

ARTIGO ORIGINAL/ORIGINAL ARTICLE

Destination Home? Patterns and Predictors of Home Discharge in Acute Stroke Survivors

Alta para Casa? Padrões e Preditores de Alta para o Domicílio em Sobreviventes de AVC Agudo

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Abstract

Introduction: Stroke is a leading cause of permanent disability, often requiring participation in a specialized and personalized rehabilitation program following the event. Around 30% of stroke survivors experience ongoing disabilities that require extensive support from families and healthcare providers. However, there is a gap in national literature on discharge planning and care coordination for these patients, as well as predictive factors for their ability to return home after a stroke.

The primary aim of this study was to describe the hospital discharge outcome of patients admitted with acute stroke. Secondary objectives included a descriptive analysis of their demographic profile, risk factors, acute phase treatment, and length of hospitalization, as well as identification of predictors of destination at discharge.

Methods: A retrospective cohort study of patients admitted with acute stroke during 2021 was performed, including a descriptive analysis of the demographic and clinical characteristics, and post-hospital discharge destination. Non-parametric tests were used for association analysis, and linear regression was used to identify predictors of home discharge.

Results: Two hundred and four patients were included. The majority were discharged home with or without outpatient rehabilitation (55.4%). Significant predictors of destination of discharge included age, previous history of stroke, nasogastric tube feeding need on admission, vesico-sphincteric abnormalities on admission, National Institutes of Health Stroke scores (NIHSS) ≤ 10 on admission and after acute treatment, and ≤ 7 days stays on the stroke unit. Sex, the type of stroke, Trial of Org 10172 in Acute Stroke Treatment classification (TOAST) or Oxfordshire Community Stroke Project (OCSP) classifications did not appear to have a discernible association with discharge destination.

Conclusion: These results help to understand the factors that influence discharge home after stroke, as well as the ability to predict discharge home. This is critical information for optimizing the rehabilitation of stroke survivors, reducing the length of hospital stays and associated costs.

Resumo

Introdução: Atualmente, o acidente vascular cerebral (AVC) constitui a principal causa de incapacidade permanente na população adulta. Após o evento agudo, os sobreviventes apresentam frequentemente necessidade de integrarem programas

de reabilitação especializados, e destes, cerca de 30% sofrem incapacidades permanentes que requerem cuidados de saúde e extenso suporte familiar. Contudo, é escassa a literatura nacional sobre o planeamento de alta e coordenação de cuidados à data de alta, assim como não estão identificados fatores preditores de regresso ao domicílio após AVC agudo.

O principal objetivo deste estudo foi descrever os padrões de alta hospitalar de doentes admitidos com AVC agudo. Como objetivos secundários, realizar uma análise descritiva do perfil demográfico, fatores de risco cardiovasculares, tratamento de fase aguda e duração do internamento, assim como identificar preditores do destino destes doentes à data de alta.

Métodos: Estudo de coorte retrospectivo de doentes admitidos em internamento hospitalar por AVC agudo durante o ano de 2021. Foi realizada uma análise descritiva das características demográficas e clínicas e do destino após alta hospitalar. Foram utilizados testes não-paramétricos para análise de associações e regressão linear para identificar preditores de regresso ao domicílio.

Resultados: Duzentos e quatro doentes foram incluídos. A maioria dos doentes teve alta para o domicílio, com ou sem necessidade de reabilitação em ambulatório (55,4%). Terapias em ambulatório incluíram fisioterapia em 80,6% dos casos, terapia da fala em 29,0% e terapia ocupacional em 6,5%. A idade, existência de história pregressa de AVC, necessidade de sonda nasogástrica à admissão, alterações vesico-esfincterianas à admissão, *National Institutes of Health Stroke score* (NIHSS) ≤ 10 à admissão e após tratamento de fase aguda, assim com permanência na unidade de AVC ≤ 7 dias demonstraram ser preditores significativos do destino de alta hospitalar. Por outro lado, o sexo, o tipo de AVC, classificação *Trial of Org 10172 in Acute Stroke Treatment* (TOAST) ou *Oxfordshire Community Stroke Project* (OCSP) não parecem ter relação com o destino de alta.

