Adherence to American Heart Association/American Stroke Association Clinical Performance Measures in a Peruvian Neurological Reference Institute

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Abstract

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There is little knowledge of adherence to American Heart Association/American Stroke Association (AHA/ASA) stroke performance measures in developing countries like Peru. The objectives of this study were to assess the percentage of adherence to AHA/ASA stroke performance measures and to determine the effect of local demographic variables and risk factors on adherence to the AHA/ASA stroke performance measures at the Neurological Institute of Neurological Science, a reference center for neurological diseases in Lima, Peru.

We examined a sample size of 150 patients with stroke, from a population of 734, admitted between 2014 and 2016. Only 5 of 15 AHA/ASA stroke performance measures were accomplished more or equal to 85% of the time (accepted by Joint Commission for Hospital Accreditation): antithrombotic treatment at discharge (94.63%), antithrombotic treatment within 2 days of hospitalization (93.33%), discharge on statins (99.32%), rehabilitation assessment (90.67%) and cardiac monitoring within 2 hours of arrival and continuing for 24 hours during

hospitalization (97.31%). The mean composite measure was 47.21%, far from the minimum percentage required for accreditation (>= 85%). After adjusting for all significant variables, we obtained the following results: stroke patients who were married had a four times higher probability of good adherence than those who were single (95% CI: 1.01-11.81, p-value=0.047) and patients who had a delay from onset of stroke to arrival at the hospital of more than 4.5 hours had 73% lower probability of receiving appropriate stroke performance measures compared to those who had a delay from onset to arrival of ≤4.5hours and those who had an National Institutes of Health Stroke Scale (NIHSS) score ≥ 13 had 90% lower probability of receiving appropriate stroke performance measures compared to those with an NIHSS of 4.

Conclusion: The mean composite measure was 47.21%, far from the minimum good quality required for accreditation (>= 85%). After adjusting for all significant variables, we obtained statistical significance for the following results: married patients had a higher probability of receiving appropriate stroke performance measures and those who had an onset to arrival time > 4.5 hours and those who had an NIHSS score >= 13 had lower probability of receiving appropriate stroke performance measures.

Title:

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Introduction:

Stroke is a leading cause of disability worldwide and is the second most common cause of mortality.(1) In Peru, stroke is the fifth most common cause of mortality and 60% of stroke patients have unfavorable outcome at discharge, as measured by a modified Rankin scale score of 3-6 points.(2)

The American Heart Association/American Stroke Association (AHA/ASA) stroke performance measures to improve stroke outcome includes a package of ten measures applied during hospitalization of a stroke patient including deep vein thrombosis prophylaxis, use of antithrombotics at day 2 of hospitalization or at discharge, discharge on anticoagulation for atrial fibrillation, thrombolytic therapy, discharge on cholesterol reducing medication, dysphagia screening, stroke education, smoking cessation and assessment for rehabilitation.(3) The quality of in-hospital stroke care is measured through the Evidence-Based Performance Measures(4) according to the Get with the Guidelines Program, (5), and the approval of these quality measures is required for accreditation of a center by the Joint Commission International.
The AHA stroke performance measures are used widely in the USA, have had a positive effect on the improvement of stroke outcomes and have been adopted in the stroke guidelines of some centers of developing countries.(6-8) In March 2014, The Joint Commission's Board of Commissioners approved a final set of standardized performance measures for the Disease-Specific Care Comprehensive Stroke Center (CSC) advanced certification program.(9)

In Perú, there are no national guidelines for stroke patients; each hospital has its own guidelines or consensus, most of them adopted or adapted from guidelines from other countries like AHA/ASA guidelines. There is lack of knowledge of the adherence to these measures in Peru.

