

Intra-urban differences in rates of admissions for ambulatory care sensitive conditions in Brazil's Center-West region

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Abstract Admissions for ambulatory care sensitive conditions (ACSCs) represent a useful indicator of access to and the effectiveness of primary health care. This article examined rates of admissions for ACSCs and the main causes of admissions in intra-urban areas of the municipality of Goiânia, capital of the State of Goiás. An ecological study was conducted to determine rates of admissions in Goiânia's seven health districts between 2008 and 2013 using data from Hospital Admission Authorization forms obtained from the municipality's Hospital Information System. Admissions were georeferenced throughout the seven health districts. Age-adjusted rates of admissions for ACSCs were calculated and the most common causes of admissions were identified for each age group. A 95% confidence interval was calculated as a measure of precision of the rates. The average overall rate of admissions for ACSCs was 155.5 per 10,000 population. Rates were highest in the Southern District and lowest in the Southwest District. Rates were highest in the youngest and oldest age groups. The Northwest District showed the highest rates in nine groups of causes, notably chronic non-communicable diseases among adults. Our findings showed that there are major differences in rates across health districts, pointing to shortfalls in primary health coverage, quality problems and an inadequate care model in districts with high coverage.

Key words Primary Health Care, Health evaluation, Hospitalization

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Introduction

Hospital activity indicators have been proposed as an indirect measure of the quality of primary health care¹. In 1993, Billings et al.² undertook a pioneering study of the use of “ambulatory care sensitive conditions” (ACSCs) as an indicator of access to and the effectiveness of primary health care^{1,3}. In Brazil, this indicator is called admissions for primary care sensitive conditions (*Internações por Condições Sensíveis à Atenção Primária* – ICSAP)⁴.

This indicator is a sign of the capacity of primary health care systems to intervene in a timely manner to prevent health problems, diagnose and treat acute episodes of diseases, control and provide follow up for chronic diseases, manage diseases, reduce hospital readmissions and length of hospital stay, and thus respond to 85% of the population’s health problems^{1,4-6}.

Studies have reported varying rates of admissions for ACSCs across different countries. In Italy, Agabiti et al.⁷ observed rates of 26.1 per 10,000 population, while in Switzerland, Egli et al.⁸ found rates of 10 per 1,000 population among patients with private health insurance. The most common causes of ACSC admissions described in the national and international literature are gastroenteritis, kidney and urinary tract infections, heart failure, angina, asthma, and diabetes mellitus⁹⁻¹⁵.

In Brazil, ecological studies have obtained the following findings: in 2006, the rate of admissions for ACSCs was 150 per 10,000 population and these conditions accounted for 28.5% of all hospital admissions; the main causes of ACSC admissions were gastroenteritis, heart failure, asthma, angina, and urinary tract infections^{4,5,16}; the risk of hospitalization was highest in the youngest and oldest age groups and among people with low levels of income and education, confirming findings from international studies; reductions in admissions for ACSCs were associated with increased primary care coverage^{4,16}.

There is scarce research into ACSCs in Brazil’s Center-West Region, particularly in intraurban areas. The municipality of Goiânia is an ideal research setting for studies examining rates of admissions for ACSCs as a potential indicator of the effectiveness of primary health care in intraurban areas. The city’s primary health care system is divided into seven health districts with varying levels of service coverage and the medium and high complexity care services benefit from a large supply of beds and well-organized bed reg-

ulation mechanisms¹⁷. Quality of infrastructure and socioeconomic status vary across districts¹⁸. The municipality’s hospital information system encompasses the primary health care network and is overseen by a municipal regulator that assesses demand for hospital admission, referring cases to the most appropriate bed available in the accredited healthcare network. The municipality also has a digital urban map that provides georeferenced health data across districts¹⁷.

Rates of admissions for ACSCs are often a sign of inequalities in health care provision and therefore constitute an important input into the reorganization of primary health care to ensure that health planning effectively incorporates regional specificities.

The present article therefore analyses the magnitude, profile and spatial distribution pattern of rates of admissions for ACSCs in the health districts of the municipality of Goiânia.

Methodology

An ecological study was undertaken to determine rates of admissions for ACSCs in the health districts of the municipality of Goiânia between 2008 and 2013. This time period was chosen because the volume of admissions during the period was sufficient to allow a stable estimate of rates; 2013 was used as the period end date because it was the most recent year for which data was available at the time of the study, considering the deadline for resubmission of Hospital Admission Authorization (*Autorização de Internação Hospitalar* – AIH) forms set by the Ministry of Health.

The municipality of Goiânia, capital of the State of Goiás, located in the country’s Center-West Region, covers an area of 739.5 km² and has a population of 1,302,001 (2010 Census - IBGE). The municipality is divided into seven health districts.

Sociodemographic characteristics vary across districts. The South District performs better against socioeconomic indicators and has a larger proportion of older people and smaller percentage of children in its population, while the Northeast District is characterized by lower average incomes, higher illiteracy rates and a younger population age structure¹⁸.

The Family Health Strategy (*Estratégia Saúde da Família* – ESF) coverage rate in each district was calculated based on the ratio between the number of service users per family health team in each district and district population according to 2010 census estimates, as follows: North-

east District, 90.9%; West District, 70.4%; North District, 49.1%; East District, 43.5%; Southeast District, 34.0%; Campinas Centro District, 8.1%; and South District, zero percent.

