for patients with stroke: review and analysis. *Stroke*. 1999;30:1478-1785. Review.
  47. O'Connor AM, Stacey D, Rovner D, Holmes-Rovner M, Tetroe J, Llewellyn-Thomas H, Entwistle V, Rostom A, Fiset V, Barry M, Jones J. Decision aids for people facing health treatment or screening decisions. *Cochrane Database Syst Rev*. 2001;(3):CD001431. Review. [Update in: *Cochrane Database Syst Rev*. 2003;(2):CD001431.]
  48. Forster A, Smith J, Young J, Knapp P, House A, Wright J. Information provision for stroke patients and their caregivers. *Cochrane Database Syst Rev*. 2001;(3):CD001919. Review.
  49. Haynes RB, McDonald H, Garg AX, Montague P. Interventions for helping patients to follow prescriptions for medications. *Cochrane Database Syst Rev*. 2002;(2):CD000011. Review.
  50. McDonald HP, Garg AX, Haynes RB. Interventions to enhance patient adherence to medication prescriptions: scientific review. *JAMA*. 2002;288:2868-2879. Review. [Erratum in: *JAMA*. 2003;289:3242.]
  51. Evans RL, Matlock AL, Bishop DS, Stranahan S, Pederson C. Family intervention after stroke: does counseling or education help? *Stroke*. 1988;19:1243-1249.
  52. 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.
  53. Rimmer JH, Braunschweig C, Silverman K, Riley B, Creviston T, Nicola T. Effects of a short-term health promotion intervention for a predominantly African-American group of stroke survivors. *Am J Prev Med*. 2000;18:332-338.
  54. Lorig KR, Sobel DS, Stewart AL, Brown BW Jr, Bandura A, Ritter P, Gonzalez VM, Laurent DD, Holman HR. Evidence suggesting that a chronic disease self-management program can improve health status while reducing hospitalization: a randomized trial. *Med Care*. 1999;37:5-14.
  55. Grant JS. Social problem-solving partnerships with family caregivers. *Rehabil Nurs*. 1999;24:254-260.
  56. Man-Son-Hing M, Laupacis A, O'Connor AM, Biggs J, Drake E, Yetisir E, Hart RG. A patient decision aid regarding antithrombotic therapy for stroke prevention in atrial fibrillation: a randomized controlled trial. *JAMA*. 1999;282:737-743.
  57. Mant J, Carter J, Wade DT, Winner S. Family support for stroke: a randomised controlled trial. *Lancet*. 2000;356:808-813.
  58. 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.
  59. Adams HP Jr, Brott TG, Crowell RM, Furlan AJ, Gomez CR, Grotta J, Helgason CM, Marler JR, Woolson RF, Zivin JA, et al. Guidelines for the management of patients with acute ischemic stroke: a statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. *Stroke*. 1994;25:1901-1914.
  60. Berlowitz DR, Brandeis GH, Anderson JJ, Ash AS, Kader B, Morris JN, Moskowitz MA. Evaluation of a risk-adjustment model for pressure ulcer development using the Minimum Data Set. *J Am Geriatr Soc*. 2001;49:872-876.
  61. Berlowitz DR, Brandeis GH, Morris JN, Ash AS, Anderson JJ, Kader B, Moskowitz MA. Deriving a risk-adjustment model for pressure ulcer development using the Minimum Data Set. *J Am Geriatr Soc*. 2001;49:866-871.
  62. Tanguay T, Eichorst C. The Braden Scale: is your patient at risk for pressure ulcers? *Alta RN*. 2000;56:24-25.
  63. Sussman C, Bates-Jensen BM, eds. *Wound Care: A Collaborative Practice Manual for Physical Therapists and Nurses*. Gaithersburg, Md: Aspen Publishers; 1998.
  64. Reding MJ, Potes E. Rehabilitation outcome following initial unilateral hemispheric stroke: life table analysis approach. *Stroke*. 1988;19:1354-1358.
  65. The International Stroke Trial (IST): a randomised trial of aspirin, subcutaneous heparin, both, or neither among 19435 patients with acute ischaemic stroke. International Stroke Trial Collaborative Group. *Lancet*. 1997;349:1569-1581.
  66. Low molecular weight heparinoid, ORG 10172 (danaparoid), and outcome after acute ischemic stroke: a randomized controlled trial. The Publications Committee for the Trial of ORG 10172 in Acute Stroke Treatment (TOAST) Investigators. *JAMA*. 1998;279:1265-1272.
  67. Bath PM, Iddenden R, Bath FJ. Low-molecular-weight heparins and heparinoids in acute ischemic stroke: a meta-analysis of randomized controlled trials. *Stroke*. 2000;31:1770-1778.
  68. Bijsterveld NR, Hettiarachchi R, Peters R, Prins MH, Levi M, Buller HR. Low-molecular weight heparins in venous and arterial thrombotic disease. *Thromb Haemost*. 1999;82 suppl 1:139-147.
  69. Bath PM, Bath FJ, Smithard DG. Interventions for dysphagia in acute stroke. *Cochrane Database Syst Rev*. 2000;(2):CD000323.
  70. Muir KW, Watt A, Baxter G, Grosset DG, Lees KR. Randomized trial of graded compression stockings for prevention of deep-vein thrombosis after acute stroke. *QJM*. 2000;93:359-364.
  71. Kamran SI, Downey D, Ruff RL. Pneumatic sequential compression reduces the risk of deep vein thrombosis in stroke patients. *Neurology*. 1998;50:1683-1688.
