

## Hospitalisations due to ambulatory care sensitive conditions (ACSC) between 2009 and 2018 in Brazil's Federal District as compared with other state capitals

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**Abstract** *This study compared standardised rates of hospitalisations due to ambulatory care sensitive conditions (ACSCs) in Brazil's Federal District from 2009 to 2018, as compared with those for selected state capitals, age groups and admissions groups. This ecological study used secondary data drawn from Hospital Information System microdata for the study period, during which, in the Federal District, the proportion of such admissions among 50-59 and 60-69 year olds declined, while those among children and adolescents held stable. Meanwhile, rates did not decrease in the ≤ 20 year age groups, a priority population in PHC, which may suggest that this population encountered barriers to access. The results showed that the expected reduction in the proportion of such admissions has not occurred, because coverage by Family Health Teams has been expanded only recently.*

**Key words** *Primary health care, Hospitalisations due to ambulatory care sensitive conditions*

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## Introduction

Primary Health Care (PHC) is interpreted in various manners, which can be explained by the manner in which it originated and has evolved in practice in health systems, by the ambiguity of some of its formal definitions as established in international forums and by the indiscriminate use of the term by some schools of thought in public health<sup>1</sup>.

That said, there are basically three main interpretations: PHC as selective primary care, understood as a specific programme offering a set of simple, low-cost technologies destined for poor populations and regions; PHC as the primary level of the health care system; and PHC as a strategy for organising the health system<sup>1</sup>.

In Brazil, PHC has been considered synonymous with basic care since publication of the 2011 National Basic Care Policy (PNAB) and then again in the 2017 PNAB<sup>2</sup>. From the outset, it was conceived as the gateway to the health system and today plays a leading role in Health Care Networks as the centre of communication and, in setting up the networks, as the organiser and coordinator of care. For these purposes, it is structured by seven attributes: first contact, comprehensiveness, continuity, coordination, family-centred, family approach and community-oriented<sup>3</sup>.

There is evidence from Brazil and internationally that strong PHC is the model of care best suited to responding to the current epidemiological and demographic transition<sup>4-6</sup>. In Brazil, the Family Health Strategy (*Estratégia de Saúde da Família*, ESF) is considered a priority strategy for expanding, establishing and informing basic care, and is producing important results as shown in indicators of health, efficiency and equity<sup>7-10</sup>.

Brazil-wide coverage by the ESF is currently estimated at 64.61% and is greatest in the Northeast Region (80.11%)<sup>11</sup>. The Federal District has invested in changing the model of care so that PHC will be grounded completely on the ESF in the terms of the National Basic Care Policy and the Federal District Health Council Resolution. In 2017 two administrative orders published in the Federal District established first a Primary Health Care Policy<sup>12</sup> and then the process of conversion of PHC to the ESF model<sup>13</sup>. The state health department (SES/DF) reports that coverage increased from 24.7% in 2015 to 69.10% in 2018<sup>14</sup>.

One of the indicators used worldwide to assess PHC indirectly is hospitalisations due to

ambulatory care sensitive conditions (HACSCs). The conceptual framework for constructing this indicator followed the model proposed by Caminal-Homar & Casanova-Matutano and was adapted to Brazilian conditions. Its underlying principle is that, for certain health conditions, timely, quality PHC can avert hospitalisation or reduce its frequency<sup>15</sup>.

The process of constructing the indicator involved criteria formulated from existing lists in some state health departments, a literature review of international studies, consensus meetings among researchers, policymakers and experts on the subject, and public consultation. The Brazilian List of HACSCs, comprising 19 groups of causes and diagnoses identified by ICD 10 codes, was then published in the form of an annex to Administrative Order SAS No. 221, of 17 April 2008<sup>16</sup>.

A number of studies conducted in Brazil have adopted HACSCs for evaluating PHC access and effectiveness. Despite certain limitations in using this indicator, it has pointed to the importance of PHC in reducing such hospital admissions<sup>17-19</sup>.