The objectives of this study were to (1) assess the percentage of adherence to AHA/ASA stroke performance measures and patient demographics association with stroke performance measures at a Peruvian neurological reference Institute and compare this percentage to that achieved in the USA; and (2) determine the effect of local demographic variables and risk factors on adherence to the AHA/ASA stroke performance measures at the Neurological Institute of Neurological Science, a reference center for neurological diseases in Lima, Peru. The determination of the adherence to AHA/ASA stroke performance measures will identify opportunities for improvement in our hospitals' current practices and will be the basis for future implementation of these and other measures to improve stroke outcomes in Peruvian Hospitals.

Methods:

This was a retrospective observational study that took place at the National Institute of Neurological Sciences in Lima Peru. The Institute has 230 beds, 20 assigned for stroke patients (Stroke Department). Most patients are Spanish-speaking of mestizo, and of low to middle income socioeconomic status.

We included patients 18 years old and older who had a diagnosis of ischemic stroke or transient ischemic attack at hospital discharge. Exclusion criteria included pregnancy, a diagnosis of intracerebral hemorrhage or subarachnoid hemorrhage, or death during hospitalization.

We reviewed 150 randomly selected medical records from patients diagnosed with acute

ischemic stroke or transient ischemic attack between January 2014 and December 2016 (3 years). We abstracted data related to each of the 15 Clinical Performance Measures for which they were eligible (e.g. all patients would be eligible for dysphagia screening, but only patients who arrived at the hospital early would be eligible for thrombolysis) (Table X).(6) Data collection was performed using the Red Cap Program.

Data included demographics, stroke risk factors, National Institutes of Health Stroke Scale (NIHSS) score at admission, in-hospital treatment, modified Rankin scale (mRs) score at discharge, neuroimaging characteristics, thrombolysis status and other elements to determine adherence on each of the measures.

We calculated composite scores to indicate performance on the AHA/ASA measures. Performance was calculated by summing the numerators for each measure across the patients evaluated to create a composite numerator, and summing the denominators for each measure for those who were eligible for each measure to form a composite denominator, and reporting the ratio (the percentage of all needed care that was given). The percentage of adherence to these measures was also obtained for each individual patient through an adherence/eligibility index calculated by the ratio between eligible measures and compliance with them in a single patient (6, 8). This study was approved by the Review Boards of the National Institute of Neurological Science in Lima, Peru and the University of Washington.

Statistical analysis:

We examined a sample size of 150, from a population of 734 during the study period, we had adequate power (>80%) to detect a deviation of 8% or greater from the recommendation from the Joint Commission (85%).

We report descriptive statistics as frequencies, mean and standard deviation or median and interquartile range. To test the distribution of demographic variables, we used Chi-squared for categorical variables and Student's T-test for continuous variables.

We used multiple logistic regression to evaluate the influence of demographic variables and risk factors on the adherence with performance measures. An adherence of equal or more than 85% was considered acceptable by Joint Commission. However, we used a cut off of 50%, which was close to the global mean of the composite outcome, because no patient received >85% adherence.

All variables that showed a p value < 0.05 in the univariate analysis were included in the multivariate analysis to adjust to confounders. We used the statistics software STATA 14.1 for analysis.

Results:

We measured adherence to AHA/ASA stroke performance measures in hospitalized ischemic stroke patients at the National Institute of Neurological Sciences in Lima, Peru during 2014-2016. We selected a sample size of 150 individuals from a population of 734 during the study period.

In Table 1 we show the baseline characteristics and patient demographics. The mean age was 66 years; with a higher proportion of males (62%). Fifty-three percent of the patients were married, with the most common occupations being independent workers (48%) and housekeepers (29%). Most patients (73%) were registered with the Integral Health Insurance (SIS) program, a Medicaid-type insurance. However, in one of our previous studies published in 2013, percentage of stroke patients covered by this insurance was only 6.1%.(2)

The median hospital stay was 16 days (IQR: 12, 22) and the median onset to hospital arrival was 27 hours (IQR: 12, 96). Four percent of this sample received intravenous thrombolysis.

