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Analysis of the performance of health services in a group of vulnerable municipalities

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Abstract *This work was a descriptive study that analyzed the performance of health services in 112 municipalities (g100) characterized by more than 80,000 inhabitants, low public revenue, and socioeconomic vulnerability. Based on the Projeto de Avaliação de Desempenho do Sistema de Saúde, 31 indicators of funding, resources, access, effectiveness, acceptability, and appropriateness were selected for the period of 2017-2020, and were compared to the variations of each year's indicators year on year. In 2020, an increase in funding, especially SUS transfers (31.6%), was observed. The availability of hospital beds had been decreasing between 2017 and 2019, but began to increase again in 2020; likewise, the availability of health professionals also showed a slight increase. A decline was observed in cervical and breast cancer screening exams of nearly 40% (2020), as well as a decrease in surgical procedures, such as cataracts and angioplasties. The hospitalizations due to conditions manageable by primary care were 15.8% in 2020, 14.1% lower than in 2019. A 55.8% increase in mortality due to diabetes and greater tuberculosis treatment non-adherence was also observed. The pandemic context calls for caution when interpreting results, which highlight access barriers and postponements of proper health care.*

Key words *COVID-19, Health services, Unified Health System, Health Care quality, access, and evaluation, Municipalities*

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Introduction

Models and methodologies for performance evaluation of healthcare systems and services have been the focus of different international and national initiatives. Their importance has been increasing since the 1980's, with emphasis on health services, especially health care[1,2]. Performance evaluation may contribute to identifying aspects which require modification in order to improve the healthcare system[1,3].

In 2000, the World Health Organization (WHO) included the issue in the international agenda with the publishing of the World Health Report[4], which included a ranking of the healthcare systems of 191 countries, based on the application of a synthetic indicator. The initiative was criticized for its conceptual and methodological aspects, as well as for its lack of transparency[5-7]. As a result, researchers from different institutions elaborated a conceptual and methodological proposal aimed at evaluating the performance of the Brazilian healthcare system[1].

In general, considering that performance is related to the accomplishment of targets, objectives, and principles of the healthcare system, a proposal was created, guided by the legal concept of the Unified Health System (SUS), its objectives and priorities, culminating into a conceptual matrix published in 2003, published by the Evaluation Project of Health System Performance (*Projeto de Avaliação de Desempenho do Sistema de Saúde* - PROADESS)[1,8]. This matrix consists of four major dimensions and their respective subdimensions, with a universal axis, equity[8]. The dimension of health determinants is made up of subdivisions: environmental, socioeconomic and demographic, and behavioral and biological. The dimension of health conditions of the population, contains: morbidity, functional state, wellbeing, and mortality. The subdimensions of the structure of the healthcare system include operations, funding, and resources. Finally, the performance of healthcare systems includes eight subdimensions: effectiveness, access, efficiency, respect to people's rights, acceptability, adequacy, and patient safety[8,9].

Few are the studies that have applied the PROADESS proposal, especially in a municipal context. Machado *et al.*[10] verified the performance of the healthcare service in the municipality of São José do Rio Preto (São Paulo, Brazil) considering the indicators and the calculation method of PROADESS for the dimensions of accessibility, adequation, and acceptability. Parente *et al.*[11] used health indicators according to geographic regions, concerning the dimensions of effectiveness, accessibility, adequation, and acceptability in the analysis of a macrogerion in the state of Pernambuco.

Using PROADESS as a conceptual and methodological framework, this article proposes to analyze the performance of healthcare services in a group of municipalities denominated as g100, in the period of 2017-2020. This choice is justified by the fact that the g100 has been used as the priority criteria for the development of public health policies since its creation, as in the case of the More Doctors Program (*Programa Mais Médicos* - PMM)[12-14]. The g100 was defined by the National Mayors Front (*Frente Nacional de Prefeitos* - FNP), and it is comprised of municipalities with more than 80,000 inhabitants, with low per capita public revenue, and in a scenario of socioeconomic vulnerability[12]. Per capita public revenue is calculated based on the System of Accounting Data Collection by Federative Entities (*Sistema de Coleta de Dados Contábeis dos Entes da Federação* - SISTN) from the National Treasury Secretary (*Secretaria do Tesouro Nacional* - STN), based on an average of the three previous years. In addition to this indicator, since 2013, the g100 has included three more: i) percentage of people living in families with a per capita monthly income of up to R$ 140 (January/2013), according to the Social Information Report of the Child Benefit System (Bolsa Família) and the Consolidated Records of the Ministry of Social Development and Fight against Hunger; ii) percentage of residents who receive supplementary health care, according to the National Agency for Supplementary Health Care (*Agência Nacional de Saúde Suplementar* - ANS); and iii) percentages of children enrolled in the regular municipal, state, and private education systems, according to data from the Anísio Teixeira National Institute for Educational Research (*Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* - Inep).

Methodology

This work is a descriptive study on performance of the healthcare services in the municipalities listed in the g100 based on indicators by PROADESS[8] during the period of 2017-2020. The year 2020 was chosen because the COVID-19 pandemic resulted in a severe overburdening of the healthcare systems[15,16], thus enabling us to observe possible variations in the analyzed period.

The indicators provided by PROADESS meet the following criteria: i) availability of data in the regular healthcare information systems; ii) periodicity, iii) reliability of the information, iv) validity of the measurement/indicator[17,18]. Moreover, these are based on national and international proposals, and when necessary, on verification by experts. The populational basis indicators used as their denominator were the population estimates for Brazilian municipalities, disaggregated by sex and age (2000-2001), published by the Datasus/Ministry of Health[8]. In the sex and age-standardized indicators, the indirect method was employed, adopting a reference population of Brazil in 2010, according to the Demographic Census by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE)[19]. It is also important to mention that some indicators refer to cutoffs according to specific ages and sex, to grievance, or to specific procedures.

Some criteria were followed in the adoption of indicators for this study. Emphasis was primarily placed on the dimensions of the healthcare system structure and performance of healthcare services. Next, the indicators available for the period of 2017-2020 were filtered, resulting in 57 indicators.

Of the eight subdimensions of performance of healthcare services, four were not included in this study due to the unavailability of indicators regarding the group of municipalities and to frequency and variability of the population in the study. Therefore, the subdimensions' respect to the rights of people and continuity lacked indicators at the municipal level. The patient safety subdimension contains three sentinel event indicators, but with no records of events in nearly all of the municipalities selected. In the subdimension of efficiency, the four indicators available are calculated according to the place where the event took place (healthcare service), and not by the place of residency, as is the case in the other subdimensions; hence, they were excluded. The list of indicators was therefore reduced to 50.

