

# Examining the Link between the SATIS-Stroke Questionnaire and the Modified Rankin Scale in Stroke Patients at 30 Days Post-discharge

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## Abstract

**Aim:** To assess the correlation between stroke patients' satisfaction with participation and activity (measured by SATIS-Stroke) and their functional independence [measured by modified Rankin Scale, (mRS)] after 30 days of hospital discharge.

**Materials and Methods:** A longitudinal study was conducted on 135 stroke patients, tracking them for 1 month after stroke. Demographic data, including sex, age, marital status, education level, living conditions, and annual budget, were collected. Data analysis was performed using Statistical Package for Social Sciences version 25.0.

**Results:** Over the 30-day follow-up period, all 135 stroke patients completed the SATIS questionnaire and recorded mRS scores. Initially, the mean mRS score was three during hospitalization, which improved to a mean score of 2 by the end of hospitalization and follow-up. The average SATIS score was 73.

**Conclusion:** The SATIS questionnaire demonstrated a significant correlation with mRS, indicating its effectiveness in predicting stroke patients' clinical status and satisfaction with daily activities and lives. The study also evaluated the questionnaire's predictive value regarding age, gender, income, and marital status. Notably, the questionnaire exhibited a higher predictive value among older females and patients with higher income levels.

**Keywords:** SATIS-Stroke, modified Rankin Scale, stroke, International Classification of Functioning

## Introduction

Stroke is the third leading cause of functional disability and the second main cause of mortality worldwide, based on the World Health Organization (WHO) (1). The affected cases, after a stroke, may have cognitive, perceptive, motor, and sensory impairments that affect the functioning and result in disability; between 24 % and 75% of stroke survivors require outside help with their daily activities (2-4). These functional limitations directly impede activities and social involvement (5).

Based on the International Classification of Functioning (ICF), Disability and Health, participation is described (6) as the patient's participation in living circumstances. Restrictions of participation illustrate patients' problems and experiences with social role performance (e.g. worker, friend, being spouse, or parent) that are considered as usual due to their sex, age, and the culture and society in which they live. Activity is the execution of action or task by an individual. Performance and capacity are the criteria for ICF's participation and activity areas.



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Various assessment methods are used to examine the concepts of participation and activity. Both performance-based and capacity-based instruments can be used to evaluate the activity of ICF components. Usually, the measurement of capacity requires a clinical setting. Although it only sometimes needs a considerable amount of time and cost, the evaluator's training is usually required prior. Generally, performance-based instruments are administered outside of a clinical setting and tend to be questionnaires, which are time-consuming and often require specialized expertise on the part of the evaluator (7,8).

The modified Rankin Scale (mRS) is a scale of global disability with a focus on mobility to assess the functional independence level for stroke cases (9). It has been widely utilized in stroke trials as an outcome and premorbid ability measure. It has seven grades between 0 and 6, with 0 indicating no symptoms and 6 indicating death. The reliability and validity of mRS in cases of stroke as a global disability clinician-reported measure in the literature have been contentious (10-12).

The SATIS-Stroke questionnaire was established as a participation and activity satisfaction measure of stroke cases in real-life environments. Based on the Rasch measurement model, the SATIS-Stroke scores have been transformed into linear and unidimensional satisfaction measures (13,14). Additionally, it is the only scale that addresses all nine ICF domains, the participation and activity component (15,16). Consequently, SATIS-Stroke contains fields that are not contained by other scales, including applying knowledge, general tasks and demands, and learning (7,8,17).

Hence, the aim of this study was to evaluate the correlation between SATIS-Stroke score and mRS 30 days after discharge in stroke patients.

## Materials and Methods

### Patients

This longitudinal study collected data from Tabriz University Hospital between March 2019 and March 2022. After the study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences (ethical code: IR.TBZMED.REC.1401.515, date: 12.09.2022), informed consent was obtained from all participants. After enrollment in the study, patients were followed up for 30 days after discharge. According to the WHO criteria, stroke was characterized in this study as "developing clinical signs of global or focal cerebral function impairment rapidly, persisting for more than 24 h or resulting in death, with no known reason other than a vascular origin" (18). Patients were included in the study if (i) were older than 18 years, (ii) were diagnosed with stroke, and (iii) were admitted to the stroke ward.

