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SPECIAL EDITION

Sustainability and Efficiency of the Brazilian Health System

SUS | MINISTÉRIO DA SAÚDE | PÁTRIA AMADA BRASIL GOVERNO FEDERAL

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SPECIAL EDITION: Sustainability and Efficiency of the Brazilian Health System

SUMMARY

The Brazilian Health System in the post-COVID-19: towards a reform agenda to strengthen the Unified Health System

The new coronavirus pandemic and its social and economic effects have demonstrated the importance of investing in health systems. The pandemic resulted in a contraction of global gross domestic product (GDP) by more than 3% in 2020, with a drop of 4.1% in Brazil and increasing unemployment and poverty worldwide.[1] In Brazil, in 2020 alone, the Federal Government allocated more than 56 billion reais (approximately 0.76% of GDP and 20% of the total health budget in the period) in additional resources for actions to combat the pandemic within the scope of the Brazilian Unified Health System (SUS).[2] In 2020, the Federal Government alone invested the equivalent of 2.16% of GDP in public health actions and services, compared to 1.68% in the previous year.[3] These resources allowed increasing federal transfers to states and municipalities to increase the capacity of intensive care units (ICU) beds, purchase essential supplies, test the population for the virus, and purchase vaccines against COVID-19.

According to the latest Health Satellite Accounts (HSA), Brazil spends 9.2% of its GDP on health.[4] Of this total, public spending represents 3.8% of GDP (without considering the indirect expenditure of fiscal waiver, amounting to approximately 0.5% of GDP), while private spending amounts to 5.4% of GDP. The Supplementary Health Sector covers 22.5% of the Brazilian population, representing more than 47 million beneficiaries, with annual revenue from benefits exceeding 220 billion reais. The health sector is also of strategic economic importance, with growing participation in the composition of the total value added of the Brazilian economy (7.6%), in income generation (9.6%), and the total number of jobs (7.1%), with an increasing number of jobs greater than that observed for the average economy. Data available indicate that each additional 1% invested in health in Brazil results in 1.44% more in family income.[5]

The COVID-19 pandemic has highlighted the urgency of accelerating the development of the Brazilian health economic-industrial complex to reduce productive and technological dependence in such a sensitive and strategic area. The health economic-industrial complex is an indisputable economic engine with excellent growth potential, and this complex interconnects several industrial sectors (chemical, biotechnology, mechanical, and electronic materials) and healthcare services. Our policy in this area aims to expand the Brazilian population's access to healthcare products and technologies and, at the same time, reduce the SUS vulnerability, rationalizing the State's purchasing power. To this end, we seek to encourage innovation, technological development, and knowledge exchange and promote the development and manufacture of strategic products for the SUS in Brazil.

In 2017, according to HSA data, health-related products represented only 0.7% of the country's total exports. Imports of pharmochemicals (active ingredients used in medicines production) represented 76.4% of its total supply.[6] And the importation of medicines for human use corresponded to 24.1% of the entire product supply. In 2020, the first year of the COVID-19 pandemic, according to the Brazilian Alliance of Innovative Health Industry data, the health sector's trade balance was in deficit by US$ 5.5 billion – an increase of 12.5% compared to the previous year. Imports totaled US$ 6.2 billion, while exports totaled US$ 726

1 IBGE, Coordination of National Accounts, 2021.
2 Information System on Public Health Budgets. Available at: https://qsprod.saude.gov.br/extensions/DEMAS_C19SIOPS/DEMAS_C19SIOPS.html.
3 Information System on Public Health Budgets. Own elaboration.
4 Health Satellite Account: Brazil – 2010-2017, IBGE (2019).
5 Institute of Applied Economic Research. Ipea Communications No. 75 – Expenses with Social Policy: a lever for growth with income distribution. IPEA (2011), 17p. Available at: http://repositorio.ipea.gov.br/bitstream/11058/4634/1/Comunicados_n75_Gastos_com.pdf.
6 Health Satellite Account: Brazil – 2010-2017, IBGE (2019).

million.[7] These numbers make clear the importance of Brazil seeking the SUS technological and economic sustainability in the short, medium, and long terms through the promotion of structural conditions to increase the country's productive and innovation capacity, resulting in the reduction of the country's trade deficit of the sector and ensuring all Brazilians the right to health. For being better prepared to respond to future public health emergencies, we need to invest more in the health economic-industrial complex in partnership with the private sector.

The Brazilian public and private healthcare systems were tested during this unprecedented crisis. The SUS has been the main asset of the Brazilian society in facing the pandemic and its effects on the population's health and life. Strengthening the Brazilian healthcare system requires identifying public policies that improve the quality of public and private spending on health to guarantee the principles established in the Brazilian Constitution of 1988. This special edition of the *"Jornal Brasileiro de Economia da Saúde" (Brazilian Journal of Health Economics)*, a partnership between the Ministry of Health and the World Bank, seeks to foster a strategic debate on health policies that seek to increase efficiency and ensure the sustainability of the Brazilian healthcare system. This discussion is part of the ongoing efforts to modernize the Brazilian State. The primary objective is to improve access and quality of services provided to the Brazilian population while maximizing the use of public resources to provide sustainable responses to the Brazilian society's demands.

Rodrigo Otávio Moreira da Cruz
Executive Secretary, Ministry of Health

7 Economic Bulletin, Brazilian Alliance of Innovative Health Industry (2021).

Strengthening the Brazilian Health System: more efficiency and more inclusion

The COVID-19 pandemic has had devastating effects on the lives and well-being of populations around the world, especially among the poorest and most vulnerable. By early 2022, there were more than 400 million cases and more than 5.8 million deaths worldwide. Its direct (number of cases and deaths) and indirect effects (abandonment of treatments, and the reduction in the number of diagnostic tests) have resulted in reduced life expectancy worldwide. The pandemic and the measures to respond to it resulted in a severe economic crisis, with a drop in global gross domestic product (GDP) of 3.4% in 2020 and a slow recovery for 2021 and 2022.[1] The crisis contributed to the increase in massive unemployment and extreme poverty more than 150 million people are estimated to have fallen into extreme poverty globally, impacting human capital accumulation in many parts of the world.[2,3] The response to the pandemic has shown that stronger health systems are essential to protect lives and lessen the impacts of pandemics on the economy.

In Brazil, the Unified Health System (SUS) played an essential role in responding to the pandemic. SUS was crucial for those who needed medical treatment and since 2021 in the implementation of one of the most extensive vaccination programs in the world. More than 10,000 intensive care unit beds were quickly added to the public health system to treat those affected by the severe form of the disease, and more than 400 million vaccines were acquired, distributed, and administered across the country in less than a year.

In Brazil, as in almost all countries worldwide, the response to the health crisis has unleashed unprecedented fiscal challenges. To respond to the demands of the health area and protect the income of the most vulnerable families, the Federal Government presented a package of fiscal measures that amount to approximately 8.6% of GDP.[4] As a result, the Brazilian primary deficit in 2020 was 10% of GDP (an increase of almost nine percentage points compared to 2019 and eight percentage points above pre-COVID-19 estimates). This fiscal scenario points out the need for adjustments and reforms for the Brazilian State to provide essential quality services to its population. To achieve these goals, having a plan to improve the efficiency of public spending is vital. World Bank analysis pointed out potential fiscal savings at the federal level of 7% of GDP by 2026.[5]

The analysis estimated potential gains of 0.3% of GDP without compromising the number of health services provided to the population in the health sector. These savings are mainly the result of the fragmentation of the public health system, especially the high number of small hospitals, which prevents economies of scale in service delivery. Shortcomings related to systems integration and insufficient incentives offered to providers and patients to choose the most cost-effective treatment were also identified. Much could be gained, for example, by identifying and treating noncommunicable diseases before they become hospital cases. In addition, tax expenditures are large and highly regressive. Improving efficiency in healthcare services will be

1 Estimated growth of 5.5% in 2022 and projected growth of 4.1% for 2022. World Bank data. 2022. Global Economic Prospects, January 2022. Washington, DC.
2 World Employment and Social Outlook: Trends 2021. ILO, 2021.
3 World Bank. 2020. Poverty and Shared Prosperity 2020: Reversals of Fortune. Washington, DC: World Bank.
4 Available at: https://documents1.worldbank.org/curated/en/106541594362022984/pdf/COVID-19-in-Brazil-Impacts-and-Policy-Responses.pdf.
5 A fair adjustment: efficiency and equity of public spending in Brazil: Volume I: syntheses (Portuguese). Washington, DC: World Bank Group.

critical to ensuring that the sector absorbs anticipated cost increases associated with changing demographics.[4]

This special edition of the *"Jornal Brasileiro de Economia da Saúde"* (Brazilian Journal of Health Economics) represents an essential contribution to the strengthening and sustainability of the Brazilian Unified Health System (SUS). The edition includes contributions from researchers, academics, SUS managers, and other professionals working in public and private health sectors. The evidence presented in this edition will assist in the search for solutions to current (post-pandemic) and future (changes in demographic and epidemiological profile) challenges. Similar themes are the actions of the World Bank in the health sector in Brazil (and in the world). Over the last few decades, the World Bank has provided technical and financial support for consolidating one of the world's largest health systems and an example for other low- and middle-income countries. Through this edition, the World Bank joins the Ministry of Health, the Brazilian Journal of Health Economics and SUS researchers and managers to produce evidence and stimulate public debate with the primary objective of strengthening the SUS.

Michele Gragnolati
Practice Manager for Health, Nutrition and Population Latin America and the Caribbean Region, The World Bank

ORIGINAL ARTICLE
ARTIGO ORIGINAL

How an electronic prescription tool enables better prescription quality for patients

Como uma ferramenta de prescrição eletrônica possibilita uma melhor qualidade na prescrição para os pacientes

Vanessa Gonçalves Pereira[1], Stéphanie Kazniakowski Guassi[1], Hugo Silva Pereira Mendes[2], André Marques dos Santos[1]

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Keywords
drug prescriptions, drug interactions, clinical decision support systems

ABSTRACT

Objective: Medication-related errors in patients are among the leading causes of preventable health damage and harm worldwide. In the United States, these errors cause at least one death a day and damage approximately 1.3 million people annually. According to the World Health Organization, the global expenditure on medication-related errors is estimated to be U$ 42 billion per year. In Brazil, the rate of potential drug interactions varies between 28% and 63.6% for primary care patients. The prevalence of drug interactions has increased following an aging population, increased chronic conditions, combined use of different drugs, and increased prescription drugs per patient. **Methods**: The data used for this study were obtained through the database from Nexodata do Brasil S.A a private health technology company with an electronic prescription system and a data intelligence area. **Results:** 65,867 electronic prescriptions were evaluated during 2019. Of these, 4,828 prescriptions had an average of 2.5 interactions. These interactive prescriptions were generated by 197 different doctors, totaling 24.5 prescriptions with interaction per doctor over 12 months. A total of 12,005 interactions were identified, 15.6% classified as mild, 70.9% as moderate, and 13.5% as severe. **Conclusion**: By implementing an electronic prescription tool, a reduction of 32.9% in the number of prescriptions with drug interaction was observed.

Palavras-chave:
prescrições de medicamentos, interações de medicamentos, sistemas de apoio a decisões clínicas

RESUMO

Objetivo: Os erros relacionados à medicação de pacientes estão entre as maiores causas de danos e prejuízos evitáveis à saúde em todo o mundo. Nos Estados Unidos, esses erros causam pelo menos uma morte por dia e causam danos a aproximadamente 1,3 milhão de pessoas anualmente. Segundo a Organização Mundial da Saúde, estima-se que o gasto global com erros relacionados à medicação seja de US$ 42 bilhões por ano. No Brasil, a taxa de interações medicamentosas potenciais varia entre 28% e 63,6% em pacientes de serviços de atenção primária. A prevalência de interações medicamentosas tem aumentado, seguindo o envelhecimento populacional, aumento de condições crônicas, uso combinado de diferentes medicamentos e aumento na quantidade de medicamentos prescritos. **Métodos**: Os dados utilizados para o presente estudo foram obtidos por meio da base de dados da Nexodata do Brasil S.A., que é uma empresa privada de tecnologia em saúde que possui um sistema de prescrição eletrônica e uma área de inteligência de dados. **Resultados**: Foram avaliadas 65.867 prescrições eletrônicas durante o ano de 2019; dessas, 4.828 prescrições apresentaram em média 2,5 interações. Essas prescrições com interação foram geradas por 197 médicos diferentes, totalizando um total de 24,5 receitas com interação por médico ao longo de 12 meses. Foi identificado um total de 12.005 interações, sendo 15,6% classificadas como leves, 70,9% como moderadas e 13,5% como graves. **Conclusão**: Por meio da implementação de uma ferramenta de prescrição eletrônica, foi observada uma redução de 32,9% na quantidade de receitas com interação medicamentosa.

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Introduction

Medication-related errors to patients are among the biggest causes of avoidable harm and damage to health worldwide. In the United States, these errors cause at least one death a day and harm approximately 1.3 million people annually. In addition, adverse drug reactions can increase the length of hospital stay by two days, twice the risk of death, and more than $2,000 in hospital costs. According to the World Health Organization, the global expenditure on medication-related errors is estimated to be US$42 billion per year (WHO, n.d.).

Among these errors are drug interactions (DIs), described as the phenomenon that occurs when the effects of a drug are modified by the previous or simultaneous administration of another drug. The final result of a DI can increase or reduce the effects of one or two active ingredients or can promote the appearance of a new effect that did not occur with one of the active ingredients alone. Interactions can occur between active ingredient-active ingredient, active ingredient-food, active ingredient-laboratory tests, and active ingredient-chemical substances (Tatro, 2011; Anvisa, 2002).

In clinical terms, DIs can lead to reduced treatment efficacy or the occurrence of adverse events of different severities. Mild DIs can cause discomfort to the patient with no need to change the treatment or medical intervention. Moderate DIs may require treatment modification, and severe DIs can cause permanent damage or worsen the patient's clinical condition, leading to hospitalization, increased length of stay, physical disability, and even death (Zwart-van Rijkom *et al.*, 2009).

In Brazil, the rate of potential DIs varies between 28% and 63.6% in primary care patients (Sousa *et al.*, 2014; Leão *et al.*, 2014; Santos *et al.*, 2019). The prevalence of DIs has increased following the population aging, increased chronic conditions, and the combined use of different drugs. The probability of occurrence increases with the number of medications prescribed (Coombes *et al.*, 2001; Johnell & Klarin, 2007; Baysari *et al.*, 2012). Among outpatients, the prevalence of potential DIs is approximately 50% and may reach over 80% (Tragni *et al.*, 2013; Kennedy-Dixon *et al.*, 2015).

Several interventions to reduce the frequency and impact of medication errors have already been developed; one of them is implementing electronic prescription in health services as a clinical decision support tool. Because the reported number of potential DIs is high, research shows that physicians have difficulty identifying them (Ko *et al.*, 2008). In this way, electronic prescribing systems can be beneficial for reducing medication errors by displaying alerts of potential DIs on the screen as the prescription is dispensed.

Many doctors do not adhere to alerts – this rate can vary from 49% to 96%. However, evidence shows that such alerts can positively affect prescriptive behavior when well designed and for a specific target audience (van der Sijs et al., 2006; Schedlbauer et al., 2009; Baysari *et al.*, 2011; Bright *et al.*, 2012).

This study aims to quantify and characterize the potential DIs in electronic prescriptions generated from care in Brazilian institutions that adhere to the technology.

Methods

The data used for this study were obtained from the database from Nexodata do Brasil S.A., a private health technology company with an electronic prescription system and a data intelligence area.

The collected data for prescriptions analysis considered the entire year of 2019 and establishments using Nexodata's software instead of the API [Application Programming Interface]. Such data contain information regarding the dispensed prescriptions, containing the physician and their characteristics, patients and their characteristics, and the drugs and possible interactions for each case.

For the analysis, medical establishments from which at least one DI alert was originated during prescription were included. The DIs considered were only between drug-drug. These DIs are classified as severe, moderate, and mild according to the events that those interactions could generate.

Data were analyzed using descriptive statistics to show the current scenario of DIs in prescribing institutions.

Results

Sixty-five thousand eight hundred sixty-seven electronic prescriptions were evaluated during 2019. Of these, 4,828 prescriptions had an average of 2.5 interactions. These interaction prescriptions were generated by 197 different physicians, totaling 24.5 interaction prescriptions per physician over 12 months. A total of 12,005 interactions were identified, with 15.6% classified as mild, 70.9% as moderate, and 13.5% as severe (Figure 1).

When we consider the number of DIs per prescription, we have an average of 2.5 interactions, ranging from 1 interaction to 23 interactions per prescription. More than half of the prescriptions (51.9%) have only one DI, while 17.3% have two DIs and 9.7% have three DIs; 21.1% are distributed between 4 and 23 DIs (Figure 2).

Table 1 shows the metrics (minimum, mean, maximum, and median) pooled by DI severity. The severity that appears the most per prescription is moderate, and DIs classified as mild and severe have remarkably similar metrics.

The distribution of the number of DIs over time shows an average of 1,000 DIs per month. Pooled by severity, we have a monthly mean of 156, 710, and 135 for mild, moderate, and severe, respectively. When analyzed by the number of prescriptions that had at least one DI, we have an average of 402 prescriptions per month and 114, 314, and 112 prescriptions per month for mild, moderate, and severe, respectively.

When comparing the number of DIs from January to December, we reduce 26.7% in overall DIs, 37.6% for mild DIs,

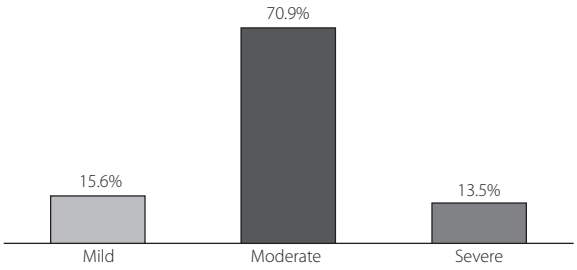

Figure 1. Distribution of DIs according to the interaction severity recorded in 2019 (n = 12.005).

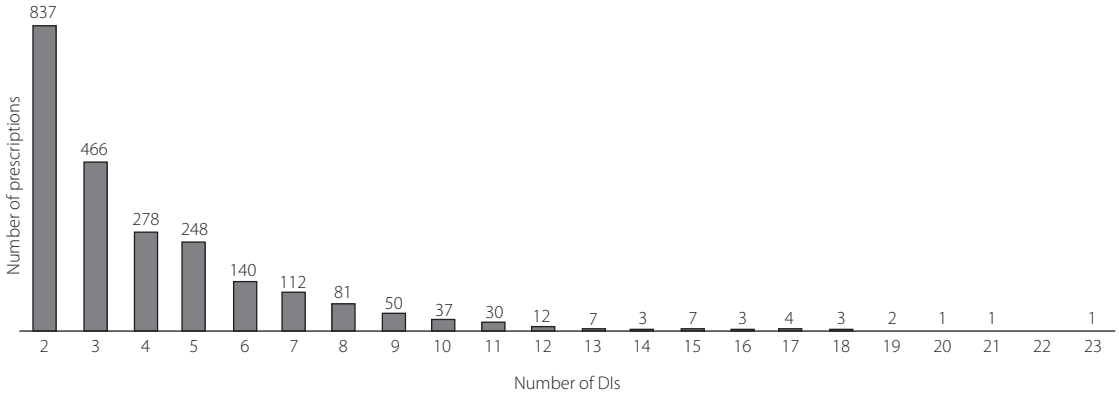

Figure 2. Number of prescriptions by number of DIs shown by each one.

26.3% for moderate, and 12.0% for severe. In Figure 3, we can see the variations in the number of DIs and the number of prescriptions dispensed with DIs.

Over the period, we can observe a reduction from the first to the second month of 27.8%; the following months show a variation of less than two percentage points (Figure 3).

Of the 562 prescribing physicians, 197 (35.1%) dispensed at least one prescription that had a DI. On average, physicians prescribe 24.5 prescriptions with at least one DI, with a minimum of one and a maximum of 806 prescriptions over the period; the 197 physicians have a median of four prescriptions with at least one DI.

When considering the prescription percentage with at least one prescription concerning the total of prescriptions dispensed, there is an average of 15.59% of prescriptions with DI, with a minimum of 0.02% and a maximum of 100.0% (Table 2). When only physicians with more than one prescription were considered, we have 12.48%, 0.02%, and 80.0% for average, minimum and maximum, respectively.

The monthly average proportion of prescriptions with interaction per physician is 9.7%. When analyzing physicians who dispensed at least one prescription per month over the entire period, which totals 48 physicians, we have an average prescription rate with interaction per month of 10.0%.

Table 1. Assessment of DIs according to the severity

	Mild	Moderate	Severe	Total
Minimum	1	1	1	1
Mean	1.4	2.3	1.2	2.5
Maximum	6	19	6	23
Median	1	2	1	1

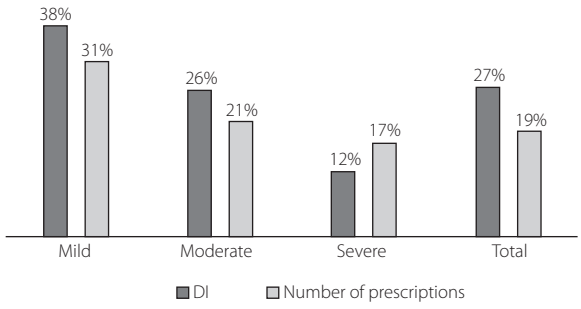

Figure 3. Reduction in the number of DIs and prescriptions with at least one DI between January and December 2019.

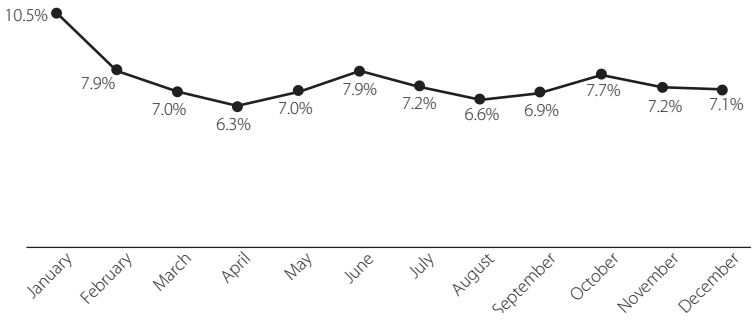

Figure 4. Time evolution of the number of prescriptions with at least one drug interaction.

When comparing December with January, of the doctors who dispensed at least one prescription per month in the period, we have an average of 5% reduction. The minimum is an increase of 272%, and the maximum is a reduction of 100% of prescriptions with at least one DI.

Of the total of 42 physicians who prescribed at least one prescription per month and presented at least one prescription with interaction in the period, 10 (23.8%) increased the number of prescriptions with DI, 16 (38.1%) maintained the same percentage of prescriptions with DI and 16 (38.1%) reduced the number of prescriptions with DI.

When compared by the classification of the anatomical group of the ATC code, it was observed that 37% of the interactions correspond to the same anatomical group, and 63% correspond to different anatomical groups. In the same anatomical group interactions, drugs classified in the Cardiovascular system group represent 72.3% of these interactions (Table 3).

In drug interactions from different anatomical groups, the primary interaction is between the Blood and hematopoietic organs and the Cardiovascular system group, corresponding to 33.1%. Secondly, between the groups Digestive system and metabolism and the Cardiovascular system, corresponding to 21.1% (Table 4).

Table 2. Proportion (%) of prescriptions with interaction to total prescriptions

	Physicians with at least one DI	Physicians with at least one interaction and more than one prescription
Minimum	0.02	0.02
Mean	15.59	12.48
Maximum	100.00	80.00
Median	7.27	6.9

Discussion

The main benefits of electronic prescription include improved readability and prescription availability (without the need to carry the paper document) and allowing for adequate continued care, as the health professional has quick and easy access to medications prescribed to the patient at different times. However, no doubt, the most significant benefit of electronic prescription is its potential to reduce medication errors (Baysari & Raban, 2019).

Medication errors are a global attention priority. A recent meta-analysis concluded that, since 2007, electronic prescribing strategies have reduced medication, dosing, and adverse event errors. The studies included DIs, incomplete prescriptions, prescription correction, dosage errors, and dispensing and administration errors (Roumeliotis *et al.*, 2019).

Although not all medication errors cause direct harm or damage to a patient's health, they can create additional work for health professionals and reduce patient confidence in the care they are receiving (Franklin & Puaar, 2020).

A limitation of the current study is that it is only possible to identify interactions dispensed with a prescription. If the physician has received the alert in the software and

Table 3. The proportion of DIs among drugs from the same anatomical group (ATC code)

ATC ANATOMICAL Group	NUMBER OF INTERACTIONS	
Cardiovascular system	3213	72.27%
Nervous system	572	12.87%
Blood and hematopoietic organs	339	7.62%
Digestive system and metabolism	126	2.83%
Anti-infectives for systemic use	99	2.23%
Genitourinary system and sex hormones	35	0.79%
Sense organs	23	0.52%
Respiratory system	22	0.49%
Dermatological	16	0.36%

Table 4. The proportion of DIs among drugs from different anatomical groups (ATC code) – 10 major ones

ATC ANATOMICAL Group	ATC ANATOMICAL Group	NUMBER OF INTERACTIONS	
Blood and hematopoietic organs	Cardiovascular system	2,501	33.1%
Digestive system and metabolism	Cardiovascular system	1,592	21.1%
Cardiovascular system	Hormonal system preparations, excl. sex hormones	440	5.8%
Digestive system and metabolism	Hormonal system preparations, excl. sex hormones	327	4.3%
Hormonal system preparations, excl. sex hormones	Anti-infectives for systemic use	322	4.3%
Cardiovascular system	Nervous system	221	2.9%
Digestive system and metabolism	Blood and hematopoietic organs	136	1.8%
Musculoskeletal system	Nervous system	123	1.6%

has changed the medication, it is impossible to identify this change. Another limitation is that the same drug can have more than one active ingredient, and drug interactions are determined by active ingredient and not by medication. In this case, even if the prescription has only two drugs, there is the possibility that the prescription has more than one interaction.

The main interactions are among drugs from different groups. This fact corroborates the information previously presented that a patient who needs to treat more than one disease has a higher risk of having a prescription with DI. The most significant number of drug interactions was identified between drugs from the "Blood and hematopoietic organs" groups interacting with medicines from the "Cardiovascular system" group; followed by drugs from the "Digestive system and metabolism" group interacting with those from the "Cardiovascular system" both interactions present medications for the treatment of diseases of the cardiovascular system.

Prescriptions with DIs were also identified for the same anatomical group. It corroborates the issue that a more significant number of drugs prescribed in the same prescription, even for the same anatomical group, increases the possibility of DIs. For our sample, drugs that presented the highest number of DIs belong to the anatomical groups "Cardiovascular system" and "Nervous system".

Over the period, the sample shows a reduction of 32.9% in the number of interactions compared with the total prescriptions, with at least one interaction to the total prescriptions. This may indicate that a DI alert tool helps reduce the number of prescriptions with drugs that interact with each other.

The most significant reduction was observed in DIs classified as mild (31%), followed by DIs classified as moderate (21%). The group of DIs ranked as severe had the most negligible reduction (17%). This result may indicate that physicians prefer to risk treating the patient with medications, even if they present an interaction, instead of changing the drug that could reduce the severity of the interaction and the effectiveness of the treatment.

Regarding physicians' behavior, when analyzing only those who had prescribed over the entire period, it was noticed that 38.1% of them had a decrease in dispensed prescriptions with DI.

Conclusion

When analyzing the number of interactions just by prescription, a reduction and a change in the prescription pattern can be seen. It indicates that a tool that assists the physician during prescription time helps him make the best decision and know the risks.

Such information to support decision-making and change the prescription pattern helps reduce events caused by administering medications with DIs, ranging from treatment of adverse events to hospitalizations and deaths.

An electronic prescribing tool enables several other benefits that are not just related to DI alerts. A tool with an up-to-date database of drugs (active or not in the regulatory agency - Anvisa) and their characteristics such as dosage form and available dosage provide support to prescribing physicians and assistance through current information to make the best decision when prescribing.

In addition, a tool can also help the physician with the legal issue of dispensing, e.g., in the case of antibiotics for which two prescription copies are required, or even in the case of controlled medications that need the completion of specific forms.

With all this decision support, the biggest beneficiary is the patient, who leaves with all the necessary information and documents to purchase the medicine and, consequently, their treatment. In addition, a digital prescription means readable information, which enables correct dispensing in pharmacies. The patient feels safer and sure about the prescribed and dispensed drugs besides being assured the doctor knows any DIs.

As a next step, we suggest an analysis of clinical data in conjunction with electronic prescribing data. It can help us understand at what point doctors risk prescribing drugs, even if they have DIs.

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ORIGINAL ARTICLE
ARTIGO ORIGINAL

Census of Brazilian social health organizations: survey and characterization

Censo das organizações sociais de saúde brasileiras: levantamento e caracterização

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ABSTRACT

Objective: To identify and characterize the Brazilians' establishments managed by the Social Health Organizations (OSS). **Methods:** The identification of these establishments was carried out through primary research on four search procedures on the websites of the health departments of the states and municipalities, and consultation on the websites of the OSS and in the Survey of Basic Municipal Information of the Brazilian Institute of Geography and Statistics (IBGE) in 2018. A descriptive analysis of the establishments managed by OSS was carried out comparing with the AD according to hospital indicators. **Results:** The OSS are concentrated mainly in the Southeast and South of the country, with 69% of these establishments are being managed by 20 social responsibility organizations. he establishments managed by OSS are concentrated mainly in the Southeast and South of the country, with 69% of these establishments managed by 20 OSS. The characterization of the hospitals shows that the OSS has a better performance than DA; however, the difference decreases as the size increases. Larger hospitals performed better than other sizes, and this is where the highest proportion of OSS is concentrated among hospitals. **Conclusion:** This is the first work that surveys the OSS at the national level. This list of OSS is an important tool for planning, monitoring, and organizing the structure of service provision in public health in Brazil. The results found demonstrate the need to organize an administrative database that allows a temporal monitoring of the establishments.

Palavras-chave:
parcerias público-privadas, administração hospitalar, organização e administração, administração de serviços de saúde, indicadores de gestão, gestão em saúde

RESUMO

Objetivo: Identificar e caracterizar os estabelecimentos geridos por Organizações Sociais de Saúde (OSSs) no Brasil. **Métodos:** A identificação desses estabelecimentos foi realizada mediante quatro procedimentos de busca por meio de pesquisa primária nos sítios das secretarias de saúde dos estados e dos municípios e consulta nos sítios das OSS e na Pesquisa de Informações Básicas Municipais do Instituto Brasileiro de Geografia e Estatística (IBGE), em 2018. Foi realizada uma análise descritiva dos estabelecimentos geridos por OSS comparando com as Administrações Diretas (ADs) segundo indicadores hospitalares. **Resultados:** Os estabelecimentos geridos por OSSs estão concentrados principalmente no Sudeste e no Sul do país, e 69% desses estabelecimentos são geridos por 20 OSSs. As OSSs estão mais presentes em hospitais-dia, seguidos de prontos atendimentos e de hospitais. A caracterização dos hospitais mostrou que aqueles administrados por OSSs apresentam

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melhor desempenho; contudo as diferenças diminuem à medida que se aumenta o porte do serviço. Os hospitais de maior porte apresentaram melhor desempenho em relação aos demais e é onde está concentrada a maior proporção de OSSs entre os hospitais. **Conclusão:** Este é o primeiro trabalho que faz uma identificação das OSSs em nível nacional. Essa listagem das OSSs é um instrumento importante de planejamento, monitoramento e organização da estrutura de oferta de serviços no Sistema Único de Saúde (SUS). Os resultados encontrados demonstram a necessidade de organização de uma base de dados administrativa que permita um acompanhamento do desempenho dos estabelecimentos no tempo.

Introduction

The Brazilian healthcare system is complex, made up of multiple financial, organizational, and ownership arrangements, encompassing both the state and private sectors for-profit and philanthropic purposes (La Forgia & Couttolenc, 2009; La Forgia & Harding, 2009). In the late 1990s, the management of public institutions changed with the enactment of Law No. 9,637/98, which instituted the management modality of Social Organizations (SO), allowing the transfer of the state sector to the public non-state sector through a management contract (Bresser-Pereira, 1995; Ibañez & Neto, 2007).

In health, this management method is called Social Health Organizations (OSS). It is up to the state and/or municipal Health Secretariats to negotiate the management contract with the managing organizations, inspect, control, and verify their results. The contract specifies the purpose of the service under OSS management and defines the responsibility levels for carrying out the activities. The assessment of accounting-financial procedures is the responsibility of different Courts of Auditors (Bresser-Pereira, 1995; Carneiro-Junior & Elias, 2006; Ibañez & Neto, 2007). This type of management came from criticism of rigidity, political interference, and excessive bureaucratization of those under Direct Administration (DA). The reform aimed to reduce the participation of public authorities' direct management in the provision of services by organizations of the Brazilian Unified Health System (SUS), with appreciation and expansion of shared management spaces (Ibañez *et al*., 2003; Ibañez & Neto, 2007; Campos, 2009). At the same time, the management contract grants managerial autonomy to hired managers (OSS). It establishes goals to be met to absorb the demand with quality (Carneiro-Junior and Elias, 2006).

This model came to Brazil based on the New Public Management (NPM) model, popularized by partnerships between the public and private sectors spread worldwide between the 1980s and 1990s. It came as a proposal to make public administration more flexible and increase accountability (Sano & Abrucio, 2008). However, NPM does not have consistent results around the world. Some studies show that management through private partners has resulted in increased expenditure in certain countries: Australia, Spain, France, England, and New Zealand (Ashton, 1998; Ashton *et al*., 2004; McKee *et al*., 2006; Simonet, 2013; Cabeller-Tarazona & Vivas-Consuelo, 2016). However, there was a reduction in expenditures in Cambodia and Guatemala after outsourcing health services management (Odendaal *et al*., 2018).

Regarding transparency, there is difficulty in the availability of information and monitoring indicators of those hired by the respective contracting governments (Ashton, 1998; Ashton *et al*., 2004; McKee *et al*., 2006; Simonet, 2013; Cabeller-Tarazona & Vivas-Consuelo, 2016). The only favorable evidence for transparency concerns hospitals in Nicaragua, which were more accountable than the previous regime, which was poorly supervised and did not respond to the population's needs (Jack, 2003). Regarding health outcomes, in the district of Alzira, Spain, hospitals managed under the PPP modality (public-private partnership) had efficiency levels above the average of public hospitals in the region (Caballer-Tarazona *et al*.; 2010).

In terms of the quality of services provided, the evidence also shows different results. In some European countries, New Zealand, Guatemala, and Cambodia, no differences have been observed in the quality of services in alternative management modalities to the so-called direct public management, both in providing vaccines and in reducing mortality (Ashton, 2004; McKee *et al*., 2006; Odendaal *et al*., 2018). It is a different result from Lesotho where a significantly lower mortality rate was observed after hiring hospital services (McKee *et al*., 2006; Sekhri *et al*., 2011; McIntosh, 2015; Vian *et al*., 2015). Regarding hospital productiveness, in Spain, at 'Hospital de Alzira', the results indicated the end of the waiting list. They presented better hospital indicators concerning the cost of hospital procedures. In Lesotho, there was an increased number of hospitals and outpatient appointments after the partnership (Sekhri *et al*., 2011; McIntosh, 2015; Vian *et al*., 2015; Cabeller-Tarazona & Vivas-Consuelo, 2016).

In Brazil, the empirical literature on OSS is still scarce, relatively recent, and focuses mainly on assessing hospital performance. This type of management has been disseminated for a longer time, in some cases, in the state of São Paulo (Ravioli *et al*., 2018). Some authors credit this greater dissemination because OSS's first twelve hospital units were implemented in new establishments (Costa & Ribeiro, 2005; World Bank, 2006). The Camata Law (Law No. 82/1995), which establishes restrictions to public expenditure on personnel,

was one of the main reasons for starting this type of management in these establishments. The Supplementary Law 846/1998 was enacted to enable the management of some hospitals newly built by the Metropolitan Health Program of the São Paulo State Government, which transfers the management of these hospitals to the OSS. The public treasury budget would fund these hospitals, so such professionals are not being considered civil servants (Ibañez *et al*., 2001; Costa and Ribeiro, 2005; World Bank, 2006; Pahim, 2009). From a regulatory point of view, São Paulo was also a pioneer in implementing a Supplementary Law to the federal regulation that requires establishments to meet performance targets defined in specific management contracts for each situation. (Supplementary Law Nº 846/1998 – São Paulo).

The literature indicates greater efficiency in São Paulo hospitals managed by OSS compared to hospitals that remained under DA regime (Costa & Ribeiro, 2005; World Bank 2006; Sano & Abrucio, 2008; Carneiro-Junior and Elias 2006; La-Forgia & Couttolenc 2008; La-Forgia & Harding 2009; Quinhões, 2009; Santos, 2012; Coelho & Greve *et al*., 2016; Greve & Coelho, 2017; Mendes & Bittar, 2017). Despite the favorable results, there is no consensus on the transparency and regulation of management contracts. Although some studies question the capacity of the São Paulo State Department of Health (SES) to regulate management contracts (Carneiro Junior & Elias, 2006; Sano & Abrucio, 2008, Pahim, 2009; Congressional Investigative Commission of Social Health Organizations, 2018) La-Forgia & Harding (2009) understand that the SES has been able to exercise its regulatory role adequately.

Outside the state of São Paulo, evidence is scarce. In a study in Santa Catarina State, Rodrigues & Sallum (2017) found greater efficiency in state hospitals managed by OSS than in other state public hospitals. A similar result was reported by Gaigher & Teixeira (2017). They did a comparative case study for Espírito Santo State, indicanting that the hospital managed by OSS showed better performance than those under DA.

OSS in Brazil is also responsible for managing other public health establishments besides hospitals. In primary care, as in-hospital care, the evidence is ambiguous. Ramos and Seta (2019) analyzed the establishments in Southeastern Brazilian capitals managed under contract and found no statistically significant performance differences concerning those under DA. Greve and Coelho (2017), in turn, evaluated the implementation of OSS contracts in 645 municipalities in the state of São Paulo using the differences-in-differences model to analyze primary care outcomes. The authors found increases in the coverage of visits and a reduction in hospitalization for preventable diseases in primary care. Similar results were found by Silva *et al.* (2016) for Rio de Janeiro, who observed expansion of the Family Health Strategy (ESF in Portuguese) coverage in the city due to the OSS role. However, this expansion of access took place without greater transparency and social control concerning those own managed.

Despite this specific evidence for some states and groups of public institutions, there is not yet a more comprehensive study of these organizations for Brazil. This study fills this gap and proposes to carry out a census survey and a characterization of OSS performance throughout the country. The study analyzes the location and distribution of OSS in Brazil, between states, types of public institutions managed, and the year of the beginning of the contract. After the survey phase of these organizations, a comparative analysis was carried out between administration by OSS and those own managed, including only public hospitals. Hospital indicators of case-mix, financial resources, infrastructure, geographic coverage, and performance were studied. The database generated in this study is unprecedented and may support future studies to plan and monitor the SUS hospital network.

Methods

It is a cross-sectional, observational, and descriptive study. The first challenge to carry out this study was identifying which Social Health Organizations manage establishments since no official database in Brazil provides reliable information. From May to December 2019, a survey of active OSS was carried out to overcome this limitation, using four search procedures:

Search procedure 1: search on websites of state and municipal health departments in Brazilian capitals for information regarding the existence of OSS either in these municipalities or in states and the local regulatory framework.

Search procedure 2: search on transparency portals. Searching health departments may not exhaust the possibility of existing OSS in these locations. One possible site for accessing this kind of information is state and municipal transparency portals. The respective transparency portals were accessed for all states and capitals that did know the existing OSS. If there is still no easily accessible information on the portals, a request was made via the Electronic System of the Citizen Information Service (e-SIC) about the presence of an establishment managed by OSS, including the identification of the managing OSS, name of the establishment and year of starting the contract. For the states of Ceará, Pará, and the municipality of São Paulo, the health departments only identified the OSS but not the establishments they managed.

Search procedure 3: investigation on both OSS and IBROSS sites. This step consisted of consulting OSS websites and contacting them directly through phone calls, when possible. Search procedures 1 and 2 identified the OSS and surveyed all establishments managed by such organizations. A search was also carried out on the Brazilian Institute of Social Health Organizations (IBROSS) website, where nineteen of these organizations are located.

Search procedure 4: Search in the Municipal Information Survey of the Brazilian Institute of Geography and Statistics. In addition to the primary survey, it is possible to obtain information at the municipal level about the existence of OSS through the Municipal Basic Information Survey - MUNIC - carried out annually by the Brazilian Institute of Geography and Statistics (IBGE). Regarding MUNIC, there is a question that identifies the municipalities that have contracts with OSS. In this search stage, all cities that declared to have this type of contract were identified. For this municipalities pool (270), search procedures 1, 2, and 3 were performed.

Partnerships between health departments and the OSS are practiced heterogeneously across the country and may occur through a management contract or shared management. In the management contract, the OSS is responsible administration of the entire establishment. In the shared management, only one sector or a set of services is under the OSS's responsibility, with the remainder under direct public management. As shared management is very heterogeneous, the survey of this study includes only establishments that have management contracts with OSS, i.e., they manage all services provided at the institution.

After identifying OSS, these establishments were characterized using three administrative databases: the National Register of Health Establishments (CNES), the Hospital Information System (SIH), and the Outpatient Information System (SIA-SUS) that are available at DataSUS.

The CNES is a registry of all health establishments with mandatory monthly completion and contains information about equipment, their employees, and the availability of beds (Ministry of Health, 2018a). In this register, although there is an item on the legal nature of the establishment, it is not sufficient to identify OSS. As the OSS survey is carried out for active establishments, its characterization requires more recent information. In this study, we chose, as a temporal reference in the CNES, the month of July 2018, which was the most recent that presented consolidated information on the date of starting the research. From this database, data were collected on the number of existing beds, SUS beds, legal nature of the establishment (private, state, philanthropic), type of service, type of management (municipal, state, or mixed). Data was also collected on the municipality, the number of doctors, nurses, health technicians, administrators of the establishments and their respective working hours, number of imaging, and life support equipment used at SUS.

In addition to the CNES, two other official databases made available by DataSUS were used: the SIH, which provides information on the Hospital Admission Authorization (AIH), and the SUS Outpatient Information System (SIA/SUS). These two databases made it possible to measure OSS's hospital and outpatient clinics' productiveness for the entire year of 2018. These two databases are mandatory for managers to fill in for production payment purposes. The AIH is a document that identifies the patient and services provided under the inpatient hospital regime and is generated when there is an admission to a provider, public or private, associated with the SUS. This database allows for a survey of health care provided in hospitals (Ministry of Health, 2018b). SIASUS is a database fed by managers of public health establishments every month about all outpatient procedures financed by the SUS (Ministry of Health, 2018c).

All performed procedures at hospitals, including information about the primary diagnosis, AIH value, patient age, city of origin, the reason for discharge, length of stay (days), and complexity of hospitalizations, were extracted from the AIH per establishments. From the SIA, the aggregated value of outpatient clinics' productiveness for each establishment was collected. Access to microdata from CNES, SIH, and SIA was performed using the R program version 3.4.3 by the RStudio software with the read.dbc package (Saldanha *et al*., 2019).

All public establishments active in 2019 were included to compare those administered by OSS with those under DA. The characterization of these health establishments (OSS and DA ones) considered the attributes "spatial location", "state and municipal regulations", "the type of service and management (municipal, state or mixed)", and "beginning of the contract's validity".

In the CNES, in July 2018, 6,154 hospitals were registered in the country. All those with a private legal nature (1,966), philanthropic (1,778), or with SUS beds equal to zero (43) were excluded. Of the public hospital pool, 102 were not counted, i.e., those that did not have doctors, equipment, beds, or production in the SIA and SIH in 2018. The final base is composed of 2,290 hospitals.

For public hospitals, productive indicators were built, measured in-service units and volume of expenditure, infrastructure, coverage area, and allocation of inputs stratified by size: small size (below 50 beds), medium size (from 51 to 150 beds), and large size (over 151 beds). The list of indicators is described in Table 1. The total number of monthly hospitalizations and the total outpatient expenditure, which represents the billing of outpatient procedures, were used to assess hospital productiveness. Outpatient procedures, being very heterogeneous, are more difficult to be counted. Using the total expenditure variable is a way to overcome this difficulty since all procedures are measured in terms of remuneration by the SUS and the average cost of hospitalizations (AIH). Monetary values were converted into US dollars at the 2018 exchange rate - conversion of R$3.51 to US$ 1 (Central Bank, 2018). Infrastructure indicators refer to the number of professionals and imaging and life support equipment per bed. Both professionals directly linked to caring and administrative professionals were included. The calculation of the

number of professionals was standardized, considering the entire period of 40 hours per week (full-time equivalent - FTE) as a reference.