Taking into consideration, besides availability, the values and variability in the universe of interest, the g100, each author of this study prioritized relevant indicators among the 50 listed. This phase was followed by a consensus meeting in which the choices were compared and pertinence and viability were evaluated, considering the different levels of health care, the grievances, and the structure and performance subdimensions. Hence, of the five indicators of funding, three were selected, given that the indicator of specific resources allocated to health care per inhabitant was included, and the indicators of specific resources per inhabitant and specific resources allocated to health care were excluded in order to avoid redundancy. Of the 16 indicators of the resources dimension, six were selected, taking into consideration those used in a publication by the Organization for Economic Cooperation and Development (OECD)[2]. Three of the indicators of effectiveness were excluded due to a low frequency of events in the g100 municipalities: those were mortality for severe respiratory infection among patients aged 5 years and younger; hospital mortality by stroke; and mortality by myocardial infarction.

In the accessibility subdimension, we did not select the indicators of hospital births and hip replacement surgeries among the elderly. Hospital births were not selected, as they showed almost no variation over time and reached almost 100% in each municipality, while hip replacement surgeries were not selected due to the low frequency among g100 residents. The excluded indicators of adequation were rate of hospitalization for hysterectomy among female residents aged 20 years and older, and average time of hospitalization for hip fracture among hospitalizations of patients aged 60 years and older due to a low frequency and variability.

At the end of the process, 31 indicators were analyzed (Chart 1). In that analysis, the averages as well as the 95% confidence intervals (95% CI) were calculated, considering the respective upper and lower limits for each indicator among the g100 municipalities during the period studied. This study also calculated the percentage variation of the result of each indicator in relation to the previous year. PROADESS adopts some suppression criteria when presenting municipal indicators; if the events occur in a frequency lower than 5, the indicator is not calculated, preventing an inadequate interpretation of unstable rates[20]. In the present article, we opted to assign a value of zero to those cases. Moreover, the indicators of funding were not deflated.

In addition to describing the location at state and regional levels, the plan to analyze the g100 municipalities initially focused on the socioeconomic profile. The 2020 resident population, as well as the Municipal Human Development Index (MHDI) from 2010, were considered. Both are available in PROADESS, in the health determinant dimension. The MHDI was calculated by the United Nations Development Program

Chart 1. Indicators of the structure of the healthcare system and the performance of the selected healthcare services: calculation method and data source.

Indicator by subdimension	Calculation method	Source
Structure of the Health System		
Funding		
Specific resources allocated to health care per inhabitant (in R$)	Numerator: expenses of specific resources allocated to healthcare. Denominator: total resident population.	SIOPS
Funds transferred from SUS per inhabitant (in R$)	Numerator: total value of funds from SUS. Denominator: total resident population.	SIOPS
Total expenses with health care per inhabitant (in R$)	Numerator: total of expenditures in health (all funding sources) of the municipalities. Denominator: total resident population.	SIOPS
Resources		
Doctors available to SUS per 1,000 inhab.	Numerator: number of doctors available to SUS x 1,000. Denominator: total resident population.	CNES
Specialist doctors available to SUS per 100,000 inhab.	Numerator: number of specialist doctors available to SUS x 100,000. Denominator: total resident population.	CNES
Nurses available to SUS per 100,000 inhab.	Numerator: number of nurses available to SUS x 100,000. Denominator: total resident population.	CNES
Hospital beds available to SUS per 1,000 inhab.	Numerator: number of hospital beds in general or specialized hospitals available to SUS x 1,000. Denominator: total resident population. Specialty areas selected: all surgical areas, all clinical areas (not including mental health), clinical obstetrics, surgical obstetrics, and pediatric surgery. COVID-19 beds were not included.	CNES
ICU/CCU beds available to SUS per 100,000 inhab.	Numerator: number of beds at Intensive Care Units (ICU) and Coronary Care Units (CCU) available to SUS x 100,000. Denominator: total resident population. Specialty areas selected: Adult ICU type I, Adult ICU type II, Adult ICU type III, Coronary type II – CCU Tipo II, Coronary ICU type III – CCU Type III. ICU COVID-19 beds were not included.	CNES
Neonatal ICU beds available to SUs per 1,000 live births	Numerator: number of Neonatal ICU beds x 1,000. Denominator: total number of live births. Specialties of the ICU beds selected from 2009 on: Neonatal ICU type I, Neonatal ICU - type II, Neonatal ICU type III.	CNES
Performance of Healthcare Services		
Accessibility		
Estimated population coverage at Primary Care level	Indicator calculated by the Ministry of Health (MH), according to the following formula - Numerator: number of Family Health teams x 3,450 + (number of Primary Health Care teams + equivalent number of Family Health Care teams) x 3,000 x 100. Denominator: total resident population. *The parameter of 3,450 is considered for eSF, and for parameterized eAB, and eSF teams the parameter is 3.000.	SAPS/ MS
Coverage by the Family Health Strategy	Indicator calculated by the MH, according to the following formula - Numerator: number of Family Health Care teams x 3,450 x 100. Denominator: total resident population.	SAPS/ MS

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(UNDP), by the Applied Research Institute (*Instituto de Pesquisa Econômica Aplicada* - Ipea), and by the João Pinheiro Foundation (*Fundação João Pinheiro* - FJP)[21], based on data from demographic census (IBGE) and continuous National Household Survey (NHS) by the IBGE. This value was calculated according to the product of the geometric average of the income rates (based in the indicator of municipal per capita income), longevity (calculated by life expectancy at birth),

Chart 1. Indicators of the structure of the healthcare system and the performance of the selected healthcare services: calculation method and data source.

