



Contents lists available at ScienceDirect

Journal of Stroke and Cerebrovascular Diseases

journal homepage: www.elsevier.com/locate/jstroke

Stroke recovery patterns and predictors in India: A post-hoc analysis from the ATTEND trial

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¹ Posthumous credit.<https://doi.org/10.1016/j.jstrokecerebrovasdis.2026.108619>

Received 16 April 2025; Received in revised form 16 February 2026; Accepted 24 March 2026

Available online 25 March 2026

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ARTICLE INFO

Keywords:
Stroke
Rehabilitation
India
Recovery
Cross sectional

ABSTRACT

Background: Functional recovery after stroke remains poor in India. However, only few data exist on stroke recovery using the modified Rankin Scale (mRS). We aimed to assess patterns and predictors of stroke recovery from a cohort of participants with acute stroke of mild to moderate severity in India.

Methods: Post-hoc analysis of the Family-led Rehabilitation after Stroke in India (ATTEND), a multicentre, prospective, randomised, open blinded endpoint (PROBE) trial conducted at 14 hospitals in India. Data were obtained on the modified Rankin Scale (mRS) at baseline, 3 and 6 months. A multivariable partial proportional logistic regression model was used to identify the predictors of recovery after stroke and reported as odds ratio (aOR) and 95% confidence intervals (CI).

Results: Of 1,250 randomised participants, 1156 had sufficient data for analysis. Overall, the severity of mRS decreased over time; the mean change in mRS [mean (SD)] was -0.96 (1.40) between baseline and 3 months and -0.30(0.83) between 3 months and 6 months. Overall, 66.7% improved on their stroke symptoms at 3 months compared to baseline. Further, 34% improved their stroke symptoms at 6 months compared to 3 months. A higher mRS score at 6 months was associated with participants aged 40-60 years (1.84, 95% CI 1.16 - 2.93), and >60 years (2.83, 1.69 - 4.75) at stroke onset compared to those aged <40 years, having daughter or daughter in law (1.44, 1.01 - 2.06) as the main caregiver compared to spouse, being dependent at home (4.93, 1.61 - 15.14) compared to being independent at home, and receiving treatment in Assam (2.43, 1.35 - 4.37), Kerala (3.52, 2.13 - 5.81), Tamil Nadu (2.76, 1.74 - 4.37), Chandigarh (1.93, 1.05 - 3.55), and Hyderabad (2.00, 1.12 - 3.58) compared to Delhi. Regarding clinical variables, not having disability (>3 mRS) at baseline (0.19, 0.12 - 0.30), and lower stroke severity scores: NIHSS 0 - <5 (0.07, 0.04 - 0.12), 5 - <10 (0.20, 0.13 - 0.30) and 10 - <15 (0.59, 0.39 - 0.88) compared to higher scores (≥ 15) were associated with lower mRS scores at 6 months.

Conclusions: Nearly 67% of patients recovered at 3 months compared to baseline, consistent with previous research. Additional follow-up at six months showed that 48% sustained their previous functional status and 34% reported improvement between 3 and 6 months. These findings also highlight that both demographic and clinical factors significantly influence recovery outcomes in patients with mild to moderate stroke severity.

Background

Stroke is a prominent contributor to global mortality and disability rates, particularly in low- and middle-income countries such as India, where approximately 150 to 200 stroke cases per 100,000 individuals are reported.^{1,2} The high prevalence and debilitating neurological effects of stroke make it a significant public health concern in India.^{3,4}

Effective rehabilitation following a stroke thus remain crucial for improving long-term prognosis and patient survival, as most stroke survivors experience dwindling health and quality of life experience post stroke diagnosis.⁵ Those maintaining sufficiently physical activity experience better outcomes; a previous study showed that those maintaining physical activity post stroke were associated with good function outcome at 6 months.⁶ However, limited information exists regarding stroke outcomes post diagnosis, its changes over time (also known as trajectories) and factors associated with these changes among stroke patients in India.