With regard to stroke subtypes, 45% had undetermined etiology, 28% had cardioembolic stroke, 14% had atherothombotic stroke, and 13% had lacunar stroke. Of the patients with an undetermined etiology, 54% had incomplete studies and 40.3% were cryptogenic. Atrial fibrillation was the most frequent cause of cardioembolism (90%); and the most commonly used anticoagulant was dabigatran (47%), followed by warfarin (43%) and apixaban (10%).

In our sample, we found 12.07% had neurologic complications, with the most frequent complication hemorrhagic transformation. Among infectious complications, the main cause was pneumonia (15.33%).

Mean NIHSS at admission was 9 points and at discharge was 7.34 points.

The composite quality of care measure indicates how well the healthcare system does in providing appropriate, evidence-based interventions for each patient (**GWTG/PAA Composite Measure)** and the Defect-free measure gauges how well your hospital performed in providing all appropriate interventions to every patient (**GWTG/PAA Defect-Free Measure).** The results for these indicators were the same in our study. In Table 2 we show the GWTG/PAA Composite Measure.

AHA/ASA stroke performance measures that were accomplished more or equal to 85% (cut off for achievement award by the Joint Commission) were: antithrombotic treatment at discharge (94.63%), antithrombotic treatment within 2 days of hospitalization el (93.33%), discharge on statins (99.32%), rehabilitation assessment (90.67%) and cardiac monitoring within 2 hours of arrival and continuing for 24 hours during hospitalization (97.31%).

Stroke performance measures that did not meet adherence to equal to or more than 85% included: deep vein thrombosis prophylaxis (16%), anticoagulation at discharge in patients with atrial fibrillation or flutter (81.08%), initiation of thrombolytic therapy in patients who presented to the hospital within two hours (0%), stroke education (2.01%), tobacco counseling (0%), door to needle time of less than 60 minutes in patients who presented within 4.5 hours of onset of symptoms (33.3%), dysphagia screen assessment within 24 hours (1.35%), dysphagia management within 24 hours(6.08%), NIHSS within 24 hours (53.37%) and early carotid imaging (5.33%).

The mean composite measure was 47.21% - far from the quality required for an achievement award.

Table 3 shows a bivariate analysis considering a composite measure as the outcome, dichotomized at 50% (<50% poor adherence and >=50% good adherence). There was a statistically significant association with gender; 50.88% of female patients had poor adherence and 49.12% good adherence; however, 29.03% of men had poor adherence and 70.97 had good adherence. NIHSS scale (stroke severity) at arrival was also significant; patients who had a NIHSS >= 13 had 46.15% adherence to performance measures and 53.85% did not have good adherence ($p < 0.001$). Other demographic variables studied were not significant (see Table 3).

In Table 4 we highlight adjusted and unadjusted Odds ratios. Before adjusting for potential confounders, factors significantly associated with good adherence (p-value <= 0.1; unadjusted ORs) included: patients who were married (OR=4.01, 95% CI 1.42-11.28, p-value= 0.008) or cohabitating (OR= 4.24, 95% CI 1.18-15.23, p-value=0.027); patients who had diastolic blood pressure at admission > 90 mmHg (OR=1.85, 95%CI 0.10-34.43, p-value=0.006); and patients who used tobacco (OR=3.95, 95% CI 0.85-18.35, p-value=0.008). However, patients who had time from onset to arrival of >= 4.5 hours (OR=0.27, 95%CI 0.05-1.31, p-value=0.106) and NIHSS >=13 at arrival (OR=0.10, 95% CI 0.02-0.46, p= 0.003) had lower probability of achieving good adherence. After adjusting for all significant variables, we obtained the following results: Patients who were married had four times higher probability of achieving good adherence compared to those who were single (95%CI: 1.01-11.81, p-value=0.047) and those who had a delay in time from onset of symptoms to arrival in hospital of > 4.5 hours had 73% lower probability of achieving good adherence to stroke performance measures compared to those who had a time from onset to arrival of <=4.5hours; patients who have a NIHSS score >= 13 had 90% less probability of achieving good adherence compared to those who had a NIHSS <=4.