Indicator by subdimension	Calculation method	Source
Mammogram ratio	Numerator: number of mammography exams performed on female residents, aged 50 to 69 years. Denominator: half the number of female residents, aged 50 to 69.	SIA-SUS
Pap smear ratio	Numerator: number of cervical cytopathological examinations performed on female residents, aged 25 to 64 years. Denominator: one-third of the number of female residents, aged 25 to 64.	SIA-SUS
Hospitalization	Numerator: number of hospital admissions of residents paid by SUS x 1,000. Denominator: total resident population.	SIH-SUS
Cataract surgery	Numerator: number of cataract removal procedures (inpatient or outpatient) among residents aged 40 years or older x 100,000. Denominator: total resident population, aged 40 years and older.	SIH-SUS and SIA-SUS
Myocardial revascularization surgeries	Numerator: number of procedures and surgeries of myocardial revascularization in residents aged 20 years and older x 100,000. Denominator: resident population, aged 20 years and older.	SIH-SUS
Angioplasties	Numerator: Number of angioplasty procedures in residents aged 20 years and older x 100,000. Denominator: resident population, aged 20 years and older.	SIH-SUS
Effectiveness		
Hospitalization due do conditions manageable by primary care	Numerator: Number of hospitalizations of residents funded by SUS for conditions manageable by primary health care x 100. Denominator: Total number of hospitalizations of residents funded by SUS, excluding those with a diagnosis related to births (CID-10: O80-O84).	SIH-SUS
Hospitalization for asthma*	Numerator: number of hospitalizations of residents, aged 15 years and older, paid by SUS, for asthma x 100,000. Denominator: resident population, aged 15 years and older. Codes CID-10: J45-46. * Sex and age-standardized rate.	SIH-SUS
Hospitalization for gastroenteritis*	Numerator: number of hospitalizations for gastroenteritis x 100,000. Denominator: total resident population. Codes CID-10: A000-A09.	SIH-SUS
Hospitalization for bacterial pneumonia*	Numerator: number of hospitalizations for bacterial pneumonia in individuals, aged 20 years and older x 100,000. Denominator: resident population, aged 20 years and older. Codes CID10: J13 J14 J15.3 J15.4 15.8 15.9.	SIH-SUS
Hospitalization for heart failure*	Numerator: number of hospitalizations of individuals, aged 40 years and older for heart failure, including pulmonary edema x 100,000. Denominator: resident population, aged 40 years and older. Codes CID-10 I50, J81.	SIH-SUS
Occurrence of tuberculosis	Numerator: number of new confirmed cases of tuberculosis (all types) in residents x 100,000. Denominator: total resident population. Codes CID-10: A15-A19.	SINAN
Number of new cases of congenital syphilis in children younger than 1 year of age	Absolute number of new cases of congenital syphilis in children, aged one year and younger, in given years of diagnosis and place of residency. CID-10: A50.	SINAN
Mortality by diabetes*	Numerator: number of deaths by diabetes among residents, aged 20 to 79 years x 100,000. Denominator: total resident population, aged 20 to 79 years. Codes CID-10: E10-E14.	SIM
Mortality by arterial hypertension*	Numerator: number of deaths by hypertension among residents, aged 50 to 64 years x 100,000. Denominator: total resident population, aged 50 to 75 years. Codes CID-10: I10-I13.	SIM

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and education (with two indicators - percentage of people aged 18 years and older with complete elementary education, and school attendance of the young population). The MHDI varies between 0 and 1; the higher the value, the better the human development of the municipality.,

Chart 1. Indicators of the structure of the healthcare system and the performance of the selected healthcare services: calculation method and data source.

Indicator by subdimension	Calculation method	Source
Maternal mortality (direct)	Numerator: number of deaths among female residents, 10 to 49 years, classified in Chapter XV of the ICD 10, except for codes O96 and O97 (Late Maternal Death and Death by direct obstetric cause sequela) x 100,000. Includes deaths encoded in the ICD 10 as: O00.0 to O08.9; O11 to O23.9; O24.4; O26.0 to O92.7. Denominator: number of live births among resident mothers, in the same place and years considered.	SIM and SINASC
Hospital mortality by stroke	Numerator: number of deaths among hospitalizations of patients aged 45 years and older, lasting up to 30 days, and having the main diagnosis of ICD-10 I63-I64. Denominator: number of hospitalizations of patients, aged 45 years and older, lasting up to 30 days.	SIH-SUS
Acceptability		
Abandonment of tuberculosis treatment	Numerator: number of cases of tuberculosis ended due to abandonment of treatment X 1,000. Denominator: number of reported cases of tuberculosis.	SINAN
Adequation		
Prenatal appointments	Numerator: number of live births from resident mothers who had more than six prenatal appointments x 100. Denominator: total number of live births from resident mothers. Occurrences without information on the number of appointments were excluded.	SINASC
C-section births	Numerator: number of live births from mothers who had a C-section x 100. Denominator: total number of live births. Occurrences without information about place and kind of birth were excluded.	SINASC

*Sex and age-standardized rates were calculated by the indirect method, using as reference population, that of Brazil in 2010[19]. CNES: National Register of Health Establishments (Cadastro Nacional de Estabelecimentos de Saúde); SIOPS: System of Information on Public Budgets for Health (Sistema de Informações sobre Orçamentos Públicos em Saúde); SIA-SUS: SUS System of Outpatient Information (Sistema de Informações Ambulatoriais do SUS); SIH-SUS: SUS Hospital Information System (Sistema de Informações Hospitalares do SUS); SAPS/MS: Primary Health Care Secretary of the Ministry of Health (Secretaria de Atenção Primária à Saúde do Ministério da Saúde); SINASC: Information System on Live Births (Sistema de Informações sobre Nascidos Vivos); SIM: Mortality Information System (Sistema de Informação sobre Mortalidade); SINAN: Information System on Notification Grievances (Sistema de Informação de Agravos de Notificação); UTI/CCU: intensive care units or coronary care units.

Source: PROADESS[8] (cited 2023 mar 1).

according to the following levels of classification: 0.000-0.499 - very low; 0.500-0.599 - low; 0.600-0.699 - average; 0.700-0.799 - high; and 0.800-1.000 - very high.

Furthermore, the descriptive analysis plan for the performance indicators prioritized temporal variation in the g100 municipalities. However, there is a lack of consensually accepted parameters in literature or in the programming of healthcare services referring to the indicators selected in the healthcare resources dimension. Thus, in the absence of a valid normative parameter that establishes the ideal proportion of doctor per inhabitant, we followed the proposal published by the More Doctors Program (*Programa Mais Médicos* - PMM), which benefited the g100 municipalities, since the aim was 1.7 doctors per 1,000 inhabitants, which is the proportion found in the United Kingdom[22], a country that also has a universal healthcare system and served as the basis for the design of the PMM.

This study did not require approval from the Ethics Research Committee, since it did not involve human beings and was based on public information of unrestricted access.

