Hospital admissions of Brazilian older adults due to oral health problems: A trend analysis

Caroline Barbosa Lourenço[1], Maria Vieira de Lima Saintrain[1*], Rosa Lívia Freitas de Almeida[1], Davi Oliveira Bizerril[2], Débora Rosana Alves Braga[1], Edla Helena Salles de Brito[1], Caroline Ferreira Martins[1], Maria Isabel Damasceno Martins Fernandes[2]Anya Pimentel Gomes Fernandes Vieira-Meyer[3]

[1]Public Health Graduate Program, University of Fortaleza-Ceará, Brazil.
[2]Dentistry Under Graduate Program, University of Fortaleza-Ceará, Brazil.
[3]Oswaldo Cruz Foundation (Fiocruz Ceará); ChristusUniversity Center -Fortaleza-Ceará, Brazil
CorrespondingAuthor
Maria Vieira de Lima Saintrain[1*]
E-mail- mvlsaintrain@yahoo.com.br
AvWhasghton Soares,1321-Édson Queiróz, Fortaleza-Ceará, Brasil. CEP 60811-905

Abstract— Background. There is a bidirectional relationship between oral health and general health, i.e., poor oral health increases the risk of general health problems and poor general health increases the risk of oral health problems. Objectives. To analyze hospital admissions of older people due to complications of orofacial diseases. Design. Quantitative ecological study. Setting. Public and private hospitals operating within Brazil's Unified Health System. Participants. People aged 60+ years hospitalized due to oral health-related problems from 2008 to 2017. Methods. Prevalence of hospital admissions was estimated based on the number of admissions due to oral diseases in each Brazilian region divided by the number of in habitants. Joinpoint regression analysis was performed to evaluate the trend of each segment of the variables using the Joinpoint Regression Program software, version 4.6.0.0.Annual percent change (APC), average annual percent change (AAPC) and confidence interval (CI) were calculated at a confidence level of 95%. Results. There was a trend towards the growth in hospital admissions in all Brazilian regions throughout the years. Most hospital admissions were among male older people aged 70-79 years and the main cause of hospitalization was lip, oral cavity and pharynx malignant tumor. The South region presented the highest prevalence of hospital admissions due to oral cancers and the North region exhibited the highest number of hospital admissions due to dental caries and other oral heatlth conditions. Conclusion. The growth in hospital admissions of older adults due to oral health problems suggests failures in the provision of health promotion and disease prevention actions.

I.   INTRODUCTION

Brazil, like many other countries around the world, is aging fast and has experienced an increase in the number and proportion of older people in its population[1,2].Oral health is an integral and essential part of health care and quality of life and it is crucial for a healthy aging; however, its importance has not been properly acknowledged[3].Oral diseases are often accepted as an inevitable consequence of life and aging and are thus neglected by people and health care professionals[4].

There is a bidirectional relationship between oral health and general health, i.e., poor oral health increases the risk of general health problems and poor general health increases the risk of oral health problems. Comorbidities like functional and cognitive decline may result in difficulty performing daily oral care[5]. For instance, arthritis can hinder the ability to hold a toothbrushor manipulate dental floss and many older people who use multiple drugs (polypharmacy) tend to have decreased salivary flow, which increases the likelihood of dental caries and periodontal diseases and, consequently, affect speech, chewing, swallowing and social interactions. Furthermore, poor periodontal health has been associated with an increased risk of diabetes and heart diseases[6].

Oral health is defined as the absence of mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases that limit a person's capacity in biting, chewing, smiling or speaking, and that compromises psychosocial well-being[7].

Untreated dental caries is the most prevalent oral disease and the most common chronic disease worldwide. Its overall prevalence rate of 40% places it as a major challenge for public health. Severe periodontitis is the sixth most common disease in the world, with an estimated worldwide prevalence of 5 to 20%, while oral cancer ranks tenth among all types of cancer[4]. The most common oral health problems among older people are root caries and periodontal disease, and both are responsible for the majority of tooth extractions. Although edentulism is considered by many to be a natural aging phenomenon, it may be a result of lack of guidance and oral health care in all age groups[3].

Early stages of dental caries are often without symptoms, but advanced stages can cause pain, infections and abscesses, or even sepsis[7]. Such infection can lead the person to hospitalization or even death. Severe complications from cellulitis can occur due to dental infections and can progress to cavernous sinus thrombosis, mediastinitis, brain abscess, or patient's death[8]. Thus, it is necessary to have access to information about hospital admissions due to diseases related to oral health problems. Also, regional inequalities should also be taken into consideration as they constitute a risk factor for most oral health problems[4]. In Brazil, the North and Northeast regions have worst social and economic conditions compared with the South and Southeast regions[9].

