Educational levels and the functional dependence of ischemic stroke survivors

Nível de escolaridade e dependência funcional em sobreviventes de acidente vascular cerebral isquêmico

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Abstract

We evaluated the functional dependence of stroke survivors from the Study of Stroke Mortality and Morbidity, *using the Rankin Scale. Out of 355 ischemic stroke survivors (with a mean age of 67.9 years), 40% had some functional dependence at 28 days and 34.4% had some functional dependence at 6 months. Most predictors of physical dependence were identified at 28 days. These predictors were: low levels of education [illiterate vs. ≥ 8 years of education, multivariate odds ratio (OR) = 3.7; 95% confidence interval (95%CI): 1.60-8.54] and anatomical stroke location (total anterior circulation infarct, OR = 16.9; 95%CI: 2.93-97.49). Low levels of education and ischemic brain injury influenced functional dependence in these stroke survivors. Our findings reinforce the necessity of developing strategies for the rehabilitation of stroke patients, more especially in formulating specific strategies for care and treatment of stroke survivors with low socioeconomic status.*

Stroke; Educational Status; Outcome Assessment (Health Care)

Introduction

The financial and social burden of functional dependence due to cerebrovascular disease is an important focus of discussion in public health, particularly among countries with resource-poor settings. Although stroke mortality rates vary greatly, low-income countries are the most affected [1]. Despite fast economic growth in some regions, Brazil has the highest stroke mortality rates in the Americas [2]. A recent review of socioeconomic status and stroke reveals evidence that suggests a strong relationship between socioeconomic status and an increased risk of stroke mortality. It also suggested that low socioeconomic status may be associated with more severe stroke, as well as an increase of dependence in daily activities, increased disability and handicap [3]. Others predictors of post-stroke disability that have been reported previously are advanced age, recurrent stroke, stroke severity, the anatomical location of brain damage, and having a high level of functional dependence at hospital discharge [4,5].

Many studies have used the modified Rankin Scale (mRS) to investigate short- and long-term disability after stroke. Some reports from developed countries describe functional dependence rates of around 30%, three months after acute stroke [6,7]. Other long-term studies found higher frequencies (in the range of 34%-47%) of poor functional outcomes (mRS 3-5), six months after

stroke [8,9]. Data on post-stroke disability in middle and low income countries is scarce. Two population based studies conducted in Latin America, including Brazil, reported functional dependence rates between 18% and 30% six months after stroke [10,11].

Previous reports have tried to identify factors associated with stroke functional prognosis after hospital discharge, but often with contradictory results [12,13,14]. A previous cohort study performed in stroke surveillance, the EMMA study (*Study of Stroke Mortality and Morbidity*), identified almost 85% of stroke survivors as being ischemic subtype [15]. In addition to occupation and income, education is considered one of the most reliable markers of socioeconomic status in many epidemiological studies [3]. Moreover, educational level can be applied equally to both genders. It is also a more reliable indicator of socioeconomic status for economically inactive people. Thus, our aim was to verify the influence of educational levels as an index for socioeconomic status. We also verified the influence of preexisting co-morbidities and hospital care, for functional dependence at 28 days and at six months among ischemic stroke survivors in the EMMA study.

Methods

Population and study area

This is an ancillary study of functional disability using data from the cohort EMMA study, which has been ongoing since April 2006 in a teaching community hospital, the University Hospital of São Paulo University (Hospital Universitário, Universidade de São Paulo). Details of the EMMA study have previously been described elsewhere [16]. The University Hospital is a teaching community hospital (260 beds) in Butantan, a neighborhood on the west side of the city with 424,377 inhabitants (2009). This hospital offers the sole support for emergencies from primary care units and also for paramedic ambulances in the area. The neurological referral for this community facility is the Clinics Hospital, a tertiary-care hospital located eight kilometers away. The district of Butantan includes several social contrasts with rich and poor areas located side by side. Cardiovascular disease represents 40% of all deaths in Butantan and the city of São Paulo. Stroke mortalities account for one-quarter of all circulatory disease deaths and are concentrated in the poorer areas.

All individuals for whom functional status information was available at 28 days and at six months after an acute event were included in this analysis. We evaluated data from 355 consecutive ischemic stroke survivors older than 35 years of age who were admitted, up until December 2009.