Admissions data was obtained from the admissions database of the Hospital Information System (*Sistema de Informações Hospitalares* – SIH), which includes information contained in the AIH forms provided by the Regulation, Evaluation and Control Board (*Diretoria de Regulação, Avaliação e Controle*) of the Municipal Health Department.

According to the National Register of Health Establishments (*Sistema de Cadastro Nacional de Estabelecimentos de Saúde* – SCNES), Goiânia has forty-two hospitals with Unified Health System (*Sistema Única de Saúde* – SUS) beds, six (14%) of which are philanthropic, 25 (60%) private, and 11 (25%) public. The overall number of beds per 1,000 population is 4.99; however, only 49% of these are accredited to the local SUS, 38% are public, 34% private, and 27% philanthropic¹⁹. This study encompasses admissions in the 42 hospitals contracted by the municipal SUS.

The place of residence (neighborhood) field of the AIH form was used to georeference individual service users on the Basic Digital Urban Map of the Municipality of Goiânia (*Mapa Urbano Básico Digital do Município de Goiânia* - MUB-DG)¹⁷, which provides an identification code for lot, block and neighborhood. After neighborhood coding, the AIHs were then grouped according to health district using a table provided by the Department of Science, Technology and Innovation (*Secretaria Municipal de Ciência, Tecnologia e Inovação* – SECTEC). In the absence of a completed place of residence (neighborhood) field, the zip code informed on the AIH form was used.

It was not possible to georeference cases in only 235 (0.05%) of the 502,908 admissions. In accordance with other studies, admissions with the following procedure codes associated with deliveries without complications, and therefore without any associated pathology, were excluded from the analysis: assisted birth without obstruction (0310010012); normal delivery (0310010039); normal delivery in a high-risk pregnancy (0310010047); normal delivery in a normal delivery center (0310010055); caesarian delivery in a high-risk pregnancy (0411010026); caesarian delivery (0411010034); caesarian with tubal ligation (0411010042). These exclusion criteria resulted in the removal of 58,525 admissions, resulting in a total sample of 441,330 ad-

missions.

Admissions were categorized into ACSCs causes and non-ACSCs causes using the list of causes contained in Directive N° 221/MS/SAS of 17 April 2008²⁰.

The principal diagnosis field of the AIH form was used to identify and categorize the cause of admission into the 19 groups of causes included in the Brazilian list of ACSCs. The cause of admission code was defined in accordance with the International Statistical Classification of Diseases and Related Health Problems – ICD-10.

The population base used to estimate admissions rates was calculated by subtracting the total population covered by private health insurance, provided by the National Supplementary Health Agency (*Agência Nacional de Saúde Suplementar* – ANS), from the overall 2010 Census population estimate¹⁸.

The number of SUS service users in each health district was calculated in the following stages: (i) census population - population census tracts were grouped into neighborhoods, which in turn were grouped into health districts; (ii) population with private health insurance - based on the table obtained from the ANS, the number of users per neighborhood with health plans including hospital coverage was determined and aggregated to obtain the number for each health district; (iii) the final population base, used as the denominator to calculate rates of admissions for ACSCs, was calculated by subtracting the population with private health insurance from the census population. The population covered by the State of Goiás and Municipality of Goiânia Civil Servants' Welfare Institute (*Instituto de Previdência dos Servidores Públicos do Estado de Goiás e do Município de Goiânia*) was not excluded from the final population.

The arithmetic mean of admissions for ACSCs between 2008 and 2013 was used as the numerator in the formula used to calculate rates of admissions for ACSCs. Choropleth maps were then elaborated using ArcGIS Desktop Advanced® to visualize rates across the different health districts²¹.

The rates of admissions for ACSCs were age adjusted (zero to nine years, 10 to 39 years, 40 to 59 years, and 60 years and over) using the direct adjustment method and the population of Goiânia in 2010 without private health insurance as the standard population, and the five most common causes of admissions were identified for each age group. A 95% confidence interval was calculated as a measure of precision of the rates

and to compare the rates of different health districts. Data analysis was performed using SPSS® Statistics 20²² and Epi info²³.

Results

Absolute numbers of admissions for ACSCs were highest in the Campinas Centro and Southeast districts and lowest in the North and West districts. The zero to nine years and 60 years and over age groups showed the highest overall rates of admissions. The Northwest and South districts had the highest and lowest proportions of SUS service users: 92% and 59%, respectively (Table 1).

The average rate of admissions for ACSCs during the period 2008 to 2013 was 152.7 per 10,000 population (CI 95% 157.0 – 162.0). The

five most common groups of causes were infectious gastroenteritis and complications, kidney and urinary tract infection, heart failure, lung disease, and angina, while the least common were nutrient deficiencies, diseases related to the prenatal period and birth, ear, nose and throat infections, pelvic inflammatory disease, and anemia (Table 2).

The districts can be divided into four groups based on the adjusted rates of admissions for ACSCs considering all groups of causes: the South District (232.8; CI95%: 224.7–241.1), where rates are highest; the Northeast District (212.1; CI 95%: 205.0–219.6) and Campinas Centro District (200.6; CI 95% 193.8–207.6); the East District (185.8; CI 95% 178.9–193.0), West District (173.0; CI 95% 166.2–180.1) and North District (169.5; CI 95% 162.3–177.0); and the

Table 1. Number of admissions for ACSC by health district - overall population and SUS dependent population. Goiânia, 2008 to 2013.