Results

Geographic distribution and socioeconomic characteristics of the g100

The current sample[12] is 112 municipalities located in 21 Brazilian States, considering that, in 2020, their residents corresponded to 12.4% of the population of the country (Table 1). The Northeast region accounts for 53 of the municipalities; given that 16 are located in the state of

Table 1. Socio-demographic characteristics of the g100 municipalities grouped according to the Brazilian state and geographic region.

Geographic region	Brazilian state	Number of municipalities	Population residing in g100 municipalities (2020)	Resident population of the state in the g100 municipality (%)	MHDI* (min-max)	g100 municipalities
Midwest	Goiás (GO)	8	1.653.352	23.2%	0.669-0.746	Águas Lindas de Goiás, Aparecida de Goiânia, Formosa, Luziânia, Novo Gama, Planaltina, Trindade, Valparaíso de Goiás
	Mato Grosso (MT)	2	382.387	10.8%	0.708-0.734	Cáceres, Várzea Grande
Northeast	Bahia (BA)	9	1.723.248	11.5%	0.623-0.712	Feira de Santana, Guanambi, Ilhéus, Jacobina, Jequié, Santo Antônio de Jesus, Serrinha, Valença, Vitória da Conquista
	Ceará (CE)	8	1.311.341	14.3%	0.640-0.713	Caucaia, Crato, Iguatu, Itapipoca, Juazeiro do Norte, Maranguape, Pacatuba, Quixadá
	Maranhão (MA)	10	1.208.381	17.0%	0.595-0.724	Bacabal, Barra do Corda, Caxias, Chapadinha, Codó, Paço do Lumiar, Pinheiro, Santa Inês, São José de Ribamar, Timon
	Paraíba (PB)	3	342.744	8.5%	0.627-0.701	Bayeux, Patos, Santa Rita
	Pernambuco (PE)	16	3.376.577	35.1%	0.602-0.735	Abreu e Lima, Araripina, Camaragibe, Carpina, Caruaru, Garanhuns, Gravatá, Igarassu, Jaboatão dos Guararapes, Olinda, Paulista, Petrolina, Santa Cruz do Capibaribe, São Lourenço da Mata, Serra Talhada, Vitória de Santo Antão
	Piauí (PI)	1**	153.482	4.7%	0.687**	Parnaíba
	Rio Grande do Norte (RN)	2	348.857	9.9%	0.640-0.766	Macaíba, Parnamirim
	Sergipe (SE)	4	478.162	20.6%	0.625-0.664	Itabaiana, Lagarto, Nossa Senhora do Socorro, São Cristóvão
North	Acre (AC)	1**	89.072	10.0%	0.664**	Cruzeiro do Sul
	Amapá (AP)	2	635.998	73.8%	0.692-0.733	Macapá, Santana
	Amazonas (AM)	3	316.566	7.5%	0.614-0.658	Manacapuru, Parintins, Itacoatiara
	Pará (PA)	13	3.619.311	41.6%	0.503-0.746	Abaetetuba, Ananindeua, Belém, Bragança, Breves, Cametá, Castanhal, Marituba, Moju, Redenção, Santarém, São Félix do Xingu, Tailândia
	Rondônia (RO)	1**	130.009	7.2%	0.714**	Ji-Paraná
Southeast	Espírito Santo (ES)	1**	383.917	9.4%	0.718**	Cariacica
	Minas Gerais (MG)	8	1.623.905	7.6%	0.684-0.770	Caratinga, Conselheiro Lafaiete, Coronel Fabriciano, Ibirité, Montes Claros, Ribeirão das Neves, Sabará, Santa Luzia
	Rio de Janeiro (RJ)	9	3.743.641	21.6%	0.659-0.753	Belford Roxo, Japeri, Magé, Mesquita, Nilópolis, Nova Iguaçu, Queimados, São Gonçalo, São João de Meriti
	São Paulo (SP)	4	1.152.327	2.5%	0.703-0.749	Carapicuíba, Ferraz de Vasconcelos, Francisco Morato, Itaquaquecetuba
South	Paraná (PR)	4	579.354	5.0%	0.695-0.733	Almirante Tamandaré, Colombo, Piraquara, Sarandi
	Rio Grande do Sul (RS	3	594.520	5.2%	0.699-0.744	Alvorada, Uruguaiana, Viamão
Total		112	23,847,151	12.4%	0.503-0.770	-

*MHDI: Municipal Human Development Index[21]. **Does not show MHDI variation, as it refers to a single municipality in the UF.

Source: FNP[12] and PROADESS[8] (cited 2023 mar 1).

Pernambuco. Two state capitals are included in the g100: Belém (PA) and Macapá (AP), with populations of 1,499,641 and 512,902 inhabitants, respectively. After Belém (PA), the g100 municipality with the highest population was São Gonçalo (RJ), with 1,091,737 residents.

In 2010, the MHDI in the group ranged from 0.503 (low) in Breves (PA) to 0.770 (high) in Montes Claros (MG). Considering the variation between geographic regions, the lower limit of the MHDI stands out, considered as low, in municipalities from the North and Northeast. By contrast, the remaining regions have lower limits when compared to average MHDI (Table 1).

Structure of the healthcare system

The average value of the specific per capita resources allocated to health care showed a slight increase over time for the g100 group, reaching R$ 204.25 per capita in 2020 (Table 2). Funding transfers from SUS increased 31.6% between 2019 and 2020 (Table 3). The average total public spending on health per capita increased from R$ 406.89 in 2017 to R$ 609.15 in 2020 (Table 2).

The offer of healthcare services in the g100 is characterized by having an average of doctors of 0.8 per 1,000 inhabitants between 2017 and 2019, with a slight increase to 0.92 in 2020 (Table 2). In 2020, the lowest offer was in the municipality of Moju (PA), with only 0.1 doctors per 1,000 inhabitants available to SUS during the entire period of 2017-2020. The offer of specialist doctors by SUS, meanwhile, increased throughout the series, rising from 79.32 professionals per 100,000 inhabitants in 2017 to 88.64 in 2020 (Table 2). On average, there were 72.35 nurses available to SUS per 100,000 inhabitants in 2017, which increased during the period, reaching 91.76 in 2020 (Table 2).

In 2020, 59 of the 122 municipalities had less than 1.00 hospital beds available to SUS per 1,000 inhabitants, which was similar to the average for the group in the period of 2017-2019 (Table 2). Four municipalities did not have a single hospital bed throughout the entire series: Almirante Tamandaré (PR), Novo Gama (GO), Japeri (RJ), and Paço do Lumiar (MA). On the other hand, two municipalities had more than three beds available to SUS per 1,000 inhabitants: Serra Talhada (PE) and Parnaíba (PI). A decrease was observed in terms of the offer of hospital beds in 37 of the g100 municipalities in 2020 as compared to 2019.