In view of the considerations outlined above, the present study aimed to analyze older people's hospital admissions due to complication of orofacial diseasesover a ten-year period.

II.   METHODS

This ecological study analyzed the Brazilian regions from 2008 to 2017. This period corresponded to the data from Brazil's Hospital Information System (*Sistema de InformaçõesHospitalares – SIH*) and the Health Secretariat which were available in the DATASUS database.

The SIH aims to standardize the process of reporting, consolidation, and sharing of hospital information in Brazil's National Health System, also called the Unified Health System (*Sistema Único de Saúde—SUS*). It is run by the Department of Informatics of SUS – DATASUS.

The data were downloaded directed from the SIH webpage in a comma-separated values file. The Tabnet software wasused totabulate the data and the study variables were: age group (60-69, 70-79, and 80+), gender, year of hospitalization, Brazilianregion, and main diagnosis atadmission (lip, oral cavity and pharynx malignanttumor, dental caries, disorders of teeth and supporting structures, or other diseases of the oral cavity, salivary glands and jaws) according to the International Classification of Diseases – Tenth Revision (ICD-10)[10].In Brazil, SIH is a data source of great importance because it discloses data on the epidemiological profile of hospital morbidity[11].

The prevalence of hospital admissions of older people was estimated based on the number of admissions due to oral diseases in each Brazilian region divided by the number of inhabitants. The twenty-six Brazilian states and the Federal District are grouped into five regions, with marked inequality between them, resulting from historical, economic, cultural, social and environmental processes[12].The population data needed for this estimation were obtained from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística – IBGE*) on the DATASUS website. The rates were adjusted by age group (60-69, 70-79, 80+), gender and region using the direct method of standardization (FIGURE 1). The data were organized and submitted to descriptive statistical analysis using the Statistical Package for the

Social Sciences (SPSS), version 20.0 (SPSS Co, Chicago, USA). Frequencies and percentages of hospital admissions were calculated for the study variables.

For the analysis of temporal trend reducing potential variability of the historical series, joinpoint regression techniques (by inflection points) were used, thus allowing to assess whether in some points, called joinpoints, there are changes in the observed trend pattern. That way, joinpoint regression analysis was performed to evaluate the trend of each segment of the variables using the Joinpoint Regression Program software, version 4.6.0.0.

The joinpoint regression provides the adjustment of a series of lines, as well as their inflection points on a logarithmic scale through the annual trend test. From the definition of the segments, an annual percent change (APC), average annual percent change (AAPC) and confidence interval (CI) were calculated. This method allows to identify significant changes in some points (joinpoints) in a given trend pattern by estimating whether these values are statistically significant at a confidence level of 95%. The number of inflections used in the analysis was the result of models defined by the program itself, in order to allow the best representation of the trend, with the least number of inflection points. The result made it possible to demonstrate growth (positive APC values), reduction (negative APC values) or maintenance (APC value equal to zero) of the trend throughout the analyzed historical series. In this way, the APC for each segment is used not only to describe and quantify the trend, but also to assess whether this trend is statistically significant. A trend was considered statistically significant, different from zero, when the p value was less than 0.05[13].

The present study used secondary data publicly available and thereforedid not need Institutional Review Board (IRB) approval. However, it should be noted that the study complied with all ethical precepts for scientific research. For this type of study, formal consent is not required.

III. RESULTS

From 2008 to 2017 there were 123,276 hospital admissions of people aged 60+ years due to orofacial diseases. The highest number of cases was found in the Southeast region (n=58,204, f=47.2%) (TABLE 1). The highest mean prevalence was found in the South region (47.9/100,000 older people) and the mean prevalence of hospital admissions in Brazil was 33.6/100,000 older people, with variations accross the regions.

There was a higher number of hospital admissions among male older people, especially among men aged 70-79 years (FIGURE 1).

Table 1. Number of hospital admissions of older adults due to oral diseases by year and region. Brazil, 2008 to 2017.

Year	North		Northeast		Souheast		South		Midwest		Total
	N	%	n	%	N	%	n	%	n	%	N
2008	251	7.8	2599	9.6	4663	8.0	2727	10.2	759	9.6	10999
2009	254	7.9	3078	11.3	5209	8.9	2537	9.5	758	9.6	11836
2010	255	8.0	2982	11.0	5527	9.5	2510	9.4	916	11.6	12190
2011	293	9.1	2738	10.1	5252	9.0	2389	8.9	818	10.4	11490
2012	305	9.5	2860	10.5	6192	10.6	2494	9.3	843	10.7	12694
2013	272	8.5	2668	9.8	6168	10.6	2594	9.7	742	9.4	12444
2014	291	9.1	2252	8.3	5851	10.1	2771	10.3	673	8.5	11838
2015	374	11.7	2496	9.2	6365	10.9	2963	11.1	722	9.2	12920
2016	433	13.5	2679	9.8	6299	10.8	2849	10.6	763	9.7	13023
2017	479	14.9	2857	10.5	6678	11.5	2946	11.0	882	11.2	13842