The modified Rankin Scale (mRS) is the mostly widely used measure of post-stroke recovery and functional independence in stroke trials.⁷ Previous studies, primary hospital based, from India have focused on assessing correlation between mRS and other instruments, post-stroke outcomes, rather than predictors of recovery, and were limited by statistical power.⁸⁻⁹ Thus, understanding recovery patterns of stroke severity following stroke will inform targeted interventions in stroke patients. This study addresses this gap, exploring stroke recovery in India from a cohort of participants with acute stroke of mild to moderate severity in India. We hypothesised that functional recovery following stroke in India is associated with demographic, caregiving, and clinical factors that independently predict poorer recovery outcomes

Methods

Design

This study uses data from the 'The Family-led Rehabilitation after Stroke in India (ATTEND) trial' (ATTEND trial). The ATTEND trial is a prospectively randomised open blinded endpoint (PROBE) trial across 14 hospitals in India. Full methodological details including sampling,

recruitment and variables, and statistical analysis plan, are available elsewhere.¹⁰⁻¹⁴ Briefly, adults aged 18 years or older with a stroke in the past month, residual disability, expected survival, and an informal family caregiver were randomised to intervention or usual care via a secure web-based system, with minimisation by site and stroke severity. Dedicated site coordinators, who were physiotherapists, conducted eligibility screening, obtained consent, and delivered the intervention. Participants randomised to the intervention group received structured family-led rehabilitation, including education, collaborative goal setting, caregiver training, and task-specific practice, initiated in hospital and continued at home for up to two months. Blinded trial assessors, who were unaware of group allocation and trial intervention details, conducted all follow-up assessments at three and six months. The trial assessed health-care resource use (visits to health professionals, hospitalisation, and medication use), indirect costs to the family (e.g., a family member giving up employment to act as a caregiver), direct medical costs (e.g., private treatment, admission charges, drug treatments), and non-medical direct costs (e.g., travelling costs).

Variables

The ATTEND trial collected information about Modified Ranking Scale (mRS) at baseline, 3 months and 6 months. This information was collected by trained clinical staff using validated mRS questionnaire. mRS was used as an ordinary variable without transformation. Besides mRS, trial collected information on stroke severity using the National Institutes of Health Stroke Scale (NIHSS) and quality of life using WHOQOL BREF.

The definition of covariates were adapted from a previously published work from the ATTEND trial.¹⁰ We used self-reported socio-demographic information including age (<40, 40-60, >60 years), sex (female, male), marital status (single, married), main caregiver (spouse, daughter or daughter in law, son/son in law, others), highest level of education completed (patient) (no schooling/primary, primary/secondary, high school/higher education, own house/flat, rent house/flat, others), accommodation (own house/flat, rent house/flat, others), pre-stroke living situation (independent at home, dependent at home), income reported during baseline survey (2014-2016) (Indian rupees (INR): <5000, 5,

000-14,999,15,000-29,999, $\geq 30,000$), types of strokes (*ischaemic, intracerebral haemorrhage*), The National Institutes of Health Stroke Scale (NIHSS) score (0 to <5, 5 to <10, 10 to <15, ≥ 15), medical history (*hypertension, diabetes, obesity, dyslipidaemia, smoking, alcohol use, others*) and study sites (*Delhi, Assam, Kolkata, Kerala, Chennai, Bengaluru, Tamil Nadu, Punjab, Chandigarh, Hyderabad, Andhra Pradesh*). All covariates were measured at baseline i.e., at the time of randomisation into the ATTEND trial (eSupplementary Table 1).