The average number of beds at Intensive Care Units and Coronary Care (UTI/UCO) available to SUS per 100,000 inhabitants grew in the period, from 3.95 in 2017 to 5.26 in 2020 (Table 2). Only four municipalities did not have any regular hospital beds available to SUS, however, half the municipalities had no adult ICS/coronary available to SUS em 2020. Four municipalities from the state of Maranhão (Bacabal, Santa Inês, Pinheiro, and Chapadinha), and the municipality of Breves (PA), had no adult ICU beds between 2017 and 2019, but they began to have them in 2020.

Of the 112 municipalities, 78 had no neonatal ICU at SUS in 2020. The average was slightly higher in 2020 (1.13), as compared to the two previous years, when it was 1.07 beds per 1,000 live births (Table 2). The municipality of São Gonçalo (RJ) stood out for not having neonatal ICU beds available during the entire period, even though it recorded more than 10,000 live births per year.

Performance of the healthcare services

Accessibility

The average population coverage estimated by the Primary Health Care (PHC) teams for the g100 increased slightly throughout the period (70.37% in 2027 to 75.53% by 2020) (Table 2). In 2020, coverage was lower than 50% in 20 municipalities; and 24 municipalities reached 100% coverage. The percentage of the population covered by the Family Health Strategy (eSF) increased an average of 66% in the g100 municipalities between 2018 and 2020, with little variation over the years (Tables 2 and 3).

Among the indicators of accessibility of the female population to cervix and breast exams to track neoplasms at SUS, the ratio in the number of cytopathological exams among female residents, aged 25 to 64 years, decreased during the period, from 0.50 (2017) to 0.27 (2020) (Table 2). Only eight municipalities had a ratio above 0.30, the highest registered in the municipality of Serra Talhada (PE). The ratio of mammograms also decreased, from 0.22 to 0.10 among the g100 municipalities, a 37.5% reduction (Tables 2 and 3).

The sex and age-standardized hospitalization rates at SUS were approximately 57.0 per 1,000 inhabitants between 2017 and 2019, and witnessed a 20.4% decline in 2020 (Tables 2 and 3). The crude rate of cataract surgeries in the g100 increased 29.9% in 2018 year on year; however, it saw a drop in 2020, returning to a level below that of 2017 (462.93) (Tables 2 and 3). The average rate of myocardial revascularization surgeries

in the group was 8.94 in 2017, dropping in the following years until reaching 5.36 per 100,000 inhabitants in 2020 (Table 2). In 39 municipalities, less than five of those surgeries were performed. Angioplasties also fell during the period, and the group of g100 municipalities, in 2020, showed an average of 33.93 of these procedures per 100,000 residents, 19.8% lower than in 2019 (Tables 2 and 3).

Effectiveness

In the g100 municipalities, the percentage of Hospitalizations for Conditions Manageable by Primary Care (HCMPC) remained at around 19% during the period, with a decrease in 2020, to 15.8% (Table 2). Only eight municipalities showed increases in the percentages of HCMPC, which varied from 3.6% to 16.0%. The municipalities of São Feliz do Xingu (PA) and Itacoati-

Table 2. Indicators of the structure of the healthcare system and the performance of the healthcare services in the g100 municipalities. 2017-2020: average and confidence interval.

Indicator by subdimension	2017	2018	2019	2020
	Average g100 (95%CI)	Average g100 (95%CI)	Average g100 (95%CI)	Average g100 (95%CI)
Structure of the Healthcare System				
Funding				
Specific resources allocated to healthcare per inhabitant (in R$) [+]	173.22 (162.33-184.10)	179.99 (168.88-191.10)	192.66 (180.30-205.02)	204.25 (190.56-217.93)
Funds transferred from SUS per inhabitant (in R$) [+]	230.94 (211.88-250.00)	270.40 (247.79-293.01)	294.01 (268.88-319.14)	386.87 (351.99-421.76)
Total expenses with healthcare per inhabitant (in R$) [+]	406.89 (384.98-428.80)	459.62 (433.30-485.95)	491.82 (465.58-518.06)	609.15 (574.58-643.71)
Resources				
Doctors available to SUS per 1.000 inhab. [+]	0.79 (0.71-0.86)	0.82 (0.74-0.89)	0.83 (0.75-0.91)	0.88 (0.80-0.97)
Specialist doctors available to SUS per 100.000 inhab. [+]	79.32 (71.86-86.79)	82.24 (74.62-89.86)	83.32 (75.53-91.11)	88.64 (80.29-97.00)
Nurses available to SUS per 100.000 inhab. [+]	72.35 (65.97-78.73)	77.07 (70.19-83.95)	83.06 (75.66-90.47)	91.76 (83.75-99.77)
Hospital beds available to SUS per 1.000 inhab. [+]	1.00 (0.87-1.13)	0.99 (0.86-1.11)	0.97 (0.85-1.10)	1.11 (0.97-1.25)
ICU/CCU beds available to SUS per 100.000 inhab. [+]	3.95 (2.86-5.04)	3.99 (2.92-3.99)	4.65 (3.42-5.88)	5.26 (3.99-6.54)
Neonatal ICU beds available to SUs per 1.000 live births [+]	0.98 (0.64-1.32)	1.07 (0.72-0.99)	1.07 (0.72-1.41)	1.13 (0.76-1.50)
Performance of Healthcare Services				
Accessibility				
Estimated population coverage at Primary Care level [+]	70.37 (66.13-74.61)	73.27 (69.03-77.50)	73.50 (69.30-77.70)	75.53 (71.27-79.78)
Coverage by the Family Health Strategy	63.04 (58.16-67.92)	66.45 (61.69-71.22)	66.12 (61.36-70.87)	66.77 (61.97-71.58)
Mammogram ratio [+]	0.22 (0.18-0.26)	0.17 (0.14-0.19)	0.16 (0.14-0.18)	0.10 (0.08-0.11)
Pap smear ratio [+]	0.50 (0.49-0.51)	0.48 (0.47-0.49)	0.46 (0.46-0.47)	0.27 (0.26-0.27)
Hospitalization* [+/-]	57.15 (54.33-59.97)	56.90 (54.32-59.47)	57.44 (54.94-59.95)	45.74 (43.89-47.60)
Cataract surgery [+/-]	486.56 (409.54-563.58)	631.85 (552.45-711.24)	663.74 (556.20-771.29)	462.93 (366.00-559.85)
Myocardial revascularization surgeries* [+/-]	8.94 (7.08-10.80)	7.71 (6.00-9.42)	7.49 (6.75-9.23)	5.36 (3.78-6.93)
Angioplasties* [+/-]	44.61 (37.44-51.79)	41.06 (34.95-47.17)	42.32 (34.65-48.98)	33.93 (28.68-39.17)

it continues

Table 2. Indicators of the structure of the healthcare system and the performance of the healthcare services in the g100 municipalities, 2017-2020: average and confidence interval.