Discussion:

The objectives of this study were to measure adherence to AHA/ASA stroke performance measures and determine the effect of local demographic variables and risk factors on adherence to the AHA/ASA stroke performance measures at the Neurological Institute of Neurological Science in Lima, Peru.

Only 5 (33%) of 15 AHA/ASA stroke performance measures were achieved at 85% or higher: antithrombotic treatment at discharge (94.63%), antithrombotic treatment within 2 days of

hospitalization (93.33%), discharge on statins (99.32%), rehabilitation assessment (90.67%) and cardiac monitoring within 2 hours of arrival and continuing for 24 hours during hospitalization (97.31%). The mean composite measure was 47.21% - far from the minimum required for an achievement award from the Joint Commission. After adjusting for significant variables, we observed statistical significance for the following variable: being married had a higher probability of good adherence with stroke performance measures, while onset of symptoms to arrival in the hospital greater than > 4.5 hours and having a NIHSS score >= 13 had lower probability of obtaining good adherence.

The determination of adherence to AHA/ASA stroke performance measures will identify opportunities for improvement in our hospitals' current practices and provide a basis for future implementation of these and other measures to improve stroke outcomes in Peruvian Hospitals. Most of the measures not accomplished were related to prevention for patients and training of physicians and nurses and are relatively low cost and potentially of great impact upon patient quality of care.

In a study by de Carvalho, adherence to a composite measure of 7 measures was 84.7%, and in a study by Fang-I Hsieh, adherence with a composite measure of 73.12% - compared to our composite measure of 15 measures, with adherence of 47.21. This large difference could be explained partially due to the under-registration of in the clinical records.

Reeves reported that between 2003 and 2012, mean hospital-level NIHSS documentation increased dramatically from 27% to 70%.(10). Stroke Severity was a crucial predictor of outcome (11).

Adherence with NIHSS evaluations was not ideal – with only 9% scored in our study; one of the reasons for this omission could be that there were different personnel in the Stroke Unit than in

the emergency room, and stroke training is more thorough for physicians working on the Stroke Service.

Complications, infectious and neurologic, usually occur within the first 4 days (12). The hospital stay for our patients was long, with a median of 16 days (IQR:12, 22), which could be explained by neurologic or infectious complications as well as logistic and administrative issues.

Anticoagulation therapy for atrial fibrillation or flutter was provided in 81.08%, very close to the ideal adherence (85%); anticoagulation was not provided for patients with large strokes or in whom hemorrhagic conversion had occurred – which would lead to a delay in anticoagulation of 3 weeks after discharge.

Stroke subtype of undetermined etiology was high (44.97%) and more than 50% (53.73%) of patients had incomplete studies at discharge. In Peru, this is a common practice; patients are often discharged with the expectation they will complete studies in the outpatient setting. In addition, as the INCN is a reference center, 27.52% of strokes were due to cardioembolism, which likely also resulted in a bias associated with providing care to more severe and complicated patients.

Limitations: although some of the measures were likely performed, they were not registered in the clinical records, sub-estimating the percentage of adherence. The small sample size did not permit an analysis of subgroups. Future research could include a multicenter prospective study to assess adherence to AHA/ASA stroke performance measures and lead to intervention studies to fill the gaps identified in this and other studies.

Conclusion:

The mean composite measure of adherence to internationally recognized standards of management of stroke in our Peruvian institution was 47.21% - far below the level needed for an

achievement award by the Joint Commission. After adjusting for all significant variables, we observed a statistically significant relationship between adherence with recognized standards of measurement and being married, as well as an inverse relationship with an onset of symptoms arrival in the hospital of greater than 4.5 hours and an NIHSS score of greater than or equal to 13.

