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ORIGINAL RESEARCH

Acute predictors of self-rated health in individuals with stroke at 3 and 12 months after hospital discharge

Camila Lima Gervásio Mendes[a], Kênia Kiefer Parreiras de Menezes[a], Nathália Aparecida Gravito Rodrigues[b], Janaine Cunha Polese[a,c], Iza de Faria-Fortini[b,d], Christina Danielli Coelho de Morais Faria[a,c,*]

[a] *Graduate Program in Rehabilitation Sciences, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil*
[b] *Graduate Program in Occupation Studies, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil*
[c] *Department of Physical Therapy, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil*
[d] *Department of Occupational Therapy, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil*

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Abstract
Background: Self-rated health (SRH) is the perception of an individual regarding their health and an indicator of health status. Identifying predictors of SRH allows the selection of evidence-based interventions that mitigate factors leading to poor SRH and the identification of individuals at risk of worse SRH.
Objective: To determine the acute predictors of general and time-comparative SRH of individuals with stroke at 3 and 12 months after hospital discharge, considering personal, physical, and mental functions.
Methods: A prospective study was developed to assess general and time-comparative SRH at 3 and 12 months after hospital discharge according to 2 questions ("In general, how would you say your health is?" and "Compared to a year ago, how would you rate your general health now?"). Potential acute predictors analyzed were personal (age, sex, comorbidities, socioeconomic status, and family arrangement), physical (stroke severity, motor impairment, and independence for basic activities of daily living [ADLs]), and mental (cognitive) functions.
Results: Age (adjusted odds ratio [aOR]=2.10) and independence in basic ADLs (aOR=0.29) were significant predictors of SRH at 3 months; at 12 months, no significant predictor was found. Motor impairment (aOR=3.90) was a significant predictor of time-comparative SRH at 3 months; at 12 months, sex (aOR=0.36) and independence in basic ADLs (aOR=0.32) were significant predictors.

* Corresponding author at: Physical Therapy, Universidade Federal de Minas Gerais, Brazil.
E-mail: cdcmf@ufmg.br (C.D. Faria).

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Conclusions: At 3 months, individuals with stroke who were ≥65 years old and dependent on basic ADLs were more likely to have worse general SRH, while those with higher motor impairments were more likely to have worse time-comparative SRH. At 12 months, women and individuals dependent on basic ADLs were more likely to have worse time-comparative SRH.

Introduction

Stroke is a condition that causes serious disability in adults, with 12 million cases registered in the world in 2019.[1] Most survivors remain with disabilities,[2] which largely compromise their health and quality of life.[3] In this context, several aspects regarding functioning and health should be investigated, including the self-perception of health, named self-rated health (SRH).[4]

SRH is an indicator of health status of the World Health Organization (WHO) that assesses the perception of an individual regarding their health.[4,5] SRH is commonly assessed using simple questions that are widely used in clinical and research contexts with various objectives and populations.[4,7-9] SRH encompasses relevant information related to the personal, physical, and mental functions of the individual.[4,10] Identifying factors related to these functions that could be associated with better or worse SRH provides useful information to health professionals in their clinical practice, focusing on measures of health that consider the individual perspective and follow the evolution of the individual's health over time. Therefore, clinical decision-making and planned actions can be based on factors associated with a health indicator that is recommended by the WHO and is a patient-centered measure.

Only three studies[11-13] investigating variables associated with better or worse SRH in individuals with stroke were found in the literature.[8] Larsen et al.[11] reported that a more severe stroke, comorbidities, smoking, worse education level, and high age were associated with worse general SRH in the subacute phase (three to six months after stroke). Mavaddat et al.[12] reported that physical impairments, comorbidities, depression, and being of lower social class were associated with worse general SRH in the chronic phase (> six months after stroke). Finally, Araújo et al.[13] reported that only depression was associated with worse general SRH in the chronic phase. Despite the important results, these studies used a cross-sectional design. Therefore, these variables cannot be considered predictors of SRH.

