ORIGINAL RESEARCH ARTICLE **OPEN ACCESS**

EPIDEMIOLOGICAL PROFILE OF MORTALITY FROM STROKE IN THE BRAZILIAN NORTHERN REGION

[1]Antônio Sávio Inácio, [2]Michel dos Santos Domingos and [3]Sibila Lilian Osis

[1]State University of Amazonas, Higher School of Health Sciences, Manaus, AM, Brazil. Rua Almir Pedreiras, 676, Petrópolis, Manaus - AM, Brazil

[2]State University of Amazonas, Higher School of Health Sciences, Manaus, AM, Brazil. Rua Apuí, 77, Flores, Manaus – AM, Brazil

[3]State University of Amazonas, Higher School of Health Sciences, Manaus, AM, Brazil. Rua Belo Horizonte, 1830, Apto 404, Adrianópolis, Manaus – AM, Brazil

ARTICLE INFO

ABSTRACT

Objective: To evaluate the sociodemographic profile of patients who progressed to death from stroke and identify the mortality rate. **Method:** Cross-sectional study using data from the Mortality Information System. Estimates of rates of deaths and odds ratios (OR) of death from stroke were performed in comparison to other causes of deaths between 2000-2015. **Results:** There were 61,973 deaths from stroke, and individuals aged ≥60 years (OR: 2.41; 95% CI: 2.36-2.45; p<0.001), widowed (2.30; 2.25-2.36; p<0.001), no schooling (1.49;1.41-1.56; p<0.001), females (1.42; 1.39-1.44; p<0.001) and black race/color (1.31; 1.30-1.40; p<0.001) showed the greatest risk. The mortality rate from stroke in the Northern Region had a mean of 23.2/100thousand inhabitants from 2000 through 2015. **Conclusion:** the female sex, aged less than 59 years, widowed and black color have a higher risk of death from stroke bird in the Brazilian northern region.

INTRODUCTION

Stroke is a neurological abnormality caused by complete or partial reduction of cerebral blood flow (Costa *et al.,* 2016; Ribeiro *et al.,* 2012; Pinno *et al.,* 2014) and can be classified as ischemic or hemorrhagic. The ischemic stroke occurs in about 80% of the cases, and can be caused by an interruption of the blood flow in certain area of the brain. The hemorrhagic stroke is less common and is characterized by the rupture of a cerebral vessel (Lopes *et al.,* 2016; Lima *et al.,* 2016a).Stroke is one of the main causes of morbidity and mortality globally, being regarded as the second leading cause of death, surpassed only by diseases of the cardiovascular system (Lima *et al.,* 2016a). According to studies, estimates show that approximately 1 in every 20 individuals residing in underdeveloped countries are victims of stroke, meaningful data for research, since the mortality rates have been constant in recent years.

Corresponding author: **Antônio Sávio Inácio**
State University of Amazonas, Higher School of Health Sciences, Manaus, AM, Brazil. Rua Almir Pedreiras, 676, Petrópolis, Manaus - AM, Brazil

In Latin America, the disease is the main cause of hospital admissions and deaths, especially in Brazil (Pinno *et al.,* 2014; Lopes *et al.,* 2016).Therefore, the rates of deaths from stroke in the Northern Region require investigation, as well as the most affected population. Since Brazil presents high levels of morbidity and mortality in Latin America, observing these indices in remote regions such as the Northern region would be crucial to improve the provision of assistance. The study also allows identifying needs for improvements in basic health services, which are directly associated with the process of control, prevention and identification of stroke. Thus, considering all the aspects mentioned, the study aims to evaluate the sociodemographic profile of patients who progressed to death from stroke and identify the mortality rate.

MATERIALS AND METHODS

This is a cross-sectional study, carried out by means of secondary data from the Mortality Information System (SIM - *Sistema de Informaçãosobre Mortalidade*) of the Ministry of Health.