Tables and figures:

Table 1. Baseline characteristics and metrics of ischemic cerebrovascular disease patients discharged at The National Institute of Neurological Sciences, Lima, Peru, 2014-2016 (N=150)

	N	%	Mean	SD
Age (years)			66.31	12.60
Gender				
Female	57	38.00		
Male	93	62.00		
Marital status				
Single	20	13.33		
Married	79	52.67		
Cohabitating	23	15.33		
Separated	2	1.33		
Divorced	2	1.33		
Widow(er)	24	16.00		
Education				
None	7	4.67		
Complete Primary	35	2333		
Incomplete Primary	29	1933		
Complete Secondary	38	2533		
Incomplete Secondary	23	1533		
Superior, no universitary	4	2.67		
Superior universitary	9	6.00		
Not mentioned	5	3.33		
Occupation				
Employee	7	4.67		
Worker	3	2.00		

Independent worker	72	48.00		
Housekeeper	44	29.33		
Affiliated to Integral Health Insurance (SIS)				
Yes	109	73.15		
No	40	26.85		
Systolic blood pressure (admission)			134.65	27.23
Diastolic blood pressure (admission)			79.21	15.12
Hospital stay (days)			16.00*	(12, 22)**
Time from onset to arrival (hours)			27.00*	(12, 96)**
Administration of IV thrombolytic therapy	6	4.00		
Door to needle time (minutes)			69.66	26.65
History of risk factors				
Hypertension	85	56.70		
Dyslipidemia	17	11.33		
Atrial fibrillation	6	4.03		
Obesity	24	16.00		
Stroke/TIA	29	19.33		
Diabetes mellitus	21	14.00		
Tobacco use	14	9.33		
Alcohol use	30	20.27		
NIHSS score				
At arrival			9.00	6.35
At discharge			7.34	4.80
Modified Rankin Scale (mRS) score				
Previous			0.70	1.20
At admission			3.37	0.89
At discharge			3.30	1.63
Stroke type				
Ischemic Stroke	149	99.33		
Transient ischemic attack (TIA)	1	0.67		
Stroke subtype (TOAST				
Atherothrombotic	21	14.09		
Cardioembolic	41	27.52		
Lacunar	19	12.75		
Unusual	1	0.67		
No determined	67	44.97		
Type of no determined				

stroke etiology				
Incomplete studies	36	53.73		
More than one etiology	4	5.97		
Cryptogenic ESUS	26	38.81		
Cryptogenic No ESUS	1	1.49		
Cause of cardioembolism				
Atrial fibrillation	37	90.24		
Other	4	9.76		
Type of antiplatelet used in non cardioembolic stroke at discharge				
Acetyl Salicylic Acid (ASA)	101	89.38		
Clopidogrel	6	5.31		
Dual antiaggregation	6	5.31		
Type of anticoagulant used in cardioembolic (FA) stroke at discharge				
Warfarin	13	43.33		
Dabigatran	14	46.67		
Apixaban	3	10.00		
Rivaroxaban	0	0.00		
Neurologic complications				
Acute symptomatic seizures	2	1.34		
Hemorragic transformation	12	8.05		
Other	4	2.68		
Infectious complications				
Urinary tract infection	19	12.67		
Pneumonia	23	15.33		
Other	2	1.33		

* Median *** Interquartile Range (IQR)

Table 2. Individual and global adherence to AHA/ASA* stroke performance measures in ischemic cerebrovascular disease patients discharged at The national Institute of Neurological Sciences, Lima, Peru, 2014-2016 (N=150)			
	Received	**Eligible**	**Adherence (%)**
Venous thromboembolism (VTE) prophylaxis (within day 1)	24	150	16.00
Discharged on antithrombotic therapy	141	149	94.63
Anticoagulation therapy for atrial fibrillation/flutter	30	37	81.08
Thrombolytic therapy initiated within 3 hours in patients that arrived within 2 hours	0	3	0.00
Antithrombotic therapy by end of hospital day 2	140	150	93.33
Discharged on statin medication	147	148	99.32
Stroke education	3	149	2.01
Tobacco use counseling	0	149	0.00
Assessed for rehabilitation	136	150	90.67
Time to intravenous thrombolytic therapy (door to needle ≤60 min) in patients that arrived within 4.5 hours	2	6	33.33
Dysphagia screen (within 24 hours): assessment	2	148	1.35
Dysphagia screen: management	9	148	6.08
National Institutes of Health Stroke Scale (NIHSS) score on arrival (within 24 hours)	79	148	53.37
Cardiac monitoring (within 2 hours and continued through the first 24 h of hospital admission)	145	149	97.31
Early carotid imaging (by the end of day 2)	8	150	5.33
Global composite measure	**866**	**1834**	**47.21**

