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Hospital admissions through the National Health System (SUS) in the east of south expanded health region of Minas Gerais, Brazil, between 2014 and 2018

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ABSTRACT

Hospitalizations occur electively in cases with no imminent risk to life or in cases of urgency and emergency, which demand immediate medical assistance. In a Health Region, these hospitalizations are conducted in reference hospitals. This study aimed to analyse hospital admissions in the Eastern South Region of Minas Gerais, by comparing the number of urgency and emergency admissions with elective procedures admissions and with the number of urgency admissions with sensitive to primary care conditions (CSAP). This longitudinal-retrospective-descriptive study was conducted with Hospital Information System (SIH) data relative to the 2014-2018 interval. Altogether, there were registered 129,524 hospitalizations, with 17,546 (13.55%) being elective admissions and 111,978 (86.45%) urgency procedures. Of the urgency hospitalizations total, 20,108 (17.95%) were CASP hospitalizations. The frequency of urgency hospitalization was six times higher than the elective hospitalization one, and even SPCC emergency admissions exceeded the elective hospitalizations offer.

Keywords: Hospitalization; Urgency; Elective; Sensitive to primary care conditions

1 INTRODUCTION

The entry of the population into the Healthcare System, preferably, should occur through a single door, correspondent to the primary level ambulatory

services, except in urgency and emergency cases. Therefore, primary health care (PHC) must be resolute and effective, referring only the most complex cases to hospital service, in order to reduce the demand in urgency and emergency services (COELHO *et al.* (2012).

According to the Brazilian Federal Council of Medicine (CFM) Resolution No. 1451/1996, public and private first aid establishments must be structured to provide care for urgency-emergency situations. Urgency is defined as the unforeseen occurrence of health problems with or without potential risk of life, whose carrier requires immediate medical assistance; and Emergency as the medical finding of health conditions that imply imminent risk of life or intense suffering, therefore requiring immediate treatment (CFM, 1995).

The growing demand for urgency and emergency services in the last few years, due to factors such as the increase in accidents in general, urban violence and the insufficient structure of the healthcare network, has decisively contributed to the overload of these services. Nowadays, both have become two of the most problematic services in the National Health System (SUS). In SUS, hospital admissions occur in situations of urgency and emergency, for which they do not require prior authorization or scheduling, or electively for patients who do not present immediate risk to life or intense suffering, being treatment for these cases carried out on a scheduled date. (Barros & Dias (2013); MINISTRY OF HEALTH, (2017).

A 2017 survey conducted by the CFM points out that at least 904 thousand elective surgeries are pending in the SUS system, throughout different states and cities in the country. Elective surgeries are not considered urgency or emergency. Minas Gerais appears in the leadership for pending surgeries, with more than 434 thousand procedures still waiting to be scheduled and done (SINMED, 2018).

Regarding the SUS organization, Decree No. 7508 (June 28th, 2011) defines Health Regions (HR) as continuous geographical spaces represented by groups of bordering cities, being those delimited based on cultural, economic and social identities, also on communication networks and shared transport infrastructures, in order to integrate the organization, planning and execution of healthcare actions and services in the country (BRASIL, 2011).

In order to Health Regions function as they were designed to, it is fundamental that all cities have an appropriate reference for referral of patients in need, according to the complexity of care, so that this reference becomes a centre for secondary and tertiary care resources and a health services exporter in hospital environment. Thus, the understanding of patient flow according to the cities that export and those that import is strategic for the correct organization of services and the planning of local and regional assistance as demanded (LOPES, 2018).

To regulate the state of Minas Gerais, its State Department of Health (SES) proposed a 'Master Plan for Regionalization of Minas Gerais' (PDR-MG) based on the Principles of Economies of Scale, Quality and Access. Hence, it divides Minas Gerais' 853 cities into 77 micro-regions, known as Health Regions, and into 13 macro-regions, known as Extended Health Regions (EHRs). Each Health Region has one or more referential cities, designated as central cities.

Aiming to organize the healthcare service network, giving transparency to the established flows and defining, based on agreed criteria and parameters, the financial limits assigned to assist the population itself and the references received from other cities, the Agreed and Integrated Program (PPI) for healthcare is an instituted process within the SUS scope. This process, integrated with the planning process, defines and quantifies healthcare actions for the population living in each territory, as well as carries out inter-manager pacts in order to guarantee access to health services for the whole population.

Among the 13 Expanded Health Regions stablished, the East of South EHR (ES-EHR) covers 53 cities and subdivides into three HRs, those having as centre cities, respectively, the cities of Manhuaçu, Ponte Nova and Viçosa. This study aimed to analyse the production of hospital admissions processed in the East of South EHR hospitals in Minas Gerais, through the SUS Hospital Information System (SIH-SUS), considering the physical aspects, from 2014 to 2018, for hospitalizations (Elective and Urgency), and within the Urgency ones, those sensitive to primary care.