Data registry

We performed the analysis from the in-hospital phase (step 1) of the EMMA study, which was based on the WHO STEPwise approach to stroke surveillance. Data collection was performed by trained interviewers and medical researchers according to the instructions in the STEPwise approach to stroke surveillance manual [17]. The socio-demographic data (gender, age, educational level, and marital status), acute stroke information (stroke subtype, onset of neurological symptoms, and pre-stroke clinical conditions), hospital care (stroke neuro-imaging diagnosis, delay from onset to hospitalization, and hospital length of stay), and functional information (mRS at 28 days and at six months after stroke) were documented. Written informed consent was obtained from all potential stroke patients admitted to the hospital, who agreed to participate in this study, and each subject received a copy of the consent form. Among those who had severe stroke or any impairment of language abilities, the consent form was obtained from *their* parent/*legal* guardian or *legally* authorized representative. The research protocol was approved by the institutional review board of the University Hospital of São Paulo University.

Variable definitions

The stroke diagnosis was confirmed based on the clinical and radiological (computed tomography) assessments of a neurologist during hospitalization and validated by a medical practitioner. Additionally, an evaluation of ischemic stroke subtypes was performed from among those who had computed tomography information in the first 48 hours of hospital admission. Diagnoses were further subdivided into total anterior circulation infarct (TACI), partial anterior circulation infarct (PACI), lacunar infarct (LACI), posterior circulation infarct (POCI), and, when there was no visible infarction, (normal).

Due to a higher proportion of individuals with low levels of education, we categorized educational levels in the following categories: 0 or < 1 year, 1 to 7 years, and ≥ 8 years. The pre-stroke clinical data wasbased on self-reported history of the following cerebrovascular risk factors (yes/no): high blood pressure, diabetes mellitus, heart disease, current smoking, and alcohol consumption. Self-reported history of high blood pressure

and diabetes mellitus, as well as hospital characteristics (onset, delay to hospitalization, length of stay and stroke diagnosis confirmed by computed tomography) were further confirmed by medical record.

The functional outcomes at 28 days and at six months after the stroke event were assessed using the mRS [6] by telephone interview. The mRS is a useful tool for a global assessment of stroke outcomes [18], and it is accepted as a measure of functioning activity, disability, and health regards in accordance with WHO international classifications [19]. The scale is defined categorically with seven different grades: 0, no symptoms; 1, no significant disability despite symptoms; 2, slight disability; 3, moderate disability; 4, moderately severe disability; 5, severe disability; and 6, death. Although the mRS has been shown to be less reliable when performed by telephone, its use is recommended for dichotomized data analyses [20,21], and it is widely used in stroke trials [19]. In the present study, the functional outcome was dichotomized into anindependent state (rankin score of 0-2) and a dependent state (rankin score of 3-5). The outcome of death was considered elsewhere. Just six participants responded the scale category interview, 28 days after the event, while they were inpatients. Among those who had severe stroke or any impairment of language abilities, the information for the mRS was obtained from their caregiver.

Statistical analysis

Categorical and continuous variables were compared according to gender using the chi-square test and Student's t-test, respectively. Age was analyzed in continuous and dichotomous variables (35-64 years and ≥ 65 years). We performed multivariate regression considering all variables that were significant at $p < 0.10$ in the age-adjusted analysis at 28 days and at six months, respectively. In the final model, we retained all of the variables that allowed a better fit according to the Hosmer-Lemeshow test. Results were expressed as odds ratio (OR), and 95% confidence intervals (95%CI) were calculated. All tests were two-tailed and the confidence interval was set at $p < 0.05$. SPSS software, version 16.0 (SPSS Inc., Chicago, USA) was used for the statistical analyses.