The survey data were obtained from the Department of Analysis and Tabulation of Data from the Unified Health System (DATASUS) database. The study also obtained data from the Brazilian Institute of Geography and Statistics (IBGE – *Instituto Brasileiro de Geografia e Estatística*) provided by the 2010 Demographic Census available on the IBGE Auto Recovery (SIDRA - *Sistema IBGE de Recuperação Automática*).The survey corresponded to the mortality data of Health Information (TABNET) available at Vital Statistics. The study included the mortality data from the records of the 10th Review of the International Classification of Diseases (CID-10) available from 2000 through 2015 of the Northern region (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins). The survey selected records of the CID-10 correlated to stroke (G45, I60-I64). The analyzed variables were age, gender, marital status, educational level and color/race. The IBGE database only provides information on the population characterized by race/color in the year 2010.Data were classified by variables and tabulated in a spreadsheet in Microsoft Excel program for later analysis. The statistical analysis was performed using Epi Info version 7.2.2 by using Yates Chi-square corrected test and Odds Ratio. To present the results, data were used in absolute values, percentages and at descriptive level. The study considered confidence interval (CI) of 95% and considered significant values with p<0.05. The calculation of specific mortality rate used the total number of deaths from stroke divided by the population x 10^5.Since this survey uses secondary data based on information in the public domain and without any identification of individuals involved, the study followed Resolution 510/2016 of the National Health Council. This allows using secondary data regardless the submission to the Research Ethics Committee.

RESULTS

From 2000 through 2015, there were 61,973 deaths from stroke in the Northern Region. Of these, 33,876 (55%) in the state of Pará (PA), 8,883 (14%) in the state of Amazonas (AM), 7,611 (12%) in Tocantins (TO), 5,981 (10%) in the state of Rondônia (RO), 2,506 (4%) in the state of Acre (AC), 1,914 (3%) in Amapá (AP), and 1,202 (2%) in Roraima (RR).The specific mortality rate from stroke in the Northern Region had a mean of 23.2/100 thousand inhabitants during the period. Tocantins presented the highest index (35.0/100thousand) and the state of Amazonas, the smallest (16.1/100thousand). Although the other states have presented significant variations over the years, Tocantins and Amazonas persisted in their extremes and were exceeded a few times during the studied period. The state of Acre has an average in the period of 22.4/100thousand. In 2003, it presented its lowest rate with 17.7/100thousand, three years after, its highest, with 27.1/100thousand. In 2015, its rate was 22.0/100thousand. Amapá had a mean of 18.8/100thousand within the studied period. In 2001, it recorded its highest rate with 26.0/100 thousand and its smallest in 2006 with 13,0/100 thousand. In 2015, the state of Amapá presented a rate of 17.5/100thousand. The state of Amazonas presented the lowest rates among the states of the north region in 8 of the 15 years studied, and its lowest occurred in 2003 with 14.1/100thousand and the largest in 2014 with 19.6/100thousand. In 2015, its incidence rate was 18.7/100thousand. In the state of Pará, the average was 28.7/100thousand, with its greatest and lowest incidence rate in the years 2015 and 2000, with 33.9/100thousand and 22.7/100thousand, respectively. In Rondônia, the average was