  72. Lyden P, Brott T, Tilley B, Welch KM, Mascha EJ, Levine S, Haley EC, Grotta J, Marler J. Improved reliability of the NIH Stroke Scale using video training. NINDS TPA Stroke Study Group. *Stroke*. 1994;25:2220-2226.
  73. Odderson IR. The National Institutes of Health Stroke Scale and its importance in acute stroke management. *Phys Med Rehabil Clin N Am*. 1999;10:787-800, vii. Review.
  74. Dewey HM, Donnan GA, Freeman EJ, Sharples CM, Macdonell RA, McNeil JJ, Thrift AG. Interrater reliability of the National Institutes of Health Stroke Scale: rating by neurologists and nurses in a community-based stroke incidence study. *Cerebrovasc Dis*. 1999;9:323-327.
  75. Goldstein LB, Samsa GP. Reliability of the National Institutes of Health Stroke Scale. Extension to non-neurologists in the context of a clinical trial. *Stroke*. 1997;28:307-310.
  76. Powers DW. Assessment of the stroke patient using the NIH stroke scale. *Emerg Med Serv*. 2001;30:52-56.
  77. Goldstein LB, Bertels C, Davis JN. Interrater reliability of the NIH stroke scale. *Arch Neurol*. 1989;46:660-662.
  78. Bushnell CD, Johnston DC, Goldstein LB. Retrospective assessment of initial stroke severity: comparison of the NIH Stroke Scale and the Canadian Neurological Scale. *Stroke*. 2001;32:656-660.
  79. Kasner SE, Chalela JA, Luciano JM, Cucchiara BL, Raps EC, McGarvey ML, Conroy MB, Localio AR. Reliability and validity of estimating the NIH stroke scale score from medical records. *Stroke*. 1999;30:1534-1537.
  80. Williams LS, Yilmaz EY, Lopez-Yunez AM. Retrospective assessment of initial stroke severity with the NIH Stroke Scale. *Stroke*. 2000;31:858-862.
  81. Wolf PA, Clagett GP, Easton JD, Goldstein LB, Gorelick PB, Kelly-Hayes M, Sacco RL, Whisnant JP. Preventing ischemic stroke in patients with prior stroke and transient ischemic attack: a statement for healthcare professionals from the Stroke Council of the American Heart Association. *Stroke*. 1999;30:1991-1994.
  82. ECRI. *Diagnosis and Treatment of Swallowing Disorders (Dysphagia) in Acute-Care Stroke Patients*. Plymouth Meeting, Pa: ECRI; 1999.



83. Perry L, Love CP. Screening for dysphagia and aspiration in acute stroke: a systematic review. *Dysphagia*. 2001;16:7–18. Review.
84. Martino R, Pron G, Diamant N. Screening for oropharyngeal dysphagia in stroke: insufficient evidence for guidelines. *Dysphagia*. 2000;15:19–30.
85. Smith HA, Lee SH, O'Neill PA, Connolly MJ. The combination of bedside swallowing assessment and oxygen saturation monitoring of swallowing in acute stroke: a safe and humane screening tool. *Age Ageing*. 2000;29:495–499.
86. Lim SH, Lieu PK, Phua SY, Seshadri R, Venketasubramanian N, Lee SH, Choo PW. Accuracy of bedside clinical methods compared with fiberoptic endoscopic examination of swallowing (FEES) in determining the risk of aspiration in acute stroke patients. *Dysphagia*. 2001;16:1–6.
87. Aviv JE. Prospective, randomized outcome study of endoscopic versus modified barium swallow in patients with dysphagia. *Laryngoscope*. 2000;110:563–574.
88. Martin-Harris B, Logemann JA, McMahon S, Schleicher M, Sandidge J. Clinical utility of the modified barium swallow. *Dysphagia*. 2000;15:136–141.
89. Nakayama H, Jorgensen HS, Pedersen PM, Raaschou HO, Olsen TS. Prevalence and risk factors of incontinence after stroke. The Copenhagen Stroke Study. *Stroke*. 1997;28:58–62.
90. Brocklehurst JC, Andrews K, Richards B, Laycock PJ. Incidence and correlates of incontinence in stroke patients. *J Am Geriatr Soc*. 1985;33:540–542.
91. Venn MR, Taft L, Carpentier B, Applebaugh G. The influence of timing and suppository use on efficiency and effectiveness of bowel training after a stroke. *Rehabil Nurs*. 1992;17:116–120.
92. Khorsandi M, Ginsberg PC, Harkaway RC. Reassessing the role of urodynamics after cerebrovascular accident. Males versus females. *Urol Int*. 1998;61:142–146.
93. Nitti VW, Adler H, Combs AJ. The role of urodynamics in the evaluation of voiding dysfunction in men after cerebrovascular accident. *J Urol*. 1996;155:263–266.
94. Bjork DT, Pelletier LL, Tight RR. Urinary tract infections with antibiotic resistant organisms in catheterized nursing home patients. *Infect Control*. 1984;5:173–176.
95. Sabanathan K, Castleden CM, Mitchell CJ. The problem of bacteriuria with indwelling urethral catheterization. *Age Ageing*. 1985;14:85–90.
96. Warren JW, Tenney JH, Hoopes JM, Muncie HL, Anthony WC. A prospective microbiologic study of bacteriuria in patients with chronic indwelling urethral catheters. *J Infect Dis*. 1982;146:719–723.
97. Saint S, Elmore JG, Sullivan SD, Emerson SS, Koepsell TD. The efficacy of silver alloy-coated urinary catheters in preventing urinary tract infection: a meta-analysis. *Am J Med*. 1998;105:236–241.
