

# Determining cut-off values of the NIHSS score at onset for predicting ADL independence at discharge in patients with acute stroke

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## Introduction & Objective

- Early prediction of ADL is crucial to facilitate discharge planning and community support. Stroke severity is one of the most important predictive factor. The National Institutes of Health Stroke Scale (NIHSS) is used to assess stroke severity. (Gialanella, EUR J PHYS REHABIL MED, 2013. Aljuhani T, Physical Therapy Research & Practice, 2024. Teasell R, EBRSR.com, 2018)
  - Functional Independence Measure(FIM) is recommended tool for assessing actual ADL. Especially, each motor items yield more detail information about the burden of care. We employ each motor scores in order to inform individualized rehabilitation goal-setting. (Sprint, IEEE Access, 2016, Katherine, EBRSR, 2013.)
  - The cut-off value of the NIHSS may serve as a useful indicator for predicting ADL outcomes. Several studies examined cut-off on the NIHSS to determine comprehensive ADL. Regarding the FIM motor items, previous studies have been limited to examining item difficulty. (Koyama, J Rehabil Med, 2006. Askim J Rehabil Med, 2016.)
- To examine whether the NIHSS score can predict independence ( $\geq 5$ ) in each FIM motor items using logistic regression analysis.
  - To identify NIHSS cut-off values for predicting independence in each motor item of FIM.

## Method

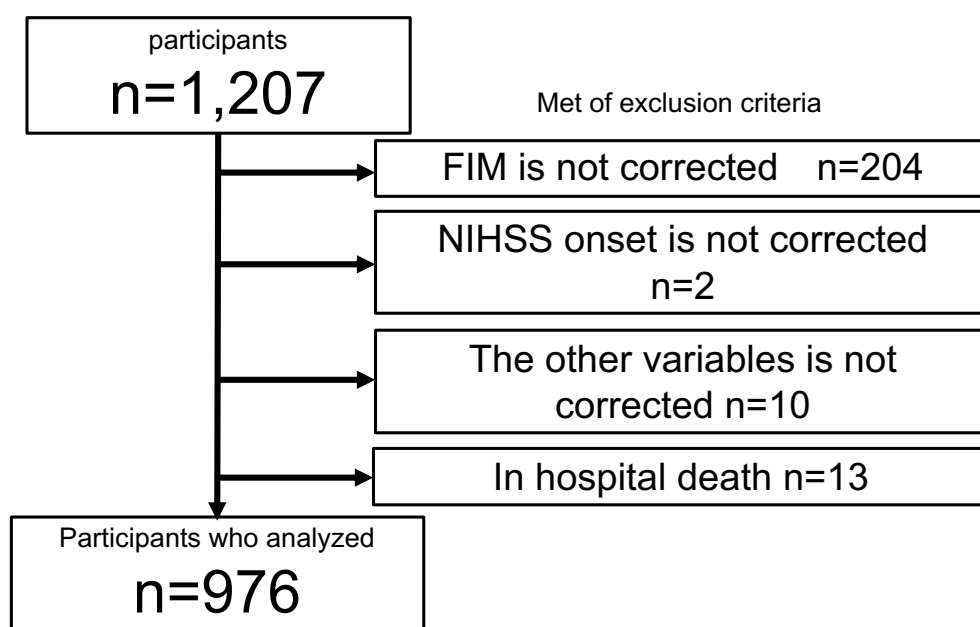
### Participants

#### Inclusion Criteria

Patients with cerebral infarction or hemorrhage admitted to our hospital's Stroke Care Unit between April 2019 and November 2023

#### Excluding Criteria

Patients who missed data of FIM, NIHSS at onset, and other variables.  
Patients who died during hospitalization.



This study was approved by the Ethics Committee of Kitasato University Hospital and School of Medicine (approval number: B21-284) .

### Measurements

#### On Admission

age, sex, stroke subtype (infarction or hemorrhage), laterality of the lesion, pre-stroke modified Rankin Scale (mRS)  
NIHSS (patients who underwent endovascular therapy, the score obtained immediately after the procedure was used instead of the admission score.)

#### At Discharge

Each motor items, total motor score and total score of the FIM.

### Statistical Analysis

- Each FIM motor subitems was classified independent ( $\geq 5$  points) or dependent ( $< 5$  points)
- Logistic regression analysis : NIHSS scores was used as the explanatory variable.
- ROC analysis NIHSS cut-off values was calculated by Youden Index.

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# Results

• **Table1. Characteristics**

			All patients (n=974)
Age, mean			71.53 ± 13.68
sex	Men		596 (61.19%)
Infarction , stroke type			742 (76.18%)
Laterality	Right		468 (48.04%)
	Left		674 (69.19%)
	Bilateral		60 (6.16%)
Pre-stroke modified Rankin Scale, mean			0.98 ± 1.46
National Institutes of Health Stroke Scale at onset, mean			10.10 ± 9.03
Functional Independence Measure motor score, mean			58.10 ± 30.45
Functional Independence Measure score, mean			84.35 ± 39.41

• **Table2. Logistic Regression Analysis**

	Model P-value	Likelihood P-value	Odds ratio (OR)	OR 95% CI	
				upper	lower
eating	<0.001	<0.001	0.850	0.832	0.869
grooming	<0.001	<0.001	0.859	0.841	0.876
bathing	<0.001	<0.001	0.844	0.824	0.864
Upper body dressing	<0.001	<0.001	0.845	0.826	0.864
Lower body dressing	<0.001	<0.001	0.848	0.829	0.868
toileting	<0.001	<0.001	0.847	0.829	0.866
Bowel management	<0.001	<0.001	0.857	0.839	0.875
Bladder management	<0.001	<0.001	0.854	0.837	0.872
Bed transfer	<0.001	<0.001	0.859	0.841	0.877
Toilet transfer	<0.001	<0.001	0.859	0.841	0.877
Shower transfer	<0.001	<0.001	0.860	0.841	0.878
locomotion	<0.001	<0.001	0.859	0.841	0.878
Stair climbing	<0.001	<0.001	0.851	0.831	0.871

All FIM subitems have significant difference.

The NIHSS is a good predictor for each subitems.

• **Table3. ROC analysis and Cut-off value of NIHSS**

FIM subitems	NIHSS cut-off values	AUC	sensitivity	1-specificity
Eating ≥5	12	0.854	0.814	0.250
Grooming ≥5	11	0.831	0.814	0.289
Bathing ≥5	6	0.820	0.748	0.243
Upper body dressing ≥5	6	0.830	0.730	0.208
Lower body dressing ≥5	6	0.826	0.731	0.222
Toileting ≥5	6	0.836	0.714	0.184
Bowel management ≥5	11	0.830	0.822	0.316
Bladder management ≥5	8	0.834	0.721	0.209
Bed transfer ≥5	6	0.824	0.690	0.191
Toilet transfer ≥5	6	0.823	0.694	0.193
Shower transfer ≥5	6	0.815	0.711	0.224
Locomotion ≥5	6	0.814	0.719	0.227
Stair climbing ≥5	6	0.816	0.742	0.262

All subitems had AUCs >0.8, NIHSS demonstrated high discriminative ability. The cut-off value is 12 in the Eating, 11 in Grooming and Bowel management, 8 in Bladder management, 6 in the other items.

## Conclusion

NIHSS scores can effectively predict independence in FIM motor items, providing valuable insights for early-stage rehabilitation planning for stroke patients.