The proportion of hospitalization of patients residing outside the city characterizes the geographic coverage of the hospital, i.e., it captures the importance of that hospital in a given region. The occupancy rate, bed turnover rate, and average length of stay were observed regarding performance indicators. The hospital occupancy rate is the ratio between the number of days the beds are occupied and the number of beds available in the year. The number of beds occupied is obtained directly from the stay of patients in each AIH. In contrast, the number of available beds is estimated, assuming that all beds in the hospital would be available 365 days a year. The average length of stay represents the average length, in days, of the hospital stay. The indicator usually varies according to the patient's diagnosis and profile, level of technology of the equipment available in the establishment, and remuneration mechanisms. The renewal or turnover rate represents the use of installed capacity. It indicates the relationship between the total number of discharges (discharges, deaths, transfers, or administrative closures) in a given period and the number of beds available to clients in the same period.

The hospital mortality rate is an indicator of the result of the care provided, measured by the ratio between the number of patients who die during hospitalization divided by the number of hospitalizations performed. This indicator depends on patients' general state of health, especially on hospital admission, the complexity of cases, its resolubility, and the quality of care provided (Travassos *et al*., 1999). In this sense, to be interpreted as an indicator of the result or quality of the care provided, it is necessary to ensure that the establishments receive patients with a similar profile.

In addition to hospitals characteristics, it was also described the risk profile of patients treated. If we consider the indicators without controlling the case-mix differences, hospitals with higher severity levels may perform worse. (La Forgia & Couttolenc, 2009). Indicators have been constructed to control differences in patients' age profile, the proportion of highly complex hospital admissions, the proportion of admissions due to Ambulatory Care Sensitive Condition (ACSC), and the mean value of the AIH. The elderly generally demand a greater volume of procedures, impacting expenses

Table 1. Description of hospital indicators of case-mix, financial resources, production, structure, demographic profile, and performance

Indicators	Description
Case-mix	
% of high complexity admissions	The proportion of highly complex hospitalizations to the total hospitalizations.
% patients over 60 years old	The proportion of older people over the total number of AIH appointments.
% of ACSC	The proportion of hospital admissions included in the list of Ambulatory Care Sensitive Condition over the total number of admissions.
Average AIH expend (US$)	Average expense on inpatient procedure per month.
Production indicators	
Total SIA expenditure (US$)	Total expenditure on outpatient procedures per month.
Total number of admissions	Number of admissions per hospital.
Infrastructure	
Number of beds	Number of beds per hospital.
Number of professionals per bed	Number of health professionals (doctors, nurses, nursing technicians and assistants) and administrative sector standardized by the number of hospital beds.
% high complexity equipment	Proportion of imaging and life support equipment compared to the total available equipment.
Geographic coverage	
% patients living outside the municipality	Proportion of patients living outside the municipality over the total number of hospital appointments in the establishment.
Performance	
Hospital occupancy rate (%)	Ratio between the number of days occupied and the number of total days available in the year.
Average length of stay (days)	Average time in days that patients were in hospital.
Mortality rate (%)	Ratio between the number of hospital deaths over the total number of hospitalizations.
Bed turnover index	Total number of leaves (discharges or deaths) over the total number of available beds.

Source: CNES e SIH/SUS, 2018 (Ministry of Helth, 2018a; Ministry of Helth, 2018b; Ministry of Helth, 2018c).

(Costa & Ribeiro, 2005). The proportion of ACSC can capture both the presence of demand induction by hospital providers and the quality of primary care services provided to the municipality (Alfradique *et al.*, 2009). The idleness of hospital equipment can change the decision to hospitalize patients, as already observed in small municipalities of Rio Grande do Sul (Souza & Costa, 2011), leading to unnecessary hospitalizations. As it reflects the number of procedures performed in one hospitalization, the average cost of AIH can be interpreted as a proxy for the complexity of care provided at the establishment.

The descriptive analysis considered the calculation of means and standard deviations by OSS administration and those under DA, with the t-Student mean difference test. Calculations were performed using STATA software version 14.2. Maps construction was carried out in QGIS version 3.12.0.

Results

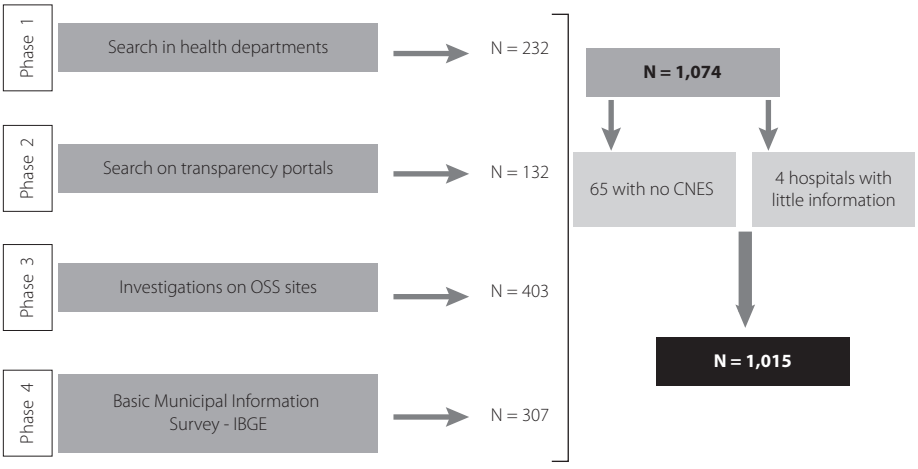
General characterization of Social Health Organizations in Brazil

Figure 1 illustrates the flowchart of steps with the respective number of the establishments in each step. A total of 1,074 units were identified in 2018, 65 of which were not in the National Register of public health establishments (CNES), and four hospitals had missing information despite having an active registry. The final base included 1,015 hospitals managed by OSS, representing 1.4% of the 70,462 units. Searching the websites of the OSS social responsibility organizations was the procedure that yielded the most significant number of results from the surveyed census.

Each OSS participates in bidding documents to manage healthcare facilities in the management contract model based on their preferences. Figure 2 presents a graph with the number of OSS that administer a given number of health facilities, with eight blocks ranging from one to more than eight facilities per OSS. This information was found for 767 units in the identification. 114 OSS manage these public units, and most of these organizations manage few establishments (46 OSS are responsible for only a single public institution). Another 20 organizations administering eight or more establishments represent 69.36% of those operated by OSS in Brazil, emphasizing the São Paulo Association for the Development of Medicine (SPDM), responsible for administering 158 establishments. The 19 OSS linked to IBROSS manage 349 establishments, representing 32.49% of the surveyed population.

Table 2 shows the states and the number of municipalities that have their regulations for OSS and the number of establishments managed by OSS listed in IBGE units, and those collected in this study. Even with the federal and state law for OSS, some municipalities throughout Brazil still work with their own rules for OSS operation in their territory. The number of OSS informed by IBGE is higher than the one found in this study. It is partially due to the difficulty of obtaining information about OSS (only 71 municipalities responded to the request). Some, who claimed to have contracts with OSS, actually have other types of partnership that do not fit as a management contract. Overall, the survey proportionally approaches the number of OSS informed by IBGE. Some states, such as Amazonas, Maranhão, and Santa Catarina, had more OSS in the survey than reported by IBGE.

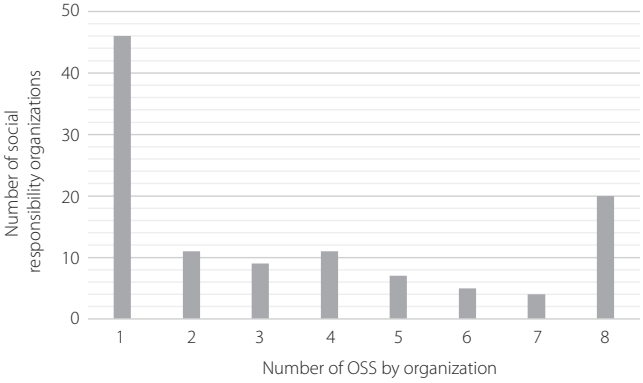
Figure 3 shows the total number of active health facilities managed by OSS by the Federative Unit and its proportion among public establishments, regardless of the management type. Of the 26 Brazilian states, 16 have a contract with OSS, besides the Federal District, and among Brazilian capitals, 16 recorded OSS. The presence of public establishments managed by OSS is more significant in the Federative Unit



Source: 1st phase: websites of state and municipal health departments. 2nd phase: Transparency and Access to State and Municipal Information Portal. 3rd phase: IBROSS and OSS website not linked to the Institute. 4th phase: IBGE Basic Information Survey (IBGE, 2019).

Figure 1. Flowchart with the OSS number by

located on the Brazilian coast, with the highest concentration (58.3%) in the state of São Paulo, followed by Rio de Janeiro (13.2%) and Pernambuco (3.8%). There were few establishments with this management in the North and Center-West regions, except Pará and Goiás. The state of Bahia was one of the first to implement the organizational model. However, in this location, the OSS did not expand as in São Paulo. The focus of OSS management in Bahia was hospital care: of the 32 establishments, 23 were hospitals. In Rio de Janeiro, most of the services managed by OSS are health centers and basic health units, followed by emergency care services and general and specialized emergency care (see Appendix 1A).



Source: Results of the four phases of the OSS survey in Brazil

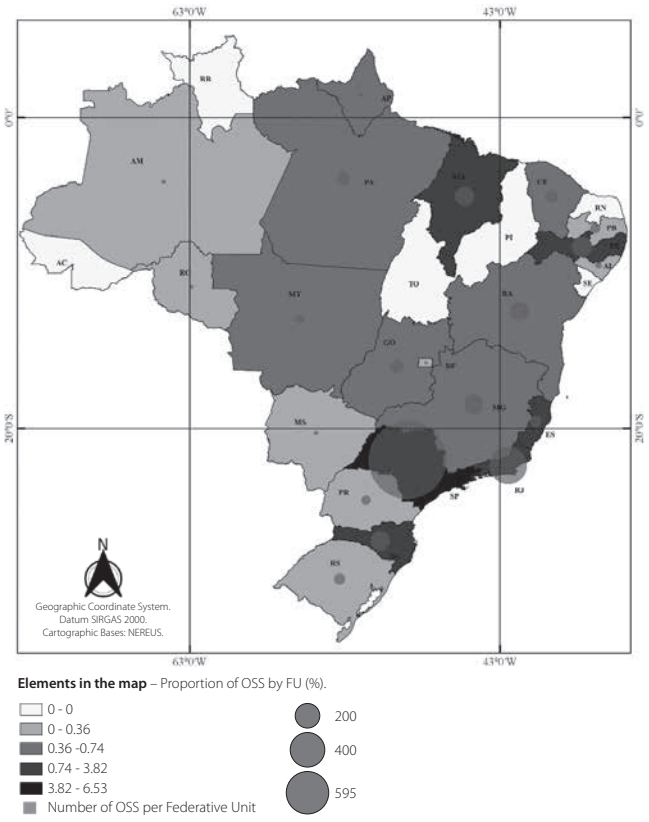
Figure 2. Distribution of OSS according to the number of social responsibility organizations that manage them. Brazil, 2018.

As discussed, the presence of OSS in Brazil is not widespread; its distribution occurs heterogeneously among the Federative Units. The states of Maranhão, Pernambuco, Rio de Janeiro, Santa Catarina, and São Paulo recorded the participation of these organizations as the manager of more than 1% of the establishments. São Paulo and Rio de Janeiro have the highest share of establishments managed by OSS, 6.5% and 3.8%, respectively, although in absolute terms, the volume observed in São Paulo (595) is higher than that observed in Rio de Janeiro (135). Pharmacy services (0.1%), public health laboratory (0.1%), medical offices (0.1%), telehealth (0.3%), and

Table 2. States and number of municipalities that have regulations with OSS and number of OSS per Federative Unit. Brazil, 2018

State	Law	No. munic. w/ Law No.	Nº OSS IBGE	Nº of OSS survey
Acre	None	0	0	0
Alagoas	Law 7,777/16	0	4	4
Amapá	Law 599/01	0	2	2
Amazonas	Law 3,900/13	0	0	2
Bahia	Ordinary Law 8,647/03	3	55	32
Ceará	Law 12,781/97	5	23	14
Distrito Federal	Law 4,081/08	-	1	1
Espírito Santo	Supplementary Law 489/09	4	13	12
Goiás	Law 15,503/05	3	17	18
Maranhão	Law 7,066/98	0	13	36
Mato Grosso	Supplementary Law 150/04	2	7	8
Mato Grosso do Sul	Law 4,698/15	1*	4	2
Minas Gerais	Law 23,081/18	12	162	36
Pará	Law 5,980/96	2	24	16
Paraíba	Provisional Measure 178/11	3	9	10
Paraná	Supplementary Law 140/11	5	20	8
Pernambuco	Law 15,210/13	5	41	39
Piauí	Ordinary Law 5,519/05	1	0	0
Rio de Janeiro	Law 5,498/09	13	302	135
Rio Grande do Norte	Supplementary Law 27/04	1	0	0
Rio Grande do Sul	Bill 44/16	6	42	12
Rondônia	Law 3,122/13	1	1	1
Roraima	None	0	0	0
São Paulo	Supplementary Law 846/98	51*	1.196	595
Santa Catarina	Law 12,929/04	5	24	36
Sergipe	Law 5,217/03	1	28	0
Tocantins	Law 2,472/11	1	3	0

Source: IBROSS and Basic Information Survey (IBGE, 2019).
*The municipalities of Santa Bárbara do Oeste-SP and Chapadão do Sul-MS have ongoing bills to establish Social Organizations.



Source: CNES, 2018 (Ministério da Saúde, 2018). University of São Paulo Regional and Urban Economy Center (NEREUS, 2018).

Figure 3. Spatial distribution, proportion of OSS in relation to the total of health establishments and their nominal amount per Federative Unit. Brazil, 2018.

indigenous health care unit (0.2%) have not been included in the total sum of establishments because, in number, they are not relevant for the analysis.

Table 3 shows the distribution of public health establishment types administered by OSS and those under DA identified in the CNES in July 2018. Most of the establishments are composed of health centers and basic health units (41.7% OSS and 50.2% DA). The importance of hospitals (23.0%) and emergency care (14.4%) in the OSS distribution is noteworthy. Clinics/specialty centers, polyclinics, and hemotherapy and hematology care centers also show a high frequency of DA establishments. The service with the highest frequency of administration by OSS is day-hospitals (32.8% of the total of these establishments), followed by emergency care (10.5%) and hospitals (10.2%).

Table 4 categorizes the types of services administered by OSS and those under DA according to administrative level. Most OSS have a contract with the municipal management (69.1%), followed by state (29.7%) and mixed (1.2%). Although most OSS contracts are carried out with municipalities, there is an expressive presence of state management. In hospitals, e.g., 63.7% of executed contracts are under state management, while only 16% DA are under state management. In health centers, OSS have 99.8% of these municipal under DA, similar to that observed in those under DA (95.3%).

Figure 4 shows the distribution of contracts according to the starting year of the partnership between public entities and OSS. This information is only available for 739 establishments. The official regulation that allows this type of management in Brazil dated to 1998, when a slight increase in contracts executed in the state of São Paulo (opening of 12 hospitals) was observed. However, even before the regulatory framework, there are contracts of this type registered in Brazil. The most significant number of contracts started in 2008, and the highest number of contracts was between 2014 and 2016.

Since OSS have expressive participation in the management of hospital services, Figure 5 shows the spatial distribution of hospitals managed by OSS according to Federative Units. All Brazilian Federative Units that have contracts with OSSs also made partnerships for the management of hospital services, with the exception of Rondônia. Again, the state of São Paulo stands out, with the highest proportion of hospitals managed by OSS (38.9%). Despite having few public establishments managed by OSS, Rio Grande do Sul e Santa Catarina show a high proportion of hospitals - 25% and 21.4%, respectively. When compared with other types of health establishments in the state of Rio de Janeiro, it did not show expressive participation of OSS in hospital services (16.1%).

Hospital indicators of OSS and DA

In 2018, of the 2,290 public hospitals, 234 were managed by OSS. Table 5 shows public hospitals according to the management type, detailed by size and purpose of the hospital (general or specialized). Most hospitals are small (1,282), with 3.0% being managed by OSS. The OSS are more present in large general hospitals (31.82%) than in medium-sized (18.99%). The distribution of OSS in specialized hospitals is more homogeneous, regardless of hospital size.

The performance analysis was restricted to the group of general hospitals. Specialized hospitals are more heterogeneous in terms of procedures performed and are therefore less comparable. As this analysis is carried out in a cross-section, it may present endogeneity problems since, on the one hand, there is a selection of which units will be offered to be managed by OSS. On the other hand, OSS also choose the establishments they are interested in managing. We compared the hospital indicators between the two groups to characterize the results obtained with both types of management in the hospital segment.

For small hospitals, the differences between OSS and those under direct administration are important. The OSS are responsible for a monthly volume of hospitalizations greater than those under direct administration, they have a higher outpatient cost, and are more intensive in human resources (doctors, nurses, assistants, nursing, and administrative

Table 3. Health establishments administered by OSS and those under Direct Administration categorized by type of services

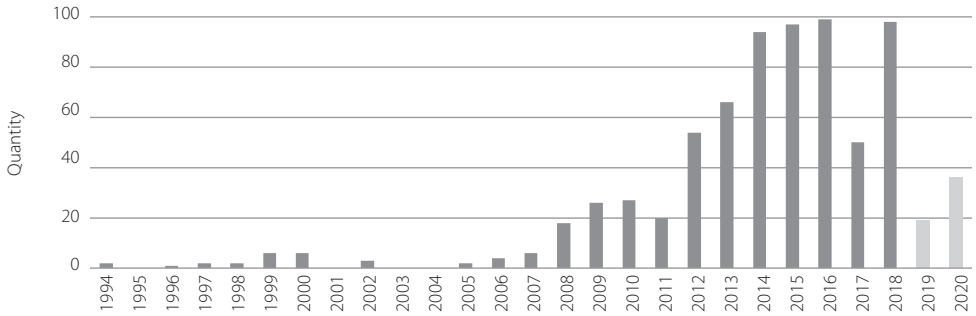
Institution	OSS		DA		OSS/Total (%)
	No. of OSS	(%)	Number	(%)	
Access Regulation and Emergency Medical Center and Surveillance Unit	9	0.9	3,598	5.0	0.2
Psychosocial Care Center	35	3.4	2,931	4.0	1.2
Health Center/Basic Health Unit	419	41.2	36,362	50.2	1.1
Clinic/Specialty Center, Polyclinic and Hemotherapy and Hematology Care Center	105	10.3	6,576	9.1	1.6
Pharmacy	1	0.1	1,965	2.7	0.1
Hospital	234	23.0	2,052	2.8	10.2
Day Hospital – Isolated	19	1.9	39	0.1	32.8
Public Health Laboratory	1	0.1	34	0.0	2.9
Health Center	12	1.2	8,995	12.4	0.1
Telehealth	3	0.3	63	0.1	4.5
Diagnosis and Therapy Support Unit	7	0.7	1,448	2.0	0.5
Mixed Unit	4	0.4	578	0.8	0.7
Mobile Unit	19	1.9	4580	6.3	0.4
Emergency Room, General and Specialized Emergency Room	146	14.4	1,231	1.7	10.6
Medical office	1	0.1	960	1.3	0.1
Indigenous Health Care Unit	2	0.2	1,023	1.4	0.2
Total	**1,015**	**100**	**72,435**	**100**	**1.4**

Source: CNES, 2018 (Ministério da Saúde, 2018a).

Table 4. Distribution of services administered by OSS and those state owned by management type

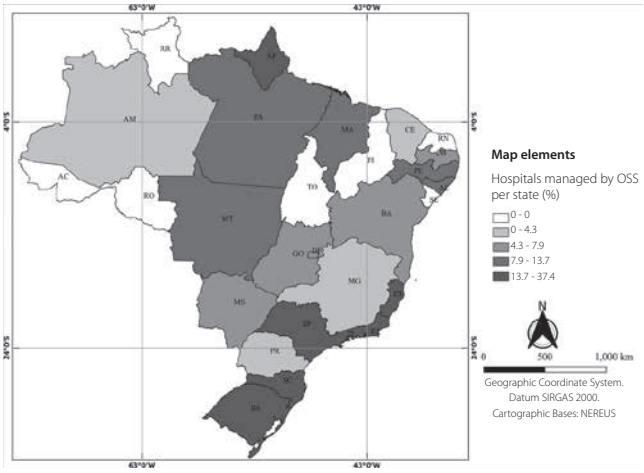
Institution	OSS Management (%)			Public Adm. Management (%)		
	Munic.	State-owned	Mixed	Munic.	State-owned	Mixed
Access Regulation and Center and Surveillance Unit	11.1	33.3	0.0	94.6	5.1	0.4
Psychosocial Care Center	100.0	0.0	0.0	91.4	7.2	1.4
Health Center/Basic Health Unit	99.8	0.2	0.0	95.3	0.9	3.8
Clinic/Specialty Center, Polyclinic and Hemotherapy and Hematology Care Center	30.5	68.6	0.0	81.9	8.2	9.9
Pharmacy	0.0	100.0	0.0	92.8	6.5	0.7
Hospital	32.1	63.7	4.3	62.9	16.0	21
Day Hospital – Isolated	100.0	0.0	0.0	82.1	12.8	5.1
Public Health Laboratory	100.0	0.0	0.0	61.8	29.4	8.8
Health Center	100.0	0.0	0.0	99.4	0.2	0.4
Telehealth	0.0	100.0	0.0	71.4	23.8	4.8
Diagnosis and Therapy Support Unit	42.9	28.6	0.0	75.4	18.4	6.4
Mixed Unit	75.0	25.0	0.0	68.7	9.5	21.8
Mobile Unit	89.5	10.5	0.0	77.5	18.4	4.1
Emergency Room, General and Specialized Emergency Room	63.0	34.9	1.4	85.1	4.0	11.0
Medical office	100.0	0.0	0.0	99.7	0.3	0.0
Indigenous Health Care Unit	100.0	0.0	0.0	99.7	0.1	0.2
Total	**69.1**	**29.3**	**1.3**	**91.9**	**4.2**	**4.3**

Source: CNES, 2018 (Ministério da Saúde, 2018a).



Source: 1st phase: websites of state and municipal health departments. 2nd phase: Transparency and Access to State and Municipal Information Portal. 3rd phase: IBROSS and OSS website not linked to the Institute. 4th phase: IBGE Basic Information Survey (IBGE, 2019).

Figure 4. Beginning of contracts in establishments managed by OSS in Brazil from 1994 to 2020



Source: CNES, 2018 (Ministry of Health, 2018). Center for Regional and Urban Economics at the University of São Paulo (NEREUS, 2018).

Figure 5. Spatial distribution of the total number of hospitals managed by OSS by the total number of hospitals by Federative Unit.

technicians) and technology (equipment). The volume of assistance to non-residents (30.71%) indicates that these hospitals have regional relevance. Small hospitals managed by OSS show unsatisfactory performance but are still higher than observed for those under DA regarding performance indicators. For example, the OSS occupancy rate was 42.65% against 18.93%; the bed turnover rate was 46.2 against 22.72 in DA institutions. Regarding the type of care, hospitals managed by OSS receive relatively fewer older people, carry out less ACSC and have a lower average AIH expense.

The results for medium-sized hospitals are similar to those observed for small-sized ones. In general, indicators showed favorable results for the OSS as they perform less ACSC, record a higher monthly hospitalization volume, and higher costs per hospitalization. They are more intensive in human resources and equipment and receive a more significant proportion of non-resident patients. The number of nurses per bed in OSS is high compared to DA ones, with 0.42 urses/bed against 0.25. The patient's profile has also shown some differences. Medium-sized OSS present proportionally less ACSC (10.01%) than those under DA (13.31%).

Indicators comparison for large hospitals administered by OSS and the DA ones shows more similar results than those observed for the other two sizes. The difference between the means was significant only for the number of life support equipment per bed, the bed turnover rate, and the average length of stay. Compared to hospitals of other sizes, indicators of case-mix dimensions (except hospitalization of the elderly), production, financial resources show this segment with a high volume of admissions per month, a high proportion of highly complex care, and high average expenditure per hospitalization and a longer average length of stay. The OSS participation is more expressive in this segment (Table 5).

Discussion

This study shows the evidence on OSS characterization in Brazil. A total of 1,074 establishments managed by OSS were found, of which 1,015 with active contracts in 2018. This survey progresses over most previous studies by investigating all the states in Brazil and checking some of the numbers raised about OSS by IBGE. Until then, the most significant number of OSS identified was available on the IBROSS website, which contains 19 organizations managing 800 establishments (IBROSS, 2020).

The prior studies were mainly focused on the state of São Paulo, either due to the phenomenon's long existence, the greater concentration of establishments, or the availability of data (Ibañez *et al.*, 2001; Costa & Ribeiro, 2005; World Bank, 2006; La Forgia & Harding, 2009; La Forgia & Couttolenc, 2008; Quinhões, 2009; Barbosa & Elias, 2010; Greve & Coelho, 2017; Mendes & Bittar, 2017). In this state, 26 large state hospitals were identified, a number higher than that investigated in the studies by Barbosa and Elias (2010) and Costa and Ribeiro (2005), 10 and 12 hospitals, respectively. Rodrigues and Sallum (2017) had already identified the same six hospitals mentioned in this study for the state of Santa Catarina.

Table 5. Distribution of hospital size and type between OSS and those under Direct Administration

Size	Hospital type	OSS	DA	Total	OSS/Total (%)
Small	General	34	1,299	1,333	2.55
	Specialized	8	57	65	12.31
	Total Small	**38**	**1,244**	**1,282**	**3.00**
Medium	General	90	384	474	18.99
	Specialized	17	105	122	13.93
	Total Medium	**107**	**489**	**596**	**17.95**
Large	General	77	165	242	31.82
	Specialized	8	42	50	16.00
	Total Large	**86**	**209**	**295**	**29.11**
Total		**234**	**2.052**	**2.286**	**10.24**

Source: CNES, 2018 (Ministério da Saúde, 2018a).

In Espírito Santo in 2018, there were four state hospitals managed by OSS, a number higher than that stated by Turino *et al.* (2016), three hospitals, and Gaigher & Teixeira (2017), one hospital. For the other Federative Units, no publication on the subject was found in an indexed journal.

The characterization of the OSS profile showed that, in addition to hospital services, OSS are already present in other types of health services, mainly Basic Health Units/Health Centers and Specialized Clinics. Regarding their spatial distribution, there is a concentration in some regions of the country, especially Southeast and South, and few in the North, which seems to have a relationship with socioeconomic conditions.

Although most of the contracted services are municipal management responsibility, the presence of the state level is also essential. The role of state governments in the OSS expansion had already been mentioned by Carneiro Junior and Elias (2006) when they noticed the importance of state managers in ensuring access to health services and the effective public control of OSS in the state of São Paulo. The health manager's commitment to overseeing OSS can be assured based on regulations in the municipality and the state, which represent the government's concern with transparency and oversight, but it is not always enough (Sano and Abrucio, 2008; Pahim, 2009; Baggenstoss and Donadone, 2014; Coelho and Greve, 2016). Responsibilities assigned to the public and private sectors are diffuse, and lack of transparency was claimed, which hinders social participation (Dualibe, 2012; Pacheco *et al.*, 2016; Graf *et al.*, 2019).

The progress of OSS in the state of São Paulo was due to the Camata Law, the predecessor of the Fiscal Responsibility Law (LRF) of 2002. It came as an incentive to outsourcing in managing the workforce in the public sector since a large part of expenditures is directed towards salaries and pensions (Costa & Ribeiro, 2005). Resolution 40, e.g., establishes that states with a Consolidated Net Debt twice the Current Net Revenue cannot request new loans from the Federal Government. The relative success observed in the OSS in São Paulo, and the LRF was the great precursor of the management contract model across Brazil (Costa & Ribeiro, 2005). Possibly due to this law, there has been a contract increase since 2007. Its peak was between 2014 and 2016, the Brazilian crisis period.

Due to the significant presence of OSS-managed hospitals in Brazil and their importance to Brazilian public health, the performance characterization of these hospitals was carried out through the construction of indicators. One of the main results pointed to a reduction in disparities between OSS and those under DA as the size of hospitals increases. For large hospitals, the differences observed in hospital indicators are less significant. The significant differences between the two types of management at this size are seen in the turnover rate and average length of stay, which showed a more substantial turnover of patients in the OSS. For small and medium-sized hospitals managed by OSS, the differences are more important, although there is less participation of Social Organizations. Establishments managed by OSS had a lower proportion of hospitalizations due to ACSC, more excellent geographical coverage, bed turnover rate, and higher occupancy rates. Although the occupancy rate is higher than observed in DA establishments, they are still much lower than recommended by the National Supplementary Health Agency (ANS) - from 75% to 85%. There are studies comparing hospital indicators of OSS with other establishments, but either did not disaggregate by size or only studied large hospitals (Ibañez *et al.*, 2001; Costa and Ribeiro, 2005; World Bank, 2006; La Forgia and Couttolenc, 2008; Sano and Abrucio, 2008; La Forgia and Hardlng, 2009; Quinhões, 2009; Barbosa and Elias, 2010; Coelho and Greve, 2016; Greve and Coelho, 2017; Mendes and Bittar, 2017; Rodrigues and Sallum, 2017). Such disaggregation is fundamental, given the economies of scale and scope of in-hospital care (Botega *et al.*, 2020). It is essential to investigate to what extent the complexity required by a larger establishment changes the results depending on the type of management. Although other studies have pointed to a lower use of human resources in OSS (Costa and

Table 6. Results of hospital indicators between hospitals administered by OSS and those under Direct Administration by size

Size	Small			Medium			Large		
Management	**OSS**	**DA**	**p-value**	**OSS**	**DA**	**p-value**	**OSS**	**DA**	**p-value**
Number of hospitals	34	1299		90	384		76	166	
Case-mix									
High complexity admissions (%)	0.58	0.15	0.33	1.45	1.37	0.13	6.04	7.46	0.31
	(2.28)	(2.39)		(4.87)	(7.23)		(11.82)	(9.40)	
Número de hospitais	30	1190		90	379		76	166	
Number of hospital	26.05	31.75	0.04	26.23	24.76	0.38	27.01	26.08	0.52
	(18.00)	(15.06)		(13.69)	(14.42)		(11.81)	(9.75)	
Elderly hospitalizations (%)	15.65	23.19	0.00	10.01	13.31	0.01	8.10	7.03	0.13
	(14.34)	(13.12)		(7.92)	(10.93)		(6.29)	(4.52)	
Average cost (US$/hospital stay)	159.34	116.61	0.00	224.4	179.48	0.00	433.83	412.54	0.7
	(98.04)	(26.66)		(102.17)	(100.87)		(621.89)	(210.89)	
Production indicator									
Monthly admissions	142.41	54.04	0.00	374.67	253.33	0.00	1027.4	919.25	0.14
	(109.14)	(53.93)		(222.13)	(167.87)		(469.18)	(544.83)	
Number of hospitals	34	1272		86	378		75	165	
Total outpatient expense (thousand US$)	280.04	143.91	0.00	666.97	530.48	0.06	2273.3	2791.95	0.28
	(235.79)	(258.38)		(537.41)	(608.51)		(2824.8)	(3719.09)	
Number of hospitals	35	1300		90	384		76	166	
Indicadores estruturais									
Beds	33.47	26.56	0.00	93.54	81.21	0.00	268.37	295.73	0.20
	(12.93)	(11.35)		(26.53)	(29.10)		(134.89)	(159.67)	
Doctors/bed	1.74	0.24	0.00	0.48	0.39	0.05	0.84	1	0.06
	(7.51)	(0.65)		(0.33)	(0.39)		(0.58)	(0.67)	
Nurses/bed	0.63	0.22	0.00	0.42	0.25	0.00	0.48	0.47	0.75
	(1.60)	(0.35)		(0.26)	(0.19)		(0.18)	(0.27)	
Nursing Tech. and Assistants/bed	1.70	0.78	0.00	1.25	0.95	0.00	1.48	1.42	0.48
	(3.91)	(1.32)		(0.71)	(0.65)		(0.54)	(0.58)	
Administration/bed	0.11	0.03	0.00	0.03	0.02	0.00	0.02	0.01	0.11
	(0.42)	(0.06)		(0.03)	(0.02)		(0.02)	(0.02)	
Imaging equip/bed	0.18	0.08	0.00	0.06	0.05	0.00	0.05	0.06	0.16
	(0.46)	(0.15)		(0.03)	(0.03)		(0.01)	(0.02)	
Life supports equip/bed	3.09	0.35	0.00	1.34	0.60	0.01	2.11	1.56	0.00
	(12.54)	(0.74)		(1.33)	(0.74)		(1.12)	(1.09)	
Geographical Coverage									
Number of hospitals	30	1190		90	379		76	166	
% patients living outside the municipality	30.71	9.41	0.00	41.75	24.94	0.00	34.4	34.6	0.95
		(12.54)		(26.46)	(22.86)		(25.13)	(21.81)	
Performance indicators									
Mortality rate (%)	3.31	2.20	0.04	5.60	3.94	0.00	6.12	6.12	0.99
	(3.88)	(2.84)		(3.91)	(4.56)		(3.72)	(3.77)	
Occupancy rate (%)	42.65	18.93	0.00	60.07	42.79	0.00	72.7	69.41	0.17
	(24.10)	(15.27)		(22.62)	(25.60)		(19.42)	(16.02)	
Turnover rate	46.20	22.72	0.00	45.70	36.00	0.00	45.69	35.44	0.00
	(29.36)	(18.56)		(20.86)	(20.33)		(17.84)	(12.62)	
Average length of stay (days)	3.70	3.34	0.28	2.78	4.29	0.36	6.04	7.41	0.00
		(1.81)		(25.85)	(8.71)		(2.51)	(3.16)	

2018 Average Exchange. Historical Series of the Central Bank of Brazil.
Source: CNES e SIH/SUS. 2018 (Ministério da Saúde. 2018a; Ministério da Saúde. 2018b; Ministério da Saúde. 2018.c).

Ribeiro, 2005; World Bank, 2006; La Forgia and Couttolenc, 2008; Quinhões, 2009; Barbosa and Elias, 2010; Mendes and Bittar, 2017), this study observed a higher average volume of professionals per bed. Only Quinhões (2009) indicated a higher concentration of doctors per bed. This result is noteworthy since the OSS expansion initiative was aimed at cost containment given by the LRF. It should be noted that, compared to what is spent on government employees, expenditure on outsourced professionals is lower (World Bank, 2006).

It is important to emphasize that this study is intended to be a census and characterization of OSS in Brazil; there was no selectivity analysis of those establishments. OSS do not register for managing establishments randomly across the country. They participate in publications that they consider attractive, as they already have expertise in the requested services or identify areas with more favorable conditions. Another point of OSS selectivity is that most of them are in the state of São Paulo, where this type of management is more consolidated. The state of São Paulo has, for the most part, cities with a high population density, a large volume of human resources, and a good service network to be hired.

Although the survey is essential for an in-depth discussion on OSS in Brazil, this census has some limitations. The first limitation refers to the data collected: even though a thorough search was done in all existing information sources, it is impossible to affirm that all existing OSS in Brazil and their contracts have been exhausted. Some municipalities did not respond to the request; others did not complete the item regarding OSS in the IBGE survey. The information provided by municipalities is significantly heterogeneous; there is no knowledge of training to fill in this IBGE database, which may have led to significant temporal and inter-municipal variation. It was observed, in some cases, municipalities that claimed to have the presence of OSS when it was a matter of partnerships with philanthropic organizations to help with services or health care providers. Such information error is due to a lack of knowledge of whom provided information in the municipality and the difficulty in using this database to measure the presence of OSS in Brazil. There were also problems with consistency in the information provided by cities. In some cases, although confirming in the IBGE survey that they had contracts with OSS, they reported that they no longer had them in response to the request via e-SIC in one of this study stages. Finally, it is noteworthy that the contractual clauses are not uniform, varying according to the municipality. Budget-financial information, as it is available in different websites and databases, in addition to not having a standard for all contracts, represents yet another limitation.

Differences were seen between establishments administered by OSS and those under DA regarding their location, management, and types of services provided. The survey and the analysis show that there is still much to be investigated, discussed, and improved about OSS. The carried-out OSS listing is a tool for future study. However, an administrative database that allows temporal monitoring of establishments is still required since these data are not static. Some contracts can be started, and others can be closed over time.

The results support the debate on administrative reform in the public health area since the management autonomy of OSS seems to be the reason for their better performance (La Forgia and Couttolenc, 2008). It is essential to draw attention to how contracts are executed. It can contribute to greater efficiency and transparency if the public manager monitors and inspects the reports published by the OSS – which does not always occur, generating a lack of consensus on the theme. While the relative ease of OSS administration quickly expanding their services was a decisive aspect for the state and municipality of São Paulo in dealing with Covid-19 (Public Call No. 002/2020 – Municipal Health Department of São Paulo), the inadequacies observed in the state of Rio de Janeiro determined to withdraw their OSS sanctioned by Law No. 8,986/2020.

Conclusion

The study contributes to an exhaustive survey of OSS. It showed relevant results regarding distribution and the importance level in managing the public hospital network in the country. More than 1,000 establishments managed by OSS were identified throughout Brazil, mainly located in the Southeast and South regions, and 114 OSS manage them. They are concentrated on 23 health services, focusing on day hospitals, health centers/basic health units, and hospitals. States and municipalities seem to have an increasing trend towards this type of management, directly linked to the public area financing contingency that started in the 1990s, with a peak in contracts from 2014 to 2016.

The study also carried out a comparative analysis between OSS and those under DA based on hospital sector indicators. The results showed that differences in terms of management decrease as hospital size increases. It is interesting to point out that small and medium-sized hospitals managed by Social Organizations, in general, showed better indicators compared to those under DA. Still, in all of them, there is room for improvement.

The listing of OSS is an essential tool for future studies. The results found in the OSS demonstrate the need for an administrative database that allows the temporal monitoring of establishments.

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Appendix 1A

	State																					
Service type	**RO**	**AM**	**PA**	**AP**	**MA**	**CE**	**PB**	**PE**	**AL**	**BA**	**MG**	**ES**	**RJ**	**SP**	**PR**	**SC**	**RS**	**MS**	**MT**	**GO**	**DF**	**Total**
Health Center	0	0	0	0	0	0	0	0	0	0	0	0	4	8	0	0	0	0	0	0	0	12
Health Center/Basic Health Unit	0	0	0	0	1	0	0	0	0	0	19	4	65	307	0	23	0	0	0	0	0	419
Clinic/Specialty Center, Polyclinic and Care Center Hemotherapy and Hematology	0	0	2	0	7	0	1	8	0	2	2	0	0	81	0	1	0	0	0	1	0	105
Hospital	0	1	13	1	20	5	6	13	2	23	4	5	24	76	5	9	7	2	8	13	1	238
Day Hospital – Isolated	0	0	0	0	0	0	0	3	0	0	0	0	0	16	0	0	0	0	0	0	0	19
Public Health Laboratory, Telehealth, Medical office and Pharmacy	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6
Diagnosis and Therapy Support Unit	0	0	0	0	0	0	0	0	0	0	2	0	0	5	0	0	0	0	0	0	0	7
Mixed Unit	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	4
Mobile Unit	0	0	0	0	0	0	0	0	0	1	0	0	3	14	0	0	1	0	0	0	0	19
Emergency Room, General and Specialized Emergency Room	0	1	1	1	7	9	3	15	2	6	10	3	36	40	3	3	4	0	0	2	0	146
Indigenous Health Care Unit	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
Psychosocial Care Center – CAPS	0	0	0	0	0	0	0	0	0	0	0	0	3	32	0	0	0	0	0	0	0	35
Access Regulation and Emergency Medical Center and Surveillance Unit	1	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	1	0	9

ORIGINAL ARTICLE
ARTIGO ORIGINAL

Assisted therapy model for dispensing immunobiological drugs for rheumatoid arthritis by the Brazilian Unified Health System: rational use of resources reduces expenses

Modelo de terapia assistida para dispensação de medicamentos imunobiológicos para artrite reumatoide no Sistema Único de Saúde: uso racional de recursos reduz despesas

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Keywords
rheumatoid arthritis, immunobiological agents, cost, rational use, economy

ABSTRACT

Objective: The incorporation of immunobiological agents for rheumatoid arthritis (RA) treatment at the Brazilian Unified Health System (SUS) represented a significant advance but had an important impact on the budget. As the current model of direct patient delivery had deficiencies, the CEDMAC model of assisted therapy was implemented to focus on rational use to minimize expenses and increase access. However, there is no data to compare the two models. Thus, this study aimed to compare the number of bottles effectively dispensed by the CEDMAC model to direct dispensing and assess its financial impact. **Methods**: Care of RA patients at CEDMAC in 2015, whose immunobiological drugs were provided by the Ministry of Health, were included. Drug and dose received, prescribed dose, the number of bottles, cancellations due to contraindication, and absences were recorded. As a comparison, the number of bottles that would be delivered by direct dispensing was estimated. The difference between the total number of bottles dispensed by the two systems and the financial impact of the purchase price in 2015 was calculated. **Results**: In 2015, CEDMAC provided 3,784 consultations for RA patients. The total number of bottles of immunobiological agents prescribed was 10,000 bottles, and 1,946 (19.5%) were not used for bottle optimization, contraindications, or absenteeism. Unused bottles reduced expenses by R$ 806,132.62. The expansion of the model to the entire SUS would reduce costs by R$ 121,110,388.27. **Conclusion**: The CEDMAC assisted therapy model considerably reduces the volume of dispensed bottles and can significantly reduce expenses in the supply of immunobiological agents for RA at SUS.

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Palavras-chave:
artrite reumatoide, imunobiológicos, custo, uso racional, economia

RESUMO

Objetivo: A incorporação dos imunobiológicos para tratamento da artrite reumatoide (AR) no Sistema Único de Saúde (SUS) representou um avanço significativo, porém teve um impacto importante no orçamento. Como o modelo vigente de dispensação direta ao paciente apresentava deficiências, implementou-se o modelo do CEDMAC de terapia assistida com foco no uso racional, visando minimizar despesas e potencializar o alcance. Entretanto, não há dados que comparem os dois modelos. Assim, esse estudo objetivou comparar o número de frascos efetivamente dispensados pelo modelo do CEDMAC à dispensação direta e avaliar seu impacto financeiro. **Métodos:** Foram incluídos atendimentos de pacientes com AR no CEDMAC em 2015, cujo imunobiológico foi fornecido pelo Ministério da Saúde. Foram registrados medicamento e dose recebidos, dose prescrita, número de frascos, cancelamentos por contraindicação e faltas. Como comparação, foi estimado o número de frascos que seriam entregues pela dispensação direta. Calculou-se a diferença entre o número total de frascos dispensados pelos dois sistemas e o impacto financeiro pelo valor de aquisição em 2015. **Resultados:** Em 2015, o CEDMAC realizou 3.784 atendimentos para pacientes com AR. O total de frascos de imunobiológicos prescritos foi de 10.000 frascos e 1.946 (19,5%) não foram utilizados por otimização de frascos, contraindicações ou absenteísmo. Os frascos não utilizados reduziram as despesas em R$ 806.132,62. A expansão do modelo para todo SUS reduziria as despesas em R$ 121.110.388,27. **Conclusão:** O modelo de terapia assistida do CEDMAC reduz consideravelmente o volume de frascos dispensados e pode trazer uma relevante redução de despesas no fornecimento dos imunobiológicos para AR no SUS.

Introduction

The incorporation of immunobiological drugs for rheumatoid arthritis (RA) treatment within the scope of the Brazilian Unified Health System (SUS) was a significant advance (Brazil, 2002). RA is a chronic inflammatory disease that affects around 1% of the population and mainly affects the joints of hands and feet, leading to severe functional limitation due to the destruction of joint structures during the disease course (Mota, 2012). Treatment primarily consists of attempting to control this inflammatory process in a sustained manner (Smolen, 2017). Several therapeutic options have been used throughout history to control inflammation and, consequently, the disease progression, initially with synthetic molecules and, more recently, with targeted therapies, constructed through genetic engineering and called generically immunobiological agents (Strand, 2007). These new technologies collaborated to change the natural course of the disease in refractory patients to the traditional treatment and contributed to reducing the patients' disability and providing a better quality of life for this population (Mota, 2012). On the other hand, access expansion to these high-cost drugs began to consume a considerable part of the public budget due to the progressive increase in the volume of dispensations over the years.

Therein, the rational use of immunobiological agents could minimize waste and potentiate the number of patients treated. However, the current predominant model of direct dispensing to the patient weakens the storage chain and drugs transport and leaves a critical gap in application safety and in ensuring the best allocation of resources. Considering that all immunobiological agents included for the treatment of RA are thermolabile and injectable (subcutaneous or intravenous), the current system does not seem ideal.

To fill this gap, it was created the Center for Dispensing High-Cost Medications (CEDMAC) in 2007, a partnership between the Rheumatology Discipline of the *Faculdade de Medicina da Universidade de São Paulo* (FMUSP) [the University of São Paulo Medical School] and the *Secretaria de Estado de São Paulo* [São Paulo Health State Department] with the support from the *Fundação de Amparo à Pesquisa do Estado de São Paulo* [Foundation for Research Support of the São Paulo State]. They proposed establishing a new model for managing immunobiological agents in Rheumatology based on assisted therapy and a focus on safety, rationalization of use, and combating waste.