Results

From April 2006 to December 2009, 678 patients ≥ 35 years old with a confirmed diagnosis of ischemic stroke (first and recurrent events) were enrolled in this study. Of these, 160 died before the 6 month follow-up and were not included in the analysis. A complete follow-up was possible with 355 out of 518 survivors, and they were included in the present analysis. It was not possible to carry out 28 day and/or 180 day follow-ups in a total of 163 cases. We compared the 355 cases included in the analysis with the 163 missing cases, regarding: age (65 years and over: cases 65.4% vs. missing 62%; $p = 0.46$); gender (men: cases 52.4% vs. missing 52.8%; $p = 0.94$); years of education (illiterate: cases 20.3% vs. missing 19.5%; $p = 0.21$); event stroke (first stroke: cases 70.3% vs. missing 68.8%; $p = 0.74$); history of high blood pressure (cases 81.4% vs. missing 81.6%; $p = 0.96$). Thus, there are no statistically significant differences between the groups. The baseline characteristics are shown in Table 1. Among ischemic stroke survivors, 52.4% were male and their mean age was 67.9 years. Most patients had < eight years of schooling (elementary school). In comparing genders, we found that women were three years older than men, most of them lived alone (single or widowed), and they took more antihypertensive drugs than men. There also was a higher frequency of smokers and higher alcohol intake among men, in comparison to women.

The most common ischemic area recognized by computed tomography was LACI (30.2%). Most cases were classified as the first ever event (70.3%), 76.9% arrived at the hospital < 24 hours after the stroke, and 57.5% remained in the hospital for two to 10 days. According to the mRS assessment of functional dependence after the acute event, there were similar rates of dependence at both intervals: 28 days (40%) and at six months (34.3%).

In age-adjusted analyses, ischemic stroke survivors without formal education or with one to seven years of education had an approximately two de four-fold risk of functional dependence compared to those with ≥ 8 years of education at the six month follow up (Table 2). As expected, patients with the worst functional dependence at both intervals after the stroke had experienced a longer hospital stay (≥ 11 days). The ischemic stroke subtype diagnosed by computed tomography was also associated with increased risk of disability during the six month follow-up. We found the highest risk of functional dependence, among those who had a TACI both at 28 days and at six months after the event. PACI and LACI represented an increased risk of disability only after six months. We observed a trend of increased risk of disability at 28 days among patients who had a previous diagnosis of hypertension and stroke recurrence. Other variables were not significantly associated with functional status.

Table 1

Baseline characteristics of 355 stroke patients from the EMMA study (*Study of Stroke Mortality and Morbidity*).

Characteristics	Women (n = 169; 47.6%)	Men (n = 186; 52.4%)	Total (n = 355; 100.0%)	p-value *
Mean age (±SD)	69.3 (12.5)	66.6 (12.1)	67.9 (12.4)	0.05
Age strata [years] (%)				
35-64	50 (29.6)	73 (39.2)	123 (34.6)	0.06
≥ 65	119 (70.4)	113 (60.8)	232 (65.4)	
Years of education (%)				
Illiterate	43 (25.4)	29 (15.6)	72 (20.3)	0.06
1-7	79 (46.7)	94 (50.5)	173 (48.7)	
≥ 8	47 (27.8)	63 (33.9)	110 (31.0)	
Marital status (%)				
Partner	64 (38.6)	134 (72.8)	198 (56.6)	< 0.001
Single	102 (61.4)	50 (27.2)	152 (43.4)	
Preclinical conditions ** (%)				
High blood pressure	144 (85.2)	145 (78.0)	289 (81.4)	0.08
Diabetes	59 (34.9)	62 (33.3)	121 (34.1)	0.75
Heart disease	50 (29.6)	49 (26.3)	99 (27.9)	0.50
Current smoking	43 (25.4)	76 (40.9)	119 (33.5)	0.002
Regular alcohol intake	10 (5.9)	37 (19.9)	47 (13.2)	< 0.001
Medication before stroke (%)				
Antihypertensive	106 (62.7)	90 (48.4)	196 (55.2)	0.007
Antiplatelet	34 (20.1)	48 (25.8)	82 (23.1)	0.20
Glucose-lowering	25 (14.8)	34 (18.3)	59 (16.6)	0.38
Lipid-lowering	18 (10.7)	12 (6.5)	30 (8.5)	0.16
Medication during hospitalization (%)				
Antihypertensive	101 (59.8)	101 (54.3)	202 (56.9)	0.30
Antiplatelet	122 (72.2)	135 (72.6)	257 (72.4)	0.93
Glucose-lowering	56 (33.1)	62 (33.3)	118 (33.2)	0.97
Lipid-lowering	30 (17.8)	36 (19.4)	66 (18.6)	0.70
Ischemic stroke by area computed tomography (%)				
TACI	3 (2.3)	11 (7.3)	14 (5.0)	0.17
PACI	31 (24.2)	30 (20.0)	61 (21.9)	
LACI	36 (28.1)	48 (32.0)	84 (30.2)	
POCI	12 (9.4)	19 (12.7)	31 (11.2)	
Normal	46 (35.9)	42 (28.0)	88 (31.7)	
Stroke event (%)				
First stroke	124 (73.8)	120 (67.0)	244 (70.3)	0.17
Recurrent stroke	44 (26.2)	59 (33.0)	103 (29.7)	
Delay from onset to hospitalization (%)				
Same day	133 (78.7)	140 (75.3)	273 (76.9)	0.54
1 day after stroke	22 (13.0)	24 (12.9)	46 (13.0)	
≥ 2 days after stroke	14 (8.3)	22 (11.8)	36 (10.1)	
Length of stay in hospital [days] (%)				
0-1	51 (30.2)	53 (28.5)	104 (29.3)	0.75
2-10	98 (58.0)	106 (57.0)	204 (57.5)	
≥ 11	20 (11.8)	27 (14.5)	47 (13.2)	
Rankin 28 days (%)				
Independent (mRS ≤ 2)	98 (58.0)	115 (61.8)	213 (60.0)	0.46
Dependent (mRS 3-5)	71 (42.0)	71 (38.2)	142 (40.0)	