District	0 to 9 years			10 to 39 years		
	Average number of admissions for ACSC 2008 - 2013	District Population 2010	SUS dependent population 2010	Average number of admissions for ACSC 2008 - 2013	District Population 2010	SUS dependent population 2010
Northeast	678	26,355	24,508(93%)	511	93,842	86,636(92%)
North	359	20,336	16,786(83%)	294	79,748	65,901(83%)
Southeast	780	31,734	26,332(83%)	524	119,112	98,041(82%)
East	666	23,760	19,921(84%)	417	92,188	77,212(84%)
Campinas Centro	760	22,730	14,497(64%)	589	114,708	82,593(72%)
West	445	24,487	22,342(91%)	324	85,294	76,926(90%)
South	691	21,895	9,732(44%)	356	114,704	67,260(59%)
Goiânia (overall)	4,379	171,297	134,118(78%)	3,015	699,596	554,569(79%)
District	40 to 59 years			60 years and over		
	Average number of admissions for ACSC 2008 - 2013	District Population 2010	SUS dependent population 2010	Average number of admissions for ACSC 2008 - 2013	District Population 2010	SUS dependent population 2010
Northeast	548	34,225	30,779(90%)	771	10,578	9,066(86%)
North	295	34,678	28,056(81%)	421	12,020	9,115(76%)
Southeast	571	51,513	41,436(80%)	843	18,082	13,662(76%)
East	437	41,163	34,001(83%)	697	15,216	12,074(79%)
Campinas Centro	666	54,831	39,473(72%)	971	28,960	,223(77%)
West	392	33,279	29,277(88%)	558	10,430	8,674(83%)
South	415	56,739	34,050(60%)	593	29,394	19,441(66%)
Goiânia (overall)	3,324	306,428	237,072(77%)	4,855	124,680	94,255(76%)

Source: SIHD and IBGE – Census 2010- authors' elaboration.

Table 2. Rate of Admissions for ACSCs (per 10,000 population) and respective CI 95% of the most common groups of causes of admissions by age group and health district. Goiânia, 2010.

a) 0 to 9 years

Health district	Infectious gastroenteritis and complications	Bacterial pneumonia	Lung disease	Asthma	Diseases related to the prenatal period and birth	Other Causes	All causes
Northeast	119.96 (106.9 - 134.6)	33.05 (26.4 - 41.3)	52.64 (44.1 - 62.7)	26.39 (20.6 - 34.0)	18.97 (14.3 - 25.7)	25.91 (20.3 - 33.6)	276.51 (256.6 - 298.1)
North	80.52 (67.7 - 95.4)	31.57 (23.9 - 41.6)	41.11 (32.2 - 52.3)	24.03 (17.2 - 32.8)	15.69 (10.3 - 23.0)	21.74 (15.7 - 30.7)	214.07 (192.8 - 237.2)
Southeast	133.93 (120.7 - 148.9)	33.03 (26.6 - 40.9)	55.45 (47.0 - 65.4)	24.62 (19.2 - 31.7)	21.71 (16.5 - 28.2)	27.72 (21.9 - 35.1)	296.28 (276.2 - 317.6)
East	139.72 (123.90 - 157.10)	46.68 (37.9 - 57.4)	59.23 (49.3 - 71.2)	31.04 (24.0 - 40.1)	23.01 (17.1 - 31.1)	34.55 (27.2 - 44.1)	334.07 (310.0 - 360.5)
Campinas Centro	231.08 (207.5 - 257.2)	69.67 (57.1 - 84.9)	84.84 (70.8 - 101.5)	51.85 (40.1 - 65.2)	35.06 (26.5 - 46.6)	52.42 (41.6 - 65.9)	524.48 (488.8 - 562.1)
West	83.85 (72.4 - 96.8)	22.78 (17.5 - 29.5)	35.36 (28.2 - 44.3)	15.59 (11.1 - 22.0)	15.29 (10.7 - 21.5)	22.08 (16.4 - 29.2)	199.10 (181.5 - 218.6)
South	262.02 (231.6 - 296.2)	158.24 (134.8 - 185.6)	96.59 (78.5 - 118.6)	85.11 (68.4 - 106.2)	48.98 (36.8 - 65.9)	59.08 (45.7 - 77.5)	709.69 (660.2 - 763.3)