In the CEDMAC model, all the logistics related to the medication do not depend on direct contact with the patient. Transport and storage are carried out by institutions involved in the process with the recommended control. For applications, only scheduled appointments are performed, following a protocol developed by CEDMAC. The attendance is multidisciplinary and involves a medical, nursing, pharmaceutical, and administrative team. The care protocol includes systematic tracking of possible contraindications to the application, assisted application under medical supervision to deal with any immediate adverse reactions, and effectiveness control, in addition to an active search for absent patients, promoting treatment adherence. The assisted application also allows the sharing of intravenous medication bottles with a dose per kilogram of weight, leading to a reduction in waste and optimization of resources by treating a higher number of patients with the same number of bottles. For subcutaneously applied medications, the assisted therapy avoids dispensing for patients with specific contraindications, increasing the safety of the treatment and preventing the accumulation of bottles in possession of patients in cases

of applications postponement. This process contrasts with the direct dispensing system, which delivers monthly doses regardless of whether the patient has already used the previously dispensed doses.

Notwithstanding the potential advantages of the CEDMAC assisted therapy model, so far, there is no data to prove and quantify its superiority to the predominant model of direct dispensing by SUS regarding the volume of immunobiological agents distributed and the financial impact.

This study evaluates the reduction in the volume of immunobiological drugs for RA dispensed through the CEDMAC assisted therapy model and the financial impact of this volume reduction compared to the direct dispensing model in force within the SUS, in addition to estimating the cost reduction that could be achieved for the acquisition of medicines, if the CEDMAC model of assisted therapy was extended to the entire SUS.

Methods

Evaluated appointments

All patients seen with RA diagnosis, scheduled at CEDMAC from 01/01/2015 to 12/31/2015, whose medication was provided by the Ministry of Health, were included.

Immunobiological drugs

The immunobiological drugs used included in the specialized component of pharmaceutical care list of the Ministry of Health for RA: abatacept, adalimumab, etanercept, golimumab, infliximab, rituximab, and tocilizumab (Table 1).

Comparison between assisted therapy and direct dispensing models

Appointments at CEDMAC were recorded for each patient according to the medication and dose received, prescribed dose, number of bottles, cancellations due to contraindication, and absences. As a comparison, the number of bottles dispenses for each patient was estimated if the system was for direct dispensing.

Patients who started or stopped treatment during the study period had their estimates adjusted proportionally to the time of medication use.

Data were aggregated, and the reduction in volume dispensed was calculated by the difference between the total number of bottles estimated by direct dispensing subtracted from the number of bottles effectively used.

The number of additional treatments that could be performed using the volume of bottles saved was also estimated. For each drug, the number of bottles saved was divided by the average number of bottles used for each treatment, thus finding the number of possible additional treatments using the total number of optimized bottles.

Financial estimate

The financial value in reais referring to the volume reduction by the CEDMAC model was calculated by multiplying the amount saved for each drug by the unit purchase price of each immunobiological drug by the Ministry of Health in 2015, shown in Table 2 (Brazil, 2017).

Table 2. Unit values for the acquisition of immunobiological drugs available in the specialized component of pharmaceutical assistance of the Ministry of Health in 2015

Medication	Acquisition value (R$)
Abatacept 250 mg	412.54
Adalimumab 40 mg	776.09
Certolizumab 200 mg	466.56
Etanercept 50 mg	381.00
Golimumab 50 mg	1,331.22
Infliximab 100 mg	939.14
Rituximab 500 mg	1,908.48
Tocilizumab 80 mg	180.49

Table 1. The dosage schedule and administration routes of immunobiological drugs for RA according to the Ministry of Health's PCDT in 2015

Medication	Route	Dose	Interval
Abatacept 250 mg	IV	500 mg (<60 kg) 750 mg (60-100 kg) 1.000 mg (>100 kg)	Weeks 0, 2 and 4 and after every 4 weeks
Adalimumab 40 mg	SC	40 mg	2 weeks
Certolizumab 200 mg	SC	400 mg	Weeks 0, 2 and 4 and after every 4 weeks
Etanercept 50 mg	SC	50 mg	Weekly
Golimumab 50 mg	SC	50 mg	4 weeks
Infliximab 100 mg	IV	3 mg/kg body weight	Weeks 0, 2 and 6 and after every 8 weeks
Rituximab 500 mg	IV	1,000 mg	Weeks 0 and 2 every 6 months
Tocilizumab 80 mg	IV	8 mg/kg (maximum dose 800 mg)	4 weeks

IV: intravenous; SC: subcutaneous.

The possible cost-cutting impact of expanding the CEDMAC assisted therapy model to the entire SUS was estimated by extrapolating the reduction in expenses seen in CEDMAC care to the total number of bottles dispensed by the SUS for the diagnosis of RA (CID10 - M05.0, M05.3, M05.8, M06.0, and M06.8) in 2015, according to Datasus, for each immunobiological drug available.

Statistical analysis

The Student's t-test was used to compare the number of bottles values. The prescribed and the used ones for each medication. *P*-values < 0.05 were considered significant.

Results

CEDMAC scheduled 9,139 appointments for patients using immunobiological agents during the study period, with 3,784 for patients diagnosed with RA. The total number of prescribed bottles of all drugs for the treatment of RA was 10,000 bottles, and 1,946 (19.5%) were not used. Table 3 describes the dispensing reduction broken down for each immunobiological drug. Bottle savings were statistically significant for all drugs except rituximab. In the analysis of dispensing reduction, 1,724 bottles saved were attributed to non-application due to contraindication or absenteeism and 222 bottles to optimization resulting from the sharing of bottles. Considering that only infliximab and tocilizumab allow sharing optimization, of the 854 bottles saved for these two drugs, 26% were because of bottle sharing at the time of application.

The number of bottles saved would allow for an additional number of treatments in the order of 20.3%, considerably increasing the system's capacity without adding cost. Table 4 shows the possible other treatments for each drug based on the bottle savings generated by the CEDMAC model.

In financial terms, unused bottles corresponded to an expense reduction of R$ 806,132.62, equivalent to 17.7% of the total prescribed value (Table 5).

If this model is expanded to the entire SUS, expenses reduction could be R$ 121,110,388.27 in values at the time, based on the total volume of units of each immunobiological

Table 3. Comparison of the prescribed and effectively used volume for each immunobiological drug in the CEDMAC model of the assisted application in 2015

Medication	Treatments (n)	Bottles prescribed (n)	Bottles used (n)	Saved volume (n)	Saved volume (%)	P
Abatacept 250 mg	96	2,553	2,177	376	14.7	<0.001
Adalimumae 40 mg	24	488	390	98	20.1	<0.001
Certolizumab 200 mg	14	217	174	43	19.8	<0.001
Etanercept 50 mg	49	1,944	1,658	286	14.7	<0.001
Golimumab 50 mg	20	165	128	37	22.4	<0.001
Infliximab 100 mg	32	696	505	191	27.5	<0.001
Rituximab 500 mg	63	398	368	30	7.5	0.08
Tocilizumab 80 mg	55	3,539	2,654	885	25.0	<0.001

Table 4. Estimate of possible additional treatments using the volume saved for each immunobiological drug in the CEDMAC model of the assisted application in 2015

Medication	Saved volume (n)	Average of bottles used per treatment (n)	Other possible treatments (n)	Treatments performed (n)	Other possible treatments (%)
Abatacept 250 mg	376	22.7	16	96	16.7
Adalimumab 40 mg	98	16.3	6	24	25.0
Certolizumab 200 mg	43	12.4	3	14	21.4
Etanercept 50 mg	286	33.8	8	49	16.3
Golimumab 50 mg	37	6.4	5	20	25.0
Infliximab 100 mg	191	15.8	12	32	37.5
Rituximab 500 mg	30	5.8	5	63	7.9
Tocilizumab 80 mg	885	48.3	18	55	32.7

drug dispensed for RA by the Ministry of Health, according to Datasus, in 2015. The percentage reduction of dispensed bottles generated by the CEDMAC model was extrapolated to Datasus data to estimate the reduction of expenses in SUS, as shown in Table 6.

Discussion

This paper is the first study to quantify the savings of bottles of immunobiological medications dispensed for RA by an assisted therapy model compared to the current model of direct dispensing to the patient predominant in SUS.

This data is relevant since RA is a chronic inflammatory disease that, as a rule, is treated for extended periods because, in the absence of treatment, the disease tends to reactivate. Thus, patients who cannot adequately control it with the traditional treatment and need to start immunobiological drugs will use them for a long time.

It is estimated that 30% of patients with RA will be indicated for immunobiological drugs for proper control of their disease. This number, associated with prolonged use and the fact that immunobiological agents are expensive, significantly impacts the SUS budget for the supply of these drugs.

On the other hand, incorporating these drugs into the SUS significantly advanced the therapeutic arsenal against RA. Immunobiological drugs have been shown to reduce the chance of these patients progressing to functional loss due to structural joint damage and, thus, contribute to less disability and less product loss in this population.

Thus, the supply of immunobiological drugs by the SUS must be done efficiently based on rational use and combating waste to impact the system's sustainability positively. However, what is observed in practice is that the current predominant model of access to biological medicines at SUS by direct dispensing to the patient is deficient in several aspects.

First, medicines are delivered directly to patients, risking their proper conservation, as they are thermolabile products

Table 5. Financial comparison of the amount prescribed and effectively used, for each immunobiological drug, in the CEDMAC model of the assisted application in 2015

Medication	Amount prescribed (R$)	Amount used (R$)	Generated savings (R$)	Generated savings (%)
Abatacept 250 mg	1,053,215.00	898,099.60	155,115.40	14.7
Adalimumab 40 mg	378,731.90	302,675.10	76,056.80	20.1
Certolizumab 200 mg	101,243.50	81,181.44	20,062.06	19.8
Etanercept 50 mg	740,664.00	631,698.00	108,966.00	14.7
Golimumab 50 mg	219,651.30	170,396.20	49,255.10	22.4
Infliximab 100 mg	653,641.40	474,030.90	179,610.50	27.5
Rituximab 500 mg	759,575.00	702,320.60	57,254.40	7.5
Tocilizumab 80 mg	638,663.90	478,851.30	159,812.60	25.0
Total 2015	**4,545,386.00**	**3,739,253.14**	**806,132.86**	**17.7**

Table 6. Estimated cost reduction in the supply of immunobiological drugs for RA in the hypothesis that the CEDMAC model of assisted therapy is disseminated within the SUS in 2015

Medication	Amount dispensed (R$)	Estimated savings (%)	Potential savings amount (R$)
Abatacept 250 mg	21,904,223.84	14.7	3,219,920.90
Adalimumab 40 mg	261,362,277.10	20.1	52,533,807.65
Certolizumab 200 mg	8,525,450.88	19.8	1,688,039.27
Etanercept 50 mg	214,365,840.00	14.7	31,511,778.48
Golimumab 50 mg	55,293,553.92	22.4	12,385,756.08
Infliximab 100 mg	44,094,501.28	27.5	12,125,987.85
Rituximab 500 mg	15,739,234.56	7.5	1,180,442.59
Tocilizumab 80 mg	25,858,621.81	25.0	6,464,655.45
Total 2015	**647,143,703.39**	**18.7**	**121,110,388.27**

and require specific storage and transport conditions that guarantee their quality. In addition, the available immunobiological drugs are injectable, requiring a healthcare structure for application, especially for the intravenous route, which the current model does not cover.

Another concern is the application itself. These medications may present contraindications at the application that may not be observed or noticed by patients who perform self-application, in the case of subcutaneous medicines, increasing the risk of adverse events. In addition, intravenous medications such as infliximab and tocilizumab have a standard dose by patient weight, leading to drug disposals when the entire bottle is not used. A final aspect about fixed dispensing, regardless of whether the patient has had the last dose or not, results in waste to the chain and drug storage outside the system.

The development of the CEDMAC assisted therapy model brought solutions to all these issues, taking the direct interaction of the patient with immunobiological drugs as a premise. The patient's access to the medication is guaranteed, and a multidisciplinary team checks possible contraindications before each application. The bottles are stored, following the safety and transport recommendations, in the institution itself, and, as a rule, the excess doses of medications by weight are shared, making drug disposal exceptional. Only the drug used is dispensed, preventing the storage of medicines outside the system, increasing efficiency, and rationalizing use. Also, the CEDMAC model monitors treatment effectiveness through a structured protocol in electronic medical records, allowing for in-depth analysis of the generated data.

Saving drugs by the CEDMAC model can be analyzed in two main ways. The first concerns the reduction of expenses itself, which would allow other uses for these public resources within the health system or even allow the incorporation of new technologies still absent from the Ministry of Health protocols. The second analysis will enable us to infer that the economy achieved in dispensing increases system capacity considerably, without adding expense, expanding population reach, as demonstrated by the number of additional treatments possible from the savings brought about by the CEDMAC model.

In this sense, the question arises about the investments needed to implement an assisted therapy network that could serve the entire public system and fund the model. This estimate was not part of the scope of this study. However, in theory, significant investments would not be necessary, as the SUS already has a capillary network of the national vaccination program's cold chain that could be used to transport and store immunobiological drugs. The adequate physical structure is not very complex, and the necessary personnel (nursing, medical team, and pharmacy) could be trained at a low cost in existing reference centers. In the case of intercurrence and complications, the support of regional reference hospitals would be established.

A possible limitation of this study is that the Hospital das Clínicas of FMUSP is a tertiary service with a population with RA that is probably more severe than the country average, making the extrapolation of the data reported here uncertain. At this point, it is noteworthy that the unit cost of acquisition of immunobiological drugs has been dropping over time. Hence, the survey of the estimate of public resources saved in this study only contributes to viewing what happened in 2015 but cannot be extrapolated to the present time, even with the growing demand for the dispensing of immunobiological agents.

On the other hand, the current study presents some advantages that corroborate its importance. It is the first study that makes this type of analysis comparing an assisted therapy model to the predominant direct dispensing model in SUS. The CEDMAC model has already been in full operation for 12 years, and it can be said that it is already tested and consolidated as an alternative. A relevant number of patients and consultations was evaluated, which increases the strength of the data obtained. And finally, the knowledge acquired over time and described in this study can serve as the basis for an expansion and multiplication project of the CEDMAC assisted therapy model within the SUS.

Conclusion

The data presented suggest that the assisted therapy model currently used at CEDMAC considerably reduces the number of bottles of immunobiological drugs dispensed, compared to the predominant model of direct patient delivery, and can bring relevant savings in the supply of these drugs for RA in the SUS.

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ORIGINAL ARTICLE
ARTIGO ORIGINAL

Analysis of practical prices in the acquisition of medicines by the health consortia compared to municipal institutions in the period from 2017 to 2018

Análise de preços praticados nas aquisições de medicamentos pelos consórcios de saúde em comparação com as instituições municipais para o período de 2017 a 2018

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Unified Health System, Health Price Bank, Health Consortia, Pharmaceutical Economics, drug prices

ABSTRACT

Objective: To identify whether the drug purchases made by the Health Consortia were more efficient, in economic terms, than the purchases made individually by the Municipal Institutions, for the years 2017 and 2018. **Methods:** Descriptive analysis of the sample, using the trend measures central, economic analysis and calculation of the economic percentage. **Results:** The values obtained showed efficiency in consortium purchases, reflected in the greater quantity acquired and the lower price practiced, for most of the items analyzed in the reference period. **Conclusions:** Purchases by Health Consortia provided more savings compared to purchases made by Municipal Institutions, proving to be an option to obtain economic resources for health.

Palavras-chave:
Sistema Único de Saúde, Banco de Preços em Saúde, Consórcios de Saúde, Economia Farmacêutica, preço de medicamentos

RESUMO

Objetivo: Identificar se as aquisições de medicamentos realizadas pelos Consórcios de Saúde foram mais eficientes, em termos econômicos, que as compras realizadas individualmente pelas Instituições Municipais, para os anos de 2017 e 2018. **Métodos:** Análise descritiva da amostra, empregando as medidas de tendência central, análise econômica e cálculo do percentual econômico. **Resultados:** Os valores obtidos mostraram eficiência nas compras dos consórcios, refletidos na maior quantidade adquirida e no menor preço praticado, para a maioria dos itens analisados no período de referência. **Conclusões:** As compras pelos Consórcios de Saúde proporcionaram mais economia em comparação com as compras realizadas pelas Instituições Municipais, mostrando-se como uma opção para obter economicidade dos recursos destinados à saúde.

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Medical Congress: This study is unprecedented, resulting from research carried out in the Health Price Database.
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Introduction

The Public Health Sector faces numerous management and operational challenges that have been intensified since the decentralization process of the Brazilian Unified Health System (SUS). Among these challenges outstand the difficulties with limited financial and human resources, problems accessing and incorporating technologies, and lack of adequate physical infrastructure. In this scenario, the municipalities were left responsible for acquiring a considerable part of essential drugs, tied to a system of limited budgets, and increasing drug costs (Rename, 2019).

For solving or at least relieving such challenges, the concept of efficiency in public administrations is used. According to the literature on the subject, there are several criteria to be considered for the proper conduct of public contracts, namely: attributes inherent to the contracting, strategic aspects, legal, managerial, and essential aspects related to the finalistic result of purchases (Costa & Earth, 2019).

For achieving the approach intended in this paper, the focus will be on attributes, which involves the quality of the acquired object and the acquisitions cost-effectiveness, in aspects of a strategic nature, namely: use of the Government's purchasing power and the scope of the public purpose of the purchase. Efficiency is associated with cost-effectiveness criteria and can be obtained in management, operation, use of resources, and administrative and financial activities. Being efficient in the acquisition of products with assured quality and appropriate quantities at a reasonable price makes the cost-effectiveness of public resources viable and, in the specific case of drug acquisition, increases the effectiveness of pharmaceutical care within the scope of the SUS, which implies the achievement of the public purpose of the purchase.

Furthermore, when considering the market structure of the pharmaceutical sector, it is essential to think about acquisition arrangements that involve the criterion of the use of the Government's purchasing power. In a more specific approach, which refers to the universe of items to be acquired, Luiza *et al.* (1999) claim that the quality of an item can be measured basically by two dimensions: i) efficacy, effectiveness, and suitability and ii) defining the required level of quality demand. The first dimension is achieved with the proper selection and standardization of items, and the second dimension with the use of standardized descriptions in the acquisition processes.

Therefore, in the Health Sector, quality can be defined through the standardization of item descriptions. The Cataloging Unit for Health Use Materials (Material Catalogue – CATMAT, in Portuguese), linked to the Ministry of Health (MS, in Portuguese), is responsible for cataloging and standardizing the description of such items. Through standardization, it is possible to observe the specificities of each item and compare it with all items with the same description, contributing to the purchasing processes carried out by health institutions.

Cost reduction can be achieved through more dynamic acquisition processes that initially involve the accurate description of items by preparing catalogs and, later, the availability of prices set in their respective acquisitions. In public health, purchases can be carried out individually by each institution or in conjunction with other institutions. The collective purchases of several institutions are called consortia (buyer pool). In the Health Sector, they are commonly called Health Consortia.

Health Institutions that partner to purchase items seek lower prices than the set ones for individual purchases. The acquisition modality via consortia is an option to reduce operating costs and drug prices (Amaral & Blatt, 2011). It can reduce the incidence of shortages in health units (Fiuza *et al.*, 2020).

In this direction, there is the hypothesis that collective purchases have advantages and may represent an option for Municipal Institutions to use their resources more efficiently and cost-effectively. Health care has high costs and is a great challenge for managers and public policymakers. Much of the costs come from drug purchases, and resorting to ways that help to reduce costs, equalizing the maximization of health benefits and access to drugs, is becoming increasingly relevant (Araújo, 2015).

Consortia are a possibility to achieve such a purpose. Alliances between health entities aim to establish interconnections to share risks, knowledge, and skills, hoping to obtain competitive advantages, economies of scale, improved efficiency, and synergy (Ferreira, 2000).

However, consortia can be inefficient. A large volume purchased does not always reflect lower prices (it occurs mainly at emergency periods and economic imbalance times, a situation in which demand is greater than the market's responsiveness). For some specific items, the negotiated price does not depend on the quantity to be purchased (e.g., items with current patent registrations, off-label items – without registration with regulatory agencies – and those produced by only one manufacturer – characteristic of monopolistic structures). Partnerships between good and bad payers can reduce the scale effect (asymmetric information between economic agents); loss of management superiority by consortia institutions, and delays in the resolution of obstacles due to the lack or delay of the central coordination of consortia (Fiuza *et al.*, 2017; Picolini *et al.*, 2016; Ferreira, 2000).

After this overview, it is possible to highlight the purpose of this study. It is intended to identify whether the public acquisitions of the Health Consortia are efficient. Therefore, purchasing drugs recorded in the Health Price Database (HPD) system will compare joint purchases to individual purchases by Municipal Health Institutions during 2017 and 2018. In

a detailed sample analysis, the most acquired items in the reporting period and the most active manufacturers will be identified.

The HPD is a system of the Ministry of Health that operates in compliance with the standards implemented by CATMAT. Several health institutions and consortia are registered with the HPD, and periodically purchased items with their respective quantities are inserted, along with the type and mode of purchase, manufacturers and suppliers, purchase date, and other information allowing the observation and detailed analysis of those acquisitions.

The study is justified by the need to understand the functioning of a part of the pharmaceutical industry to point out more efficient operational ways that optimize public resources in the Health Sector and contribute to purchasing drugs at lower prices and with guaranteed quality.

Methods

A cross-sectional descriptive study was carried out with secondary data. The analyzed database came from the HPD system covering the years 2017 and 2018. All the Health Consortia and Municipal Institutions[1] recording their purchases[2], and only drugs presenting more than ten records in both shopping options were selected to compose the sample.

Outliers were eliminated to avoid data scattering. Thus, the sample consisted of items that met the selection and screening criteria, totaling 7,399 elements (purchase records).

For the descriptive analysis, measures of central tendency were used (mean value, weighted mean value, and median value). For the economic analysis, the variation between the prices recorded at purchases from Health Consortia and Municipal Institutions was estimated, using the price regulated by the Medicines Market Regulation Chamber (CMED, in Portuguese) as a reference.

The calculation of saving percentage between the lowest observed price (average unit purchase price) and the regulated price (Maximum Sales Prices to the Government – PMVG, in Portuguese) by the CMED [Medicines Market Regulation Chamber] was used, according to the methodology developed by the Pan American Health Organization (PAHO) in partnership with the Ministry of Health, adapted by Mastroianni et al. (2017):

[Equation 1]

$$\text{Saving Percentage} = \left[1 - \frac{\text{average unit purchase price}}{\text{PMVG CMED}}\right] \times 100$$

1 In the HPD, there are registered institutions at the federal, state, municipal, and private levels. For this study, it was decided to look only at municipal-level institutions.

2 Every purchase record presents the information: purchased items, supply unit, manufacturer, supplier, purchasing institution, purchased quantity, unit price, and other information pertinent to those items. Each item has a standardized BR code.

Results

The sample has 7,399 information for the 24 selected items[3]. All items are registered with the Brazilian Health Regulatory Agency (Anvisa), 23 items are included in the National List of Essential Medicines (Rename) and compose the list of drugs provided at SUS Primary Care. Only levomepromazine (BR0268129) is not on the Rename.

Of all records, 474 (6.4%) refer to purchases from 17 Health Consortia[4], and 6,925 (93.6%) are from 710 Municipal Institutions[5]. The economic volume handled in the sample was around R$ 514 million, with 53.4% (R$ 275 million) coming from the Health Consortia. Table 1 shows the distribution of the Health Consortia and Municipal Institutions by Federative Unit.

The quantitative list of manufacturers and suppliers who operationalized the sample items was composed of 71 manufacturers and 422 suppliers who produced and marketed the items studied. It was noticed that the network of suppliers had a greater volume and was better distributed across all country regions than the network of manufacturers. For the market structure of manufacturers by item, only 12 of these manufacturers (16.9%) accounted for most of the market. Table 2 shows the manufacturers that are responsible for 91.0% of the sample resources.

Table 3 shows the market leaders for each sample item. The manufacturer Prati Donaduzzi (CNPJ 73.856.593/0001-66) is the market leader for four items and has a turnover of over R$ 92 million. Cristália (CNPJ 44.734.671/0001-51) is the market leader for seven items with a turnover of around R$ 86.6 million.

To analyze the individual behavior of each item, comparing the unit values paid by the Health Consortia and by the Municipal Institutions, the mean, weighted and median values, shown in Table 4, were used.

It is observed that the purchases made by the Health Consortia had lower unit values for most items than the purchases made by the Municipal Institutions. It is 19 times for the mean value, 18 times for the weighted mean value, and 20 times for the median value. Only one case in which the price paid by Health Consortia and Municipal Institutions showed equal values. Municipal Institutions showed better variation in five items for mean value, six items for weighted mean value, and three cases for median value.

Table 5 simulates the use of the Lowest Unit Value to estimate the savings that could have been made if this value had been used. The "Lowest Unit Value" is the smallest value, selected from the mean, weighted and median values. This

3 Please see Appendix 1 for a listing of items composing the sample.

4 Please see Appendix 2 for Health Consortia.

5 Please see Appendix 3 for Municipal Institutions.

Table 1. Municipal Institutions and Health Consortia, by Federal Unit, 2017 and 2018

Federative Region	Municipal Institutions	%	Population	%	Resources (R$)	%
Southeast	259	36.5	31,469,155	58.9	146,043,913,96	61.0
Northeast	199	28.0	9,346,381	17.5	33,197,279,24	13.9
South	193	27.2	9,994,545	18.7	46,891,179,25	19.6
Central-West	33	4.6	838,822	1.6	4,650,376,73	1.9
North	26	3.7	1,776,950	3.3	8,675,951,40	3.6
Total	710	100.0	53,425,853	100.0	239,548,700,58	100.0 (46.6)
Federative Region	**Health Consortia**	**%**	**Population**	**%**	**Resources (R$)**	**%**
South	11	64.7	13,905,010	75.6	162,482,613,09	59.1
Southeast	04	23.5	3,753,646	20.4	75,900,409,24	27.6
Northeast	02	11.8	743,352	4.0	36,507,250,15	13.3
Total	17	100.0	18,402,008	100.0	274,890,272,48	100.0 (53.4)
Grand Total					514,348,973,06	(100.0)

Source: Prepared by authors, 2020.

Table 2. Main manufacturers, by Federative Unit, 2017 and 2018

Manufacturer	Company	Municipality	FU	Turnover value	%	Cumulative
%	Prati, Donaduzzi	Toledo	PR	R$ 99,206,181.97	19.3	19.3
44.734.671/0001-51	Cristália	Itapira	SP	R$ 88,838,719.53	17.3	36.6
17.159.229/0001-76	Laboratório Teuto	Anápolis	GO	R$ 79,146,210.14	15.4	51.9
61.068.755/0001-12	Sanval	São Paulo	SP	R$ 41,484,968.75	8.1	60.0
33.078.528/0001-32	Torrent	Barueri	SP	R$ 36,901,557.30	7.2	67.2
19.570.720/0001-10	Hipolabor	Sabará	MG	R$ 29,217,554.69	5.7	72.9
57.507.378/0003-65	EMS Hortolândia	Hortolândia	SP	R$ 25,230,838.93	4.9	77.8
61.286.647/0001-16	Sandoz	Cambé	PR	R$ 21,540,936.33	4.2	82.0
03.485.572/0001-04	Geolab	Anápolis	GO	R$ 13,335,768.20	2.6	84.6
00.394.502/0071-57	Comando da Marinha	Rio de Janeiro	RJ	R$ 12,155,090.40	2.4	86.9
04.099.395/0001-82	Santisa	Bauru	SP	R$ 11,296,661.43	2.2	89.1
17.875.154/0001-20	Medquímica	Juiz de Fora	MG	R$ 9,724,142.48	1.9	91.0
Other manufacturers				R$ 46,270,342.91	9.0	100.0
Total				R$ 514,348,973.06	100.0	

Source: Prepared by authors, 2020.

Table 3. Manufacturers leading the market by item, 2017 and 2018

BR Code	Market-Leading Manufacturer	Company	Turnover Value	Market Share
BR0267509	73.856.593/0001-66	Prati, Donaduzzi	R$ 4,187,440.29	99.7%
BR0267517	73.856.593/0001-66	Prati, Donaduzzi	R$ 61,481,426.41	96.8%
BR0267632	73.856.593/0001-66	Prati, Donaduzzi	R$ 8,581,344.72	89.2%
BR0267663	73.856.593/0001-66	Prati, Donaduzzi	R$ 18,672,859.34	51.0%
BR0267197	44.734.671/0001-51	Cristália	R$ 37,183,987.90	57.7%
BR0267635	44.734.671/0001-51	Cristália	R$ 5,389,677.21	76.9%
BR0267638	44.734.671/0001-51	Cristália	R$ 4,580,782.68	51.6%
BR0267670	44.734.671/0001-51	Cristália	R$ 1,878,631.12	80.7%
BR0267768	44.734.671/0001-51	Cristália	R$ 9,211,525.21	90.5%

BR Code	Market-Leading Manufacturer	Company	Turnover Value	Market Share
BR0268129	44.734.671/0001-51	Cristália	R$ 19,162,333.72	97.1%
BR0270140	44.734.671/0001-51	Cristália	R$ 9,194,514.06	74.0%
BR0267618	17.159.229/0001-76	Laboratório Teuto	R$ 70,988,254.87	71.1%
BR0270130	17.159.229/0001-76	Laboratório Teuto	R$ 1,987,613.34	54.3%
BR0267613	61.068.755/0001-12	Sanval	R$ 14,840,778.75	45.8%
BR0267564	33.078.528/0001-32	Torrent	R$ 15,854,563.70	92.6%
BR0267566	33.078.528/0001-32	Torrent	R$ 9,458,247.95	72.6%
BR0267567	33.078.528/0001-32	Torrent	R$ 2,255,505.57	50.3%
BR0267503	19.570.720/0001-10	Hipolabor	R$ 13,549,119.78	38.4%
BR0267565	57.507.378/0003-65	EMS Hortolândia	R$ 15,176,489.30	59.2%
BR0271217	61.286.647/0001-16	Sandoz	R$ 21,306,118.63	79.7%
BR0267194	04.099.395/0001-82	Santisa	R$ 429,203,98	60.2%
BR0267140	17.875.154/0001-20	Medquímica	R$ 7.790,867,88	55.4%
BR0267735	02.433.631/0001-20	Aspen	R$ 745.941,51	40.6%
BR0292196	17.174.657/0001-78	Hypofarma	R$ 358,409.46	61.9%

Source: Prepared by authors, 2020.

Table 4. Variation between unit values paid by Health Consortia and Municipal Institutions, 2017 and 2018

BR Code	Mean Value				Weighted Mean Value				Median Value			
	HC	IM	Variation		HC	IM	Variation		HC	IM	Variation	
BR0267140	R$ 0.45	R$ 0.57	HC	26.80%	R$ 0.44	R$ 0.50	HC	13.20%	R$ 0.44	R$ 0.52	HC	16.30%
BR0267194	R$ 0.52	R$ 0.62	HC	20.30%	R$ 0.50	R$ 0.61	HC	17.80%	R$ 0.50	R$ 0.60	HC	16.70%
BR0267197	R$ 0.48	R$ 0.52	HC	7.70%	R$ 0.45	R$ 0.43	MI	6.00%	R$ 0.50	R$ 0.50	=	0.00%
BR0267503	R$ 0.36	R$ 0.42	HC	18.70%	R$ 0.36	R$ 0.39	HC	7.90%	R$ 0.36	R$ 0.40	HC	10.00%
BR0267509	R$ 0.13	R$ 0.15	HC	20.50%	R$ 0.13	R$ 0.12	MI	0.90%	R$ 0.12	R$ 0.14	HC	14.30%
BR0267517	R$ 0.30	R$ 0.39	HC	27.80%	R$ 0.31	R$ 0.33	HC	7.30%	R$ 0.30	R$ 0.38	HC	21.30%
BR0267564	R$ 0.89	R$ 0.13	MI	85.70%	R$ 0.81	R$ 0.12	MI	85.30%	R$ 0.90	R$ 0.12	MI	86.20%
BR0267565	R$ 0.74	R$ 0.63	MI	15.40%	R$ 0.65	R$ 0.67	HC	3.20%	R$ 0.74	R$ 0.70	MI	5.40%
BR0267566	R$ 0.69	R$ 0.62	MI	9.40%	R$ 0.67	R$ 0.71	HC	5.30%	R$ 0.68	R$ 0.70	HC	2.90%
BR0267567	R$ 0.13	R$ 0.17	HC	27.90%	R$ 0.13	R$ 0.14	HC	12.10%	R$ 0.13	R$ 0.15	HC	13.30%
BR0267613	R$ 0.14	R$ 0.23	HC	68.50%	R$ 0.15	R$ 0.22	HC	32.10%	R$ 0.13	R$ 0.20	HC	35.00%
BR0267618	R$ 0.68	R$ 0.65	MI	3.10%	R$ 0.67	R$ 0.66	MI	2.10%	R$ 0.66	R$ 0.69	HC	4.30%
BR0267632	R$ 0.18	R$ 0.22	HC	22.80%	R$ 0.17	R$ 0.19	HC	7.40%	R$ 0.17	R$ 0.20	HC	16.00%
BR0267635	R$ 0.17	R$ 0.21	HC	19.40%	R$ 0.18	R$ 0.19	HC	4.00%	R$ 0.17	R$ 0.20	HC	15.00%
BR0267638	R$ 0.16	R$ 0.20	HC	20.20%	R$ 0.17	R$ 0.18	HC	6.60%	R$ 0.16	R$ 0.18	HC	11.80%
BR0267663	R$ 0.24	R$ 0.33	HC	41.40%	R$ 0.22	R$ 0.30	HC	25.10%	R$ 0.23	R$ 0.30	HC	23.30%
BR0267670	R$ 0.11	R$ 0.13	HC	23.30%	R$ 0.11	R$ 0.12	HC	10.50%	R$ 0.10	R$ 0.12	HC	13.30%
BR0267735	R$ 0.36	R$ 0.40	HC	10.30%	R$ 0.40	R$ 0.38	MI	5.50%	R$ 0.35	R$ 0.38	HC	8.90%
BR0267768	R$ 0.79	R$ 0.13	MI	83.00%	R$ 0.79	R$ 0.12	MI	84.50%	R$ 0.80	R$ 0.12	MI	84.90%
BR0268129	R$ 0.66	R$ 0.77	HC	16.30%	R$ 0.67	R$ 0.69	HC	3.70%	R$ 0.63	R$ 0.72	HC	12.40%
BR0270130	R$ 0.59	R$ 0.73	HC	22.90%	R$ 0.62	R$ 0.74	HC	16.30%	R$ 0.60	R$ 0.75	HC	20.00%
BR0270140	R$ 0.13	R$ 0.18	HC	37.60%	R$ 0.14	R$ 0.16	HC	13.30%	R$ 0.13	R$ 0.17	HC	22.40%
BR0271217	R$ 0.83	R$ 0.99	HC	20.00%	R$ 0.79	R$ 0.93	HC	15.60%	R$ 0.81	R$ 0.96	HC	16.20%
BR0292196	R$ 0.88	R$ 1.25	HC	41.30%	R$ 0.79	R$ 1.13	HC	29.60%	R$ 0.89	R$ 1.17	HC	23.50%

Source: Prepared by authors, 2020.

study considered the "optimal value" to generate the greatest savings.

The lowest calculated unit values were selected to estimate the reduction in monetary volume that could have been practiced. It was identified that there would be a decrease in the financial expenditure of approximately R$ 54.6 million, reflecting a savings of 10.6% on the resources used.

Across the entire sample, the average quantity[6] acquired by the Health Consortia was more significant than that done by Municipal Institutions. It may have contributed to the consortia's acquisitions showing lower average prices for most of the items analyzed. Therefore, it can be pointed out that the Health Consortia had greater purchasing power and more significant savings in financial resources.

Only three items showed divergent results. Items coded BR0267564 and BR0267768 showed lower mean, weighted and median values for the acquisitions of Municipal Institutions. And the code item BR0267565 presented mean and median values below the values found for the consortia[7].

It was found that, on average, the arithmetic mean of the consortia's acquisitions is 12.4% below that presented for the Municipal Institutions. The weighted mean (4.3%) and the median (9.1%) are always favorable to consortia.

Table 6, for the saving percentages of means and median, shows that, e.g., for item BR0267140, the arithmetic mean

6 The average quantity is calculated by the ratio between the total amount purchased by the number of consortia (Average Number of Consortia) or by the number of municipal institutions (Average Quantity of Municipalities).

7 The most used study to identify the causes of this fact is not within the scope of this study.

Table 5. Simulation of using the Lowest Unit Value for the quantity purchased

Item	Quantity	Extraction Resources	Lowest Unit Value	Origin	Quantity x Lowest Unit Value	Savings
BR0267140	29,904,443	R$ 14,054,505.34	R$ 0.44	Median Consortium	R$ 13,157,954.92	-6.4%
BR0267194	1,267,287	R$ 712,654.67	R$ 0.50	Median Consortium	R$ 633,643.50	-11.1%
BR0267197	146,988,625	R$ 64,424,689.75	R$ 0.43	Weighted Mean Municipality	R$ 63,205,108.75	-1.9%
BR0267503	93,386,787	R$ 35,249,790.62	R$ 0.36	Mean Consortium	R$ 33,619,243.32	-4.6%
BR0267509	33,823,167	R$ 4,200,884.59	R$ 0.12	Median Consortium	R$ 4,058,780.04	-3.4%
BR0267517	195,357,899	R$ 63,527,084.01	R$ 0.30	Median Consortium	R$ 58,607,369.70	-7.7%
BR0267564	43,357,058	R$ 17,123,175.33	R$ 0.12	Weighted Mean Municipality	R$ 5,202,846.96	-69.6%
BR0267565	39,097,585	R$ 25,634,326.41	R$ 0.63	Mean Municipality	R$ 24,631,478.55	-3.9%
BR0267566	18,958,992	R$ 13,033,338.61	R$ 0.62	Mean Municipality	R$ 11,754,575.04	-9.8%
BR0267567	33,246,605	R$ 4,486,611.43	R$ 0.13	Wheighted Mean Consortium	R$ 4,322,058.65	-3.7%
BR0267613	190,575,885	R$ 32,388,512.85	R$ 0.13	Median Consortium	R$ 24,774,865.05	-23.5%
BR0267618	149,339,600	R$ 99,880,534.30	R$ 0.65	Mean Municipality	R$ 97,070,740.00	-2.8%
BR0267632	52,845,494	R$ 9,621,034.80	R$ 0.17	Median Consortium	R$ 8,983,733.98	-6.6%
BR0267635	38,225,799	R$ 7,007,873.71	R$ 0.17	Median Consortium	R$ 6,498,385.83	-7.3%
BR0267638	50,747,916	R$ 8,869,839.58	R$ 0.16	Median Consortium	R$ 8,119,666.56	-8.5%
BR0267663	137,476,465	R$ 36,646,580.67	R$ 0.22	Wheighted Mean Consortium	R$ 30,244,822.30	-17.5%
BR0267670	21,043,912	R$ 2,327,069.28	R$ 0.10	Median Consortium	R$ 2,104,391.20	-9.6%
BR0267735	4,763,034	R$ 1,838,736.81	R$ 0.35	Median Consortium	R$ 1,667,061.90	-9.3%
BR0267768	19,441,732	R$ 10,179,774.37	R$ 0.12	Median Municipality	R$ 2,333,007.84	-77.1%
BR0268129	29,088,954	R$ 19,733,781.40	R$ 0.63	Median Consortium	R$ 18,326,041.02	-7.1%
BR0270130	5,636,357	R$ 3,662,586.34	R$ 0.59	Mean Consortium	R$ 3,325,450.63	-9.2%
BR0270140	84,404,595	R$ 12,423,483.34	R$ 0.13	Median Consortium	R$ 10,972,597.35	-11.7%
BR0271217	32,504,373	R$ 26,743,253.58	R$ 0.79	Wheighted Mean Consortium	R$ 25,678,454.67	-4.0%
BR0292196	577,366	R$ 578,851.28	R$ 0.79	Wheighted Mean Consortium	R$ 456,119.14	-21.2%
Total		R$ 514,348,973.06			R$ 459,748,396.90	-10.6%

Source: Prepared by authors, 2020.

(R$ 0.45) of the Health Consortia is 26.8% below the arithmetic mean (R$ 0.57) of Municipal Institutions.

To check that unit prices set were compatible with CMED's prices, a comparison was carried out between the Lowest Unit Value of the Health Consortia and that of the Municipal Institutions, with the average of the regulated price. The CMED value is the average of the PMVG values without taxes for 2017 and 2018, shown in Table 7.

Comparing the prices set in public acquisitions with the CMED price is a way of observing the market. The regulated price is the maximum price allowed for drug sale among manufacturing and supplier companies and pharmacies, drugstores, and public institutions.

The "variation" column shows values resulting from Equation 1, previously shown, and establishes the difference between the "Lowest Unit Value" and the price regulated by the CMED. Positive variation results indicate that, on average, the price set was lower than the regulated price and, therefore, the negative variation values indicate the opposite. Thus, it is expected that the mean unit values set are positive to show more significant savings in the use of resources, pointing to a better scenario. For example, for item BR0267140, the observed variation indicates that the Lowest Unit Value is 86.4% lower than the regulated value. In item BR0267194, the Lowest Unit Value is 25.0% higher than the regulated price.

When comparing the unit prices set to the average regulated value, it was observed that 15 items had their prices below the regulated value. Of these, 11 referred to the prices set by the Health Consortia. However, for nine items with higher prices than the regulated ones, seven were also prices set by the Health Consortia. Even so, the prices of the Health Consortia were, in most of them, lower than the regulated price, showing their relevance in negotiations.

Table 6. Saving Percentage between the prices set and regulated ones, 2017 and 2018

Item	Health Consortia			Municipal Institutions			Means		
	Mean	Weighted	Median	Mean	Weighted	Median	Mean	Weighted	Median
BR0267140	R$ 0.45	R$ 0.44	R$ 0.44	R$ 0.57	R$ 0.50	R$ 0.52	26.8%	15.3%	19.5%
BR0267194	R$ 0.52	R$ 0.50	R$ 0.50	R$ 0.62	R$ 0.61	R$ 0.60	20.3%	21.6%	20.0%
BR0267197	R$ 0.48	R$ 0.45	R$ 0.50	R$ 0.52	R$ 0.43	R$ 0.50	7.7%	-6.0%	0.0%
BR0267503	R$ 0.36	R$ 0.36	R$ 0.36	R$ 0.42	R$ 0.39	R$ 0.40	18.7%	8.5%	11.1%
BR0267509	R$ 0.13	R$ 0.13	R$ 0.12	R$ 0.15	R$ 0.12	R$ 0.14	20.5%	-0.9%	16.7%
BR0267517	R$ 0.30	R$ 0.31	R$ 0.30	R$ 0.39	R$ 0.33	R$ 0.38	27.8%	7.8%	27.0%
BR0267564	R$ 0.89	R$ 0.81	R$ 0.90	R$ 0.13	R$ 0.12	R$ 0.12	-85.7%	-85.3%	-86.2%
BR0267565	R$ 0.74	R$ 0.65	R$ 0.74	R$ 0.63	R$ 0.67	R$ 0.70	-15.4%	3.3%	-5.4%
BR0267566	R$ 0.69	R$ 0.67	R$ 0.68	R$ 0.62	R$ 0.71	R$ 0.70	-9.4%	5.6%	2.9%
BR0267567	R$ 0.13	R$ 0.13	R$ 0.13	R$ 0.17	R$ 0.14	R$ 0.15	27.9%	13.8%	15.4%
BR0267613	R$ 0.14	R$ 0.15	R$ 0.13	R$ 0.23	R$ 0.22	R$ 0.20	68.5%	47.3%	53.8%
BR0267618	R$ 0.68	R$ 0.67	R$ 0.66	R$ 0.65	R$ 0.66	R$ 0.69	-3.1%	-2.1%	4.5%
BR0267632	R$ 0.18	R$ 0.17	R$ 0.17	R$ 0.22	R$ 0.19	R$ 0.20	22.8%	8.0%	19.0%
BR0267635	R$ 0.17	R$ 0.18	R$ 0.17	R$ 0.21	R$ 0.19	R$ 0.20	19.4%	4.2%	17.6%
BR0267638	R$ 0.16	R$ 0.17	R$ 0.16	R$ 0.20	R$ 0.18	R$ 0.18	20.2%	7.0%	13.4%
BR0267663	R$ 0.24	R$ 0.22	R$ 0.23	R$ 0.33	R$ 0.30	R$ 0.30	41.4%	33.5%	30.4%
BR0267670	R$ 0.11	R$ 0.11	R$ 0.10	R$ 0.13	R$ 0.12	R$ 0.12	23.3%	11.7%	15.4%
BR0267735	R$ 0.36	R$ 0.40	R$ 0.35	R$ 0.40	R$ 0.38	R$ 0.38	10.3%	-5.5%	9.7%
BR0267768	R$ 0.79	R$ 0.79	R$ 0.80	R$ 0.13	R$ 0.12	R$ 0.12	-83.0%	-84.5%	-84.9%
BR0268129	R$ 0.66	R$ 0.67	R$ 0.63	R$ 0.77	R$ 0.69	R$ 0.72	16.3%	3.8%	14.1%
BR0270130	R$ 0.59	R$ 0.62	R$ 0.60	R$ 0.73	R$ 0.74	R$ 0.75	22.9%	19.4%	25.0%
BR0270140	R$ 0.13	R$ 0.14	R$ 0.13	R$ 0.18	R$ 0.16	R$ 0.17	37.6%	15.3%	28.8%
BR0271217	R$ 0.83	R$ 0.79	R$ 0.81	R$ 0.99	R$ 0.93	R$ 0.96	20.0%	18.5%	19.4%
BR0292196	R$ 0.88	R$ 0.79	R$ 0.89	R$ 1.25	R$ 1.13	R$ 1.17	41.3%	42.0%	30.8%
Average							12.4%	4.3%	9.1%

Source: Prepared by authors, 2020.