Statistical analysis

Descriptive analyses were used to show number of participants with percentages for binary variables, means with SDs for age at stroke and medians with IQRs for stroke scores, which were used to show characteristics of participants by 6-months. Further, patterns of mRS change (worsening, improving, constant) over six months of follow up were analysed descriptively. We assessed the relationship between demographic, socio-economic, and clinical characteristics predicting mRS at 6-months using partial proportional odds ordinary logistic regression model, following previous practices^{7,15} and recommendation of Optimizing Analysis of Stroke Trials Collaboration.¹⁶ ATTEND trial found no significant difference in functional outcomes between intervention and usual care groups¹⁰; therefore, results are not stratified by trial arm to maintain parsimony. With very low missing data at baseline (<5%), complete case analysis was used without imputation. All the analysis were performed using SAS 9.4, using PROC logistic for partial proportional odds models.¹⁵ The Sankey diagrams were done in Python using pySankey package.

Results

Descriptive characteristics

Table 1 summarises baseline cohort characteristics. Of the 1250 patients randomly assigned at baseline, 27 deaths were reported during baseline. For the remaining sample, 67(5.8%) had missing covariates information and were excluded from the analysis, leaving a final sample of 1156 patients for analyses.

Among 1156 stroke patients at baseline, 42.7% were 40-60 years of age, 48.4% of >60 years and 32.9% were female. 47.6% of participants had completed high school/higher education, 84.1% owned their own house/flat and 40.7% had either a paid full or part time work. Most (77.3%) had ischaemic stroke, and 85.8% had either moderate (NIHSS scale 5 - <10) or moderate to severe stroke (NIHSS scale ≥ 15) (Table 1).

Recovery of mRS at 3- and 6-months

The mean mRS score decreased from 3.8 (SD 0.96) at baseline to 2.83 (1.66) at 3 months and further to 2.55 (1.82) at 6 months, indicating overall functional recovery (Table 2). This is also shown in Fig. 1 which illustrates the shifts in mRS categories over 6 months of follow up, particularly evident from reduced number of people in the 'Moderate severe disability' and 'Severe disability' categories. Percentage of deaths as well as those who have 'No symptoms' and 'No significant disability' increased over time (Fig. 1).

The Fig. 2 is a Sankey diagram showing the recovery patterns of mRS over six months. The size of the nodes shows percentages with particular mRS scores at baseline, 3 and 6 months. Between baseline and 3 months, a large portion of those with 'Moderate severe disability' transitioned to either 'moderate disability', 'slight disability' and 'no significant disability' and 'death'. Similar transition can be seen for those with 'moderate disability' and 'severe disability' (see Fig. 2A).

The reduction in stroke severity further continued at 6 months, shown by further transition from 'Moderate severe disability' to 'slight disability' and 'no symptoms at all' at six months (see Fig. 2B).

Fig. 2A, B. Sankey diagram showing recovery patterns of mRS scores

Table 1

Baseline characteristics of regression variables of interest (n = 1156).

Variables	N (%)
Age (years) Mean (std)	58.1(13.1)
<40	103(8.9)
40-60	494(42.7)
>60	559(48.4)
Sex	
Male	776(67.1)
Female	380(32.9)
Marital status	
Single	1036(89.6)
Married	120(10.4)
Main caregiver	
Spouse	481(41.6)
Daughter / Daughter in law	261(22.6)
Son / Son in law	339(29.3)
others	75(6.5)
Highest level of education completed(patient)	
No schooling/primary	287(24.8)
Primary/secondary	319(27.6)
High school/higher education	550(47.6)
Accommodation	
Own house/flat	972(84.1)
Rent house/flat	66(5.7)
Others	118(10.2)
Work situation	
Paid work (full/part time)	470(40.7)
Home duties	340(29.4)
Retired	195(16.9)
Unemployed	72(6.2)
Others	79(6.8)
Pre-stroke living situation	
Independent at home	1140(98.6)
Dependent at home	16(1.4)
Gross income (INR)	
< 5,000	178(15.4)
5,000-14,999	356(30.8)
15,000-29,999	294(25.4)
>30,000	215(18.6)
Missing	113(9.8)
Types of strokes	
Ischaemic	893(77.3)
Intracerebral haemorrhage	263(22.8)
NIHSS score	
0 - <5	164(14.2)
5 - <10	460(39.8)
10 - <15	337(29.2)
≥ 15	195(16.9)
Medical history	
Hypertension	208(18.0)
Diabetes	227(19.6)
Obesity	87(7.5)
Dyslipidaemia	162(14.0)
Smoking	88(7.6)
Alcohol Use	322(27.9)
Others	62(5.4)
Study site	
Delhi	148(13.7)
Assam	119(11.0)
Kerala	160(14.8)
Tamil Nadu	200(18.5)
Chandigarh	99(9.1)
Hyderabad	91(8.4)
Andhra Pradesh	117(10.8)
West Bengal	150(13.8)
Others	72 (6.2)
N, %	1156(100)