b) 10 to 39 years

Health district	Infectious gastroenteritis and complications	Diabetes mellitus	Kidney and urinary tract infections	Skin and subcutaneous tissue infections	Diseases related to the prenatal period and birth	Other Causes	Total
Northeast	4.62 (3.3 - 6.3)	2.77 (1.8 - 4.2)	25.05 (21.9 - 28.7)	3.23 (2.2 - 4.7)	6.23 (4.7 - 8.2)	17.20 (14.6 - 20.2)	58.98 (54.0 - 64.3)
North	3.79 (2.5 - 5.7)	2.73 (1.7 - 4.4)	17.91 (14.9 - 21.5)	3.95 (2.6 - 5.9)	3.34 (2.1 - 5.1)	13.35 (10.8 - 16.5)	44.61 (39.7 - 50.0)
Southeast	5.92 (4.5 - 7.7)	4.28 (3.1 - 5.8)	23.56 (20.7 - 26.8)	3.37 (2.7 - 4.8)	1.43 (0.8 - 2.5)	14.99 (12.7 - 17.7)	53.45 (49.0 - 59.5)
East	4.66 (3.3 - 6.5)	3.24 (2.1 - 4.9)	21.11 (18.0 - 24.7)	3.63 (2.5 - 5.3)	3.50 (2.3 - 5.2)	17.87 (15.1 - 21.2)	54.01 (49.0 - 59.5)
Campinas Centro	6.30 (4.7 - 8.3)	5.81 (4.3 - 7.8)	28.69 (25.2 - 32.6)	5.69 (4.2 - 7.6)	3.39 (2.3 - 5.0)	21.55 (18.6 - 25.0)	71.31 (65.7 - 77.3)
West	3.38 (2.2 - 5.0)	1.94 (1.5 - 3.9)	17.55 (14.8 - 20.8)	2.99 (1.9 - 4.6)	2.21 (1.3 - 3.6)	13.91 (11.4 - 16.9)	42.12 (37.7 - 47.0)
South	4.76 (3.3 - 6.8)	3.57 (2.3 - 5.4)	18.58 (15.5 - 22.2)	3.42 (2.2 - 5.2)	2.23 (1.3 - 3.8)	20.52 (17.3 - 24.3)	54.37 (52.5 - 56.3)

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Southeast District (148.8; CI 95%: 143.2–154.5), where rates are lowest.

The analysis of the adjusted rates of admis-

sions for ACSCs of greater magnitude in each district showed the following spatial distribution pattern: the East District showed the highest rate

Tabela 2. continuation

c) 40 to 59 years

Health district	Hypertension	Angina	Heart failure	Diabetes mellitus	Kidney and urinary tract infections	Other Causes	Total
Northeast	20.47 (15.9 - 26.4)	28.92 (23.4 - 35.7)	31.19 (25.4 - 38.2)	21.12 (16.4 - 27.1)	24.04 (19.0 - 30.3)	52.63 (45.0 - 61.5)	178.04 (163.7 - 193.6)
North	11.41 (7.9 - 16.3)	16.40 (12.1 - 22.1)	14.97 (10.9 - 20.4)	13.54 (9.7 - 18.8)	14.97 (10.9 - 20.4)	33.50 (27.2 - 41.2)	105.15 (93.7 - 118.0)
Southeast	12.55 (9.5 - 16.6)	18.82 (15.0 - 23.6)	21.24 (17.1 - 26.3)	18.10 (14.3 - 22.8)	20.51 (16.5 - 25.5)	46.58 (40.3 - 53.7)	137.80 (126.9 - 149.6)
East	13.82 (10.3 - 18.5)	21.18 (16.7 - 26.8)	18.23 (14.1 - 23.5)	15.29 (11.5 - 20.2)	15.88 (12.0 - 20.9)	44.12 (37.5 - 51.9)	128.53 (117.0 - 141.2)
Campinas centro	16.97 (13.7 - 21.7)	24.07 (19.6 - 29.5)	26.85 (22.1 - 32.6)	20.01 (15.9 - 25.0)	22.29 (18.0 - 27.6)	58.52 (51.3 - 66.7)	168.72 (156.4 - 182.0)
West	12.98 (9.3 - 18.0)	15.20 (11.8 - 19.6)	18.79 (14.3 - 24.6)	17.76 (13.4 - 23.5)	17.42 (13.1 - 23.1)	45.09 (37.9 - 53.6)	133.89 (121.2 - 147.9)
South	11.16 (8.0 - 15.5)	19.68 (15.4 - 25.1)	17.03 (13.1 - 22.2)	12.63 (9.2 - 17.2)	14.68 (11.0 - 19.5)	46.99 (40.1 - 55.0)	121.88 (110.6 - 134.2)

d) 60 years and over

Health district	Angina	Heart failure	Cerebrovascular diseases	Diabetes mellitus	Kidney and urinary tract infections	Other Causes	Total
Northeast	103.68 (84.3 - 127.3)	185.31 (159.0 - 215.8)	95.96 (77.4 - 118.8)	83.83 (66.5 - 105.4)	67.28 (51.9 - 86.9)	314.36 (279.9 - 352.9)	850.43 (794.2 - 910.2)
North	65.83 (50.7 - 85.5)	121.78 (100.7 - 147.0)	55.95 (42.1 - 74.1)	39.50 (28.1 - 55.7)	37.30 (26.2 - 52.7)	142.62 (119.7 - 169.7)	461.88 (420.1 - 507.5)
Southeast	68.80 (55.93 - 84.5)	149.32 (130.0 - 171.5)	62.22 (50.0 - 77.3)	62.22 (50.0 - 77.3)	59.29 (47.4 - 74.0)	215.20 (191.8 - 241.3)	617.04 (577.6 - 659.0)
East	77.85 (63.3 - 95.6)	138.31 (118.6 - 161.2)	68.74 (55.1 - 85.6)	54.66 (42.6 - 69.9)	46.38 (35.4 - 60.6)	192.15 (168.8 - 218.6)	577.27 (536.7 - 620.7)
Campinas centro	52.65 (43.7 - 63.3)	106.65 (93.7 - 121.3)	49.95 (41.3 - 60.7)	40.95 (33.2 - 50.5)	39.15 (31.5 - 48.5)	148.49 (133.2 - 165.5)	436.93 (410.6 - 464.8)
West	85.31 (67.5 - 107.6)	94.42 (124.8 - 177.0)	72.63 (56.3 - 93.4)	61.10 (46.2 - 80.5)	55.34 (41. - 73.9)	221.35 (191.9 - 255.1)	643.30 (593.0 - 697.50)
South	44.75 (36.1 - 55.4)	63.27 (52.8 - 75.7)	45.78 (37.0 - 56.6)	26.75 (20.2 - 35.3)	25.72 (19.3 - 34.2)	99.27 (86.0 - 114.5)	305.03 (281.5 - 330.4)