98. Berghmans LC, Hendriks HJ, De Bie RA, van Waalwijk van Doorn ES, Bo K, van Kerrebroeck PE. Conservative treatment of urge urinary incontinence in women: a systematic review of randomized clinical trials. *BJU Int*. 2000;85:254–263. Review.
99. Eustice S, Roe B, Paterson J. Prompted voiding for the management of urinary incontinence in adults. *Cochrane Database Syst Rev*. 2000;(2):CD002113. Review.
100. Nwosu CR, Khan KS, Chien PF, Honest MR. Is real-time ultrasonic bladder volume estimation reliable and valid? A systematic overview. *Scand J Urol Nephrol*. 1998;32:325–330.
101. Ramsay IN, Ali HM, Hunter M, Stark D, McKenzie S, Donaldson K, Major K. A prospective, randomized controlled trial of inpatient versus outpatient continence programs in the treatment of urinary incontinence in the female. *Int Urogynecol J Pelvic Floor Dysfunct*. 1996;7:260–263.
102. Roe B, Williams K, Palmer M. Bladder training for urinary incontinence in adults. *Cochrane Database Syst Rev*. 2000;(2):CD001308. Review. [Update in: *Cochrane Database Syst Rev*. 2004;(1):CD001308.]
103. Hawksley H. Pain assessment using a visual analogue scale. *Prof Nurse*. 2000;15:593–597.
104. Ouimet MA, Primeau F, Cole MG. Psychosocial risk factors in post-stroke depression: a systematic review. *Can J Psychiatry*. 2001;46:819–828. Review.
105. Tsouna-Hadjis E, Vemmos KN, Zakopoulos N, Stamatelopoulos S. First-stroke recovery process: the role of family social support. *Arch Phys Med Rehabil*. 2000;81:881–887.
106. Evans RL, Hendricks RD. Evaluating hospital discharge planning: a randomized clinical trial. *Med Care*. 1993;31:358–370.
107. Lawton MP, Moss M, Fulcomer M, Kleban MH. A research and service oriented multilevel assessment instrument. *J Gerontol*. 1982;37:91–99.
108. Lin JH. Influence of admission functional status on functional gain and efficiency of rehabilitation in first time stroke patients. *Kaohsiung J Med Sci*. 2001;17:312–318.
109. Ottenbacher KJ, Hsu Y, Granger CV, Fiedler RC. The reliability of the functional independence measure: a quantitative review. *Arch Phys Med Rehabil*. 1996;77:1226–1232.
110. Early Supported Discharge Trialists. Services for reducing duration of hospital care for acute stroke patients. *Cochrane Database Syst Rev*. 2005;18;(2):CD000443.
111. Rudd AG, Wolfe CD, Tilling K, Beech R. Randomised controlled trial to evaluate early discharge scheme for patients with stroke. *BMJ*. 1997;315:1039–1044. [Erratum in: *BMJ*. 1998;316:435.]
112. Nourhashemi F, Andrieu S, Gillette-Guyonnet S, Vellas B, Albaredo JL, Grandjean H. Instrumental activities of daily living as a potential marker of frailty: a study of 7364 community-dwelling elderly women (the EPIDOS study). *J Gerontol A Biol Sci Med Sci*. 2001;56:M448–M453.
113. Ginsberg GM, Hammerman-Rozenberg R, Cohen A, Stessman J. Independence in instrumental activities of daily living and its effect on mortality. *Aging (Milano)*. 1999;11:161–168.
114. Macko RF, DeSouza 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.
115. Potempa K, Braun LT, Tinknell T, Popovich J. Benefits of aerobic exercise after stroke. *Sports Med*. 1996;21:337–346. Review.
116. Rimmer JH, Riley B, Creviston T, Nicola T. Exercise training in a predominantly African-American group of stroke survivors. *Med Sci Sports Exerc*. 2000;32:1990–1996.
117. 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.
118. Wang CC, Kosinski CJ, Schwartzberg JG, Shanklin AV. *Physician's Guide to Assessing and Counseling Older Drivers*. Washington, DC: National Highway Traffic Safety Administration; 2003. Available at: <http://www.nhtsa.dot.gov/people/injury/olddrive/Olderdriversbook>. Accessed August 10, 2005.
119. Burgener S, Logan G. Sexuality concerns of the post-stroke patient. *Rehabil Nurs*. 1989;14:178–181, 195. Review.
120. Wade DT. Evidence relating to goal planning in rehabilitation. *Clin Rehabil*. 1998;12:273–275.
121. Joyce BM, Rockwood KJ, Mate-Kole CC. Use of goal attainment scaling in brain injury in a rehabilitation hospital. *Am J Phys Med Rehabil*. 1994;73:10–14.
122. Smith A, Cardillo JE, Smith SC, Amezaga AM Jr. Improvement scaling (rehabilitation version). A new approach to measuring progress of patients in achieving their individual rehabilitation goals. *Med Care*. 1998;36:333–347.
123. Stolee P, Stadnyk K, Myers AM, Rockwood K. An individualized approach to outcome measurement in geriatric rehabilitation. *J Gerontol A Biol Sci Med Sci*. 1999;54:M641–M647.
124. Stolee P, Zaza C, Pedlar A, Myers AM. Clinical experience with Goal Attainment Scaling in geriatric care. *J Aging Health*. 1999;11:96–124.
125. Bath PM, Lindstrom E, Boysen G, De Deyn P, Friis P, Leys D, Marttila R, Olsson J, O'Neill D, Orgogozo J, Ringelstein B, van der Sande J, Turpie AG. Tinzaparin in acute ischaemic stroke (TAIST): a randomised aspirin-controlled trial. *Lancet*. 2001;358:702–710. [Erratum in: *Lancet*. 2001;358:1276.]