Conclusão: Estes dados ajudam compreender os fatores que influenciam a orientação após hospitalização por AVC, bem como a capacidade de prever a alta para o domicílio, dados cruciais para tentar otimizar a reabilitação dos sobreviventes, reduzir a duração dos internamentos e os seus custos associados.

Introduction

Stroke is a major public health concern, causing significant disability and death. In Europe, at the beginning of the 21st century, around 1.34% of the population experienced a stroke each year, equating to six million prevalent stroke cases.¹ Portugal has a high incidence rate of 250 strokes per 100 000 people per year,² and it is the leading cause of death in the country, claiming 58.4 per 100 000 inhabitants.³

Despite progress in lowering stroke mortality rates,³ Global data indicates that stroke is the second leading cause of disability-adjusted life-years among individuals over the age of 50, and a substantial portion of stroke survivors, around 30%, experience ongoing disabilities that require extensive support from families and health-

care providers.⁴ These cases have a significant socio-economic impact, with both direct (stemming from acute hospitalization, rehabilitation, and medical complications) and indirect (attributable to reduced productivity) costs.⁴

Rehabilitation plays a crucial role in reducing impairments, enhancing functional abilities, and facilitating integration into social, family, and professional aspects. Given the high costs associated with rehabilitation, it is essential to identify patients who can return home and prioritize their admission to a specialized hospital service for Physical Medicine and Rehabilitation (PMR).

In Portugal, the post-acute hospitalization and discharge destination following an acute stroke should follow the guidelines outlined in *Direção Geral da Saúde*

054/2011, issued on 27/12/2011.⁵ This guideline considers the patients individual requirements, such as their level of impairment, functional capacity, social support system, and availability of informal caregivers. Patients may be discharged home with or without additional outpatient therapy, be admitted to an inpatient PMR department, or be admitted to a skilled nursing facility (SNF), depending on their individual needs. The SNF is categorized into a convalescence unit (anticipated stay of 1 month), a medium-term unit (anticipated stay of 3 months), and a long-term unit for patients with less potential for autonomy recovery in activities of daily living with a predicted stay of more than 90 days, alongside integration with the home-based care option.

Recognizing destination patterns after hospital discharge, understanding factors influencing post-hospitalization destinations, and predicting conditioning for home discharge are essential for optimizing rehabilitation, reducing hospitalization durations, and associated costs. Nevertheless, a notable gap exists in comprehensive national literature addressing hospital discharge and the predictive factors influencing stroke patients; ability to return home.

This study primary objective was to describe the discharge destination of patients admitted with acute stroke, including integration in outpatient rehabilitation programs. A second aim was to perform a descriptive analysis of their demographic profile, risk factors, acute-phase treatment, and the duration of hospitalization. The last aim was to identify predictors of destination at discharge.

Methods

This retrospective study examined all acute stroke patients admitted at Hospital Pedro Hispano in Porto, Portugal, from January to December 2021. We carefully extracted demographic, clinical, and stroke-specific data [type, Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification, Oxfordshire Community Stroke Project (OCSP) score] from the hospitals electronic medical record system.

We also obtained clinical outcomes, including National Institutes of Health Stroke Scale (NIHSS) scores upon admission and after treatment, stroke unit admission, length of stay, the need for a nasogastric tube, and the presence of vesicosphincteric abnormalities at admission. Additionally, we investigated the destinations at discharge following acute stroke, as well as the therapies performed in an outpatient setting.

The study was approved by the Ethics Committee for Health of Unidade Local de Saúde de Matosinhos.

Discharge Destination

Data were collected on the post-hospital discharge outcomes of patients with acute strokes, including whether they returned home without further treatment, were home discharged requiring outpatient rehabilitation, were admitted to a rehabilitation hospital, were transferred to a SNF (convalescence unit, medium-stay, long-term, or in-home care), or were transferred to a hospital in their local area. Information was also gathered on whether patients experienced a fatal outcome.

To enhance statistical analysis and streamline conclusions, the dataset was dichotomized into two groups: (1) individuals discharged home, irrespective of the need for outpatient treatment, and (0) those hospitalized in rehabilitation settings. Rehabilitation settings included facilities such as the SNF, nursing homes, and specialized rehabilitation hospitals.