Identifying well-established predictors of SRH that rehabilitation strategies can modify may allow the selection of evidence-based interventions that mitigate factors leading to poor SRH. Furthermore, identifying acute predictors of SRH may help target effective treatment by defining risk groups for adverse outcomes.[5,8,13,14] Finally, a complete SRH assessment for individuals with stroke requires the use of general and time-comparative questions.[5] Therefore, the present study aimed to determine the acute predictors of general and time-comparative SRH of individuals with stroke at 3 and 12 months after hospital discharge, considering personal (age, sex, comorbidities, socioeconomic status, and family arrangement), physical (stroke severity, motor impairment, and independence for basic activities of daily living [ADLs]), and mental (cognitive) functions. Our findings may assist in developing new treatment strategies and public policies to improve SRH throughout the subacute (3 months) and chronic (12 months) phases following hospital discharge.

Methods

Design

This longitudinal, observational, study was conducted in a public hospital of Belo Horizonte (Minas Gerais state, Brazil). This metropolis has the third largest urban agglomeration in Brazil. This study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and was approved by the research ethics committees of the Universidade Federal de Minas Gerais and the Hospital Risoleta Tolentino Neves (CAAE: #26431319.6.0000.5149). All individuals who agreed to participate signed the informed consent form.

Participants

Individuals ≥ 20 years old, diagnosed with primary stroke confirmed by neuroimaging, and admitted to the stroke unit of the hospital between February 2020 and February 2021 were invited to participate in this study. We only included individuals without previous disabilities as defined by a Barthel Index score > 17[14] and without cognitive deficits as determined by the Cognition Hetero-Anamnesis List.[15] For the initial assessment, family and caregivers answered both questionnaires referring to activity performance and cognitive function of the participants immediately before the stroke, following established procedures and recommendations.[14] SRH evaluation was performed by telephone at 3 and 12 months after hospital discharge. Individuals with cognitive impairments (assessed using the 22-item of the Mini-Mental State Examination, cut-off score < 15[16]) or aphasia (identified by the subtest of sentence comprehension of the Quick Aphasia Battery[17]) at 3 and 12 months were excluded.

Procedures

Within 72 h after hospital admission, individuals or their caregivers answered a semi-structured questionnaire regarding sociodemographic data (age, sex, civil status, schooling, comorbidities, socioeconomic status, and family arrangement). Clinical-functional assessments (stroke type and severity, motor impairment, independence for basic ADLs, and cognitive function) were performed using

instruments applied by trained examiners and following recommended and standardized procedures.[18-22]

At 3 and 12 months after hospital discharge, individuals were contacted by telephone, and those without cognitive impairments or aphasia had their SRH assessed. These criteria were adopted because the SRH is self-reported, thus requiring adequate cognitive and language functions to ensure data reliability.

The dependent variable was general and time-comparative SRH, being evaluated by two questions of the Short-Form-36 questionnaire ("In general, how would you say your health is?" and "Compared to a year ago, how would you rate your general health now?").[18] The general SRH question was dichotomized into good and poor, with the responses "excellent," "very good," and "good" considered as "good SRH," and the responses "poor" and "very poor" as "poor SRH."[5] The time-comparative SRH question was dichotomized into better and worse, with the responses "much better," "little better," and "almost the same" considered as "better SRH," and the responses "little worse" and "much worse" as "worse SRH."[5] In the time-comparative SRH, for both periods (3 and 12 months), the comparison period to be considered by the patient was before the stroke.

The independent variables and potential predictors of SRH were organized according to personal, physical, and mental functions:

- Personal: 1) age (adult $<$ 64 years, or older adults $\geq$ 65 years); 2) sex (male or female); 3) comorbidities (present or absent); 4) socioeconomic status according to the economic classification criteria of the Brazilian Association of Research Companies (ABEP), classified as high (A, B, and C ABEP classes: monthly family income $\geq$ R$1024.00 / ~$200.00) or low (D and E ABEP classes: monthly family income $<$ R$1024.00 / ~$200.00)[19]; and 5) family arrangement (alone or accompanied).