There is disagreement in the literature, however, as to the effects of expanding Primary Health Care coverage on reducing HACSCs. Campos & Theme-Filha<sup>20</sup>, for example, observed an inverse correlation between ESF coverage and HACSC coefficients in the municipality of Campo Grande. Mendonça *et al.*<sup>21</sup>, examined the trend in Belo Horizonte, finding 74.5% ESF coverage and significant reduction in HACSCs. Morimoto & Dias da Costa<sup>22</sup>, meanwhile, did not find this negative correlation and thus suggested that other factors may be associated with these results.

At present the Federal District is converting its model of care and considering expanding ESF coverage, making this an opportune moment for studies and research, considering that evidence based policymaking can produce social and economic impacts, as well as equity and health benefits.

In that light, the purpose of this study is to describe the change over time in hospital admissions for conditions amenable to Primary Health Care, comparing the Federal District with other selected state capitals.

## Material and Methods

This ecological study used secondary data drawn from the number of hospital admis-

sions in Brazil's Single Health System (*Sistema Único de Saúde*, SUS) recorded in the Hospital Information System (*Sistema de Informações Hospitalares*, SIH-SUS). Data were collected from the system by a census study of Type-1 Short-Term Hospital Admission Authorisation (AIH tipo 1) records and were grouped by municipality of residence. These records are in the public domain on the web site of the Executive Secretariat of the Ministry of Health's data processing department (DATASUS), and are available month by month in the form of "reduced" files (microdata in RD files). The study period was from 2009 to 2018, totalling 3,240 files (12 per year x 10 years x 27 states). These were read using SAS System software with statistics programming and macros, thus creating the variable "number of hospitalisations due to ambulatory care sensitive conditions (HACSCs)", as defined by Alfradique et al.<sup>15</sup>

HACSC rates were calculated and standardised by the direct method (age group). The data of the 2010 IBGE Population Census were used for standard population. These rates were then compared with those for "Not HACSCs" in selected geographical areas and also for the 20 groups that make up HACSCs. For that purpose, it was decided to select the state capitals with the largest populations in Brazil's South and Southeast regions.

Unfortunately, the Ministry of Health did not begin publishing microdata for Brasilia separately from its satellite towns until 2012, thus precluding the historical comparisons proposed here, which would have considered only the city of Brasilia.

## Results and Discussion

### The Federal District: age profile and groups of hospitalisations due to ambulatory care sensitive conditions

Stratification of HACSCs by age group highlighted the large proportion of such admissions among children up to nine years of age, who represented around 20% of total admissions in the Federal District. From 2009 to 2018, the relative share of the 50-59 and 60-69 year age groups declined, while the proportion of such admissions among children and adolescents held stable, suggesting that in the last 10 years efforts to expand primary care have had more effect in reducing admissions among young adults, concentrated

in the 40-59 year age group. On the other hand, the absence of any reduction among the under 20s, who are a priority population for PHC, may suggest that this population encounters barriers to access to PHC in the Federal District (Table 1), which may have to do with the working hours of primary health facilities there.

Studies of HACSCs in Brazil, as in other countries that use the indicator, vary greatly in methodology, in control variables used, especially the socio-demographic variables, and in the groups of diseases included. While, on the one hand, percentage rates of HACSCs in the state capitals are stable at around 10 to 15% of total admissions, an examination of the groups that make up HACSCs reveals regional inequalities that may reflect the stage of health system organisation and PHC's centrality or otherwise to the system<sup>23,24</sup>.

On examining the groups into which HACSCs can be subdivided (Table 2), municipal-based studies, mainly in the South and Southeast regions, of the under-20s, find that there has been a decrease in admissions connected with avoidable and immunisable conditions, nutritional deficiencies and anaemia, and those relating to the perinatal period and parasitic infectious diseases, such as gastroenteritis. Non-reductions (stability or increases in the time analyses) were found in admissions for bronchopneumonia and asthma. However, studies of children under five years old in municipalities in the states of Piauí<sup>25</sup> and Pernambuco<sup>26</sup> and of Yanomami indigenous children in Boa Vista (Roraima)<sup>27</sup> have found gastroenteritis to be the most prevalent cause of admissions, along with pneumonia.