Indicator by subdimension	2017	2018	2019	2020
	Average g100 (95%CI)	Average g100 (95%CI)	Average g100 (95%CI)	Average g100 (95%CI)
Effectiveness				
Hospitalization due to conditions manageable by primary care [-]	19.48 (18.37-20.59)	18.79 (17.85-19.73)	18.39 (17.48-19.30)	15.80 (15.00-16.60)
Hospitalization due to asthma* [-]	10.69 (5.83-15.55)	8.03 (2.91-13.14)	7.61 (2.88-12.34)	5.16 (0.37-9.95)
Hospitalization due to gastroenteritis* [-]	63.05 (46.38-79.72)	55.21 (40.98-69.44)	54.77 (40.02-69.52)	29.30 (21.27-37.32)
Hospitalization due to bacterial pneumonia* [-]	58.58 (46.09-71.07)	50.99 (41.73-60.25)	55.11 (41.15-65.07)	33.45 (27.34-39.55)
Hospitalization due to heart failure* [-]	278.36 (249.38-307.33)	226.52 (203.83-249.21)	219.86 (203.15-244.57)	158.38 (137.46-179.31)
Occurrence of tuberculosis [-]	24.49 (23.30-25.68)	24.94 (23.86-26.01)	24.65 (23.69-25.61)	22.46 (21.38-23.53)
Number of new cases of congenital syphilis in children younger than 1 year of age [-]	4.593**	5.219**	5.152**	4.990**
Mortality due to diabetes* [-]	41.91 (39.13-44.70)	36.21 (33.47-38.96)	36.26 (33.50-39.03)	40.65 (37.66-43.64)
Mortality due to hypertension* [-]	33.61 (27.65-39.56)	26.84 (21.35-32.33)	26.47 (21.52-31.42)	41.23 (36.44-46.03)
Maternal mortality (direct) [-]	62.88 (52.10-73.65)	64.84 (54.30-75.38)	62.97 (54.50-74.43)	74.52 (62.49-86.55)
Hospital mortality by ischemic stroke [-]	18.19 (16.42-19.96)	16.72 (14.97-18.47)	16.63 (14.21-18.05)	17.10 (15.60-18.60)
Acceptability				
Abandonment of tuberculosis treatment [-]	10.39 (9.05-11.74)	10.38 (9.13-11.62)	9.48 (9.10-10.85)	11.67 (10.23-13.10)
Adequation				
Prenatal appointments [+]	57.90 (55.36-60.44)	60.37 (57.93-62.82)	62.74 (57.38-65.10)	60.71 (58.05-63.36)
C-section births [-]	50.85 (48.76-52.94)	51.97 (49.88-54.05)	52.79 (49.70-54.88)	54.17 (52.08-56.25)

*Sex and age-standardized rates were calculated by the indirect method. using as reference population. that of Brazil in 2010 (Censo Demográfico. IBGE). **Absolute number of cases. [+] higher values are preferable; [-] lower values are preferable; [+/-] the interpretation of indicator's polarity must take the context into consideration. ICU/CCU: intensive care unit or coronary care unit.

Source: PROADESS[8] (cited 2023 mar 1).

ara (AM) had the highest values throughout the series (~ 40% of HCMPC).

Among the rates of HCMPC due to specific conditions (asthma, gastroenteritis, bacterial pneumonia, and heart failure) in the g100 municipalities, the standardized rate of hospitalization due to asthma showed a decreasing tendency during the entire period of 2017-2020, reaching 5.16 hospitalizations per 100,000 inhabitants in 2020 (Table 2). In 68 municipalities, the frequency of hospitalizations of residents due to asthma was below 5 cases in 2020. However, in 2020, municipalities from the state of Pará (Abaetetuba and São Félix do Xingu) showed rates above the previous years, respectively of 138.5 and 246.7 hospitalizations due to asthma. In terms of rates of hospitalization due to gastroenteritis in the g100, a decline of 46.5% was found in the first years of the pandemic, as compared to the previous year (Tables 2 and 3). However, 49 of the 112 municipalities showed an increase in hospitalizations, especially the municipalities of Chapadinha (MA) and Ilhéus (BA), with increases of more than 150%. In the case of bacterial pneu-

Table 3. Percentage variation of the averages in comparison to the previous years - g100, 2017-2020.

Indicator by subdimension	% Variation (2018/2017)	% Variation (2019/2018)	% Variation (2020/2019)
Structure of the Healthcare System			
Funding			
Specific resources allocated to healthcare per inhabitant (in R$)	3,9	7,0	6,0
Funds transferred from SUS per inhabitant (in R$)	17,1	8,7	31,6
Total expenses with healthcare per inhabitant (in R$)	13,0	7,0	23,9
Resources			
Doctors available to SUS per 1,000 inhab.	3,9	1,2	6,7
Specialist doctors available to SUS per 100,000 inhab.	3,7	1,3	6,4
Nurses available to SUS per 100,000 inhab.	6,5	7,8	10,5
Hospital beds available to SUS per 1,000 inhab.	-1,1	-1,3	14,4
ICU/CCU beds available to SUS per 100,000 inhab.	1,1	16,6	13,1
Neonatal ICU beds available to SUs per 1,000 live births	1,88	0	5,6
Performance of Healthcare Services			
Accessibility			
Estimated population coverage at Primary Care level	4,1	0,3	2,8
Coverage by the Family Health Strategy	5,4	-0,5	1,0
Mammogram ratio	-24,2	-5,5	-37,5
Pap smear ratio	-4,0	-4,2	-41,3
Hospitalization	-0,4	1,0	-20,4
Cataract surgery	29,9	5,04	-30,3
Myocardial revascularization surgeries	-13,8	-2,8	-28,5
Angioplasties	-8,0	3,1	-19,8
Effectiveness			
Hospitalization due to conditions manageable by primary care	-3,6	-2,1	-14,1
Hospitalization due to asthma	-24,9	-5,2	-32,2
Hospitalization due to gastroenteritis	-12,4	-0,8	-46,5
Hospitalization due to bacterial pneumonia	-13,0	8,1	-39,3
Hospitalization due to heart failure	-18,6	-2,9	-28,0
Occurrence of tuberculosis	1,8	-1,2	-8,9
Number of new cases of congenital syphilis in children younger than 1 year of age	13,6	-1,3	-3,1
Mortality due to diabetes	-13,6	0,1	12,1
Mortality due to arterial hypertension	-20,1	-1,4	55,8
Maternal mortality (direct)	3,1	-2,9	18,3
Hospital mortality due to ischemic stroke	-8,1	-0,5	2,8
Acceptability			
Abandonment of tuberculosis treatment	-0,2	-8,7	23,1
Adequation			
Prenatal appointments	4,3	3,9	-3,2
C-section births	2,2	1,6	2,6