* AHA/=American Heart Association/American Heart Association

Table 3. Sample characteristics by composite outcome. P-value for difference tested with χ^2 for categorical variables in ischemic cerebrovascular disease patients discharged at The national Institute of Neurological Sciences, Lima, Peru, 2014-2016 (N=150)					
	Composite measure <50% poor adherence (n=56)		Composite measure >=50% good adherence (n= 94)		
	N	%	N	%	P-value
Age (years)					
19-49	6	42.86	8	57.14	0.886
50-69	27	36.00	48	64.00	
>=70	23	37.70	38	62.00	
Gender					
Female	29	50.88	28	49.12	0.007
Male	27	29.03	66	70.97	
Marital status					
Single	13	65.00	7	35.00	0.087
Married	25	31.65	54	68.35	
Cohabitating	7	30.43	16	69.57	
Divorced	1	50.00	1	50.00	
Widow(er)	10	41.67	14	58.33	
Education					
None	3	42.86	4	57.14	0.560
Complete Primary	12	34.29	23	65.71	
Incomplete Primary	14	48.28	15	51.72	
Complete Secondary	13	34.21	25	65.79	
Incomplete Secondary	5	21.74	18	78.26	
Superior, no universitary	2	50.00	2	50.00	
Superior universitary	5	55.56	4	44.44	
Occupation					
Employee	3	42.86	4	57.14	0.109
Worker	1	33.33	2	66.67	
Independent worker	19	26.39	53	73.61	
Housekeeper	22	50.00	22	50.00	
Unemployed	11	45.83	13	54.17	
Affiliation to Integral Health Insurance (SIS)					
No	12	30.00	28	70.00	
Yes	43	39.45	66	60.55	
Systolic blood pressure (admission)					

<= 140 mmHg	44	41.51	62	58.49	0.101
> 140 mmHg	12	27.27	32	72.73	
Diastolic blood pressure (admission)					
<= 90 mmHg	50	37.88	82	62.12	0.708
> 90 mmHg	6	33.33	12	66.67	
Hospital stay (days)					
<= 7	4	44.44	5	55.56	0.649
> 7	52	36.88	89	63.12	
Time from onset to arrival (hours)					
<= 4.5	2	15.38	11	84.62	0.087
> 4.5	54	39.42	83	60.58	
History of hypertension					
No	22	33.85	43	66.15	0.440
Yes	34	40.00	51	60.00	
History of dyslipidemia					
No	47	37.30	79	62.70	0.085
Yes	7	41.18	10	58.82	
History of atrial fibrillation					
No	50	36.50	87	63.50	0.320
Yes	4	66.67	2	33.33	
History of obesity					
No	46	38.33	74	61.67	0.880
Yes	8	33.33	16	66.67	
History of stroke/TIA					
No	42	35.29	77	64.71	0.593
Yes	13	44.83	16	55.17	
History of diabetes mellitus					
No	47	36.43	82	63.57	0.573
Yes	9	42.86	12	57.14	
History of tobacco use					
No	54	39.71	82	60.29	0.061
Yes	2	14.29	12	85.71	
History of alcohol use					
No	46	38.98	72	61.02	0.569
Yes	10	33.33	20	66.67	
NIHSS at arrival					
<=4	2	10.53	17	89.47	0.000
5-7	2	8.33	22	91.67	
8-12	3	18.75	13	81.25	
>=13	49	53.85	42	46.15	
mRS previous					
0-2	4	11.43	31	88.57	0.588
3-6	1	20.00	4	80.00	