Source: SIHD – authors' elaboration.

of admissions for vaccine-preventable diseases and sensitive conditions; the Northwest District showed higher rates in nine groups – kidney and urinary tract infections, heart failure, angina, diabetes mellitus, cerebrovascular diseases, hypertension, nutrient deficiencies, diseases related to the prenatal period and birth, and pelvic inflammatory disease; the South District showed higher

rates in eight groups of causes – infectious gastroenteritis and associated complications, lung disease, bacterial pneumonia, asthma, epilepsy, gastrointestinal ulcers, ear, nose and throat infections, and anemia; and the Campinas Centro District showed the highest rate of admissions for skin and subcutaneous tissue infections (Figure 1).

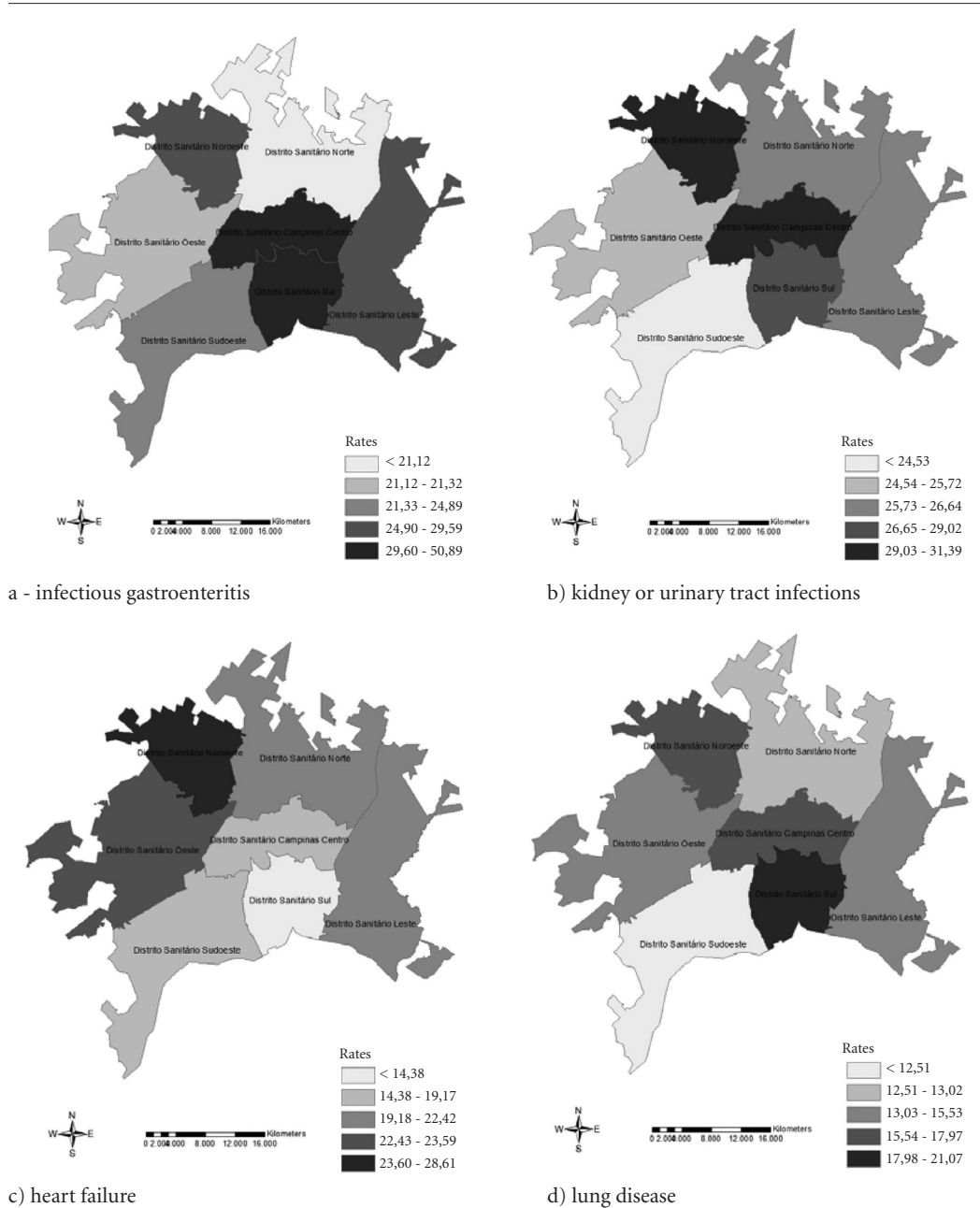


Figure 1. Spatial distribution pattern of adjusted rates of admissions for ACSC considering the 10 most common groups of sensitive conditions by health district. Goiânia, 2008 to 2013.

