

RESEARCH PAPER (ORIGINAL)  
ARTIGO DE INVESTIGAÇÃO (ORIGINAL)

## Association between the Manchester Triage System and the final outcome in stroke patients

Relação entre o Sistema de Triagem de Manchester em doentes com AVC e o desfecho final

Relación entre el Sistema de Triunfo de Manchester en emitir a AVC y el desfecho final

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### Abstract

**Background:** Stroke is one of the leading causes of death in Portugal, and the leading cause of disability in older people. Strategies should be established to mitigate damages.

**Objectives:** To establish an association between the priority defined by the Manchester Triage System for stroke patients and the final outcome (discharge/death/hospitalization).

**Methodology:** An observational study was conducted to analyze data from the ALERT® software in all stroke patients who were admitted to a Portuguese multipurpose emergency department between 2010 and 2012, in a total of 864 cases.

**Results:** Most patients were triaged with high priority, and the ages differed between men and women. Higher priorities (red and orange) were assigned to older persons and patients who eventually died or were hospitalized ( $p < 0.001$ ). The *Via Verde* do AVC program was seldom activated (14%).

**Conclusion:** Inpatients and those who eventually died were triaged with higher priorities. A statistically significant association was found between the highest priorities (red and orange), hospitalization rate, and mortality ( $p < 0.001$ ).

**Keywords:** stroke; nursing; emergency medical services; triage; clinical evolution

### Resumo

**Enquadramento:** O acidente vascular cerebral (AVC) é uma das principais causas de morte em Portugal, e a principal causa de incapacidade nos idosos. Torna-se necessário definir estratégias para amenizar os danos.

**Objetivos:** Relacionar a prioridade definida pelo Sistema de Triagem de Manchester para doentes com AVC e o desfecho final (alta/óbito/internamento).

**Metodologia:** Estudo observacional que analisou dados do *software* ALERT® em todos os doentes com AVC que entraram num serviço de urgência polivalente português entre 2010 e 2012, totalizando 864 casos.

**Resultados:** A maioria dos doentes foi triada com elevada prioridade, sendo as idades diferentes entre homens e mulheres. Prioridades mais elevadas (cor vermelha e laranja) foram atribuídas aos mais idosos, aos que faleceram e aos que foram internados ( $p < 0,001$ ). Houve reduzida ativação da *Via Verde*-AVC (14%).

**Conclusão:** Doentes internados e os que faleceram foram triados com prioridades mais elevadas, existindo relação estatística significativa entre as prioridades mais altas (vermelha e laranja), a taxa de internamento e a mortalidade ( $p < 0,001$ ).

**Palavras-chave:** acidente vascular cerebral; enfermagem; serviços médicos de emergência; triagem; evolução clínica

### Resumen

**Marco contextual:** Accidente cerebrovascular (ACV) es una de las principales causas de muerte en Portugal, y la principal causa de discapacidad en los ancianos. Es necesario definir las estrategias para mitigar el daño.

**Objetivos:** Relacionar la prioridad establecida por el sistema de triaje de Manchester para los pacientes con accidente cerebrovascular y el resultado final (descarga/muerte/hospitalización).

**Metodología:** Estudio observacional analizaron datos de *software* ALERT® en todos los pacientes con accidente cerebrovascular que hayan introducido un servicio de urgencias de usos múltiples portugués entre 2010 y 2012, un total de 864 casos.

**Resultados:** La mayoría de los pacientes fueron examinados con alta prioridad, y las diferentes edades para los hombres y las mujeres. Prioridades más altas (de color rojo y naranja) fueron asignados a los ancianos, a los que murieron y que fueron hospitalizados ( $p < 0,001$ ). No hubo reducción de la activación de *Via Verde* de carrera (14%).

**Conclusión:** Los pacientes hospitalizados y los que murieron fueron seleccionados con las prioridades más altas y una relación estadística significativa entre las prioridades más altas (rojo y naranja), la tasa de hospitalización y la mortalidad ( $p < 0,001$ ).