Table 4. Unadjusted and adjusted relative risk estimates and corresponding 95% confidence intervals in ischemic cerebrovascular disease patients discharged at The national Institute of Neurological Sciences, Lima, Peru, 2014-2016 (N=150)

	Unadjusted Relative Risk		Adjusted Relative Risk	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age (years)				
19-49	Ref			
50-69	1.33 (0.41-4.24)	0.627		
>=70	1.23 (0.38-4.02)	0.721		
Gender				
Female	Ref		Ref	
Male	2.53(1.27-5.02)	0.008	2.18 (0.89-5.30)	0.084
Marital status				
Single	Ref		Ref	
Married	4.01 (1.42-11.28)	0.008	3.46 (1.01-11.81)	0.047
Cohabitating	4.24 (1.18-15.23)	0.027	2.84 (0.64-12.61)	0.169
Divorced	1.85 (0.10-34.43)	0.678	0.38 (0.00-263.77)	0.776
Widow(er)	2.60 (0.76-8.85)	0.127	3.58 (0.80-16.01)	0.094
Education				
None	Ref			
Complete Primary	1.43 (0.27-7.49)	0.667		
Incomplete Primary	0.80 (0.15-4.24)	0.797		
Complete Secondary	1.44 (0.27-7.43)	0.662		
Incomplete Secondary	2.70 (0.44-16.25)	0.278		
Superior, no universitary	0.75 (0.06-8.83)	0.819		
Superior universitary	0.60 (0.08-4.39)	0.615		
Occupation				
Employee	Ref			
Worker	1.50 (0.08-25.39)	0.779		
Independent worker	2.09 (0.42-10.21)	0.362		
Housekeeper	0.75 (0.15-3.74)	0.726		
Unemployed	0.88 (0.16-4.84)	0.889		
Affiliation to Integral Health Insurance (SIS)				
No	Ref			
Yes	0.65 (0.30-1.43)	0.291		
Systolic blood pressure (admission)				
<= 140 mmHg	Ref		Ref	
> 140 mmHg	1.89 (0.87-4.07)	0.103	1.67 (0.64-4.33)	0.287
Diastolic blood pressure (admission)				
<= 90 mmHg	4.24 (1.18-15.23)	0.709		
> 90 mmHg	1.85 (0.10-34.43)	0.006		

Hospital stay (days)	2.60 (0.76-8.85)	0.12		
<= 7	Ref			
> 7	1.36 (0.35-5.32)	0.650		
Time from onset to arrival (hours)				
<= 4.5	Ref		Ref	
> 4.5	0.27 (0.05-1.31)	0.106	0.15 (0.02-0.96)	0.046
History of risk factors				
Hypertension (Ref=no)	0.76 (0.39-1.50)	0.440	0.98 (0.40-2.38)	0.975
Dyslipidemia (Ref=no)	0.84 (0.30-2.38)	0.757		
Atrial fibrillation (Ref=no)	0.28 (0.05-1.62)	0.158		
Obesity (Ref=no)	1.24 (0.49-3.13)	0.645		
Stroke/TIA (Ref=no)	0.67 (0.29 1.52)	0.342		
Diabetes mellitus (Ref=no)	0.76 (0.29 1.94)	0.573		
Tobacco use	3.95 (0.85 18.35)	0.080	4.11 (0.75-22.37)	0.101
Alcohol use	1.27 (0.54 2.97)	0.569		
NIHSS at arrival				
<=4	Ref		Ref	
5-7	1.29 (0.16-10.14)	0.806	1.36 (0.16-11.29)	0.775
8-12	0.50 (0.07-3.51)	0.494	0.43 (0.05-3.39)	0.428
>=13	0.10 (0.02-0.46)	0.003	0.11 (0.02-0.58)	0.009
mRS previous				
0-2	Ref			
3-6	0.51 (0.04-5.84)	0.593		

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