Additionally, information was obtained on those who were discharged home but required outpatient treatments, specifying the therapies they underwent, including physiotherapy (PT), speech therapy (ST), and occupational therapy (OT).

Statistical Analysis

A descriptive analysis was conducted, presenting categorical variables as frequency rates (percentages) and continuous variables as mean (standard deviation). To assess the strength of the univariate relationship between predictive factors and home discharge, we performed a comparative statistical analysis. Bivariate correlation was used for continuous variables, chi-square tests for categorical variables, and point-biserial correlation for discrete variables measuring the strength and direction of the linear relationship between binary and continuous variables. Additionally, logistic regression analysis was employed, with home discharge serving as the dependent variable, and relevant covariates included in the model. Odds ratios were calculated to identify significant factors associated with returning home. The association of each individual variable was expressed in an odds ratio, 95% confidence interval, and *p*-value. Statistical analysis of the collected data was done through the IBM SPSS statistics software version 28.0. *p*-values <0.005 were considered statistically significant.

Results

Two hundred and four patients were included in the study. The average patient age was 70.2 years (SD 13.8 years), ranging from 31 to 95 years. Approximately half of the patients (55.9%) were male, and the mean score for modified Rankin (mRankin) was 0.9 (SD 1.1). The most prevalent comorbidity was hypertension in 134 patients (73.6%).

Ischemic strokes accounted for 76.5% of cases, and the most common etiology considering TOAST classification was cardioembolic (36.0%). Thrombolysis and thrombectomy were provided in 19.6% and 14.2% of cases, respectively. The mean NIHSS on admission was 8.0, decreasing to 6.7 post-acute phase treatment. Hospital admission to the stroke unit was observed in the majority (79.9%) of cases, with an average stroke unit stay of 9.7 days. Upon admission, 22.8% of cases required nasogastric tube feeding, and 28.3% exhibited vesico-sphincteric abnormalities. The demographic and clinical characteristics of the patients at baseline are summarized in **Table 1**.

Discharge Destination

After discharge, 28.3% of patients attended outpatient treatments, 23.9% were directed home with no additional rehabilitation treatment needed, 24.7% were referred to the National Network of Integrated Continued Care, with the most frequent referrals being to convalescence units and medium-term units. Additionally, 8.1% were directed to a specialized rehabilitation hospital. Outpatient therapeutic interventions included physiotherapy (PT) in 80.6% of cases, speech therapy (ST) in 29.0% of cases, and occupational therapy (OT) in 6.5% of cases (**Table 2**).

Predictors of Home Discharge

The study identified several factors significantly associated with home discharge. **Table 3** presents the bivariate correlations between prognostic factors and discharge destination, and **Table 4** displays the results of the logistic regression analysis.

• Age

Age showed a significant association with home discharge (point-biserial correlation=0.29, $p < 0.001$). This finding was supported by the linear regression study, indicating that patients 70 years or less were 2.73 times more likely to be discharged home than older ones ($p = 0.004$; 95% CI for OR 1.38-5.45).

Table 1. Demographic and clinical characteristics.