at baseline, 3 months and 6 months. mRS scale is shown in severity order on the left (dead, severe disability, moderate severe disability, moderate disability, slight disability, no significant disability, no symptoms at all) illustrating the 3 and 6 months trajectories (diagram software optimises common trajectories flow).

Table 2 presents the patterns of recovery as measured by mRS over

Table 2

Patterns of follow-up change in mRS between baseline, 3 months and 6 months (n = 1156).

	Baseline	3 months ^δ n(%)	6 months ^ε n (%)
Worsening n (%)	-	54(4.7)	79(6.8)
No change, n (%)	-	240(20.8)	559(48.4)
Improving, n (%)	-	772 (66.7)	394(34.1)
Incremental deaths, n (%)	-	90(7.8)	124(10.7)
mRS, mean (SD)	3.8 (0.96)	2.83(1.66)	2.55(1.82)
mRS, median (IQR)	4 (1)	3(3)	2(3)
mRS change, mean (SD)	-	-0.96 (1.40)	-0.30(0.83)

^δ compared with baseline,.

^ε compared with 3 months.

six months. Worsening, no change, and improvement describe the changes in a participant's mRS score when compared to their previous assessment. Most improved in mRS scores occurred at 3 months where 66.7% improved on their stroke symptoms at 3 months compared to baseline. At 6 months, 34% had improved on their stroke symptoms between 3 and 6 months. The mean and median mRS scores show a small decrement over the six months; a change [mean (SD)] of -0.96 (1.40) between baseline and 3 months. Similarly, a change of -0.30 (0.83) between 3 months and 6 months (Table 2).

Regression analyses

Table 3 shows the relationship between baseline (demographic, clinical) characteristics and ordinal mRS scores using single measure partial proportional odds regression model at 6 months. A higher mRS scores at 6 months was associated with participants aged 40-60 years (1.84, 95% CI 1.16 - 2.93), and >60 years (2.83, 1.69 - 4.75) at stroke compared to those aged <40 years, having daughter or daughter in law (1.44, 1.01 - 2.06) as main caregiver compared to spouse, being dependent at home (4.93, 1.61 - 15.14) compared to being independent at home, and having treatment in Assam (2.43, 95% CI 1.35 - 4.37), Kerala (3.52, 2.13 - 5.81), Tamil Nadu (2.76, 1.74 - 4.37), Chandigarh (1.93, 1.05 - 3.55), Hyderabad (2.00, 1.12 - 3.58) compared compared to Delhi.

Regarding clinical variables, not having disability (>3 mRS) at baseline (0.19, 0.12 - 0.30), and lower stroke severity scores: NIHSS 0 - <5 (0.07, 0.04 - 0.12), 5 - <10 (0.20, 0.13 - 0.30) and 10 - <15 (0.59, 0.39 - 0.88) compared higher scores (≥15) were associated with having lower mRS scores at 6 months (Table 3).

Discussion

Summary

This study shows the patterns of stroke recovery over 6 months in India. Nearly 67% of patients reported improvement in functional status within the first three months. At six months, 48% maintained their previous functional status, while 34% showed further improvement compared to their status at three months. Further, we showed that both demographic and clinical factors strongly predict post stroke recovery among stroke patients of mild to moderate severity.