In the Federal District, among the adult and elderly population, the groups in which reductions were observed were cardiovascular diseases such as hypertension, cardiac insufficiency and angina, while some studies found increases in the diabetes mellitus and stroke groups. The most prevalent infectious diseases causing admissions were bronchopneumonia, gastroenteritis and infections of the kidney and urinary tract (Table 2).

### The Federal District compared with other state capitals in Brazil

A consolidated analysis for the period from 2009 to 2018 in certain selected state capitals and the Federal District revealed that Florianópolis and Curitiba (cities with high primary care coverage) historically have returned rates of hospital admissions for conditions amenable to primary

**Table 1.** Distribution (%) of hospitalisations due to ambulatory care sensitive conditions (HACSCs) in the SUS, by age group Federal District – 2009 to 2018 (\*).

Years	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80 or +	Total
2009	21.7%	9.8%	5.4%	6.8%	14.2%	21.5%	21.7%	12.8%	15.7%	12.7%
2010	22.2%	10.4%	5.0%	6.8%	14.4%	22.3%	22.8%	12.1%	13.4%	12.9%
2011	23.3%	10.5%	5.6%	7.8%	14.0%	22.6%	22.6%	11.1%	13.6%	13.3%
2012	26.2%	10.9%	5.5%	7.6%	14.7%	22.6%	23.0%	12.1%	14.3%	14.1%
2013	26.9%	10.3%	5.5%	6.9%	13.6%	22.5%	21.8%	13.1%	16.7%	13.9%
2014	23.9%	9.7%	5.3%	6.3%	12.9%	20.9%	20.7%	12.1%	15.5%	12.8%
2015	28.2%	10.9%	4.9%	5.9%	13.1%	20.9%	19.8%	11.9%	14.5%	13.4%
2016	24.3%	10.0%	4.8%	6.0%	12.7%	19.3%	17.5%	11.4%	14.0%	12.6%
2017	22.9%	11.4%	5.2%	6.2%	12.0%	18.1%	16.6%	10.9%	15.0%	12.7%
2018	22.6%	11.1%	5.5%	5.7%	11.1%	17.0%	16.3%	10.6%	15.6%	12.6%

Source: Prepared by the authors from microdata in the Hospital Information System, available at: <http://www2.datasus.gov.br/DATASUS/index.php?area=0901&item=1&acao=25>

(\*). Considers the overall total of SUS admissions in each age group as the denominator of the calculation of each percentage, where the numerator is the total HACSCs in the SUS in each age group.

**Table 2.** Distribution (%) of total hospitalisations due to ambulatory care sensitive conditions (HACSCs) in the SUS, by group – Federal District, 2009 to 2018.