23.5/100thousand. Its highest rate occurred in 2004 with 27.7/100thousand and its lowest rate, in 2015, with 20.0/100thousand. In the state of Roraima, there was an average of 17.7/100thousand. Its highest rate occurred in 2000, with 24.6/100thousand, four years after, its lowest rate was 13.5/100thousand. In 2015, its rate was 14.2/100thousand. The state of Tocantins presented the highest average of the Northern Region with 35.0/100thousand.The highest value was observed in 2008 with 39.8/100thousand and the lowest in 2000 with 27.3/100thousand (Figure 1).
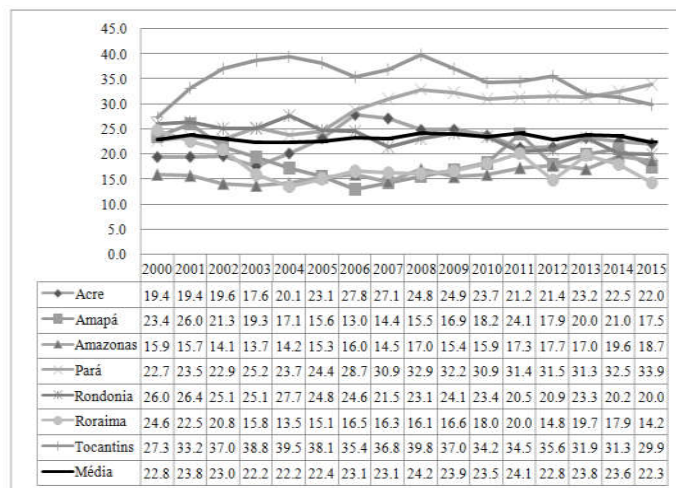

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Acre	19.4	19.4	19.6	17.6	20.1	23.1	27.8	27.1	24.8	24.9	23.7	21.2	21.4	23.2	22.5	22.0
Amapá	23.4	26.0	21.3	19.3	17.1	15.6	13.0	14.4	15.5	16.9	18.2	24.1	17.9	20.0	21.0	17.5
Amazonas	15.9	15.7	14.1	13.7	14.2	15.3	16.0	14.5	17.0	15.4	15.9	17.3	17.7	17.0	19.6	18.7
Pará	22.7	23.5	22.9	25.2	23.7	24.4	28.7	30.9	32.9	32.2	30.9	31.4	31.5	31.3	32.5	33.9
Rondonia	26.0	26.4	25.1	25.1	27.7	24.8	24.6	21.5	23.1	24.1	23.4	20.5	20.9	23.3	20.2	20.0
Roraima	24.6	22.5	20.8	15.8	13.5	15.1	16.5	16.3	16.1	16.6	18.0	20.0	14.8	19.7	17.9	14.2
Tocantins	27.3	33.2	37.0	38.8	39.5	38.1	35.4	36.8	39.8	37.0	34.2	34.5	35.6	31.9	31.3	29.9
Média	22.8	23.8	23.0	22.2	22.2	22.4	23.1	23.1	24.2	23.9	23.5	24.1	22.8	23.8	23.6	22.3

Figure 1. Means of mortality from cerebrovascular accident in the states of the Brazilian Northern Region, 2000-2015

In the period studied, there was a higher prevalence of deaths in individuals aged over 60 years with 45,534 (73.5%) cases and in male individuals with 33,114 (53.4%) deaths. The most affected marital status was married, with 25,468 (41.1%) cases. The color/race *pardo* presented prevalence of 39,115 (63.1%) deaths and of the total, 17,967 (29%) cases were illiterate. Table 1 shows the sociodemographic characteristics for each state. In 2010, the rate of deaths by race identified in the black population a value of 35.9/100thousand, being in the state of Tocantins 55.5/100thousand. Pardo Brazilians showed an average rate of 25.8/100000 with higher prevalence also in the state of Tocantins. The white color/race (24.4/100 thousand) appeared next, with emphasis to the states of Amazonas (27.9/100thousand), Pará (27.9/100 thousand) and again Tocantins (29.8/100thousand). The yellow color/race (15.0/100thousand) and indigenous (8.8/100000) have the lowest rates. The yellow color/race stood out in the state of Rondônia (22.5/100thousand) and the highest indigenous color/race occurred in the state of Roraima (12.1/100thousand). The states of Acre and Rondôniastood out with zero rates for yellow and indigenous color/race, respectively (Figure 2). Among the states of the Northern Region, Tocantins presented 13% greater chance when compared to Pará (OR: 1.13; 95%CI 1.10-1.16; p<0.001). The states of Acre (0.72; 0.69-0.75; p<0.001), Amapá (0.55; 0.52-0.57; p<0.001), Amazonas (0.58; 0,56-0,59; p<0.001), Rondônia (0.76; CI 0.73-0.78; p<0.001) and Roraima (0.64; 0,60-0,68; p<0.001) showed no significant chance of death from stroke when compared to the state of Pará. In the Northern Region, when associating deaths from stroke with other causes of death between the years 2000 and 2015, individuals aged ≥60 years (OR: 2.41; 95% CI: 2.36-2.45; p<0.001) are 2.4 times more likely to die from stroke than those aged ≤59 years.