**Palabras clave:** accidente cerebrovascular; enfermería; servicios médicos de urgencia; triaje; evolución clínica

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## Introduction

According to the Portuguese Directorate-General for Health (*Direção-Geral da Saúde* - DGS), mortality due to cerebrovascular diseases was 61.9 per 100,000 inhabitants in 2011, which corresponds to 12,690 deaths, and it is one of the leading causes of death and leading cause of disability in older people (DGS, 2013). According to the DGS, in 2011, cerebrovascular diseases resulted in the death of about 12 people per 100,000 inhabitants under the age of 70 years, and around 721 people per 100,000 inhabitants over the age of 70 years in Portugal (DGS, 2013). This situation is likely to be aggravated by the almost constant incidence rates and the increasing prevalence rates, mostly caused by the increasing number of older people and their survival rate.

Stroke sequelae can lead to major psychomotor disabilities, which increasingly demands a quick intervention from health services and an effective response from health professionals, namely nurses. It is a disease for which treatment and recovery depend on the individual's ability to use the emergency department (ED), in the shortest time possible, since the only approved medical treatment for ischemic stroke must be administered up until 4.5 hours after the onset of symptoms (Hacke et al., 2008). In addition, an earlier administration will bring more benefits.

The triage systems of patients admitted to the ED are an essential link in the strategy to reduce the time elapsed between symptom onset and the treatment of stroke victims.

The Manchester Triage System (MTS) is applied in the EDs of several countries, including Portugal, but its performance clearly depends on the context in which it is applied, namely on the patients' characteristics, the training of the professionals involved in the process, and the association between the number of patients admitted to the ED and its capacity for response (Van der Wulp, Van Baar, & Schrijvers, 2008). Studies conducted with the MTS have shown that the system is more inclusive (Souza, Toledo, Tadeu, & Chianca, 2011), allows making an association be-

tween patient complaints during risk classification and the final outcome (Guedes, Souza, Lima, Martins, & Chianca, 2015), and predicting the length of hospital stay in individuals classified as high priority (Guedes, Martins, & Chianca, 2015).

Due to its severe impact on stroke patients' lives, both in terms of disabilities and the psychological and social impact, a study should be conducted to analyze the clinical outcome of patients who are admitted to the ED. This analysis would aim at minimizing health risks and sequelae.

Therefore, the results of this study will be used to improve emergency care to stroke patients so that they can receive faster and better assistance.

The objective of this study is to establish an association between the priority set by the MTS for stroke patients and the final outcome (discharge/death/hospitalization).

## Background

According to the World Health Organization (2016), stroke is caused by the interruption of brain irrigation, either due to a blood vessel rupture (hemorrhagic stroke) or occlusion (ischemic stroke), thus restricting the normal supply of glucose and oxygen to brain cells, often causing irreversible damage. The transient ischemic attack (TIA) is a sudden and reversible focal, brainstem or retinal neurological deficit, with a duration of less than 1 hour and/or within 24 hours, and without imaging evidence of ischemic injury (Jauch et al., 2013).

Hemorrhagic stroke represents about 15% of all stroke cases and ischemic stroke around 85% of the cases (Kurz, Kurz, & Farbu, 2013).

Although the incidence of cerebrovascular diseases has been declining over the last 25 years and substantial progress has been made over the last decade, Portugal still falls behind other European countries in this matter. In 2012, in Portugal, 19,177 stroke patients were admitted to the hospital, i.e. a stroke victim was admitted to the hospital every 30 minutes (DGS, 2013).

The ED is the patient's first point of contact

with a healthcare unit, and, for this reason, it should be able to identify the stroke signs and symptoms early, as well to immediately provide the most adequate treatment (Delfim, Melo, Chaves, Duarte, & Brito, 2012). Stroke is considered as a medical emergency, and time plays a critical role in early treatment (Delfim et al., 2012).