2 METHODOLOGY

All data were obtained from SIH/SUS, managed by the Ministry of Health, through the Health Assistance Administration, in conjunction with the State and the Municipal Health Administrations, being processed by the SUS Computer Department (DATASUS), from the Ministry of Health's Executive Administration. Hospitalization Authorizations (AIH) were used, once representing the registration instrument used by SUS managers and service providers.

On the ground that these are secondary, non-nominal and publicly available data, there was no necessity to submit this project to the Research Ethics Committee, as established by National Health Council's Resolution No. 580 (March 22, 2018) (MINISTRY OF HEALTH, 2018).

DATASUS TABWIN was used for the data collection, as this tool allows the selection and organization of data according to the research objective, as well as the association of tabulation and maps, allowing visual and spatial evaluation of the information. Ordinance No. 221 (April 17, 2008) (MINISTRY OF HEALTH, 2008), was also used as a reference, once it lists the causes for sensitive conditions to primary care hospitalizations and their respective International Disease Codes (ICD 10).

Our goal was to develop a longitudinal-retrospective-descriptive study, carried out through the analysis of all hospital admissions that occurred in

hospitals in the ES-EHR in Minas Gerais, from 2014 to 2018. The region comprises 53 cities in Minas Gerais, which, according to the PDR of the state of Minas Gerais, have a total population of approximately 669,824 inhabitants. According to the National Register of Health Establishments (CNES), there are19 hospital institutions in the region.

Two inclusion criteria were used for the study of hospitalizations in the focused region: the first was the inclusion of hospitals that had an agreed reference of Medium and High Complexity in the PPI of all cities in their micro-region. This database detailed the agreements by physical goals and discriminated financial values, allowing comparison with execution and procedures databases; and the second criterion was if the hospital chose had served all cities in its micro-region in at least one of years relevant for the study.

According to the SES-MG, the Health Region of Manhuaçu comprises 23 cities, with an estimated population of 316,444 and ten hospital institutions; the Ponte Nova Health Region contains 21 cities, an estimated population of 219,662 and seven hospital institutions; the Viçosa Health Region, nine cities with an estimated population of 133,718 and two hospital institutions. Only four cities and six hospitals met this study criteria: Manhuaçu - Hospital Cesar Leite (HCL); Manhumirim - Hospital Padre Julio Maria (HPJM); Ponte Nova - Hospital Nossa Senhora das Dores (HNSD) and Hospital Arnaldo Gavazza Filho (HAGF); Viçosa - Hospital São Sebastião (HSS) and Hospital São João Batista (HSJB). Manhumirim city belongs to the Health Region of Manhuaçu and it is the only one selected that is not a region.

Surgical procedure services were divided into six categories: (1) Elective; (2) Urgency; (3) Accidents in the workplace or when in service for one company; (4) Accidents on the way to work; (5) Other types of traffic accidents; and (6) Other types of injuries and poisoning by chemical or physical agents. Categories 3, 4, 5 and 6 are underused in the SIH service and were considered for the study as

Urgency (2), once they represent services that had not been previously scheduled (MINISTRY OF HEALTH, 2017).

Health problems whose profile of morbidity and mortality could be reduced or modified by resolute and efficient primary care were here considered 'sensitive to primary care' conditions (CSAP), as presented in the list contained in Ordinance No. 221 (April 17, 2008) (MINISTRY OF HEALTH, 2008): Immunization preventable diseases and sensitive conditions (A33-A37, A95, B16, B05-B06, B26, G00.0, A17.0, A19, A15-A16, A18, A17.1-A17.9, I00 -02, A51-A53, B50-B54 and B77); Infectious gastroenteritis and complications (E86 and A00-A09); Anaemia (D50); Nutritional deficiencies (E40-E46 and E50-E64); Ear, nose and throat infections (H66, J00-J03, J06 and J31); Bacterial pneumonia (J13-J14, J15.3-J15.4, J15.8-J15.9 and J18.1); Asthma (J45-J46); Lung diseases (J20, J21, J40-J44 and J47); Hypertension (I10-I11); Angina (I20); Heart failure (I50 and J81); Cerebrovascular diseases (I63-I67, I69 and G45-G46); Diabetes mellitus (E10-E14); Epilepsies (G40-G41); Infection in the kidneys and urinary tract (N10-N12, N30, N34 and N39.0); Infection of the skin and subcutaneous tissue (A46, L01-L04 and L08); Inflammatory disease of the female pelvic organs (N70-N73 and N75-N76); Gastrointestinal ulcer (K25-K28, K92.0, K92.1 and K92.2); Diseases related to prenatal and childbirth (O23, A50 and P35.0).