- Physical: 1) stroke severity assessed by the National Institute Health Stroke Scale, classified as mild ($\leq$ 3 points) or moderate to severe (4 to 42 points)[20]; 2) motor impairment assessed by the Fugl-Meyer Scale (FMS), classified as mild ($>$ 79 points) or moderate to severe $\leq$ (79 points) motor impairment[21-23]; and 3) independence in basic ADLs assessed by the Modified Barthel Index, classified as full to moderate dependence ($\leq$ 45 points) or slight dependence to total independence (46 to 50 points).[24]

-Mental: cognitive function assessed by the MMSE,[16] classified as high ($\leq$ 23 points) or moderate (24 to 30 points).

Sample size

For the sample size calculation, nine independent variables were considered as possible predictors for general and time-comparative SRH, including five personal (age, sex, comorbidities, socioeconomic status, and family arrangement), three physical (stroke severity, motor impairment, and independence in basic ADLs), and one mental (cognitive function). The formula used was $P = (n + 1)*10$, where "n" is the number of independent variables inserted in the model. At least 100 individuals were estimated to be evaluated at 3 and 12 months after hospital discharge. However, a loss of follow-up of 50% was considered, totaling 150 individuals to be recruited and included in this study.

Statistical analysis

Descriptive statistics and normality tests (Kolmogorov-Smirnov) were conducted for all variables. Binary logistic regression (stepwise method) was used to identify the general and time comparative SRH predictors at 3 and 12 months after hospital discharge, resulting in four regression models, all including the nine independent variables. Multicollinearity was verified considering tolerance value $>$ 0.1 and variance inflation factors (VIF) $<$ 10. The association between the dependent and independent variables was adjusted considering $\chi 2$, p, R^2 Nagelkerke, and Hosmer–Lemeshow. The results were presented in odds ratio (OR) with a confidence interval of 95% (95% CI). All statistical analyses were performed using the SPSS software (SPSS Inc., Chicago, IL, USA), version 20, considering a significance level of $\alpha = 0.05$.

Results

Of the 538 individuals admitted to the stroke unit during the recruitment period, 342 met the eligibility criteria, and 307 were evaluated. General and time-comparative SRH were assessed in 200 and 121 individuals at 3 and 12 months, respectively. Of the 107 participants who were not assessed at the first follow-up, 62 were lost and 45 excluded. Of the 186 participants who were not evaluated in the second follow-up, 148 were lost and 38 were excluded. The detailed reasons and respective values are shown in Fig. 1. No statistical differences were found in the baseline characteristics between individuals who dropped out and those who remained in the study during the follow-up. The sociodemographic and clinical-functional characteristics of the individuals included in the study are described in Table 1.

The four regression models met the assumptions of error independence, linearity, and absence of multicollinearity (VIF values ranging from 1.0 to 1.2). At 3 months, age and independence in basic ADLs were significant predictors of general SRH (X^2 = 18.78; $p < 0.001$; R^2 Nagelkerke = 0.146; Hosmer–Lemeshow test = 0.979). Individuals $\geq$ 65 years had a greater chance of having worse general SRH (adjusted OR = 2.10), whereas individuals independent in basic ADLs had a lesser chance of having worse general SRH (adjusted OR = 0.29). No significant predictor was found for general SRH at 12 months (Table 2).

Motor impairment was a significant predictor of time-comparative SRH at 3 months, (X^2 = 17.50; $p < 0.001$; R^2 *Nagelkerke* = 0.124; Teste de *Hosmer–Lemeshow* = 0.979). Individuals with higher motor impairments were more likely to have worse time-comparative SRH (adjusted OR = 3.90). Sex and independence in basic ADLs were significant predictors of time comparative SRH at 12 months (X^2 = 12.06; p = 0.002; R^2 *Nagelkerke* = 0.166; Teste de *Hosmer–Lemeshow* = 0.995). Women (adjusted OR = 0.36) and individuals dependent on basic ADLs (adjusted OR = 0.32) were more likely to have worse time-comparative SRH.