Table 1. Characteristic of fatal victims of cerebrovascular accident in the Northern Region, Brazil, 2000-2015

Indicators	AC		AP		AM		PA		RR		RO		TO		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Age group																
<19 years	36	6.5	19	3.4	107	19.3	273	49.3	21	3.8	45	8.1	53	9.6	554	0.9
20-59 yearss	685	4.3	515	3.3	2,570	16.3	8,098	51.2	403	2.6	1,654	10.5	1,878	11.9	15,803	25.5
>60 years	1,785	3.9	1,378	3.0	6,186	13.6	25,479	56.0	771	1.7	4,255	9.3	5,680	12.5	45,534	73.5
Ignored	0	0.0	2	2.4	20	24.4	26	31.7	7	8.5	27	32.9	0	0.0	82	0.1
Gender																
Male	1,344	4.1	1,078	3.3	4,587	13.9	17,939	54.2	673	2.0	3,427	10.3	4,066	12.3	33,114	53.4
Female	1,162	4.0	836	2.9	4,292	14.9	15,930	55.2	528	1.8	2,551	8.8	3,545	12.3	28,844	46.5
Ignored	0	0.0	0	0.0	4	26.7	7	46.7	1	6.7	3	20.0	0	0.0	15	0.0
Marital status																
Unmarried	641	4.4	590	4.1	2,307	15.9	8,062	55.6	259	1.8	781	5.4	1,850	12.8	14,490	23.4
Married	842	3.3	636	2.5	3,540	13.9	14,235	55.9	427	1.7	2,533	9.9	3,255	12.8	25,468	41.1
Widow(er)	517	3.8	392	2.9	2,018	15.0	7,462	55.3	221	1.6	1,103	8.2	1,773	13.1	13,486	21.8
Separated	69	4.8	50	3.5	216	15.2	607	42.6	42	2.9	202	14.2	239	16.8	1,425	2.3
Other	72	3.8	53	2.8	277	14.6	1,217	64.2	48	2.5	70	3.7	158	8.3	1,895	3.1
Ignored	365	7.0	193	3.7	525	10.1	2,293	44.0	205	3.9	1,292	24.8	336	6.5	5,209	8.4
Color/race																
White	509	3.6	401	2.8	2,227	15.6	6,699	47.0	336	2.4	2,265	15.9	1,802	12.7	14,239	23.0
Black	134	2.7	131	2.6	308	6.2	2,790	56.4	87	1.8	502	10.1	995	20.1	4,947	8.0
Yellow	8	3.1	9	3.5	41	16.0	131	51.2	5	2.0	19	7.4	43	16.8	256	0.4
Pardo	1,432	3.7	1,298	3.3	5,821	14.9	22,851	58.4	591	1.5	2,566	6.6	4,556	11.6	39,115	63.1
Indigenous	8	2.2	7	1.9	156	41.9	82	22.0	78	21.0	19	5.1	22	5.9	372	0.6
Ignored	415	13.6	68	2.2	330	10.8	1,323	43.5	105	3.4	610	20.0	193	6.3	3,044	4.9
Education																
None	739	4.1	611	3.4	2,355	13.1	9,439	52.5	315	1.8	1,271	7.1	3,237	18.0	17,967	29.0
1 - 3 years	475	3.1	450	2.9	2,166	14.1	8,993	58.4	245	1.6	935	6.1	2,142	13.9	15,406	24.9
4 - 7 years	211	2.2	224	2.3	1,624	16.9	6,015	62.5	166	1.7	550	5.7	836	8.7	9,626	15.5
8 - 11 years	135	2.8	130	2.7	984	20.1	3,058	62.6	94	1.9	155	3.2	328	6.7	4,884	7.9
1 - 8 years	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	100.0	0	0.0	2	0.0
> 12 years	44	2.4	62	3.4	407	22.2	1,094	59.7	53	2.9	75	4.1	96	5.2	1,831	3.0
Ignored	902	7.4	437	3.6	1,347	11.0	5,277	43.1	329	2.7	2,993	24.4	972	7.9	12,257	19.8