2.1 Statistical Analysis

Microsoft Excel 2016 software was used to tabulate all data, which was then processed by the IBM SPSS Statistics 20 software, with a 5% significance level. The Shapiro-Wilk test was used in all quantitative variables, in order to verify the existence of a normality pattern. To evaluate the difference between average values, T-Test for independent samples and Mann-Whitney U Test were used, respectively, for parametric and non-parametric distributions. Categorical variables were assessed using Pearson's Chi-squared test and binary logistic regression. All tests performed presented a sample power above 80%.

3 RESULTS

The body of work consists of cases frequency data collected in six hospitals in the region of Minas Gerais, between 2014 and 2018. Stratifications were conducted for the frequency in each hospital, considering the type of care provided and hospitalization for urgency: for type of care, cases of emergency care (n = 111978) or elective care (n = 17546) were considered; and for emergency hospitalization, cases of SPCC (n = 20108) or others (n = 91870) were considered.

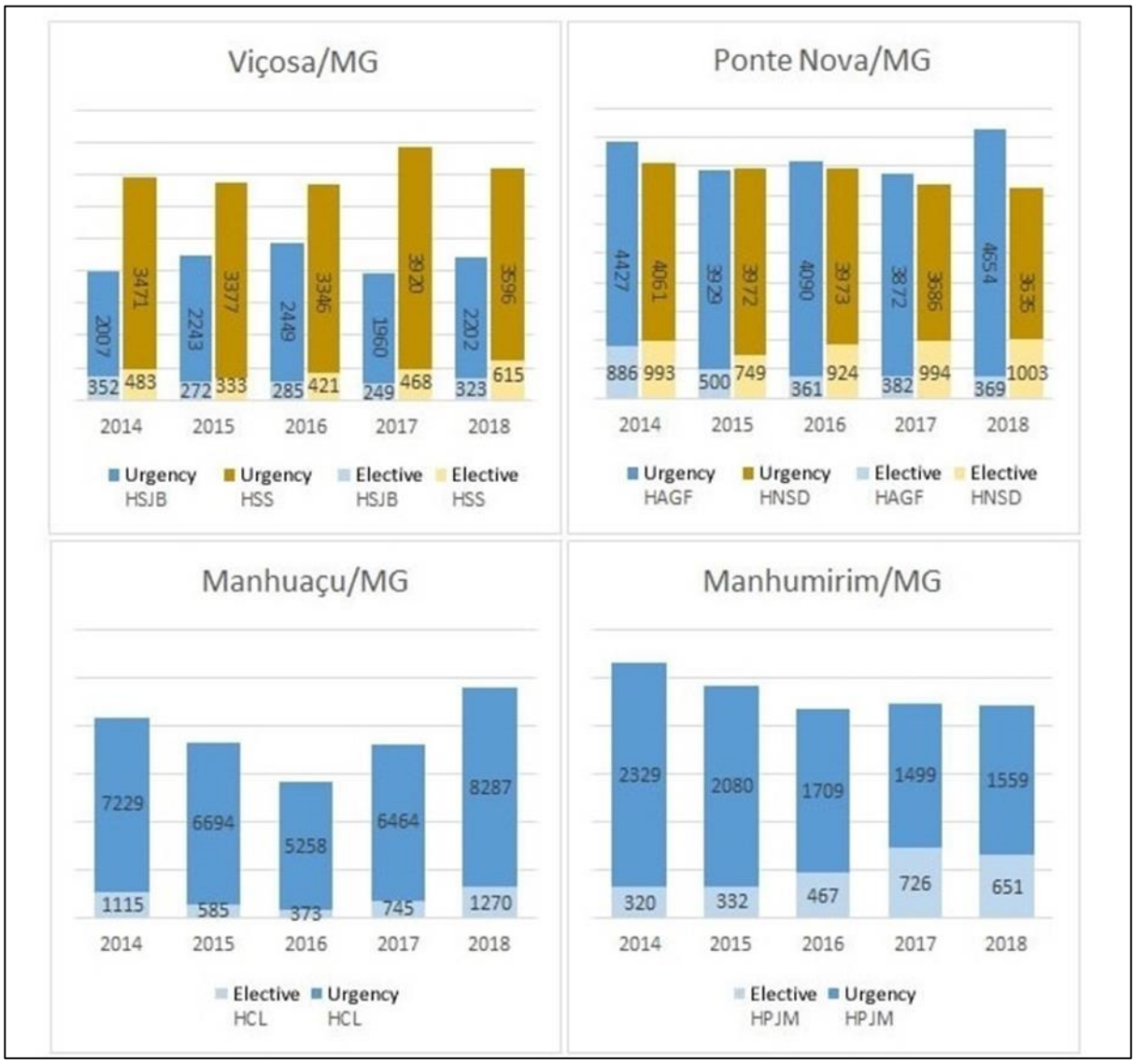
Once assessing the distribution of frequencies for the 2014-2018 period, a normal distribution in terms of emergency care, hospitalizations for CSAP or other emergencies cases was observed for all considered hospitals. In elective care cases, only the hospitals in Ponte Nova / MG (HAGF and HNSD) showed abnormal distributions (HAGF, p = 0.018; HNSD, p = 0.028). Average distribution and standard deviation for all data are presented in Table 1. Cases distribution by hospital are shown in Figures 1 and 2.