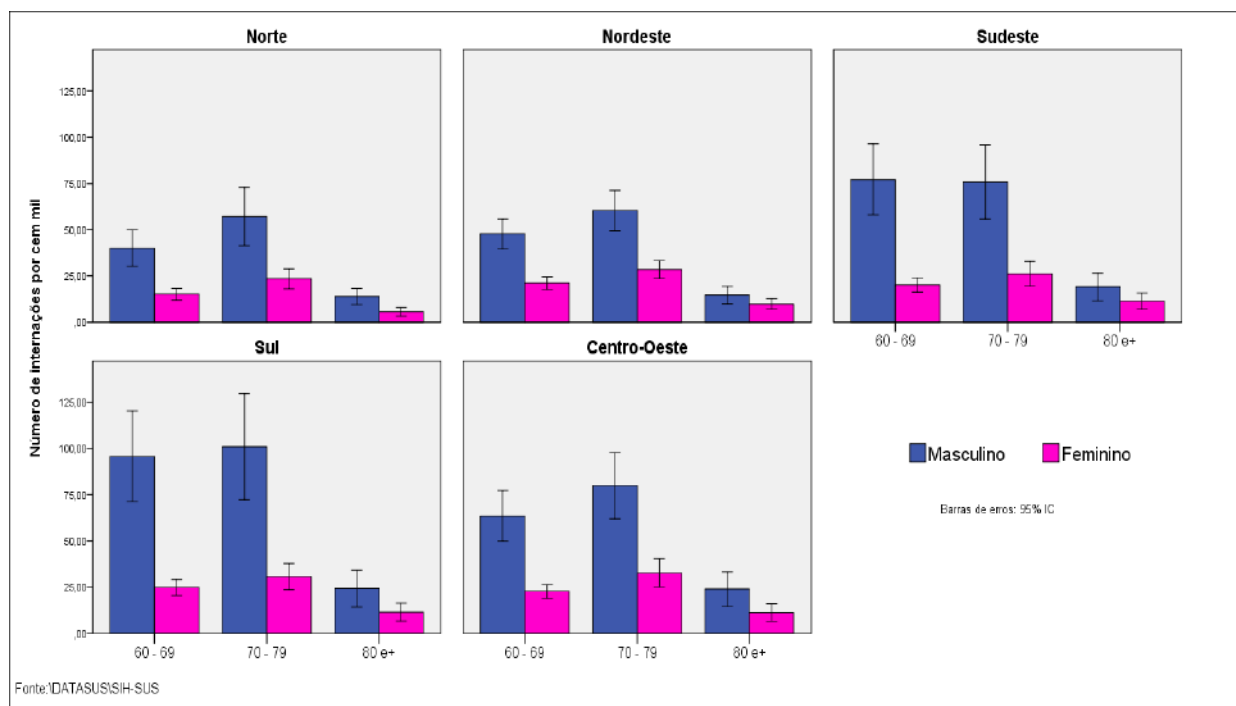Hospital Information System (SIH/SUS)

Fig.1 Number of hospital admissions of older adults per one hundred thousand older adults by region, gender and age. Brazil, 2008 to 2017.

Figure 2 displays thematicmaps showing regional difference. It also shows that the main cause of hospital admission was lip, oral cavity and pharynx malignant tumor. The Northregion presented a lower rate of hospital admissions due to cancers and a higher rate of hospital admissions due to other oral diseases, such as dental caries.

In regard to hospital admissions due to diseases related to dental caries and disorders of teeth, oral cavity and salivary glands (TABLE 2), there was a trend towards higher hospital admission rates among people aged 60-69 years and 70-79 years and lower rates among people aged 80+. The rates remained stable from 2014 to 2017 in all the regions and in both genders. The North region presented joinpoints for men aged 60-69 years. The first joinpoint identified was in the period from 2008 to 2012 with a decreasing APC of -17.92 (95%CI= -36.7; 6.5). The second joinpoint was in the period from 2012 to 2014, with an increasing APC of 143.73. The Northeast region presented joinpoints for men aged 70-79 years, with one joinpoint in the period from 2008 to 2012, with a decreasing APC of -14.41 (95%CI= -29.8, 4.3) and another in the period from 2012 to 2014, with an increasing APC of 94.98. As for the South region, a joinpoint was identified for men aged 70-79 years in the period from 2008 to 2012, with a decreasing APC of -4.54 (95%CI= -18.2; 11.3) and an increasing APC of 67.94 in the period from 2012-2014. In the Southeast region, there was one joinpoint for women aged 60-69 years in the period from 2008 to 2012, with an increasing APC of 1.10 (95%CI= -8.2; 11.3) and a second joinpoint in the period from 2012 to 2014, with an increasing APC of 48.55. The Midwest region did not present joinpoints.