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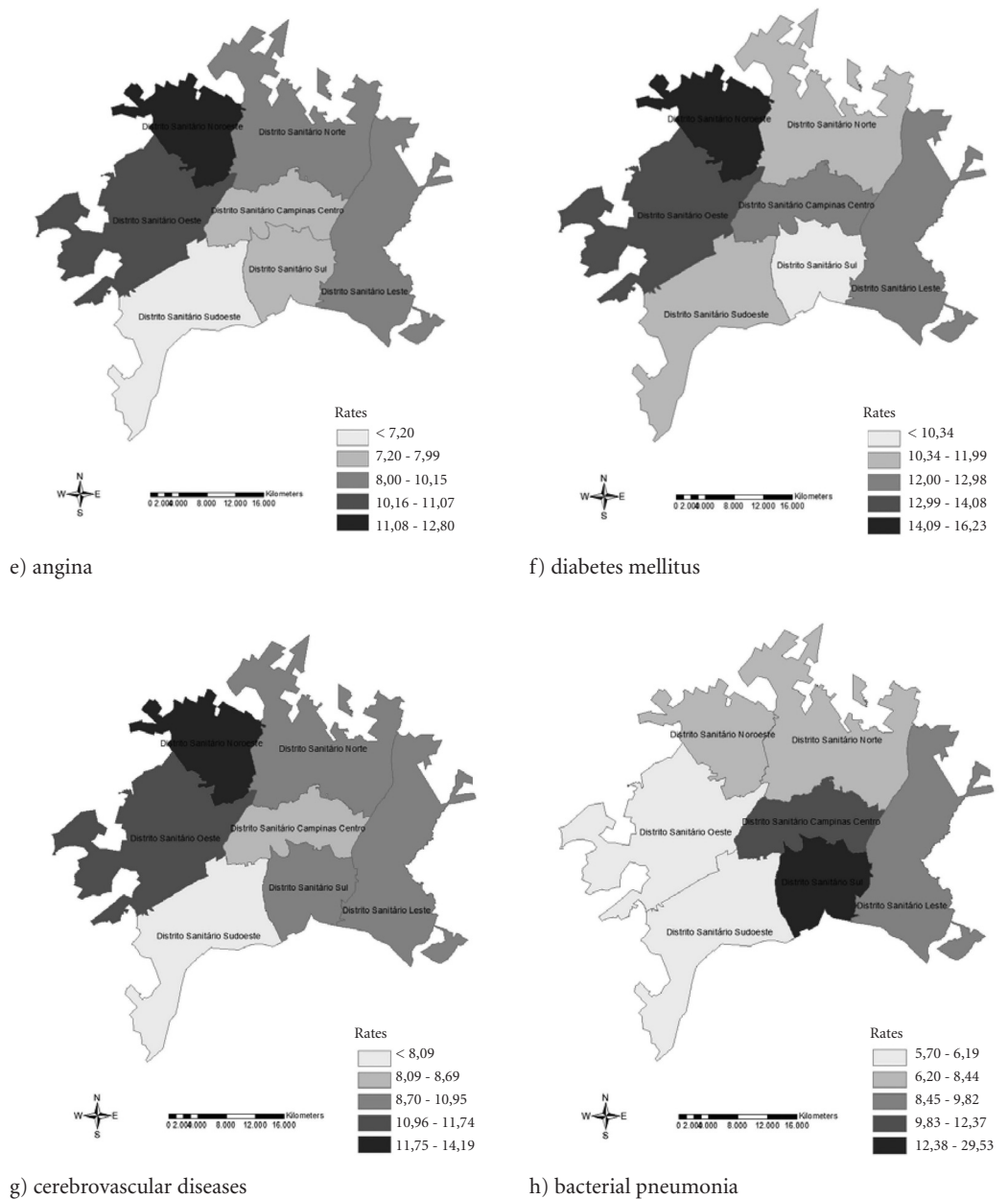


Figure 1. continuation

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The following results show that rates of admissions for ACSCs were highest in the youngest and oldest age groups: zero to nine years, 326.5 per 10,000 population (CI 95%: 317.1–336.2); 10 to 39 years, 54.4 per 10,000 population (CI 95%: 52.4–56.3); 40 to 59 years, 140.2 per 10,000 population (CI 95%: 135.5–145.0); and 60 years

and over, 515.1 per 10,000 population (CI 95%: 501.1–529.4).

The prevalence of specific groups of causes also varies according to age group: the prevalence of admissions for infectious gastroenteritis was greater among the zero to nine years age group, while the prevalence of admissions for kidney