HACSC groups	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1	0.3	0.3	0.3	0.5	0.4	0.7	0.3	0.2	0.2	0.1
2	0.6	0.7	0.7	0.8	0.9	0.7	1.1	1.3	1.0	1.0
3	0.6	0.3	0.6	0.9	0.7	0.5	0.6	0.5	0.6	0.5
4	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
5	0.9	1.2	0.9	1.1	0.9	0.8	0.8	1.0	0.7	0.8
6	3.3	2.9	3.2	2.7	3.0	2.9	2.6	4.0	4.0	4.0
7	15.3	14.7	11.3	12.1	11.7	11.2	13.5	13.5	14.9	15.5
8	6.6	5.5	6.6	8.1	9.1	7.2	8.5	7.7	7.9	8.6
9	5.0	6.3	7.9	8.7	7.4	6.9	9.9	8.8	12.3	11.9
10	7.2	6.6	6.0	5.4	6.2	5.5	3.6	3.5	2.8	2.8
11	4.8	5.6	5.4	5.9	5.7	6.1	5.7	4.5	3.2	3.3
12	8.1	7.1	6.7	6.7	8.3	9.0	9.3	7.8	7.7	6.4
13	5.8	7.4	7.9	8.1	6.0	7.0	6.3	7.0	6.6	6.0
14	9.6	10.0	9.6	9.1	8.8	9.4	7.9	8.4	7.6	7.7
15	4.6	3.9	4.3	4.7	5.1	4.6	5.1	6.7	5.3	6.7
16	11.2	10.9	11.5	10.9	11.7	12.2	12.7	12.9	11.8	11.1
17	7.0	7.0	7.5	6.4	5.8	6.1	5.2	5.1	4.8	4.8
18	1.9	1.9	1.7	1.7	1.8	1.9	1.3	1.5	1.7	1.9
19	2.5	2.5	2.5	2.1	2.1	1.9	1.9	2.4	2.5	2.8
20	4.5	5.2	5.2	4.3	4.5	5.2	3.5	3.2	4.3	4.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Prepared by the authors, from microdata in the Hospital Information System, available at: <http://www2.datasus.gov.br/DATASUS/index.php?area=0901&item=1&acao=25>

Groups: 1. Immunisable diseases; 2. Avoidable conditions; 3. Infectious gastroenteritis; 4. Anaemia; 5. Nutritional deficiencies; 6. Ear; nose and throat infections; 7. Bacterial pneumonias; 8. Asthma; 9. Diseases of the lower airways; 10. Hypertension; 11. Angina pectoris; 12. Cardiac insufficiency; 13. Cerebrovascular diseases; 14. Diabetes mellitus; 15. Epilepsies; 16. Infection of the kidney and urinary tract; 17. Infection of the skin and subcutaneous tissue; 18. Female pelvic inflammatory disease; 19. Gastrointestinal ulcer; 20. Antenatal and childbirth-related diseases.

care close to 10%, which were not attained by the city of Rio de Janeiro until 2013, as a result of the process of PHC expansion implemented there, as described by Soranz et al.<sup>23</sup>. The Federal District was one of the worst performing states in the historical series examined, starting at values of around 13% and tending to stabilise at that level. Overall performance was similar to DF when statistics for the set of 27 state capitals was considered (Table 3).

The statistical treatment used in order to reduce data analysis bias in comparing standardised rates was to compare HACSCs vs Non-HACSCs; after all, reductions in HACSC rates may have occurred as a result of overall reductions in admissions in Brazil.

In this case, when variations in standardised rates of HACSCs vs Non-HACSCs for the period from 2009 to 2018 are examined (Table 4), differences can be seen over the course of the decade: (a) in Brazil overall, the reductions in standardised HACSC rates were far greater (-26.6%) than in non-HACSC rates (-12.4%); (b) Rio de Janeiro municipality stands out as where the reduction in standardised HACSC rates was greatest (-13.4%), as compared with non-HACSC rates (-2.0%); (c) in the Federal District, the decrease was similar in both statistics (-15.2% and -13.7%). When these variations were calculated for the 2013-2016 municipal electoral cycle, the state capitals of the Southeast Region and the Federal District stand out as having the largest reductions in total standardised HACSC rates (Graph 1).

### Limitations of the study

This study's internal validity is limited by the fact that both the admitting diagnosis and the classification of diseases by CID-10 codes at the time the hospital admission authorisation (*Autorização de Internação Hospitalar*, AIH) records were completed are influenced by the doctor's clinical knowledge and other organisational factors at the hospital facility, as also reported by Rehem et al.<sup>28</sup>. However, this is the only major data base of microdata in the Hospital Information System (SIH-SUS) with consolidated historical series on Brazil's national public health system. Also, coverage by private health insurance in the state capitals diverges widely from the situation in other parts of the country, and part of the admissions in state capitals, which occur in the private sector, are not contemplated in the analysis conducted here.