Comparison with existing studies

The identified associations with mRS in this study are comparable with past studies which showed both demographic (e.g. age) and clinical variables (e.g. lower NIHSS scores, no prestroke comorbidities) were associated with stroke recovery at 6 months.^{7,17} Similar relationship with demographic and clinical factors were also found for stroke severity using Barthel Index.¹⁸ Our study also supports previous research which shown pre stroke independence at home associated with post stroke recovery. In our study, nearly 99% are independent at home, 84% owns house/flat and 71% are engaged in work either paid or voluntary. This could explain why being independent is associated with better recovery.¹⁹ Though having a marital partner was not associated with better recovery (unlike previous studies²⁰⁻²²); having daughter or daughter in law as caregiver was associated with improved recovery. Unlike a previous study which showed association between male sex and better stroke recovery at long term after stroke^{23,24}; our analysis did not reveal such association at 6 months.

Stroke is associated with accelerated decline in cognitive and functional outcomes due to increased risk of recurrent vascular and non-vascular events and underlying factors that lead to initial stroke. Further, a third of stroke survivors develop dementia within five years.²⁵ A previous pooled study of 14 international cohort revealed that stroke is associated with annual decline of -0.038 standard deviation (SD) in global cognition compared with decline without a previous stroke (-0.049 SD/year).²⁶ These decline in cognitive function may worsen physical health and increase dependence.

Given risk of complications, understanding stroke recovery following stroke events are crucially important for developing management strategies. Perhaps the most pressing need in resource limited setting like India, is developing low-cost, effective and culturally responsive models