Demographic and clinical characteristics	Total n = 204
Males, n (%)	114 (55.91%)
Age (years), mean (SD)	70.2 (+ 13.82)
Previous mRankin. mean (SD)	0.9 (+ 1.14)
Relevant clinical background, n (%)	
Hypertension	134 (73.63%)
Diabetes mellitus	61 (33.72%)
Dyslipidemia	120 (66.34%)
Atrial fibrillation	39 (21.50%)
Obesity	67 (37.00%)
Smoker/ex-smoker	33 (18.31%)
Stroke history	36 (19.81%)
Stroke characteristics	
Stroke, n (%)	
Ischemic	156 (76.51%)
Hemorrhagic	47 (23.49%)
TOAST classification, n (%)	
Large artery atherosclerosis	38 (25.34%)
Cardioembolism	54 (36.02%)
Small artery occlusion	28 (18.71%)
Stroke of other determined cause	9 (6.00%)
Stroke of undetermined cause	21 (14.02%)
OCSP classification, n (%)	
TACI	44 (30.34%)
PACI	42 (29.4%)
LACI	31 (21.41%)
POCI	28 (19.32%)
Acute treatment, n (%)	
None	64 (31.45%)
Thrombolysis	29 (14.27%)
Mechanical thrombectomy	18 (8.89%)
Thrombectomy + Thrombolysis	11 (5.41%)
Medication	65 (31.92%)
Surgical evacuation of intracerebral hemorrhage	1 (0.58%)
Clinical outcomes	
Nasogastric tube feeding need on admission, n (%)	43 (22.87%)
Vesico-sphincteric abnormalities on admission, n (%)	43 (28.37%)
NIHSS on admission, mean (SD)	8.03 (+ 6.86)
NIHSS after acute treatment, mean (SD)	6.67 (+ 6.78)
Stroke unit admission, n (%)	163 (79.93%)
Days on Stroke unit, mean (SD)	9.7 (+ 9.81)
Death, n (%)	8 (3.92%)

Results were presented as n (%) or mean \pm SD standard deviation, LACI lacunar infarct. NIHSS National Institutes of Health Stroke Scale, OCSP Oxfordshire Community Stroke Project, PACI partial anterior circulation infarcts, POCI posterior circulation infarcts, TACI total anterior circulation infarcts.

• Personal antecedents

A notable observation in personal history was a significant correlation between a prior history of stroke and the destination of discharge (Chi-square=5.0, $p=0.025$). This association was further corroborated by the linear regression analysis, which revealed that individuals with a prior history of stroke were 3.33 times more likely to be discharged to a non-home setting compared to those without such a history.

• Nasogastric tube feeding need on admission

An association was observed between the need for a nasogastric tube on admission and the destination of discharge (Chi-square=26.06, $p<0.001$). This finding was further supported by linear regression analysis, revealing that patients requiring nasogastric tube feeding on admission were 13.72 times more likely not to be discharged home compared to patients who did not require nasogastric tube feeding ($p=0.016$; 95% CI for OR 1.63-115.78).

Table 2. Discharge destination of the patients.

Destination	n=130
Home with no treatment need, n (%)	33 (25.38%)
Outpatient clinic, n (%)	39 (30.00%)
PT	23 (59.0%)
ST	6 (15.4%)
PT + ST	7 (17.9%)
PT + OT	3 (5.1%)
Skilled Nursing Facility, n (%)	
Convalescence unit	15 (11.54%)
Medium term unit	15 (11.54%)
Long term unit	1 (0.77%)
In-home care	3 (2.31%)
Other hospital, n (%)	10 (7.69%)
Nursing homes, n (%)	3 (2.31%)
Rehabilitation specialized hospital, n (%)	11 (8.46%)

Results were presented as n (%), PT physiotherapy, ST speech therapy, OT occupational therapy.

Table 3. Bivariate Correlation analyses of predictive factors and home discharge.

Predictive factor	Chi-square	p value
Sex	0.83	0.363
Relevant clinical background		
Hypertension	0.75	0.388
Diabetes mellitus	1.29	0.255
Dyslipidemia	0.24	0.628
Atrial fibrillation	3.91	0.048*
Obesity	0.31	0.579
Smoker/ex-smoker	4.74	0.029*
Stroke history	5.00	0.025*
Stroke type (ischemic vs hemorrhagic)	1.22	0.544
TOAST classification	5.95	0.203
OCSP classification		
Anterior vs posterior circulation	0.03	0.868
TACI vs other OCSP classifications	3.31	0.077
Nasogastric tube feeding need on admission	26.06	$p<0.001^*$
Vesico-sphincteric abnormalities on admission	33.27	$p<0.001^*$
Predictive factor	Point-biserial correlation	p value
Age	0.29	$p<0.001^*$
NIHSS on admission	0.44	$p<0.001^*$
NIHSS after acute treatment	0.57	$p<0.001^*$
Days on Stroke unit	0.41	$p<0.001^*$

The Chi-square test or Point-biserial correlation were applied, p-values < 0.05 were considered statistically significant, NIHSS National Institutes of Health Stroke Scale, OCSP Oxfordshire Community Stroke Project, TACI total anterior circulation infarcts.