Another aspect which is often mentioned in studies of HACSCs<sup>24</sup> is the proportional analysis of these groups, given that diseases compete for a finite number of beds (smaller than the demand), and as a result a proportional reduction in one group may in fact reflect a proportional increase in occurrences of competing conditions.

Lastly, another limitation of the study is the fact that the SIH-SUS does not unequivocally link which people are or are not covered by the Family Health Strategy or traditional primary care, just as other factors, such as disease prevalence, disease burden, multi-morbidity, the clin-

**Table 3.** Distribution of hospitalisations due to ambulatory care sensitive conditions (HACSCs) in relation to total admissions in the SUS – Brazil and selected areas, 2009-2018.

Year	Distribution (%) of HACSCs in relation to total admissions								
	BR TT	BR CAP	DF	SP (Mun)	RJ (Mun)	BH	POA	CUR	FL
2009	13.9	10.9	12.7	11.1	10.8	14.7	14.2	6.4	10.4
2010	13.7	10.8	12.9	11.0	11.8	14.2	15.1	6.3	9.8
2011	13.6	10.9	13.3	11.4	11.0	12.7	15.9	6.7	9.3
2012	13.3	11.0	14.1	11.2	10.4	13.2	16.0	7.3	8.2
2013	13.1	10.8	13.9	11.1	9.6	12.6	15.2	7.6	8.8
2014	12.8	10.7	12.8	10.9	8.7	11.9	15.0	7.8	9.8
2015	12.6	10.8	13.4	10.9	9.2	12.1	15.7	7.9	9.9
2016	12.2	10.7	12.6	10.8	8.8	12.3	15.6	7.9	10.4
2017	12.1	10.7	12.7	10.6	8.6	12.7	14.9	8.0	10.3
2018	12.2	10.8	12.6	10.7	9.5	12.9	14.5	8.5	11.1

Source: Prepared by the authors, from microdata in the Hospital Information System, available at: <http://www2.datasus.gov.br/DATASUS/index.php?area=0901&item=1&acao=25>

Legend: BR TT = Brazil, all municipalities; BR CAP = Brazil all 27 state capitals; DF = Federal District; SP (Mun) = São Paulo municipality; RJ (Mun) = Rio de Janeiro municipality; BH = Belo Horizonte; POA = Porto Alegre; CUR = Curitiba; FL = Florianópolis.

**Table 4.** Distribution of standardised HACSC and Non-HACSC rates – Brazil and selected areas, 2009-2018.

Distribution of standardised HACSC rates per 10,000 population									
Year	BR TT	BR CAP	DF	SP (Mun)	RJ (Mun)	BH	POA	CUR	FL
2009	84.3	58.7	81.1	57.4	36.0	76.7	96.2	39.1	51.6
2010	84.2	60.4	83.8	59.6	39.8	81.7	105.0	39.9	46.0
2011	82.0	60.5	84.2	61.2	38.1	70.6	104.7	41.7	45.7
2012	78.2	59.4	86.0	58.3	35.0	72.9	112.4	43.6	38.4
2013	73.8	57.5	78.3	56.1	33.3	69.5	104.8	42.1	39.4
2014	71.5	54.8	66.4	54.7	29.5	67.7	104.9	42.1	48.0
2015	69.9	56.2	67.9	53.9	34.7	66.7	112.4	43.9	49.9
2016	66.0	55.2	68.2	55.2	29.6	68.5	108.8	44.9	53.6
2017	62.8	54.6	66.5	54.0	29.3	68.9	102.7	47.9	50.7
2018	61.9	54.2	68.8	51.0	31.2	71.6	90.3	51.0	57.5
Distribution of standardised Non-HACSC rates per 10,000 population									
Year	BR TT	BR CAP	DF	SP (Mun)	RJ (Mun)	BH	POA	CUR	FL
2009	521.3	477.2	533.0	461.3	300.3	436.3	564.4	574.9	434.4
2010	530.4	486.9	538.9	479.3	292.2	456.8	559.1	602.2	408.7
2011	523.1	483.8	526.0	473.5	304.7	451.5	521.4	588.6	428.6
2012	511.2	471.1	500.3	462.7	296.8	441.4	553.0	560.8	408.4
2013	497.9	461.8	460.7	447.0	309.6	448.1	548.4	518.5	387.8
2014	497.1	449.1	429.1	442.9	304.0	468.1	553.4	504.9	422.0
2015	492.5	453.8	417.7	436.0	339.8	455.4	559.5	515.4	431.8
2016	483.4	451.8	455.1	451.3	302.1	465.1	543.8	524.6	442.1
2017	464.2	445.3	440.9	444.5	307.5	446.5	539.4	553.4	416.6
2018	456.7	433.1	460.0	414.9	294.4	462.6	486.0	545.0	432.4