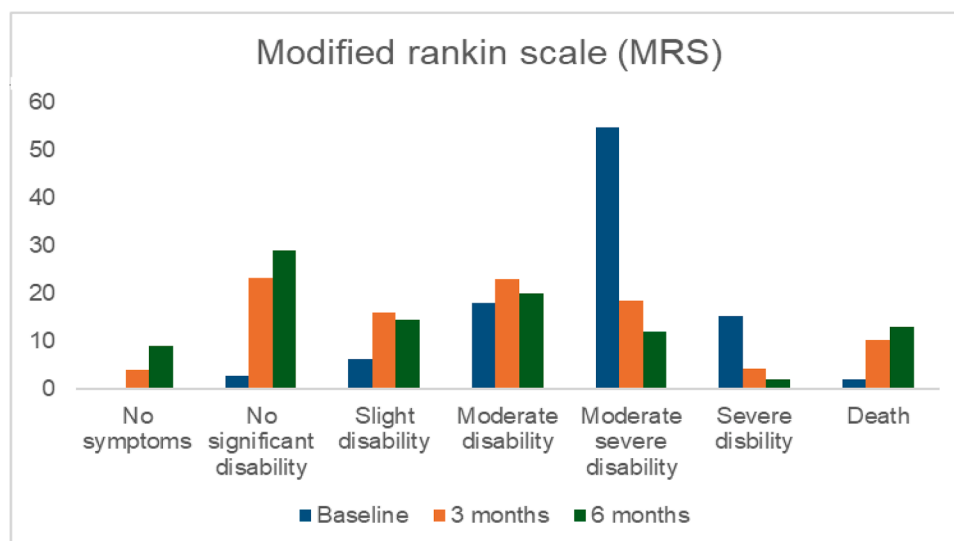
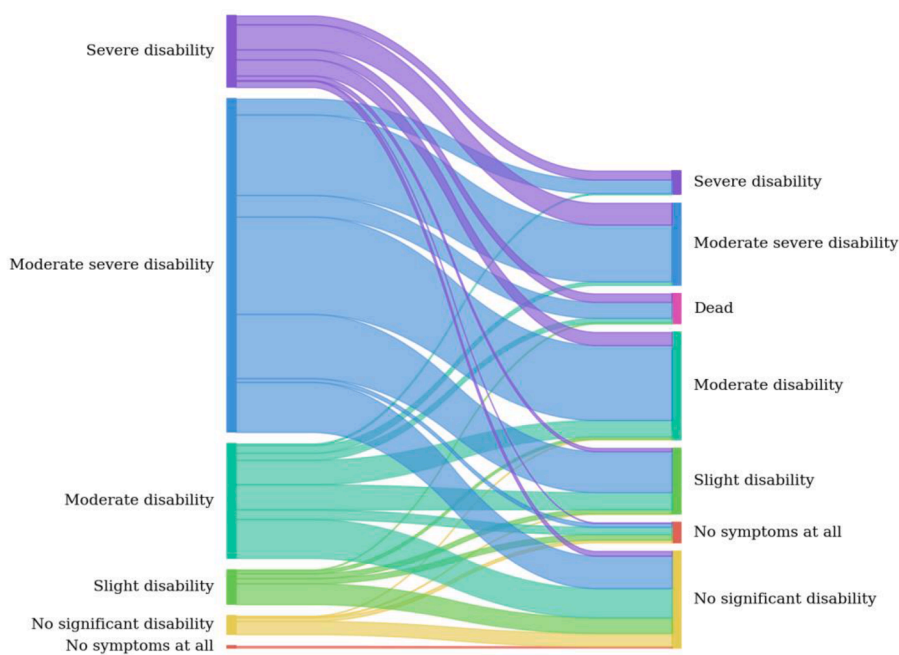
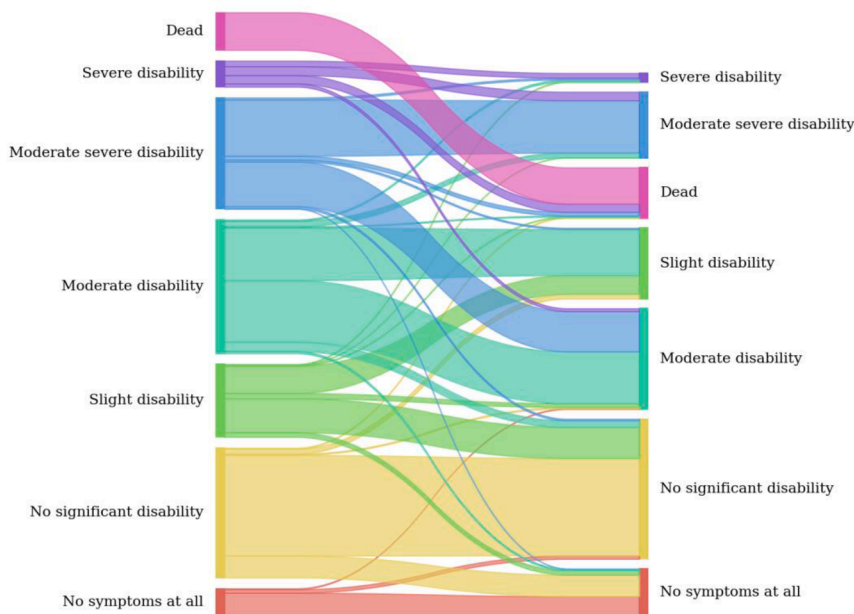


Fig. 1. Distribution of mRS scores at baseline, 3 months and 6 months.



(A) Baseline visit vs 3 months



(B) 3 months vs 6 months

Fig. 2. A, B. Sankey diagram showing recovery transitions of mRS scores at baseline, 3 months, and 6 months. Each node represents a category of functional status (mRS), with node sizes proportional to the number of participants. Flows indicate transitions between categories over time. Axis labels denote time points (x-axis: baseline, 3 months, 6 months) and proportion of participants (y-axis: % of total cohort).

of care for stroke rehabilitation, through adequately powered clinical trials.^{27 28}

Strengths and limitations

There are several strengths of this study. First, we derived data from

ATTEND trial, which is one of the largest randomised control trials in stroke rehabilitation that allowed capturing stroke cases using patient data from 14 sites in India. Second, we were able to assess the relationship of wide range of baseline covariates with mRS at 6 months.¹⁰ Also, this study has some limitations. First, our results are not generalisable to more severe stroke patients (nearly 99% reported to be

Table 3
Multivariable Partial Proportional Odds Regression of 6 months' mRS on Baseline Characteristics (n = 1156).