Table 2. Joinpoint analysis of dental caries and disorders of teeth, oral cavity and salivary glands by gender, age and region. Brazil, 2008-2017.

		Men								
		Age Group								
Region	**Year**	**60-69 yearsold**			**70-79 yearsold**			**80+ yearsold**		
		APC	CI (95%)	AAPC	APC	CI (95%)	AAPC	APC	CI (95%)	AAPC
North	2008 – 2017		(8.5; 20.6)	14.39		(10.4; 31.9)	20.68		(-67.6; -32.4)	-53.18
Northeast	2008 – 2017		(4.3; 13.9)	8.99		(4.7; 18.5)	11.38		(-64.0; -29.5)	-49.62
Southeast	2008 – 2017		(7.6; 18.5)	12.91		(6.0; 22.1)	13.77		(-63.9; -27.0)	-48.64
South	2008 – 2017		(5.6; 17.6)	11.43		(4.9; 21.7)	13.01		(-62.9; -31.0)	-49.65

|								
Midwest	2008 – 2017		(6.1; 12.0)	9.02	(3.3; 15.3)	9.12	(-67.7; -33.5)	-53.68
Women								
North	2008 – 2017		(7.8; 14.2)	10.96	(12.5; 24.1)	18.15	(-68.3; -27.3)	-51.98
Northeast	2008 – 2017		(-1.5; 6.1)	2.24	(0.2; 8.1)	4.08	(-60.1; -29.7)	-47.03
Southeast	2008 – 2017		(3.1; 13.5)	8.17	(1.0; 11.8)	6.24	(-60.3; -26.4)	-45.98
South	2008 – 2011	-16.12	(-20.3; -11.7)		-17.56	(-20.9; -14.1)		
	2011 – 2014	34.25	-		28.25	(16.3; 41.5)		
	2014 – 2017	-2.39	(-5.8; 1.1)		-5.80	(-10.0; -1.3)		
	2008 – 2017		-	-0.4	(-1.9; 1.6)	-0.1	(-57.1; -31.5)	-45.76
Midwest	2008 – 2017		(-2.8; 6.3)	1.61	(0.6; 15.9)	7.97	(-65.8; -27.1)	-50.08
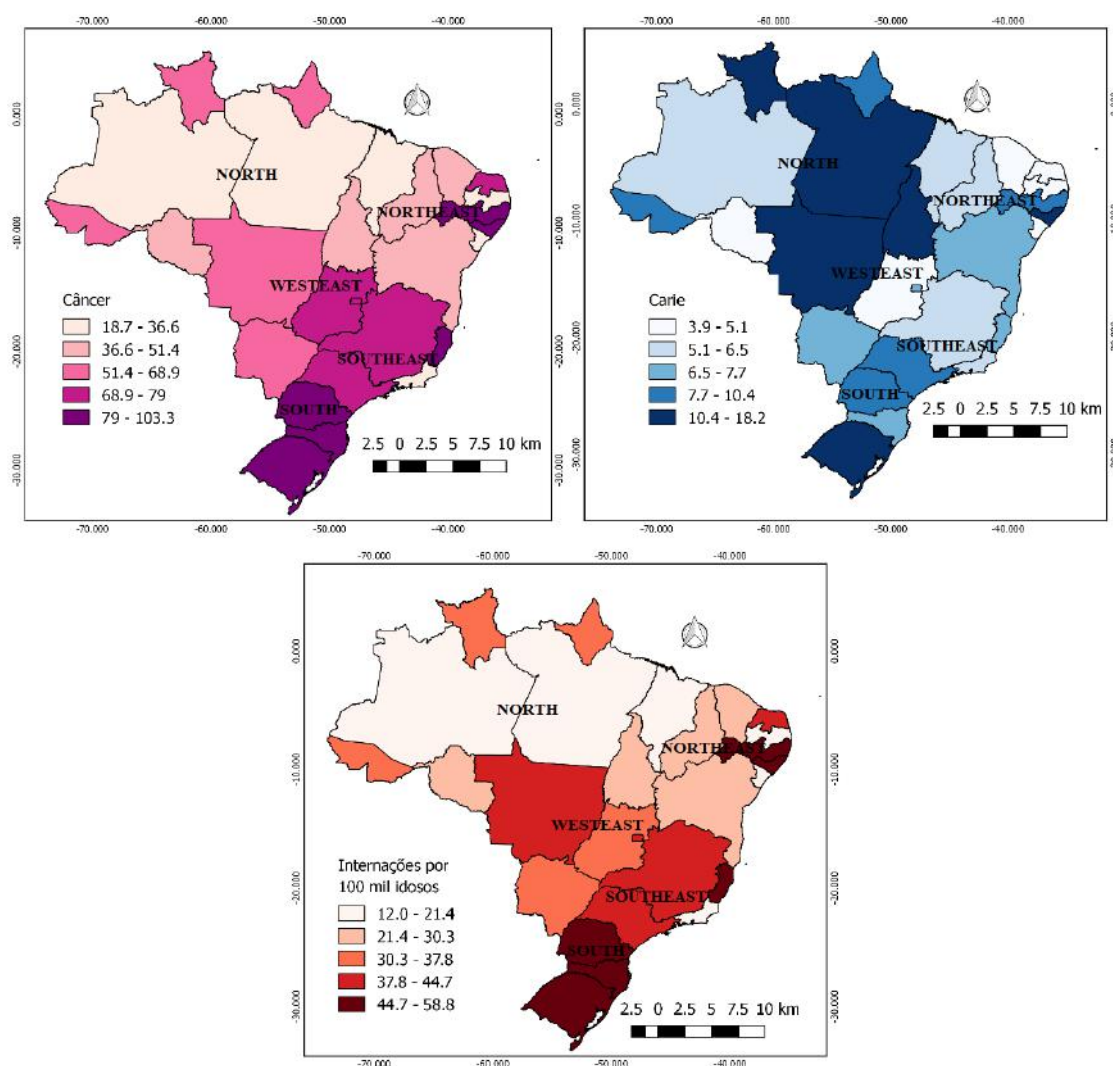
Fig. 2 Thematic maps displaying the distribution of hospital admissions by region. Brazil, 2008-2017.