Source: PROADESS[8] (cited 2023 mar 1).

monia, the average number of hospitalizations remained above 50 per 100,000 inhabitants, with a 39.3% drop in 2020, in comparison to 2019 (Tables 2 and 3). The highest rate of hospitalizations for bacterial pneumonia was in Trindade (GO), which had 153.8 hospitalizations per 100,000 inhabitants, aged 20 years or older, in 2020. The rates of hospitalization for heart failure also witnessed a decrease during the period, especially between 2017 and 2018, and from 2019 to 2020, varying from 278.36 hospitalizations per 100,000 inhabitants to 158.38 in the first years of the COVID-19 pandemic (Table 2). Only 17 of the g100 municipalities showed an increase in hospitalizations due to heart failure in 2020 when compared to 2019, given that the highest

variation (64%) occurred in Parnamirim (RN). São Félix do Xingu (PA) stood out for presenting the highest rates throughout the series, reaching 786.8 hospitalizations for heart failure per 100,000 inhabitants, aged 40 years and older, in 2020.

Among the indicators referring to mandatory reporting of diseases and grievances, the incidence of tuberculosis remained t around 24 confirmed cases per 100,000 inhabitants, with a slight decrease in 2020 (Table 2), which was lower than that verified for Brazil nationally (40.8, in 2020). However, five g100 municipalities showed values above 100 cases per 100,000 inhabitants: São Cristóvão (SE) - 164.7; Abreu e Lima (PE) - 160.4; Marituba (PA) - 148.9; Japeri (RJ) - 131.7; and Belém (PA) - 106.3.

In the g100, 4,990 new cases of congenital syphilis in children younger than 1 year of age were registered in 2020, a value that is 3.1% lower than in the previous year (Tables 2 and 3). Four municipalities from the state of Rio de Janeiro (São Gonçalo, Nova Iguaçu, Belford Roxo, and São João de Meriti), with 500,000 inhabitants or more, presented the highest frequencies during the period, and when added, amounted to 30.72% of the total number of cases in the group in 2020 (1,533 cases).

In the g100, the standardized rate of mortality due to diabetes mellitus, which was 41.91 per 100,000 inhabitants in 2017, presented a slight decline in the following year (36.21), remaining stable in 2019, and increased by 12.1% in 2020 when compared with the previous year (Tables 2 and 3). Deaths caused by hypertension among residents, aged 50 to 64 years per 100,000 inhabitants also increased substantially (55.8%) in 2020, when the average was 41.23 (Tables 2 and 3). The highest rates, above 80 deaths per 100,000 inhabitants, were verified in three municipalities from the state of Maranhão – Timon, Bacabal, and Chapadinha – and in Vitória de Santo Antão (PE).

The percentage of hospital deaths due to ischemic stroke among hospitalized patients, aged 45 years and older, fell by 8% between 2017 and 2018, but increased (2.8%) in 2020 when compared to 2019, with a 17.10% average in 2020 (Tables 2 and 3), amounting to 3,090 deaths in the entire g100 group.

Maternal deaths by obstetric complications during pregnancy, birth, and postpartum remained around 63 and 65 deaths per 100,000 live births, with an increase to 74.52 in 2020 (Table 2). Of the 112 municipalities, 95 did not report five or more maternal deaths in the first year of the COVID-19 pandemic. The highest rate was in Cáceres (MT), with 330.03 maternal deaths per 100,000 live births.

Acceptability

In the g100, there was a 23.1% increase in the rate of abandonment of tuberculosis treatment in 2020 as compared to 2019, with 11.67 cases of abandonment per 1,000 notified cases (Tables 2 and 3).

Adequation

The percentage of live births whose mothers had more than six prenatal care appointments increased by approximately 4% from 2017 to 2018 and from 2018 to 2019; however, this value dropped by 3.2% in 2020, with an average of 60.71% (Tables 2 and 3). By contrast, 26 of the g100 municipalities registered less than 50% of the live births as having had adequate prenatal care, with eight of those municipalities located in the state of Pará and nine in Maranhão. The percentage of births by C-section ranged between 50.85% (2017) and 54.17% (2020), with an annual variation below 3% (Tables 2 and 3).

Discussion

This article followed the matrix proposed by PROADESS to analyze the performance of healthcare services in a group of populous municipalities considered socioeconomically vulnerable – the g100. In general, the g100 municipalities represent a heterogenous group, varying considerably in terms of socioeconomic conditions, healthcare resources, and performance of their healthcare services. In the structure of the healthcare system, an increase in expenditure on healthcare was verified, especially in 2020, although not deflated, which was also a tendency verified in the totality of the Brazilian municipalities[8].

In the pandemic scenario, it is important to highlight that the FNP[12], main representative of the g100 municipalities, questioned the manner in which extraordinary fund transfers were made by the federal government in the first years of the COVID-19 pandemic and has pressed for changes in tax distributions. In the present article, little variation in the providing of health resources was noticed, as was a considerable inequality in terms of resources available to SUS from municipality to municipality. None of the g100 municipalities reached the parameter of 2.7 doctors available to SUS per 1,000 inhabitants. However, Montes

Claros (MG), the g100 municipality with the highest MHDI, almost reached the PMM goal[22], ranging between 2.40 and 2.48 doctors available to SUS per 1,000 inhabitants throughout the series. In such a scenario, it is important to recognize changes in the organization of healthcare and the need for resources. Rodrigues *et al.*[23] showed a tendency of decline in the availability of hospital beds, as well as the scarcity and poor distribution of the availability of ICU beds in particular, an issue that had been described previously in literature and that worsened with the pandemic. Likewise, in the OECD countries, a decline has been observed in terms of availability, given that in 2019, the average number of hospital beds in those countries was 4.4 per 1,000 inhabitants[2].

