

# Stroke Outcome and its Rehabilitation

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**Abstract:** *Outcome after stroke is measured in a number of ways, including medical morbidity, mortality, length of hospitalization, cost, functional ability, placement at discharge, and quality of life. The aim of the study was to assess the efficacy of rehabilitation in maintaining achieved gains and reducing long-term costs and illustrate the efficacy of various levels of rehabilitative services on stroke outcome. Recovery from a stroke can be a challenging process. Inpatient rehabilitation teams should combine personalized attention with leading-edge therapies to help each patient achieve the highest possible level of independence.*

**Keywords:** stroke, traumatic brain injury, risk factors

## 1. Introduction

Outcome after stroke is measured in a number of ways, including medical morbidity, mortality, length of hospitalization, cost, functional ability, placement at discharge, and quality of life. The usefulness of factors as predictors of outcome depends on the type of outcome measurement desired. Reliable predictors of increased medical morbidity and mortality, measured in the first week after stroke, include increased age, hemorrhagic etiology, global deficits, altered level of consciousness, electrocardiographic abnormalities, pre-illness nursing home placement, delay in medical care, signs of brainstem involvement, and hemiplegia (1). Consistent predictors of increased length of total hospitalization and cost, measured in the first month after stroke, are delayed acute medical care, delayed rehabilitation, rehabilitation in general medical/neurologic units, and more severe initial neurologic and functional deficits (2,3).

Predictors of functional outcome following a stroke have been extensively studied. Reliable predictors of poor functional outcome at discharge and 1 year follow-up, determined during the first month after stroke, include prior stroke, urinary and bowel incontinence, depression, visual, spatial, cognitive, and perceptual deficits, delayed acute medical care, delayed rehabilitation, low functional score on admission to rehabilitation program, poor social supports (unmarried, unemployed), cardiac disease, inability to perform basic tasks of everyday living (feeding, grooming), and poor sitting balance. Factors that have inconsistently predicted functional outcome include large cerebral, basal ganglia, or bilateral lesions by computed tomography scan, homonymous hemianopsia, dense hemiplegia, and aphasia. Increased age has been reported as a predictor of poor functional outcome, but concurrent morbidity (cerebrovascular disease, cardiac disease, diabetes mellitus) confounds most analyses. Older adults tend to be discharged at reduced levels of functional independence, but they make similar improvement during acute rehabilitation compared with younger patients. Factors that do not predict outcome after stroke are side and specific location of cerebral lesions, gender, educational level, socioeconomic status, handedness, cause of stroke, ability to ambulate on admission to

rehabilitation program, and degree of sensory deficits (4,5). Placement at discharge correlates well with functional status. Discharge to an extended-care facility has similar predictors as poor functional outcome. Additionally, patients with inadequate social supports (often older adults) often are placed in extended-care facilities despite relatively good functional status.

Poststroke quality of life has proven difficult to quantify accurately, and therefore predictors of poor quality of life after stroke have not been well studied. Predictors of a good quality of life after stroke are limited concurrent illness, ability to perform basic ADL skills, married status, ability to use available outside services, and return to work. Age, gender, socioeconomic status, side of lesion, functional level, and ability to use a wheelchair are not predictive of poststroke quality of life (7). The aim of the study was to assess the efficacy of rehabilitation in maintaining achieved gains and reducing long-term costs and illustrate the efficacy of various levels of rehabilitative services on stroke outcome.

## 2. Material and Methods

We conducted a systematic review of literature published between 2010-2016 regarding the stroke outcome and its rehabilitation. The relevant articles were retrieved from the following electronic databases: MEDLINE; Embase; Cochrane.

## 3. Results

Functional independence improves spontaneously for at least the first 6 months after stroke. In the past, the effect of a rehabilitation program in augmenting recovery and improving outcome was unclear. Initial studies of stroke outcome were primarily observational without adequate case control groups. These studies concluded both in favor of and against rehabilitation as an aid to recovery after stroke. More recent methodologically rigorous, case-controlled studies have shown that acute and post-acute rehabilitation have positive effects on outcome. Several recent studies document the efficacy of acute rehabilitation. In a randomized study 95

stroke patients were randomly assigned to either intensive rehabilitation (intensive treatment group) or only physical therapy (normal treatment group) on a medical unit (8). Although the intensive treatment group had significantly more rehabilitation days than the normal treatment group in the first 3 months, there was no difference in total rehabilitation days at 6 and 12 months after stroke. The intensive treatment patients had improved ADL and motor function scores at 6 and 12 months. Researchers concluded that the more intensive rehabilitation improved the functional recovery of stroke patients.