Table 1 – Average Admissions Distribution (Urgency or Elective) and Emergency Admissions (other or SPCC) in the considered hospitals (2014-2018)

Admission	**Elective**	**Urgency**
HCL – MANHUAÇU	818 ± 371	6786 ± 1106
HPJM – MANHUMIRIM	499 ± 184	1835 ± 357
HAGF - PONTE NOVA	500 ± 223	4194 ± 336
HNSD - PONTE NOVA	933 ± 107	3865 ± 191
HSJB – VIÇOSA	296 ± 41	2172 ± 197
HSS – VIÇOSA	464 ± 103	3542 ± 233
Urgency Hospitalization Types	**Others**	**SPCC**
HCL – MANHUAÇU	6012 ± 976	774 ± 132
HPJM – MANHUMIRIM	1097 ± 305	738 ± 63
HAGF - PONTE NOVA	3068 ± 180	1127 ± 157
HNSD - PONTE NOVA	3473 ± 158	393 ± 57
HSJB – VIÇOSA	1827 ± 183	345 ± 41
HSS – VIÇOSA	2897 ± 195	645 ± 51

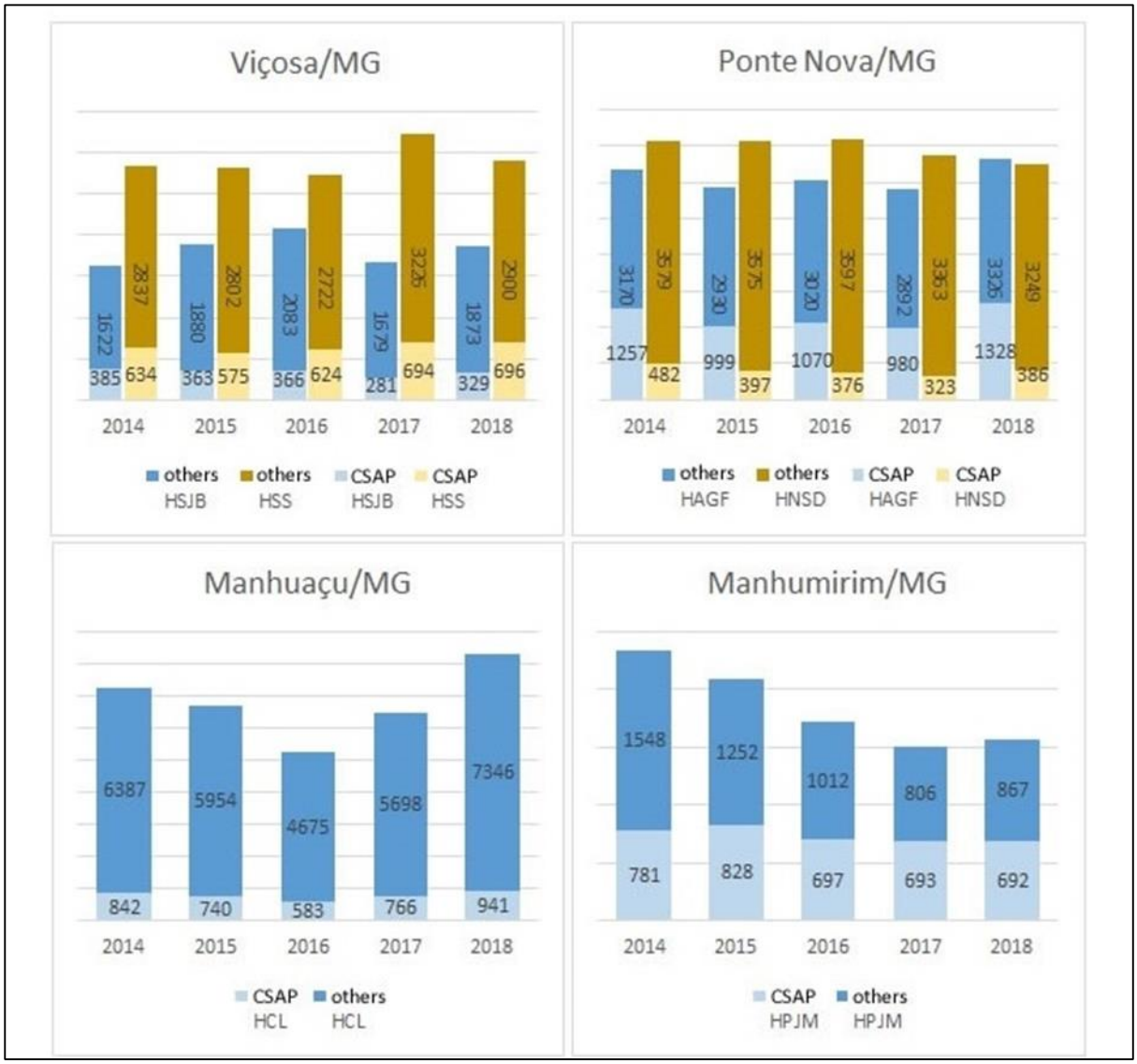
Source: Authors (2020)
In were: HCL = Hospital César Leite; HPJM = Hospital Padre Júlio Maria; HAGF = Hospital Arnaldo Gavazza Filho; HNSD = Hospital Nossa Senhora das Dores; HSJB = Hospital São João Batista; HSS = Hospital São Sebastião.