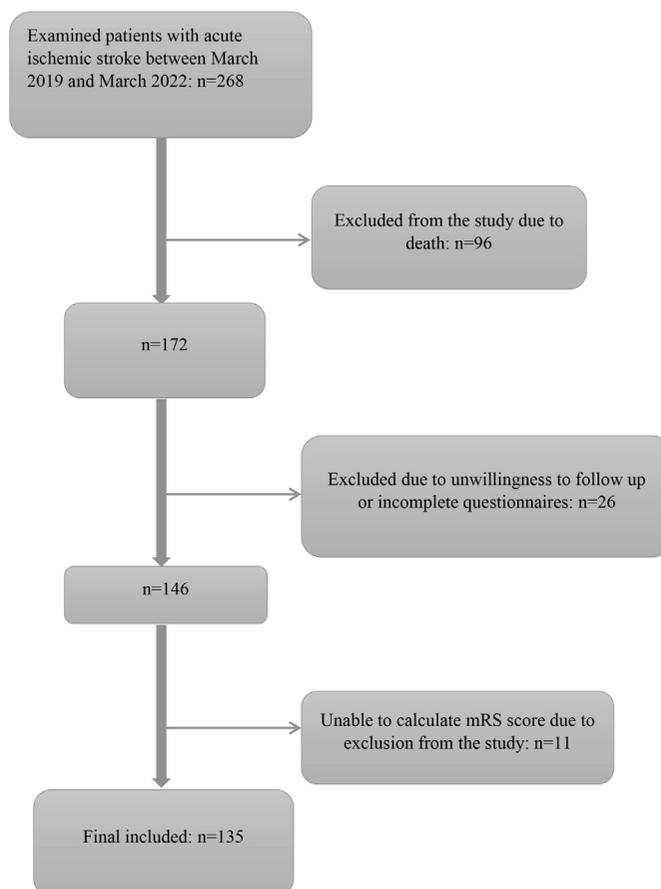
Patients were excluded if (i) another diagnosis was made during admission, (ii) incomplete filling of the questionnaire, and (iii) they had mental disorders and were taking medications related to them. The participants' flow chart is shown in Figure 1.

### Sample Size

Following the quality criteria guidelines for addressing the health status of questionnaires (19), it was revealed that at least 50 individuals are required for reliability analysis. Nevertheless, considering the sample features studied, we adopted Hobart et al. (20) recommendations, who recommended an adequate analysis of at least 80 participants of the measurement characteristics of testing equipment for neurological disease patients.

### Procedure

Based on the patient follow-up chart, 268 patients were initially examined. Of these, 96 patients were excluded from the study because of death. Among the remaining 172 patients, 24 were excluded because of unwillingness to follow up, and two were excluded because of incomplete questionnaires. After excluding these patients, 146 patients remained. However, for 11 of these patients, the follow-up mRS score needed to be calculated, which



**Figure 1.** Patient flow chart mRS: modified Rankin Scale

resulted in their exclusion from the study. Finally, 135 patients completed the SATIS questionnaire, and their mRS score was known during their follow-up, making them eligible for inclusion in the study. A total of 135 stroke cases were followed for one month following the onset of stroke. Each patient received instructions on how to complete the questionnaire, and each was tested individually in a quiet setting. mRS (21) was applied to assess the degree of disability on the first and last day of admission and the 30<sup>th</sup> day after discharge. SATIS-Stroke (14) was also measured on the 30<sup>th</sup> day after discharge. mRS was used as a criterion for the SATIS-Stroke questionnaire.

SATIS-Stroke is a functional assessment tool designed to assess stroke patients' level of satisfaction with their activities and participation in treatment. It provides clinicians with valuable goal-setting guidelines for effective treatment planning. With its suitable range and precise measurement capabilities, SATIS-Stroke is well suited for clinical practice (14).

### Data Collection

Demographic data included sex, age (<65, ≥65), marital status, education level, living conditions, and annual budget. Disease variables included pathological side and subtype of stroke.

### Statistical Analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 25.0 for Windows (SPSS Inc., IL, USA). Data distribution was used to test normality using the Kolmogorov-Smirnov test. Continuous variables were displayed as mean±standard deviation (SD) or median+interquartile range (IQR): 25-75%, and categorical variables were expressed as absolute and relative frequencies (%). Because of the non-normal distribution of the variables, the non-parametric Spearman test was used to measure correlations. Where applicable, a multivariate regression analysis was conducted. Statistical significance was defined as a p value <0.05.

### Results

In total, 135 registered stroke patients completed the SATIS questionnaire with recorded mRS scores during their 30-day follow-up. There were 72 (53.3%) males and 63 (46.7%) females with a mean (±SD) age of 63.33 years (±14.41). Ninety-two cases (68.1%) were urban and 41 (30.4%) were rural. Most individuals in this study were married (122 people); 5 (3.7%) of the patients were single. Ninety-five (70.4%) and 40 (29.6%) cases had an ischemic and hemorrhagic stroke, respectively. All participants' baseline characteristics are shown in Table 1.

