



## National Institutes of Health Stroke Scale (NIHSS)

### Description

The National Institutes of Health Stroke Scale (NIHSS) is a 15-item impairment scale used to measure stroke severity. It was originally developed in 1989<sup>1</sup> and is now a widely used outcome measure in the recombinant tissue plasminogen activator stroke trials.<sup>2</sup> In the current National Stroke Foundation guidelines, the NIHSS is recommended as a valid tool to assess stroke severity in emergency departments.

The NIHSS includes the following domains: level of consciousness, eye movements, integrity of visual fields, facial movements, arm and leg muscle strength, sensation, coordination, language, speech and neglect. Each impairment is scored on an ordinal scale ranging from 0 to 2, 0 to 3, or 0 to 4. Item scores are summed to a total score ranging from 0 to 42 (the higher the score, the more severe the stroke). The original 15-item NIHSS remains the most widely accessible, although several versions have been developed (such as the 5-, 8- and 11-item modified NIHSS) and are available in many languages (Cantonese, Chinese, Estonian, German, Hindi, Hungarian, Italian, Marathi, Portuguese, Spanish and Telugu) ([http://strokeengine.ca/assess/module\\_nihss\\_indepth-en.html](http://strokeengine.ca/assess/module_nihss_indepth-en.html)).

**Reliability, validity, responsiveness and predictive ability:** The psychometric properties of the original 15-item NIHSS have been

studied extensively. The NIHSS has moderate-to-high reliability when carried out by medical and non-medical staff (intra-rater  $\kappa = 0.66$  to  $0.77$ ; inter-rater  $\kappa = 0.69$ ).<sup>1</sup> Very high reliability has also been demonstrated when clinicians rate from videos of patients (intra-rater ICC =  $0.93$ ; inter-rater ICC =  $0.95$ ).<sup>3</sup> The NIHSS has moderate concurrent validity when compared to CT and MRI data on infarct size and volume ( $r = 0.61$  and  $0.68$ ).<sup>1,4</sup> The NIHSS items have also been shown to adequately represent right-brain and left-brain functions.<sup>5</sup> Some evidence suggests that the NIHSS is responsive to detecting clinically important change over time,<sup>1</sup> although a specific cut-off score or a specific change score to reflect a clinically important outcome is less clear. Different types of scoring, such as final scores of 0 to 1, or change scores of 1, 4 or 8 points, have been used to reflect a favourable or unfavourable outcome in recombinant tissue plasminogen activator stroke trials.<sup>2</sup> The NIHSS is a strong predictor of outcomes after stroke. Prediction models such as the iScore and the ASTRAL include the NIHSS as one of several predictors. These models have been externally validated and discriminate well between those at risk, from those not at risk of death, (AUC =  $0.78$  and  $0.79$ ),<sup>6</sup> and between those likely, from those not likely, to recover physical function (AUC =  $0.77$  and  $0.94$ ).<sup>7</sup>

### Commentary

The NIHSS is a reliable, valid and responsive tool for measuring stroke severity; it is useful both in clinical practice and research. It can be used in people with language and cognitive deficits. Importantly, the NIHSS is quick to administer (less than 10 minutes)<sup>1</sup> and requires minimal equipment (only a sharp object is required for sensory testing). In addition, resources are free and readily available to help clinicians learn how to administer the NIHSS (<http://nihss-english.trainingcampus.net/uas/modules/trees/windex.aspx>). This course provides sample videos demonstrating how each NIHSS item is conducted on people with varying degrees of stroke severity. Idiosyncrasies associated with each item are noted and where scoring is ambiguous, recommendations for scoring are provided.

The NIHSS' strong ability to predict outcomes after stroke helps clinicians provide accurate information to patients, set realistic goals for therapy and plan for discharge. The NIHSS captures both motor and non-motor impairments of stroke, and provides a good overview of people's deficits. The NIHSS may however be inadequate in providing information to guide exercise prescription, as it does not measure specific muscle strength. Also, since the NIHSS only measures impairments, it does not provide information on activity limitations such as difficulties with bed mobility, sitting, standing, walking and upper limb function. However, the NIHSS could be used in conjunction with scales such as the Motor Assess-

ment Scale to overcome this problem. Importantly, the NIHSS may not detect cognitive deficits and is likely to underestimate the severity of neurological deficits from lacunar infarcts and cerebellar strokes. More detailed cognitive assessment and further testing of functional activities will be required in these people. Overall the NIHSS is an important and commonly used assessment of stroke severity that physiotherapists working in the area need to be familiar with.

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