126. Finestone HM, Foley NC, Woodbury MG, Greene-Finestone L. Quantifying fluid intake in dysphagic stroke patients: a preliminary comparison of oral and nonoral strategies. *Arch Phys Med Rehabil*. 2001;82:1744–1746.
127. Rasley A, Logemann JA, Kahrilas PJ, Rademaker AW, Pauloski BR, Dodds WJ. Prevention of barium aspiration during videofluoroscopic swallowing studies: value of change in posture. *AJR Am J Roentgenol*. 1993;160:1005–1009.
128. Hinds NP, Wiles CM. Assessment of swallowing and referral to speech and language therapists in acute stroke. *QJM*. 1998;91:829–835.
129. Perry L, McLaren S. An evaluation of implementation of evidence-based guidelines for dysphagia screening and assessment following acute stroke: phase 2 of an evidence-based practice project. *J Clin Excel*. 2000;2:147–157.

130. American Speech-Language-Hearing Association. *Scope of Practice in Speech-Language Pathology*. Rockville, Md: American Speech-Language-Hearing Association; 2001.
131. American Speech-Language-Hearing Association. 15.0 Speech-Language treatment/instruction/early intervention, preferred practice patterns for the profession of speech-language pathology. *ASHA Desk Reference*. Vol 1;2002:160–162.
132. Robey RR. The efficacy of treatment for aphasic persons: a meta-analysis. *Brain Lang*. 1994;47:582–608.
133. Robey RR. A meta-analysis of clinical outcomes in the treatment of aphasia. *J Speech Lang Hear Res*. 1998;41:172–187.
134. 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.
135. Katz RC, Wertz RT. The efficacy of computer-provided reading treatment for chronic aphasic adults. *J Speech Lang Hear Res*. 1997;40:493–507.
136. Wertz RT, Weiss DG, Aten JL, Brookshire RH, Garcia-Bunuel L, Holland AL, Kurtzke JF, LaPointe LL, Milianti FJ, Brannegan R, et al. Comparison of clinic, home, and deferred language treatment for aphasia: a Veterans Administration Cooperative Study. *Arch Neurol*. 1986;43:653–658.
137. Lincoln NB, McGuirk E, Mulley GP, Lendrem W, Jones AC, Mitchell JR. Effectiveness of speech therapy for aphasic stroke patients: a randomised controlled trial. *Lancet*. 1984;1:1197–1200.
138. 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.
139. Whurr R, Lorch MP, Nye C. Efficacy of speech and language therapy for aphasia: a meta-analytic review. *Neurol Rev Int*. 1997;1:7–11.
140. Bohannon RW, Walsh S. Nature, reliability, and predictive value of muscle performance measures in patients with hemiparesis following stroke. *Arch Phys Med Rehabil*. 1992;73:721–725.
141. Andrews AW, Bohannon RW. Discharge function and length of stay for patients with stroke are predicted by lower extremity muscle force on admission to rehabilitation. *Neurorehabil Neural Repair*. 2001;15:93–97.
142. Visintin M, Barbeau H, Korner-Bitensky N, Mayo NE. A new approach to retrain gait in stroke patients through body weight support and treadmill stimulation. *Stroke*. 1998;29:1122–1128.
143. 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.
144. Teixeira da Cunha Filho I, Lim PA, Qureshy H, Henson H, Monga T, Protas EJ. A comparison of regular rehabilitation and regular rehabilitation with supported treadmill ambulation training for acute stroke patients. *J Rehabil Res Dev*. 2001;38:245–255.
145. Kunkel A, Kopp B, Muller G, Villringer K, Villringer A, Taub E, Flor H. Constraint-induced movement therapy for motor recovery in chronic stroke patients. *Arch Phys Med Rehabil*. 1999;80:624–628.
146. Dromerick AW, Edwards DF, Hahn M. Does the application of constraint-induced movement therapy during acute rehabilitation reduce arm impairment after ischemic stroke? *Stroke*. 2000;31:2984–2988.
147. Winstein CJ, Miller JP, Blanton S, Taub E, Uswatte G, Morris D, Nichols D, Wolf S. Methods for a multisite randomized trial to investigate the effect of constraint-induced movement therapy in improving upper extremity function among adults recovering from a cerebrovascular stroke. *Neurorehabil Neural Repair*. 2003;17:137–152.
148. van der Lee JH, Wagenaar RC, Lankhorst GJ, Vogelaar TW, Deville 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.
149. Glanz M, Klawansky S, Stason W, Berkey C, Chalmers TC. Functional electrostimulation in poststroke rehabilitation: a meta-analysis of the randomized controlled trials. *Arch Phys Med Rehabil*. 1996;77:549–553.
150. Price CI, Pandyan AD. Electrical stimulation for preventing and treating post-stroke shoulder pain: a systematic Cochrane review. *Clin Rehabil*. 2001;15:5–19. Review.
151. Bogataj U, Gros N, Kljajic M, Acimovic R, Malezic M. The rehabilitation of gait in patients with hemiplegia: a comparison between conventional therapy and multichannel functional electrical stimulation therapy. *Phys Ther*. 1995;75:490–502.
152. Daly JJ, Kobetic R, Marsolais EB. Electrically induced gait changes post stroke, using an FNS system with intramuscular electrodes and multiple channels. *J Neurol Rehabil*. 1993;7:17–25.
153. Daly JJ, Ruff RL. Electrically induced recovery of gait components for older patients with chronic stroke. *Am J Phys Med Rehabil*. 2000;79:349–360.