The mean mRS score at the beginning of hospitalization was 3. In comparison, the mean score of mRS at the end of hospitalization

and during follow-up was 2. The mean case SATIS score was 73. Table 2 illustrates the recorded mRS grades and SATIS scores of all participants.

Spearman correlations of the SATIS-Stroke questionnaire, mRS, age (<65, ≥65), sex, marital status, and annual budget were quantified. The results revealed that the Spearman's rank correlation coefficient (rs) was -0.765 (p<0.001) between the SATIS-Stroke questionnaire and mRS, and in Table 3, Spearman correlations between the SATIS-Stroke questionnaire and other mentioned demographic data are shown. The multiple regression analyzes of mRS, age (<65, ≥65), sex, marital status, and annual budget for association with the SATIS-Stroke questionnaire score are shown in Table 3.

### Discussion

Stroke remains a public health challenge that results in disability in survivors, which then places a heavy financial burden on the healthcare system (22). This issue places great importance on public health agenda systems and is considered a vital area for public health research (23). Although there is no definitive method to check the severity of stroke in patients, several

**Table 1. Demographic data and clinical characteristics of the 135 patients**

Characteristics (n=135)	Statistics
Age (mean±SD, years)	63.33±14.41
Gender (n, %)	
Male	72 (53.3%)
Female	63 (46.7%)
Residence (n, %)	
Urban	92 (68.1%)
Rural	41 (30.4%)
Unknown	2 (1.5%)
Marital status (n, %)	
Single	5 (3.7%)
Married	122 (90.4%)
Unknown	8 (5.9%)
Annual income (n, %)	
Low	51 (37.8%)
Moderate	67 (49.6%)
High	17 (12.6%)
Involved side of the brain (n, %)	
Right	72 (53.33%)
Left	63 (46.7%)
Type of stroke (n, %)	
Ischemic	95 (70.4%)
Hemorrhagic	40 (29.6%)
Patient outcome at discharge (n, %)	
Partial recovery	55 (40.8%)
Morbidity	80 (59.2%)
Duration of hospitalization (M, IQR, days)	9 (10)
SD: Standard deviation, M: Median, IQR: Interquartile range	

methods have been developed for this purpose. The SATIS questionnaire, for the first time by Bouffiuolx et al. (14) in 2008, was used to evaluate the level of satisfaction of stroke patients with the quality of life, activity, and participation in daily life events. Dr. John Rankin presented a scale in 1957 that is currently used to assess the outcome of acute stroke patients after being slightly modified (24).

Ageing is the leading risk factor for stroke, which is a non-modifiable risk and doubles every ten years after age 55. Strokes commonly occur in people over 65 years of age, accounting for almost three-quarters of all strokes. There is a predicted increase in the number of people over 65, and the number of strokes in the elderly is expected to increase, creating significant challenges for clinicians and policymakers in the foreseeable future (25).

In our study, several demographic and clinical characteristics of the participants were observed. The study sample consisted of more men than women, and most patients resided in urban

areas. Furthermore, a significant proportion of the patients were married. The average annual income was the highest among the studied patients. In the United States, 795,000 strokes occur each year, of which 87% are classified as ischemic strokes (26).

Our study found a decrease in stroke symptom severity over time, with an average mRS score of 3 at admission and two at discharge/follow-up. A strong correlation was observed between SATIS and mRS scores, indicating that higher mRS scores were associated with lower SATIS questionnaire scores. Gender and income influenced this association. This is the first article that compares SATIS-Stroke and mRS scores at the same time. In comparison, the other articles that will be mentioned have examined each of them individually. All the information above is shown in Table 4.

One of the essential factors for stroke care, outcomes, and risk is socioeconomic status. Socioeconomic status is characterized by a person's social and economic association with others and is usually assessed by income, occupation, and education (27). A study revealed that approximately 30% of the heightened risk of severe stroke in low socioeconomic status patients could be attributed to differences in risk factors. In contrast, the impact of stroke prevention drugs was minimal. This emphasizes the need for clinicians to prioritize aggressive management of risk factors in individuals with lower education levels to reduce stroke severity. Furthermore, the study advocates for the broader adoption of mediation analysis to better understand the intricate connections between socioeconomic status and health outcomes (28). As our study evaluated the relationship between economic

**Table 2. The recorded modified Rankin Scale grades and SATIS scores of patients**

Parameter	Median	IQR
mRS		
Beginning of hospitalization mRS	3 (1-5)	2
End of hospitalization mRS	2 (0-4)	2
30-day mRS	2 (0-6)	2
SATIS		
30-day SATIS	73 (0-108)	72

mRS: modified Rankin Scale, IQR: Interquartile range

**Table 3. The Spearman correlations and multiple regression analyses between the SATIS-Stroke questionnaire, mRS and age (<65, ≥65), sex, marital status, and annual budget**