Other authors randomized 121 patients into groups: intensive rehabilitation (4 full days of service week), conventional therapy (3 half days per week), and no therapy (9). The functional gains made by the no-treatment group could be explained by spontaneous recovery, and any additional gains made by the intensive and conventional-therapy groups were attributed to the rehabilitation. Improvement in function was greatest the intensive rehabilitation group least in the no-treatment group.

These findings were confirmed by other authors. Other studies have shown the effectiveness of rehabilitation 6 to 12 months after stroke. Lehmann et al examined 33 patients who were admitted to an inpatient rehabilitation unit 6 after their stroke. These patients made significant improvements in function (dressing, bladder and bowel elimination, walking, and transfers) during their rehabilitation stay. Achieved gains were maintained 12 months after discharge from rehabilitation. Lehmann et al concluded that gains could be attributed to the rehabilitation process and not spontaneous recovery (10,11). Tangeman et al examined 40 patients receiving rehabilitation 1 year after their stroke and noted gains in balance, weight shift, and ADL score. Wade et al, (12) a randomized, single blind, crossover study demonstrated that a structured physical therapy program improved gait speed 1 year after stroke. Young and Forster in a randomized single-blind, controlled study showed that physical therapy used fewer resources was more effective in producing functional improvement than an adult day program (no therapy) in postacute stroke patients. Gains made in rehabilitation generally persist. Lehmann et al noted that gains after stroke were maintained at 6 to 12 months discharge from rehabilitation. Tangeman et al demonstrated functional gains 1 year stroke were at least months after from discharge from rehabilitation. Tangeman et al demonstrated that functional gains made 1 year after stroke were maintained at least 3 months discharge from rehabilitation (13).

Some authors found that motor function gains made during rehabilitation were maintained at 12 months stroke. They noted that functional gains made in rehabilitation were maintained 2 to 12 years later (14). Studies suggest that patients generally improve their mobility skills after discharge from rehabilitation, but they lose ground in self-dressing and self-feeding, because families often choose to perform tasks for them. It is estimated that of acute stroke survivors, 10% are not disabled, 40% are mildly disabled, 40% have moderate to severe disability requiring special services, and 10% require long-term care (15). Framingham data indicate that 70% of stroke survivors live 1 to 3 years

after stroke, 50% live for 3 to 6 years, and 30% live 11 years or more. Of these stroke survivors, up to 69% were independent in self-care and 80% were independent in mobility, but 70% lost vocational and social function. It was estimated in 1985 that an unrehabilitated stroke patient costs society about \$100,000 more over the course of his or her life than did a rehabilitated stroke survivor. Cost savings are greatest for those rehabilitated patients who would otherwise have required institutionalization (16).

Functional improvement after stroke, above and beyond that expected from natural recovery, has been shown to occur in all rehabilitation treatment settings (17). Specialized rehabilitation units have been shown in randomized, prospective studies to achieve faster and better functional outcomes than general medical units but these special units have not been directly compared with day, outpatient, or home-based rehabilitation settings. Patients who meet criteria for intensive rehabilitation but who can be managed at home may benefit from a full-day rehabilitation program. Greater intensity of inpatient rehabilitation programs and outpatient therapies has been shown to produce greater and more rapid functional improvements. Additionally, interdisciplinary rehabilitation care has been demonstrated to be more efficacious than multidisciplinary therapy programs (18). Therefore, day rehabilitation would seem to be preferable to typically less intensive and multidisciplinary outpatient or home therapies. The specific benefits of day rehabilitation and home therapies have not been well studied (19). Slower-paced, multidisciplinary subacute rehabilitation (in specialized units or skilled nursing facilities) for the stroke patient who is unable to tolerate inpatient or day rehabilitation also has not been well studied (20). While there is a growing trend toward interdisciplinary treatment in these facilities, the overriding importance of a supportive environment after discharge to help maintain achieved gains cannot be overemphasized.

## 4. Conclusions

Recovery from a stroke can be a challenging process. Inpatient rehabilitation teams should combine personalized attention with leading-edge therapies to help each patient achieve the highest possible level of independence. The stroke specialty programs should define intervention to the prevention, recognition, assessment, and treatment of conditions related to stroke and its complications; to promote lifestyle changes that focus on reducing risk factors for recurrent stroke; increasing functional independence; provide psychological and social coping and adaptation skills; integrate persons served back into the community, and participate in life roles; and to offer services for families and/or support systems.

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