Regarding hospital admissions due to oral cancers (TABLE 3), there was a trend towards higher rates of admissions among people aged 60-69 years and 70-79 years and lower rates among people aged 80+. The rates remained stable in the period from 2014 to 2017. Only the South region exhibited changes in the trend pattern – only in women and ages 60-69 years and 70-79 years. As for people aged 60-69 years, we found one joinpoint for in the period from 2008 to 2011, with a decreasing APC of -16.12 (95%CI=-20.3; -11.7) and another jointpont in the period

from 2011 to 2013, with an increasing APC of 34.25. With regard to people aged 70-79 years, we found one joinpoint in the period from 2008 to 2011, with a decreasing APC of

-17.56 (95%CI= -20.9; -14.1) and another joinpoint in the period from 2011 to 2014, with an increasing APC of 28.25 (95%CI=16.3; 41.5).

Table 3. Joinpoint analysis of oral neoplasms by gender, age and region. Brazil, 2008-2017.

		Male								
		Age Group								
Region	**Years**	**60-69 yearsold**			**70-79 yearsold**			**80+older**		
		APC	**IC (95%)**	**AAPC**	**APC**	**IC (95%)**	**AAPC**	**APC**	**IC (95%)**	**AAPC**
North	2008-2012	-17.92	(-36.7; 6.5)							
	2012-2014	143.73	-							
	2014-2017	23.86	(-2.1; 56.7)							
	2008-2017		-	19.9		(6.6; 34.6)	19.78		(-63.3; -35.7)	-51.43
Northeast	2008-2012				-14.41	(-29.8; 4.3)				
	2012-2014				94.98	-				
	2014-2017				-8.56	(33.0; 24.7)				
	2008-2017		(4.1; 14.2)	9.02	5.1	-			(-60.6; -28.0)	-46.76
Southeast	2008-2017		(6.3; 14.6)	10.37		(7.9; 16.6)	12.19		(-63.3; -27.8)	-48.51
South	2008-2012				-4.54	(-18.2; 11.3)				
	2012-2014				67.94	-				
	2014-2017				-4.52	(-24.6; 20.9)				
	2008-2017		(3; 15.2)	8.89		-	8.2		(-61.0; -32.9)	-48.82
Midwest	2008-2017		(-0.4; 18.8)	8.77		(1.1; 39.3)	18.64		(-66.6; -27.1)	-50.67
		Female								
North	2008-2017		(15.2; 36.2)	25.27		(13.9; 36.7)	24.77		(-66.1; -39.2)	-54.60
Northeat	2008-2017		(-0.8; 8.6)	3.79		(-1.1; 13.1)	5.75		(-56.3; -24.8)	-42.63
Southeast	2008-2017		(3.4; 11.4)	7.35		(2.1; 12.5)	7.18		(-55.7; -26.3)	-42.87
South	2008-2011	1.10	(-8.2; 11.3)							
	2011-2014	48.55	-							
	2014-2017	-0.94	(-12.3;11.8)							
	2008-2017		-	9.4		(-1.6; 17.9)	7.71		(-55.9; -23.7)	-41.95
Midwest	2008-2017		(1.9; 26.8)	13.68		(-2.9; 17.1)	6.66		(-57.3; -29.5)	-45.13

IV. DISCUSSION

Population aging and its implications for health are a major challenge for public oral health. Hospital admissions are known to lead to older people's worse

quality of life and the present study seeks to provide a more in-depth analysis of the issue by addressing hospital admissions due to oral health problems. This discussion is

important due to the lack of information in this issue in the literature by the scientific community.