154. Daly JJ, Ruff RL, Haycock K, Strasshofer B, Marsolais EB, Dobos L. Feasibility of gait training for acute stroke patients using FNS with implanted electrodes. *J Neurol Sci*. 2000;179(S 1-2):103–107.
155. Daly JJ, Kollar K, Debogorski AA, Strasshofer B, Marsolais EB, Scheiner A, Snyder S, Ruff RL. Performance of an intramuscular electrode during functional neuromuscular stimulation for gait training post stroke. *J Rehabil Res Dev*. 2001;38:513–526.
156. Mathiowetz V, Haugen JB. Motor behavior research: implications for therapeutic approaches to central nervous system dysfunction. *Am J Occup Ther*. 1994;48:733–745. Review.
157. Brunham S, Snow CJ. The effectiveness of neurodevelopmental treatment in adults with neurological conditions: a single-subject study. *Physiother Theory Pract*. 1992;8:215–222.
158. Mulder T, Hulstijn W, van der Meer J. EMG feedback and the restoration of motor control: a controlled group study of 12 hemiparetic patients. *Am J Phys Med*. 1986;65:173–188.
159. Wagenaar RC, Meijer OG, van Wieringen PC, Kuik DJ, Hazenberg GJ, Lindeboom J, Wichers F, Rijswijk H. The functional recovery of stroke: a comparison between neuro-developmental treatment and the Brunnstrom method. *Scand J Rehabil Med*. 1990;22:1–8.
160. Gelber DA, Good DC, Dromerick A, Sergay S, Richardson M. Open-label dose-titration safety and efficacy study of tizanidine hydrochloride in the treatment of spasticity associated with chronic stroke. *Stroke*. 2001;32:1841–1846.
161. Ketel WB, Kolb ME. Long-term treatment with dantrolene sodium of stroke patients with spasticity limiting the return of function. *Curr Med Res Opin*. 1984;9:161–169.
162. Katrak PH, Cole AM, Poulos CJ, McCauley JC. Objective assessment of spasticity, strength, and function with early exhibition of dantrolene sodium after cerebrovascular accident: a randomized double-blind study. *Arch Phys Med Rehabil*. 1992;73:4–9.
163. Milanov IG. Mechanisms of baclofen action on spasticity. *Acta Neurol Scand*. 1992;85:305–310.
164. Pedersen E, Arien-Soborg P, Mai J. The mode of action of the gaba derivative baclofen in human spasticity. *Acta Neurol Scand*. 1974;50:665–680.
165. Kirazli Y, On AY, Kismali B, Aksit R. Comparison of phenol block and botulinus toxin type A in the treatment of spastic foot after stroke: a randomized, double-blind trial. *Am J Phys Med Rehabil*. 1998;77:510–515.
166. Kong KH, Chua KS. Neurolysis of the musculocutaneous nerve with alcohol to treat poststroke elbow flexor spasticity. *Arch Phys Med Rehabil*. 1999;80:1234–1236.
167. On AY, Kirazli Y, Kismali B, Aksit R. Mechanisms of action of phenol block and botulinus toxin Type A in relieving spasticity: electrophysiologic investigation and follow-up. *Am J Phys Med Rehabil*. 1999;78:344–349.
168. Childers MK, Stacy M, Cooke DL, Stonnington HH. Comparison of two injection techniques using botulinum toxin in spastic hemiplegia. *Am J Phys Med Rehabil*. 1996;75:462–469.
169. Burbaud P, Wiart L, Dubos JL, Gaujard E, Debelleix X, Joseph PA, Mazaux JM, Bioulac B, Barat M, Lagueny A. A randomised, double blind, placebo controlled trial of botulinum toxin in the treatment of spastic foot in hemiparetic patients. *J Neurol Neurosurg Psychiatry*. 1996;61:265–269.
170. Hesse S, Reiter F, Konrad M, Jahnke MT. Botulinum toxin type A and short-term electrical stimulation in the treatment of upper limb flexor spasticity after stroke: a randomized, double-blind, placebo-controlled trial. *Clin Rehabil*. 1998;12:381–388.
171. Simpson DM, Alexander DN, O'Brien CF, Tagliati M, Aswad AS, Leon JM, Gibson J, Mordaunt JM, Monaghan EP. Botulinum toxin type A in the treatment of upper extremity spasticity: a randomized, double-blind, placebo-controlled trial. *Neurology*. 1996;46:1306–1310.
172. Goldstein LB. Common drugs influence motor recovery after stroke. The Sygen In Acute Stroke Study Investigators. *Neurology*. 1995;45:865–871.
173. Goldstein LB. Potential effects of common drugs on stroke recovery. *Arch Neurol*. 1998;55:454–456.

174. Graham GD, Ahmed W, Davis LE, et al. Effects of commonly prescribed medications on stroke recovery: a TOAST study analysis. *Stroke*. 1999;30:236. Abstract.
175. Troisi E, Paolucci S, Silvestrini M, Matteis M, Vernieri F, Grasso MG, Caltagirone C. Prognostic factors in stroke rehabilitation: the possible role of pharmacological treatment. *Acta Neurol Scand*. 2002;105:100–106.
176. Bakheit AM, Thilmann AF, Ward AB, Poewe W, Wissel J, Muller J, Benecke R, Collin C, Muller F, Ward CD, Neumann C. A randomized, double-blind, placebo-controlled, dose-ranging study to compare the efficacy and safety of three doses of botulinum toxin type A (Dysport) with placebo in upper limb spasticity after stroke. *Stroke*. 2000;31:2402–2406.