Variable	rs	p value
mRS	-0.765	<0.001
Age		
<65	-0.0623	<0.001
≥65	-0.0810	<0.001
Gender		
Male	-0.730	<0.001
Female	-0.803	<0.001
Marital status		
Single	-0.765	<0.001
Married	-0.763	<0.001
Annual budget		
Low	-0.849	<0.001
Moderate	-0.669	<0.001
High	-0.902	<0.001

mRS: modified Rankin Scale, rs: Spearman's rank correlation coefficient

**Table 4. Multiple regression analyses between the SATIS-Stroke questionnaire, mRS and age (<65, ≥65), sex, marital status, and annual budget**

Parameter	CI 95%	Beta	p value
mRS	[-19.7, -14.7]	-17.2	<0.001
Age			
<65	[-16.7, -8.8]	-12.8	<0.001
≥65	[-21.5, -14.9]	-18.22	<0.001
Gender			
Male	[-20, -12.7]	-16.4	<0.001
Female	[-21.4, -14.6]	-18	<0.001
Marital status			
Single	[-63.1, 13.5]	-24.7	0.132
Married	[-19.4, -14.2]	-16.84	<0.001
Annual budget			
Low	[-22.2, -15.5]	18.9	<0.001
Moderate	[-19.4, -11.0]	15.2	<0.001
High	[-27.4, -15.9]	21.6	<0.001

mRS: modified Rankin Scale, CI: Confidence interval

factors and stroke severity, the results from both articles were consistent with each other.

In ElHabr et al. (29), it was observed that the discharge mRS scores of stroke patients remained consistent for the first month. However, within 30 to 90 days post-discharge, approximately two-thirds of patients experienced a significant change in their mRS scores, with approximately one-third showing an improvement, deterioration, or no change. Our research also revealed similar findings, with the median and IQR of mRS scores during discharge and follow-up on the 30<sup>th</sup> day consistent with ElHabr et al.'s (29) study, but without measuring SATIS-Stroke scores. Notably, ElHabr et al.'s (29) study also evaluated mRS scores on the 90<sup>th</sup> day. These results suggest that long-term monitoring is crucial for assessing the recovery trajectory of stroke patients after hospital discharge.

In the study by Pereira et al. (30) in 2021 in Brazil, the clinical characteristics of the SATIS-Stroke questionnaire were evaluated in the population of Brazil. In this study, 80% of stroke survivors were examined. The mean age was 57/98±13/85 years. Good reliability was obtained from this questionnaire. In concurrent validity analysis, a positive, strong, and notable association was found between stroke-specific life scale quality and SATIS-Stroke scores. Diagnostic accuracy was revealed with a sensitivity of 80.8% and specificity of 85.2%. This study showed that the Brazilian version of the SATIS-Stroke questionnaire has reasonable diagnostic accuracy, concurrent validity, and adequate reliability.

Banks and Marotta (11) examined the validity and reliability of mRS in stroke cases, among other studies. Several studies have reported the construct validity of mRS based on its association with physiological factors such as perfusion, lesion size, a type of stroke, and neurological disorders. It is well documented that the mRS and other disability scales have convergent validity. Patients' comorbidities and socioeconomic factors should be considered in the correct application and interpretation of mRS (11).

### Study Limitations

There are limitations to our data that must be considered when interpreting our results; we could not communicate with Wernicke aphasia patients; therefore, we could not include this group of patients in the study. In addition, more research for a higher level of data granularity with a greater sample size is required, which could reveal the correlation between the SATIS questionnaire and other factors.

### Conclusion

In conclusion, this study demonstrated a strong correlation between the SATIS questionnaire and the mRS in assessing follow-up stroke patients' clinical status and satisfaction. The

results indicated that the SATIS questionnaire could effectively predict patients' functional outcomes and overall quality of life. Moreover, the analysis of demographic factors revealed that the predictive value of the questionnaire was exceptionally high among older patients, females, and those with higher income levels. These findings highlight the importance of incorporating the SATIS questionnaire as a valuable tool for evaluating stroke patients' recovery and satisfaction with life and daily activities.

### Ethics

**Ethics Committee Approval:** The study was approved by the Tabriz University of Medical Sciences of Ethics Committee (ethical code: IR.TBZMED.REC.1401.515, date: 12.09.2022).

**Informed Consent:** Written informed consent was obtained from the patient to publish this study.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: A.A., Concept: S.S.V., Design: S.S.V., Data Collection or Processing: A.R., Analysis or Interpretation: N.G., Literature Search: F.O., M.M., Writing: A.K.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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