Discussion

The present study aimed to determine the acute predictors of general and time-comparative SRH of individuals with

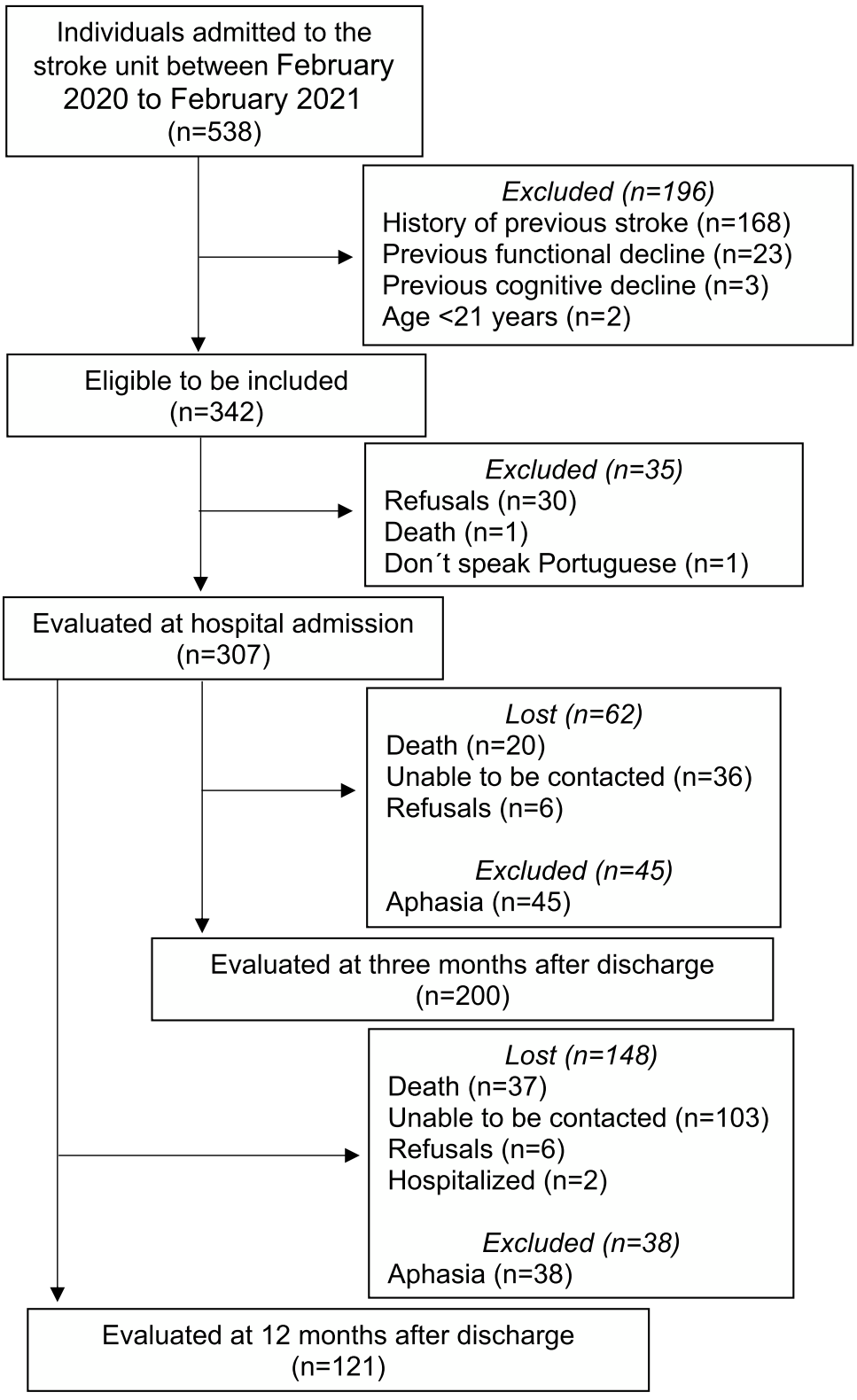

Fig. 1 Flow of the participants thorughout the study.