Figure 1 – Frequency distribution of Urgency and elective care cases in the respective health centres. Viçosa and Ponte Nova cities have two hospitals, presented comparatively in the same chart



Source: Authors (2020)

Figure 2 – Frequency distribution of Emergency hospitalization for CSAP or Others, in the respective health centres. Viçosa and Ponte Nova cities have two hospitals, presented comparatively in the same chart

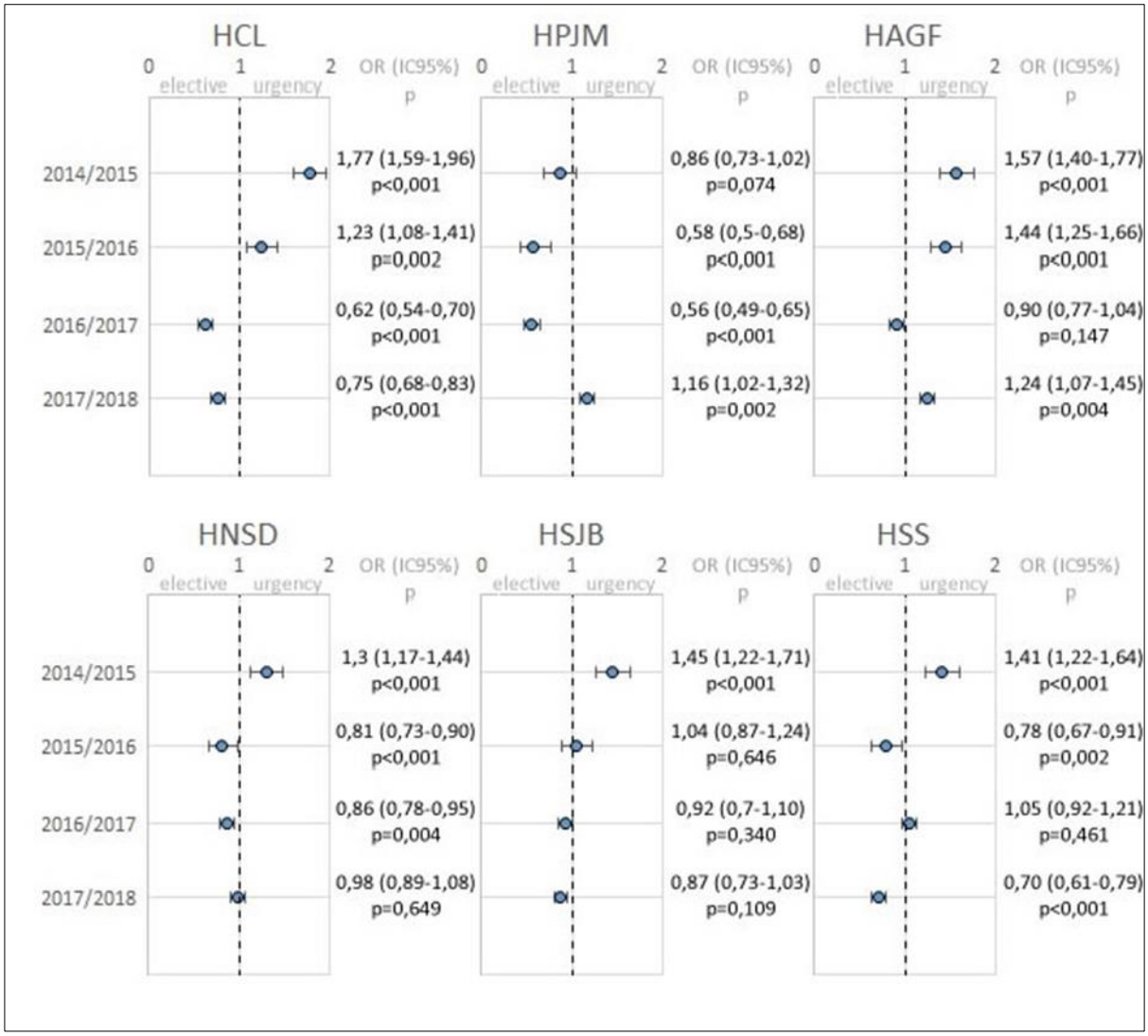


Source: Authors (2020)