177. Richardson D, Sheehan G, Werring D, Desai M, Edwards S, Greenwood R, Thompson A. Evaluating the role of botulinum toxin in the management of focal hypertonia in adults. *J Neurol Neurosurg Psychiatry*. 2000;69:499–506.
178. Meythaler JM, Guin-Renfroe S, Brunner RC, Hadley MN. Intrathecal baclofen for spastic hypertonia from stroke. *Stroke*. 2001;32:2099–2109.
179. Glanz M, Klawansky S, Stason W, Berkey C, Shah N, Phan H, Chalmers TC. Biofeedback therapy in poststroke rehabilitation: a meta-analysis of the randomized controlled trials. *Arch Phys Med Rehabil*. 1995;76:508–515.
180. Moreland J, Thomson MA. Efficacy of electromyographic biofeedback compared with conventional physical therapy for upper-extremity function in patients following stroke: a research overview and meta-analysis. *Phys Ther*. 1994;74:534–543; discussion 544–547.
181. Moreland JD, Thomson MA, Fuoco AR. Electromyographic biofeedback to improve lower extremity function after stroke: a meta-analysis. *Arch Phys Med Rehabil*. 1998;79:134–140.
182. Schleenbaker RE, Mainous AG 3rd. Electromyographic biofeedback for neuromuscular reeducation in the hemiplegic stroke patient: a meta-analysis. *Arch Phys Med Rehabil*. 1993;74:1301–1304.
183. Bradley L, Hart BB, Mandana S, Flowers K, Riches M, Sanderson P. Electromyographic biofeedback for gait training after stroke. *Clin Rehabil*. 1998;12:11–22.
184. 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.
185. Walker C, Brouwer BJ, Culham EG. Use of visual feedback in retraining balance following acute stroke. *Phys Ther*. 2000;80:886–895.
186. Van Ouwenaller C, Laplace PM, Chantraine A. Painful shoulder in hemiplegia. *Arch Phys Med Rehabil*. 1986;67:23–26.
187. Zorowitz RD. The hemiplegic shoulder. *Stroke Clinical Updates*. 2001;11:1–4.
188. Dekker JH, Wagenaar RC, Lankhorst GJ, de Jong BA. The painful hemiplegic shoulder: effects of intra-articular triamcinolone acetonide. *Am J Phys Med Rehabil*. 1997;76:43–48.
189. Bohannon RW, Larkin PA, Smith MB, Horton MG. Shoulder pain in hemiplegia: statistical relationship with five variables. *Arch Phys Med Rehabil*. 1986;67:514–516.
190. Kumar R, Metter EJ, Mehta AJ, Chew T. Shoulder pain in hemiplegia: the role of exercise. *Am J Phys Med Rehabil*. 1990;69:205–208.
191. Dean CM, Mackey FH, Katrak P. Examination of shoulder positioning after stroke: a randomised controlled pilot trial. *Aust J Physiother*. 2000;46:35–40.
192. Braus DF, Krauss JK, Strobel J. The shoulder-hand syndrome after stroke: a prospective clinical trial. *Ann Neurol*. 1994;36:728–733.
193. Ancliffe J. Strapping the shoulder in patients following a cerebrovascular accident (CVA): a pilot study. *Australian J Physiother*. 1992;38:37–40.
194. 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.
195. Ciccone KD, Dahlberg C, Kalmr 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. Review.
196. Lincoln NB, Majid MJ, Weyman N. Cognitive rehabilitation for attention deficits following stroke. *Cochrane Database Syst Rev*. 2000;(4):CD002842. Review.
197. Bowen A, Lincoln NB, Dewey M. Cognitive rehabilitation for spatial neglect following stroke. *Cochrane Database Syst Rev*. 2002;(2):CD003586. Review.
198. Majid MJ, Lincoln NB, Weyman N. Cognitive rehabilitation for memory deficits following stroke. *Cochrane Database Syst Rev*. 2000;(3):CD002293. Review.
199. Pohjasvaara T, Leskela M, Vataja R, Kalska H, Ylikoski R, Hietanen M, Leppavuori A, Kaste M, Erkinjuntti T. Post-stroke depression, executive dysfunction and functional outcome. *Eur J Neurol*. 2002;9:269–275.
200. Gray JM, Robertson I, Pentland B, et al. Microcomputer-based attentional retraining after brain damage: a randomized group controlled trial. *Neuropsychol Rehabil*. 1992;2(2):97–115.
201. Niemann H, Ruff RM, Baser CA. Computer-assisted attention retraining in head-injured individuals: a controlled efficacy study of an outpatient program. *J Consult Clin Psychol*. 1990;58:811–817.
202. Sohlberg MM, Mateer CA. Effectiveness of an attention-training program. *J Clin Exp Neuropsychol*. 1987;9:117–130.
203. Strache W. Effectiveness of two modes of training to overcome deficits of concentration. *Int J Rehabil Res*. 1987;10:141–145.
204. Ryan TV, Ruff RM. The efficacy of structured memory retraining in a group comparison of head trauma patients. *Arch Clin Neuropsychol*. 1988;3:165–179.
205. Robinson RG. *The Clinical Neuropsychiatry of Stroke*. New York: Cambridge University Press; 1998.
206. Lincoln NB, Flannaghan T, Sutcliffe L, Rother L. Evaluation of cognitive behavioural treatment for depression after stroke: a pilot study. *Clin Rehabil*. 1997;11:114–122.
207. Castillo CS, Robinson RG. Focal neuropsychiatric syndromes after cerebrovascular disease. *Curr Opin Psychiatry*. 1993;6:109–112.