Table 2. Odds Ratio (OR) of deaths from cerebrovascular accident in relation to general deaths in the Northern Region, Brazil, 2000-2015

Variable	Deathsfrom Stroke		General Deaths		OR(95%CI)	P
	n	%	n	%		
Age group						
≥60	45,534	8.5	487,318	91.5	2.41 (2.36-2.45)	<0.001
≤59	16,357	3.7	422,216	96.3		
Gender						
Female	28,844	7.7	346,675	92.3	1.42 (1.39-1.44)	<0.001
Male	33,114	5.5	565,398	94.5		
Marital Status						
Unmarried	14,490	4.5	309,343	95.5	-	-
Married	25,468	8.7	267,059	91.3	2.03 (1.99-2.07)	<0.001
Widow(er)	13,486	9.8	124,672	90.2	2.30 (2.25-2.36)	<0.001
Separated	1,425	7.5	17,615	92.5	1.72 (1.63-1.82)	<0.001
Other	1,895	5.9	30,060	94.1	1.34 (1.28-1.41)	<0.001
Color/race						
White	14,239	6.7	197,012	93.3	-	-
Black	4,947	8.9	50,571	91.1	1.31 (1.30-1.40)	<0.001
Yellow	256	7.8	3,033	92.2	1.16 (1.02-1.32)	0.019
Pardo	39,115	6.1	598,146	93.9	0.90 (0.88-0.92)	<0.001
Indigenous	372	2.2	16,717	97.8	0.30 (0.27-0.34)	<0.001
Education						
None	17,967	8.5	193,030	91.5	1.49 (1.41-1.56)	<0.001
1-12 years	29,918	6.6	425,694	93.4	1.12 (1.07-1.18)	<0.001
>12 years	1,831	5.9	29,332	94.1	-	-
Total	61,973		913,006			

a) 95%CI: 95%ConfidenceInterval

The prevalence was also identified in female individuals (1.42; 1.39-1.44; p<0.001), widowed marital status (2.30; 2.25-2.36; p<0.001), in the black race/color (1.31; 1.30-1.40, p<0.001) and in individuals with no schooling (1.49; 1.41-1.56; p<0.001). Data categorized as "Ignored" were removed since they did not present specificity (Table 2). An analysis at national level, comparing the chance of death from stroke in the Northern Region to other Brazilian regions, showed that the residents of the Northern Region are 9% more likely to die from it when compared to the Southeastern Region (Table 3).

Table 3. Odds Ratio (OR) of deaths from cerebrovascular accident among Brazilian Regions, 2000-2015

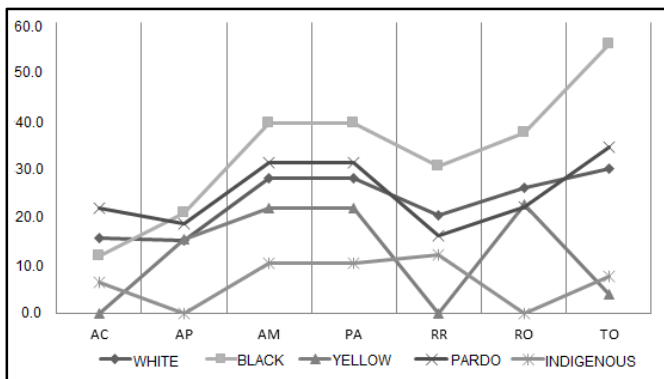| Region	Stroke		OR (95%CI)	P
	Yes	No		
Southeast	478,092	7,684,776	-	-
North	61,973	913,006	1.09 (1.08-1.10)	p<0.001
Northeast	295,489	4,122,868	1.15 (1.14-1.15)	p<0.001
South	176,331	2,557,520	1.10 (1.10-1.11)	p<0.001
Midwest	57,319	1,026,760	0.89 (0.88-0.90)	p<0.001