The difference between the average number of cases in each stratum was evaluated for health centres that comprises two hospitals: for Ponte Nova, the average value of elective care was significantly higher in the HNSD hospital ($p = 0.009$), with no significant difference in the average number of urgency visits ($p = 0.093$). Furthermore, the average value of SPCC urgency cases was significantly higher in HAGF ($p <0.001$), while Other urgencies average value was higher in HNSD ($p = 0.005$); and for Viçosa, the average number of elective visits ($p = 0.009$), urgency ($p <0.001$), CSAP ($p <0.001$) and other morbidities ($p <0.001$) was significantly higher in the HSS.

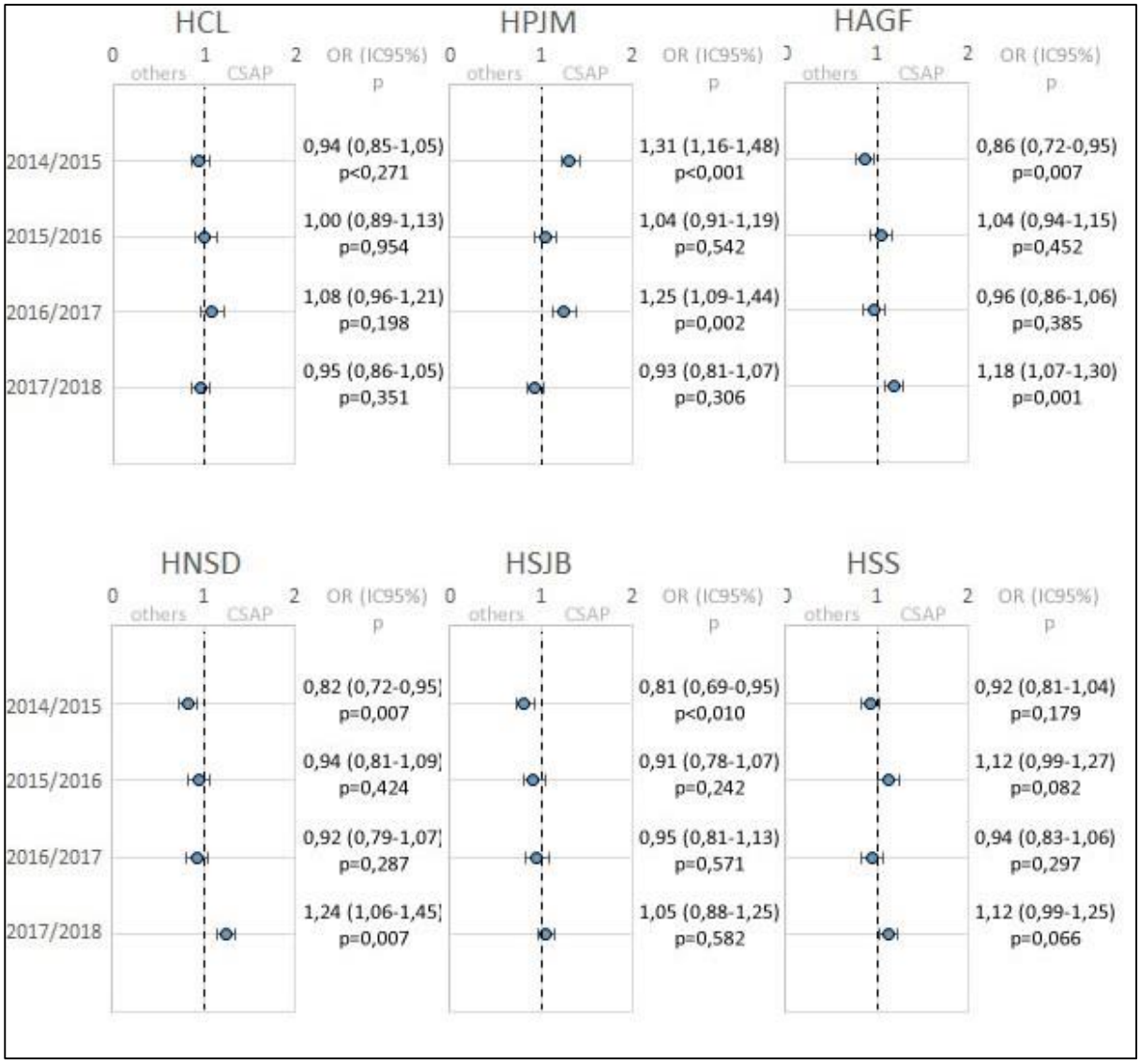
The progressive behaviour of annual case distributions in the selected hospitals was also evaluated. In order to do so, frequency data were stratified in one-year periods ranging from 2014 to 2015; 2015 to 2016; 2016 to 2017; and 2017 to 2018. In these progressions, the type of care (elective/urgency) and the type of urgency hospitalization (others/SPCC) were evaluated. Obtained results are shown in Figures 3 and 4.

