

## The American Heart Association Stroke Outcome Classification: Executive Summary

Panel

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Stroke remains one of the major public health problems in the United States today, with approximately 500 000 new or recurrent cases occurring each year.<sup>1</sup> About 4 000 000 persons alive today have survived a stroke and have some neurological deficits. Although the magnitude of healthcare resources used to treat and rehabilitate stroke survivors is considerable, to date a standardized, comprehensive classification system to document the resultant impairments and disability has not been developed.

Successful management of any disabling disease, including stroke, should benefit from the use of a classification system to judge the impact of treatment, particularly emerging therapies. Participants in the Methodologic Issues in Stroke Outcome Symposium<sup>2</sup> determined that the complex nature of stroke recovery demands clarification of its natural history and classification of the variable patterns of functional recovery. For stroke survivors to receive the best care, a comprehensive stroke outcome classification system is needed to direct appropriate therapeutic interventions.<sup>3</sup> Building on the work and recommendations of the Stroke Outcome Symposium, the American Heart Association Classification of Stroke Outcome Task Force has worked to develop a valid and reliable global classification system that accurately summarizes the neurological impairments, disabilities, and handicaps that occur after stroke.

The development of a stroke outcome classification system is predicated on the belief that neurological deficits often lead to permanent impairments, disabilities, and compromised quality of life.<sup>4-6</sup> Although a person's ability to complete daily functional tasks is thought to be largely dependent on and often limited by the type and degree of impairment, additional factors are often relevant in the ultimate determination of functional outcome.<sup>7-9</sup> Thus, a classification of stroke outcome should include the broad range of disabilities and impairments as well as the relationship of disability and impairment to independent function.

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It is important to underscore that impairment alone does not define level of disability. In a study of stroke survivors<sup>10</sup> it was determined that although a disability is most directly influenced by impairments, current stroke scales that measure impairments only partially explained the level of disability, handicap, or quality of life for those surviving at least 6 months. Some persons adapt well to many and/or severe impairments caused by stroke. Others with only minimal neurological impairments can be severely disabled. Many factors determine function, including the influence of poststroke rehabilitation training and the physical and social environments.

### Approach to Stroke Assessment

The schema for the stroke outcome classification score presented here is conceptually similar to the New York Heart Association functional and therapeutic classification of patients with diseases of the heart framework.<sup>11</sup> However, unlike heart disease, in which the primary limitation is impairment of physical activity due to chest pain, shortness of breath, and fatigue, stroke impairs many critical neurological functions, resulting in a greater number and broader range of physical and social disabilities. The AHA Stroke Outcome Classification (AHA.SOC) score (Figure) classifies the severity and extent of neurological impairments that are the basis for disability. The classification also identifies the level of independence of stroke patients according to basic and more complex activities of daily living both at home and in the community. The classification score is meant to describe the limitations resulting from the current stroke. It is not an evaluation of disabilities caused by other neurological events. Furthermore, it is a summary score. The task force recommends that clinicians support their rating decisions with standardized assessment instruments whenever possible.

### Components of the AHA Stroke Outcome Classification Score

#### Classification of Neurological Impairments

The first area of assessment in the AHA.SOC score is the evaluation of neurological impairment. A complete clinical examination is the basis for documenting the major domains of neurological impairment.<sup>12</sup> In this classification schema the number of affected domains is recorded as well as severity of impairments.