(continues)

Table 1 (continued)

Characteristics	Women (n = 169; 47.6%)	Men (n = 186; 52.4%)	Total (n = 355; 100.0%)	p-value *
Rankin 180 days (%)				
Independent (mRS ≤ 2)	103 (60.9)	130 (69.9)	233 (65.6)	0.08
Dependent (mRS 3-5)	66 (39.1)	56 (30.1)	122 (34.3)	

LACI: lacunar infarct; mRS: modified Rankin Scale; Normal: examination without visible changes; PACI: partial anterior circulation infarct; POCI: posterior circulation infarct; SD: standard deviation; TACI: total anterior circulation infarct.

* p-values were obtained using ANOVA for continuous variables and chi-square for categorical variables. Some proportions do not add up to 100% because of rounding;

** Cardiovascular risk factors were based on previous history, medical files and medication use.

Table 2

Age-adjusted risk of functional dependence after stroke in the EMMA study (*Study of Stroke Mortality and Morbidity*).

Risk factors (variables)	Dependence at 28 days		Dependence at 6 months	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Years of education				
≥ 8	Reference (1.00)	0.002	Reference (1.00)	0.01
1-7	2.29 (1.31-3.99)		1.90 (1.06-3.40)	
Illiterate	3.15 (1.62-6.12)		2.85 (1.44-5.64)	
Gender				
Women	Reference (1.00)	0.74	Reference (1.00)	0.17
Men	0.93 (0.60-1.44)		0.73 (0.46-1.14)	
Marital status				
Partner	Reference (1.00)	0.66	Reference (1.00)	0.16
Single	1.11 (0.71-1.72)		1.39 (0.88-2.20)	
Preclinical conditions				
High blood pressure	1.67 (0.91-3.07)	0.09	1.33 (0.71-2.49)	0.37
Diabetes	1.23 (0.78-1.95)	0.37	0.98 (0.61-1.58)	0.94
Heart disease	1.04 (0.64-1.69)	0.87	0.68 (0.41-1.14)	0.14
Current smoking	1.04 (0.65-1.68)	0.86	0.97 (0.59-1.58)	0.89
Regular alcohol intake	0.90 (0.46-1.77)	0.77	1.21 (0.60-2.43)	0.58
Ischemic stroke by area computed tomography				
Normal	Reference (1.00)	0.004	Reference (1.00)	< 0.001
TACI	18.34 (3.67-91.65)		16.69 (4.29-64.98)	
PACI	1.90 (0.94-3.84)		3.28 (1.50-7.18)	
LACI	1.45 (0.76-2.78)		3.57 (1.74-7.34)	
POCI	0.82 (0.31-2.19)		1.78 (0.63-5.07)	
Stroke event				
First stroke	Reference (1.00)	0.44	Reference (1.00)	0.07
Recurrent stroke	1.21 (0.75-1.95)		1.56 (0.96-2.55)	
Delay from onset to hospitalization				
Same day	Reference (1.00)	0.36	Reference (1.00)	0.14
1 day after stroke	0.80 (0.41-1.56)		0.57 (0.27-1.19)	
≥ 2 days after stroke	0.59 (0.27-1.29)		0.53 (0.23-1.24)	
Length of stay in hospital (days)				
0-1	Reference (1.00)	< 0.001	Reference (1.00)	< 0.001
2-10	1.56 (0.93-2.63)		2.05 (1.17-3.58)	
≥ 11	5.79 (2.67-12.54)		5.50 (2.54-11.91)	