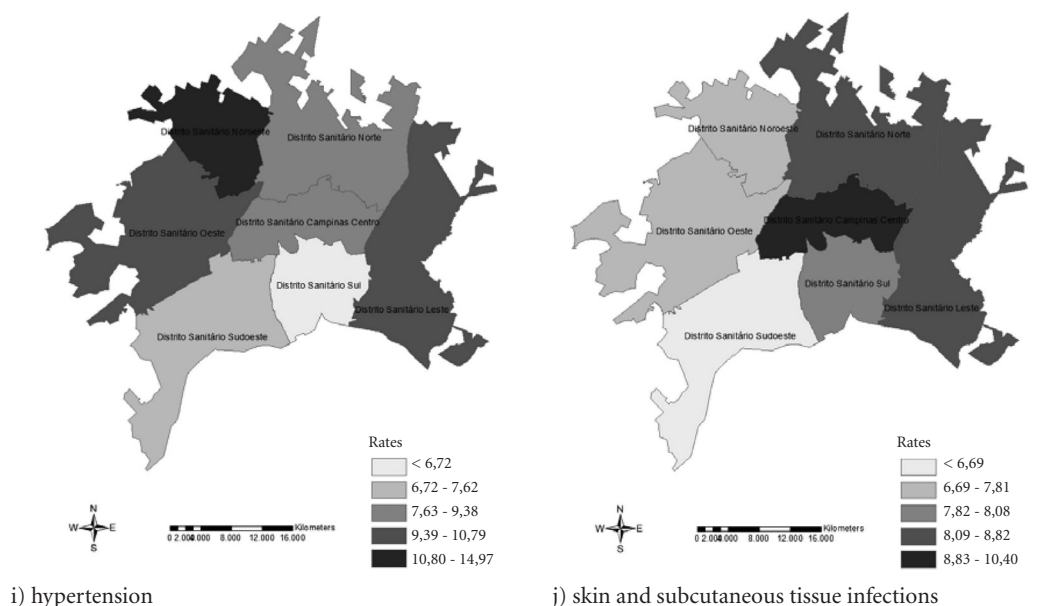


Figure 1. continuation

Source: SIHD – authors' elaboration.

and urinary tract infection and angina was higher in the 10 to 39 years and 40 to 59 years age groups, respectively. The prevalence of heart failure was greatest among the elderly (Table 2).

In the zero to nine years age group, the most common group of causes of ACSC admissions across all districts was infectious gastroenteritis and complications. In this respect, the districts can be separated into three groups according to magnitude, as follows: the South and Campinas Centro districts, which showed higher rates; the Southeast, Northwest and East districts, which showed intermediate rates, and the North and West districts, which showed lower rates. It is interesting to note that the rate shown by the South District is 3.3 times greater than that of the North District (Table 2).

In the 10 to 39 years age group, the most common group of causes was kidney and urinary tract infections. Rates were highest in the Campinas Centro and Northwest districts and lowest in the North and West districts (Table 2).

In the 40 to 59 years age group, the main causes were heart failure, angina, arterial hypertension, and diabetes mellitus. The most common cause of admissions for ACSCs among this group was heart failure, in the Northwest, South-

east, Campinas Centro and West districts and angina, in the North and South districts. The rate of admissions due to heart failure in the Northwest District was 1.8 times greater than that shown by the South District, while rates of admissions due to hypertension and diabetes mellitus in the Northwest District were, respectively, 1.8 and 1.7 times greater than those shown by the South District (Table 2).

Among the 60 years and over age group, the most common cause of admissions across all districts was heart failure. However, the rate of admissions due to heart failure in the Northwest District was 2.9 times greater than that of the South District. It is also interesting to note that there was a threefold difference between the rate of admissions due to diabetes mellitus in these two districts (Table 2).

Discussion

This present study may be considered innovative in that it analyzes intraurban differences in rates of admissions for ACSCs and excludes the population with private health insurance from the base population. The latter is justified given that

the objective of this study was to assess the provision of primary health care via the public health care system.

Studies conducted both inside and outside Brazil have shown that epidemiological indicators built upon ACSCs data, such as the rates of admission examined in this article, provide a quick and simple way of monitoring and evaluating access to and the effectiveness of primary health care services provided by universal public health systems such as the SUS²⁴⁻²⁹. Despite their usefulness, other studies have suggested that the use of ACSCs as indicators is limited due to the following reasons: (i) they do not consider the severity of a patient's medical condition and the fragility of the individual; (ii) they do not consider specific patient characteristics and differences in admission criteria between different hospital services; (iii) they do not directly consider the socioeconomic profile of a given population, level of education and cultural characteristics^{1,3,30-34}.

Our findings show that the average rate of admissions for ACSCs in Goiânia in the period 2008 to 2013 was 152.7 per 10,000 population and that rates were highest among the zero to nine years and 60 years and over age groups.

These findings are consistent with the results of other studies conducted both inside and outside Brazil. Studies undertaken in Brazil, for example, have shown rates of between 143.3 and 149.6 per 10,000 population^{4,5}; 14.5 per 1,000 population in the State of Rio Grande do Sul; 10.8 per 1,000 population in the State of São Paulo^{26,30}; and 154.0 per 10,000 population in Belo Horizonte, capital of the State of Minas Gerais³⁵. However, the results of the present study differ from those found by studies carried out in Italy and Spain, which reported rates of 26.1 per 10,000 population⁷ and 11 per 1,000 population, respectively¹³.

The highest rates of admissions for ACSCs were found in the youngest and oldest age groups (under 10 years and over 60 years), which is consistent with the findings described in the literature^{5,6,13,27-29,36}. The most common ACSCs in the youngest and oldest age groups were infectious diseases and cardiovascular diseases, respectively³⁷.

Another finding of the present study that is corroborated by other studies is the variation in rates across districts despite the fact that the region is covered by the same universal public health system subject to the same policies and underlying principles³⁸. This situation can be explained by differences in health service organiza-

tion and provision and in levels of literacy and income among the local population³⁹⁻⁴¹.

Our findings concerning rates of admissions for ACSCs by groups of causes and age are consistent with the findings described in the literature. The most common group of causes among the zero to nine years age group was infectious gastroenteritis and complications, followed by pneumonia, lung disease, including acute bronchitis, and asthma. A national study found that asthma was the third most common condition in this age group⁴². One possible explanation for this finding is that bronchitis is still commonly used as a synonym for asthma, particularly among children⁴³.