208. Shimoda K, Robinson RG. Effects of anxiety disorder on impairment and recovery from stroke. *J Neuropsychiatry Clin Neurosci*. 1998;10:34–40.
209. Hackett ML, Anderson CS, House AO. Interventions for treating depression after stroke. *Cochrane Database Syst Rev*. 2004;(3):CD003437. Review.
210. House AO, Hackett ML, Anderson CS, Horrocks JA. Pharmaceutical interventions for emotionalism after stroke. *Cochrane Database Syst Rev*. 2004;(2):CD003690. Review.
211. Andersen G. Treatment of uncontrolled crying after stroke. *Drugs Aging*. 1995;6:105–111. Review.
212. Cole MG, Elie LM, McCusker J, Bellavance F, Mansour A. Feasibility and effectiveness of treatments for post-stroke depression in elderly inpatients: systematic review. *J Geriatr Psychiatry Neurol*. 2001;14:37–41.
213. Kimura M, Robinson RG, Kosier JT. Treatment of cognitive impairment after poststroke depression: a double-blind treatment trial. *Stroke*. 2000;31:1482–1486.
214. Miyai I, Reding MJ. Effects of antidepressants on functional recovery following stroke: a double-blind study. *J Neurol Rehabil*. 1998;12:5–13.
215. Robinson RG, Schultz SK, Castillo C, Kopel T, Kosier JT, Newman RM, Curdew 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.
216. Wiart L, Petit H, Joseph PA, Mazaux JM, Barat M. Fluoxetine in early poststroke depression: a double-blind placebo-controlled study. *Stroke*. 2000;31:1829–1832.
217. Brown KW, Sloan RL, Pentland B. Fluoxetine as a treatment for post-stroke emotionalism. *Acta Psychiatr Scand*. 1998;98:455–458.
218. Burns A, Russell E, Stratton-Powell H, Tyrell P, O'Neill P, Baldwin R. Sertraline in stroke-associated lability of mood. *Int J Geriatr Psychiatry*. 1999;14:681–685.
219. Robinson RG, Parikh RM, Lipsey JR, Starkstein SE, Price TR. Pathological laughing and crying following stroke: validation of a measurement scale and a double-blind treatment study. *Am J Psychiatry*. 1993;150:286–293.
220. Grober S, Hibbard M, Gordon WA, et al. The psychotherapeutic treatment of post-stroke depression with cognitive behavioral therapy. In: Gordon WA, ed. *Advances in stroke rehabilitation*. Andover, Mass: Andover Medical; 1993: 215–241.
221. Dam M, Tonin P, De Boni A, Pizzolato G, Casson S, Ermani M, Freo U, Piron L, Battistin L. Effects of fluoxetine and maprotiline on functional recovery in poststroke hemiplegic patients undergoing rehabilitation therapy. *Stroke*. 1996;27:1211–1214.



222. Palomaki H, Kaste M, Berg A, Lonnqvist R, Lonnqvist J, Lehtihalmes M, Hares J. Prevention of poststroke depression: 1 year randomised placebo controlled double blind trial of mianserin with 6 month follow up after therapy. *J Neurol Neurosurg Psychiatry*. 1999;66:490–494.
223. Raffaele R, Rampello L, Vecchio I, et al. Trazodone therapy of the post-stroke depression. *Arch Gerontol Geriatr*. 1996;5 Suppl:217–220.
224. 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.
225. O'Young BJ, Young MA, Stiens SA, et al. *Physical Medicine and Rehabilitation Secrets*. 2nd ed. Philadelphia: Hanley & Belfus, Inc; 2002.
226. Zoltan B. *Vision, Perception and Cognition: A Manual for the Evaluation and Treatment of the Neurologically Impaired Adult*. Thorofare, NJ: SLACK Incorporated; 1996.
227. Agrell BM, Dehlin OI, Dahlgren CJ. Neglect in elderly stroke patients: a comparison of five tests. *Psychiatry Clin Neurosci*. 1997;51:295–300.
228. Halligan PW, Marshall JC, Wade DT. Visuospatial neglect: underlying factors and test sensitivity. *Lancet*. 1989;2:908–911.
229. Jehkonen M, Ahonen JP, Dastidar P, Koivisto AM, Laippala P, Vilkki J. How to detect visual neglect in acute stroke. *Lancet*. 1998;351:727–728.
230. Schubert F, Spatt J. Double dissociations between neglect tests: possible relation to lesion site. *Eur Neurol*. 2001;45:160–164.
231. Stone SP, Halligan PW, Wilson B, Greenwood RJ, Marshall JC. Performance of age-matched controls on a battery of visuo-spatial neglect tests. *J Neurol Neurosurg Psychiatry*. 1991;54:341–344.
232. Wilson B, Cockburn J, Halligan P. Development of a behavioral test of visuospatial neglect. *Arch Phys Med Rehabil*. 1987;68:98–102.
233. Antonucci G, Guariglia C, Judica A, Magnotti L, Paolucci S, Pizzamiglio L, Zoccolotti P. Effectiveness of neglect rehabilitation in a randomized group study. *J Clin Exp Neuropsychol*. 1995;17:383–389.
234. Beis JM, Andre JM, Baumgarten A, Challier B. Eye patching in unilateral spatial neglect: efficacy of two methods. *Arch Phys Med Rehabil*. 1999;80:71–76.
235. Fanthome Y, Lincoln NB, Drummond A, Walker MF. The treatment of visual neglect using feedback of eye movements: a pilot study. *Disabil Rehabil*. 1995;17:413–417.