LACI: lacunar infarct; Normal: examination without visible changes; OR: odds ratio; PACI: partial anterior circulation infarct; POCI: posterior circulation infarct; TACI: total anterior circulation infarct; 95%CI: 95% confidence intervals.

Multivariate analyses found the same higher risks of dependence in patients with low levels of education and among those who had suffered from a total anterior circulation infarct. In particular, in patients with no formal education, the risk of dependence after ischemic stroke was persistently higher during the six month follow-up. Finally, the association between functional disability and longer hospitalization after stroke was confirmed (Table 3). Table 4 analyzed patients who died in the same period. The results did not materially change the association between education and functional dependence.

Discussion

In the present study, 40% of the participants, who were assisted at a community hospital, had functional impairment 28 days after an ischemic event. Although post-stroke functional status was influenced by many factors, the most important disability predictors were practically the same at 28 days and at six months after hospital discharge. In addition to advanced age, a low level of education, TACI and a hospital stay of > 11 days were also associated with higher functional dependence among stroke survivors.

As expected, disability rates after an acute event tended to decrease over time. This may occur due to the natural history of disease and rehabilitation, as well as survival bias [8,22]. Compared to previous studies performed in developed countries that used the mRS as a measure of functional outcome, we found higher proportions of dependence at 28 days and at six months after stroke (40% and 34.4%, respectively) [6,7,23]. Data from a population-based study conducted

Table 3

Multivariate risk of functional dependence after stroke in the EMMA study (*Study of Stroke Mortality and Morbidity*).

Risk factors (variables)	Dependence at 28 days *		Dependence at 6 months *	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Years of education				
≥ 8	Reference (1.00)	0.004	Reference (1.00)	0.002
1-7	2.92 (1.43-5.97)		2.51 (1.19-5.29)	
Illiterate	3.66 (1.57-8.54)		5.09 (2.09-12.37)	
Age strata (years)				
35-64	Reference (1.00)	0.04	Reference (1.00)	0.004
≥ 65	2.01 (1.05-3.86)		2.76 (1.38-5.53)	
Stroke subtype by area computed tomography				
Normal	Reference (1.00)	0.03	Reference (1.00)	0.002
TACI	17.23 (2.93-101.07)		14.26 (3.14-64.76)	
PACI	1.51 (0.70-3.26)		2.62 (1.12-6.11)	
LACI	1.40 (0.70-2.83)		3.48 (1.61-7.53)	
POCI	0.84 (0.29-2.45)		1.84 (0.61-5.62)	
Length of stay in hospital (days)				
0-1	Reference (1.00)	0.008	Reference (1.00)	0.02
2-10	1.45 (0.77-2.73)		2.12 (1.06-4.24)	
≥ 11	4.09 (1.66-10.06)		3.62 (1.43-9.15)	
High blood pressure				
No	Reference (1.00)	0.14	Reference (1.00)	0.72
Yes	1.86 (0.82-4.21)		1.16 (0.52-2.62)	
Stroke event				
First stroke	Reference (1.00)	0.83	Reference (1.00)	0.87
Recurrent stroke	0.93 (0.49-1.78)		1.06 (0.55-2.05)	

LACI: lacunar infarct; Normal: examination without visible changes; PACI: partial anterior circulation infarct; POCI: posterior circulation infarct; TACI: total anterior circulation infarct.