The *Via Verde* program is a strategy designed to improve the welcoming, referral and treatment of seriously-ill patients in the pre-, intra-, and inter-hospital phases. This is the case of the *Via Verde do AVC* program (VV-AVC), which aims to speed up triage, with evaluation and guidance of patients in the acute stroke phase, thus enabling the most adequate diagnosis and treatment within an effective door-to-needle time or therapeutic window (Vaz, 2011).

Nurses play a clear role in the recognition of stroke signs and symptoms and the activation of the VV-AVC based on the ED triage. Emergency nurses are responsible for the accurate, quick, and effective triage process of stroke patients and the activation of the VV-AVC based on specific criteria.

At triage, nurses search for warning signs (lip pulling, arm weakness, trouble in speaking) and assess the criteria for inclusion in the VV-AVC (patient aged between 18-80 years, signs or symptoms with less than three hours of evolution, absence of prior dependence). After checking all the inclusion criteria, the VV-AVC is immediately activated and the patient is transferred to the emergency room, where he/she is immediately observed by a neurologist and all complementary diagnostic exams are done as quickly as possible. The first three hours after the onset of stroke symptoms are essential for patient treatment, as this temporal window allows the key treatments to be effective (Centro Hospitalar e Universitário de Coimbra, 2014).

## Hypothesis

Stroke patients classified as severely-ill (red, orange) by the Manchester Triage System have worst clinical outcome (higher mortality) and higher hospitalization rates.

## Methodology

This observational prospective study was conducted with all stroke patients who were admitted to the multipurpose ED in the center region of Portugal. These patients were followed-up for identification of clinical outcomes (discharge/death/hospitalization).

Data on the 864 patients who were admitted to the ED between 1 January 2010 and 31 December 2012 were analyzed. All patients whose records were incomplete were excluded.

Data were collected using the ALERT® software covering all types of stroke (ischemic stroke, transient ischemic attack, and hemorrhagic stroke). The following variables were analyzed: date and time of admission, age, gender, discharge diagnosis, flow charts and discriminators selected in the triage, clinical priority set in the triage (color), and destination after discharge.

Data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS), version 19.0. Patients' characteristics were analyzed using descriptive statistics with analysis of frequencies and measures of central tendency and dispersion. Since the Kolmogorov-Smirnov confirmed the non-normal distribution of some variables, non-parametric tests were used. The association of categorical data was verified through the chi-square test. The relationship between age and priority classification was verified by the Kruskal-Wallis test. The level of significance was 95% ( $p < 0.05$ ) for both tests.

The study was approved by the Ethics Committee of the Health Sciences Research Unit: Nursing of the Nursing School of Coimbra (Opinion No. P120-11/2012) and the Board of Directors of the Hospital Center where the study was conducted (Opinion 026-13).