Source: Prepared by the authors from a critical reading of the microdata of monthly reduced hospital admission authorisations (AIHs) available on the website of the Ministry of Health data processing department, DATASUS.

Note: the rate standardised by the direct method considered, as its standard population, the resident population of Brazil by age group as in the 2010 IBGE population census.

Legend: HACSCs = hospitalisations due to ambulatory care sensitive conditions; Non- HACSCs = hospitalisations due to ambulatory care not sensitive conditions.

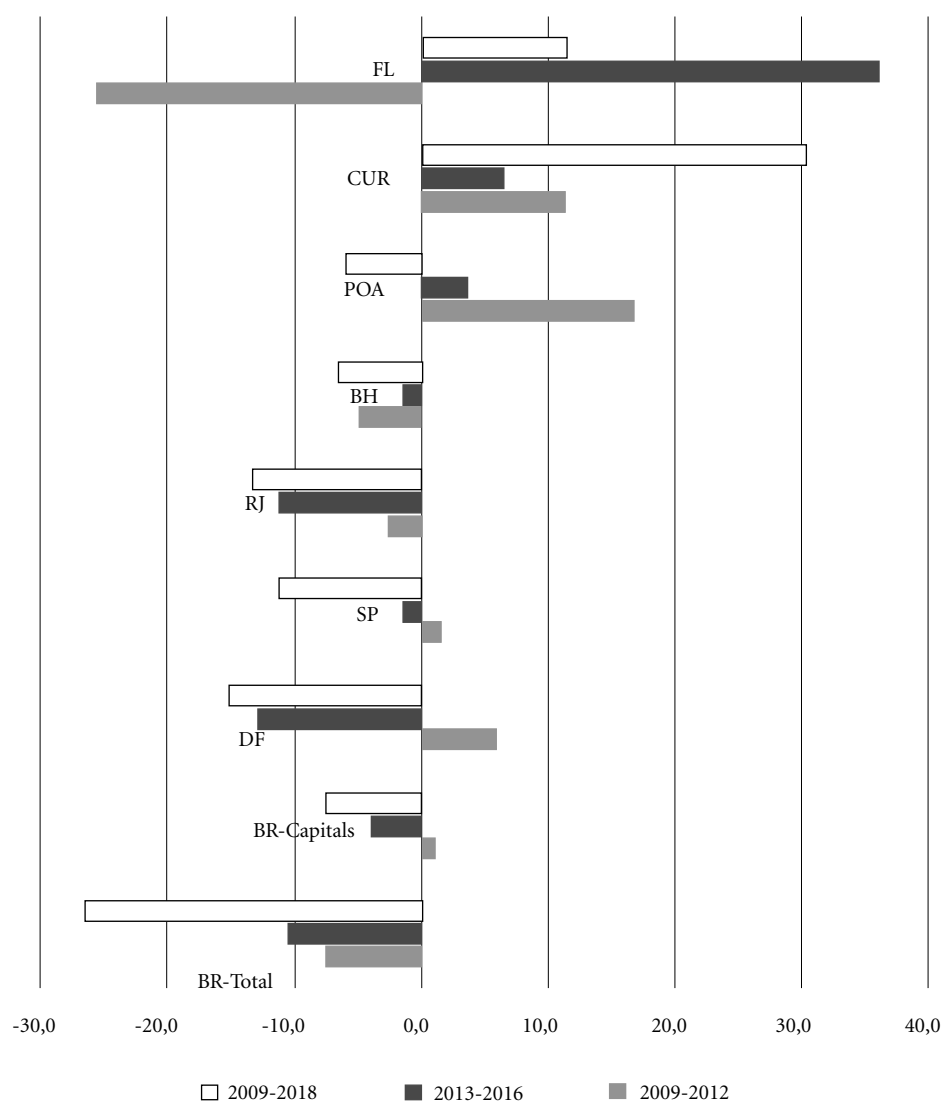
ical practice of doctors and multi-professional teams, which could potentially explain the hospital admissions outcome, were not included in the analysis and could have affected these results.