Table 7. Saving Percentage, 2017 and 2018

Item	Lowest Unit Value	Origin	CMED	Variation
BR0267140	R$ 0.44	Median Consortium	R$ 3.24	86.4%
BR0267194	R$ 0.50	Median Consortium	R$ 0.40	-25.0%
BR0267197	R$ 0.43	Weighted Mean Municipality	R$ 0.09	-377.8%
BR0267503	R$ 0.36	Mean Consortium	R$ 0.18	-100.0%
BR0267509	R$ 0.12	Median Consortium	R$ 0.33	63.6%
BR0267517	R$ 0.30	Median Consortium	R$ 0.25	-20.0%
BR0267564	R$ 0.12	Weighted Mean Municipality	R$ 1.12	89.3%
BR0267565	R$ 0.63	Mean Municipality	R$ 1.02	38.2%
BR0267566	R$ 0.62	Mean Municipality	R$ 0.87	28.7%
BR0267567	R$ 0.13	Wheighted Mean Consortium	R$ 1.19	89.1%
BR0267613	R$ 0.13	Median Consortium	R$ 0.25	48.0%
BR0267618	R$ 0.65	Mean Municipality	R$ 0.28	-132.1%
BR0267632	R$ 0.17	Median Consortium	R$ 1.65	89.7%
BR0267635	R$ 0.17	Median Consortium	R$ 0.14	-21.4%
BR0267638	R$ 0.16	Median Consortium	R$ 0.20	20.0%
BR0267663	R$ 0.22	Wheighted Mean Consortium	R$ 0.19	-15.8%
BR0267670	R$ 0.10	Median Consortium	R$ 0.09	-11.1%
BR0267735	R$ 0.35	Median Consortium	R$ 0.95	63.2%
BR0267768	R$ 0.12	Median Municipality	R$ 0.24	50.0%
BR0268129	R$ 0.63	Median Consortium	R$ 0.51	-23.5%
BR0270130	R$ 0.59	Mean Consortium	R$ 0.79	25.3%
BR0270140	R$ 0.13	Median Consortium	R$ 0.16	18.8%
BR0271217	R$ 0.79	Wheighted Mean Consortium	R$ 2.90	72.8%
BR0292196	R$ 0.79	Wheighted Mean Consortium	R$ 3.21	75.4%

Source: Prepared by authors, 2020.

In the analysis of the origin of prices, it was noticed that for 18 times, the lowest values were identified in purchases by Health Consortia. According to the saving percentage, it was observed that purchases through collective purchases tend to generate lower expenses than individual purchases.

Conclusion

The Health Sector has very particular characteristics, and the pharmaceutical industry emphasizes specific economic features of this sector, especially about the market structure. In the drug market, there are many items and a considerable range of manufacturers and suppliers. However, when this market is analyzed from the perspective of therapeutic classes and substances produced, it reveals a high degree of concentration, which justifies the need for public managers to evaluate acquisition arrangements that lead to advantageous negotiations for the SUS.

Anvisa regulates this market and establishes the maximum marketing price for drugs – CMED price. The description for standardizing purchases is carried out in CATMAT/MS. And the HPD system presents a part of this market, as it is intended for recording and consulting information on purchases of health items carried out by public and private institutions.

In turn, institutions that purchase health items can operate in individual or collective purchase processes. Regardless of the type of purchase, all public drug procurement processes must comply with the lowest price requirement. Therefore, in public purchases, the combination of standardization of items and the lowest price is used.

This study has observed the difference in the price set by public health institutions that made purchases via Health Consortia compared to unit values paid by institutions that made individual purchases. For composing the sample, the data available in the HPD system for 2017 and 2018 were used.

The items studied were standardized and registered with Anvisa and have been informed by the purchasing institutions. The sample selection consisted of 24 items, totaling 7,399 records reported by 17 Health Consortia and 710 Municipal Institutions. The sample features 71 manufacturers and 422 suppliers.

As a result, it was noticed that purchases through Health Consortia were relevant in obtaining lower prices. It may be due to the greater bargaining power presented by the consortia, especially the large volume of items traded. The studied consortia operate in the South, Southeast, and Northeast regions and have negotiated more than 741 million items, with a turnover of approximately R$ 275 million.

According to estimates on the lowest value set, there would have been 10,6% savings on financial resources if it had been carried out, representing a reduction of about R$ 55 million in the public treasury. Such savings could have been used for purchasing more drugs or incrementing the sector's activities.

When analyzing the saving percentage, it was noticed that the variation was more efficient in Health Consortia's purchases. And, when reviewing the values established by the CMED, most items are within the limit defined for the purchase of drugs.

Economic evaluations using quantitative and qualitative indicators are relevant for maintaining the quality of public health services. Even if the analysis is of a small sample, it can be used as an indicator for monitoring the reasonableness and efficiency of public expenditures towards government principles (Mastroianni *et al*., 2017).

The collected results follow what had already been identified by studies discussing the topic, i.e., joint purchases tend to be an effective means of reducing costs in health systems. Acquisitions by joining the Health Consortia allowed some savings in the use of resources and a more regular drug supply, also contributing to smaller municipalities, with lower purchasing power and incipient administrative infrastructure to participate in this composition, achieving the same benefits as other participants (Amaral & Blatt, 2011). As stated by Fiuza *et al.* (2020), the consortia concentrate the negotiation and can generate a centralized organization to operationalize the acquisition processes for the benefit of its members.

Silva & Lima (2017) claim that consortia are responsible for providing cost reduction and avoiding drug shortages, so the participation of municipalities in consortia can be one reason that facilitates more the structuring of the acquisition phases, even influencing the availability of various items.

However, mediating purchases only by price is not enough. It is necessary to combine strategies to rationalize stocks, logistics, and management support to obtain quality in the segment. Other factors can also contribute to reducing drug costs, such as: making scheduled purchases and generic drugs; know the supplier; know the product; establish clear rules with suppliers and comply with them; and constitute a purchasing system in which buyers are easily identified (Picolini *et al*., 2016; Luiza *et al*., 1999).

Furthermore, economic efficiency reflects only a nuance of the actual complexity of the segment. Other ways can be applied in the search to solve problems across the sector, such as the standardization of inputs and drugs, the incorporation of treatment protocols, and the rational use of resources, in addition to building contractual relationships between suppliers and buyers (Luiza *et al*., 1999; Ferraes & Cordoni Jr., 2007).

Given the analysis carried out, some limitations of the study that can be further developed had been observed, such as the time frame expansion; extension of the sample size; analysis of purchases recorded by other government levels: state and federal; comparison with an international price; study focused on standardized items in specific treatment protocols; among other aspects that can be included to expand knowledge about the Health Sector.

Finally, the topic presented is relevant. The results found can be used as a benchmark in the definition of government strategies, mainly to improve Pharmaceutical Assistance management. It is a segment that operates values and directly reflects on the well-being of society.

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Appendices

Appendix 1. Description of items for Health Consortia, Municipal Institutions and Total Purchases, 2017 and 2018

Item		Health Consortia (HC)			Municipal Institutions (MI)			Total Purchases (HC + MI)		
BR Code	Description	HC	Records	Quantity	MI	Records	Quantity	HC + MI	Records	Quantity
BR0267140	Azithromycin, 500 mg – Tablet	13	23	14,482,595	322	391	15,421,848	335	414	29,904,443
BR0267194	Diazepam, 5 mg/mL, Injectable Solution – 2.00 mL vial	12	19	579,044	238	281	688,243	250	300	1,267,287
BR0267197	Diazepam, 10 mg – Tablet	13	23	61,132,303	260	315	85,856,322	273	338	146,988,625
BR0267503	Folic Acid, 5 mg – Tablet	13	21	43,844,045	300	374	49,542,742	313	395	93,386,787
BR0267509	Allopurinol, 300 mg – Tablet	11	18	8,373,580	234	293	25,449,587	245	311	33,823,167
BR0267517	Atenolol, 50 mg – Tablet	12	19	74,698,620	373	471	120,659,279	385	490	195,357,899
BR0267564	Carvedilol, 12.5 mg – Tablet	09	13	17,399,150	190	234	25,957,908	199	247	43,357,058
BR0267565	Carvedilol, 6.25 mg – Tablet	10	16	32,217,324	75	81	6,880,261	85	97	39,097,585
BR0267566	Carvedilol, 3.125 mg – Tablet	10	13	9,984,745	122	139	8,974,247	132	152	18,958,992
BR0267567	Carvedilol, 25 mg – Tablet	12	19	14,234,603	196	242	19,012,002	208	261	33,246,605
BR0267613	Captopril, 25 mg – Tablet	12	21	131,988,575	202	233	58,587,310	214	254	190,575,885
BR0267618	Carbamazepine, 200 mg – Tablet	12	21	95,792,759	186	212	53,546,841	198	233	149,339,600
BR0267632	Ciprofloxacin hydrochloride, 500 mg – Tablet	14	21	17,204,036	396	506	35,641,458	410	527	52,845,494
BR0267635	Chlorpromazine, 25 mg – Tablet	14	23	18,725,442	295	366	19,500,357	309	389	38,225,799
BR0267638	Chlorpromazine, 100 mg – Tablet	15	22	28,606,097	286	358	22,141,819	301	380	50,747,916
BR0267663	Furosemide, 40 mg – Tablet	12	20	59,063,375	234	272	78,413,090	246	292	137,476,465
BR0267670	Haloperidol, 1 mg – Tablet	11	14	12,213,830	248	302	8,830,082	259	316	21,043,912
BR0267735	Ranitidine Hydrochloride, 25 mg/mL, Injectable Solution – 2.00 mL vial	12	19	2,087,862	275	323	2,675,172	287	342	4,763,034
BR0267768	Promethazine Hydrochloride, 25 mg – Tablet	12	18	11,635,740	186	202	7,805,992	198	220	19,441,732
BR0268129	Levomepromazine, 100 mg – Tablet	13	26	13,867,165	278	353	15,221,789	291	379	29,088,954
BR0270130	Levodopa combined with Carbidopa, 250 mg + 25 mg – Tablet	12	21	4,121,080	96	104	1,515,277	108	125	5,636,357

Item		Health Consortia (HC)			Municipal Institutions (MI)			Total Purchases (HC + MI)		
BR Code	**Description**	**HC**	**Records**	**Quantity**	**MI**	**Records**	**Quantity**	**HC + MI**	**Records**	**Quantity**
BR0270140	Biperiden, 2 mg – Tablet	15	22	44,569,025	343	440	39,835,570	358	462	84,404,595
BR0271217	Amoxicillin combined with Potassium Clavulanate, 500 mg + 125 mg – Tablet	14	22	24,212,711	143	166	8,291,662	157	188	32,504,373
BR0292196	Haloperidol, 5 mg/mL, Injectable Solution – 1.00 mL vial	13	20	215,590	239	267	361,776	252	287	577,366
Total	24 items	296	474	741,249,296	5,717	6,925	710,810,634	6,013	7,399	1,452,059,930

Source: Prepared by authors, 2020.

Appendix 2. Health Consortia, 2017 and 2018

Institution	Municipality	FU	Region	Municipalities	Population*
Consórcio Intermunicipal do Sul do Estado de Alagoas – CONISUL	Penedo	AL	NE	18	592,878
Consórcio Intermunicipal do Vale do São Francisco – CONIVALES	Amparo de São Francisco	SE	NE	13	150,474
Consórcio Intermunicipal de Saúde do Médio Paraopeba	Betim	MG	SE	39	2,272,066
Consórcio Intermunicipal do Oeste Paulista	Presidente Prudente	SP	SE	24	545,065
Consórcio Intermunicipal de Saúde do Vale do Paranapanema	Assis	SP	SE	27	434,941
Consórcio de Desenvolvimento da Região de Governo de S.J.B.Vista	Casa Banca	SP	SE	16	501,574
Consórcio Intermunicipal de Saúde	Pato Branco	PR	S	20	178,746
Consórcio Intermunicipal de Saúde do Oeste de SC	Chapecó	SC	S	22	320,938
Consórcio Intermunicipal de Saúde do Nordeste de Santa Catarina	Joinville	SC	S	12	1,091,189
Consórcio Intermunicipal de Saúde do Médio Vale do Itajaí	Blumenau	SC	S	15	795,067
Consórcio Intergestores Paraná Saúde	Curitiba	PR	S	397	9,172,929
Consórcio Intermunicipal de Saúde do Vale do Rio Taquari – CONSISA – VRT	Lajeado	RS	S	37	338,966
Consórcio Intermunicipal do Vale do Rio Caí – CIS-CAÍ	Montenegro	RS	S	23	234,253
Consórcio Intermunicipal de Saúde do Alto Vale do Itajaí – CISAMAVI	Rio do Sul	SC	S	28	295,201
Consórcio Intermunicipal Catarinense – CIMCatarina	Florianópolis	SC	S	74	990,207
Consórcio Intermunicipal de Desenvolvimento Sustentável da Serra Gaúcha – CISGA	Garibaldi	RS	S	17	377,193
Consórcio Integrado de Gestão Pública do Entre Rios – CIGAMERIOS	Maravilha	SC	S	17	110,321
TOTAL				799	18,402,008

Source: Prepared by authors, 2020.

*Estimated population - 2018 (IBGE, 2020).

For 2018, the estimated population for the 5,570 Brazilian municipalities was 208,494,900 inhabitants. Thus, the studied consortia represent 14.3% of the municipalities and 8.8% of the population.

Appendix 3. Municipal Health Institutions, 2017 and 2018

Region [No. of municipalities]	State (No. of municipalities): Municipalities*
Central-West [33]	**Goiás (12):** Abadiânia, Buriti Alegre, Caldazinha, Campo Alegre de Goiás, Córrego do Ouro, Goianésia, Goiás, Mineiros, Morrinhos, Ouvidor, Paraúna e Rianápolis. **Mato Grosso (19):** Anastácio, Aparecida do Taboado, Aquidauana, Bataguassu, Batayporã, Brasilândia, Camapuã, Corguinho, Douradina, Figueirão, Ivinhema, Laguna Carapã, Nova Andradina, Paranaíba, Santa Rita do Pardo, Selvíria, Sidrolândia, Sonora e Três Lagoas. **Mato Grosso do Sul (2):** Campo Verde e Comodoro..
Northeast [199]	**Alagoas (11):** Campestre, Canapi, Coqueiro Seco, Estrela de Alagoas, Jacaré dos Homens, Maceió, Murici, Paulo Jacinto, Piranhas, Santana do Mundaú e São Miguel dos Milagres. **Bahia (7):** Amargosa, Boa Vista do Tupim, Ibipitanga, Itaparica, Piritiba, Remanso e Santa Cruz da Vitória. **Ceará (5):** Fortaleza, Jardim, Quixeré, Sobral e Viçosa do Ceará. **Paraíba (74):** Aguiar, Alagoinha, Algodão de Jandaíra, Alhandra, Aparecida, Araçagi, Arara, Araruna, Baía da Traição, Bananeiras, Barra de Santana, Belém, Boa Ventura, Boa Vista, Cabedelo, Cacimba de Dentro, Caiçara, Caldas Brandão, Capim, Carrapateira, Casserengue, Condado, Conde, Cuité, Cuitegi, Damião, Dona Inês, Duas Estradas, Esperança, Frei Martinho, Gurinhém, Ingá, Itabaiana, Itapororoca, Jericó, João Pessoa, Joca Claudino, Juarez Távora, Juazeirinho, Juripiranga, Lagoa de Dentro, Logradouro, Lucena, Mamanguape, Manaíra, Marcação, Mataraca, Mogeiro, Natuba, Nazarezinho, Nova Floresta, Nova Palmeira, Pedras de Fogo, Pedro Régis, Pilar, Pilões, Pilõezinhos, Pirpirituba, Riachão, Riachão do Bacamarte, Salgado de São Félix, São Bentinho, São Francisco, São João do Rio do Peixe, São José da Lagoa Tapada, São José de Caiana, São José dos Ramos, São Miguel de Taipu, Serra da Raiz, Serra Grande, Sertãozinho, Solânea, Sossêgo e Tacima. **Pernambuco (29):** Afogados da Ingazeira, Água Preta, Alagoinha, Aliança, Barreiros, Belém de Maria, Bom Jardim, Cabrobó, Catende, Condado, Cortês, Escada, Feira Nova, Ferreiros, Gameleira, Igarassu, Ipojuca, Itambé, Macaparana, Machados, Palmares, Paudalho, Saloá, São Benedito do Sul, São Joaquim do Monte, São José da Coroa Grande, Tamandaré, Vicência e Xexéu. **Piauí (46):** Alagoinha do Piauí, Alto Longá, Alvorada do Gurguéia, Antônio Almeida, Aroazes, Baixa Grande do Ribeiro, Barra D'Alcântara, Batalha, Bertolínia, Bom Princípio do Piauí, Buriti dos Montes, Campo Alegre do Fidalgo, Campo Maior, Canavieira, Castelo do Piauí, Colônia do Gurguéia, Conceição do Canindé, Dom Inocêncio, Domingos Mourão, Esperantina, Floresta do Piauí, Francinópolis, Francisco Ayres, Fronteiras, Itainópolis, Lagoa Alegre, Lagoa de São Francisco, Landri Sales, Marcos Parente, Miguel Alves, Nazária, Novo Santo Antônio, Oeiras, Pajeú do Piauí, Porto Alegre do Piauí, Redenção do Gurguéia, Rio Grande do Piauí, Santa Cruz dos Milagres, São Francisco de Assis do Piauí, São Francisco do Piauí, São Gonçalo do Piauí, São João da Serra, São João da Varjota, São José do Divino, São José do Piauí e Tanque do Piauí. **Rio Grande do Norte (21)**: Água Nova, Angicos, Caicó, Caraúbas, Carnaubais, Coronel Ezequiel, Florânia, Frutuoso Gomes, Lajes, Macaíba, Major Sales, Monte das Gameleiras, Natal, Olho-D'Água do Borges, Pendências, Rodolfo Fernandes, São João do Sabugi, São Rafael, Severiano Melo, Taboleiro Grande e Viçosa. **Sergipe (6):** Aracaju, Canhoba, Cedro de São João, Itabaiana, Pacatuba e Porto da Folha.
North [26]	**Acre (3):** Manoel Urbano, Rio Branco e Xapuri. **Pará (7):** Castanhal, Conceição do Araguaia, Jacundá, Monte Alegre, Paragominas, Sapucaia e Xinguara. **Rondônia (6):** Buritis, Ji-Paraná, Mirante da Serra, Pimenta Bueno, Teixeirópolis e Vilhena. **Roraima (2):** Boa Vista e Bonfim. **Tocantins (8):** Centenário, Cristalândia, Guaraí, Pedro Afonso, Pequizeiro, Pium, Porto Nacional e Recursolândia.
Southeast [259]	**Espírito Santo (32):** Água doce do Norte, Alegre, Anchieta, Aracruz, Barra de São Francisco, Boa Esperança, Cachoeiro de Itapemirim, Cariacica, Castelo, Ecoporanga, Fundão, Governador Lindenberg, Guaçuí, Ibiraçu, Itapemirim, Jaguaré, Jerônimo Monteiro, João Neiva, Laranja da Terra, Linhares, Marataízes, Mucurici, Nova Venécia, Presidente Kennedy, Santa Maria de Jetibá, São Roque do Canaã, Serra, Venda Nova do Imigrante, Viana, Vila Pavão, Vila Velha e Vitória. **Minas Gerais (63):** Alpinópolis, Alto Jequitibá, Araporã, Arceburgo, Areado, Bambuí, Betim, Bom Despacho, Bom Jesus do Amparo, Cachoeira Dourada, Campina Verde, Campos Gerais, Capinópolis, Cascalho Rico, Cássia, Delfinópolis, Divisa Nova, Doresópolis, Engenheiro Navarro, Estrela do Sul, Franciscópolis, Governador Valadares, Grupiara, Guapé, Guaranésia, Guaxupé, Ibiraci, Indianópolis, Ipatinga, Ipiaçu, Itamarandiba, Itamogi, Itaú de Minas, Iturama, Jacuí, Januária, Juruaia, Lamim, Manhuaçu, Monte Alegre de Minas, Monte Carmelo, Montes Claros, Muzambinho, Nova Era, Nova Ponte, Pai Pedro, Paraguaçu, Piumhi, Prata, Rio Pomba, Santa Vitória, São João Batista do Glória, São José da Barra, São Pedro da União, São Roque de Minas, São Sebastião do Oeste, São Tomás de Aquino, Senhora dos Remédios, Tupaciguara, Uberlândia, Vargem Bonita, Varginha e Visconde do Rio Branco. **Rio de Janeiro (8):** Cachoeiras de Macacu, Itaguaí, Paty do Alferes, Petrópolis, Rio Bonito, São Fidélis, Três Rios e Volta Redonda.

Region [No. of municipalities]	State (No. of municipalities): Municipalities*
Southeast [259]	**São Paulo (156):** Aguaí, Agudos, Altinópolis, Álvaro de Carvalho, Américo Brasiliense, Anhumas, Arandu, Araraquara, Areiópolis, Artur Nogueira, Arujá, Assis, Atibaia, Avaí, Avaré, Balbinos, Barretos, Barrinha, Barueri, Bastos, Batatais, Bauru, Birigui, Boa Esperança do Sul, Bom Jesus dos Perdões, Boracéia, Brotas, Caiabu, Cândido Rodrigues, Caraguatatuba, Cássia dos Coqueiros, Catanduva, Cerqueira César, Conchas, Cotia, Diadema, Divinolândia, Dobrada, Dourado, Duartina, Embu das Artes, Embu-Guaçu, Emilianópolis, Fartura, Fernandópolis, Florínia, Francisco Morato, Garça, Gavião Peixoto, Guará, Guarantã, Guararema, Guarujá, GuataPará, Holambra, Ibaté, Ibirá, Ibirarema, Igarapava, Ilhabela, Itapecerica da Serra, Itapetininga, Itápolis, Itaquaquecetuba, Itirapuã, Jaboticabal, Jacareí, Jaguariúna, Jardinópolis, Junqueirópolis, Lins, Lucianópolis, Luís Antônio, Lupércio, Macatuba, Manduri, Maracaí, Martinópolis, Matão, Meridiano, Mirante do Paranapanema, Mogi das Cruzes, Monções, Monte Alto, Nantes, Neves Paulista, Nova Europa, Osasco, Oscar Bressane, Panorama, Paraguaçu Paulista, Paranapanema, Pederneiras, Piacatu, Piedade, Piquerobi, Pirapora do Bom Jesus, Pirassununga, Platina, Pongaí, Pontalinda, Porangaba, Porto Ferreira, Pradópolis, Pratânia, Presidente Prudente, Regente Feijó, Registro, Ribeirão Preto, Rincão, Sales Oliveira, Salto, Santa Branca, Santa Clara d'Oeste, Santa Cruz da Conceição, Santa Cruz da Esperança, Santa Cruz do Rio Pardo, Santa Ernestina, Santa Fé do Sul, Santa Gertrudes, Santa Lúcia, Santa Rita do Passa Quatro, Santo André, Santo Antônio de Posse, Santo Antônio do Jardim, Santópolis do Aguapeí, Santos, São Bernardo do Campo, São Caetano do Sul, São João da Boa Vista, São José do Rio Pardo, São Manuel, São Paulo, São Sebastião, São Sebastião da Grama, São Vicente, Serrana, Sertãozinho, Socorro, Tabatinga, Taboão da Serra, Taciba, Taiúva, Tambaú, Taquaral, Taquaritinga, Tejupá, Trabiju, Três Fronteiras, Ubarana, Ubatuba, Uchoa, Uru, Várzea Paulista, Vera Cruz e Votuporanga.
South [193]	**Paraná (136):** Adrianópolis, Agudos do Sul, Almirante Tamandaré, Alto Paraíso, Alto Paraná, Altônia, Amaporã, Antônio Olinto, Apucarana, Arapuã, Araucária, Ariranha do Ivaí, Assis Chateaubriand, Astorga, Balsa Nova, Bandeirantes, Barracão, Bituruna, Boa Esperança do Iguaçu, Boa Vista da Aparecida, Bocaiúva do Sul, Bom Jesus do Sul, Cafeara, Cafezal do Sul, Califórnia, Cambé, Campo do Tenente, Campo Largo, Campo Magro, Campo Mourão, Cândido de Abreu, Capanema, Carlópolis, Cascavel, Cianorte, Cidade Gaúcha, Clevelândia, Colombo, Colorado, Contenda, Coronel Vivida, Cruzeiro do Iguaçu, Curitiba, Douradina, Doutor Camargo, Esperança Nova, Fazenda Rio Grande, Floraí, Flórida, Formosa do Oeste, Foz do Iguaçu, Francisco Alves, Goioerê, Grandes Rios, Guamiranga, Guaporema, Iguaraçu, Imbituva, Inácio Martins, Indianópolis, Itambé, Jacarezinho, Jandaia do Sul, Japurá, Jataizinho, Juranda, Lapa, Laranjeiras do Sul, Leópolis, Lidianópolis, Lobato, Lunardelli, Lupionópolis, Mandaguari, Mandirituba, Mangueirinha, Marechal Cândido Rondon, Maria Helena, Marialva, Maringá, Maripá, Marmeleiro, Matelândia, Mercedes, Missal, Nossa Senhora das Graças, Nova Aurora, Nova Esperança, Nova Esperança do Sudoeste, Nova Tebas, Ouro Verde do Oeste, Paiçandu, Palotina, Paraíso do Norte, Paranavaí, Paula Freitas, Piên, Pinhais, Piraquara, Planaltina do Paraná, Pranchita, Prudentópolis, Querência do Norte, Quitandinha, Realeza, Renascença, Reserva, Ribeirão do Pinhal, Rio Azul, Rio Negro, Rolândia, Roncador, Rondon, Sabáudia, Salto do Lontra, Santa Fé, Santa Helena, Santa Isabel do Ivaí, Santa Terezinha de Itaipu, Santo Antônio da Platina, São João, São João do Ivaí, São João do Triunfo, São Jorge do Ivaí, São Jorge do Patrocínio, São José dos Pinhais, São Mateus do Sul, São Pedro do Iguaçu, São Pedro do Paraná, Sarandi, Tamarana, Toledo, Ubiratã, Umuarama, União da Vitória e Uniflor. **Rio Grande do Sul (18):** Barão do Triunfo, Barra do Ribeiro, Camaquã, Capivari do Sul, Charqueadas, Coqueiro Baixo, Eldorado do Sul, Independência, Lindolfo Collor, Mostardas, Nova Hartz, Novo Hamburgo, Osório, Palmares do Sul, Santo Antônio da Patrulha, São Jerônimo, São José do Norte e Xangri-Lá. **Santa Catarina (39):** Anchieta, Bandeirante, Barra Bonita, Blumenau, Braço do Norte, Campo Erê, Campos Novos, Criciúma, Descanso, Dionísio Cerqueira, Entre Rios, Florianópolis, Forquilhinha, Guaramirim, Guarujá do Sul, Jaraguá do Sul, Joinville, Lages, Massaranduba, Mondaí, Nova Itaberaba, Otacílio Costa, Ouro, Palhoça, Palma Sola, Papanduva, Paraíso, Peritiba, Pinhalzinho, Princesa, Saltinho, Santa Terezinha do Progresso, São Domingos, São Miguel do Oeste, Schroeder, Sul Brasil, Tunápolis, União do Oeste e Xavantina.
710 Municipalities**	

Source: Prepared by authors, 2020.

*Municipal Institutions (Municipal Health Departments, Municipal Health Foundations, Municipal Health Funds and/or Municipal Governments).

**The 710 municipalities of these institutions represent 12.7% of 5,570 municipalities in the country. The estimated population for 2018 is over 53 million inhabitants, about 25.6% of the population in Brazil (IBGE, 2020).

ORIGINAL ARTICLE
ORIGINAL ARTICLE

Efficiency in hospital care in Brazilian capitals for the period 2014-2017

Eficiência nos atendimentos hospitalares nas capitais brasileiras no período de 2014-2017

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health care sector, outpatient care, resource allocation

ABSTRACT

Objective: Analyze the level of efficiency of the hospital care in the Brazilian capitals and the Federal District between the years 2014 to 2017. **Methods:** The investigation method used was the Data Envelopment Analysis to estimate resource the resource efficiency levels. **Results:** The results indicate that there are differences in the level of efficiency of the state capitals and the Federal District, making it possible to develop the potential of inefficient units, in order to increase technical efficiency in hospital care. **Conclusion:** Analyzing the use of public resources helps to identify whether resources are being applied efficiently and when not, they signal the need for decision making that is more consistent with the reality of each capital.

Palavras-chave:
setor de assistência à saúde, atendimento ambulatorial, alocação de recursos

RESUMO

Objetivo: Analisar o nível de eficiência dos atendimentos hospitalares nas capitais brasileiras e Distrito Federal entre os anos de 2014 e 2017. **Métodos:** O método de investigação utilizado foi a Análise Envoltória de Dados para estimar os níveis de eficiência dos recursos. **Resultados:** Os resultados indicam que ocorrem diferenças no nível de eficiência das capitais estaduais e Distrito Federal, sendo possível desenvolver o potencial das unidades ineficientes, de forma que aumentem a eficiência técnica nos atendimentos hospitalares. **Conclusão:** Analisar o uso dos recursos públicos contribui para identificar se os recursos estão sendo aplicados de forma eficiente e, quando não, sinaliza para a necessidade de tomada de decisões mais coerentes com a realidade de cada capital.

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Introduction

The search for efficiency has been very recurrent in the public sphere, being linked to production quality, waste reduction, greater efficiency and lower costs. In the health sector, in addition to these functions, increased efficiency enables comprehensive access, at the lowest possible cost, since needs are unlimited, resources are finite and costs are increasing; thus, the importance of obtaining maximum efficiency in the use of material, human and financial resources in the sector is highlighted.

The concept of efficiency results from comparing the amount produced and what could have been produced, considering the same amount of available resources. Efficiency can be separated into technical, productive and allocative efficiency. Technical efficiency results from comparing performances of production units from different institutional environments or from institutions of different natures. In production, efficiency can be divided between productive efficiency and allocative efficiency. The first refers to the ability to avoid waste, producing the best possible results regarding the resources used or making use of the least possible resources for the same production (Mello *et al*., 2005).

Productive efficiency can aim for production growth – by increasing production levels, keeping the same amount of resources – or it can be oriented towards saving resources – which goal is to reduce resources used and maintain the same production levels – or even for a combination of these two types of efficiency. The goal is to achieve maximum productivity by eliminating inefficiencies. Allocative efficiency, on the other hand, comes from the ability to combine inputs and products in optimal proportions, with prevailing prices. The absence of any type of price-value relationship between the results of a given activity makes the assessment of allocative efficiency unfeasible (Casado & Souza, 2005).

In public sectors, several factors make it impossible to reach an optimal and efficient level of resource use, such as negative externalities, information asymmetry, opportunism, incomplete markets, scale decreasing returns, lack of transparency, government failures, excessive bureaucracy and other market distortions. The lack of political coalitions capable of encouraging sustained economic development and promoting social inclusion for a large part of society can also be considered an obstacle to achieving the efficiency of public resources (Gruening, 2001; Fernandes, 2016; Souza, 2006).

In the health sector, there is a growing concern regarding quality and effectiveness of the provision of public services. The use of techniques and methods that enable evaluating efficiency is a reference to regional units, being increasingly frequent. Analyzes of this type aim to identify the maximum product level, considering the amount of productive factors used, allowing a a better perception on how to achieve the greatest number of health products and services with the resources available (Fonseca & Ferreira, 2009).

The search for the available resources' technical efficacy is strictly related to four basic points that comprehend health management: care cost, opportunity cost, possibility of planning actions based on results and competence to identify whether the outlined actions are being obtained. The use of these indicators allows different health institutions to guide their actions towards the intended goals (Fonseca & Ferreira, 2009).

Public policies generally need constant evaluation due to problems found in the public sphere, related to results, social impacts and resource constraints. Among the characteristics of social programs are the care for several and multiple purposes, usually difficult to check *a priori*, given their limited possibilities of recognition (Marinho & Façanha, 2001).

The evaluation of public policies is linked to the causal relationship between policy and result. Thus, using research methods and techniques contributes to establish a relationship between resources and products. The evaluation is based on assessing results of policies/actions/programs/projects, verifying their efficiency, efficacy and effectiveness (Dalfior *et al*., 2015). This means that the assembled investments must generate the desired effects in defining the action.

Given the operational decentralization of health programs between the levels the federation (state, city and district), complex organizational and administrative assemblies are required, whose purposes are developed and performed by agents, that are complex organizations (for example, universities, hospitals and social organizations). This fact leads to problems of coordination between program goals and agents' objectives, for example. Furthermore, financing and transfer rules are generally not integrated and structured according to the objectives pursued, due to difficulties in measuring program goals, which may reduce the motivation of rules and financing instruments (Marinho & Façanha, 2001).

The expiration horizon of social programs, which usually extends beyond fiscal and budgetary years, subordinates the programs, on the one hand, to general resource constraints and recurring disputes for resources, and, on the other, to formal control mechanisms of government activities (Marinho & Façanha, 2001).

Public policies are usually assessed based on financial and non-monetary resources (resources/inputs), directed towards implementing and executing a policy or program that searches material and immaterial achievements (products/outputs) and the effects or results (results/outcome) generated in an economy or territory (Santos *et al*., 2015).

Once the objectives of the action have been established and its extension and available resources delimited, it is expected that the results fully contemplate the objectives. Not identifying efficient results suggests the remodeling of

actions to reach their end. To prevent results that differ from those established, follow-up and monitoring of actions are essential. Likewise, analyzing what has already been done exemplifies what can be adjusted in the search for the best results of the next policies.

Among the methods most seen in the literature for evaluating policies or programs is Data Envelopment Analysis (DEA). DEA calculates the maximum efficiency limit for certain inputs and outputs, showing the amount executed and what could be done to reduce inefficiency. DEA can be used in financial and budgetary, material, human resources and program analyses, as it relates effective rules for resource distribution with the reality in which the programs cause impact (Almeida, 2017).

This method was chosen to investigate the object of analysis of this article, evaluating levels of efficiency of hospital care in the Brazilian Public Health System (SUS), in state capitals and the Federal District, in the years 2014 to 2017. The methodology used was the DEA method applied to the SUS results, published on the official websites of SUS' IT Department (Datasus) and the National Register of Health Establishments (*CNES – Cadastro Nacional de Estabelecimentos de Saúde*).

Several points interfere in the functioning of the health sector; the most relevant are financial, administrative and organizational. However, there is pressure to reduce public resources, with the need to implement more technological and sophisticated treatments, increase supply and reduce costs. All these obstacles affect the sector's management and can be analyzed regarding performance (Guerra, 2011).

Therefore, the work is justified by the need to measure differences in efficiency, as it can help to disseminate the most successful models and follow them as parameters for improvement in less efficient organizations. Thus, the theme is relevant given the need to identify possible gaps not used to improve the efficiency of a program, sector or public policy.

Methods

DEA is a statistical method of non-linear programming to classify in efficiency levels the different resources in generating the best results. The approach is very relevant when considering public resources, since, given what was used, the result exposes what could have been reduced while maintaining the same product and serves as an instrument for evaluating and monitoring public resources (Silva *et al*., 2017).

Based on the idea that public health resources should be made available in the best way to serve the majority of the population that needs public health care, the approach becomes relevant as policy and management instrument (Marinho & Façanha, 2001).

DEA is a widely used method to measure the efficiency of production units, by comparing the available resources, since the search to quantify the efficiency in the management of the health sector is verified on a global scale. Through this, it is possible to monitor and adjust suggestions for the management units. Furthermore, it allows society to verify how public resources are being managed.

The concept of efficiency that guided the formulation of the method started with the study of Koopmans (1951) and Debreu (1951), approaching the definition of productive efficiency. In 1957, Farrell developed a procedure to calculate Debreu's productive efficiency indicator. In 1978, Charnes et al. generalized Farrell's studies to work with multiple resources and multiple outcomes. After this work, the technique was developed for the construction of production frontiers and productive efficiency indicators. And, in 1984, Banker et al. developed the modality of variable returns to scale

DEA is a non-parametric linear programming method used to assess the efficiency and productivity of decision-making units (DMUs). The method seeks to measure the efficiency of DMUs through linear programming techniques to observe in detail the input vectors (material/inputs) and the output vectors (product/outputs). The DEA analysis methodology allows, at the same time, multiple inputs and outputs to be weighted, regardless of data distribution (Almeida, 2017).

To analyze the efficiency of a DMU, input (to minimize resources, keeping results values constant) or output (to maximize outputs without decreasing inputs) orientation can be used. Efficient DMUs should not be dominated by any other DMU, determining efficacy boundaries. The closer to 1, the more efficient the DMU is considered.

DEA calculates the technical efficiency (TE) by maximizing the ratio between outputs and inputs, following the mathematical notation (1) subject to restrictions and weight vectors for products and inputs.

$$ET_{DMU_i} = \frac{\mu' y_i}{v' x_i} = \frac{\mu_i y_{1i}}{v_1 x_{1i}} + \cdots + \frac{\mu_m y_{mi}}{v_2 x_{mi}} \quad (1)$$

μ is the column vector (m x 1) of output weights and v is the column vector (k x 1) of input weights. The optimal weights are the results of a mathematical programming model for each DMU, according to equation (2), which aims for the optimal set of weights.

$$\underset{y,v}{\text{MAX}}\left(\frac{\mu' y_i}{v' x_i}\right), \textit{ subject to: } \frac{\mu' y_i}{v' x_j} \leq 1; j = 1,2,\ldots,I \; e \; \mu, v \geq 0 \quad (2)$$

The mathematical programming model finds values for μ and v to maximize the efficiency of the i-th DMU. With the restriction imposed on the problem, no efficiency measure is greater than 1. This formulation can provide infinite solutions to the problem, even with the non-negativity imposition of the vector weights. As a correction for this result, another restriction is imposed on the model so that it has a single solution – equation (3).

$$\underset{y,v}{\text{MAX}}(\mu' y_i), \textit{ subject to: } v' x_i = 1, \mu' y_i - v' x_j \leq 0; j = 1,2,\ldots,I \; e \; \mu, v \geq 0 \quad (3)$$

The model observed in equation (3) can be derived into an equivalent problem by duality in linear programming using envelope form. The dual form represents a minimization model, defined in the equation (4).

$$\underset{\theta,\lambda}{\text{MIM}}\, \theta \text{ , subject to: } -y_i + Y\lambda \geq 0, \theta x_i - X\lambda \geq 0;\ e\,\lambda \geq 0 \qquad (4)$$

Here, θ is a scalar and λ is a vector of constant I x 1, whose values are computed to obtain the optimal solution in which the efficient firm will have all λ equal to zero. The scalar θ provides the firm's efficiency measure, with values between 0 and 1; if θ is equal to unity, the i-th firm is efficient, otherwise the firm has a certain degree of inefficiency. In inefficient firms, the values of λ will be used as the weights in the linear combination of other efficient firms, which should serve as a reference for the efficient unit in relation to the generated frontier. Efficient firms will be benchmarks for inefficient units. (Almeida, 2017).

The DEA technique can be segregated into two models:

- CRS (Constant Returns to Scale) or CCR – developed by Charnes et al. in 1978, this model assumes constant returns to the production scale and adopts proportionality between input and output;
- VRS (Variable Returns to Scale) or BCC; created by Banker et al. in 1984, assumes variable returns to scale, which can be: NIRS (Non-Increasing Returns to Scale), IRS (Increasing Returns to Scale), and DRS (Decreasing Returns to Scala).

This methodology has several advantages: it does not require prior knowledge of weights, inputs and products; inputs and outputs can be measured in different units, being invariant in relation to scale; any type of production function is considered; it can integrate expert opinion to plan, monitor and evaluate certain projects/programs; results in specific estimates of targeted changes in inputs and outputs for projecting DMUs below the efficiency frontier; its calculation focuses on identified best practices, rather than measures of central tendency of the borders (Ji & Lee, 2010; Casado & Souza, 2005).

Disadvantages pervade: as a non-parametric technique, it is difficult to formulate statistical hypotheses; it may take long computational time, for its linear programming for each unit under analysis; it is an extreme point methodology, and measurement errors can hamper the analysis of results; the results are sensitive to the methodology in relation to the number of inputs and outputs used and the size of the DMUs samples, that is, by increasing the number of DMUs, there is a tendency to reduce the average of the sample's efficiency scores, as the higher the number of DMUs, the greater the number of DMUs at the border may be, moreover, when the size of the DMUs is small in relation to the sum of the number of inputs and outputs, the average efficiency of the sample tends to increase, it is recommended that the size of observed DMUs from the sample is at least three times greater than the sum of inputs and outputs; the methodology only results in relative efficiency measures within a particular sample, and the scores between two different results cannot be compared whenever practices are unknown (Ji & Lee, 2010; Casado & Souza, 2005).

Given the advantages and disadvantages, in economic literature, recognizing DEA as a powerful tool to aid decision-making is remarkable. DEA is an instrument that compares productive units in order to find an efficiency frontier that can be reference for the units considered inefficient, within the analyzed DMUs.

In this article, the BCC (or VRS) model with input-oriented orientation was used to measure how much resources could be reduced by keeping the results values constant. As it is not possible to change the results based on ex-post analysis, the method tries to calculate possible inputs reduction to reach the same product.

Given the limited resources allocated to health in Brazil, the analysis seeks to prioritize the optimization of available resources with the lowest possible costs. The guidance for minimizing inputs, in the variable returns to scale model, may represent the ideas of those who performed the procedure, and the focus is to improve the use of resources (Guerra, 2011).

Definition of variables

To assess the efficiency of hospital care in Brazilian capitals and in the Federal District, a quantitative survey with descriptive approach was performed. The database was collected on Datasus and CNES websites from 2014 to 2017. The data were tabulated in the statistical program Stata 13.

All information was collected from the SUS Hospital Information System (SIH/SUS – *Sistema de Informações Hospitalares do SUS*), under the Ministry of Health, through the Health Care Department, State Health Departments and Municipal Health Departments. The hospital units collaborating with SUS, being public or private affiliated, send information on admissions made through the Hospital Admission Authorization (AIH – *Autorização de Internação Hospitalar*) to municipal or state managers. Datasus consolidates and processes this information, forming the database.

Brazil has a territorial extension that involves several regional and access inequalities. Hospital health care is concentrated in Brazilian capitals, as very small municipalities do not have enough capacity and resources for this type of service. Thus, the sample cut was made to assess the hospital efficiency of the 26 capital states and the federal district.

The selection of variables used for the analysis was based on works that study the topic, as shown in Chart 1. The research sample covers the 27 Brazilian capitals. Each Brazilian capital represents a DMU, interaction between inputs and outputs that will determine the level of efficiency of each DMU, and allows comparing their performance.

Chart 1. Description of variables

Data	Variable	Description	Authors
Inputs	Outpatient capacity – Equipment	Number of equipment available to SUS, in use, classified by categories (imaging diagnosis, infrastructure, optical methods, graphic methods, life maintenance, dentistry and other equipment)	Hu *et al.*, 2012 Politelo *et al.*, 2013 Politelo & Scarpin, 2013 Kaveski *et al.*, 2013 Costa & Rodrigues, 2016 Vasconcelos *et al.*, 2017
	Average price of admissions	Average hospitalization price for the period, divided by the number of hospitalizations	Marinho, 2003 Politelo *et al.*, 2013 Politelo & Scarpin, 2013 Kaveski *et al.*, 2013 Vasconcelos *et al.*, 2017
	Number of hospital beds	Number of hospital beds by type of provider	Marinho, 2003 Clement *et al.*, 2008 Santos *et al.*, 2008 Hu *et al.*, 2012 Politelo *et al.*, 2013 Politelo & Scarpin, 2013 Kaveski *et al.*, 2013 Vasconcelos *et al.*, 2017
	Average stay	Average length of hospital stay (days) of a patient	Vasconcelos *et al.*, 2017
	Outpatient capacity - Professionals	Number of health professionals linked to SUS	Costa & Rodrigues, 2016
Outputs	Hospitalizations	Total number of admissions – referring to the AIHs approved in the period, excluding extensions (long stays).	Marinho, 2003 Hu *et al.*, 2012 Politelo *et al.*, 2013 Politelo & Scarpin, 2013 Kaveski *et al.*, 2013 Vasconcelos *et al.*, 2017
	Inverse on mortality rate	Inverse of the mortality rate (1/mortality rate), ratio between the number of deaths and the number of AIHs approved in the period, considered as admissions, multiplied by 100.	Clement *et al.*, 2008 Santos *et al.*, 2008 Hu *et al.*, 2012 Politelo *et al.*, 2013 Politelo & Scarpin, 2013 Kaveski *et al.*, 2013 Vasconcelos *et al.*, 2017

Source: Author's elaboration, 2018.