236. Paolucci S, Antonucci G, Gialloreti LE, Traballese M, Lubich S, Pratesi L, Palombi L. Predicting stroke inpatient rehabilitation outcome: the prominent role of neuropsychological disorders. *Eur Neurol*. 1996;36:385–390.
237. Rossetti Y, Rode G, Pisella L, Farne A, Li L, Boisson D, Perenin MT. Prism adaptation to a rightward optical deviation rehabilitates left hemispatial neglect. *Nature*. 1998;395:166–169.
238. Wiart L, Come 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.
239. Crisostomo EA, Duncan PW, Propst M, Dawson DV, Davis JN. Evidence that amphetamine with physical therapy promotes recovery of motor function in stroke patients. *Ann Neurol*. 1988;23:94–97.
240. Walker-Batson D, Smith P, Curtis S, Unwin H, Greenlee R. Amphetamine paired with physical therapy accelerates motor recovery after stroke: further evidence. *Stroke*. 1995;26:2254–2259.
241. Walker-Batson D, Curtis S, Natarajan R, Ford J, Dronkers N, Salmeron E, Lai J, Unwin DH. A double-blind, placebo-controlled study of the use of amphetamine in the treatment of aphasia. *Stroke*. 2001;32:2093–2098.
242. Borucki SJ, Langberg J, Reding M. The effect of dextroamphetamine on motor recovery after stroke. *Neurology*. 1992;42:329. Abstract.
243. Sonde L, Nordstrom M, Nilsson CG, Lokk J, Viitanen M. A double-blind placebo-controlled study of the effects of amphetamine and physiotherapy after stroke. *Cerebrovasc Dis*. 2001;12:253–257.
244. Unwin H, Walker-Batson D. No side effects after low-dose amphetamine administration in stroke rehabilitation. *Stroke*. 2000;31:1788–1789.
245. Grade C, Redford B, Chrostowski J, Toussaint L, Blackwell B. Methylphenidate in early poststroke recovery: a double-blind, placebo-controlled study. *Arch Phys Med Rehabil*. 1998;79:1047–1050.
246. Scheidtmann K, Fries W, Muller F, Koenig E. Effect of levodopa in combination with physiotherapy on functional motor recovery after stroke: a prospective, randomised, double-blind study. *Lancet*. 2001;358:787–790.
247. Nishino K, Sasaki T, Takahashi K, Chiba M, Ito T. The norepinephrine precursor L-threo-3,4-dihydroxyphenylserine facilitates motor recovery in chronic stroke patients. *J Clin Neurosci*. 2001;8:547–550.
248. Pariente J, Loubinoux I, Carel C, Albuher JF, Leger A, Manelfe C, Rascol O, Chollet F. Fluoxetine modulates motor performance and cerebral activation of patients recovering from stroke. *Ann Neurol*. 2001;50:718–729.
249. Greener J, Enderby P, Whurr R. Pharmacological treatment for aphasia following stroke. *Cochrane Database Syst Rev*. 2001;(4):CD000424. Review.
250. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. 2003;289:2560–2572. [Erratum in: *JAMA*. 2003;290:197.]
251. Blazer D, Hughes DC, George LK. The epidemiology of depression in an elderly community population. *Gerontologist*. 1987;27:281–287.
252. Kramer M, German PS, Anthony JC, Von Korff M, Skinner EA. Patterns of mental disorders among the elderly residents of eastern Baltimore. *J Am Geriatr Soc*. 1985;33:236–245.
253. Lichtenberg P, Barth J. Depression in elderly caregivers: a longitudinal study to test Lewinsohn's model of depression. *Med Psychother*. 1990;3:147–156.
254. Schultz R, Visintainer P, Williamson G. Psychiatric and physical morbidity effects of caregiving. *J Gerontol*. 1990;45:181–191.
255. Lichtenberg PA, Gibbons TA. Geriatric rehabilitation and the older adult family caregiver. *Neurorehabilitation*. 1992;3(1):62–71.
256. Joslin BL, Coyne AC, Johnson TW, et al. Dementia and elder abuse: are caregivers victims or villains? Paper presented at: The 44th Annual Meeting of the Gerontological Society of America, 1991; San Francisco, Calif.
257. Stephens MA, Kinney JM, Ogrocki PK. Stressors and well-being among caregivers to older adults with dementia: the in-home versus nursing home experience. *Gerontologist*. 1991;31:217–223.
258. Evans RL, Bishop DS, Ousley RT. Providing care to persons with physical disability: effect on family caregivers. *Am J Phys Med Rehabil*. 1992;71:140–144.
259. Drummond A. Leisure activity after stroke. *Int Disabil Stud*. 1990;12:157–160.
260. Jongbloed L, Morgan D. An investigation of involvement in leisure activities after a stroke. *Am J Occup Ther*. 1991;45:420–427.
261. Krefting L, Krefting D. Leisure activities after a stroke: an ethnographic approach. *Am J Occup Ther*. 1991;45:429–436.
262. Shank J. *The Role of Therapeutic Recreation in Rehabilitation Research*. The National Center for Medical Rehabilitation Research; March 6, 1992.
263. Sjogren K. Leisure after stroke. *Int Rehabil Med*. 1982;4:80–87.
264. Weir RP. *Rehabilitation of Cerebrovascular Disorder (Stroke): Early Discharge and Support: A Critical Review of the Literature*. Christchurch, New Zealand: New Zealand Health Technology Assessment (NZHTA); 1999.

KEY WORDS: AHA/ASA-Endorsed Practice Guidelines ■ stroke ■ rehabilitation ■ quality of life