stroke at 3 and 12 months after hospital discharge, considering personal, physical, and mental functions. Regarding the general SRH, age and independence in basic ADLs were significant predictors at 3 months. No significant predictors were found for general SRH at 12 months. Regarding the time-comparative SRH, motor impairment was a significant predictor at 3 months, and sex and independence in basic ADLs were at 12 months.

At 3 months, age was a significant and strong (aOR=2.10) predictor of general SRH, indicating that individuals ≥

Table 1 Sociodemographic and clinical-functional characteristics of the sample.

Variables		At 3 months (*n* = 200)	At 12 months (*n* = 121)
Age (years), mean (SD)		61.1 (14.8)	59.6 (14.9)
Sex	Men, n (%)	107 (53.8%)	53 (43.8%)
	Women, n (%)	93 (46.2%)	68 (56.2%)
Civil status, n (%)	Married	101 (50.8%)	67 (55.3%)
	Single	35 (17.6%)	18 (14.9%)
	Widower	34 (17.1%)	18 (14.9%)
	Separated	30 (14.5%)	18 (14.9%)
Schooling, n (%)	Illiterate	24 (11.5%)	14 (11.6%)
	From 1 to 4 years	87 (43.7%)	47 (38.8%)
	From 5 to 7 years	33 (16.6%)	25 (20.7%)
	From 8 to 10 years	29 (14.6%)	22 (18.2%)
	11 or more years	27 (13.6%)	13 (10.7%)
Stroke type, n (%)	Ischemic	173 (86.9%)	103 (85.1%)
	Hemorrhagic	27 (13.1%)	18 (14.9%)
Stroke severity (NIHSS), n (%)	Mild ($\leq$3)	120 (60.0%)	74 (61.2%)
	Moderate to severe (4—42)	80 (30.0%)	47 (38.8%)
General SRH, n (%)	Good	149 (74.5%)	102 (84.2%)
	Bad	51 (25.5%)	19 (15.8%)
Time comparative SRH, n (%)	Better	109 (54.5%)	77 (63.7%)
	Worse	91 (45.5%)	44 (36.3%)

NIHSS, National Institute Health Stroke Scale; SD, standard deviation; SRH, self-rated health.

65 years old are more likely to have a worse SRH. One previous study also found age as predictor of general SRH in individuals with chronic stroke (aOR=0.99),[6] indicating that older age seems to contribute to a worse general SRH. A possible explanation is that older adults, especially in Brazil, are often exposed to different types of violence, lack of specialized medical care, low retirement and pension incomes, and few leisure opportunities.[25] These factors can lead to a negative self-perception of health, especially for those with chronic diseases, such as stroke. In addition, older adults are also more vulnerable to developing other diseases, which can generate more disabilities, limitations, and restrictions that impact their general SRH.[26]

Thus, although age is not a modifiable variable, public policies aimed at preventing and promoting health throughout the ageing process should be increasingly encouraged and valued.

Independence in basic ADLs was also a significant predictor of general SRH at 3 months and for time-comparative SRH at 12 months, indicating that independent individuals are less likely to have a worse general SRH. One previous study also found a significant association between independence and general SRH in individuals with chronic stroke,[6] indicating that dependence level also contributes to worse general SRH. This may occur because more dependent individuals commonly have limitations in activities performed in and outside the home environment, and restrictions on social participation.[27] These limitations can generate disabilities and affect personal, physical, and mental functions,[27] which are part of the health concept according to the WHO.

At 12 months, no significant predictors were identified for general SRH. A possible explanation is that the time-comparative SRH question is specific, and the general SRH question is broad. Thus, other variables of the acute phase not

Table 2 Results of binary logistic regression models.