a) 95%CI: 95%ConfidenceInterval

Figure 2. Mortality rate from cerebrovascular accident by race in the Northern Region, Brazil, 2010

DISCUSSION

The present study found that stroke has occurred predominantly in males, aged over 60 years, married, Pardo Brazilians, and without schooling. The mortality rate from strokein the Northern region has been similar to the values described in the literature (Fang *et al.,* 2014). The analysis of the states of the region showed that the state of Tocantins presents the highest mortality rate and the greatest chance of deaths from stroke in the Northern Region. Tocantins was one of the Brazilian states that most invested in health in recent years (IBGE, 2013). In this way, greater investment leads to greater personal and materials/technological resources, making data reliably reflect the real situation that occurs in the Brazilian states (Araújo *et al.,* 2015). This investment might have led to a better condition in the identification of cases of stroke, which justifies this high rate. Studies conducted in the state of Paraíba found prevalence of stroke in individuals aged over 60 years, *pardo*color/race, married and with a low educational level among those most affected by stroke (Costa *et al.,* 2016; Dutra *et al.,* 2017). These data corroborate our study, which also found a similar profile. However, the year 2010, when the last demographic census was carried out, was used to assess the color/race with the highest rate of deaths in the Northern Region. With this, one can say that the black color/race showed higher values in comparison to the others, especially when compared to *pardo* color/race, which in terms of prevalence, between the years 2000 and 2015, was higher than the others were in numbers of recorded deaths from stroke. Although the total values presented the *pardo*color/race as the most affected among deaths from stroke in the Northern region, in the year 2010, there was no representativeness of this ethnic group, making the black color/race with the highest rate of deaths from stroke this year. The black color/race presented 30% more risk than other ethnic groups. The black race/color is directly associated with the incidence of stroke, because the literature indicates it as a risk factor for cardiovascular diseases, such as systemic arterial pressure, pathology strongly associated with stroke and commonly correlated as one of the main causes of evolution for the cerebral lesion picture (Lima *et al.,* 2016b).

The results of this study show that subjects aged greater than or equal to 60 years have 2 times more chance to die than individuals aged less than or equal to 59 years. Several studies show similar results, bringing individuals aged over 60 years as the most affected, which, in a way, can be explained by risk factors such as age, chronic diseases and life style, common in most cases (Lima *et al.,* 2016b; Damata *et al.,* 2016). Although

national researchers have identified the prevalence of morbidity and mortality in individuals aged over 60 years, (Dutra *et al.,* 2017; Sarmento *et al.,* 2017; Silva *et al.,* 2016),national and international recent studies point to the growing number of cases of stroke in young adults. According to data from the Stroke Association (2017), in the 1990's, in the United Kingdom, a quarter of the cases of deaths from stroke affected the population between 20-64 years old; in 2010, these values corresponded to one third of the cases (Stroke Association, 2018; Grumann *et al.,* 2017). This constantly growing cases in young people leads to a more judicious notification, causing a significant increase in the values that represent such age. Regarding the risk of death from stroke, the present study found that female individuals are 42% more likely to die than men are. This statement can be corroborated by observing that the female sex itself is a risk factor for chronic diseases such as hypertension and diabetes, diseases directly associated with the occurrence of stroke (Ribeiro *et al.,* 2012; Fernandes *et al.,* 2015).