Untreated dental caries get worse over time and its sequelae compromise the oral health of the older population. In a study conducted by Nogueira et al., 85.26% of the older adults who were interviewed presented dental complaints, including self-reported pain, missing teeth, spots, difficulty speaking, gingival bleeding, dry mouth, loose teeth, crooked teeth, difficulty swallowing or chewing, discomfort caused by dentures, bad breath and wounds[14].

In Brazil, the data from the latest oral health survey (SBBrasil-2010) show regional differences in all age groups in both big cities and small towns. The North and Northeast regions exhibit the worst epidemiological profiles of periodontal conditions in all age groups compared with the other regions. The number of people aged 65-74 years who did not need dentures was very low, 12.7% in the South region and 2.8% in the North region. Regardless of the low number for all regions, the difference between the South and the North regions is remarkable. The reason may not be so evident, but may be related to social-economic conditions (North region is poorer than the South region)[15], the oral health service offer (lower number of dentists per capita in the North region compare to all other regions) and attitudinal populational differences[16]. In the North, 46.2% of the older adults sought dental care facilities for tooth extraction and 24.9% sought these services for treatment. A contrasting behavior was observed in the South, where 22.9% of the older adults sought dental care facilities for tooth extraction and 38.3% attended these services looking for dental treatment[9].

We found that the Southeast region had the highest absolute number of oral health-related hospitalization. However, when the size of the population in each region was considered, the South region presented the highest prevalence of hospitalizations and the North region presented the lowest prevalence. The hospitalization of people aged 60 years or older for oral health problems was previously highlighted by Freitas et al. who found a total of 2,626,225 hospital admissions were authorized by SUS throughout Brazil in 2013. The researchers calculated morbidity rates for the five geographic regions, and, as in our results, they found the highest rates in the South region. The reason for that may be related to demographic, economical, oral health care infrastructure (including number of dentist per capita), being the South region known for their higher longevity rate, less social economic discrepancy, higher (together with the Southeast region) number of dentist per capita[17,18].It is known that poor access to dental care often prevents early detection of cancer and hence results in pain, loss of function, disfiguration,

impairment and even death[6].Corroborating to this line of thinking, Freitas et al. research concluded that the older population outnumbers the general population in the South region and that it features better infrastructure, which may explain the highest number of hospitalizations in this area of the country[19].

Most older adults will experience oral diseases in an advanced stage at some point in life. Therefore, receiving uncoordinated and fragmented care that fails to meet their values and preferences will result, most of the times, in unnecessary hospitalizations, unwanted treatment, adverse drug reactions, and higher health care costs[20].

For many years Brazilian older people have had little access to dental treatments and these treatments were almost always nonconservative. Since 2000, with the inclusion of the oral health team in the Family Health Strategy and the creation of dental specialty centers, the country started to provide more effective oral health programs[21,22].Nevertheless, research conducted with peopleaged 65-74 years using decayed, missing and filled teeth (DMFT) index found that the oral health of the older population was still compromised after a period of seven years, as the mean DMFT score remained practically the same (27.8 in 2003 and 27.5 in 2010), with missing teeth being the most prevalent condition[9,23]. As it can be seen, despite the attempts to restructure its Health System in view of the growing demand generated by the growth of the older population, Brazil does not seem prepared to deal with the rapid increase in the number of older adults.

Despite the official guidelines, Brazil's oral health care system still focus on immediacy and acute care rather than health promotion and disease prevention. Primary health care (PHC) is the main level of care for health promotion and disease prevention and care. In Brazil, the PHC is structured through the Family Health Strategy (FHS), which is formed by doctors, nurses, dentists, nurse and oral health auxiliaries and community health agents[24].Our research, corroborating to other studies, points to the necessity of FHS professionals to develop knowledge and skills to tackle the changes caused by the demographic and epidemiological shift and serve a population that is becoming older[2]. However, in order for this to became a reality, public policies and government will need to be align in this perspective, financing professional formation and the shift of healthcare system focus.

The analysis of gender in our study showed a higher number of hospital admissions among men. A similar finding was reported by Silveira et al., who found that the prevalence of hospital admission was 1.6 times higher in male older adults[25].This may seem intriguing, as the longevity is higher among women. However, women are

also more likely to seek health care services for health promotion, prevention and care, which may decrease their need to hospitalization[26]. Also, it should be noted that oral cancer is the oral disease responsible for the highest number of hospitalizations among older adults and it is most prevalent among men, with a male-to-female ratio of 2:1[4].