## Results

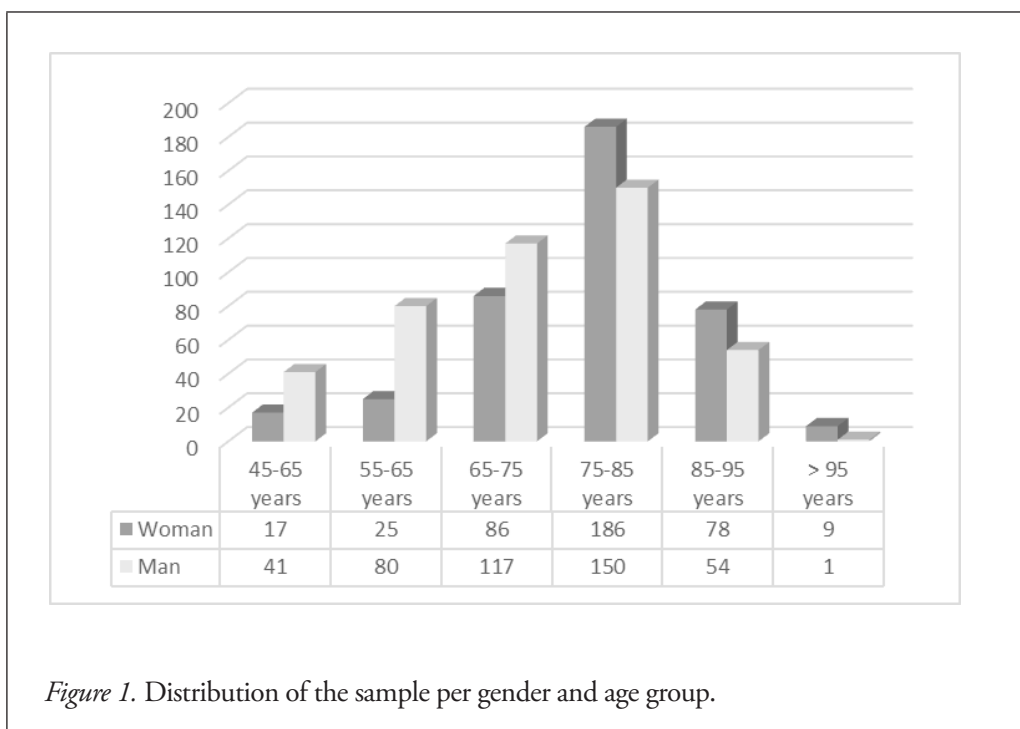
Of the 864 patients with a stroke diagnosis, in recent years the number of stroke patients admitted to the hospital under analysis has increased: 220 patients in 2010 (25.5%),

232 in 2011 (26.8%), and 428 in 2012 (47.7%).

Stroke was predominant in 459 (53.1%) male individuals aged between 28 and 110 years, with a mean age of 74.5 years and a standard deviation of 12.2 years.

The analysis of the distribution of the sam-

pled individuals per gender and age showed that the incidence of stroke up to the age of 75 years was always higher in men, as shown in Figure 1. After this age, it was always higher in women. The chi-square test showed that age is statistically different between men and women ( $p < 0.001$ ).



With regard to the time of admission, 8-hour shifts were created, corresponding to the morning, afternoon, and evening nursing shifts. Data showed that 110 patients (12.7%) were admitted between 12 p.m. and 8 a.m., 465 patients (53.9%) were admitted between 8 and 4 p.m., and 289 patients (33.4%) were admitted between 4 and 12 p.m.. A more detailed analysis showed that the most intense periods were 9 a.m. and 12 p.m. (22.9%), and the less intense periods were between 3 and 6 a.m. (2.3%).

With regard to the day of the week, the number of hospital admission of stroke patients increased on Fridays (213; 24.7%),

followed by Sundays (134; 15.5%), Wednesdays (126; 14.5%), Saturdays (121; 14.0%), Tuesdays (103; 11.9%), Mondays (94; 10.8%), and Thursdays (73; 8.5%).

With regard to the MTS color code, most patients were classified as orange (393; 45.5%) and yellow (359; 41.6%), followed by white (47; 5.4%), green (46; 5.3%), and red (19; 2.2%). No patient was triaged as blue.

Of the 22 flow charts used for patient triage in this sample (Table 1), four stood out: unwell adult (64.00%), behaving strangely (10.07%), headache (7.06%), and altered conscious level (3.94%). The *Via Verde* flow chart was used in only 14 cases (1.62%).

Table 1  
*Distribution of the sample per flow chart*

Flow chart	N	%
Headache	61	7.06
Behaving strangely	87	10.07
Fits	8	0.93
Diabetes	4	0.46
Shortness of breath	9	1.04
Mental illness	7	0.81
Chest pain	6	0.69
Altered conscious level	34	3.94
Wounds	1	0.12
GI bleeding	1	0.12
Referral by physician	24	2.78
Unwell adult	553	64.00
Torso injury	1	0.12
Other	8	0.93
Limb problems	9	1.04
Ear problems	3	0.35
Eye problems	13	1.50
Falls	12	1.39
Examination/Testing	1	0.12
Head injury	4	0.46
<i>Via Verde</i>	14	1.62
Vomiting	4	0.46
Total	<b>864</b>	<b>100.0</b>

With regard to the selected discriminators, altered conscious level was the most prevalent indicator (31.8%), followed by abrupt onset (24.2%), abnormal pulse (11.2%), moderate pain (7.7%), and new neurological deficit (5.0%). The other discriminators were less prevalent.