Epidemiological studies also indicate the females with higher prevalence in all cases of deaths from stroke in Brazil (Costa *et al.,* 2016; Dutra *et al.,* 2017).Several studies bring individuals with low or no education as the main affected by stroke (Sarmento *et al.,* 2017; Pereira *et al.,* 2009). The present study has identified that individuals without schooling had 49% more chance of being affected that individuals with some schooling. The difficult access and the inability to seek information make these individuals vulnerable to risk factors, becoming part of the statistics (Silva *et al.,* 2016).According to the results, married patients had a higher prevalence, but the widows are approximately two times more likely to suffer from stroke than the others are, going against what other studies mention (Dutra *et al.,* 2017). This may be related to the fact that widowed individuals are generally at more advanced age, which keeps them within the risk group (Araújo *et al.,* 2018). The study also presents a comparison at national level, which shows that the population in the Northern region is 9% more likely to develop a stroke picture than individuals are in the Southeast. According to information from the Ministry of Health, in 2007, 31.7 billion were invested in health in the Southeastern Region, and a large part of this money would be assigned to the basic attention, creating 3,962 new teams in the Family Health Program, hiring 8,159 community health agents and constructing 3,319 Basic Health Units (Brazil, 2007). Thus, it allowed an even greater control through the HIPERDIA program of one of the main risk factors of the stroke, which are chronic diseases such as hypertension and diabetes. On the same premise, the Northern region lies in a greater risk by the inverse of the same reason. The North and Northeast regions are prioritized in the transfer of funds for being considered the most needy, rising from 641 million in 2003 to 1.7 billion in 2009 (Brazil, 2010).

However, a recent study reveals that the North and Northeast regions are those which least invest in primary care, and the North had the lowest rates of investment in health. Even possessing the greatest federal fund, it presents in sensitive conditions to primary care (David *et al.,* 2015). In the period from 2000 through 2015, there were 61,973 deaths from stroke in the Northern Region, of them, the female gender, aged less than 59 years, widowed and black color have a higher chance of death from stroke. The mortality indices are not declining, and this may be a reflection of the inefficiency of the programs responsible for control and provision of assistance to the

subject holders of risk factors for stroke. Prevention is a determinant for minimizing damage and mortality from stroke. A possible limitation of the study is the underreporting of cases due to the difficulty of specific diagnoses of stroke in remote locations in the Northern Region that do not have access to imaging exams (Computed Tomography). The lack of an imaging exam for diagnosing individuals with no classic signs of stroke may have caused the incorrect record of deaths from other causes. Nevertheless, the data identified can serve as an aid for improving programs for primary and tertiary care, since stroke is one of the leading causes of death in the country, and the study presents significant rates and evident risk of deaths from stroke in the Northern Region.

REFERENCES

Araújo, J.P., Darcis, J.V.V., Tomas, A.C.V., Mello, W.A., 2018. Mortality Trend Due to Cererovascular Accident in the City of Maringá, Paraná between the Years of 2005 to 2015. *Int. J. Cardiovasc. Sci.,* 31(1)56-62.

Araújo, M.M.P. and Silva, C.G., 2015. The importance of the information of diseases notification system – SINAN for epidemiological surveillance of Piauí. *RevInterdCienc e Saúde.* ISSN: 2358-6966.

Brasil. Ministério da Saúde, 2007. "Mais Saúde" investirá R$31,7 bilhões na região Sudeste. Brasília, DF.

Brasil.Ministério da Saúde, 2010. Saúde, um bem coletivo. Brasília, DF.

Canuto, M.A., Nogueira, L.T., 2015.Stroke and quality of life: anintegrativereview.*J.Res.Fundam.Care.,*7(2):2561-2568.

Costa, T.F., Gomes, T.M., Viana, L.R.C., Martins, K.P., Macêdo-Costa, K.N.F. 2016. Stroke: patient characteristics and quality of life of caregivers. *Rev. Bras. Enferm.,* 69(5):877-83.