## Conclusion

The findings of this study are evidence that the Federal District has not yet displayed the decreasing proportion of hospital admissions for conditions amenable to primary care which was expected to result from the expansion of primary care observed since 2016. It is hoped that in coming years, other studies will examine the historical series analysed here and measure the related medium- and long-term effects.

However, a considerable downward trend was observed in the proportion of HACSCs in the 40-69 year age group in the Federal District (Table 1), suggesting that the adult health measures taken in the past ten years are helping to improve the situation. Although it is impossible to isolate the effects of primary health care, it is quite plausible that the reduction in HACSCs in this specific age group are connected with increased PHC coverage in the Federal District, especially in the monitoring of chronic conditions such as hypertension and diabetes, improved diagnosis, greater ease of access to medicines and coordination of care by the Family Health Teams.

The actions and procedures that are to be incorporated into the portfolio of Primary Health Care services in the Federal District to address



**Graph 1.** Variation (%) in standardised HACSC rates for Brazil and selected areas – 2009-2012, 2013-2016 and 2009-2018.

Source: Prepared by the authors from a critical reading of the microdata of monthly reduced hospital admission authorisations (AIHs) available on the website of the Ministry of Health data processing department, DATASUS.

Note: the rate standardised by the direct method considered, as its standard population, the resident population of Brazil by age group as in the 2010 IBGE population census.

Legend: HACSCs = hospitalisations due to ambulatory care sensitive conditions.

Legend: BR Total = Brazil, all municipalities; BR Capital = Brazil all 27 state capitals; DF = Federal District; SP = São Paulo municipality; RJ = Rio de Janeiro municipality; BH = Belo Horizonte; POA = Porto Alegre; CUR = Curitiba; FL = Florianópolis.

chronic conditions are multiple and multi-professional. Stratification for risk and vulnerability, supply of collective care and continuous care, supported self-care, complex clinical case management, tele-healthcare support and planned home

care, particularly following hospital discharge, prevent re-admissions and reduce costs<sup>29,30</sup>.

The factors with which primary health care services work to reduce health conditions are different for each type of condition. On the one

hand, reducing admissions for chronic conditions depends on greater access to PHC doctors and on the type of medicine practiced, as measured by clinical care management technologies, such as adherence to protocols, continuity of care and collaboration among different professions in PHC. As regards acute and infectious conditions, on the other hand, the teams' endeavour is to assure that interventions of proven effectiveness and efficiency – for example, increasing water intake among the elderly, so as to avert admis-

sions for dehydration and kidney infections, and increasing vaccination coverage among the frail elderly, so as to prevent complications from bacterial pneumonias – are being conducted appropriately and reaching the most vulnerable population groups. Monitoring of such admissions, by population group, group of diseases and regions in a given municipality, can help in setting health service investment priorities, with a view to maintaining rates at acceptable levels associated with expansion of effective primary health care.

### **Collaborations**

LF Pinto contributed to the design, design, writing, analysis and review of data. CS Mendonça conducted the critical review of the article. TCMSB Rehem contributed in the Introduction and B Stelet in the analysis of the data.



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Article submitted 30/01/2019

Approved 06/02/2019

Final version submitted 27/03/2019