With regard to the identification of the type of *Via Verde* activated after identification of patient priority, no type of *Via Verde* was activated (or the activation was not registered) in 85.3% of the cases. The VV-AVC was activated for 14.3% of the patients and the *Via Verde Coronária* program was activated for 0.4% of the patients.

With regard to the length-of-stay in the ED, patients stayed on average 8h12m with a standard deviation of 7h47m, a minimum period of 0 minutes and a maximum period

of 55h10m. The median was 6h32m. The first quartile was 3h13m and the third quartile was 10h08m.

When analyzing the association between age and clinical priority, there was a higher percentage of patients aged between 75-85 years in all priorities since it is the predominant age group in the sample, as shown in Figure 2. Most patients aged less than 75 years were classified as yellow, whereas most patients aged over 70 years were classified as red and orange. The Kruskal-Wallis test showed at least one statistically significant difference in the priority given according to age ( $p < 0.001$ ). The pair-to-pair Kruskal-Wallis test showed statistically significant differences between the red and orange priorities and the other priorities.

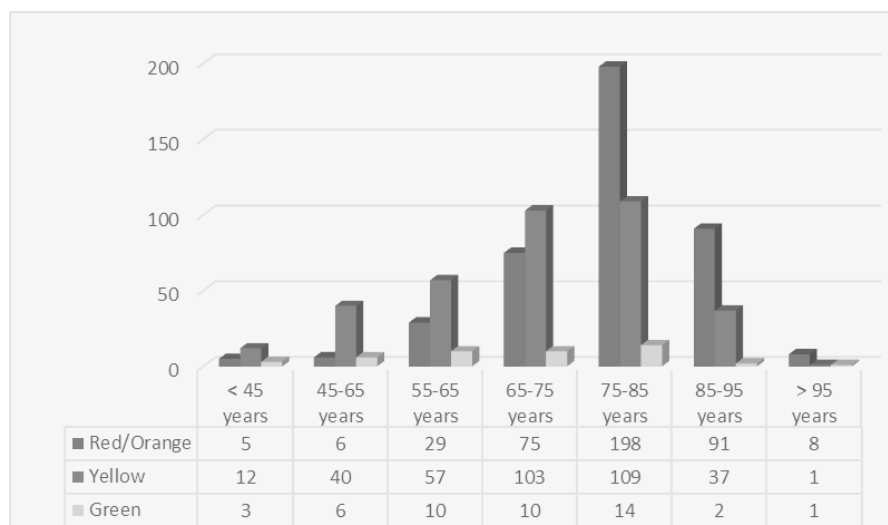


Figure 2. Sample distribution per priority and age group.

Note. The white color was excluded. Total chart sample of 816 stroke patients.

The analysis of the association between emergency priority and outcome (Figure 3) showed that most patients who were discharged home were triaged as yellow (58.3%). Death was more prevalent among

patients triaged as red and orange (75%), as well as hospitalization (57.6%). The outcomes of the emergency episode showed a statistically significant difference ( $p < 0.001$ ) according to the triage priority.