* Multivariable adjustment by age, years of education, length of stay in hospital, stroke subtype by area computed tomography, high blood pressure and recurrent stroke. Significance of Hosmer-Lemeshow test: 28 days = 0.38 and six months = 0.75.

Table 4

Multivariate risk of functional dependence, including deaths, after stroke in the EMMA study (*Study of Stroke Mortality and Morbidity*).

Risk factors (variables)	Dependence at 28 days * OR (95%CI)	p-value	Dependence at 6 months * OR (95%CI)	p-value
Years of education				
≥ 8	Reference (1.00)	0.004	Reference (1.00)	0.002
1-7	2.97 (1.46-6.06)		2.55 (1.21-5.37)	
Illiterate	3.62 (1.55-8.42)		4.95 (2.05-11.97)	
Age strata (years)				
35-64	Reference (1.00)	0.03	Reference (1.00)	0.004
≥ 65	2.04 (1.06-3.90)		2.79 (1.40-5.57)	
Stroke subtype by area computed tomography				
Normal	Reference (1.00)	0.03	Reference (1.00)	0.003
TACI	16.64 (2.84-97.47)		13.29 (2.95-59.80)	
PACI	1.46 (0.67-3.14)		2.45 (1.06-5.64)	
LACI	1.35 (0.67-2.72)		3.24 (1.52-6.92)	
POCI	0.81 (0.28-2.36)		1.72 (0.57-5.20)	
Length of stay in hospital (days)				
0-1	Reference (1.00)	0.01	Reference (1.00)	0.026
2-10	1.39 (0.74-2.60)		1.98 (1.00-3.90)	
≥ 11	3.94 (1.61-9.65)		3.38 (1.35-8.46)	
High blood pressure				
No	Reference (1.00)	0.13	Reference (1.00)	0.68
Yes	1.88 (0.83-4.26)		1.19 (0.53-2.67)	
Stroke event				
First stroke	Reference (1.00)	0.80	Reference (1.00)	0.90
Recurrent stroke	0.92 (0.48-1.76)		1.04 (0.54-2.02)	

LACI: lacunar infarct; Normal: examination without visible changes; PACI: partial anterior circulation infarct; POCI: posterior circulation infarct; TACI: total anterior circulation infarct.

* Multivariable adjustment by age, years of education, hospital length of stay, stroke subtype by area computed tomography, high blood pressure, and recurrent stroke. Significance of Hosmer-Lemeshow test: 28 days = 0.44 and six months = 0.84.

in Martinique [24] that evaluated two age groups, very old (mean age of 88.8 years) and younger individuals (mean age of 65.8 years) 28 days after stroke, reported 78% and 48% functional impairment, respectively. The highest rate of functional impairment was reported by Dalal et al. [25] in a population-based study performed in Mumbai, India. In this study, a poor functional outcome was observed in approximately 60% of stroke survivors at 28 days after an acute event. A hospital-based study conducted in Antalya (Turkey) evaluated the one year functional outcome after ischemic stroke and found that 26% of stroke survivors (mean age of 61.2 years) were functionally dependent [26]. Consistent with our findings, the PISCIS project, a stroke community-based study performed in Iquique (Chile), also found a six month disability rate of about 30% after acute stroke [10]. Our findings diverged from those of a study in Joinville (Santa Catarina State, Brazil) [11], which found a 18% poor functional outcome rate among first-stroke survivors (mean age of 65 years), similar to the rate reported in Italy [23]. Although the Joinville region and the region included in our study have similar per capita incomes, in Joinville there is a smaller social gap compared to our sample population. In addition to the educational level, differences in access to medical services and rehabilitation can also exert an influence on recovery, as discussed below. Furthermore, advanced age and some characteristics, such as stroke subtypes and recurrent stroke events, may partially explain differences in functional outcome after an acute stroke event. Overall, ischemic functionally dependent patients had a longer survival than intracerebral hemorrhage

functionally dependent patients, and those who had their first-ever stroke event survived longer than those who had recurrent strokes [27].