Lip, oral cavity and pharynx malignant tumor was the main cause of hospital admission in our study. According to the International Dental Federation, oral cancer is an important and growing global public health problem, and it remains the leading cause of death from oral disease. Furthermore, oral cancers are highly lethal, incapacitating and disfiguring and occur predominantly as squamous cell carcinomas, which have one of the lowest 5-year survival rates (about 50%)[27]. In all, therewere 299,051 cases of lip and oral cavity cancers in 2012 and 145,353 deaths worldwide[27].

Between 80% to 90% of all cancer cases are associated with environmental factors, including drinking and smoking, which can cause mouth, oropharynx and larynx cancer[28].Research has shown changes in the epidemiology of oral diseases in the older population led by the increased prevalence of oral cancer, which has been associated with drinking and smoking at younger ages. As mentioned earlier, poor access to dental care often prevents early detection of cancer and hence results in pain, loss of function, disfiguration, impairment and even death[6].However, these effects can be reduced by engaging older adults in health promotion activities that favor social interaction and healthy lifestyles[25].Our findings suggest potential failures to deliver health promotion and disease prevention actions, which may have contributed to the high number of oral cancer-related hospital admissions.

The present study has some limitations. The SIH data are limited to admissions to public and private hospitals that are authorized by SUS. Therefore, hospital admissions for private medical and hospital care covered by health insurances were not included in the study. Having said that, it is important to know that the vast majority of Brazilian population is SUS dependent for health care attention. Thus, the findings of the present study can contribute to complementary and in-depth studies of oral health.

The complications associated with the oral diseases suggest potential failures to deliver health promotion and disease prevention actions. Thus, it is necessary to elaborate policies for the implementation of actions to improve older adults' quality of life.

Information systems are important for the consolidation of epidemiological data for adequate planning and monitoring of health care actions, as well as public policies that meet the population needs. Moreover, the methodology used in our study should be highlighted as a strength as it allowed the easy and fast analysis of a large database at a low cost.

V.   CONCLUSION

The Information System proved to be an important tool for monitoring the epidemiology of oral health problems, as it helped to detect a significant number of hospital admissions of older people due to oral health problems. The findings showed a trend towards the growth in hospital admissions in all Brazilian regions throughout the years, as well as a difference on regions' hospitalization rate. The complications associated with the poor oral health suggest failures in the provision of health promotion and disease prevention actions. Thus, it is necessary to elaborate effective policies to tackle oral diseases. Such policies may contribute to the implementation of actions to improve older adults' quality of life.

REFERENCES

[1] Nations U. World population ageing 2015. 2015:164. doi:ST/ESA/SER.A/390

[2] Brasil. *Brasil 2050: desafios de uma nação que envelhece*. Vol 44.; 2017.

[3] Simões AC de A, Carvalho DM. The reality of the oral/dental health of the elderly in the Brazilian Southeast. *Cien Saude Colet*. 2011;16(6):2975–2982. doi:10.1590/S1413-81232011000600035

[4] Allen CM, Camisa C. *The Challenge of Oral Disease – A call for global action. The Oral Health*. 2a. Geneva: FDI World Dental Federation; 2015. doi:10.1038/npg.els.0002133

[5] Saintrain M de L, Saintrain S, Sampaio E, Ferreira B, Nepomuceno T, Frota M. Older adults' dependence in activities of daily living: Implications for oral health. *Public Health Nurs*. 2018;35(6):473–481.

[6] Batchelor P. The changing epidemiology of oral diseases in the elderly, their growing importance for care and how they can be managed. *Age Ageing*. 2015;44(6):1064–1070. doi:10.1093/ageing/afv148

[7] Organization WH. WHO | Sugars and dental caries. *Who*. 2017;(October):1–4. http://www.who.int/oral_health/publications/sugars-dental-caries-keyfacts/en/#.WmRgwZTEeIU.mendeley.

[8] Azenha MR, Lacerda SA de, Bim AL, Caliento R, Guzman S. Celulite facial de origem odontogénica. Apresentação de 5 casos. *Rev cir traumatol buco-maxilo-fac*. 2012;12(3):41–48. http://pt.

[9] Ministério da Saúde. *SB Brasil 2010: Pesquisa Nacional de Saúde Bucal: resultados principais*. 1a. (MS E, org.). Brasília: Biblioteca virtual em saúde do Miniistério da Saúde; 2012. doi:10.3310/hta21210

[10] OMS Organização Mundial de Saúde. CID-10 Classificação Estatística Internacional de Doenças e Problemas Relacionados à Saúde. 10ª. Revisão. 1997.

http://www.datasus.gov.br/cid10/V2008/cid10.htm.