David, G.C., Shimizu, H.E., Silva, E.M. 2015. Primary Health Care in Brazilian municipalities: efficiency and disparities. SaúdeDebateRiodeJaneiro,v.39,n. Especial,p.232-245.

Damata, S.R.R., Formiga, L.M.F., Araújo, A.K.S., Oliveira, E.A.R., Oliveira, A.K.S., Formiga, R.C.F., 2016. Epidemiological profile of elderly afflicted with stroke. *Revista Interdisciplinar.*, 9(1): 107-117.

Dutra, M.O.M., Coura, A.S., França, I.S.X., Enders, B.C., Rocha, M.A., 2017. Sociodemografic factors and functional capacity of elderly affected by stroke. *Rev Bras Epidemiol.*, 20(1): 124-135.

Fang, M.G., Perraillon, M.C., Ghosh, K., Cutler, D.M., Rosen, A.B., 2014.Trends in Strokes Rates, Risk, and Outcomes in the United States, 1988-2008. *Am. J. Med.,* 127(7): 608-615.

Fernandes, J.G., 2015. Stroke prevention and control in Brazil: missed opportunities. *ArqNeuropsiquiatr.* 73(9):733-735.

Grumann, A.R.S., Schoeller, S.D., Martini, A.C., 2017. Characteristics of Encephalic Vascular Accident patients treated at a state reference center. *FundCare Online.* 9(2):315-320.

Instituto Brasileiro de Geografia e Estatísticas, 2013. Pesquisa de Informações Básicas Estaduais. Perfil dos Estados Brasileiros.

Lima, A.C.M.A.C.C., Silva, A.L., Guerra, D.R., Barbosa, I.V., Bezerra, K.C., Oria, M.O.B., 2016a.Nursing diagnoses in patients with cerebral vascular accident: an integrative review. *Rev Bras Enferm.,* 69(4):738-45.

Lima, M.J.M.R., Moreira, T.M.M., Florêncio, R.S., Neto, P.B., 2016b. Fatores associados ao conhecimento dos adultos jovens sobre histórico familiar de Acidente Vascular Cerebral. *Rev. Latino-Am. Enfermagem*, 24:e2814.

Lopes, J.M., Sanchis, G.J.B., Medeiros, J.L., Dantas, F.G., 2016. Hospitalization for ischemic stroke in Brazil: na ecological study on the possible impact of hiperdia. *Rev Bras Epidemiol.* 19(1): 122-134.

Pereira, A.C.N.G., Alvarenga, H., Júnior, R.S.P., Barbosa, M.T.S, 2009. Stroke prevalence among the elderly in Vassouras, Rio de Janeiro State, Brazil, according to data from the Family Health Program.Cad. Saúde Pública, Rio de Janeiro, 25(9):1929-1936.

Pinno, C., Birrer, J.A., Colpo, A.P.F., Tavares, A.C., Schmitt, F.V., Santos, A.A. 2014. Stroke: Challenge for managers in the health care network. *Rev Enferm UFSM.* 4(4): 667-677.

Ribeiro, K.S.Q.S.*et al*. 2012. Profile of users affected by stroke followed by the Family Health Strategy in a capital of northeastern Brazil. *Rev. Bras. de Ciências da Saúde.* 16(2):35-44

Sarmento, S.D.G., Dantas, R.A.N., Dantas, D.V., Oliveira, S.P., Henrique, L.M.N., Costa, I.B., 2017. Profile of Individuals with neurological disorders assisted by a prehospital mobile emergency care service. *Cogitare Enferm.* (22)2: e49698.

Silva, B.M. and Lin, K., 2016. Demographic profile of stroke in hospital universitário prof. Polydoro Ernani de São Thiago (Florianópolis, SC) Between 2001 and 2012. *Arq.Catarin Med.* 45(2): 43-58.

Stroke Association, 2018.State of the Nation. Stroke Statistics February 2018.

****