• Vesico-sphincteric abnormalities on admission

Similarly, a significant association was indicated between the presence of vesico-sphincteric dysfunctions

and the destination of discharge (Chi-square=33.27, $p<0.001$). Patients with vesico-sphincteric dysfunctions present at admission were 10.01 times more likely to not

Table 4. Logistic regression analyses of associated home discharge predictors.

Predictive factor	OR	p value	95% CI for OR
Sex	0.73	0.363	0.37-1.44
Age ≤ 70 years	2.74	0.004*	1.38-5.45
Relevant clinical background			
Hypertension, n (%)	0.80	0.627	0.33-1.94
Diabetes mellitus, n (%)	1.26	0.593	0.54-2.92
Dyslipidemia, n (%)	1.14	0.765	0.47-2.77
Atrial fibrillation, n (%)	2.31	0.081	0.90-5.89
Obesity, n (%)	0.98	0.961	0.46-2.11
Smoker/ex-smoker, n (%)	0.37	0.064	0.13-1.06
Stroke history, n (%)	3.03	0.032*	1.10-8.37
Stroke type (ischemic vs hemorrhagic)	1.23	0.634	0.53-2.86
OCSF classification			
Anterior vs posterior circulation	0.92	0.868	0.34-2.47
TACI vs other OCSF classifications	0.31	0.090	0.78-1.20
Nasogastric tube feeding need on admission	13.72	0.016*	1.63-115.80
Vesico-sphincteric abnormalities on admission	10.01	<0.001*	2.65-37.87
NIHSS on admission ≤10	8.83	<0.001*	3.23-21.25
NIHSS after acute treatment ≤ 10	9.82	<0.001*	2.66-26.37
Days on stroke unit ≤ 7	4.97	<0.001*	2.28-10.86

The logistic regression was applied, p-values < 0.05 were considered statistically significant, NIHSS National Institutes of Health Stroke Scale, OCSF Oxfordshire Community Stroke Project, OR odds ratio. TACI total anterior circulation infarcts.

be discharged home compared to patients without such dysfunctions ($p < 0.001$; 95% CI for OR 2.65-37.87).

• NIHSS on admission

Patients with an NIHSS score on admission ≤ 10 were 8.83 times more likely to be discharged home compared to patients with a higher NIHSS score ($p = 0.016$; 95% CI for OR 3.23-21.25).

• NIHSS after acute treatment

Patients with an NIHSS score after acute treatment ≤ 10 were 9.82 times more likely to be discharged home compared to patients with a higher NIHSS score ($p = 0.016$; 95% CI for OR 2.66-26.37).

• Days on stroke unit

Patients who spent ≤ 7 days on the stroke unit were 4.97 times more likely to be discharged home compared to patients with a longer stay on the stroke unit ($p = 0.016$; 95% CI for OR 2.28-10.86).

Discussion

Our findings provide valuable insights into the discharge destinations and predictive factors of home discharge among acute stroke patients in Portugal.

The results indicate that about 55.4% of patients were discharged to their homes, either with or without outpatient rehabilitation. This percentage appears to be lower compared to figures reported in other European countries,⁶⁻⁸ but it is important to consider that the populations studied may not be directly comparable. Dutrieux *et al*⁶ reported a 70% home discharge rate for all patients admitted to the acute care unit of a hospital stroke unit, while Ottiger *et al*⁸ indicated an even higher rate of 84.3% for patients being discharged home. These variations between the outcomes could be attributed to various factors, including living conditions, accessibility to home modifications, financial resources for outpatient therapies, and the availability of government-supported solutions such as SNF, which may vary across countries.

In addition to providing a unique perspective on the hospital discharge of patients in Portugal, this study has uncovered significant findings less explored in previous research. The research has identified several factors that play a crucial role in influencing the decision to discharge patients to their homes. These factors included age, medical history (previous history of stroke), nasogastric tube feeding need on admission, vesico-sphincteric abnormalities on admission, NIHSS on admission and after

acute treatment, and days in the stroke unit.