Results and discussion

After selecting the variables and identifying the values of inputs and outputs, descriptive statistics of the data was performed. The following information for each variable was highlighted: minimum value, maximum value, mean, median and standard deviation. In this case, the median is more representative than the mean, as the data did not show a normal distribution and there are outliers (Vasconcelos et al., 2017); thus, the median serves as a signal of data dispersion, which can be explained due to the regional and economic diversities of a country with great territorial extension, as Brazil. However, the two measures for sample comparison criteria will be presented.

From the descriptive statistics presented in Table 1, the minimum amount of equipment is in Macapá and the maximum in São Paulo, for all years of assessment. For the number of beds, the minimum number was observed in Palmas and the maximum in São Paulo, for all years surveyed; from the median perspective, the variation in the number of beds is high among Brazilian capitals.

Boa Vista had the lowest average amount of admissions for the years 2014, 2016 and 2017, and Macapá, the minimum amount for 2015; while Porto Alegre presented the highest average value of hospitalizations for 2014 and Belo Horizonte, the maximum value for 2015, 2016 and 2017, by the median, with discrepancy between hospitalization amounts across the country.

Table 1. Descriptive statistics of variables

Variables	Minimum	Maximum	Average	Median	Standard deviation
			2014		
Equipment	2,699	92,724	18,344.26	11,361	18,246.07
beds	4,861	182,249	41,034.89	29,209	40,305.78
Average price of admissions	680.19	2,052.19	1,421.58	1,394.03	366.92
Average stay	4.90	10.10	6.64	6.50	1.30
Professionals	44,238	1,705,340	258,882.2	133,019	341,642.5
Hospitalizations	24,455	667,992	129,045.7	85,291	130,857.4
Inverse - Mortality rate	0.15	0.47	0.25	0.23	0.06
			2015		
Equipment	2,654	94,542	18,991	12,038	18,628.37
beds	5,122	186,181	40,298.04	27,760	40,298.04
Average price of admissions	716.58	2,121.60	1,472.00	1,396.47	1,472.00
Average stay	5.00	10.00	6.62	6.50	1.14
Professionals	52,279	1,707,338	269,385.90	140,042	342,812.40
Hospitalizations	23,140	663,064	133,145.50	90,617	130,909.60
Inverse - Mortality rate	0.14	0.41	0.24	0.22	0.05
			2016		
Equipment	2,857	95,346	19,593.67	12,507	18,888.76
beds	5,185	186,321	39,806	28,342	39,503.41
Average price of admissions	757.96	2,094.32	1,497.12	1,460.05	361.64
Average stay	4.9	10.2	6.66	6.4	1.18
Professionals	57,759	1,699,896	280,825.30	154,001	344,142.90
Hospitalizations	23,188	686,470	134,792.70	92,627	133,696.60
Inverse - Mortality rate	0.16	0.35	0.23	0.22	0.04
			2017		
Equipment	2,667	98,679	20,060.41	12,526	19,513.52
beds	5,196	181,859	39,261.19	28,634	38,272.45
Average price of admissions	763.94	2,177.32	1,524.45	1,540.09	372.07
Average stay	4.6	9.9	6.52	6.3	1.14
Professionals	63,291	1,723,728	291,842.30	161,214	353,532.20
Hospitalizations	21,486	685,966	136,186.80	92,316	134,729.10
Inverse - Mortality rate	0.15	0.34	0.24	0.23	0.04

Source: Author's elaboration, 2018.

Regarding the average number of days of stay, Palmas had the lowest number of days of stay for the year 2014, and Curitiba presented the minimum for the other years; Rio de Janeiro presented the maximum number of days of stay for 2014 and São Luís, the maximum number of days for the other years analyzed. Palmas presented the minimum number of health professionals for the years assessed, except 2017, which had the smallest number of professionals in Boa Vista and, in São Paulo, the maximum number of professionals for all years assessed.

About admissions, Macapá, in 2014 and 2016, and Palmas, in 2015 and 2017, presented the minimum number of admissions; while São Paulo has the highest representation for all years assessed. For the inverse relationship on mortality rates, the minimum was found in Curitiba (2014) and Rio de Janeiro (2015, 2016 and 2017), and the maximum was found in Boa Vista (2014, 2015 and 2016) and in Macapá (2017). Thus, in Rio de Janeiro and Boa Vista there were the highest number of deaths at SUS. Lower value of the inverse on mortality rate means a higher hospital mortality rate on SUS.

Table 2 shows efficiency levels, according to the BCC model, from the highest (1) to the lowest (0). DMUs are expected to be efficient as this is the best result.

Table 2. Efficiency Scale Ranges

Efficiency level	Efficiency range
Efficient	1
High Level of Efficiency	0.8001-0.9999
Medium Efficiency Level	0.5001-0.8000
Low Efficiency Level	0.0000-0.5000

Source: Author's elaboration, 2018.

Observing capitals that present better results can open the way for opportunities that improve the potential of hospital care, in order to minimize inefficiencies and positively impact the equity of health services and indicators of well-being in society. Furthermore, the management employed in capitals is sometimes followed by the municipalities, and these, by following higher standards of efficiency, can contribute to increasing their state's health indicators.

Table 3 presents the number of capitals considered efficient in each estimator, rank and efficiency ratios for all analyzed years. Rank refers to the position of results, showing from best to worst. Technical efficiency shows the level of efficiency of each capital. Benchmark shows how many times the DEA technique used the results of DMUs as a reference.

Considering the 27 capitals in the analysis, in 2014, 10 capitals were evaluated as efficient; in 2015 and 2016, 13 capitals were efficient; and in 2017, only eight capitals were evaluated as efficient.

Among the most efficient capitals, in 2014, Palmas presented the best results for the resources employed and was considered as a benchmark for 17 other assessments. For the other years, Boa Vista was considered the best efficiency measurement parameter for the other capitals, being used 15 times as a benchmark in 2015, 16 times in 2016 and 18 times in 2017.

High levels of efficiency were verified in eight capitals in 2014 and 2015; in five capitals in 2016; and in nine capitals in 2017. For medium levels of efficiency, there were nine capitals in 2014 and 2016; six capitals in 2015; and 10 capitals in 2017.

As shown in Table 3, some capitals continued to be efficient in all the years analyzed (Palmas, Recife, Boa Vista, Macapá, São Paulo, Curitiba and Brasília), being references for hospital care in the other capitals. The capital Florianópolis deserves attention, as it showed medium level of efficiency in 2014 and, in the other years, was positioned as efficient. Among high levels of efficiency, the capitals Rio Branco and Vitória remained in this classification throughout the analyzed period, while Belo Horizonte, Fortaleza and Goiânia moved from efficient to high levels of efficiency in 2017.

For medium level of efficiency, the capitals Salvador, Porto Alegre, João Pessoa, Natal, Rio de Janeiro and São Luís showed this classification during all the years analyzed. The capitals Aracaju, Campo Grande and Porto Velho fell from high levels of efficiency to medium level of efficiency in 2016 and 2017. Of the four years analyzed, 2015 had the best result for the analysis of technical efficiency, when 13 capitals were classified as technically efficient, eight as highly technically efficient, and six as having medium technical efficiency. The worst result of the series occurred in 2017, with eight capitals considered as having technical efficiency, nine capitals having high levels of technical efficiency and 10 capitals having medium level of efficiency.

DEA modeling consists of comparing some DMUs that perform similar activities and differ in the number of inputs used and outputs that are produced. The technique seeks to identify efficient DMUs, in a way that allows measuring and locating inefficiency to provide a benchmark for inefficient DMUs.

The more times a unit is used as reference, the more likely it is to showing great operational performance. DMUs that do not have high efficiency values or that have unusual combinations of inputs and outputs are not used as basis for comparison and are not likely to offer the best operational practices for units considered inefficient.

Thus, benchmark represents the model capital for the others. It is up to public managers to identify management model and practices employed in such capital. It is interesting to emphasize that each capital has its particularities (population quantity, assistance from other regions, public debt and availability of resources). Furthermore, the analysis and suggestions arising from this approach are conditioned to the variables and DMUs included in the survey, and the inclusion of any other variable and/or DMU might change the results.

Capitals not classified with technical efficiency will be able to follow their benchmarks to guide the optimal allocation of productive resources and improve levels of efficiency. For example, using benchmarks as a reference can contribute to the improvement of production processes in the service of SUS users, in the administration of resources and in the efficiency of products.

Table 4 presents efficiency statistics, showing that the minimum efficiency value was 0.676 in 2014, 0.729 in 2015, 0.734 in 2016 and 0.739 in 2017. The maximum value was 1 for all years analyzed. The mean and median presented values close to 0.9, showing that the greatest variation of the analyzed units stands around these measures.

Table 5 presents slacks of the variables by input and product, indicating what can be improved to obtain the same level of efficiency verified in the reference DMU each year. Benchmark capital must not have slacks, non-zero clearances disqualify the capital as presenting technical efficiency. Thus, the analysis of weights makes it possible to better identify which variables were more influential in the model and which inputs were most used.

Table 3. Technical efficiency of state capitals and the Federal District of Brazil, from 2014 to 2017

Capital	2014			2015			2016			2017		
	Rank	TE	*Benchmark*	*Rank*	TE	*Benchmark*	*Rank*	TE	*Benchmark*	*Rank*	TE	*Benchmark*
Palmas	1	1.000	17	1	1.000	2	1	1.000	2	1	1.000	2
Recife	1	1.000	16	1	1.000	8	1	1.000	14	1	1.000	17
Boa Vista	1	1.000	15	1	1.000	15	1	1.000	16	1	1.000	18
Macapá	1	1.000	7	12	1.000	5	12	1.000	6	1	1.000	6
Belo Horizonte	1	1.000	4	13	1.000	4	1	1.000	3	11	0.971	0
Fortaleza	1	1.000	4	1	1.000	5	1	1.000	1	10	0.973	0
São Paulo	1	1.000	4	1	1.000	4	1	1.000	4	1	1.000	4
Curitiba	1	1.000	4	1	1.000	2	1	1.000	5	1	1.000	10
Goiânia	1	1.000	2	1	1.000	6	1	1.000	4	9	0.976	0
Brasília	1	1.000	1	1	1.000	1	1	1.000	1	1	1.000	4
Belém	11	0.966	0	1	1.000	6	1	1.000	2	12	0.970	0
Maceió	12	0.945	0	1	1.000	2	15	0.938	0	14	0.938	0
Rio Branco	13	0.936	0	19	0.923	0	16	0.929	0	15	0.930	0
Vitória	14	0.931	0	14	0.977	0	14	0.972	0	13	0.967	0
Aracaju	15	0.929	0	22	0.910	0	19	0.898	0	19	0.865	0
Campo Grande	16	0.921	0	17	0.930	0	22	0.855	0	20	0.853	0
Porto Velho	17	0.917	0	16	0.951	0	23	0.853	0	23	0.817	0
Teresina	18	0.915	0	18	0.926	0	17	0.911	0	21	0.845	0
Manaus	19	0.893	0	21	0.920	0	18	0.904	0	16	0.909	0
Cuiabá	20	0.876	0	15	0.971	0	13	1.000	0	17	0.908	0
Florianópolis	21	0.874	0	1	1.000	1	1	1.000	4	1	1.000	6
Salvador	22	0.831	0	23	0.874	0	24	0.825	0	24	0.810	0
Porto Alegre	23	0.831	0	24	0.871	0	21	0.878	0	22	0.841	0
João Pessoa	24	0.809	0	26	0.830	0	26	0.788	0	26	0.759	0
Natal	25	0.807	0	20	0.921	0	20	0.883	0	18	0.884	0
Rio de Janeiro	26	0.793	0	25	0.869	0	25	0.792	0	25	0.765	0
São Luís	27	0.676	0	27	0.729	0	27	0.734	0	27	0.739	0

Source: Author's elaboration, 2018.

Caption: Technical efficiency: no shading; high level of efficiency: light gray; medium level of efficiency: dark gray; low level of efficiency: no cases.

Table 4. Efficiency statistics for the years 2014 to 2017

Statistic	2014	2015	2016	2017
Minimum	0.676	0.729	0.734	0.739
Maximum	1.000	1.000	1.000	1.000
Median	0.931	0.977	0.972	0.938
Average	0.920	0.948	0.932	0.915

Source: Author's elaboration, 2018.

The vast majority of DMUs classified as inefficient had indications to reduce inputs and/or products. The recommendations suggested by the method, through a slack index, indicate how much of the inputs and outputs of the DMUs should be reduced to improve their performance, approaching the efficiency frontier (benchmark). The DEA identifies how much each DMU can reduce its inputs, as they are larger than necessary. For example, in the capital Rio Branco, some equipment was not being used efficiently and the average amount paid for admissions should be lower in 2017.

Table 6 shows efficiency scales for the DMUs analyzed, showing the technical efficiency levels for constant returns to scale (CRS), variable returns to scale (VRS), non-increasing returns to scale (NIRS), increasing returns to scale (SCALE) and decreasing returns to scale (RTS). Efficiency is measured in values from zero to 1; values closer to 1 show greater degrees of efficiency verified, except for decreasing returns to scale, when values closer to zero show lower levels of inefficiency.

Table 5. Variable slacks

DMUs	2014							2015						
	Equip.	Beds Total	Price m. inter.	Aver. perm.	Amount Prof.	Amount Inter.	Inverse mort. rt.	Equip.	Beds Total	Price m. inter.	Aver. perm.	Amount Prof.	Amount Inter.	Inverse mort. rt.
Rio Branco	2,022.06	0.0004	91.14	0	262.89	2,576.68	0.155	1,224.8	678.78	0	0.72	0	77.41	0.11
Macapá	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manaus	14,869.5	0	0	0.25	0	0	0.060	13,586.5	0	0	0.12	0	0	0.055
Belém	871.726	0	0	0	0	0	0	0	1,011.09	0	0	0	0	0.104
Porto Velho	0	2,913.77	444.97	1.26	0	0	0.165	0	3,333.19	0	1.03	0.001	0	0.052
Boa Vista	0	0	0	0	0	0	0	0	0	0	0º	0	0	0
Palmas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maceió	0	0	0	0	0	0	0	0	7,166.69	0	1.58	0	0	0.036
Salvador	8,849.66	0	0	0.74	0.001	0	0.035	6,208.16	0	0	0.21	0	0	0.022
Fortaleza	0	0	0	0	0	0	0	0	0	0	0	0	0	0
São Luís	0	572.63	0.0008	1.02	0	0	0.065	0	2,463.71	0	0.91	0.004	0	0.121
João Pessoa	2,127.87	0	53.57	0.12	0.003	0	0.094	2,614.09	0.0006	0	0.13	0	0	0.115
Recife	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Teresina	2,333.63	0	0	0.01	0	0	0.109	1,203.09	681.84	0	0	0	0	0.134
Natal	0	0	711.07	1.12	0	0	0.100	0	552.51	267.20	0.83	0.0005	0	0
Aracaju	0	286.17	406.81	0	25,457.5	0	0.156	0	5,066.93	76.46	0	39,371.6	0	0
Goiânia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cuiabá	0	530.67	698.85	0	0.0008	0	0.181	101.17	830.83	193.28	0	0	0	0.052
Campo Grande	0	0	793.5	0.52	0.02	0	0.180	0	0	471.35	0.63	0	0	0.043
Brasília	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vitória	892.87	815.05	458.91	0	0	0	0.072	413.44	237.64	265.74	0	0	0	0
Belo Horizonte	0	0	0	0	0	0	0	0	0	0	0	0	0	0
São Paulo	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rio de Janeiro	5,274.40	30,920	0	2.01	97557.5	0	0.183	3,859.94	40,163.4	0	2.32	104,503	0	0.232
Curitiba	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porto Alegre	1,207.19	0	211.06	0.58	0	0	0.043	0	0	70.48	0.79	0	0	0.019
Florianópolis	1,953.30	0	0	0	0	0	0	0	1,232.39	0	0	0.02	0	0.024

DMUs	2016							2017						
	Equip.	Beds Total	Price m. inter.	Aver. perm.	Amount Prof.	Amount Inter.	Inverse mort. rt.	Equip.	Beds Total	Price m. inter.	Aver. perm.	Amount Prof.	Amount Inter.	Inverse mort. rt.
Rio Branco	892.43	563.50	0	218.29	0.18	0	10,596.6	0.085	0	211.96	0	3,146.55	6,871.08	0.097
Macapá	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manaus	13,306.30	12,619.90	0	0	0.28	0.03	0	0.080	0	0	0	0	0	0.073
Belém	0	0.0001	0	276.70	0.01	8,404.39	0	0.083	0	0	0	0	0	0
Porto Velho	0	0	2,286.17	371.58	0.19	0.004	0	0.083	1,770.42	332.52	0.29	0.002	0	0.088
Boa Vista	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Palmas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maceió	0	0	1,947.68	190.86	0.0000001	1,130.46	0	0.115	1695.79	144.31	0.003	0	0	0.114
Salvador	5,099.51	5,890.73	0	0	0.27	0.017	0	0.038	0	0	0.61	0.03	0	0.025
Fortaleza	0	6,655.85	7,835.46	181.81	1.87	0.004	0	0.027	0	0	0	0	0	0
São Luís	0	0	2,005.48	105.44	1.42	0.004	0	0.108	1,968.25	99.66	1.34	0	0	0.099
João Pessoa	105.84	1,125.05	152.60	109.61	0	0.013	0	0.095	594.28	0	0	0	0	0.112
Recife	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Teresina	1,095.65	927.54	1,516.10	0	0	0	0	0.081	0	51.64	0	0.00006	0	0.102
Natal	0	0	211.96	587.04	0.77	0.005	0	0.087	0	656.00	1.11	1,751.35	0	0.095
Aracaju	0	0	0	390.19	0.73	19,997.8	0	0.128	0	440.64	0.13	27,333.6	0	0.129

DMUs	2016							2017						
	Equip.	Beds Total	Price m. inter.	Aver. perm.	Amount Prof.	Amount Inter.	Inverse mort. rt.	Equip.	Beds Total	Price m. inter.	Aver. perm.	Amount Prof.	Amount Inter.	Inverse mort. rt.
Goiânia	0	1,223.10	4,234.97	46.29	0	0.007	0	0.012	0	0	0	0	0	0
Cuiabá	1,907.59	134.14	2,106.79	581.69	0	0	0	0.095	1,020.19	765.86	0.23	9,956.44	0	0.129
Campo Grande	0	0.0009	0	794.53	0.41	19,877.1	0	0.151	0	718.73	0	12,631.3	0	0.135
Brasília	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vitória	0	404.95	0	487.77	0	0.0001	0	0.019	0	488.26	0	1,594.83	0	0.021
Belo Horizonte	0	0.0013	0	220.18	1.02	178,077	0	0.005	0	0	0	0	0	0
São Paulo	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rio de Janeiro	7,645.52	4,677.91	16,137	0	1.03	137,820	0	0.138	26,791.9	0	1.34	162,674	0	0.142
Curitiba	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porto Alegre	0	0.0014	0	371.25	0.65	108,472	0	0.051	0	317.10	0.67	49,443.7	0	0.050
Florianópolis	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Author's elaboration, 2018.

Table 6. Efficiency scales per year

DMUs	2014						2015					
	CRS_TE	VRS_TE	NIRS_TE	SCALE	RTS		CRS_TE	VRS_TE	NIRS_TE	SCALE	RTS	
Rio Branco	0.8425	0.9364	1.0000	0.8997	1.0000	Irs	0.8440	0.9231	1.0000	0.9132	1.0000	Irs
Macapá	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Manaus	0.8843	0.8935	1.0000	0.9897	1.0000	Irs	0.9096	0.9207	1.0000	0.9879	1.0000	Irs
Belém	0.9268	0.9661	0.9433	0.9592	1.0000	Irs	1.0000	1.0000	1.0000	1.0000	1.0000	-
Porto Velho	0.8300	0.9173	1.0000	0.9047	1.0000	Irs	0.8131	0.9516	1.0000	0.8544	1.0000	Irs
Boa Vista	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Palmas	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Maceió	0.8992	0.9459	1.0000	0.9506	1.0000	Irs	0.9028	1.0000	1.0000	0.9028	1.0000	Irs
Salvador	0.8276	0.8313	0.0000	0.9956	1.0000	Irs	0.8705	0.8742	1.0000	0.9957	1.0000	Irs
Fortaleza	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
São Luís	0.6133	0.6767	1.0000	0.9062	1.0000	Irs	0.6828	0.7296	1.0000	0.9359	1.0000	Irs
João Pessoa	0.7780	0.8091	0.8381	0.9615	1.0000	Irs	0.8178	0.8302	0.8800	0.9850	1.0000	Irs
Recife	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Teresina	0.8626	0.9153	0.9228	0.9423	1.0000	Irs	0.9130	0.9266	0.9655	0.9852	1.0000	Irs
Natal	0.7885	0.8071	1.0000	0.9769	1.0000	Irs	0.9084	0.9215	1.0000	0.9857	1.0000	Irs
Aracaju	0.7219	0.9299	1.0000	0.7763	1.0000	Irs	0.8485	0.9106	0.9036	0.9318	1.0000	Irs
Goiânia	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Cuiabá	0.8272	0.8765	1.0000	0.9437	1.0000	Irs	0.9170	0.9710	1.0000	0.9443	1.0000	Irs
Campo Grande	0.9089	0.9219	1.0000	0.9858	1.0000	Irs	0.9229	0.9304	1.0000	0.9918	1.0000	Irs
Brasília	0.9664	1.0000	1.0000	0.9664	1.0000	Irs	0.9970	1.0000	1.0000	0.9970	1.0000	Irs
Vitória	0.9292	0.9317	1.0000	0.9972	1.0000	Irs	0.9409	0.9778	1.0000	0.9622	1.0000	Irs
Belo Horizonte	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
São Paulo	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Rio de Janeiro	0.6406	0.7932	1.0000	0.8076	1.0000	Irs	0.7389	0.8692	1.0000	0.8500	1.0000	Irs
Curitiba	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Porto Alegre	0.8286	0.8312	1.0000	0.9968	-1.0000	Drs	0.8676	0.8715	1.0000	0.9954	1.0000	Irs
Florianópolis	0.8064	0.8744	1.0000	0.9222	1.0000	Irs	0.8886	1.0000	1.0000	0.8886	1.0000	Irs
DMUs	2016						2017					
	CRS_TE	VRS_TE	NIRS_TE	SCALE	RTS		CRS_TE	VRS_TE	NIRS_TE	SCALE	RTS	
Rio Branco	0.7453	0.9290	0.7832	0.8023	1.0000	Irs	0.6797	0.9307	1.0000	0.7303	1.0000	Irs
Macapá	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-

DMUs	2016						2017					
	CRS_TE	VRS_TE	NIRS_TE	SCALE	RTS		CRS_TE	VRS_TE	NIRS_TE	SCALE	RTS	
Manaus	0.8925	0.9046	1.0000	0.9866	1.0000	Irs	0.8969	0.9097	1.0000	0.9860	1.0000	Irs
Belém	0.9470	1.0000	0.9592	0.9470	1.0000	Irs	0.9687	0.9708	0.9988	0.9978	1.0000	Irs
Porto Velho	0.7784	0.8530	1.0000	0.9126	1.0000	Irs	0.7358	0.8171	1.0000	0.9005	1.0000	Irs
Boa Vista	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Palmas	0.9766	1.0000	1.0000	0.9766	1.0000	Irs	1.0000	1.0000	1.0000	1.0000	0.0000	-
Maceió	0.8742	0.9385	0.9786	0.9314	1.0000	Irs	0.8678	0.9380	0.9697	0.9251	1.0000	Irs
Salvador	0.8240	0.8252	1.0000	0.9985	1.0000	Irs	0.8098	0.8107	0.8505	0.9988	1.0000	Irs
Fortaleza	1.0000	1.0000	1.0000	1.0000	1.0000	-	0.9693	0.9739	1.0000	0.9953	1.0000	Irs
São Luís	0.6842	0.7349	1.0000	0.9310	1.0000	Irs	0.6872	0.7394	1.0000	0.9295	1.0000	Irs
João Pessoa	0.7495	0.7886	0.7869	0.9503	1.0000	Irs	0.7345	0.7591	0.8527	0.9675	1.0000	Irs
Recife	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Teresina	0.9005	0.9114	0.9375	0.9879	1.0000	Irs	0.7975	0.8459	0.8503	0.9427	1.0000	Irs
Natal	0.8663	0.8835	1.0000	0.9805	1.0000	Irs	0.8658	0.8841	1.0000	0.9794	1.0000	Irs
Aracaju	0.8577	0.8981	1.0000	0.9550	1.0000	Irs	0.8345	0.8658	1.0000	0.9639	1.0000	Irs
Goiânia	0.9873	1.0000	1.0000	0.9873	1.0000	Irs	0.9149	0.9765	1.0000	0.9369	1.0000	Irs
Cuiabá	1.0000	1.0000	1.0000	1.0000	1.0000	-	0.8153	0.9089	1.0000	0.8971	1.0000	Irs
Campo Grande	0.8468	0.8553	1.0000	0.9900	1.0000	Irs	0.8469	0.8532	1.0000	0.9926	1.0000	Irs
Brasília	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Vitória	0.9327	0.9724	1.0000	0.9592	1.0000	Irs	0.9383	0.9674	1.0000	0.9699	1.0000	Irs
Belo Horizonte	1.0000	1.0000	1.0000	1.0000	0.0000	-	0.9710	0.9711	1.0000	0.9999	-1.0000	Drs
São Paulo	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Rio de Janeiro	0.6268	0.7929	1.0000	0.7905	1.0000	Irs	0.6300	0.7650	1.0000	0.8235	1.0000	Irs
Curitiba	1.0000	1.0000	1.0000	1.0000	0.0000	-	1.0000	1.0000	1.0000	1.0000	0.0000	-
Porto Alegre	0.8735	0.8789	1.0000	0.9938	1.0000	Irs	0.8408	0.8415	1.0000	0.9991	1.0000	Irs
Florianópolis	0.8830	1.0000	1.0000	0.8830	1.0000	Irs	0.8676	1.0000	1.0000	0.8676	1.0000	Irs

Source: Author's elaboration, 2018.

For constant returns to scale, nine capitals had values equal to unity in 2014 and 2016; 10 capitals in 2015, and seven capitals in 2017. For variable returns to scale, 10 capitals were efficient in 2014; 13 capitals in 2015 and 2016; and eight capitals achieved variable returns in 2017. For non-increasing returns to scale, only four capitals had different unit values in 2014; only three capitals in 2015; and five capitals did not present NIRS equal to 1 in 2016 and 2017.

Thus, as shown in the tables, it is possible to verify that, given the available resources, more can be done through the search for efficiency, reaching the same results with reduced resources. In other words, the problem may be linked not only to the scarcity of resources, but also to the misuse and inefficiency of public resources (human, capital and technological) used in the analyzed units.

Conclusion

The allocative role of the State impacts the provision of goods and services to society to foster socioeconomic development. Development can be understood as the interrelationship between different dimensions (health, education, employment and income) that aim to increase the levels of well-being and quality of life in society.

In the health sector, SUS is one of the strategies to achieve this goal. Therefore, understanding its functioning, or part of it, contributes to the adjustment of inconsistencies in the implementation of health policies. For managers, this knowledge can support correcting/reducing inconsistencies in the conduction of health policies.

The DEA approach, to assess the efficiency of public health policies, is a high-quality technical tool used to support health managers in their decisions, in the definition of priorities and in the distribution of public resources. This method allows to diagnose the efficiency of the assessed unit and indicate the resources that can be better employed.

The Brazilian continental dimension contributes to the heterogeneity of geographic, economic and social characteristics of the country, and for this reason, health policies can present different results in each location. Therefore, to capture efficiency levels in hospital care, it was necessary to use the DEA to analyze all state capitals and the federal district between 2014 and 2017, as hospital care is concentrated in those.

The use of the DEA methodology was based on the assumption that the DMUs, represented by Brazilian capitals, will be seeking to improve the results of health policies to reach the production frontier based on the more efficient use of their inputs used in health. In other words, the capitals will be aiming for better results, using fewer resources. Therefore, input-oriented BCC or VRS was the DEA model used.

Results showed that during the years analyzed there were differences regarding efficiency levels between the state capitals and the federal district in the allocation of resources to hospital health care units linked to SUS. The statistical findings showed that technical efficiency could be obtained with variable input levels, proving that it is possible to have the same results with a reduction in resources.

As observed in the tabular analyses, several capitals do not present the level of technical efficiency; this fact only reflects that there is great potential for an increase in the provision of hospital care. However, technical inefficiency in production must be reduced to improve the performance of these capitals. It is important to note that the strategies to improve performance must be directed according to each need, due to the characteristics of each capital, having as a reference the capitals considered benchmark, without slack.

Concurrently with the ideas of Santos et al. (2008), it is possible to improve health care by optimizing productive and financial resources. The results can be relevant for managers in guiding the adoption of policies consistent with regional needs, to provide more efficient hospital care.

When looking at the literature on which this article was based, the studies by Santos et al. (2008), Politelo et al. (2013), Kaveski et al. (2013), Costa & Rodrigues (2016) and Vasconcelos et al. (2017), who analyzed health care at the state level in Minas Gerais, Santa Catarina, West Santa Catarina, Natal and Paraná, respectively, showed that there are differences between levels of efficiency and there is scale variation between the years analyzed. Although the DMUs and the time frame are different, individual results, considering only the analyzed capitals, are close to those obtained in the efficiency analysis in the capitals.

It is pertinent to emphasize that results can go further for more in-depth assessments. The use of the DEA method is feasible to assess the performance of public policies, to constantly assess and signal possible interventions by managers, to support technical information, as well as to promote better results in terms of resource allocation efficiency and increase the offering of services to society.

In this sense, this work aimed to contribute with theoretical, scientific and technological information to those interested in the area, showing possibilities for analysis from open data as an aid to public management. However, the work did not use variants of the method or other assessment methods, the sample was restricted to Brazilian capitals, the time frame was only four years and only hospital services were considered; therefore, it is expected that future studies should overcome these limitations.

Finally, the conclusion is that a management seeking efficiency and continuous monitoring and evaluation of results is an essential resource for public health policies. Therefore, monitoring and evaluating public resources is a way to avoid waste and increase the efficiency of resources made available to meet social needs.

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Analysis of payment models applied to federal funding from the perspective of the Brazilian Health System

Análise dos modelos de pagamento aplicados ao financiamento federal na perspectiva do Sistema Único de Saúde

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ABSTRACT

Objective: This study aims at identifying the payment methods existing in the Unified Health System referring to federal transfers to Primary Health Care (PHC) and Specialized Health Care. **Methods:** A quantitative and analytical study was carried out, developed in three stages: survey of all types of transfers from the Union; classification of each transfer category according to the types of payment methods and measurement of the participation of each payment methods, according to the financing components analyzed, in relation to the net values transferred. **Results:** Federal transfers were classified into seven payment methods. For PHC, in 2020, approximately R$ 21.7 billion was calculated, including resources destined for the pandemic, and R$ 20.9 billion without considering resources to face the COVID-19 pandemic. More than 50% of the amounts used were classified as capitation, in both cases. For specialized health care, in 2019, around R$ 48.5 billion were calculated, and in 2020 more than R$ 49.2 billion. For the two years, more than 70% of the funds were allocated to fee for service. **Conclusions:** This study allowed for an expansion in knowledge about the allocation of resources referring to transfers from the Union to states, the Federal District and municipalities. As the payment methods are related to productivity, access and quality of the health service, knowing and identifying the most appropriate payment methods for each situation contributes to the achievement of the goals and to the mitigation of eventual losses of efficiency in the healthcare systems.

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Palavras-chave:
Sistema de pagamento prospectivo, organização do financiamento, financiamento da assistência à saúde, economia da saúde, Sistema Único de Saúde

RESUMO

Objetivo: Este estudo tem por objetivo identificar os modelos de pagamento existentes no Sistema Único de Saúde referentes aos repasses federais para a Atenção Primária à Saúde (APS) e a Atenção Especializada à Saúde. **Métodos:** Foi realizado um estudo quantitativo e analítico, desenvolvido em três etapas: levantamento de todos os tipos de repasse da União; classificação de cada categoria de repasse segundo os tipos de modelos de pagamentos; e mensuração da participação de cada modelo de pagamento, de acordo com os componentes de financiamento analisados, em relação aos valores líquidos repassados. **Resultados:** Os repasses federais foram classificados em sete modelos de pagamentos. Para a APS, em 2020, foram apurados R$ 21,7 bilhões, aproximadamente, incluindo os recursos destinados para a pandemia, e R$ 20,9 bilhões, sem considerar os recursos para enfrentamento da pandemia de COVID-19. Mais de 50% dos valores empregados foram classificados como capitação, em ambos os casos. Para a Atenção Especializada à Saúde, em 2019, foram computados em torno de R$ 48,5 bilhões e, em 2020, acima de R$ 49,2 bilhões. Para os dois anos, mais de 70% dos recursos foram destinados a pagamentos por procedimento. **Conclusões:** Este estudo permitiu a ampliação do conhecimento sobre a alocação dos recursos referentes aos repasses da União para estados, Distrito Federal e municípios. Como os modelos de pagamentos estão relacionados com a produtividade, acesso e qualidade do serviço de saúde, conhecer as formas de pagamento e identificar a mais adequada para cada situação contribui para o alcance das metas e para a mitigação de eventuais perdas de eficiência nos sistemas de saúde.

Introduction

From the health reforms promoted in the 1990s (Ugá, 2012), the idea that payment models can be powerful tools for efficiently allocating resources while prioritizing the quality of care was strengthened (Cyclus *et al.*, 2016). Based on this premise, the search for remuneration models that increase the quality and access of health services to the population has become a challenge for health systems worldwide (Prada, 2016).

Resource allocations in health systems can be considered before the volume and type of output (*ex-ante*), as in the global budget and *capitation per capita*; or after the volume and type of output (*ex-post*), such as fee-for-service, hospital *per diem* rate, and prospective per procedure (based on cases, *Diagnosis Related Groupings* - DRG) (Ugá, 2012; Cashin, 2015; ICOS, 2017). In addition to these payments, there are *payments for performance*, payments per production item (*line-item budget*), and the *bundled payment* (Cashin, 2015; Conrad, 2015).

Combining different payment models is a strategic choice for managing the Brazilian Unified Health System (SUS). Its effect affects the output of services provided to society, the quality of service, sector expenditures, and the universality and equity of access (Girardi *et al.*, 2007).

Currently, the *Programa Previne Brasil* [Prevent Brazil Program] is in effect within the scope of Primary Health Care (PHC) in the SUS. The program presents new PHC financing rules, being built on three payment methods from the Federal Government to Brazilian municipalities: (i) weighted capitation, (ii) payment for performance, and (iii) incentive for strategic actions (Harzheim *et al.*, 2020). Payment for performance is a component that seeks to qualify the information produced and the services provided by the PHC, calculating result indicators for teams every four months (Brazil, 2021c). In addition, transfers were implemented to help municipalities transition from the old to the new PHC financing model, the compensatory transition factor, and the added per capita value for cities with reduced transfers under the new financing rules (Brazil, 2019).

Financing for Specialized and Hospital Health Care, also known as Medium and High Complexity (MAC), consists of production payment and incentives in the hospital and outpatient setting. This level of care is divided into two components: (i) the MAC Financial Limit (MAC financial ceiling) addressed to the Dental Specialties Center (CEO), the Mobile Emergency Care Service (SAMU), the Reference Center in Occupational Health Services, adherence to Contracting Teaching Hospitals, Small Hospitals, and Philanthropic Hospitals, among others; and (ii) the Strategic Actions and Compensation Fund Component (FAEC), presenting resources for financing procedures regulated by the National Center for High Complexity Regulation (CNRAC), such as transplants and related procedures, for strategic or emergency actions and by new procedures not in the SUS listing (Brazil, 2017).

The highly complex distribution of these mechanisms in the SUS potentially complicates assessing ways of remuneration, as health policies developed include measures and incentives that should allow for changes over time, according to epidemiological priorities and aligned with the monitoring of generated indicators and providers information (Kondo *et al.*, 2016).

This scenario makes the debate about the SUS efficiency increasingly current (Araujo *et al.*, 2018). It demands decisions from providers to ensure the fiscal sustainability of the health system without harming the principles of universality, equity, and integrality (Brazil, 1988; Matta & Pontes, 2007). Therefore, the objective of this article is to map the SUS remuneration models regarding transfers from the Federal Government to primary and specialized health care.

Methods

This study is a quantitative and analytical one aiming to present the distribution of SUS payment models, focusing transfers from the Federal Government to other federation states, for PHC benefit, in 2020, and of medium and high complexity (MAC), in 2019 and 2020. The methodological option of analyzing only the year 2020 for PHC is justified by the substantial change in the criteria for financing this level of care from that year, considering that the parameters of the historical series before this period would not allow the continuity of data comparison.

The methodology was developed in three steps. In the first stage, all types of transfers from the Federal Government were collected, according to the PHC and MAC financing components. Regarding the PHC, transfers were mapped as proposed by the Prevent Brazil Program, considering the specific information of each incentive contained in the MS/GM Consolidation Ordinance No. 6 (Brazil, 2017) and other PHC initiatives related to fighting COVID-19 (Brazil, 2020a; 2020b). For the MAC level, transfers made by the Federal Government via the National Health Fund (FNS) (Brazil, 2021b) and through the Financial Limit of Medium and High Complexity Control System (SISMAC) (Brazil, 2021d) were identified. Regarding SISMAC, resources referring to incentives and the output of the MAC Financial Ceiling directed to states and municipalities were disaggregated.

For the second stage, the main characteristics, favorable and unfavorable points of the payment models considered in this study were initially presented (Box 1), according to the scientific literature (Ugá, 2012; Cashin, 2015; ICOS, 2017). Then, based on options described in Box 1 and Consolidation Ordinance No. 6 (Brazil, 2017), each transfer category raised in the first stage was classified according to types of payment models. It is important to emphasize that the survey of the incentives of the MAC Financial Limit Component considered information made available by the technical area of the Ministry of Health, which presented all the incentives registered to date, including those that may have an inactive status. In this way, all the listed incentives were classified according to the types of payment methods. However, for calculating transfers made in this category through SISMAC, those with effective transfers within the reporting period were considered.

For the third stage, the participation of each payment method mapped to PHC and MAC concerning net amounts transferred was measured. Besides these steps, the proportion of values approved for outpatient and hospital output were calculated, by type of financing, to obtain a proxy to be used on transfers in each MAC payment method, according to the kind of output (outpatient or hospital).

Box 1. Payment models considered in the study

Payment methods	Characteristics	Strengths	Weaknesses
Global budget	Periodic transfers of an annual amount defined through a budget schedule. Resources transferred are not linked to the effective production of services and can be spent flexibly.	Allows the resource manager to forecast their revenues.	Does not create incentives for the employee's good performance. Insufficient provision of services may occur.
Capitation (*per capita*)	Transfers cover a services package, defined by the number of individuals covered and multiplied by a *per capita* amount, considering health risk and classification factors (gender and age).	Allows the resource manager to forecast their revenues. May favor competition among providers. Focus on primary care and cost control. Improves the mix of results and inputs and helps attract subscribers and reduce inputs.	May generate underproduction of services since resources do not depend on production (patients treated) but on the number of people involved. Providers may provide insufficient services, increase referrals to other providers, and have a healthier patient selection.
Fee-for-service	Transfer linked to services performed (treatment of each patient), i.e., by remuneration broken down with the sum of all services (intermediate and final) that make up the procedure performed.	Allows the resource manager a moderate management capacity. May help to increase the efficiency of the input mix.	May lead to an overuse of intermediary services, especially those of higher amounts, resulting in a loss of quality in medical care and an increase in the medical care cost.

Payment methods	Characteristics	Strengths	Weaknesses
Hospital *per diem* rate	Refers exclusively to hospital admissions. Its amount is equivalent to the number of *per diem* multiplied by a unit amount assigned to each *per diem* rate (medical cost), differentiated according to the hospital's complexity and clinical characteristics.	Improves efficiency and increases bed occupancy. Contributes to the definition of different *per diem* rates (decreasing) with the length of stay.	Hospitals are paid for the effective cost of each patient treated. It might lead to segregation of some patients, depending on the pathology. There may also be an extension of the patient's stay in the hospital.
Diagnosis Related Groups – DRG	Payment per treatment episode and hospital stay, and according to the nosological condition. Amounts are defined in advance but may vary depending on the diagnosis. It stipulates a series of pre-fixed admission prices by type of patient. However, such charges do not depend on the effective cost of each patient treated for their episode of hospitalization.	This payment method requires a system of patients classification into homogeneous cost groups to support economic and clinical management and also requires a system of definition of unit prices for discharges considering the hospital characteristics that might influence costs.	May reduce intermediate inputs and services used in each hospitalization, changing the production functions and reducing hospitalization costs There may be an increase in readmissions, suggesting early discharges, either reducing the cost or generating new hospitalizations, and allocating patients into groups with diagnoses incompatible with the nosological picture. Change in providers' priorities, putting financial goals above the quality of care.
Payment for performance	Mixed payment method, based on the managerial model, combining actions that focus on the demand and supply of health services. It uses demand management mechanisms (e.g., gatekeeping doctors) and mechanisms for co-payment or co-participation in services costs. It also uses various methods of contracting health services by system managers, according to the modality of resource allocation according to the provider's performance (fulfillment of quantitative and qualitative goals). For the management of technological incorporation, goals it may include the technology type to be incorporated to obtain more value on the applied resources (value for money).	Reduction of overall costs, increase of providers efficiency, and effectiveness of health services.	Over time, results may stabilize or improve more slowly. It may not encourage the continuation of improvements once the established minimum goals are reached. Different ties/contracts with varying funding agencies can limit the financial incentive impact and make assessing the mixed payment method complicated. And the complexity of the performance evaluation process, incurring additional costs to the system.
Production item budget	Transfer of a fixed amount over some time to cover expenses for specific inputs (production items).	Allows the resource manager to forecast their revenues. Focus on cost management.	May involve reducing services, increasing referrals of patients to other providers, increasing inputs, using the resource before the budget deadline. It may not generate an incentive or mechanism to increase efficiency.
Bundle payment	Amount transferred to service providers, considering the care cycle and the difference among services based on the expected cost per clinical episode.	The patient's extended stay facilitates more coordinated and multidisciplinary clinical care. Shared risk between the paying source and service providers.	Implementation complexity. It may not be applicable for all clinical cases. It may require a lot of operational effort.

Source: Adapted from Ugá, 2012; Cashin, 2015; ICOS, 2017.

Regarding SUS outpatient and hospital output, the Outpatient Production (PA) and Reduced (RD) AIH data files were used to estimate the proportions of approved values. (Source: DATASUS, referring to the SUS Outpatient Information System – SIA/SUS – and the SUS Hospital Information System – SIH/SUS). The files were treated according to the year of competence of approved procedures, using the files available for the years 2019, 2020, and 2021 (only January data were available on the collection date) for analyzing just the production of years 2019 and 2020. Therefore, amounts approved for procedures by financing type were subsequently added up, according to the year of competence. Proportions were calculated based on the production type, with a particular interest in proportions found for Strategic Actions and Compensation Fund Component (FAEC) and MAC ceiling.

For obtaining data on PHC, it was considered the information from the financing section of the e-Gestor platform and the monthly spreadsheets, consolidated for the year 2020 (Brazil, 2021a), were retrieved. Regarding MAC, data from the FNS were used for transfers to the FAEC component, and from MAC Finance, the transfer information recorded in SISMAC was used for 2019 to 2020. All data were processed, and results have been obtained through R software (version 3.6.3) and Microsoft Excel (2008).

Results

The qualitative classification of payment components mapped to PHC, and specialized care allowed consolidating various instruments that inform payment models in the SUS (Box 2). This product listed the components established by federal regulations, involving four items in the PHC, called "weighted capital", "pay for performance", "incentives for strategic actions," and "COVID-19". In specialized care, three components were compiled: "Strategic Actions and Compensation Fund Component (FAEC)", "Incentives – MAC Financial Limit Component (MAC)", and "Component linked to productivity". In PHC, 25 payment categories were summarized. Of this total, 68% (n = 17) are categories classified in the global budget payment method and 16% (n = 4) in the capitation modality (Figure 1). In specialized care, 50 categories were classified, with 50% (n = 25) included as overall budget and 18% (n = 9) as *per diem* rate (Figure 2).

Analyzing payment transfers in the PHC for the year 2020, including extra credits to face the pandemic (COVID-19), a total of approximately 21.7 billion was calculated. It was possible to observe that the payment mechanism by capitation accounted for 53.6%, equivalent to R$ 11.6 billion. The global budgeting component, which generally comprises incentives for defined theme strategic actions, represented 36.9%, totaling around R$ 8 billion. The transfer by performance contributed 8.2% of the total, while the payment linked directly to procedures represents only 1.3% (Table 1).