SRH	Time after hospital discharge	Predictors	Adjusted OR (95% CI)	*p-value*
General SRH	3 months	Age	2.10 (1.04, 4.26)	0.04
		Independence for basic activities of daily living	0.29 (0.14, 0.58)	0.001
	12 months	-*	—	—
Time-comparative SRH	3 months	Motor impairment	3.90 (2.01, 7.60)	0.001
	12 months	Sex	0.36 (0.14, 0.93)	0.030
		Independence for basic activities of daily living	0.32 (0.13, 0.82)	0.020

95% CI, 95% confidence interval; OR, odds ratio; SRH, self-rated health.
* No significant predictor was found.

considered in the present study may be significant predictors, such as depression. Furthermore, the recovery of individuals after the stroke varies according to each phase (hyperacute, acute, early subacute, late subacute, and chronic).[28] Consequently, it is possible that the general SRH at 12 months is predicted by variables obtained in more advanced stages of the condition (3 or 6 months after the stroke).

At 3 months, motor impairment was a significant and strong (aOR=3.90) predictor of time-comparative SRH, indicating that individuals with greater motor impairments are more likely to have worse SRH. No previous study investigated associations between motor impairment and SRH after stroke. However, individuals after stroke commonly present motor impairments, which limit their ADLs, restrict their social participation, and may be associated with a worse perception of health.[27] Thus, interventions focused on these impairments need to be prioritized in the acute period of the stroke.

Finally, at 12 months, sex was a significant predictor of time-comparative SRH, indicating that women are more likely to have worse SRH. This result differs from the findings of Bjälkefur et al.,[6] probably because these authors evaluated general SRH, while the present study rated the time-comparative SRH. Furthermore, cultural differences may also explain this variation. According to the National Health Survey of 2019, in Brazil, women seek health services more than men (22.1% versus 14.8%).[29] Therefore, women possibly tend to self-evaluate health more carefully than men. Lastly, women have higher rates of comorbidities after a stroke when compared to men, which may also justify worsened SRH perception among this group.[30] This reasoning is corroborated by a previous Brazilian study reporting that men tend to worry less about their health[31] and may reflect less on their time-comparative SRH.

Among the acute predictors of SRH identified in this study, independence in basic ADLs and motor impairment are aspects modifiable by health professionals over time. Previous studies have shown that muscle strength training[32] positively affects these outcomes (independence in basic ADLs and motor impairment) in individuals with stroke. Therefore, if implemented immediately after stroke, it may positively impact general and time-comparative SRH at 3 and 12 months after hospital discharge. Future studies should investigate the effectiveness of these interventions to improve the general and time-comparative SRH in individuals with stroke.

Limitation

To our knowledge, this study was the first to investigate the acute predictors of SRH in individuals with stroke in the subacute and chronic phases, considering personal, physical, and mental functions and using two questions of the SRH. The first limitation of this study was the large drop-out rate of participants mainly due to the difficulty of contacting individuals by telephone, which limits the generalization of the results. Also, other variables not evaluated by this study, such as depression, may be predictors of general and time-comparative SRH. Finally, the individuals were recruited in only one hospital. Although this was a reference hospital for urgent and emergency care offering a stroke unit and specialized care to this population, future studies could purposedly collect data from various health settings relevant to neurologic care.

Conclusions

Individuals $\geq$ 65 years old and dependent on basic ADLs were more likely to have a worse general SRH at 3 months. Individuals with higher motor impairments were more likely to have worse time-comparative SRH at 3 months, while women and individuals dependent on basic ADLs were more likely to have worse time-comparative SRH at 12 months. The strongest predictors were age for general SRH at 3 months and motor impairments for time-comparative SRH at 3 months. Therefore, actions directed at elderly people and for motor impairments must be implemented immediately after the stroke.

Conflicts of interest

The authors declare no conflicts of interest.

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