These associations seem to better convey the relationship between the severity of the stroke and its orientation at the time of discharge than other clinical classification systems, such as the OCSP, which has shown no significant association. Also, variables such as sex, the type of stroke, and its etiology (classified according to the TOAST system) do not appear to have a discernible association with whether a patient is discharged to their home.

Our findings are consistent with previous research on home discharge following stroke, which has shown that patients with less severe strokes and higher levels of function are more likely to be discharged home. The study also found that patients who require less intensive medical support, such as those who do not need nasogastric tube feeding or have vesico-sphincteric abnormalities, are more likely to be discharged home.

However, it is essential to recognize the limitations of this study. As a retrospective analysis focused on a single hospital, the generalizability of findings may be restricted. The characteristics of the patient population, hospital practices, and available resources at this specific hospital might not fully represent the diversity observed in other healthcare institutions. The reliance on electronic medical records introduces the potential for data incompleteness or bias. Missing data or incomplete records could introduce variability and affect the precision of the results. This study did not utilize a standardized metric for assessing functional independence, such as the Functional Independence Measure (FIM), upon admission and discharge. Since FIM scores were not routinely recorded in the available medical records, they could not be included in the analysis. However, incorporating such a measure in future studies would provide valuable insights into a patient's functional capacity and its potential influence on discharge decisions, as outlined in DGS guideline nº 054/2011 for patient orientation. Additionally, another limitation is that we do not have access to potentially relevant predictors of home discharge, such as social support,⁹ and important clinical signs like cognitive impairments, loss of consciousness, spasticity, postural control, and hemianopsia.¹⁰⁻¹³

While the 2011 DGS guideline nº 054 provides essential frameworks for PMR prescription in post-stroke patients, our study highlights several areas that call for revision and modernization. The current guideline lacks clear referral criteria for stroke patients, particularly those with

mild strokes, leading to inequitable access to rehabilitation services. To ensure fair access to quality PMR, it is crucial to implement more explicit criteria. Additionally, establishing indicators to assess the effectiveness and efficiency of PMR care delivery is paramount. These indicators will help monitor and enhance the quality of rehabilitation services provided to stroke patients. Furthermore, incorporating the latest advancements in stroke rehabilitation and updating the guideline to reflect the current profile of stroke patients would significantly elevate the quality of care and improve patient outcomes.

Establishing a robust system for collecting and analyzing patient data across multiple centers would provide valuable insights into patient outcomes and help refine the guidelines further.

Future research in this domain holds the potential to further refine our understanding and improve the overall quality of care provided to stroke survivors. Addressing these limitations through prospective, multicentred studies with a more extensive set of variables and a diverse patient population would enhance the robustness and generalizability of the findings, enriching our understanding of the complex dynamics influencing post-stroke care decisions.

Conclusion

The present study provides valuable insights into post-stroke outcomes and discharge destinations. The identified predictors can guide tailored interventions for stroke patients, reinforcing the crucial role of PMR in optimizing outcomes and supporting home return. This information aids healthcare professionals in efficiently managing acutely admitted stroke patients, potentially minimizing hospitalization durations, and reducing costs. The study underscores considering patient-specific factors in discharge decisions, enabling providers to optimize rehabilitation outcomes and alleviate healthcare system burdens. Further research is crucial to explore home-based rehabilitation programs for stroke survivors and develop evidence-based discharge planning guidelines. ■

Contributorship Statement / Declaração de Contribuição

Author roles:

1. Research project: A. Conception, B. Organization, C. Execution.
2. Statistical Analysis: A. Design, B. Execution, C. Review and Critique.
3. Manuscript Preparation: A. Writing of the first draft, B. Review and Critique.+

PFR: 1A, 1B, 1C, 2A, 2B, 2 C, 3A
 JA: 1A, 2A, 2B, 3A
 JR: 1A, 2A, 2B, 3A
 UM: 1A, 1B, 1C, 2C, 3C
 RV: 2C, 3B

Responsabilidades Éticas

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Proteção de Pessoas e Animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pela Comissão de Ética responsável e de acordo com a Declaração de Helsínquia revista em 2013 e da Associação Médica Mundial.

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