Observing the financing schemes behavior for PHC without the inclusion of extra credits to face the pandemic (COVID-19), the global amount remained similar, with a calculation of R$ 20.9 billion applied. Of this total, 55.5% were employed via capitation, in addition to 34.6% through global budgeting, and 8.5% were transferred by performance (Table 2).

For the specialized care level, consolidating transfers through FAEC and MAC Financial Ceiling, in 2019, around R$ 48.5 billion were computed. Fee-for-service was 72.7% of the total amount, comprising approximately R$ 35.2 billion (Table 3). There is a set of 10 fee-for-service in this group, including the excess output of the financial ceiling, intensive care, oncology, nephrology, and transplants, which concentrated more than 68% of the total amount calculated. The overall budget participated in the composition with 18.1%. Over 60% of this percentage was attributed to incentives from philanthropic hospitals, emergency care units, SAMU, and psychosocial care centers, together. The hospital *per diem* rate accounted for 6.3%, mainly represented by intensive care units, with 3.45%, more than 50% of the transfer for this payment type.

In 2020, there was an increase in identified transfers, totaling R$49.2 billion. Distribution remained similar, with 71.1% of transfers through the fee-for-service modality. Subsequently, 19.2% were carried out by global budgeting, 6.8% related to the cost of *per diem* expenses, and 1.4% to payments via bundle (Table 4). The same group of components for the previous year concentrated transfers of fee-for-service. For global budgeting, the same incentives described in the prior year accounted for 57% of the total for this category in 2020. The *per diem* payment had a similar characteristic to the previous year. The main component of the bundle category was cancer care.

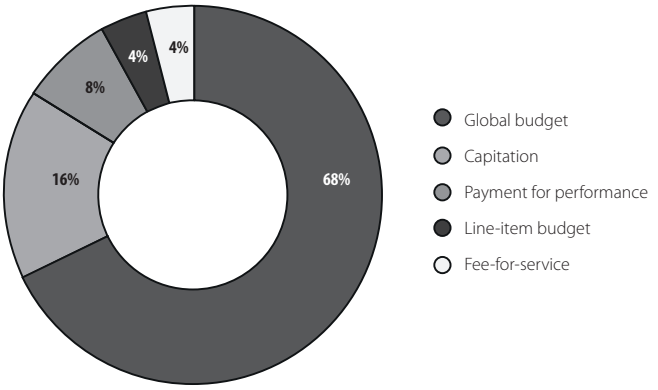
The participation of each financing type in the total value of production approved in specialized care, by outpatient and hospital level, was also evaluated (Table 5). From the survey of production proportions carried out through the SIA/SUS and SIH/SUS, it was found that, in 2019, specialized outpatient care was responsible for 75.42% of the care provided in the FAEC modality, while procedures recorded during hospital admissions in this modality accounted for 24.58% of the approved frequency. This proportion was 53.72% for the outpatient level and 46.28% for the hospital level for the MAC component. In 2020, the proportion found in FAEC procedures increased to 81.12% at the outpatient level, reducing the hospital level to 18.88%. This distribution for MAC was inverted to 47.15% and 52.85%, respectively, for the outpatient and hospital levels (Table 5). The values calculated in 2019 allowed the identification of R$ 21.4 billion in approved specialized outpatient production and R$ 15.9 billion for hospital

Box 2. Primary Health Care and Medium and High Complexity components and incentives, classified according to the payment models considered in the study

Primary Health Care		
Component	**Categories**	**Categories**
Weighted capitation	Weighted capitation	Capitation
	Compensating Transition Factor	Capitation
	Per capita amount	Capitation
Payment for performance	Payment for performance	Payment for performance
	Payment for performance Final Synthetic Indicator (ISF)	Payment for performance
Incentives for strategic actions	Community Health Agents (CHA)	Global budget
	Dental Specialties Center (CEO)	Global budget
	Funding for the federative entity responsible for managing actions of comprehensive health care for adolescents in liberty deprivation.	Global budget
	Prison Primary Care Team (eABP)	Global budget
	Street Office Team (eCR)	Global budget
	Oral Health Team (eSB)	Global budget
	Ribeirinha Family Health Team (eSFR)	Global budget
	Incentive to municipalities with medical and multi-professional residency	Global budget
	Regional Dental Prosthesis Laboratory (LRPD)	Fee-for-service
	Microscopist	Production item budget
	Health Academy Program (investment and funding)	Global budget
	School Health Program (PSE)	Global budget
	Health on Time Program	Global budget
	PHC computerization support programs	Global budget
	Basic Fluvial Health Unit (UBSF)	Global budget
	Mobile Dental Unit (UOM)	Global budget
COVID-19	Additional federal financial incentive *per capita*	Capitation
	Reference Community Centers to fight COVID-19	Global budget
	Health Care Centers to fight COVID-19	Global budget
	Emergency Health Care	Global budget
Medium and High Complexity		
Components	**Categories**	**Payment method**
Strategic Actions and Compensation Fund Component (FAEC)	Strategic or emergency actions, temporary nature, and implemented with a predefined deadline	Fee-for-service
	New procedures, not related to those in the current price table or that do not have parameters to allow the definition of a funding limit, for six months, to allow the formation of the historical series required for its aggregation to the Financial Limit of Care Component of Medium and High Outpatient and Inpatient Complexity (MAC)	Fee-for-service
	Procedures regulated by the National Center for High Complexity Regulation (CNRAC)	Fee-for-service
	Transplants and linked procedures	Fee-for-service

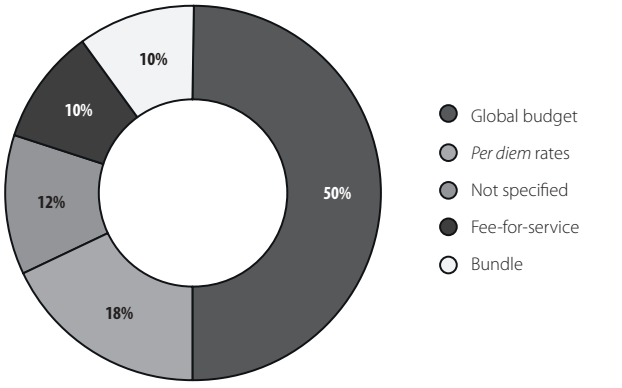
Medium and High Complexity		
Components	**Categories**	**Payment method**
Incentives - MAC Financial Limit Component (MAC)	Expansion of service offer	Not specified
	Cardiovascular	Bundle
	Long-term care – UCP	Per diem rates
	First-aid room	Per diem rates
	CAPS I, II, III, i and ad incentive	Global budget
	Pregnant Woman's Home Incentive	Global budget
	Birth Center Incentive	Global budget
	CEREST Incentive	Global budget
	EMAD I, EMAD II and EMAP Incentive	Global budget
	100% SUS Hospitals Incentive	Global budget
	Teaching Hospitals Incentive	Global budget
	Philanthropic Hospitals Incentive	Global budget
	Federal University Hospital Incentive	Global budget
	HPP Incentive	Global budget
	IAEPI Incentive	Global budget
	INTEGRASUS Incentive	Global budget
	Mental Health Beds Incentive – SHR	Per diem rates
	Specialized Hospital Gateway Incentive	Global budget
	General Hospital Gateway Incentive	Global budget
	Medical Residency Incentive	Global budget
	Therapeutic Residency Incentive - SRT	Global budget
	Stabilization Room Incentive	Global budget
	SAMU Incentive	Global budget
	SAMU Incentive - Qualification	Global budget
	ORAL HEALTH Incentive - LRPD	Not specified
	Health for People with Disabilities Incentive	Global budget
	Mental Health Incentive	Global budget
	Reception Unit Incentive	Global budget
	UPA Incentive	Global budget
	UPA Incentive - Qualification	Global budget
	Kangaroo bed	Per diem rates
	Pregnant woman's bed	Per diem rates
	Medicines	Global budget
	Not specified	Not specified
	New prenatal tests	Not specified
	Oncology	Bundle
	Thematic networks	Bundle
	Hearing health	Bundle
	Newborn Screening Service	Not specified
	Procedure price table	Not specified
	Trauma-orthopedics	Bundle
	U stroke	Per diem rates
	ICU	Per diem rates
	OCU	Per diem rates
	ICU	Per diem rates
Components linked to production	Procedures	Fee-for-service

Source: Prepared by authors.



Source: Prepared by authors.

Figure 1. Percentage of PHC categories by payment method.



Source: Prepared by authors.

Figure 2. Percentage of MAC categories by payment method.

Table 1. Federal transfer by payment method to Primary Health Care including extra credits to fight the pandemic (COVID-19) – 2020

Payment method	Amount paid	Participation
Capitation	R$ 11,622,484,688.90	53.6%
Global budget	R$ 7,997,905,599.53	36.9%
Pay for performance	R$ 1,780,040,576.70	8.2%
Fee-for-service	R$ 274,704,100.17	1.3%
Production item budget	R$ 8,369,200.00	0.0%
Total	**R$ 21,683,504,165.30**	**100.0%**

Source: Prepared by authors.

Table 2. Federal transfer by payment method to Primary Health Care without including extra credits to fight the pandemic (COVID-19) – 2020

Payment method	Amount paid	Participation
Capitation	R$ 11,609,524,248.90	55.5%
Global budget	R$ 7,228,220,599.53	34.6%
Payment for performance	R$ 1,780,040,576.70	8.5%
Fee-for-service	R$ 274,704,100.17	1.3%
Production item budget	R$ 8,369,200.00	0.0%
Total	**R$ 20,900,858,725.30**	**100.0%**

Source: Prepared by authors.

Table 3. Federal transfer by payment method to Medium and High Complexity – 2019

Payment method	Amount paid	Participation
Fee-for-service	R$ 35,244,633,672.35	72.7%
Global budget	R$ 8,789,589,780.45	18.1%
Per diem rates	R$ 3,064,448,849.96	6.3%
Not specified	R$ 703,510,663.38	1.5%
Bundle	R$ 695,952,893.08	1.4%
Total	**R$ 48,498,135,859.22**	**100.0%**

Source: Prepared by authors.

care. In 2020, these values fluctuated to R$18 and R$16.4 billion, respectively (Table 6).

From the percentage distribution of specialized care between the outpatient and hospital levels (Table 5) obtained from the SIA/SUS and SIH/SUS systems, the production proportion of 56.8% and 43.2% for these two levels, respectively, was applied to estimate a breakdown of financial transfers from the FAEC and MAC Financial Ceiling components. In this study, R$ 27.5 billion was calculated for the outpatient level and R$ 21 billion for the hospital level in 2019. For 2020, these amounts were estimated at R$ 25.5 billion and R$ 23.7 billion for each care level, respectively. Breaking down payments per procedure as the primary model observed, R$ 20 billion is attributable to outpatient care, while R$ 15.2 billion is potentially related to transfers to hospital care, recorded in 2019.

In 2020, there was an approximation in the proportion between SIA/SUS and SIH/SUS, with shares of 51.8% and 48.2%, respectively, about the total of R$ 49.2 billion calculated from specialized care records. This proportion comprises R$ 18.2 and R$ 16.9 billion when considering only transfers of fee-for-service.

Discussion

The qualitative mapping of payment models for federal transfers for health resources allowed us to present a broad overview of the SUS financing schemes. The survey carried out for primary care and specialized care offers a detailed understanding of possible outcomes according to the category in which each transfer is performed. As expected, the most frequent rankings are related to global budgeting and fee-for-service models.

Table 4. Federal transfer by payment method to Medium and High Complexity – 2020

Payment method	Amount paid	Participation
Fee-for-service	R$ 35,011,606,143.71	71.1%
Global budget	R$ 9,462,165,736.81	19.2%
Per diem rates	R$ 3,325,957,593.20	6.8%
Not specified	R$ 719,758,974.55	1.5%
Bundle	R$ 694,478,828.56	1.4%
Total	**R$ 49,213,967,276.83**	**100.0%**

Source: Prepared by authors.

Table 5. Percentage of amounts approved by funding type according to SIA/SUS and SIH/SUS data

Funding	2019 (SIA)	2019 (SIH)	2020 (SIA)	2020 (SIH)
Primary Care (PAB)	-	-	-	-
Pharmaceutical Assistance (AF)	100.00%	-	100.00%	-
Strategic Shares and Compensation Fund (FAEC)	75.42%	24.58%	81.12%	18.88%
MAC – Incentive	100.00%	-	100.00%	-
Medium and High Complexity (MAC)	53.72%	46.28%	47.15%	52.85%
Health Surveillance	100.00%	-	100.00%	-

Source: Prepared by authors.

Table 6. Approved amounts by funding type according to SIA/SUS and SIH/SUS data

Funding	2019 (SIA)	2019 (SIH)	2020 (SIA)	2020 (SIH)
Primary Care (PAB)	R$ 0.00	R$ 0.00	R$ 0.00	R$ 0.00
Pharmaceutical Assistance (AF)	R$ 483,702,814.44	R$ 0.00	R$ 345,366,504.88	R$ 0.00
Strategic Shares and Compensation Fund (FAEC)	R$ 3,942,459,774.25	R$ 1,284,804,855.10	R$ 3,820,339,250.92	R$ 889,182,328.03
MAC – Incentive	R$ 833,652.84	R$ 0.00	R$ 470,316.48	R$ 0.00
Medium and High Complexity (MAC)	R$ 16,952,046,892.98	R$ 14,606,785,328.86	R$ 13,797,078,126.70	R$ 15,463,193,827.16
Health Surveillance	R$ 24,225,013.59	R$ 0.00	R$ 17,921,582.95	R$ 0.00
Total	**R$ 21,403,268,148.10**	**R$ 15,891,590,183.96**	**R$ 17,981,175,781.93**	**R$ 16,352,376,155.19**

Source: Prepared by authors.

Reflection on these choices is necessary, as there is an increasingly global movement towards incorporating payment methods that generate outcome indicators to ensure services effectiveness. Likewise, an ideal type of payment is not defined either, which can be mixed or complementary, in such a way that it is possible to have increased quality outcomes in health care given the needs in force in the reporting period (Brazil, 2019). Therefore, combining global budgeting and fee-for-service with other models can increase access and quality of access to the health system.

Detailing by health care level, particularly in primary care, outcomes showed a mixed payment logic, combining capitation with global budgeting for thematic and strategic actions, in addition to the performance component. Considering that this arrangement was launched in 2020, it is likely that the amounts presented will vary in the coming years. This movement may occur due to the change in the capitation criterion, already present in previous years, but which considered only the transfer of *per capita* value and the coverage of teams in the family health strategy. As of 2020, the criterion started to adopt the number of people registered in the territory, with an effectiveness indicator more consistent with the expected health overcome.

The second factor that tends to generate changes in the transfer distribution according to models presented is the introduction of the performance logic in a more objective way, which for the year analyzed considers: proportions of pregnant women with at least six prenatal consultations, pregnant women undergoing tests for syphilis and HIV, pregnant women receiving dental care, coverage of cytopathological examination, inactivated and pentavalent poliomyelitis vaccines, percentage of hypertensive people with blood pressure measured every semester and rate of people with diabetes with a request for glycated hemoglobin. The transition in the financing logic and the need to adapt services and professionals involved may have contributed to the still discrete participation of the performance component to the total composition (Brazil, 2019).

Selecting a more synthetic set of indicators certainly increases the capacity to monitor incentive overcomes generated in the PHC. Previously, the National Program for Improving Access and Quality of Primary Care (PMAQ), consisting of more than 40 indicators, figured as a performance component in the PHC. Studies report that it can be more challenging to ensure the set of actions that are encouraged in these cases (Kovacs *et al.*, 2020).

The evaluation of primary care without including extra credits to face the pandemic (COVID-19) showed that the reduced participation of transfers through global budgeting might be attributed to transfers for actions to fight the pandemic. Given the emergency need to transfer resources, together with the short time available between planning and carrying out measures, this model can be considered appropriate to meet the immediate action context. The difficulty in establishing a more assertive volume of demand for services due to the absence of a reliable history series also weakens the proposition of a more elaborate association among transfer options.

The analysis of the production proportion presented concerning procedures in specialized care made it possible to assess the participation of records linked to the FAEC. This assessment showed that the registration of appointments in this modality is predominant at the outpatient level. Regarding the composition of the production informed within the MAC Financial Ceiling, it is possible to see a more outstanding balance between the outpatient and hospital levels.

Possibly, the allocation of highly complex procedures through the FAEC for outpatient care has been caused by strategic health actions. The post-fixed character of this category favors the agreement of pre-established goals. It is noteworthy that there has been gradual incorporation of medium and high complexity funding from the FAEC to the MAC Ceiling in recent years (Brazil, 2017). This type of transfer is usually for less frequent events in the population (Andrade *et al.*, 2018).

Regarding the production values collected from the outpatient and hospital information systems, organized by financing type, it was possible to verify the proximity of these data with those found from the *System of Health Accounts* (SHA) methodology, recommended by the Organization for Economic Cooperation and Development (OECD). In the "SUS Accounts from the international accounting perspective" (2018), the current values found for the year 2014 showed a federal expenditure of R$ 16.8 billion on hospitalizations and R$ 15.1 billion on specialized outpatient care (Brazil, 2018).

In the analysis carried out for specialized care, the predominance of the fee-for-service modality can be seen with a potential loss of quality and health outcomes. Production volume-based payment systems penalize providers that operate with higher quality, as keeping people healthy, loss of service quality, and avoiding unnecessary services do not enter into the production volume logic (NRHI Healthcare Payment Reform Summit, 2008; Mendes, 2011). There is a trend of change in payment schemes in several countries, with an increased focus on value-based health, combining patient experience, clinically relevant outcomes, and sustainable costs across the care cycle (Timpka *et al.*, 2018). Recommendations point out to a system of payment per care episode for the most severe acute events and the global budgeting adjusted for risks or capitation for specific health conditions for chronic diseases. This design strengthens the PHC (NRHI Healthcare Payment Reform Summit, 2008; Mendes, 2011).

Thus, productivity, access, and quality of health care are directly related to payment models. Therefore, to a certain extent, the health system will have its result conditioned by the payment methods adopted (Girardi *et al.*, 2007). The efficient use of payment mechanisms makes it possible to reach the goals defined by the health system, which must be reviewed and if required, a new configuration of payment methods carried out through changes in providers' goals and adaptation (Cashin, 2015).

Among the limitations found, it was noticed that the records of information systems, especially outpatients, suffered considerable fluctuations in the reporting period. The collected data may not capture a portion of actual production. In addition, the presentation of output by health care sites is underestimated, which may lead to changes in the estimated scenario. Classifications of funding components according to payment models have a certain degree of choice by researchers due to the complex array of regulations.

Conclusion

The contribution of our findings of the payment models adopted in the Federal Government transfers to the States, the Federal District, and Municipalities brings a panoramic perspective on how resource applications for public health actions and services occur, in addition to macroeconomic aspects. The approach aimed at analyzing the resource distributions brings a relevant reflection on the improvement in the use of resources in the context of needing increased funding and suitable to increase the capacity of the health system to generate better outcomes with the available resources.

The choice of payment schemes directly influences the quality, access, and productivity of health care networks.

Overall, payment models mapped in the SUS are concentrated in values and more traditional instruments of resource allocation: the global budget, payment by procedure, and capitation. However, as pointed out in this study, there is an effort to combine these payment models with others that reward quality and performance and share the risk in health provision (payment for performance and bundle), approaching the reality of other universal health care systems.

It is noteworthy that this study was unprecedented in the comprehensive classification of transfers from the Federal Government to other federative entities for financing the SUS, according to payment models, and measuring the participation of each one regarding federal resources allocated to health care. As a perspective, the mapping of resources applied by other federative entities, the impact assessment of these mechanisms in health care, and the analysis of actions beyond those addressed can elucidate the need for adjustments from a management perspective. This advance will undoubtedly contribute to discussions on efficiency in public health, presenting the structure of health financing and its financial proportions. It serves as a criterion to be considered to define policies and actions involving the financing system.

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INSTITUTIONAL ARTICLE
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Contributions to the improvement of Health Economics in the Brazilian Health System

Contribuições para o avanço da Economia da Saúde no sistema de saúde brasileiro

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Introduction

Structuring and consolidating economic schemes to make health systems with universal coverage viable remain as challenges globally. It is not unique to Brazil the need to find a balance, as much as possible, to provide the population with adequate access to health actions and services aimed at promoting quality of life and socioeconomic development.

The evolution of the Brazilian Unified Health System (SUS) in its 30 years of existence inevitably leads to evaluating measures that can better sustain its operation. The qualification of management in the three spheres of the government, combined with the continuous improvement of health care networks (Mendes, 2011), is an aspect that, together with health economics, is essential to allow the SUS to renew its central role as the State public policy (Brazil, 1988).

In the Health Economics (HE) area, main drivers have been developed over the last decades in the country, including financing public health actions and services, resource allocation, health efficiency, qualification and economic regulation of health prices, and the health sector's role as a social and economic development instrument. At the federal level, the Department of Health Economics/Ministry of Health coordinates, encourages and participates in various strategic actions to deepen the technical capacity of the SUS. It ensures an action model viable from society's interest since it is a constitutionally guaranteed social right (Brazil, 2003).

Formalized in the regimental structure of the Ministry of Health in 2003 (Brazil, 2003), the then Department of Health Economics was responsible for coordinating the Brazilian System on Public Health Budget (SIOPS) and the Health Price Database. It was already active in conducting technical analyzes involving the topics described above, supporting institutional management.

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Medical Congress: This study is unprecedented, resulting from research carried out in the Department of Health Economics, Investments and Development.
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From 2007 to 2009, being a part of the Federal Executive Secretariat structure (Brazil, 2007a, 2007b), the Health Economics department formally regained its autonomy in 2009. Its performance has been expanded to encompass programs and projects, including investments in infrastructure and equipment (Brazil, 2016a, 2019). As of 2011, the area assumes the current nomenclature – Department of Health Economics, Investment and Development (DESID) – consolidating its national and international cooperation (Brazil, 2019).

Main areas of action

The performance of DESID in the areas of monitoring health costs, qualification and economic regulation of prices, management of SIOPS, and preparation of economic studies for decision-making at various levels has contributed to the evolution of the health economy and the SUS in the last 18 years.

Human Resources Training

By expanding the health system's technical management capacity through fostering human resources and research training, 160 specialization places in Health Economics and 60 vacancies for professional master's degrees in Health Management and Economics in partnerships with universities have been offered. Updating public health budgets and cost management courses were also held with groups of technicians and managers all over the country.

Regarding training human resources, it is noteworthy that even high-income countries have fundamental challenges in managing limited health resources, and this scenario becomes more acute in low- and middle-income countries (Pitt *et al.*, 2016). Health economists in these locations face a lack of data, severely limited skilled personnel, and weak governance, combined with complex disease burdens, including infectious and noncommunicable chronic diseases. Education in Health Economics (HE) becomes an essential ally in developing critical thinking skills, communicating technical details to decision-makers, and working in multidisciplinary HE teams (Frew *et al.*, 2018; Rosa *et al.*, 2018).

Strategic knowledge generation

Within the scope of the development of research lines consolidated in HE's medium and long term, several studies on diseases cost, such as diabetes and chronic kidney disease, were promoted to expand knowledge to guide resources application.

The initiative to strategically invest resources in a study of the cost attributable to diabetes in the SUS has allowed us to observe several beneficial findings for planning public policies, such as the characterization of expenditure on hospital admissions associated with the disease under analysis and attributable complications, totaling 4.6% of the total amounts calculated in 2014, as well as the direct and indirect costs per patient and total for the management of diabetes and macro and microvascular complications. The values with hospitalizations associated with diabetes were 19% higher than those without this comorbidity, especially those for cardiovascular diseases related to diabetes (Frew *et al.*, 2018). Another example was the epidemiological profile of renal replacement therapy patients in Brazil, analyzing chronic kidney disease costs (Rosa *et al.*, 2018).

To provide the Brazilian population with an essential instrument for monitoring health expenditure and its participation in the economy, tracking the share of public spending concerning total spending, an inter-institutional initiative for conducting health accounts began in the 2000s. It was based on a collaborative network among the Ministry of Health, the National Supplementary Health Agency (ANS), the Oswaldo Cruz Foundation (Fiocruz), the Brazilian Institute of Geography and Statistics (IBGE), and the Institute for Applied Economic Research (Ipea). Since then, five editions of the "Health Satellite Account: Brazil" have made it possible to analyze the spending evolution from 2005 to 2017 (Cherchiglia, 2010). It is the only satellite-account success case found in Brazil.

About the last year analyzed, 9.2% of the Gross Domestic Product (GDP) expenditure on health was found, with 3.9% government spending in the three spheres. The health sector's role in the economy could also be quantified, noting that health activities contributed 7.6% of income generation in the country in gross value added. It is equivalent to R$ 429.2 billion and makes it possible to reduce the common sense that using health resources is only an expense and would not generate economic development. In the end, these data favor the comparison with other countries for assessing the Brazilian Health System and the discussion of priorities (IBGE, 2019).

The collaborative network of Health Accounts was also responsible for introducing, since 2014, the methodology of *Health Accounts System*, recommended by the Organization for Economic Cooperation and Development (OECD) and adopted by the World Health Organization in 2018. After the pilot project from the Reproductive, Maternal, Neonatal, and Child Health Account, a study conducted by DESID and Fiocruz to assess the SUS, an analysis of public health expenditure from 2010 to 2014 showed that 52.4% of the public health expenditure refers to remedial actions, in addition to 11.3% with prevention, promotion and health surveillance (Brazil, 2018a).

Another 11.2% are addressed to diagnostic tests and transport, and only 2.9% to rehabilitation and long-term care. Such data unequivocally allow measuring the amount invested in health and each sponsor's participation, in addition to the allocation of resources in health classifications

(Barros, 2016). Since then, the analysis of data from 2015 to 2019 has been ongoing.

DESID's economic studies team also develops several scientific studies for the Ministry of Health's internal consumption to guide decisions on reimbursing amounts for procedures, technical positioning on financial aspects in planning the main object areas of the Department, and the technical positioning on general health funding, etc. Analyzes of federal spending on chronic noncommunicable diseases and values of renal replacement therapy procedures are some examples of high impact for the institutional mission.

Health price qualification

There is transparency as a management strategy and instrumentalized action to allocate public resources in this topic efficiently. More specifically, it is intended to highlight the practice of transparency in computerized systems for providing information on public purchases of medicines and health products, presenting the experience of the Health Price Database System (BPS) and the Health Material Catalog (CATMAT/MS). It was highlighted by Barros (2016):

> "the attitude of public sphere transparency has as an ally the computerization process, which allowed public organizations to get to know each other and make themselves known better. The last two decades have been rich in expanding government performance and their organizations in the virtual environment, especially in the world wide web, the internet. This phenomenon was called e-government".

The development of the BPS system by the Ministry of Health in 1998 aims to provide transparency to values set in public purchases of medicines and health products to allow greater social control and generate positive consequences for management. It is a public and accessible system that allows monitoring a market that turns over tens of billions of 'reais' in contracts signed with the SUS in its different instances – federal, state, municipal, and district (Brazil, 2017). Considering updated data[1], BPS has 17,605 registered users, who are linked to 6,585 institutions, which, in turn, represent 4,009 municipalities. Thus, 72% of Brazilian cities have institutions registered in the system.

In an accessory but no less significant way, the Cataloging Unit of the Ministry of Health (UC/MS) is presented. It is worth mentioning that the pillar on which a database is constructed for price research is based on the structure of a broad catalog with an adequate description of items. The Material Catalog (CATMAT) of the Integrated General Services Administration System (SIASG) of the Ministry of Economy (ME) is a computerized system that allows cataloging materials intended for the core and supportive activities of the Public Administration. The health item catalog generated by the UC/MS team currently totals a portfolio of approximately 50,000 items, of which about 30,000 are available for price consultation in the BPS. The legitimization and consolidation of the BPS as a public price research tool are dissociated from generating and cataloging items at UC/MS (Brazil, 2001).

What at first glance appears as a simple way of making purchase data available - with items properly described - for the public knowledge, it unfolds into an essential management tool with the potential to promote substantial savings in the public expenditure on contracts for purchasing medicines and health products. Enabling this information to the public domain allows SUS managers and technicians to research and compare prices of approximately 30,000 health items, which are transacted in the order of billions of 'reais'.

The availability of price research using BPS makes the purchasing process more efficient regarding the following aspects: legal-administrative, economic regulation, and, above all, in reducing information asymmetry in the market for purchased items.

First, the use of BPS complies with purchasing legislation, which directs that prior price research be carried out. On the other hand, it facilitates price research. In a specific virtual environment, it centralizes information on purchases made throughout the national territory, which, through reports, can be viewed regionally by type of purchase, by the supplier manufacturer, etc. It is also worth noting that such information is statistically treated to eliminate "outliers" and provide values fitted to the reality.

Regarding the economic regulation of the market, the BPS allows consultation of the regulated prices of medicines, per the table published by the Drug Market Regulation Chamber – CMED (Brazil, 202-). Thus, in BPS reports, it is possible to consult the prices set and the prices of economically regulated drugs. The availability of regulated prices, as of 2017, is one of the main evolutions of the BPS system in the recent period.

A critical aspect is the purchased item. BPS uses the information to minimize/correct market failures and let one knows the acquired good's market structure. For example, the drug market has high deviation rates: highly concentrated by therapeutic class and active substances, which sell products with low price elasticity and highly asymmetric information (Fiuza & Lisboa, 2001). The literature on the subject generally addresses information asymmetry from the following relations: 1) consumer *vs.* prescriber and 2) prescriber *vs.* manufacturer. However, another view should be observed (Brazil, 2001).

When referring to public purchases of medicines, there is another perspective for addressing the information

[1] The item description for public purchases must comply with a technique that describes it in a non-generic way – compromising the identification of the purchase object – nor very specific, to direct the purchase.

asymmetry, i.e., the relationship between SUS decentralized institutions *vs.* drugs' manufacturers/suppliers. The asymmetric relationship between these two poles takes place fundamentally in the aspect of unequal knowledge of the variable "set price", and here are the main contributions of the BPS to the efficient management of public resources. This asymmetry is evident when considering the high dispersion of prices charged. It is not uncommon for users of the BPS system who, when using the system's research report, find a high price dispersion for the same item in their respective price surveys, with a high coefficient of variation. This dispersion does not only occur at a national level, which logistic, tax issues, etc., could hypothetically justify it but also at the regional, municipal level. The same company often charges different prices for the same item for geographically bordering municipal institutions.

This scenario of high price dispersion also allows us to infer great savings potential in this market. In this way, the BPS, by providing transparency to purchase information and allowing knowledge of the prices charged, contributes to reducing information asymmetry and enables the convergence of values set in acquisitions to the best prices charged to the public administration, making purchasing processes efficient.

The BPS potential contribution to the identification and formulation of efficient acquisition arrangements is a highly relevant perspective. In its different segments, SUS is inserted in the health items market as the primary institutional buyer. This insertion pattern places it in the condition of an oligopsonist in this market and, consequently, gives it, hypothetically, high potential in negotiating the prices of contracted items.

However, in practical terms, SUS is administratively decentralized. Contrary to the practice of homogeneous prices, the reality is divergent prices and a high coefficient of variation for identical items throughout the national territory. The ideal scenario would be the practice of relatively homogeneous prices by federated entities and, at the same time, adherent to the best prices set in this market for the different items purchased.

The BPS's main contribution in the aspect mentioned above is to demonstrate that a possible way to circumvent the price dispersion caused by administrative decentralization – and consequent nationally dispersed purchasing processes – is being aware of prices charged. A significant example is consortia: in general, it appears that consortia offer better prices *vis-à-vis* those practiced in the context of decentralized purchases.

As challenges in managing the BPS system and the cataloging unit of health items (CATMAT/MS), it is possible to point out the need for expansion, quality, regularity, and presentation of the information provided to managers.

Calculation and cost management at the SUS

One of the health economics aspects is cost management for decision-making, mainly by health service managers, to better allocate available resources. The survey of the health service costs offered by the SUS is an essential tool for providing public managers with information on the output process of health activities and providing people with adequate information on the resource consumption, thus enabling measuring and analyzing the SUS efficiency, transparency, social participation and the (re)formulation of public health policies.

Therefore, cost management emerges as a fundamental action. It should be directed towards strategic decision-making for ensuring the provision of health care services to system users. It is allied to the quality management of such services, controlling, and managing expenses, i.e., decision-making based on the cost of the best treatment provided for the most acceptable cost, thus ensuring efficiency to the service provision.

Efficiency can also be defined as the relationship between goods and services and resource costs used for such generation. It can be achieved, maintaining quality if costs are minimized to produce the same quantity of goods and services performed (input-oriented) or if this quantity is maximized at the same price (output-oriented). Given this, the discussion on SUS efficiency should also make use of the implementation of cost management in health facilities so that, in this way, the debate can be substantially enriched.

Intending to foster cost management in SUS health facilities, DESID has been carrying out actions since 2004 to advance cost management based on successful experiences conducted by SUS public providers.

At that time, a working group (WG) was created to systematize the National Cost Management Policy (after a workshop with representatives of hospitals that worked with costs in the SUS). WG discussions resulted in the proposition to create the National Cost Management Program (PNGC).

From there on, some activities were carried out to implement the Program, such as the preparation of the PNGC Technical Manual, published in 2006; the survey of the costing systems most used at the time; and visits to institutions that had cost systems in place, to acquire knowledge and good practices.

The PNGC is a set of actions that involve the generation, improvement, and encouragement of the effective use of cost information by health managers, aiming to optimize the SUS's performance. In short, it aims to provide a standardized methodology and specific information system, and technical support in all phases of cost management implementation. The PNGC's information tool is the SUS Cost Management and Calculation System (APURASUS), developed with DATASUS

to incorporate technological and methodological advances that better serve the SUS units.

As a strategy for calculating and managing healthcare costs, APURASUS is available to those who voluntarily adhere to the PNGC, considering that the Program is not mandatory. It is a website with restricted access to program participants only and has several profiles. It can be used in several health units, allowing them to determine the cost of services provided. Its methodology is absorption costing, with reciprocal allocation. It enables the unit's configuration by cost center in a standardized and structured way, considering the specificities of the SUS.

Despite their track record of results, only in 2018, the PNGC and APURASUS were officially established under the Ministry of Health, representing yet another progress in the consolidation of cost management in the SUS (Brazil, 2018b).

Due to the incipience of public administration, many SUS health units, the complexity of the health sector, and the said issue, states, and municipalities willing to have a team responsible for monitoring the process are prioritized as an implementation strategy at the local level, to facilitate the implementation of the Program, consolidating and sustaining costs management and calculation.

Another strategy adopted was to start cost management by hospitals and emergency care units (UPAs), gaining expertise, and only later including other health units. Pilot projects are currently being developed to include primary health units, polyclinics, and blood centers.

The implementation of the PNGC takes place in five major successive and dependent stages. Units are required to go through these stages to achieve the Program's main objectives. For the Program to be considered 100% implemented, the following steps must be completed: (i) Sensitization at the strategic, tactical, and operational level; (ii) training in cost management methodology by the Ministry of Health; (iii) structuring of cost centers and data collection; (iv) training in APURASUS and data processing; and (v) analysis, monitoring, and evaluation of the information entered in APURASUS.

The PNGC's technical team provides training in cost management introduction for employees of state and municipal health secretariats and hospitals, makes APURASUS available and enables it to be used, and performs constant technical monitoring at all stages of implementation. The mere availability of the system did not prove to be effective since the main difficulties identified by the system users are conceptual and methodological.

In March 2021, 219 units implemented cost management through the PNGC. Of these, 36 were collecting data and 183 using data from APURASUS. Altogether 13 state secretariats (*Acre, Amapá, Amazonas, Bahia, Distrito Federal, Paraíba, Pernambuco, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, São Paulo, Sergipe* and *Tocantins*), 14 municipal secretariats (*Aracaju, Bento Gonçalves, Campo Bom, Cássia, Fortaleza, Ibiraci, Joinville, Mauá, Natal, Parauapebas, Petrópolis, Porto Alegre, Rio de Janeiro* and *São Sebastião do Paraíso*), 8 university hospitals linked to EBSERH (*Hospital Universitário da Universidade Federal de Juiz de Fora, Hospital de Clínicas da Universidade Federal do Triângulo Mineiro, Hospital Universitário da Universidade Federal da Grande Dourados, Hospital Escola da Universidade Federal de Pelotas, Hospital Universitário de Sergipe – HUSE –, Hospital Universitário Maria Aparecida Pedrossian – HUMAP –, Hospital Universitário Antônio Pedro – HUAP-UFF –* and *Hospital Universitário de Lagarto – HUL)* and *Instituto Fernandes Figueira da Fiocruz have participated*.

Regarding PNGC benefits, the following should be mentioned: (i) formation of technical capacity through training in cost management, (ii) adoption of a costing methodology suitable for the different SUS health sites, (iii) technical support in person, remotely, and full support to implement the Program and information qualification, (iv) encouragement and support for information exchange and experiences in costs calculation among participants, (v) availability of the information system (APURASUS) and training for using it, and (vi) creation of a cost information database for different health units, heterogeneous structures, and other regions.

Implementing cost management in any organization, public or private, requires the organization of work processes, working structuring systems, decentralization of information, and staff with exclusive dedication, which is not always consistent with the reality of the SUS health units. In addition, the PNGC is extremely sensitive to a robust institutional governance system that includes its development in the priority schedule, spanning the three levels of management and its dependents, and supporting its implementation, expansion, and continuity.

The constant management changes in partner institutions, the high turnover of technicians responsible for cost management, the lack of knowledge about the use and benefits of cost information, among other aspects, make the implementation of cost management in the SUS more challenging and complex.

The applicability of information from this process is highly strategic for management planning, monitoring, and evaluation. Among these points, the following stand out: 1) prepare the budget based on the total cost of the health unit; 2) know the costs of the services provided, monitoring them month by month, making it possible to identify what influences the dynamics of calculated costs; 3) identify inefficient activities and their causes; 4) know if it is really advantageous to outsource services; 5) subsidize the hiring of ICU beds and other services; 6) define the cost of implementing a new service or expanding an existing one;

7) generate indicators to demonstrate successful experiences; 8) strengthen social control through transparency in the use of resources and costs of services provided by each health unit to society; 9) support the control of agreements between municipalities; 10) discuss management contract values with third sector institutions responsible for health services; 11) respond to demands from control agencies; 12) improve human resource management; 13) support economic evaluation in health; 14) generate standardized indicators that enable benchmarking; among others.

In time, regardless of its paramount importance, cost information cannot be the focus point. Ideally, cost information should be used together with other indicators to understand the context better and support qualified decision-making.

Information on public health budgets

In basic terms, SIOPS is a computerized system, accessible via the internet, with mandatory feed which data are generated by the federated entity accounting sector, as a record recommended by the central accounting agency of the Brazilian government, which is the National Treasury Department (STN-ME). The system also enables the consolidation of expenses with public health actions and services (ASPS), calculating the percentage applied by the entity and comparing it with the minimum rates established by Constitutional Amendment No. 29. The rule considers 12% of states' revenues or 15% of municipalities' revenues. For calculating the Brazilian government minimum application, the rule outlined in Constitutional Amendment No. 95/2017 is used, and the sum of paid expenses and those remaining to be paid from the previous year, corrected by the variation of the Extended National Consumer Price Index – IPCA (Brazil, 2016b).

SIOPS has a relevant role in enabling the consolidation of budget data from all federated entities. There is no other information system in Brazil that allows the consolidation of health budget data like SIOPS. To achieve this consolidation level of information and data quality required the hard work of several people and entities. They searched for continuous improvement of the system, not as an accountability instrument but as a management tool that enables the actors involved with the federated entity's administration to follow, monitor, and evaluate the health area budget.

In addition, from the data collected through SIOPS, reports – including the health annex of the Budget Execution Summary Report (RREO) –, indicators and other information are generated to support the society and public managers in the search for knowledge in the field of public health.

The system provides an overview of total revenues and expenditures on public health. Its content enables consultations that work as an instrument for planning, management, control, and evaluation. It also allows other ways of research and investigation, such as comparing federal entities in the execution of budget resources; or the dimensioning of health expenditure by government sphere, providing detection of changes in the pattern of health expenditure over time (Figure 1, Graph 1).

The availability of information in SIOPS has primarily contributed to monitoring resources minimum legal application for public health actions and services to analyze public spending behavior by government sphere and over the years. Verifying the composition of the financing by federative entity plays a fundamental role in the agreements of the Tripartite Intermanagers' Commission and the Bipartite Intermanagers' Commission. The system allows the monitoring of resources application by each manager, with a level of detailing by sub-function and expense elements, which favors the organization of the resource allocation process.

Another highlight of SIOPS in the search for information reliability provided in the system lies in the fact that it has an exclusive access module for the Courts of Auditors, the External Control Module (MCE), through which the courts of accounts can resolve the information provided by federated entities within its jurisdiction. It is a way for the Courts of Auditors to validate the information provided by federated entities in SIOPS – including the possibility of overlaying the data approved by the health manager if any inconsistency in the declared data is detected.

Final considerations

As the SUS consolidates, society has come to understand its relevance as a social achievement; however, it is necessary to strengthen the availability of information that allows each system user to understand the predominant role of health actions in their life cycle. By building a solid knowledge framework on issues related to health economics and presenting it with an adequate translation of knowledge to managers, health professionals, and users, the consensus on the importance of making choices involving trade-offs for guaranteeing access to healthcare with equity and efficiency.

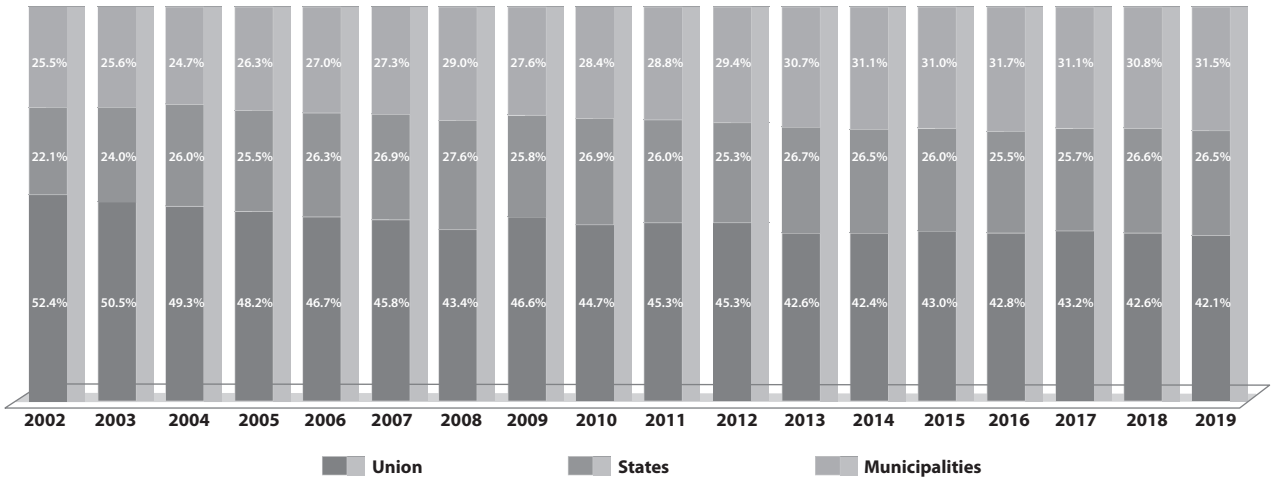
Understanding that financing a health care system with universal coverage bringing immense social and economic benefits is part of the process to reduce individual choices to guarantee access to private health in favor of increasing public health participation.