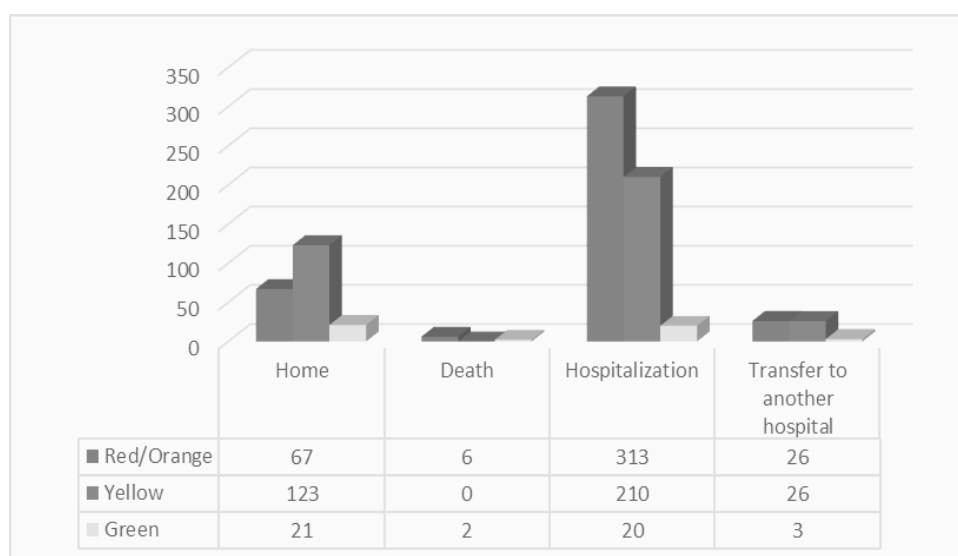


Figure 3. Sample distribution per priority and outcome of the emergency episode.



## Discussion

Data showed that the number of stroke patients admitted to the hospital under analysis has increased over the years, which is explained by the fact that this is a central hospital with a multipurpose ED that receives all types of patients, with different levels of severity, and a stroke care unit operating 24/7. With regard to the gender distribution, stroke was more prevalent in men (53.13%), which is in line with another study (Gabriel et al., 2007).

In relation to the age variable, the number of stroke cases increased with age, decreasing only after the age of 85, as expected.

This higher incidence of stroke in older women relates to the fact that women live longer than men. Therefore, there are more women in more advanced age groups.

The majority of stroke patients was admitted to the ED between 8 a.m. and 12 p.m. (87.2%). This may be associated with the presence of an accompanying person. Medical attention is rarely sought by the patient, in many cases contact is made by a family member (European Stroke Organization Executive Committee, European Stroke Organization Writing Committee, 2008).

With regard to the days of the week, admissions occurred more frequently during the weekend (Friday till Sunday; 54.3%) when compared to the other days (Monday till Thursday; 45.7%). These data may be justified by the fact that there is a predisposition for excesses on weekends, particularly in terms of food and alcohol, which are modifiable risk factors (Sá, 2009), thus increasing the probability of stroke.

Unwell adult (64.0%), behaving strangely (10.1%), headache (7.1%), and altered consciousness level (3.9%) were the more commonly used flow charts. Gabriel et al. (2007) found that these flow charts were used in 88% of the cases. The authors also added that, unlike what happens when using the chest pain flow chart for acute myocardial infarction patients, such uniformity is not observed in stroke presentation, which restricts the MTS, thus making it difficult to exhaust its entire semiology in a single flow chart.

Guedes, Souza et al. (2015) draw attention to

the wide use of the unwell adult flow chart, because it is a nonspecific flow chart used for patients who do not feel well, without specific complaints. However, the question remains as to whether it is indeed impossible to identify the main complaint. It is somewhat convenient for health professionals to use this flow chart in clinical practice, since it is widely applicable.

With regard to the discriminator, at the time of data collection, the hospital was using the old version of the MTS, which does not include the discriminator acute neurological deficit. This discriminator implies the classification of the patient as very urgent (orange color) and is integrated into several flow charts that are potentially relevant in stroke cases, as it allows assessing the presence of neurological changes across the system and identifying the greatest number of cases possible (Mackway-Jones, Marsden, & Windle, 2010).

In relation to the VV-AVC, this program was activated only in 14% of the cases, which can only be explained by non-registration. On the other hand, the sampled patients' mean age was approximately 75 years, so the low activation of VV-AVC may be related to the age limit criterion. In addition, it may also be associated with the fact that older patients usually have more comorbidities and, therefore, an increasing level of dependence, which again limits the VV-AVC activation.