Factors	Categories	Univariable single measure model [OR, (95% CI)]	Adjusted single measure model [OR, (95% CI)]
Baseline – Demographic factors			
Age (years)	<40	Reference	Reference
	40-60	1.61 (1.08 - 2.40)	1.84 (1.16 - 2.93)
	>60	2.53 (1.69 - 3.78)	2.83 (1.69 - 4.75)
Sex	Female	1.57 (1.23 - 2.00)	1.38 (0.89 - 2.14)
	Male	Reference	Reference
Marital status	Married	1.44 (0.97 - 2.14)	1.17 (0.73 - 1.88)
	Single	Reference	Reference
Baseline - Socio-economic factors			
Main giver	Daughter / Daughter in law	2.42 (1.80 -,3.26)	1.44 (1.01 - 2.06)
	Son / Son in law	1.49 (1.13 - 1.97)	1.18 (0.87 - 1.61)
	Spouse	Reference	Reference
Highest level of education completed(patient)	Others	1.02 (0.63 - 1.66)	0.92 (0.52 - 1.63)
	Primary/secondary	0.84 (0.62 - 1.15)	1.04 (0.74 - 1.46)
	High school/higher education	0.59 (0.45 - 0.79)	0.91 (0.64 - 1.30)
Accommodation	No schooling/primary	Reference	Reference
	Rent house/flat	0.78 (0.48 - 1.27)	1.14 (0.67 - 1.93)
	Own house/flat	Reference	Reference
Work situation	Others	0.79 (0.54 - 1.14)	1.10 (0.74 - 1.64)
	Paid work (full/part time)	Reference	Reference
	Home duties	1.96 (1.49 - 2.58)	1.01 (0.64 - 1.59)
	Retired	1.41 (1.00 - 1.97)	1.45 (0.96 - 2.19)
	Unemployed	1.25 (0.77 - 2.03)	0.92 (0.51 - 1.64)
Dependence	Others	1.02 (0.65 - 1.61)	0.88 (0.52 - 1.48)
	Independent at home	Reference	Reference
Income (INR)	Dependent at home	4.13 (1.41 - 12.1)	4.93 (1.61 - 15.14)
	<5000	Reference	Reference
	5000-14,999	0.64 (0.45 - 0.91)	1.13 (0.77 - 1.64)
	15,000-29,999	0.40 (0.28 - 0.57)	0.88 (0.57 - 1.35)
	>30,000	0.42 (0.29 - 0.63)	0.60 (0.38 - 0.94)
Sites	Missing	0.71 (0.45 - 1.13)	0.68 (0.40 - 1.18)
	Delhi	Reference	Reference
	Assam	2.07 (1.29 - 3.30)	2.43 (1.35 - 4.37)
	Others	1.09 (0.71 - 1.67)	2.18 (1.31 - 3.62)
	Kerala	4.11 (2.68 - 6.32)	3.52 (2.13 - 5.81)
	Tamil Nadu	2.71 (1.81 - 4.04)	2.76 (1.74 - 4.37)
	Chandigarh	2.94 (1.78 - 4.85)	1.93 (1.05 - 3.55)
	Hyderabad	1.18 (0.72 - 1.93)	2.00 (1.12 - 3.58)
Andhra Pradesh	0.95 (0.61 - 1.48)	0.61 (0.35 - 1.04)	

Table 3 (continued)