The main determining factors for ACSCs among this age group are socioeconomic conditions (basic sanitation and levels of education and income) and existing health care services⁴³. It is important to note, however, that in the South District, despite generally better socioeconomic conditions, the rate of admission for ACSCs is 262.02 per 10,000 population. This finding suggests a lack of access to primary health care services, reflecting the fact that the district has only two primary health care units for SUS patients. On the other hand, the rate of admissions for infectious gastroenteritis and complications in the Northwest District, which has the worst socioeconomic conditions and yet enjoys wide primary care coverage, was 2.2 lower than that of the South District.

The five most common causes of admissions among the 10 to 39 years age group are the same as those reported by the literature: kidney and urinary tract infections, infectious gastroenteritis and complications, skin and subcutaneous tissue infections, diabetes mellitus, and diseases related to the prenatal period and birth^{12,44}.

Rates of admissions for ACSCs in this age group were highest in the Campinas Centro and Northwest districts and lowest in the North and West districts. The rate of admissions due to kidney and urinary tract infections in the Campinas Centro District was 1.6 times higher than that shown by the West District.

It is interesting to note that the rate of admissions due to diseases related to the prenatal period and birth in the Northwest District was 4.4 times greater than that found for the Southeast District. Coverage of the ESF is greatest (90.9%) in the Northwest District, which, besides having the largest number of primary health centers in the region, has a primary maternity unit. At the same time, however, it is the worst performing

district against socioeconomic indicators and has the highest illiteracy rate.

Several hypotheses may explain this high rate: (i) quality of prenatal care is still compromised despite the coverage rate⁴⁵; (ii) studies have reported that sociodemographic factors such as low income levels associated with low levels of maternal education can have a negative impact on a woman's ability to seek health care and therefore lead to an increased risk of hospital admission⁴⁵; and (iii) supply-induced hospital admissions due to the number of existing available beds in the region. Similar results were found by Burgdof & Sundmacher⁶ and Pazo et al.⁴⁶, who reported a positive association between number of beds and rates of admissions for ACSCs. This finding contradicts several studies that found an association between increased primary health care coverage and reduced rates of admissions for ACSCs^{29,31,47-49}.

The most common group of causes among the 40 to 59 years age group was chronic disease, comprised of angina and heart failure, diabetes mellitus and hypertension. Kidney and urinary tract infections were the third most common cause of admissions. These findings are consistent with the findings described in the literature, which show that rates of admissions for ACSCs are higher among this age group^{5,7,49-52}.

The most prevalent conditions among the 60 years and over age group were circulatory system diseases, the most common of which were heart failure, angina and cerebrovascular diseases. Rates of admissions for all groups of causes were highest in the Northwest District and lowest in the South District. The rate of admission due to heart failure in the Northwest District was three times greater than that of the South District. In contrast to other studies, diseases of the respiratory system were not among the five most common causes of admission for ACSCs⁵².

The difference in rates of admissions due to chronic diseases across districts are particularly important. This disparity may be explained by socioeconomic differences between districts: the population of the South District, for example, enjoys better socioeconomic conditions than that of the Northwest District, which has particularly low levels of education and income and is therefore more exposed to risk factors for hospital admissions due chronic disease, such as smoking and inadequate diet⁵³⁻⁵⁵.

The higher rates of admissions for ACSCs among the 60 years and over age group also

suggest that this group experiences difficulty in accessing health services due to several factors, including mobility, socioeconomic vulnerability and inability of the primary care services to effectively address the health needs of older persons and the aging process^{44,50}.

The results show that there are significant differences across health districts in rates of potentially preventable hospitalizations. The high rates of admissions due to chronic disease in districts with high ESF coverage rates point towards an inadequate health care model and quality problems. High rates of admissions due to infectious diseases among children in districts with generally good sanitation and socioeconomic conditions are probably due to social inequalities within districts. These inequalities go unidentified by the health care services, which in turn fail to assume a leading role in mobilizing the different sectors responsible for tackling these problems.

One of the limitations of this study is that it used secondary data obtained from the SIH, which is oriented towards billing hospital admissions funded by the SUS. When filling out the AIH form, health facilities are often induced to enter a primary and/or secondary diagnosis code that matches the code of the procedure that was performed in order to avoid nonpayment⁴⁶. However, studies have shown that admissions entered into the SIH have a good diagnostic validity, with adequate sensitivity (between 70.1% and 81.9%) and specificity (between 88.4% and 95.2%)⁵⁶⁻⁵⁸. Another limitation is that it is necessary to update the Brazilian list of ACSCs to reflect changes in epidemiological profiles and patterns of morbidity among the Brazilian population.

Conclusions

Our analysis of the spatial distribution pattern of rates of admissions for ACSCs in the urban area of the municipality of Goiânia adjusted according to age and groups of causes reveals shortfalls in health coverage and an overall lack of effectiveness of primary health care services. These failings deserve further investigation using different evaluation methodologies and should be tackled by introducing new models of service delivery. Furthermore, it is recommended that health managers should review work processes, the need for intersectoral policies and the location of the individual facilities that make up the health care network within the municipality.

Collaborations

ALA Magalhães and OL Morais Neto were responsible for study conception and design, research, and drafting the final version of this manuscript.

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