Also, understand that there are substantial gains with disseminating national immunization, distributing drugs for chronic diseases, and massively monitoring health conditions with self-care and primary health care. Undoubtedly, this will make the population realize that their health expenses are reduced by accessing these services. More than that, it helps avoid catastrophic expenditures that reduce the productive

Year	GDP – (R$ million)	Population	Federal			State			Municipal			Total		
			Expenditure (R$ thousand) (A)	Expenditure per inhabitant (R$) (B)	GDP proportion (%) (C)	Expenditure (R$ thousand) (D)	Expenditure per inhabitant (R$) (E)	GDP proportion (%) (F)	Expenditure (R$ thousand) (G)	Expenditure per inhabitant (R$) (H)	GPD proportion (%) (I)	Expenditure (R$ thousand) (A+D+G)	Expenditure per inhabitant (R$) (B+E+H)	GPD proportion (%) (%) (C+F+I)
2002	1,488,788	174,632,960	24,736,843	141.65	1.66%	10,447,105	59.82	0.70%	12,029,688	68.89	0.81%	47,213,635	270.36	3.17%
2003	1,717,951	176,871,437	27,181,155	153.68	1.58%	12,904,186	72.96	0.75%	13,765,417	77.83	0.80%	53,850,758	304.46	3.13%
2004	1,957,750	181,581,024	32,703,495	180.10	1.67%	17,272,899	95.13	0.88%	16,409,723	90.37	0.84%	66,386,118	365.60	3.39%
2005	2,170,584	184,184,264	37,145,779	201.68	1.71%	19,664,416	106.76	0.91%	20,287,287	110.15	0.93%	77,097,481	418.59	3.55%
2006	2,409,450	186,770,562	40,750,155	218.18	1.69%	22,978,253	123.03	0.95%	23,568,595	126.19	0.98%	87,297,003	467.40	3.62%
2007	2,720,263	183,989,711	44,303,496	240.79	1.63%	25,969,634	141.15	0.95%	26,426,564	143.63	0.97%	96,699,694	525.57	3.55%
2008	3,109,803	189,612,814	48,670,190	256.68	1.57%	30,976,460	163.37	1.00%	32,471,345	171.25	1.04%	112,117,994	591.30	3.61%
2009	3,333,039	191,480,630	58,270,259	304.31	1.75%	32,274,085	168.55	0.97%	34,542,847	180.40	1.04%	125,087,191	653.26	3.75%
2010	3,885,847	190,747,855	61,965,198	324.85	1.59%	37,296,383	195.53	0.96%	39,290,644	205.98	1.01%	138,552,225	726.36	3.57%
2011	4,376,382	192,379,287	72,332,284	375.99	1.65%	41,511,838	215.78	0.95%	46,005,793	239.14	1.05%	159,849,915	830.91	3.65%
2012	4,814,759	193,946,886	80,063,148	412.81	1.66%	44,822,698	231.11	0.93%	52,034,361	268.29	1.08%	176,920,208	912.21	3.67%
2013	5,331,618	201,032,714	83,053,255	413.13	1.56%	52,148,018	259.40	0.98%	59,908,108	298.00	1.12%	195,109,381	970.54	3.66%
2014	5,778,953	202,768,562	91,898,531	453.22	1.59%	57,305,396	282.61	0.99%	67,381,118	332.31	1.17%	216,585,044	1,068.14	3.75%
2015	5,995,786	204,450,649	100,054,862	489.38	1.67%	60,540,190	296.11	1.01%	72,223,158	353.25	1.20%	232,818,211	1,138.75	3.88%
2016	6,259,228	206,081,432	106,235,537	515.50	1.70%	63,293,423	307.13	1.01%	78,513,046	380.98	1.25%	248,042,006	1,203.61	3.96%
2017	6,559,940	207,660,929	114,700,610	552.35	1.75%	68,415,055	329.46	1.04%	82,614,406	397.83	1.26%	265,730,071	1,279.63	4.05%
2018	6,889,176	208,494,900	116,820,887	560.31	1.70%	72,859,835	349.46	1.06%	84,619,936	405.86	1.23%	274,300,658	1,315.62	3.98%
2019	7,256,927	210,147,125	122,269,918	581.83	1.68%	76,960,337	366.22	1.06%	91,530,201	435.55	1.26%	290,760,456	1,383.60	4.01%

Source: Department of Health Economics, Investment, and Development (DESID) – Ministry of Health.

Figure 1. Public spending on public health actions and services (ASPS) compared to GDP – 2002 to 2019.



Source: Department of Health Economics, Investment, and Development (DESID) – Ministry of Health.

Graph 1. Scaling public spending on public health actions and services (ASPS) by government sphere – 2002 to 2019

capacity and increase the individual's dependence, overloading the social protection system.

Given these factors that may seem simple, the performance of this thematic area in the last 18 years needs to be increasingly strengthened in the health schedule to ensure sustainability and, consequently, perpetuity to the system.

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INSTITUTIONAL ARTICLE
ARTIGO INSTITUCIONAL

Efficiency and sustainability of public health spending in Brazil

Eficiência e sustentabilidade do gasto público em saúde no Brasil

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ABSTRACT

Objective: This paper discusses issues related to the efficiency and sustainability of public spending on health in Brazil. Despite the achievements of recent decades, the Unified Health System (SUS) faces structural challenges with consequences on the access to public health services and on the financial protection of the population. **Methods:** The paper provides a brief overview of the public healthcare financing in Brazil over the last ten years and presents an efficiency analysis of the SUS public health spending, using data envelopment analysis (DEA) models for the years of 2013 and 2017. **Results:** In terms of public spending, the paradox that Brazil spends little but poorly on health still persists. Public expenditures on health are relatively lower than those observed in countries with health systems with similar characteristics, but public expenditures per capita grow at rates higher than the growth of gross domestic product (GDP) *per capita*. In terms of efficiency of public health spending, the analysis shows that there is potential to increase the efficiency of the SUS. In 2017, these inefficiencies amounted R$ 35.8 billion. In general, SUS primary healthcare (APS) is more efficient (63% and 68% in 2013 and 2017) than high and medium complexity care (MAC) (29% and 34% in the same years, respectively). **Conclusion:** Improving the efficiency of public spending on health is particularly important in the current context of low economic growth and strong fiscal constraints in the post-pandemic environment. Efficiency gains can be achieved with: (i) scale gains in the structure and operation of hospitals, (ii) integration of care in health care networks, (iii) increased density and better distribution of the health workforce, (iv) change in mechanisms and incentives to link payments to providers and professionals to health outcomes, with the PHC as the organizer of the system, (v) innovations in the management of health service providers, with an emphasis on public partnership models and private companies (PPPs) . The consolidation of the SUS depends on public policies to improve the efficiency and quality of services provided to the population.

Palavras-chave:
financiamento da saúde, eficiência dos sistemas de saúde, financiamento do SUS, reformas do SUS

RESUMO

Objetivo: Este artigo discute questões relativas à eficiência e à sustentabilidade do gasto público com saúde no Brasil. A despeito das conquistas das últimas décadas, o Sistema Único de Saúde (SUS) enfrenta desafios estruturais com consequências no acesso aos serviços públicos de saúde e na proteção financeira da população. **Métodos:** O artigo traça um breve panorama do financiamento da saúde no Brasil nos últimos 10 anos e apresenta análise da eficiência do gasto público em saúde utilizando modelos de análise envoltória de dados (*data envelopment analysis* – DEA) para os gastos com o SUS nos de 2013 e 2017. **Resultados:** Do ponto de vista do financiamento do sistema público de saúde, persiste o paradoxo de que o Brasil gasta pouco, mas gasta mal. Os gastos públicos com saúde são relativamente menores que os observados em países com sistemas de saúde com caraterísticas semelhantes, porém os gastos públicos *per ca pita* crescem a taxas maiores do que o crescimento do Produto Interno Bruto (PIB) *per capita*. Do ponto de vista da eficiência, a análise demonstra que há potencial de aumentar a eficiência do SUS. Apenas em 2017 essas ineficiências somavam R$ 35,8 bilhões. De forma geral, a atenção primária à saúde (APS) do

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SUS tem eficiência maior (63% e 68% em 2013 e 2017) do que a atenção de alta e média complexidade (MAC) (29% e 34% nos mesmos anos, respectivamente). **Conclusão:** Melhorar a eficiência do gasto público com saúde é particularmente importante no contexto atual de baixo crescimento econômico e fortes restrições fiscais no ambiente pós-pandemia. Ganhos de eficiência podem ser alcançados com: (i) ganhos de escala na estrutura e operação dos hospitais, (ii) integração do cuidado em redes de atenção à saúde, (iii) aumento da densidade e melhor distribuição da força de trabalho em saúde, (iv) mudança nos mecanismos e incentivos para vincular os pagamentos aos provedores e profissionais aos resultados de saúde, tendo a APS como organizadora do sistema, (v) inovações na gestão dos provedores de serviços de saúde, com ênfase em modelos de parcerias público-privadas (PPPs). A consolidação do SUS depende de políticas públicas que melhorem a eficiência e a qualidade dos serviços prestados à população.

Introduction

Brazil built and consolidated one of the largest public health systems in the world in the last three decades. The Brazilian Unified Health System (SUS) provided advancement in the country's social policies, allowing millions of Brazilians previously without coverage to access health services. Creating the SUS, there was a considerable expansion of the public health service delivery network, with great coverage and access to health services and improved health indicators for the Brazilian population (Gragnolati *et al*., 2013). Thus, in 2017, Brazil achieved the highest coverage of essential health services among the ten most populous countries in Latin America, with 79% of its population (Table 1).[1] Primary Health Care (PHC), through the Family Health Strategy (FHS), is one of the expansion pillars of health services coverage. From 1998 to 2020, the family health (FH) teams increased from 4.0 thousand to 43.3 thousand.[2] The increased number of teams, accompanied by increased FHS coverage, reached 63.6% of the total Brazilian population in 2020. More recently, with the registration incentives implemented by the Prevent Brazil Program, the number of people enrolled in the FHS teams reached over 145 million in 2020.

The coverage and access increase were, to some extent, followed by the increased production of services. Considering the SUS outpatient care services, which include a considerable volume of PHC actions between 2008 and 2016, there was a growth of 32% in the *per capita* volume of services produced. However, there was a reduction of 26.2% between 2016 and 2020, with production returning to levels before 2008 (Graph 1). This trend, particularly in the year 2020, should have been affected by the pandemic crisis, which resulted in a reduction in demand (and supply) for regular health services.[3]

However, expanding health services had not achieved a proportional effect on reducing family health expenditures. Recent evidence indicates that, on average, health spending accounts for 13.0% of total household consumption, ranging from 12.1% for the lowest consumption decile to 14.0% for the highest income decile. Health corresponds to the fourth-largest expense in the family budget, after housing (36.6%), transport (18.1%), and food (17.5%). Araujo and Coelho (2021) used data from the 2017-2018 Household Budget Survey (HBS) of the Brazilian Institute of Geography and Statistics (IBGE) for estimating that 33.4% of Brazilian families incur catastrophic health expenditures (37% between the poorest). More than 10 million Brazilians fall into poverty annually due to direct spending on health. It corresponds to 4.7% of the Brazilian population, i.e., representing a higher percentage than that seen globally (2.5%) or among Latin America and the Caribbean (1.8%). These data reflect that there are still difficulties accessing health services (Graph 2).

1 The Universal Health Coverage (UHC) - Service Coverage Index (SCI) has been calculated by the World Health Organization (WHO) for all countries, based on their national statistics, as one of the indicators that monitor the universal health coverage target of the Sustainable Development Goals (Indicator 3.8.1). The Index comprises an extensive set of indicators grouped into four components of service coverage: (i) reproductive, maternal, newborn, and child health; (ii) infectious or communicable diseases; (iii) non-communicable or chronic diseases and (iv) service capacity and access.

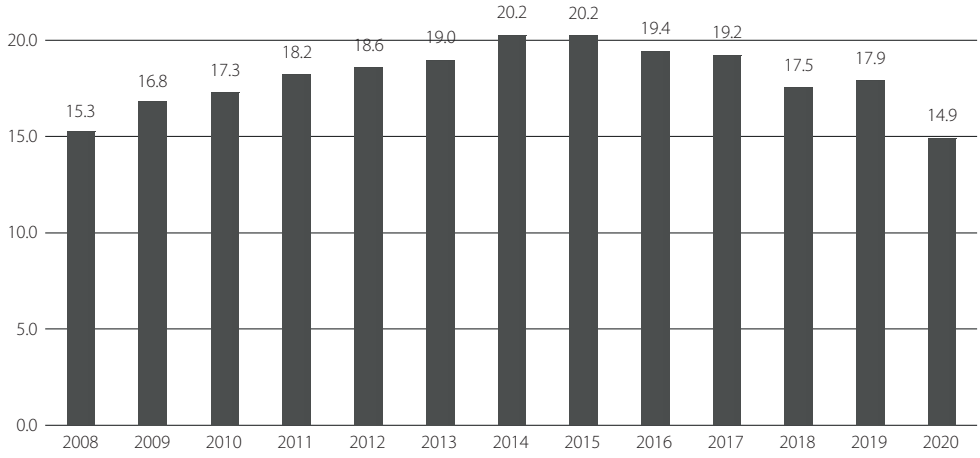
2 See https://sisaps.saude.gov.br/painelsaps/saude-familia. According to this portal, the number of FHS in December 2020 was 43,286. However, an additional number of traditional primary care teams are equivalent to 8,639, which would give a total of 51,325 primary care units (FHS + traditional primary care teams)

3 It is worth mentioning that outpatient services are more significant than the medical appointments *per se*, as it includes a series of services, such as various tests, vaccination, therapies, drug delivery, and others that are not associated with the visit to a doctor. Between 2008 and 2020, SUS outpatient procedures *per capita*, as shown in Graph 3, went down from 15.3 to 20.2, but it started to decrease until reaching 14.7 in 2020. The reduction in outpatient procedures cannot always be seen as a negative factor, and it can also be associated with a reduction in waste and increased efficiency. Much of the value-based health care strategy (VBHC) seeks to transform health systems oriented towards producing a volume of services to health systems oriented towards achieving good clinical outcomes and care outcomes for the patient.

Table 1. Universal Health Coverage Service Index (UHC-SCI), Selected Latin American and the Caribbean States

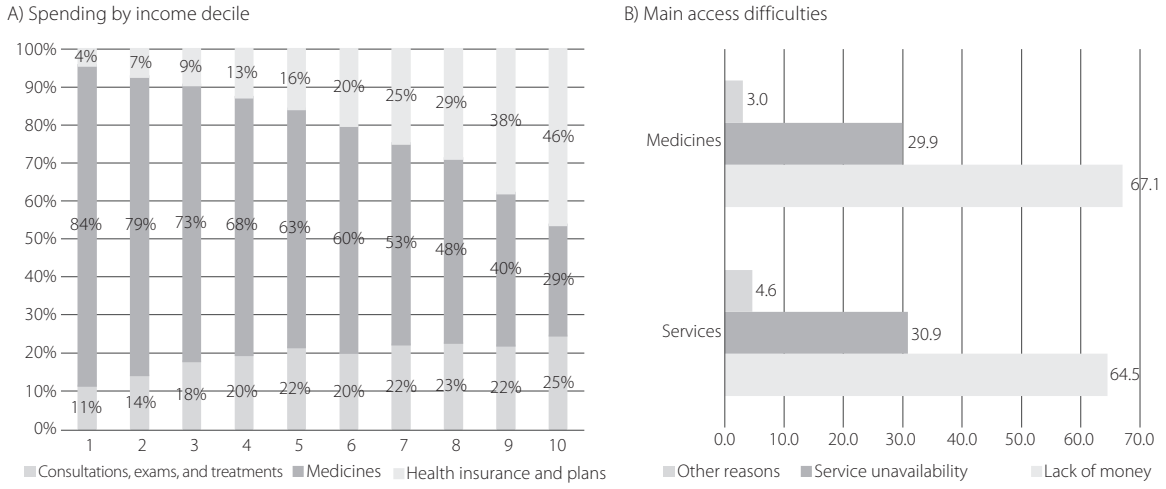
Country	Pop (Millions in 2021	UHC-SCI 2015	UHC-SCI 2017	SCI-1 2015	SCI-1 2017	SCI-2 2015	SCI-2 2017	SCI-3 2015	SCI-3 2017	SCI-4 2015	SCI-4 2017	DA (%)
Brazil	214.0	78.0	79.0	78.6	77.2	66.4	70.4	70.6	71.2	98.8	98.7	43.0
Mexico	130.4	76.0	76.0	83.7	83.3	68.0	71.0	71.1	71.7	80.3	79.7	54.0
Colombia	51.3	76.0	76.0	81.9	82.2	62.7	61.0	77.0	77.4	83.3	85.5	54.0
Argentina	45.7	76.0	76.0	89.7	87.9	60.0	64.3	65.7	66.9	93.8	88.9	34.0
Peru	33.4	77.0	77.0	76.4	75.3	63.4	68.9	82.2	83.3	88.9	81.1	70.0
Venezuela	28.7	73.0	74.0	82.8	75.7	63.3	67.3	78.8	79.2	69.6	75.0	41.0
Chile	19.2	66.0	70.0	92.0	91.6	64.1	74.0	35.6	38.0	90.8	94.2	43.0
Guatemala	18.3	57.0	55.0	68.6	70.7	53.6	44.6	71.8	72.1	41.1	32.0	46.0
Ecuador	17.9	76.0	77.0	78.8	80.6	59.1	63.7	77.6	77.9	91.9	85.6	39.0
Bolivia	11.8	64.0	68.0	70.0	69.0	42.0	48.6	78.5	78.8	74.5	81.5	50.0

The UHC-SCI ranges from 0 to 100, with 0 representing no coverage and 100 full population coverage.
SC-1: reproductive, maternal, newborn, and child health; SC-2: infectious diseases; SC-3: non-communicable (chronic) diseases; SC-4: capacity of health services; DA: data availability for calculating the UHC-SCI.
Source: World Health Organization (WHO). Available at: https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4834.



Source: Ministry of Health Siasus. Available at: http://sia.datasus.gov.br/principal/index.php.

Graph 1. Production of Outpatient Services per capita, Brazil 2008-2020



Source: Authors' calculation based on POF/IBGE 2017/2018.

Graph 2. Health expenses and difficulties in accessing services

The SUS consolidation has been based on a debate on the appropriate public health spending and the efficiency of using these resources. Brazil's total health expenditure is comparable to the average spending among the Organization for Economic Cooperation and Development (OECD) countries. Brazil allocated the equivalent of 9.2% of its Gross Domestic Product (GDP) to health in 2018, while OECD countries allocated, on average, 8.8% (OECD, 2019). However, in 2017, public sources accounted for 71%, on average, of health expenditure in OECD countries, while in Brazil, public sources accounted for only 43% of health expenditure. Private spending, direct payments, and spending through plans and health insurance accounted for 57% of total health financing sources in the country. According to the IBGE Health Satellite Accounts, in 2017, the *per capita* expenditure of families and private institutions (including the portion dedicated to health insurance) was 40% higher than the *per capita* expenditure of the government. Such difference between public and private *per capita* expenditures has increased in recent years, indicating the trend of health expenditures in Brazil being supported by resources that come directly from family budgets and non-governmental institutions.

Although relatively lower, the public spending *per capita* has continued to rise in recent years, with rates above GDP growth rates *per capita*. Graph 3 shows in the series 2011-2020, the growth of total public health expenditure *per capita* (including the three spheres of government) was systematically higher than the GDP growth *per capita*, except in 2018. It means that the expansion of public health spending over the past few years has been more significant than the Brazilian economy expansion.

Despite efforts to consolidate a global public health system, Brazil still faces enormous challenges to strike a balance between an adequate level of (public) expenditures and better results from resources invested in the public health system. In the context of fiscal restrictions, the discussion on improving the quality of public health spending is essential to consolidate gains achieved in recent decades. This discussion should consider mechanisms that avoid resource wastage and increase efficiency, improving the sector management and work processes and creating underlying incentives for patients, managers, professionals, and providers.

This article discusses the efficiency agenda importance to ensure the sustainability of public health spending in Brazil. Challenges will be even more significant due to the possible trend of increasing health spending due to the incorporation of technology in the sector and changes in the demographic and epidemiological profile, which create an increased spending trend. This article firstly presents a brief overview of health financing in the country, emphasizing the composition and trajectory of public health spending in the last ten years. Then, the article presents and discusses an analysis of the efficiency of public health expenditure in Brazil. Finally, it discusses health policies that could improve the efficiency of using public health resources in Brazil.

Overview of health financing in Brazil

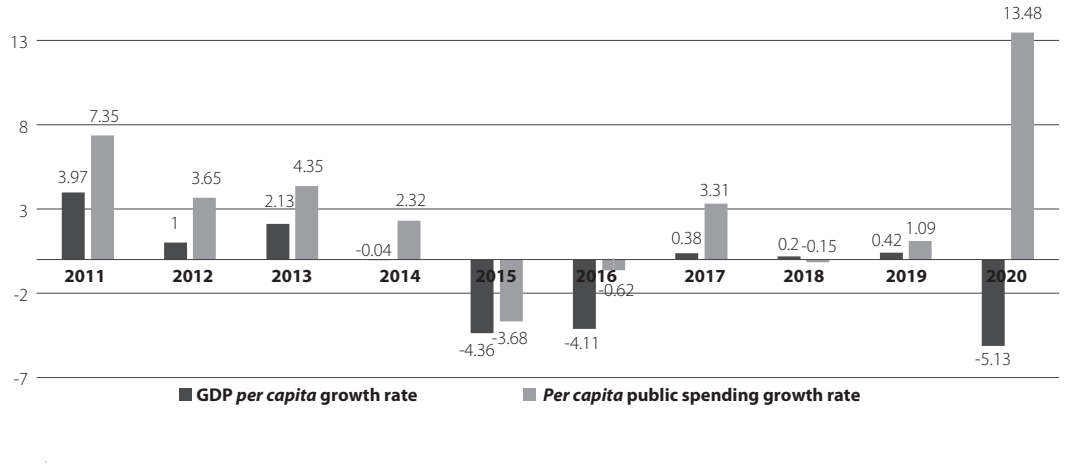
Based on data from the Information System on Public Health Budgets (SIOPS) from the Ministry of Health, it is estimated that expenditure on Public Health Actions and Services (ASPS) within the three government spheres reached 4.83% of GDP in 2020.[4] Graph 4 shows that, in 2020, health spending amounted to BRL 358 billion, an increase of 44.3% compared to 2011 total expenditure (BRL 241 billion), in constant values of December 2020. However, 2020 was atypical due to the COVID-19 pandemic, when extraordinary resources were allocated in response to the pandemic. Compared with the pre-pandemic period, 2019 (BRL 304 billion), the growth reaches 26.2%, a real annual geometric growth of public health spending of 2.6% per year throughout the period.

The federal health expenditure share was reduced by 3% from 2010 to 2019. This reduction was reversed in 2020 with the increased federal resources to respond to the pandemic, surpassing the participation percentage observed in 2010 (46% in 2020), due to the federal government's role in assisting states and municipalities in setting up infrastructure, purchasing equipment, supplies, and vaccines to fight the pandemic. When considering the entire pre-pandemic period, a participation increase of local levels of government, states, and municipalities is seen, highlighting the latter, which, in 2020, contributed 29% of total public spending in the sector, compared to the 26% from state spheres.

A more detailed analysis of federal health expenditures, using the ASPS [Public Health Actions and Services] criterion, allows us to demonstrate some changes in the composition of main expenditure groups in the last ten years.[5]

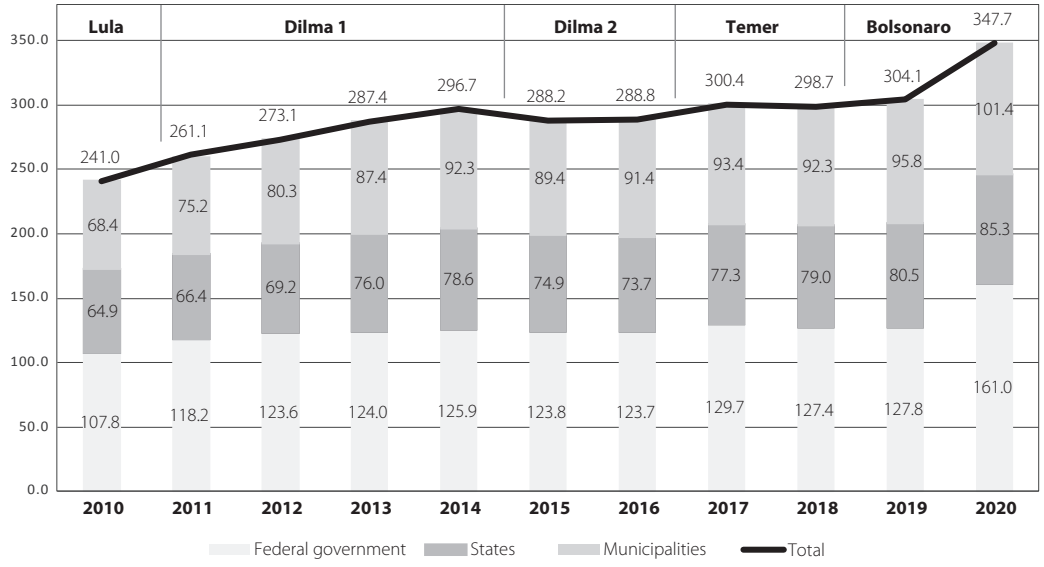
4 It was the highest share of public health spending in Brazil. This data corresponds to the year in which the COVID-19 pandemic started. It led to a drop in GDP of 4.1% and a growth in public health spending of 17.6% for facing extraordinary expenses to contain the pandemic and treat critically ill patients. It required expenditure on equipment, emergency beds, and medical products, such as personal protective equipment, medicinal gases, and medicines, which had high prices due to international demand.

5 Other expenses include various lesser representativeness groups, such as general administration, internal control, regulation and inspection, social communication, special assistance to population groups (children and adolescents, elderly, indigenous people, people with disabilities), food and nutrition, early childhood education, higher education, basic urban sanitation, training on human resources, technological development and engineering, among others.



Source: SIOPS. Available at http://antigo.saude.gov.br/repasses-financeiros/siops.

Graph 3. GDP *per capita* growth and public health spending: Brazil, 2011-2020.

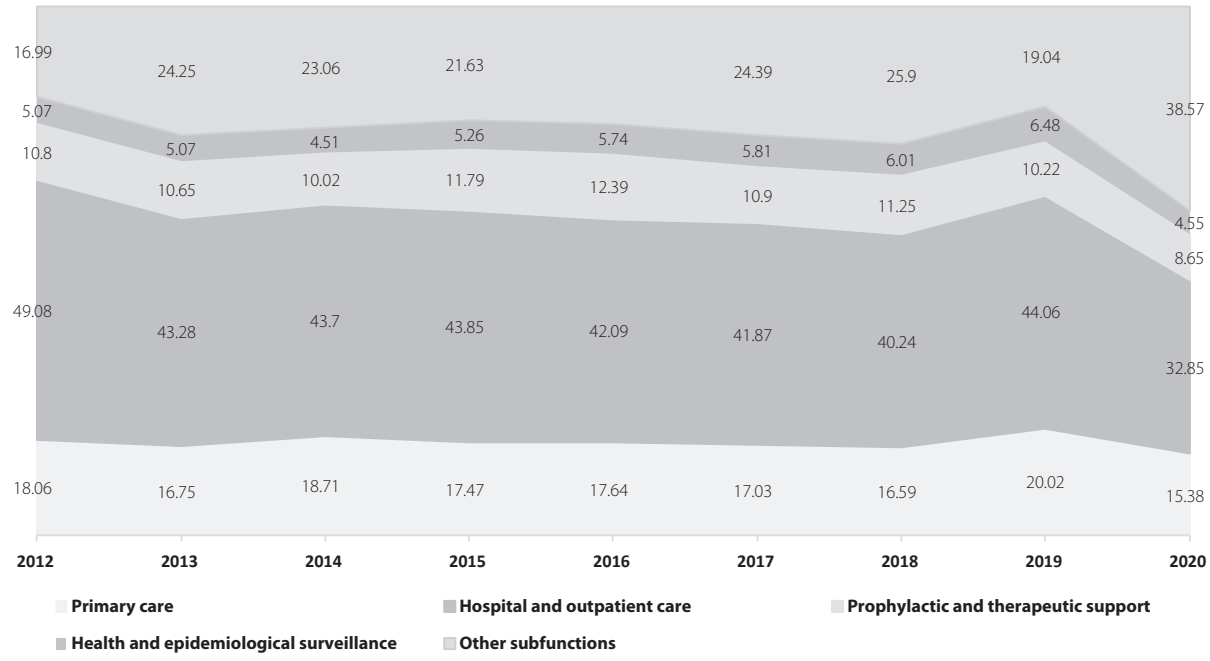


Source: Authors' calculation from SIOPS/MS data. Available at: http://antigo.saude.gov.br/repasses-financeiros/siops. *In BRL billion from Dec. 2020 deflated by the Extended National Consumer Price Index (IPCA).

Graph 4. Public health spending in Brazil by the government sphere, 2010-2020*

Expenditure on primary health care, for example, increased marginally from 18% to 20% of SUS federal spending between 2012 and 2019 (despite the drop in 2020, probably due to the pandemic). Spending on hospital and outpatient care decreased from 49% to 44% between 2012 and 2019, reaching its lowest participation in the series in 2020 (33%).[6] Expenditure on prophylactic and therapeutic support (including medications) ranged between 9% and 12% over the period, with no defined trend. Health spending and epidemiological surveillance, on the other hand, ranged between 4.5% and 6.5% throughout the series, also not showing a defined trend (Graph 5).

6 This drop is due to the reduction in hospital admissions in the public sector, mainly due to the cancellation of elective surgeries during the COVID-19 pandemic (Medici AC, 2021).



Source: Authors' calculation from SIOPS/MS data. Available at: http://antigo.saude.gov.br/repasses-financeiros/siops

Graph 4. Percentage distribution of SUS federal expenditures according to expenditure components: 2012-2020

The efficiency of public health spending in Brazil

Studies that usually seek to measure health efficiency apply production frontier techniques, such as data envelopment analysis (DEA) and stochastic frontier analysis (SFA). These techniques aim to estimate a boundary representing the maximum level of outputs (health services produced or health outcomes) that may achieve given the number of inputs (financial and human resources, for example) and technology available. DEA is a non-parametric technique based on linear programming to build a production frontier, with the advantage of considering multiple inputs and outputs simultaneously in the efficiency estimate. In Brazil, the DEA methodology has been widely used to measure health efficiency, such as to analyze the efficiency of the Brazilian Health System (Pires & Marujo, 2008), hospitals (Lins *et al.*, 2007), and public health programs (Afonso & Perobelli, 2018).

This article presents an efficiency analysis of public health spending in Brazil using DEA. It was designed to reflect SUS organization and financing: (i) It uses municipalities as a decision-making unit (DMU). The choice of municipalities as DMUs follows the SUS's decentralized institutional arrangement, defining health care as a tripartite responsibility. Municipalities provide health services and implement essential health policies; (ii) Two DEA models were estimated. The first analyzes efficiency within the PHC scope, considering inputs and outputs related to services provided within the health care context. The second model analyzes efficiency in medium and high complexity (MHC) care, following the efficiency estimate from inputs and results related to services provided at this care level. These models show these care levels are funded separately and allow us to examine how the efficiency at one level influences the other; (iii) Both models are product- (or result-) oriented. The product-oriented model was chosen since the ultimate goal is to maximize results, i.e., for achieving maximum results (of health indicators and health service delivery) with the available resources; (iv) The models assume variable returns to scale (VRS). The VRS model is justified because DMUs used (municipalities) are quite different in scale (population size), reflecting the variables used. Two non-discretionary variables were also included in the models, not specific to the health sector, to control by sociodemographic heterogeneity among DMUs; (v) The models were estimated for 2013 and 2017 to measure the performance variation in the period.

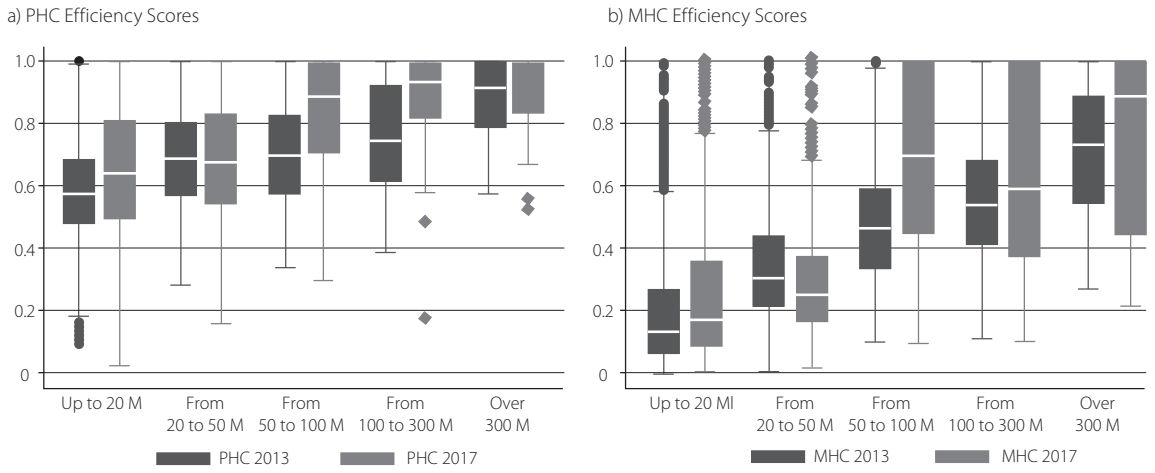
Table 2 presents the variables, inputs, and outputs used to estimate the PHC and MHC models. Inputs are public health expenditure at each care level: PHC (subfunction 301) and MHC (subfunction 302). These two care levels correspond to approximately 59% of the total consolidated

health public spending in 2017 (Graph 5). Outcomes are divided into intermediate products (or health service delivery indicators, such as outpatient procedures and FHS coverage) and end products (or health outcomes, such as preventable mortality for different age groups).

The World Bank's analysis shows significant scope for making health spending more efficient. Municipalities are consistently more efficient in providing PHC services than MHC services, a pattern observed across all regions and municipality sizes. In regional terms, the North and Northeast are the most efficient regions in the PHC and MHC (due to the inputs' lower relative consumption). Locally, the average efficiency score for PHC was 63% and 68% in 2013 and 2017, respectively. The average efficiency score for MHC was 29% and 34% in 2013 and 2017, respectively. Efficiency is highly correlated with the municipality's population at both care levels, demonstrating a scale effect. The effect of population size is more evident for MHC when the highest average efficiency scores (above 60% in 2017) are only found in municipalities with more than 50,000 inhabitants (Graph 6).

Table 2. Variables (inputs and outputs) DEA, PHC, and MHC models

Level	Variables		Sources
PHC	Inputs	Total PHC spending (*subfunction* 301)	SIOPS
	Outputs	Primary Care Medical Appointments	SIA/SUS
		Primary Care Appointments (other healthcare professionals)	SIA/SUS
		Administered Doses of Tetravalent	SI-PNI
		Primary Care Coverage	SIAB
		Preventable Deaths, aged 0-4 years	SIM
		Preventable Deaths, aged 5-75 years	SIM
	Non-discretionary	*Per capita* GDP	IBGE – 2010 Census
		Literacy rate	IBGE – 2010 Census
MHC	Inputs	Total MHC spending (subfunction 302)	SIOPS
	Outputs	Adjusted Admissions (by complexity)	SIH/SUS
		Adjusted Outpatient Procedures (by complexity)	SIA/SUS
		Preventable Deaths, aged 0-4 years	SIM
		Preventable Deaths, aged 5-75 years	SIM
	Non-discretionary	*Per capita* GDP	IBGE – 2010 Census
		Literacy rate	IBGE – 2010 Census



Source: Prepared by the authors.

Graph 6. PHC and MHC efficiency by Municipalities Size, Brazil 2013-2017

The main determining factor observed for PHC efficiency is the number of FHS teams (World Bank, 2017). It has been considered the most effective mechanism for inducing PHC coverage expansion in Brazil, leading to increased access, reduction of unnecessary hospitalizations, and a drop in mortality (Macinko & Mendonça, 2018). The *Programa Mais Médicos* [More Doctors Program], established in 2013, was able to increase the number of "family and community" doctors by 7,000 starting in 2014, with an annual increase of 1,000 doctors in subsequent years (reaching 30,181 in 2017). When the program ended in 2018, these numbers were again equal to 2014 (around 27,000) (Gomes *et al.*, 2020).

Concerning human resources, a recent medical demography study in Brazil showed that the number of doctors in Brazil has practically doubled in the last 20 years, reaching 2.4 doctors per 1,000 inhabitants. However, the large concentration of these professionals remains in large urban centers and the private market (while the proportion of family doctors remained at 5.0%) (Scheffer *et al.*, 2018).

The MHC performance is linked directly to the primary care efficiency score and the organization and functioning of the SUS hospital network. Brazilian hospitals operate on a small scale since 55% of hospitals have fewer than 50 beds and approximately 80% have fewer than 100 beds – compared to an estimated ideal size of 150 and 250 beds to achieve economies of scale (La Forgia & Coutollenc, 2008). Diseconomies of scale associated with the high number of small and medium-sized hospitals lose BRL 7.3 billion annually to SUS. A World Bank study (2016)[7] that used DEA to analyze the specific efficiency of SUS general hospitals estimated the average efficiency score at 28%, i.e., there would be scope for a mean increase in production at 72% to achieve better parameter practices with the same resources. Other factors that influenced the efficiency of general hospitals were: public nature, the relationship between doctors and nurses/bed (up to 6.5), positively associated; average stay and density of beds per 1,000 inhabitants in the surroundings, negatively associated. This last aspect indicates that the hospital care quality also depends on the organization of the surrounding network by promoting the articulation between demand and supply of services at different care levels and the structuring of health regions. It is worth noticing that the integration between primary care and other care levels would imply gains of 7.7 billion or 0.12% of the Brazilian GDP (World Bank, 2017). Currently, the biggest bottleneck is the entry of secondary care – medium complexity (Lobo & Araújo, 2017).

Improving the efficiency of the public health system means that scarce resources could be saved and, above all, could be allocated to other services provided. Allocative efficiency distortions result from the pressure suffered by managers to take decisions in a constrained resources' environment, among other reasons. In 2017, 66% and 77% of the municipalities conducted PHC and MHC activities, respectively, in scenarios where increased funding could enhance efficiency. The analysis pointed out that BRL 35.8 billion (32% of the federal government expenditure settled in PHC and MHC) was wasted due to inefficiencies in providing services (BRL 9.5 billion in PHC and BRL 26.3 billion in MHC). For example, if all municipalities reached the best practices in PHC in 2017, there would be scope for expanding the FHS coverage by 61%, increasing the number of medical consultations by 58% and, with other healthcare professionals, by 86%, in addition to the 58% expansion in vaccination coverage in the first year of life. If better practices were achieved at MHC in 2017, there would be scope to increase outpatient procedures by 176% and hospitalizations by 163%. Furthermore, this increase in providing services would imply an estimated drop in preventable mortality of 3.6% in the age group 0-4 years and 7.3% in the age group 5-74 years.

Discussion: an efficiency agenda for the SUS

These results corroborate previous evidence demonstrating inefficiencies in Brazil's public health system. Although resource constraints resulting from low public spending are one of the reasons for the SUS limited consolidation, the system operates with relatively high levels of inefficiency. If these inefficiencies were remedied, the SUS could obtain better health outcomes even without more resources, particularly in the Brazilian fiscal crisis.

In summary, the main challenges related to efficiency faced by SUS are: (i) Institutional arrangements that, by municipal level, decentralizing resulted in fragmentation and diseconomies of scale; (ii) Organization of provision of services addressed to curing acute pathologies, with limited coordination between providers and care levels (primary, secondary and tertiary). Hospital and diagnostic services are unevenly distributed and are often too small to operate efficiently and ensure quality; (iii) Inefficient payment mechanisms to health care providers (hospitals, clinics, etc.). Current payment methods are not based on the actual costs of providing services; they are almost unrelated to clinical diagnoses or adjusted to cases' severity. The Hospital Admission Authorization (AIH in Portuguese), a mechanism used to pay hospitals based on a SUS contract, pays a pre-established amount linked to the procedures. The AIH contributes modestly to cost control because the amounts paid are strongly

7 Not published yet.

skewed. Hospitals are often paid through line-item budgets based on historical spending patterns, which do not reward quality or cost containment. In PHC, providers are mainly salaried; (iv) Inadequate supply and suboptimal use of essential elements of health systems. For example, there are situations where population density is less than one PHC doctor per thousand inhabitants. New technologies are often incorporated to meet specific cases, such as lawsuits, without assessing economic efficiency.

Proposing an efficiency agenda to the SUS is essential to consolidate and expand the advances of the last 30 years. Achieving better health spending outcomes is a global challenge, and most countries face such challenges in providing efficient and sustainable health services for their population. The experience of countries that have consolidated their health systems with periodic reforms shows that the consolidation of the SUS depends on the ability to adopt measures of modernization and structural reforms, considering the qualification of managers, science, and dialogue between the multiple perspectives of the agents involved in the system improvement.

The progressive control of the COVID-19 pandemic, with the adopted health measures and the advance of vaccination, represents a unique opportunity for an inclusive debate on the achievements and challenges of the Brazilian public health system and options for its improvement. This debate is essential to improve health care, ensure services that meet the needs and expectations of the Brazilian population, and balance public accounts. Health has one of the most significant budgets in the Brazilian government (BRL 304 billion for the three levels of government in 2019, BRL 128 billion just for the Federal Government in 2019). If the current patterns of nominal growth expenditures are maintained, the SUS's account will reach more than BRL 700 billion by 2030.

An efficiency agenda for the SUS has to face structural challenges, many of them exacerbated during the COVID-19 pandemic, e.g.: (i) Rationalize the supply and management of outpatient and hospital services to maximize scale, quality, and efficiency and encourage access to the system and the PHC ordering power; (ii) Improve care integration and coordination within the SUS through the implementation of integrated health care networks (IHN); and (iii) Increase the performance of health services and workforce by expanding and better distributing professionals, systematic qualification, changes in contractual labor relations and introduction of technologies and incentives to increase the productivity of professionals. These reforms aim to increase SUS services' efficiency, effectiveness, and quality to ensure sustainability in the medium and long term.

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OPINION ARTICLE
ARTIGO DE OPINIÃO

Opportunities and challenges of value-based healthcare: how Brazil can learn from the United States' experience

Oportunidades e desafios da saúde baseada em valor: como o Brasil pode aprender com a experiência dos Estados Unidos

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Keywords
value health based, value in health, payment systems

ABSTRACT

The movement toward value-based care is an evolution occurring in many nations of the world. The increasing population, longer life expectancy, and rising cost for high-tech care necessitates that government and private payers around the world devise new ways to ensure that healthcare dollars are spent on the most impactful interventions. In this viewpoint, we present the case of the value-based care transformation that is currently in its infancy in Brazil. Brazil has a mix of private and public payers but still largely reimburses based on a fee-for-service model. We contrast that with recent experience in the United States, where value-based care is slowly but surely becoming the norm. The Brazilian system has many opportunities to learn from the US shift to value-based care – including the development of quality measures, transition to value-based payment, and leveraging data to rank performance across Brazilian Health Systems. Pharmaceutical manufacturers in Brazil can play a role as well, with value-based agreements and partnerships with payers. Each nation will travel on its own path to value-based healthcare, but the opportunity to learn from each other presents one of the best chances for success.

Palavras-chave:
saúde baseada em valor, valor em saúde, sistemas de pagamento

RESUMO

O movimento em direção à saúde baseada em valor é uma evolução que ocorre em muitas nações do mundo. O crescimento populacional, o aumento da expectativa de vida e o custo crescente com uma saúde de alta tecnologia exigem que os pagadores públicos e privados de todo o mundo criem novas maneiras de garantir que os gastos com saúde sejam feitos nas intervenções de maior impacto. Nesse ponto de vista, apresentamos o caso da transformação da saúde baseada em valor, que está atualmente em sua infância no Brasil. O Brasil possui pagadores públicos e privados e ainda paga os serviços na maioria das vezes no modelo de pagamento por procedimento. Comparamos isso com a experiência recente nos Estados Unidos, onde a saúde baseada em valor está, de maneira lenta, mas segura, se tornando a norma. O sistema de saúde brasileiro tem muitas oportunidades de aprender com a mudança ocorrida nos EUA para um modelo de saúde baseado em valor – incluindo o desenvolvimento de medidas de qualidade, a transição para pagamento baseado em valor e a melhoria dos dados para avaliar o desempenho nos sistemas de saúde brasileiros. As indústrias de produtos farmacêuticos no Brasil também podem desempenhar um papel, com acordos baseados em valor e parcerias com pagadores. Cada nação seguirá seu próprio caminho para uma saúde baseada em valor, mas a oportunidade de aprender um com o outro possibilita melhores chances de sucesso.

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Current state of reimbursement and value in the Brazilian healthcare system

The private sector in Brazil currently covers 22.5% of the Brazilian population, yet this sector accounts for 57% of all healthcare spending in Brazil, including out-of-pocket expenses. Private health care is accessed either through employers or as supplemental insurance purchased by individuals. Private health plans are regulated by ANS (*Agência Nacional de Saúde Suplementar*, a government regulatory agency) and are classified into several types, which comprise different forms of operation, such as HMOs (Health Maintenance Organizations), health insurers, self-insured companies, philanthropies, and medical cooperatives. In November 2018, according to data from ANS and ANAHP (*Associação Nacional dos Hospitais Privados* – Private Hospitals National Association), Brazil had a total of 746 health plans with a total of 47.38 million beneficiaries (ANS, n.d.; ANAHP, 2019). The predominant reimbursement model in private sector healthcare in Brazil is still fee-for-service. However, momentum is growing for other models of payment, such as capitation and Adjusted Global Budget Payment, a fixed reimbursement for a period of time in a specific patient population.

Value-Based Health Care (VBHC) is a current topic discussed in the majority of sectors of healthcare. Unfortunately, most of the discussion remains in theoretical fields in Brazil with minimal action taken to date. Movement to VBHC is starting. The Private Hospitals National Association (ANAHP) is implementing ICHOM (International Consortium for Health Outcomes Measurements) standards for Heart Failure, Stroke, and Hip and Knee Osteoarthritis. Some of ANAHP hospitals have already set up a VBHC department to run this project. This is a good start, but the majority of them are not measuring costs, just the outcomes. The regulatory agency for private health plans (ANS) started discussing value-based payment models in 2019 (ANS, 2019). The public sector is starting to discuss VBHC, although there is no practical implementation yet.