Factors	Categories	Univariable single measure model [OR, (95% CI)]	Adjusted single measure model [OR, (95% CI)]
Baseline – clinical factors			
Baseline disability (mRS >2)	No	0.11 (0.07 - 0.16)	0.19 (0.12 - 0.30)
	Yes	Reference	Reference
Type of stroke	Intracerebral hemorrhage	1.52 (1.16 - 1.99)	1.20 (0.89 - 1.62)
	Ischaemic	Reference	Reference
NIHSS	0 - <5	0.07 (0.05 - 0.12)	0.07 (0.04 - 0.12)
	5 - <10	0.19 (0.13 - 0.27)	0.20 (0.13 - 0.30)
	10 - <15	0.50 (0.34 - 0.73)	0.59 (0.39 - 0.88)
Comorbidities	≥15	Reference	Reference
	Hypertension	Reference	Reference
	Diabetes	0.96 (0.66 - 1.40)	1.07 (0.71 - 1.61)
	Obesity	1.18 (0.72 - 1.93)	1.30 (0.76 - 2.22)
	Dyslipidemia	1.25 (0.83 - 1.88)	1.06 (0.67 - 1.68)
	Smoking	0.95 (0.58 - 1.53)	1.25 (0.73 - 2.14)
	Alcohol Use	0.77 (0.54 - 1.09)	1.04 (0.69 - 1.56)
	Others	1.07 (0.62 - 1.87)	1.01 (0.55 - 1.84)

functionally independent at home; but received care and support from family). Second, despite using a validated instrument assessing mRS; variation in interrater and intrarater reliability between 3 months and 6 months cannot be underestimated. Third, our model does not incorporate repeated measures of independent variables over time (e.g. stroke severity). Fourth, this study only examined the cross-sectional relationship of mRS from 3-month and 6-month of follow up, therefore no causal interpretation can be derived. Further limitations include that this information is based on self-reported, not observed behaviour, which therefore is prone to reporting bias. Though mRS is the most widely used global measure of post-stroke disability, it may not fully capture recovery in domains such as activities of daily living, cognition, or quality of life. Further, absence of repeated measures using complementary instruments limits a more granular assessment of recovery trajectories. Other validated functional or cognitive instruments, such as Montreal Cognitive Assessment, could not be assessed in this study. Although missing data were relatively low (<5% at baseline), selective loss to follow-up may still have biased recovery estimates. Finally, as this was a post-hoc analysis of the ATTEND trial—which was not originally designed to investigate recovery predictors—there is potential for unmeasured confounding (e.g., variation in rehabilitation intensity or adherence to secondary prevention), which may have influenced the observed associations.

Conclusions

The study shows stroke recovery over six months in India. Nearly 67% of patients reported improvement in functional status within the first three months, consistent with previous research. Additional follow-up at six months showed that 48% sustained their previous functional status at three months and 34% reported improvement. It also highlights that both demographic and clinical factors significantly influence recovery outcomes in patients with mild to moderate stroke severity.

Data access statement

Data is available from ATTEND Collaborative Team upon reasonable request.

Funding

These analyses were supported by NHMRC Program Grant APP1149987.

CRediT authorship contribution statement

SR Mishra: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **JD Pandian:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **S Aaron:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **M BK:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **NC Borah:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **A Forster:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **DBC Gandhi:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **DS Halprashant:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **ML Hackett:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **LA Harvey:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **S Jan:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **S Kaul:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **D Khurana:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **P Langhorne:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **L Billot:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **L John:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **PK Maulik:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **GVS Murthy:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **V Nambiar:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **MV Padma:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **J Roy:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **S Sachin:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **PN Sylaja:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **P Vijaya:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **MF Walker:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **CS Anderson:** Writing – review & editing, Writing – original draft, Conceptualization. **A Webster:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **CK Chow:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **RI Lindley:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

Authors would like to thank the ATTEND Study team and the study participants who participated in the study.

Supplementary materials

Supplementary material associated with this article can be found, in

the online version, at [doi:10.1016/j.jstrokecerebrovasdis.2026.108619](https://doi.org/10.1016/j.jstrokecerebrovasdis.2026.108619).

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