[11] Góis ALB de, Veras RP. Informações sobre a morbidade hospitalar em idosos nas internações do Sistema Único de Saúde do Brasil. *Cien Saude Colet*. 2010;15(6):2859–2869. doi:10.1590/s1413-81232010000600023

[12] Etges VE, Degrandi JO. Desenvolvimento regional : a diversidade regional como potencialidade. *Rev Bras Desenvolv Reg*. 2013;1(1):85–94. doi:10.7867/2317-5443.2013

[13] Almeida FS e S de, Morrone LC, Ribeiro KB. Trends in incidence and mortality due to occupational accidents in Brazil , 1998-2008 Tendencias en la incidencia y la mortalidad por accidentes de trabajo en Brasil , 1998-2008. *Cad Saúde Pública*. 2014;30(9):1957–1964.

[14] Nogueira CMR, Falcão LMN, Nuto S de AS, Saintrain MV de L, Vieira-Meyer APGF. Self-perceived oral health among the elderly: a household-based study. *Rev Bras Geriatr e Gerontol*. 2017;20(1):7–19. doi:10.1590/1981-22562017020.160070

[15] Rands A. *"Desigualdades Regionais No Brasil: Natureza, Causas, Origens E Soluções", De Alexandre Rands Barros*. Rio de Janeiro; 2012.

[16] San Martin AS, Chisini LA, Martelli S, Sartori LRM, Ramos EC, Demarco FF. Distribuição dos cursos de Odontologia e de cirurgiões-dentistas no Brasil: uma visão do mercado de trabalho. *Rev da ABENO*. 2018;18(1):63–73. doi:10.30979/rev.abeno.v18i1.399

[17] Schmidt A, Martin S, Chisini LA, Martelli S, Morello LR. Distribuição dos cursos de Odontologia e de cirurgiões-dentistas no Brasil : uma visão do mercado de trabalho. *Rev da ABENO*. 2018;18(1):63–73.

[18] Penna C. Desigualdades Regionais no Brasil: Natureza, Causas, Origens e Soluções. *Análise Econômica*. 2013;31(59):279–285.

[19] Castro VC, Borghi AC, Mariano PP, Fernandes CAM, Mathias TA de F, Carreira L. Hospitalization Profile of Elderly Within the Unified Health Sistem. *Rev da Rede Enferm do Nord*. 2013;14(4):791–800.

[20] Rowe JW, Berkman L, Fried L, et al. Preparing for Better Health and Health Care for an Aging Population: A Vital Direction for Health and Health Care. *NAM Perspect*. 2018;6(9). doi:10.31478/201609n

[21] Antunes JLF, Narvai PC. Dental health policies in Brazil and their impact on health inequalities. *Rev Saude Publica*. 2010;44(2):360–365. doi:10.1590/S0034-89102010005000002

[22] de Medeiros JJ, Rodrigues LV, Azevedo AC, Lima Neto E de A, Machado L dos S, Valença AMG. Edentulismo, uso e necessidade de prótese e fatores associados em município do nordeste brasileiro. *Pesqui Bras Odontopediatria Clin Integr*. 2012;12(4):573–578. doi:10.4034/PBOCI.2012.124.20

[23] Saintrain MV de L, Marques PLP, Saintrain S V., Landim FLP, Vieira APGF. Structural violence on elderly people's oral health. *J Am Geriatr Soc*. 2013;61(12):2264–2265.

[24] Brasil. PORTARIA No 2.436, DE 21 DE SETEMBRO DE 2017. *Diário Of da União*. 2017;(183):68–76.

[25] Eurípedes Da Silveira R, Da Á, Santos S, Campos De Sousa M, Silva T, Monteiro A. HealtH economics and management Expenses related to hospital admissions for the elderly in Brazil: perspectives of a decade Gastos relacionados a hospitalizações de idosos no Brasil: perspectivas de uma década. *Einstein*. 2013;11(4):514–520. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4880392/pdf/1679-4508-eins-11-04-0514.pdf.

[26] Botton A, Cúnico SD, Strey MN. Diferenças de gênero no acesso aos serviços de saúde: problematizações necessárias. *Mudanças - Psicol da Saúde*. 2017;25(1):67. doi:10.15603/2176-1019/mud.v25n1p67-72

[27] FDI. Oral Cancer [1]. 2015:3–5. https://www.fdiworlddental.org/resources/policy-statements-and-resolutions/oral-cancer.

[28] ABRAHÃO KDS. *ABC do Câncer, Abordagens Básicas para o controle do Câncer*. 2a. Rio de Janeiro: Inca. Instituto Nacional de Câncer; 2015. doi:978-85-7318-194-4