Figure 3 – Odds ratio distribution according to type of care (urgency/elective) for the progressive years analysed. (OR = Odds Ratio; IC = confidence interval; HCL = Hospital César Leite; HPJM = Hospital Padre Júlio Maria; HAGF = Hospital Arnaldo Gavazza Filho; HNSD = Hospital Nossa Senhora das Dores; HSJB = São João Batista Hospital; HSS = São Sebastião Hospital.)



Source: Authors (2020)

Figure 4 – Odds ratio distribution according to type of emergency hospitalization (SPCC: others) for the progressive years analysed. (OR = Odds Ratio; IC = confidence interval; HCL = Hospital César Leite; HPJM = Hospital Padre Júlio Maria; HAGF = Hospital Arnaldo Gavazza Filho; HNSD = Hospital Nossa Senhora das Dores; HSJB = São João Batista Hospital; HSS = São Sebastião Hospital.)



Source: Authors (2020)

4 DATA AND RESULTS DISCUSSION

The conducted analysis of the production of hospital admissions processed in the East of South EHR hospitals through SIH-SUS have demonstrated that all institutions present a higher frequency of urgency hospitalizations than elective

admissions in all considered years. Regarding the number of CSAP emergency hospitalizations, it has been observed a higher value when compared to that of elective surgeries ones (20,108 - 15.52% of the total - and 17,546 - 13.55% of the total-, respectively). If considering that SPCC emergency care hospitalizations can be (and could have been) avoided with distinct and resolute primary care, thus allowing greater access to elective procedures, reducing the time and waiting time for these procedures, the here obtained data and results present expressive relevance and meaning.

Table 1 displays that Ponte Nova and Viçosa hospitals had a low variation in urgency care between 2014 and 2018, since the standard deviation was relatively small when compared to the central average (below 10%). This means that the distribution of urgency in these hospitals over this period was relatively homogeneous. In contrast, elective cases, in all hospitals, showed a much greater relative variability, with a standard deviation above 10% of the central average, thus giving the impression that the elective cases were not so homogeneous. One possible explanation, in part, for this homogeneity of distribution would be the intrinsic variables that can generate bias in each stratum. In the case of the current study, each year. Theoretically, biases related to elective cases are expected, as they depend on factors such as will, attitude, price and preference (doctor/patient/hospital). Additionally, homogeneity in urgency cases is expected, since their annual incidence usually do not present a high variability. All these considered and discussed variability can be inferred through the columns1 size in both figures 1 and 2 for each year.

Regarding the health centres comprising two hospitals, data showed, for Ponte Nova, that the HNSD hospital was preferred for elective cases, while not being observed any explicit preference for urgency cases, as both had statistically equal averages. (Authors question whether professional or infrastructure bias could justify the findings). In Viçosa, on the other hand, both urgency and elective cases presented higher values at the HSS, reference in the region. In Ponte Nova,

cases of SPCC hospitalization occurred more in the HAFG, while hospitalizations for other reasons were higher in the HNSD. Location bias, in this case, can be considered an important factor. Could be the HAFG hospital located in a more susceptible region to SPCC cases, in a sense that explains the preference in this regard? Further studies are needed to clarify, with confidence, the questions raised.

Figures 3 and 4 show the odd ratio (OR) of each year progression in the form of the chances of a one-year event in relation to its previous one. Evaluating the HCL, in 2015, compared to 2014, chances of urgency cases were 1.77 times (77%) higher than the ones of an elective event. In the 2016-to-2015 comparison, OR was still positive, revealing chances of an emergency case to be 23% higher than the ones of elective cases. As the OR decreased, and the assessment was made considering progressive years, the urgency/case relation increased from 2014 to 2016. This means that, since 2014 (until 2016), the chance of urgency cases was gradually greater, but losing "strength" with each passing year. Corroborating these findings, in 2017 (compared to 2016), the chance of urgency decreased by 38%. Elective cases started to present a greater chance than urgency ones in relation to the previous year. In 2018, again comparing to its previous year, the chance of elective cases still prevailed, but with "less force". At HCL, the chance of elective cases gradually increased from 2014 to 2018, which may have occurred due to the greater preference of patients/doctors for this hospital, due to motivational issues such as price, greater infrastructure and equipment, etc. Considering the analysed hospitals, HCL performed the highest quantity of procedures: 33,932 (89.25%) urgency and 4,088 (10.75%) elective admissions, with 3,872 (11.41%) SPCC hospitalizations.