Potentially affected neurological domains are

- **Motor:** Motor impairments are the most prevalent of all deficits seen after stroke, usually with involvement of the face, arm, and leg, alone or in various combinations. Motor functions assessed in the AHA.SOC include cranial nerve



# Stroke Outcome Classification

AHA.SOC Score \_\_\_\_\_ • \_\_\_\_\_ • \_\_\_\_\_  
 Number of Domains                      Severity                      Function

## Number of Neurological Domains Impaired

Score	
0	0 domains impaired
1	1 domain impaired
2	2 domains impaired
3	>2 domains impaired

### Neurological Domains

**Motor, sensory, vision, affect, cognition, language**

## Severity of Impairment

Level	
A	No/minimal neurological deficit due to stroke in any domain
B	Mild/moderate deficit due to stroke in $\geq 1$ domain(s)
C	Severe deficit due to stroke in $\geq 1$ domain(s)

## Function

Level	
I	<b>Independent</b> in BADL and IADL activities and tasks required of roles patient had before the stroke. Patient is able to live alone, maintain a household, and access the community for leisure and/or productive activities such as shopping, employment, or volunteer work.
II	<b>Independent</b> in BADL but partially dependent in routine IADL. Patient is able to live alone but requires assistance/supervision to access the community for shopping and leisure activities. Patient may require occasional assistance with meal preparation, household tasks, and taking medications.
III	<b>Partially dependent</b> in BADL (<3 areas) and IADL. Patient is able to live alone with substantial daily help from family or community resources for more difficult BADL tasks such as dressing lower extremities, bathing, or climbing stairs. Patient requires assistance with such IADL tasks as meal preparation, home maintenance, community access, shopping, handling finances, and/or taking medications.
IV	<b>Partially dependent</b> in BADL ( $\geq 3$ areas). Patient is unable to live alone safely and requires assistance with IADL except for simple tasks such as answering the telephone.
V	<b>Completely dependent</b> in BADL ( $\geq 5$ areas) and IADL. Patient is unable to live alone safely and requires full-time care.

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American Heart Association Stroke Outcome Classification (AHA.SOC). BADL indicates *Basic Activities of Daily Living*: feeding and swallowing, grooming, dressing, bathing, continence, toileting, and mobility; and IADL, *Instrumental Activities of Daily Living*: using the telephone, handling money, shopping, using transportation, maintaining a household, working, participating in leisure activities, etc.

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- function (including speech and swallowing), muscle power and tone, reflexes, balance, gait, coordination, and apraxia.
- *Sensory*: Sensory deficits range from loss of primary sensations to more complex loss of perception. Patients may describe numbness, tingling, or altered sensitivity. The more complex sensory losses include astereognosis, agraphia, and extinction to double simultaneous stimuli.
  - *Vision*: Stroke can cause monocular visual loss, homonymous hemianopia, or cortical blindness.
  - *Language*: Dysphasia may be exhibited by disturbances in comprehension, naming, repetition, fluency, reading, or writing.
  - *Cognition*: Stroke can cause impairments in memory, attention, orientation, calculation abilities, and construction. It is important to assess ability to learn and retain new information in the cognitive evaluation.
  - *Affect*: Depression is the most common affective disturbance seen after stroke. It tends to be observed more often in the months after stroke than during the acute event. Symptoms include loss of energy, lack of interests, loss of appetite, and insomnia.<sup>13</sup>

The domains of stroke impairments are documented both in the number and severity of the neurological deficits observed. When >1 domain is affected, severity is defined by the most impaired domain. The categories for the number of domains involved after stroke are Level 0, no domains impaired; Level 1, 1 domain impaired; Level 2, 2 domains impaired; and Level 3, >2 domains impaired. For stroke severity, impairment is classified as being either Level A, minimal or no neurological deficit due to stroke in the above domains; Level B, mild/moderate deficit due to stroke; or Level C, severe deficit due to stroke.

The neurological examination is the basis for determining neurological impairments in the AHA.SOC score. However, the task force recommends that clinicians support their rating decisions by using standardized assessment measures whenever possible. The Appendix describes several available, well-documented assessment instruments that have been tested in stroke populations. This listing is suggestive and not all-inclusive of other available measures.