Similar to other epidemiological studies of stroke survivors, we found high frequencies of cardiovascular risk factors, such as hypertension, diabetes, and heart disease [11,26,28]. However, they were not predictors for long-term disability as previously described [29,30]. A low level of education, as a marker of socioeconomic status, was the most important risk factor for functional dependence in our sample. Overall, our patients had low levels of education (< 8 years) and, as previously reported [3,31], we found an inverse association between education and functional outcome, indicating a dose-response effect. In particular, among stroke survivors with no formal education, the risk of disability was progressively higher during the follow-ups. There are several possible explanations for this relationship, such as difficulties related to; access of rehabilitation centers, adherence to treatment, comorbidities and a lack of knowledge about cardiovascular health [32]. The University Hospital facility belongs to the Brazilian Unified National Health System (SUS) which offers universal healthcare coverage [33], including emergency care and hospitalizations that are totally free of charge. The majority of our study patients lived in the poorest areas on the west side of the city, and had few specialized services to help with their recovery process. Knowledge about stroke risk factors, symptoms and treatment is an important outcome predictor. It has been reported that people with low levels of education and income have less knowledge about stroke, even among those who have experienced a previous event or who have had a family historyof stroke [34,35]. Previous studies performed in Brazil reinforce our findings about the relationship between socioeconomic and functional outcome [36,37]. Moreover, low levels of education may interfere with treatment adherence and medical recommendations.

Regarding the severity of stroke, and in agreement with previous studies, we found that TACI was the most important predictor of poor functional recovery during the six month follow-up [12,38,39]. Finally, longer hospitalizations were associated with a higher risk of disabilitiesin our study. As inour findings, previous reports found that patients with severe injuries, delay from onset to hospitalization and complications from the disease resulted in a worse functional outcome [4,40].

Our study has some limitations, such as the use of dichotomized mRS as the only measure of functional outcome, which may not be sensitive enough to capture small functional improvements. Considering the complexity involved in predicting disability after stroke, it is important to examine other variables of interest, such as the National Institutes of Health Stroke Scale (NIHSS) score at admission, atrial fibrillation and patient access to rehabilitation information. Community-based studies using standardized diagnostic criteria with verified diagnoses are an ideal means of studying the burden of disease in general and stroke in particular. Hospital-based studies of stroke are also useful, but are more prone to selection bias and are influenced to varying degrees in different countries by factors like wealth, health insurance, stroke specialization of the receiving center, confidence in diagnosis by the referring physician and proximity to health care facilities. However, our study has some strength, such as the use of the WHO STEPwise approach to stroke surveillance method, which has been characterized as a good tool for collecting reliable and easily comparable data in less-developed countries.

Conclusions

In conclusion, we found that the most important post-stroke predictors of functional disability were low levels of education and the anatomical location of cerebral injury. Our findings reinforce the necessity of developing strategies to reduce social inequalities, which will result in more suitable management of stroke patients in developing countries.

Resumo

Foi avaliada a dependência funcional em sobreviventes de acidente vascular cerebral (AVC) do Estudo da Mortalidade e Morbidade do Acidente Vascular Cerebral*, utilizando a Escala de Rankin. De 355 sobreviventes com AVC isquêmico (idade média de 67,9 anos), 40% tinham dependência funcional em 28 dias e 34,4% em 6 meses. Os principais indicadores de dependência física foram identificados em 28 dias, e eram: baixa escolaridade (analfabetos* vs. ≥ *8 anos de educação, RC = 3,7; IC95%: 1,60-8,54) e localização do AVC (infarto circulação total anterior, RC = 16,9; IC95%: 2,93-97,49). Baixo nível educacional e insulto cerebral isquêmico influenciaram o grau de dependência funcional nesses sobreviventes de AVC. Nossos achados reforçam a necessidade de desenvolvimento de estratégias para reabilitação de pacientes com AVC e formulação de estratégias específicas de atenção e tratamento para essas pessoas, especialmente na população com baixo nível socioeconômico.*

Acidente Vascular Cerebral; Escolaridade; Avaliação de Resultados (Cuidados de Saúde)

Contributors

T. G. Fernandes participated in the design of study, performed statistical analyses, wrote the first draft of the manuscript and reformulated subsequent revisions. A. C. Goulart, I. M. Benseñor and P. A. Lotufo participated in the design of study, performed statistical analyses and revised the final version of manuscript. W. R. Santos-Junior revised the final version of manuscript. A. P. Alencar performed statistics analyses and revised the final version of manuscript.

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