Moreover, indicators of accessibility decreased throughout the period, with an intense drop in the performance of cancer tracking exams, such as cytopathological exams and mammograms. Although expected, considering the recommendations during the COVID-19 pandemic to postpone actions of tracking, appointments, and examinations[24,25], these findings show that there are later health concerns, which will require proper attention. Furlam *et al.*[26] identified a 44%decrease in cancer tracking in Brazil in 2020, as compared to what would be expected, with inequalities found between the geographic regions of the country. Meanwhile, in the g100, there was a 37.5% decline in the mammogram ratio in 2020 when compared to 2019.

A decrease was also observed, as expected, in specific surgical and clinical hospitalizations during the first year of the COVID-19 pandemic. The pandemic caused changes in healthcare standards at different levels, especially by postponing elective actions, such as medical appointments, exams, and surgeries. This might result in the late diagnosis of chronic diseases and in a discontinuity in terms of the follow-up of patients who are already diagnosed[2,16]. Moreover, according to the WHO[27], the COVID-19 pandemic pushed back the efforts of countries to protect the population against Non-Communicable Diseases (NCDs). Therefore, this new context must be taken into consideration in the planning and execution of public health policies, especially among vulnerable populations, as is the case of the g100.

The ICSAP has been used to evaluate the results of the expansion in coverage of Primary Care and of the Family Health Strategy[28]. However, caution is important when interpreting its decline in 2020, as well as when analyzing the declines in rates of hospitalization for specific conditions and rates of grievances or diseases that should be mandatorily reported (such as syphilis and tuberculosis). Although those rates diminished in the g100 group, they may well reflect the restrictions in access to healthcare or even diagnosis delays caused by the COVID-19 pandemic. Regarding abandonment of tuberculosis treatment, it is notable that only 25 of the 112 g100 municipalities had rates of abandonment below the reference value (< 5%) defined by the WHO[29]. At the same time, the increases of 12.1% and 55.8%, respectively, in the rates of mortality due to diabetes and hypertension in 2020 may be related to the fact that these are comorbidities with higher risk and that aggravate cases of COVID-19[30,31].

In this context, it is important to recognize that in 2020, COVID-19 was the main cause of hospitalization and hospital deaths in SUS, higher than that of circulatory system diseases and of respiratory diseases, which ranked higher in the past[32]. Moreover, as other countries, in Brazil, an excessive number of deaths and a decrease in life expectancy of the population were observed, with a higher impact on some regions of the country and some population groups[33-36].

The use of conceptual frameworks aids in the selection of indicators and provides coherence to the analysis of healthcare[37]. The theoretical-methodological framework of PROADESS values the SUS principles, especially universalization and equity of offer, access, and use. Therefore, the scenario reveals a wealth of information concerning the performance of healthcare services in the g100 municipalities, although limitations should be considered. It provides subsidies for decision-making regarding the allocation of resources and quality improvement; however, it also reveals challenges, especially as regards the distinctions of these municipalities when compared to others with different socioeconomic vulnerabilities, financial needs, and sanitary differences[38]. Furthermore, the tendencies discussed here were clearly influenced by the pandemic context; hence, caution is required when evaluating the improvements or the worsening of performance measured provided by these indicators during that period of study.

It is important to highlight that some of the dimensions of performance, such as the respect to patient's rights, continuity, and acceptability, throughout the 20 years since their formulation, are still in an incipient state in terms of the production of indicators, especially due to the availability of information in the systems. It is particularly challenging to work with municipal data,

considering the low frequencies of some events and grievances.

In spite of the wealth of data regarding the performance of healthcare services in the g100, some other limitations should also be mentioned. One such limitation is the descriptive nature and the design centered around the analysis of performance indicators, which has inherent limitations in terms of the approach and the validity of the measurements, the most noteworthy of which refer to the use of preventative exams for breast and uterine cancer, which used the production of exams as the numerator, with those limitations being found in the healthcare information systems. In this regard, there are several gaps in terms of completion, updating, and interconnection of the data banks, indicating aspects to be improved.

Finally, the variability and inequality noticed in the indicators found for the g100 municipality is connected to the blatant regional inequalities present in the Brazilian reality, which are expressed in terms of the distribution of healthcare resources[39] and compromise the equity of access, use, and effectiveness, which also reflects the socioeconomic inequalities of the country[40].

Final considerations

Despite the limitations, this study enabled us to conduct an empirical exploration of the conceptual matrix and the indicators of PROADESS, describing the performance in g100 municipalities and considering a four-year period, which included the first year of the COVID-19 pandemic, which caused extra overburden of the SUS. In this exploration, the strengths and the weaknesses of the information systems in terms of monitoring the performance of the healthcare system and services at the municipal level, as well as the need for improvements, were evident.

It is still early to measure all of the impacts of the COVID-19 pandemic on the population's health conditions. However, it is evident that the absence of continuous monitoring of SUS by government agencies, due to the frequent discontinuity in the selection of indicators, in the analysis models, and in the actors involved in the process of agreement, are elements which compromise the planning and the management of the healthcare system, as well as the evaluation of public policies[41].

In such a context, evaluative research may contribute to the improvement of adopted policies and to exercising social control, thereby strengthening the resilience of the healthcare system. Meanwhile, the repercussions and consequences of the COVID-19 pandemic in the health of the population and impacts on the profiles of morbidity may require the creation of new strategies for evaluation and monitoring. In face of such challenges, the production of a panel of indicators that aids in discussing the structure and performance of healthcare services in a group of municipalities may well contribute to furthering the debate regarding the use of methodologies and approaches in the evaluation of the performance of healthcare systems and services, and can also serve as input for the planning of health policies in the years to come.

Collaborations

CC Carvalho was responsible for the conception, analysis, data interpretation, writing of the manuscript, and revision of the final manuscript. F Viacava was responsible for the conception, analysis, interpretation of data, critical review, and revision of the final manuscript. M Martins was responsible for the conception, critical review, and revision of the final manuscript. RAD Oliveira was responsible for the conception, critical review, and revision of the final manuscript.

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