### **Classification of Functional Disabilities and Handicap**

The second major area of assessment in determining the stroke outcome classification score is the evaluation of function in terms of resultant disability. Disability is defined as “any restriction or lack of ability to perform an activity in a manner or within the range considered normal for a human being.”<sup>14</sup> The basic self-care tasks are feeding; grooming; dressing; bathing; toileting, including sphincter control; and mobility, including transferring from place to place. These are called *basic activities of daily living (BADL)*. Independence in BADL could enable the stroke patient to live at home with help from family or community providers for meals and other household tasks as needed. More complex activities of daily living are called *instrumental activities of daily living (IADL)*. These tasks are performed to maintain independence in the home and community and include shopping, using transportation, telephoning, preparing meals,

handling finances, and maintaining a household. Independence in these activities enables the stroke patient to be discharged to home without being dependent on others. Other instrumental activities of daily living that affect quality of life are work skills, religious activities, and leisure-time and recreational activities (see Appendix).

### **Application of the AHA Stroke Outcome Classification Score to Sample Cases**

The following cases illustrate the decision-making process and use of the AHA.SOC in assessments of 3 stroke patients.

*Case 1*: A 62-year-old man has an ischemic infarct in the left hemisphere. Neurologically he is cognitively intact, not depressed, and able to communicate. He has no residual weakness or sensory loss. Three months after the stroke he is living independently at home without healthcare assistance for basic daily activities. He manages routine household maintenance and needs assistance only with community activities such as shopping and banking. The stroke classification score for this patient is *number of domains impaired=0; stroke severity=A; functional classification=Level II. AHA.SOC score=0.A.II.*

*Case 2* is a 74-year-old woman with a large-vessel infarct in the right hemisphere. Neurologically she has the following residual impairments: partial hemianopia, facial palsy, and sensory loss and weakness in the upper and lower left extremities. She is not depressed and is cognitively intact. She lives at home with professional home healthcare assistance. She requires the assistance of another person to access the community. She is unable to do housekeeping tasks or prepare meals. She can take her own medications and use a telephone; however, she cannot bathe independently or climb stairs. The stroke classification score for this patient is *number of domains impaired=3; stroke severity=B; functional classification level=III. AHA.SOC score=3.B.III.*

*Case 3* is an 85-year-old woman with a right-hemisphere infarct who lives in a skilled-nursing facility. She has paralysis of the left upper and lower extremities, partial hemianopia, cognitive impairment, and depression. She eats independently but is incontinent and needs help with dressing, bathing, toileting, and mobility-related activities. She cannot manage her medications, prepare her meals, use the telephone, or access the community without special transportation arrangements. The stroke classification score for this patient is *number of domains impaired=3; stroke severity score=C; functional classification level=V. AHA.SOC score=3.C.V.*

### **Conclusion**

New therapies and improved survival after stroke provide an opportune time to develop a stroke outcome classification system that measures the full range of domains affected by stroke. The AHA.SOC score provides a mechanism to comprehensively document stroke impairments and disabilities in a single summary stroke score. The system can be used by healthcare providers to reliably assess recovery, measure responses to treatment, and describe the long-term impact of stroke on survivors.

## Appendix

### Stroke Deficit Scales

Scale	Description and Type of Scale	Time and Administration	Comments
NIH Stroke Scale <sup>14</sup>	15 items scored on 3- or 4-point interval scales  Domains: consciousness, vision, extraocular movements, facial palsy, limb strength, ataxia, sensation, speech, and language	Uses: acute care, screening, formal assessment, and monitoring Time: 10 min	Brief. Can be administered by non-neurologists.  Interval scale good reliability. Omits dysphagia.
Canadian Neurological Scale <sup>15</sup>	8 items scored on 3-point interval scale  Domains: consciousness, orientation, speech, motor function, and facial weakness	Uses: acute care, screening, formal assessment, and monitoring Time: 5 min	Brief.  Omits ataxia, visual fields, and eye movements. Interval scale relatively insensitive to change.