In the HPJM hospital, chances of urgency/elective cases were equal in 2015 (compared to 2014). In the following years, preference for elective cases grew gradually until 2017, presenting a greater chance of urgency cases only 2018, which may have happened due to an atypical greater occurrence of urgency cases in the region, for example. From all the analysed hospitals analyzed, HPJM performed one

of the lowest number of procedures: 9,176 (78.62%) urgency and 2,496 (21.38%) elective admissions in total, with the best proportion of elective procedures among the hospitals analysed, considering it to be the hospital with the highest proportional rate of SPCC admissions.

HAGF, among the analysed hospitals, presented the highest number of SPCC hospitalizations and the second one of urgency hospitalizations. In relation to the total number of admissions, it places at third position, having the highest proportional production of urgency procedures, constraining a total of 20,972 (89.36%) urgency and 2,498 (10.64%) elective admissions. HNSD, on the other hand, performed 19,327 (17.26%) urgency hospital admissions over the five years, with 1,964 (10.16%) of these admissions due to SPCC, the lowest proportional rate of SPCC hospitalizations, in addition to being the second lowest hospital in number of procedures, with a total of 10,861 (88.00%) urgency and 1,481 (12.00%) elective admissions. Among the analysed institutions, HNSD also presented the lowest num HSJB hospital performed 10,861 (9.70%) urgency admissions over the five years, with 1,724 (15.87%) of those hospitalizations due to SPCC, positioning as the second lowest hospital in number of procedures among the analysed, with a total of 10,861 (88.00%) urgency and 1,481 (12.00%) elective admissions and presenting one of the lowest number of elective admissions. HSS performed 17,710 (15.82%) urgency admissions over the five years, with 3,223 (18.20%) of those being SPCC hospitalizations, placing as fourth in production of procedures, with a total of 17,710 (88.42%) urgency admissions and 2,320 (11.58%) elective admissions, the second lowest number of this last type.

Over the five analysed years, the highest number of procedures, combining all analysed hospitals, follows the sequence 2018-2014-2015-2017-2016. 2018 presents the highest number of procedures, both elective and urgency ones, followed by 2014. From the analysed hospitals, only HCL follows the sequence of all added up. HPJM, HAGF and HNSD hospitals had their highest production in 2014; HSJB had its highest production in 2016, year with the lowest total production; and

HSS had its highest production in 2017, second year with the lowest total production. Here we see plausible to point out the necessity of carrying out studies in other regional reference hospital institutions, in order to verify if the quantity of elective surgeries offered in the institutions studied is within a national reality, especially considering the lack of studies on this matter so far. The proper knowledge of elective procedures offer reality for reference institutions would allow managers and co-ordinator to have a stronger understanding of the offer being, for that reason, able to work more efficiently within their demand.ber of elective admissions.

A decreasing tendency in CSAP admissions can be stablished for HSJB and HPJM hospitals (Figure 2). Studies by Moretti & Fedosse (2016) analysed data on SPCC hospital admissions in Brazil between 2000 and 2016, verifying a reduction in CSAP hospitalization rates all over the country. According to studies by Pinto and Giovanella (2018), this reduction can be justified by improvement in primary care coverage in the country.

CSAP hospitalizations can be used as one of the measures of evaluating Primary Health Care effectiveness and how it influences regions, by discussing and stablishing the factors that may influence in results such as the ones observed in this study, and then taking effective measures to reduce this type of hospitalizations, reallocating their resources to other needs, such as elective surgeries.

5 STUDY LIMITATIONS

Limiting factors to this study must be highlighted, such as: the restricted scope of the CSAP hospitalizations rate (only SUS admissions were considered); the lack of a recording standard procedure and even hospitalizations underreporting and possible failures in diagnostic classification. The fact that the hospitals in Ponte Nova presented a non-normal distribution, specifically for elective care, clearly

indicates that the distribution of these cases is not aligned with the distribution of elective cases from other hospitals (which assumed normal behaviour). In a way, this asymmetry may indicate the existence of biases, which present themselves differently from other hospitals. These biases can be multifactorial and may be related to the local conditions, such as supply, demand, price, and even hospital management limits itself.

6 CONCLUSIONS

For all hospital institutions analysed, urgency admissions represented the largest portion in hospital procedures linked to SUS, comprising a total value six times higher than elective surgeries. The total frequency of CSAP urgency admissions exceeded the number of elective admissions, which leads to the general agreement that, if existing a more resolute and effective primary care system, the decrease in the number of these SPCC admissions could and would imply an increase in access to elective surgeries, benefiting the whole population and healthcare system.

Thus, it is extremely important to analyse and control urgency admissions quantitative data, the access to elective procedures and the number of CSAP hospitalizations as a starting point to guide actions in the primary health care context, in view of their potential to measure the quality of the provided health services and to identify the critical points that deserve intervention, as well as assess whether the strategic actions implemented in the community have been effective, so that the population's morbidity and mortality profile can become clear and adequate.

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