Data show the need to optimize the VV-AVC with the purpose of speeding up triage through the evaluation and referral of patients in the acute stroke phase, thus enabling the most adequate diagnosis and treatment within an effective therapeutic window.

Future studies should analyze the entire route of the VV-AVC, from the pre-hospital Via Verde to the intra-hospital Via Verde, and compare these data with inpatient data for a better assessment of the whole care approach to stroke patients.

In relation to the length-of-stay in the ED, patients remained, on average, 8h12m at the ED between the record of stroke diagnosis and their transfer to another institution or hospitalization. These results are below expectations and do not follow the guidelines of the American Heart Association & Amer-

ican Stroke Association (Jauch et al., 2013), which recommend the creation of a protocol for patients with suspected stroke so that the evaluation and therapeutic decision can be made within 60 minutes of their arrival in the ED. The High Commissioner for Health, National Coordinator for Cardiovascular Diseases (2007) suggests the early hospitalization of these patients with the aim of reducing morbidity and mortality in the short- and long-term and treatment-associated costs. Early treatment is a critical factor for a successful intervention in acute stroke.

The comparison between the priority classification and the age group showed that patients' priority increased with their age. The highest percentage of patients triaged as red and orange are distributed by the age groups between 75-85 years and > 95 years. This means that the older the patients, the more severe is their illness, which is explained by the greater number of comorbidities and diseases associated with individuals from older age groups, namely hypertension and diabetes mellitus.

In relation to the emergency outcome, the percentage of hospitalizations was lower than desired, which shows that not every patient was hospitalized in a stroke care unit. Despite the low percentage of deaths (0.9%), the mortality rate due to cerebrovascular diseases in Portugal was 119 per 100,000 inhabitants in 2010, 111.2 in 2011, and 116.6 in 2012 (Instituto Nacional de Estatística, 2014). However, it should be noted that stroke patients usually do not die immediately after the acute event, but rather some days or weeks later.

The analysis of the association between the priority classification and the emergency outcome showed that the greatest number of hospitalizations and deaths are linked to the highest priorities, which is in line with the clinical severity of each priority. A statistically significant difference was found between the highest priorities (red and orange), hospitalization rate, and mortality ( $p < 0.001$ ).

National and international studies have concluded that the MTS has proved to be a very powerful tool to identify the risk of death, the need for hospitalization, and the use of diagnostic testing (Guedes, Martins et al., 2015; Santos, Freitas, & Martins, 2014).

This study contributes to science by showing that the assignment of the MTS priorities was sensitive to the triage of stroke patients, which shows that the MTS is a useful tool for the management of emergency care. The MTS has a high sensitivity for assigning the *immediate/very urgent* priority levels when stroke patients are admitted to the ED. Death or hospitalization are more frequent outcomes among patients classified as severe (red and orange) than among patients who are diagnosed as non-severe (yellow, green).

A limitation of this study was the fact that other criteria in the recommendations of the VV-AVC were not obtained, namely the time elapsed between the admission to ED and the evaluation by a neurologist, the CT scan, the fibrinolysis, the hospitalization, the length-of-stay, and the mortality during hospitalization. These data would enable further analyses.

## Conclusion

The main results obtained in the study have shown that most stroke patients were triaged as high priority patients (red/orange/yellow). Age is statistically different between male and female stroke patients, with a predominance of men aged less 75 years and women aged over 75 years, with a statistically significant difference between age and gender ( $p < 0.001$ ).

We concluded that inpatients and patients who eventually died were triaged with higher priorities, and that there are statistically significant differences between the highest priorities (red and orange), hospitalization rate, and mortality ( $p < 0.001$ ).

The MTS has proved to be an effective tool for triage. The nurse should pay more attention to patients classified as severe, the physician should make a quicker diagnosis, and both professionals should activate the VV-AVC as early as possible.

Awareness campaigns should also be organized to inform the community, not only about the signs and symptoms of stroke but also about its risk factors, and to call health professionals' attention to the need to assess and treat stroke patients in a timely manner.



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