### Mental Status Screening Test

Scale	Description and Type of Scale	Time and Administration	Comments
Mini-Mental State Exam <sup>16</sup>	7 domains, including orientation to time and place, registration of words, attention, calculation, recall, language, and visual construction	Uses: screening, assessment, and monitoring Time: <10 min	Widely used for screening. May misclassify patients with aphasia. Education and normal aging must be considered in interpreting overall score.
Neurobehavioral Cognitive Status Exam <sup>17</sup>	10 scales: graded assessment of function Domains: orientation, attention, comprehension, naming, construction, memory, calculation, similarities, judgment, and repetition	Uses: screening, assessment, and monitoring Time: <30 min	Does not distinguish right- from left-hemisphere strokes. Correlates with education.

### Language Scales

Scale	Description and Type of Scale	Time and Administration	Comments
Boston Diagnostic Aphasia Examination <sup>18</sup>	Assesses sample speech and language behavior on a 6-point ordinal scale Modalities assessed: fluency, naming, word finding, repetition, serial speech, auditory comprehension, reading, and writing. Examiner judges grammar, syntax, frequency of paraphrases, and articulation.	Uses: formal assessment and monitoring Time: 1–4 h	Widely used, comprehensive, good standardization data, and sound theoretical rationale.
ASHA FACS <sup>19</sup>	43-item rating scale of functional communication skills Modalities assessed: social communication, communication of daily needs, reading, writing, number concepts, and daily planning	Uses: formal assessment and monitoring Time: 15 min	Relies on observations of communicative behavior by rater, although input from professionals and families is also permitted.

### Depression Scales

Scale	Description and Type of Scale	Time and Administration	Comments
Geriatric Depression Scale (GDS) <sup>20</sup>	Self-rating scale with 30 items in "yes/no" format. No items refer to disability.	Uses: screening and monitoring Time: 10 min	Brief. Less affected by visual impairments, physical illness, difficulty in choosing options, and poor motivation. "Yes/no" format better for the elderly and the cognitively impaired.
Center for Epidemiologic Studies of Depression (CES-D) <sup>21</sup>	Self-rating scale, measures severity of depressive symptoms 20-item questionnaire investigates perceived mood and level of functioning within the past week.	Uses: screening and monitoring Time: <15 min	Brief self-report, easily administered. Useful in the elderly. Effective for screening stroke population.

## BADL Scales

Scale	Description and Type of Scale	Time and Administration	Comments
Barthel Index <sup>22</sup>	Ordinal scale with scores from 0 (totally dependent) to 100 (independent)  10 weighted items: feeding, bathing, grooming, dressing, bladder control, bowel control, toileting, chair/bed transfer, mobility, and stair climbing	Clinician observation <40 min  Appropriate for screening, formal assessment, monitoring, and maintenance	Widely established measure for disability; strong reliability and validity.
FIM <sup>23</sup>	Ordinal scale with 18 items, 7-level scale with scores 18–126. Areas of evaluation: feeding, self-care, sphincter control, mobility, locomotion, communication, and social cognition	Clinician observation <40 min Appropriate for screening, formal assessment, monitoring, maintenance, and program evaluation	Widely accepted in rehabilitation; proven measure of ADL and social cognition; standardized interobserver reliability by certification of clinicians.

## IADL Scales

Scale	Description and Type of Scale	Time and Administration	Comments
PGC Instrumental Activities of Daily Living <sup>24</sup>	Guttman scale Questions on telephone use, shopping, food preparation, walking, public transportation, and medicines	Interviewer <30 min Appropriate for maintenance in community setting	Simple measure design with general functioning questions on information necessary for independent living.
Frenchay Activities Index <sup>25</sup>	15 items concerning activities at and outside the home. Summary score (15–60) and subscale scores for domestic, leisure/work, and outdoor activities. Depends on self-reports by patient and family.	Uses: monitoring Time: 10–15 min	Developed specifically for stroke patients. Assesses broad array of activities of daily living.

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