In 2019, a not-for-profit organization was created to discuss VBHC in Brazil. It is called IBRAVS (Brazilian Value-Based Health Care Institute). Its mission is to consolidate, validate, and standardize patient outcomes information in order to improve the provision of care based on value. IBRAVS will call for proposals of VBHC project proposals to be submitted by hospitals, health plans, pharma and device manufacturers, and other healthcare players. The publication of the projects selected will be presented at a Second Latin American Congress on VBHC in the beginning of 2021. Besides the submission of VBHC projects, IBRAVS will have monthly webinars featuring prominent healthcare professionals who are on its Advisory Board to align and spread VBHC concepts and ideas for enactment in Brazil.

One of the greatest challenges to implementing VBHC in Brazil is to capture data to measure value. Due to fragmented system as well as the health care information systems available in Brazil which main focus are in billing process and inventory control, the challenge to have data is even worst then to have the right data to measure value.

There are other challenges, the most impactful, besides accessing the data, are the following: changes in providers' and payers' mindset from decades of focusing in a supply-driven model to a more patient-centered system; transparency – there are strong regulation and political restrictions about what can be disclosed for patients compromising their ability to choose and increase the information asymmetry; aligning the interests between stakeholders due to the culture of a zero-sum relationship that hovers in the sector; among others.

How Brazil can build these measurement systems and begin the transition to value-based care may depend on learning from examples of those nations that have their own transition underway.

The US evolution to value-based care

The evolving U.S. health care landscape may provide lessons for Brazil as the Brazilian system begins a transformation from volume-based payment to that based on value. After World War II, employer-sponsored health plans proliferated in the United States, moving health care spending away from consumers and toward employers. The introduction of Medicare and Medicaid in the 1960s further expanded coverage and made the U.S. government a significant stakeholder in health care spending (CMS, n.d.). However, as costs began to grow, U.S. purchasers increasingly asked what they were getting for their money. In the decades that followed, successive pieces of legislation, including the Employee Retirement Income Security Act and the Affordable Care Act, began to introduce the concept of quality and payment based on outcomes in U.S. health care (KFF.org, n.d.; NCSL, 2011).

A core component of the US transformation has been the ability to measure elements of care. The US healthcare marketplace, even today, is notoriously fragmented with a myriad of private payers, health systems, and other stakeholders. Layered atop this confusing setup are government payers and diverse reimbursement methodologies. However, the variety of US healthcare stakeholders are now being measured on performance by an equally varied set of performance metrics. Health plans have the Healthcare Effectiveness Data and Information Set (HEDIS); Medicare plans have the Five-Star Quality Rating System; health systems have measurement programs such as the Hospital Readmission Reduction Program; and individual providers have the Medicare Access and CHIP Reauthorization Act (MACRA) (Meola, 2019). Many of these measurement systems began voluntarily or with mandatory reporting but no effect on reimbursement. As stakeholders became accustomed to reporting data, payers

such as the Centers for Medicare & Medicaid Services introduced pay-for-performance reimbursement. By gradually introducing measurement and reporting, U.S. payers gradually got health care stakeholders on board, making it easier to attach performance to reimbursement in later years.

The US transition to value continues apace with both private and public payers introducing more value-based reimbursement models. In addition, evolving payment models are growing and beginning to address some of the most complex cost issues in the US system, including the Oncology Care Model for cancer therapy. Pharmaceutical manufacturers have joined in as well with the development of value-based contracts with private payers in diverse disease areas as high cholesterol, rheumatoid arthritis, oncology, and diabetes. The US example demonstrates that the transition facing Brazil can be done but it requires the engagement of all stakeholders and it may be a gradual process.

Opportunities for Brazil based on the US experience

One of the aspects that Brazil can learn from the US experience is the strategy of starting disclosure of measures voluntarily or with some bonus. The beneficial aspect is that inevitably separation between entities doing well and those doing poorly will begin to show. When that happens there will be opportunities to bring that data back to stakeholders, government, and private payers and say: "We've been collecting this information; why are you paying hospital A the same as you are paying to hospital B when hospital A outcomes are way worse than at hospital B?" That will begin to instill a mindset of paying for quality while also stoking the competitive nature of hospitals and providers to deliver better healthcare.

The right measure is the one that is reliable and consistent, but viable, or easy to measure. When we talk about selecting appropriate criteria for Brazil's transition to VBHC, less may be more. It means choosing as few metrics as possible to get actionable and relevant results. Brazil should invite feedback from a broad section of stakeholders including payers, providers, and hospitals to obtain not only a relevant standard set but also one that can be measured and reported accurately.

Nevertheless, after choosing the right standards it is important to compose them. When we talk about quality or performance measurement, it is important to understand that just one measure alone does not convey the right understanding about how good or bad one is. However, when you compose the right metrics you can have a broader view about one's performance, quality or, better, value. The challenge is also how to compose those measures the right way. Choosing a reliable, consistent, relevant, and viable option is one aspect. Another aspect is to weigh them, because one measure may be more important than others. Brazil can analyze which healthcare issues are most pressing to the nation's healthcare spending and focus initial measures around these areas.

There are some initiatives in measuring value currently underway in Brazil. One of them is called EVS (*Escore de Valor em Saúde* – in English, Value-Based Healthcare Score), which creates quality measures while considering process, outcomes, and patient experience and relates those composed measures with costs. This EVS yields a single score from 0 to 5. This approach has been used to evaluate value-based payment programs as well as provider performance. Reporting the data and changes over time for EVS may be useful in bringing more Brazilian stakeholders on board to embrace VBHC (2iM Inteligência Médica, n.d.).

Another lesson learned from the US is that you must have an influential stakeholder (large payer, government etc.) to support VBHC and publish success stories. Why doesn't Brazil's Health Ministry and ANS join efforts to establish the quality and value measures, and suggest incentives to prescribers and hospitals to adopt VBHC strategies? Medical and specialty associations can also help establish some measures that are important for a specific clinical condition. For example: the orthopedist medical association can validate the measures that will be used to evaluate the processes and outcomes from a hip replacement.

The authors also suggest involving a third party to help measure value and quality. It is known that the Health Ministry is working with the World Bank in supporting Brazil in the Primary Care program. Why not invite ANS to join the discussion and establish some metrics not just for the public, but also for the private sector? This standardization will be very good for the whole market. A third party, agreed upon by all stakeholders, may also reduce any mistrust between different healthcare stakeholders in Brazil.

Another important aspect is that, today in Brazil, payers do not have the amount of data needed to measure basic value-based metrics. A recent poster presented at ANAHP showed that less than 45% of discharges from the main hospitals have generated enough data to measure performance (Abicalaffe *et al.*, 2018). The conclusion of the study recommended changing the amount of data that is sent from the provider to payers, and it is the regulatory agency that must define what is the minimum. Electronic medical record vendors must be part of this discussion because their systems must capture what is needed to measure value, as well as to have systems that are compatible to send data and/or integrate with the payers and other systems used to collect data

The shift in payment system from fee-for-service to any model of value-based payment will cause a profound change on the provider side. The providers will have to bear some risks. The payers will not assume all providers are

efficient and higher performers. Providers will be measured on objective data, inputted by providers and health systems, and informed by outcomes and trends in population health data. The US system is doing this as well with data on hospital and provider performance becoming increasingly visible to payers and consumers alike, putting pressure on providers to evolve and deliver optimal care.

Finally, patient involvement and empowerment in the value-based health care system must be addressed. The transparency of data and value-based measures is imperative to change the system because it empowers patients to make their own decisions. In Brazil, unfortunately, disclosure of this information to patients is a challenge. However, simply educating patients on the evolution toward value-based health care and the idea that health care in Brazil will increasingly be measured by the quality of outcomes rather than by volume of patients will send a strong message that Brazil is evolving health care for the betterment of patient care. Doing so will grow patient advocacy and help accelerate the change.

Role of pharmaceutical manufacturers in Brazil's value evolution

The participation of the pharma and device manufacturers companies in VBHC can be challenging but vital. Many of the performance- and value-based contracts are between payers and providers. The manufacturers are not necessarily directly involved in that. However, manufacturers are impacted when providers and hospitals ask questions to manufacturers, such as outcome expected, cost-effectiveness, different value metrics if the drug is changed etc.

Essentially, IBRAVS and its advisory board are discussing in Brazil a deeper involvement besides merely discount agreements. The manufacturers have an opportunity to participate in VBHC projects supporting payers and providers in terms of technology, knowledge, and investment in helping stakeholders engage in the patient full circle of care, collecting the right datasets and disclosure of outcomes. Acquiring real-world data benefits manufacturers and can incentivize participation. The access to the right measure allows manufacturers to participate in a different reimbursement arrangements such as a risk-sharing or value-based contract.

VBHC contracts between payers and manufacturers are beginning to emerge in Brazil. In April 2019, a ruling was signed for the inclusion of the drug *nusinersen* in the Brazilian Unified National Health System (SUS). Nusinersen, used to treat spinal muscular atrophy, is the most expensive drug ever incorporated by the SUS (Caetano *et al*., 2019).

On the other hand, in the private sector there is a project running with breast cancer patients. On this project the payer, the provider, and manufacturers have met and are discussing how they can track those patients and follow them in their journey within the healthcare system. An interesting part of this project is that all the implementation of the analytics tools is outsourced by the manufacturers to a third-party company that is responsible to collect the data, produce the measures, and disclose them to the stakeholders. For the first time in Brazil, the manufacturer, payer, and provider are sitting together to discuss what is best for the patient and how they can measure it.

The next step of this project is to develop a risk-sharing contract between payers and manufacturers as well as with the preferred provider. It is known that the one who drives the change is the one who pays the bill. However, what we are discussing in Brazil is that it is possible to stimulate this change by supporting the provider through technology, know-how and tools to deliver value and thus be paid based on value as well.

Private payers in the United States have experimented with value-based formulary models where medication access is primarily determined by the value generated for the health care system through greater cost offsets and reduced health care utilization (Yeung *et al*., 2017). Manufacturers bringing products to Brazil should be prepared to discuss medical cost offsets and any reductions in health care utilization that a product can provide. Payers and providers in Brazil, in turn, can motivate the use of high-value therapies through easier access and higher prescribing.

Summary

The new decade promises to be one of change for healthcare in Brazil. The predominantly fee- for-service based system must evolve in order for Brazil to continue to care for its population, both public and private. The US example, particularly the introduction of measurement systems and rewarding performance, may be one way for Brazil to drive its own evolution to VBHC. However, doing so will require the engagement of a broad set of Brazilian stakeholders including hospitals, payers, providers, and government agencies. Despite the challenges, the evolution is possible and imperative. VBHC will not only aid in delivering cost-effective care but will ultimately benefit the most important healthcare stakeholder of all: the Brazilian patient.

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OPINION ARTICLE
ARTIGO DE OPINIÃO

Risk Sharing Agreement: a pilot project in the Brazilian Unified Health System

Acordo de Compartilhamento de Risco: projeto-piloto no Sistema Único de Saúde

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ABSTRACT

Risk Sharing Agreement is defined as an agreement in which the State agrees to offer temporary access to a new drug, while the pharmaceutical industry accepts to receive the product according to the performance of the drug in real conditions of use. Risk sharing necessarily depends on the collection of additional evidence that may refer to the therapeutic benefits or the volume of patients, according to the assessment of its use in practice. The authors described the experience of the pilot project of a Risk Sharing Agreement in the Unified Health System.

Palavras-chave:
contrato de risco, participação no risco financeiro, avaliação da tecnologia biomédica

RESUMO

O Acordo de Compartilhamento de Risco é definido como um acordo no qual o Estado concorda em oferecer acesso temporário a um novo medicamento, enquanto a indústria farmacêutica aceita receber pelo produto conforme o desempenho do medicamento em reais condições de uso. A partilha de risco depende, necessariamente, da coleta de evidências adicionais, que podem se referir aos benefícios terapêuticos ou ao volume de pacientes, conforme avaliação de seu uso na prática. Os autores descreveram a experiência do projeto-piloto de Acordo de Compartilhamento de Risco no Sistema Único de Saúde.

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Introduction

Law No. 8,080/1990, which established the Brazilian Unified Health System (SUS, in Portuguese), completed 30 years on September 19, 2020.

The advances were significant in expanding the coverage of primary care, the Brazilian National Immunization Program (PNI, in Portuguese), treatment of patients with HIV/AIDS/viral hepatitis, access to high-cost drugs, and overly complex procedures, with relevant impacts on outcome indicators in health. However, the Brazilian Unified Health System (SUS, in Portuguese) was conceived in the 1980s in a scenario of health care costs different from the current moment that diagnostic and therapeutic technologies took over a significant portion of the total health budget.

The uncritical incorporation of new health technologies, associated with the rise in the prevalence of non-communicable chronic diseases and population aging, is a determining factor in the increase in SUS costs. In this context, discussions regarding Health Technology Assessment (HTA) contribution to the formulation of health policies are increasingly relevant.

HTA aims to provide decision-makers with information about the possible impact and consequences of new technology on health or changes in established technology. It is responsible for assessing the direct and indirect effects, benefits and drawbacks, and mapping the steps involved in any technology transfer, both in the private and public sectors. The role of the HTA is to provide decision-makers with a hierarchical analysis of health policy options, with an understanding of the health, economic, environmental, social, political, and legal implications for society (Araújo *et al*., 2017).

In Brazil, the HTA process has been developed at an accelerated pace since 2004, when the Department of Science and Technology (DECIT, in Portuguese) was created, and the National Policy for Health Technology Management was approved. The Brazilian Network for Health Technology Assessment (REBRATS) was developed in 2007 to improve the government's regulatory capacity, define priority criteria, and disseminate the HTA study methodology. In 2011, Law No. 12,401, which amends Law No. 8,080, of 1990, regulated by Decree No. 7,646, of December 21, 2011, established the National Commission for Technology Incorporation (CONITEC) at SUS. Since then, HTA started to be used to support decision-making at SUS, supported by the legislation. Despite advances in HTA processes, there is a need to adopt new models for incorporating technologies, given the increased uncertainty about the benefits of new technologies and seeking greater budget predictability in the medium and long term.

Government's role in the acquisition of health technologies

The Brazilian Federal government plays several roles in the health area. The processes inherent to governmental activity have several components. One of the most important is public procurement management, including how the input acquisitions comply with the criteria of transparency, agility, and economy, subject to the highest possible competition (Giambiagi *et al*., 2020).

The Brazilian Federal government's purchase of general goods and services represents a considerable portion of the Gross Domestic Product (GDP). In the Organization for Economic Cooperation and Development (OECD) countries, this percentage was, on average, 12% in 2016. In the same period, Brazil represented 12.5% of GDP, 7.1% of which from the Federal Government (including state-owned enterprises and direct administration), 2.2% of states, and 3.2% of municipalities (Ribeiro *et al*., 2018).

Innovation in management to improve efficiency

A relevant issue concerns the process of innovation within governmental sectors, e.g., innovations in management processes (in the search for higher speed in serving the citizen and/or reduction of operational costs and risks), which is crucial for the provision of standardized services and on a large scale, such as health.

Social impact contracts – an instrument that transfers the risk of failure of pilot projects from governmental sectors to investors – are still hampered by Brazilian legislation.

Over the past decade, drug spending has increased rapidly and burdens more than other components of health care costs in many European countries and the United States (Adamski *et al*., 2010). One path taken in countries with universal access to health care systems was introducing new financing and payment modalities for innovative therapies.

One of the new modalities is the Risk-Sharing Agreement (RSA), defined as an agreement in which the Government agrees to offer access to a new therapy. At the same time, the pharmaceutical industry accepts to be paid for the product according to the drug's performance in its current conditions of use. Risk-sharing depends on collecting additional evidence, which may refer to the therapeutic benefits or the volume of patients, according to the evaluation of its use in practice.

Typically, some requirements are needed before these new types of agreements can become a realistic option in middle-income countries like Brazil. These requirements include: (i) a flexible legal framework, (ii) an adequate infrastructure for data collection within the country, for better assessment of all agreement points, (iii) potential for integration

between different databases for analysis of results, (iv) good alignment of objectives among health authorities, physicians and pharmaceutical industries, including appropriate incentives for all major stakeholder groups (Zampirolli *et al.*, 2020).

SUS's Experience with RSA

Given the severity of a rare disease called spinal muscular atrophy (5q SMA) and, consequently, the clinical and social relevance of ensuring access to the only medication approved in Brazil at that time, which altered the natural course of the disease, the Ministry of Health considered it positive and enriching to have a more in-depth discussion on the use of the RSA.

The use of RSAs to incorporate new technologies into health systems has become more common as governments seek alternatives to traditional forms of incorporation. This movement aims to ensure quick access to treatment for patients while reducing the government's risks for governments in offering relatively new high-cost technologies.

There are two options to use RSAs (Hauegen, 2014). They are divided according to the type of uncertainty they aim to face: the volume and budgetary impact or the product's clinical performance.

Volume-based risk-sharing agreement

Volume-based RSAs have been used longer and by more countries than clinical outcome-based agreements because they are more easily operationalized and focus primarily on the financial impacts of the therapy.

The decision to incorporate a drug is made based on an estimate of demand – based on the prevalence and incidence of the disease in the country –, which, in turn, makes it possible to calculate the budgetary impact of the technology. However, once used in the system, it is not uncommon for the effective demand for the drug to increase, mainly due to the lack of national data on the referred disease or the encouragement of diagnosis, since there is a new treatment option available.

In general, these are the cases where volume-based risk-sharing arrangements are adopted. The Government and the provider agree on a limit on expenditure, doses, patients seen, or treatment time, depending on the case. On the part of the Government, there is more management over demand growth and, consequently, more budget predictability. On the part of the company, the remuneration for the drug is subject to the risk of having to see more patients than initially planned. In this situation, the company can offer a differentiated price to the Government for additional treatment or even provide it at no extra cost. In this context, the manufacturer bears the risk of a financial impact by the demand increase, an expense that the public entity would previously pay.

Clinical outcome-based risk-sharing agreement

Clinical outcome-based RSAs are essential for real-life data generation and, therefore, to better understand available therapies in the market.

However, its operationalization is complex and costly. It requires the structuring or preparation of a network for performance assessment, clinical data management, and the involvement of patients, professionals, and health facilities during data collection. This model, particularly, requires a longer maturation time for its implementation.

The HTA process involves analyzing clinical evidence of the drug's safety, efficacy, and effectiveness. Such evidence, however, becomes more evident as its use is expanded beyond controlled trials in clinical research. Analyzes aiming to assess the product's cost-effectiveness and therapeutic value also tend to be strengthened once the technology starts to be used in the system.

In these cases, the technology's performance-based RSAs allow it to be offered to patients while making real-life evidence more robust. The agreement provides that the parties define what clinical uncertainty they want to resolve, such as target population, clinical performance, adverse effects, among others.

RSA pilot project at the Ministry of Health of Brazil in 2019-2020

Phase 1 – Mitigation of financial risks and access to Spinraza® (Nusinersen)

Objective

Ensure timely access to patients with 5q SMA, including those not included in the SCTIE Ordinance No. 24/2019, and at the same time mitigate the financial risk for the Ministry of Health arising from uncertainties about the epidemiology of the disease during the period of structuring the RSA model.

Activity proposal

- Incorporation of Spinraza® (Nusinersen) for type 1 SMA following the traditional patterns of incorporation and acquisition of health technologies at SUS.
- Incorporation of Spinraza® (Nusinersen) for late-start 5q SMA subject to the RSA and with a financial risk mitigation model in the first year of incorporation, during the structuring of the RSA model, valid as from the second year of incorporation.

At this phase, a limit of patients and/or bottles to be purchased by the Ministry of Health was established. The other bottles would be provided free of charge by the pharmaceutical industry that produces Spinraza® (Nusinersen). A second limit can be negotiated, at which cost-free bottles will no longer be supplied, and supply conditions will be renegotiated.

Phase 2 – Structuring the RSA by the outcome

Objective

Structure the RSA model by the outcome and ensure the existence and implementation of all the required structures to execute the agreement.

Description

In parallel with establishing the budget limit model and 5q SMA patients' access, it is proposed to define all principles and criteria for structuring the agreement by the outcome and preparing reference centers responsible for collecting the results to be analyzed.

Activity proposal

1. Definition of RSA's outcomes and conditions

A discussion group was organized with specialist physicians, a multidisciplinary team, and representatives of the patient community to generate a broad and integrated understanding of the disease and to collect information about the relevance of different clinical outcomes that support the definition of outcomes to be adopted in the RSA by the outcome.

Still, after defining the outcomes, the agreement conditions to be signed have also been discussed. They were as follows: expected clinical results for the selected outcomes, value, and reimbursement terms to be granted in case of failure to achieve the result defined as the objective [as free bottles, or another model to be decided along with the Ministry of Health and the pharmaceutical industry that produces Spinraza® (Nusinersen)], minimum follow-up time per patient to analyze the achievement of expected outcomes and dates for their evaluation. For the follow-up and assessment of patients with 5q SMA, the model suggested for structuring the RSA is that of a patient record capable of receiving information about the characteristics of patients with the disease and measuring the previously defined outcomes.

2. Assessment of patient care reference centers

This phase included assessing the main 5q SMA care centers in Brazil, their geographic distribution, and the conditions for diagnosing, treating, and providing multidisciplinary support to patients.

A survey carried out at the end of 2018 identified 59 institutions across the country that monitor patients with 5q SMA, with the highest concentration in the Southeast and South regions (69%), but with locations also in the Central-West and Northeast regions. Among them, 71% are public institutions, 21% are public and private, and 8% are private institutions. Currently, 32% already administer the drug regularly. Another 34 institutions do not monitor the patient but are able to carry out the drug administration or multidisciplinary procedures (e.g., physiotherapy, rehabilitation, etc.). Currently, in Brazil, the scope of this global care varies from place to place and from region to region.

Considering Brazil's continental dimension and aiming to ensure a quick and viable implementation of the RSA project for Spinraza® (Nusinersen), it is proposed to develop a pilot analysis. It will involve the main reference centers in the country with a physical structure, information technology infrastructure, multidisciplinary professionals trained at the end of the first year of the project, and whose results are extrapolated to the population undergoing treatment with Spinraza® (Nusinersen). This analysis in the main centers would not prevent the construction of the patient record at the federal level. Still, it would facilitate the audit and guarantee the adequate training of professionals responsible for capturing and inserting information to evaluate the outcomes obtained about the expected results for the treatment.

3. Operationalization

Genetic test

The diagnosis of 5q SMA is genetically defined through the MLPA test (multiplex ligation-dependent probe amplification) or qPCR (quantitative polymerase chain reaction) and sequencing to the detection of compound heterozygotes (Mercuri *et al.*, 2018). Since 2018, the pharmaceutical industry that produces Spinraza® (Nusinersen) has offered MLPA testing to medical professionals through its patient support program.

Multidisciplinary team education

The care of 5q SMA patients should ideally include professionals from different areas working in an integrated manner (pediatric, neurology, neuropediatric, intensive care, pulmonology, anesthesiology, orthopedic, clinical nutrition, nutrition, motor and respiratory physiotherapy, psychology, occupational therapy, speech therapy, genetics, nursing, among others).

Continuing education topics: 5q SMA (clinical, epidemiology), diagnosis of 5q SMA and family genetic counseling, the guidance of caregivers, monitoring of motor and respiratory functions by qualitative clinical assessments and validated scales, respiratory and motor care in a proactive and reactive context, intensive care in urgencies and emergencies, care in the administration of Spinraza® (Nusinersen), insertion of the person with 5q AME in the society, nutritional care, among others. Among these topics, essential outcomes, and evaluations for assessing disease progression and response to the treatment were discussed in the context of the natural history of 5q SMA.

The proposed format was based on online platforms available on the internet, with classes filmed and edited in advance and made available as webinars. The classes would be prepared by specialists from different areas with vast experience in neuromuscular diseases and in 5q SMA, specifically.

Except for the one on pharmacological treatment, the themes would be made available to all professionals involved

in caring for people with 5q SMA. Regarding the pharmacological treatment topic, it would be available to professionals qualified to prescribe and dispense medication.

Phase 3 – Elaboration of the RSA contract

Objective

The drafting of a new contract, specific to the RSA model, is based on the previous phase's outcomes. It is important to note that the Ministry of Health and the pharmaceutical industry that produces Spinraza® (Nusinersen) understand that risk-sharing is exclusively an agreement between the manufacturer and the paying source and should not fall, in any way, on the patient community.

Description

To ensure transparency and reliability and provide legal certainty for both parties, a robust contract would be built with which everyone is comfortable and clear. This contract should contain clauses referring to the defined outcomes for the assessment, duration of the RSA, closing criteria, transparency, and data protection, among others until all relevant points had been exhaustively discussed.

Activity proposal

The contract drafting should be carried out by the legal entity of each of the parties, with the assistance of medical and multidisciplinary specialists.

Those responsible for measuring the outcomes agreed between both parties must be defined in a contract. How such results will be collected must be described in detail, and clauses relating to monitoring the progress of the project and those responsible and how the data collected will be audited.

It is essential that the RSA drafting define the deadlines for each phase to be completed, for the outcome assessments to be collected, and for the outcome assessment to be carried out. The deadline for completing the contract and price review, suggested here after two years after the start of the RSA by the outcome, must also be established in the contract.

Criteria for the contract termination by both parties will also need to be defined and established in the contract.

The start of the RSA contract should be related to the end of the volume pricing procurement model. It will only be implemented in the first year of the project.

A working group (and those responsible for each party) was also determined to carry out periodic monitoring of the project's progress and define the responsibilities of each member of the group in ensuring compliance with each process and the quality of the project.

Considering the data to be evaluated, it was also suggested such data be anonymized and made public to ensure the transparency of the process and the safety for analyzing the outcomes obtained concerning the expected results. It was also recommended that there be an independent entity responsible for auditing and evaluating the data collected.

Phase 4 – Information Collection

Objective

Start recording the outcomes and information to be evaluated in the RSA at the defined reference centers.

Description

The collection of information should start within one year at the latest after incorporating the drug to guarantee an appropriate follow-up time for analyzing defined outcomes.

Activity proposal

All centers designated for the collection of outcomes will start recording data as soon as they are fully trained for this activity. All centers chosen for the pilot analysis must be prepared at the beginning of the first year of the RSA's validity, and all other centers must be able to start collecting on the first day of the third year of the project (second of the RSA).

Information recording must be kept confidential until the first reading, at the end of the first year of the RSA by the outcome, to ensure the impartiality of the analysis of the collected results. The periodic evaluation of the working group responsible for monitoring the project's execution and progress will also be of great importance to identify possible failures, lack of technical training, or practices that could generate biases or impair the analysis of previously defined outcomes.

The last collection to be used for the final analysis of outcomes and for defining the responsibilities of each party involved in the RSA should take place on the last day of the second year of the RSA.

Phase 5 – Analysis of outcomes

Objective

Evaluate the performance of Spinraza® (Nusinersen) in patients with later types of disease concerning the expected results for the product and define the responsibilities of the parties involved in the contract.

Description

At the end of the first year of RSA, an interim analysis will be carried out to identify the performance of Spinraza® (Nusinersen) and possible price renegotiation. At the end of the second year of RSA and consequent contract termination, the parties involved must define whether the expected outcomes have been achieved, in what proportion, and whether there will be a need for a retroactive discount. At this phase, the purchase price can be discussed again.

Proposed activities

Although patient assessment and data collection are carried out individually, patient by patient, it is suggested that the analysis of outcomes be carried out at the population level. The rationale is to establish the number of patients who should respond to treatment (according to predefined outcomes). In the end, the result is compared to the percentage of those patients who responded.

It is worth emphasizing that the definition of the criteria considered as a response to the treatment must have the function of determining the financial reimbursement (or not) based on the expected outcomes. An independent entity must analyze results to develop the statistical evaluation of the outcomes (Clinical Research Organization or CRO, for example), both at the end of the first year and the end of the second year of the RSA.

After each analysis, the risk-sharing criteria previously defined in the contract must be met. If the outcomes evaluated are below expectation for the product, a retroactive discount must be provided, granted through the purchase of bottles at no cost.

Phase 6 – Review of the Clinical Protocol and Therapeutic Guidelines (PCDT, in Portuguese)

Objective

Identify, from the assessed outcomes, whether it is required to update the PCDTs, restrict access to the drug to any subpopulation based on its performance concerning what was expected, or expand access to a more significant portion of patients without the need for the RSA maintenance.

Description

At the end of the evaluation of outcomes and if compensation to the government for performance below the established level is required, it is suggested assessing, more depth, which subpopulations may have presented an inadequate response to the drug and which, therefore, justified the review of the federal protocol initially established.

Proposed activities

Qualitative, quantitative, and statistical analyses of subgroups of patients with similar profiles should be performed based on variables that a group of specialist physicians may suggest defining possible criteria for excluding patient profiles from the protocol.

Legal evaluation for the RSA at SUS

One of the most critical phases in drafting the RSA pilot project was the appreciation of the Legal Advisory of the Ministry of Health (CONJUR-MS, in Portuguese) on the topic. CONJUR-MS recognized that uncertainty regarding treatment performance under actual conditions of use is considered one of the most significant challenges for public health. However, the greatest challenge faced by the Ministry of Health was the absence of a normative forecast that anticipated and prepared the system for the RSA.

In the initial phase of the pilot project, CONJUR-MS assessed that concerning the "Risk-Sharing Agreement - RSA" compatibility with the legal-normative framework that governs the SUS, there was no legal obstacle to its implementation and use for the incorporation of health technologies.

Regarding the institution of a "Pilot Project" for the RSA, it was understood as a prudent measure since it is an unprecedented situation. Caution and exceptionality in its use are recommended.

Therefore, about the constitutionality and legality of the ordinance draft under analysis, the Legal Counsel understood that there are no legal obstacles to the continuity of the process and its edition, considering the technical inputs contained in the records.

However, CONJUR-MS recommended that the execution of the pilot project should necessarily be preceded by the incorporation of the drug Spinraza® (Nusinersen) for the treatment of types II and III SMA, in compliance with the rules introduced by Chapter VIII of Law No. 8,080/1990.

Given this recommendation by CONJUR-MS, the Ministry of Health's Department of Science, Technology, Innovation and Strategic Inputs (SCTIE-MS) conducted the pilot project. It was characterized as a research project, with submission to the research ethics committees of the health centers reference, to the end of the proposed period, with the evidence analyzed, submit to CONITEC's evaluation for its incorporation or not.

Conclusion

The experience with RSA at the Ministry of Health indicated strengths and bottlenecks for implementing this model at SUS. As for strengths, we can list the existence of infrastructure and specialized human capital for assistance and research in reference centers in Brazil; the managerial capacity of SCTIE/MS technicians to plan and monitor the execution of the RSA; the receptiveness of the pharmaceutical industry to carry out this type of agreement. The biggest bottleneck for implementation is the current legal framework, which prevents SUS from acquiring technologies.

The debate on the RSA pilot project at the Ministry of Health involved academics, managers, public policy makers, parliamentarians, regulators, oversight bodies, and civil society.

Below is the conclusion of the master's thesis "Risk-sharing agreements for the acquisition of drugs by the government to supply the SUS: legal analysis in the light of the case of the nusinersen product", carried out at the São Paulo Law School of Fundação Getúlio Vargas (Ueno, 2020):

- "The future general standard will regulate risk-sharing agreements for incorporating health technologies at SUS, based on the nusinersen pilot project, should establish detailed governance rules and management procedures to prevent conflicts of interest, and a clear delimitation of the extent for using risk-sharing agreements, restricting it to situations involving innovative drugs with the high cost and technological content. It is a topic that generates large financial liabilities to the Government, i.e., it should be applied as a special regime for specific purposes".
- "To ensure good faith, transparency, and legal certainty for the parties, the instrument formalizing the clinical outcomes defined for the assessment, duration of the agreement, closing criteria, transparency and data protection, and all other issues relating to risk-sharing."
- "A formal governance structure is essential to ensure the transparency of the risk-sharing nature and objectives, accountability rules, and means to mitigate possible conflicts. since, as explained, there will be the involvement of different parties motivated by different interests and need to measure highly complex results."
- "It is important to emphasize that the issue of data collection is fundamental and should be thought through with caution, as sensitive and confidential data (both from the industry regarding the intellectual property of the technology and from patients regarding their health status) will be collected and treated. The conditions and terms for data collection and processing must be specified (who will hold them, who could publish them, how the results will be treated and processed, etc.)".
- "Certainly, the adoption of innovative and complex models, such as the risk-sharing agreement in the health field, will be simpler and safer when the specific legislation that protects it is enacted."

There is a need to reform the Brazilian Federal Government to improve public management efficiency and maximize the use of resources under conditions of uncertainty, such as, e.g., the public health scenario. As the Nobel Memorial Prize in Economic Sciences, Jean Tirole states, "reforming the Government means transforming it into an instrument that will put the economy to work for the common good" (Tirole, 2020).

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OPINION ARTICLE
ARTIGO DE OPINIÃO

Value-based healthcare: will it work?

Saúde baseada em valor: será que isso vai dar certo?

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This JBES special issue discusses "efficiency in healthcare systems". To start a subject, it is always good to establish some definitions.

Efficiency may be defined as *the rational use of means available to achieve a predetermined objective*. Another definition is *the ability to achieve desired objectives and goals with the least possible expenditure of resources*. Where is the search for greater efficiency in healthcare-associated with *Value-Based Healthcare* – VBHC?

In my opinion, it will depend on two basic definitions: 1. what are the healthcare goals we want to achieve, and 2. what do we understand by Healthcare Value?

Ahluwalia *et al.* (2017) conducted a systematic review of publications in English in the period between 1999 and 2016 to identify which concept best defines the goals of high-performance healthcare organizations, concluding that none of them permeated all organizations consistently. The definition of high performance was expressed in different dimensions across articles, most frequently for the quality dimension (93% of articles), followed by cost (67%), access (35%), equity (26%), patient experience (21%) and patient safety (18%). Most articles used more than one dimension to define high performance (75%), and the most paired dimensions were quality and cost (63%) (Ahluwalia *et al*., 2017).

Using the term "quality" as a dimension that establishes the objectives of efficiency requires a new depth of philosophical character: what is defined by "healthcare quality"? Quality is, in a broad definition, the perception a person or group has about the usefulness of a good or service received and the trade-offs[1] required to obtain them. And within healthcare systems, all too often, trade-offs result from choices made on behalf of these individuals/groups by decision-makers in healthcare organizations. And, of course, there will always be some people who will agree with the choice, while another will disagree. It is the presence of a positive balance between groups that disagree versus those that disagree with a choice that ultimately defines the value of a healthcare choice.

The mention of the terms "access" and "equity" as objectives to reach high performance in healthcare organizations is more related to a social point of view. It may be understood as the capacity of the healthcare system or organization to include the most significant possible number (perhaps all) of individuals from a collectivity (community), providing them the same level of goods and services. It is an objective of extremely high value from an ethical and humanistic point of view. Still, it requires a significant trade-off to be achieved: to waiver individual results in favor of the

1 Trade-off defines a situation in which there is a conflict of choice, i.e., when the option of an alternative (e.g., spending money on good treatment) implies abandoning another alternative (e.g., using the same money to go on vacation).

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collective impact. With current resource levels (financial, human, and technological), achieving the best possible individual goals without sacrificing collective goals will not be possible. Just as it will not be possible to reach the best results of access and equity at the same time as all individual goals, in all diseases, are achieved with the best resources available. There would not be the money to pay for those simultaneously.

Still, about the Ahluwalia *et al.* (2017) publication, the cost is the second most frequently mentioned item in the articles used in the review. It is the key that starts the discussion about efficiency and value-based healthcare. No one is unaware that healthcare costs have grown disproportionately faster than other inflation indicators, and this fact is regarded as a considerable risk to the sustainability of healthcare systems. Regarding this increase in healthcare costs, criticisms addressed to the pharmaceutical and medical equipment & devices industries are also frequent and well-known. They are continually launching innovations on the market, whose prices spiral up and without a relationship between cost and effectiveness justifying it.

There is a frisson in the air about Value-Based Healthcare. Like other movements that preceded it, such as Evidence-Based Medicine (EBM), Managed Care, and Pharmacoeconomics, it is hailed by many people as the new opportunity to control the progression of healthcare costs and improve the quality of results. There is no doubt that other methodologies have made significant contributions, but since they emerged (approximately in the years 1972 (Cochrane, 1972), 1973 (Patel; Rushefsky, 2006), and 1986 (Mauskopf, 2001), respectively), costs continued to rise. In Brazil, according to the IESS - Institute of Supplementary Health Studies (IESS – Instituto de Estudos Da Saúde Suplementar, 2021), between 2010 and 2020, the median of health care inflation in the private sector was 15 .9% (ranging from 7.6% to 20.6%), against median inflation (measured by the IGP-M) of 7.3% (ranging from -1.17% to 23.1%) (Mariano, 2021).

Costs increase is a severe problem, considering what is said about the threat hanging over the sustainability of healthcare systems (something that also seems logical and reasonable to me, but that I have heard since I graduated in the 80s). But what bothers me the most is that there is no such great concern with the quality of healthcare outcomes, especially in Brazil. I will emphasize the phrase "such a BIG concern with the quality of results". I am not claiming or even implying that we do not have healthcare quality in Brazil, and I intend to say that none of us has factual data to attest that the healthcare system in Brazil has the quality that it should provide. How could we want to increase the value of healthcare interventions if we do not even know how these results are currently presented?

Indeed, we have several islands of excellence of professionals and healthcare institutions. But, observing the greater frequency of healthcare services, all statements we may make, in favor or against the system, will result from impressions, samples, and personal concepts. We do not have systems (and I am not referring specifically to computerized systems) that allow us to capture the reality of healthcare for specific diseases, limiting ourselves to data on mortality.

How can we implement any significant Value-Based Healthcare process if the data we have as a starting point is unsatisfactory or non-existent? For example, how can we provide a Value-Based Healthcare project to reduce morbidity and mortality associated with ischemic stroke (CVA) if the most available information is hospitalizations and deaths? These data are limited to events that do not allow a longitudinal assessment of patients' journeys, from their first CVA occurrence to death. Such data include every case leading to premature death or survival with sequelae recorded as death without considering CVA as the root cause.

But suppose that was the only cause of my pessimism about Value-Based Healthcare. In that case, I could even believe that it would not be difficult for the participating healthcare systems to organize themselves to start recording and evaluating diseases more profoundly to investigate both the results of actions and omissions that occur throughout the incidences. Such knowledge would make it possible to qualify and quantify the effects and determine their causes to generate more efficient interventions. If it is impossible to apply such ideas to all, at least some of the most critical diseases could be chosen to start a movement of an authentic search for improvement.

The primary issue is that few agents at the forefront of this movement in Brazil are seeking the Value-Based Healthcare philosophy core, which is to provide, as far as possible, the best results for patients at the lowest cost. The main quest is cost control.

The difference between controlling expenses and providing the best results at the lowest cost seems clear, at least to me. If the objective is focused on controlling expenses, any intervention is inefficient, as any financial value above zero is an expense. However, we could discuss how to execute that delivery more efficiently by knowing the expected result. To make this statement clearer, I will resort to a metaphor: if I am going on a trip and do not have a city as my goal, the simple act of starting the car to travel is priceless inefficiency, but if I go from São Paulo

to Rio de Janeiro, I may set as goals to make this trip with the shortest road time, or with minor fuel consumption, or by the fastest route, or in the safest way, or even with a combination of these goals.

The same could be said for CVA treatment. We may set some objectives about this medical condition: to reduce its incidence, its morbidity, and mortality, or modify some specific parameters, such as the rate of patients with sequelae or improve the quality of life, as well as assuming other required premises, such as the time horizon of the evaluation. At first, we could measure the occurrence rates of these indicators and compare institutions, regions, or even countries, to know what the possible and desirable values are to be achieved for these rates. With this data in hand, we could assess the costs and outcomes currently observed in our institutions and determine how we could improve our results.

Analyzing this mockery of a project that I mentioned, it is easy to see that it will imply new costs, starting with the costs associated with measuring and comparing results, which is little practiced among us. It will require implementing improvements in the processes, which could advance even on primary factors, such as campaigns to raise population awareness on risk factors for CVA and increase the efficiency of emergency care provided by ambulances, reduce the time between the event, and the first care. It will be necessary to optimize the infrastructure to professionals and equipment to provide the proper care for each case, from the first presentation to the chronic care of patients with sequelae, with the integration of all levels of the healthcare and social assistance systems. The main objective would be to reduce the morbidity and mortality of people who will consist mainly of individuals whose average age varies between 53 and 68 years in Brazil (Santos; Waters, 2020). This age group comprises people who will generate high and prolonged costs if they survive the CVA with severe sequelae, often being indirect (loss of work capacity and need for caregivers, for example). Which will affect the healthcare system? Which costs will be absorbed by patients and their caregivers? The analysis of most healthcare systems rests on this issue. Suppose there is no favorable cost-benefit ratio for adopting effective measures to reduce morbidity. In such cases, maintaining patients with CVA sequelae might be lower than the costs to adopt effective measures to reduce the occurrence of sequelae.

For such reasons, Value-Based Healthcare needs to be understood much more as a philosophy than the application of new remuneration models, which is the facet of this concept most frequently presented. There is a lot of talk about remuneration models for risk sharing, payment for bundles, capitation, and others. Still, any of these models will be insufficient to provide actual healthcare value if the outcomes of interest to the patient are not considered the final product to be delivered. These models appear, at first, as ways of not placing all the business risk and the financial burden of health interventions on the payer's shoulders. Still, ultimately these models need to demand value delivery to the patient.

Defining "outcomes of interest to the patient" is perhaps the most challenging part of this approach. The ICHOM (International Consortium for Health Outcomes Measurement), an international organization promoting the VBHC (Value-Based Healthcare), has created different outcomes of interest for many diseases.[2] They are built through the collaboration of professionals from other areas (according to the condition). Outcome sets are specific for each disease, and the main objective of creating them is to provide a guideline for measuring outcomes that are perceived as valuable for each condition. In addition, the establishment of well-defined sets of outcomes for each disease allows the results obtained in institutions, regions, or even countries to be compared with each other. It will enable these separate entities to compare themselves. When identifying the one that obtains the best results for specific outcomes, they seek to reproduce the good practices that led to this quality. And so, the feedback provides the possibility of continuous improvement of care and constantly increasing value for patients.

It is one of the existing and already in practice ways to achieve reasonable healthcare goals. Then, the challenge of achieving these financially efficient results arises, something that is not easy in Brazil since participants of the healthcare systems have been interacting asynchronously (some want to increase the expenses volume, while others prefer to reduce or control such increase), in addition to not being able to enter into agreements other than those of "zero-sum game", where one wins, the other loses.

The metrics that measure the efficiency of healthcare entities are almost always linked to financial performance, resulting from high prices or large production volumes – and when I refer to this fact, I am not just mentioning materials and medicines. We do not have information about which institutions have the best (or even the worst) rates of clinical outcomes, which brings all choices of service providers into the realm of opinion and external appearances.

Since I talked about opinions, this item would form a separate chapter, especially when discussing patients' perceptions of value. In general, the value perceived by

2 https://www.ichom.org/standard-sets/#standard-sets

healthcare service users is measured by indicators with little or no direct relation to healthcare, such as attendance time, complaints, and the number of providers available, with little or no correlation with the quality of healthcare outcomes achieved. Another factor that substantially impacts the perception of value regarding healthcare interventions is the patient's expectations about results. Some seem frustrated for not having the benefits they expected to get, affecting the perception of value about the professionals and organizations involved.

Any relevant change in the models currently in use in Brazilian healthcare will also have to consider the professionals' satisfaction, particularly physicians. It is relatively evident but always important to mention that the success of any activity depends on the engagement of the people involved. I think these professionals' satisfaction should be measured to guide decision-making that maintains an adequate level of pleasure with working conditions and, of course, earnings.

An essential item for those who progress in implementing remuneration models using Value-Based Healthcare principles is collecting information. The objective evaluation of results is a key to justifying the investments (monetary, time, and expectations) in these changes. Without these measurements, there are no conditions to say the desired value is being delivered and even fewer conditions to evaluate the improvements obtained, if any. And, of course, it is only with an adequate measurement that it is possible to verify if there are possible corrections or improvements, especially if the data collected are shared with other institutions.

Comparing the results obtained between different institutions is also a concern, as there is no culture of data sharing in Brazil, especially in the healthcare area. Everything that matters in healthcare outcomes is confidential, mainly because data is not collected, but also because of a fear of judgment. Bad results could be seen as incompetence or even guilt that perhaps should not be in the face of the context. By this last situation, I mean complex clinical cases, therefore very prone to bad results, but due to ignorance or bad faith of the judges, could destroy reputations or give rise to even worse consequences. In evaluating healthcare interventions, the exposure of data on results could not be a mere presentation process since the context could be decisive in obtaining results. For instance, it is not appropriate to expect that a tertiary-level hospital, which is referred to receive the most complicated cases of a given pathology, presents treatment costs and mortality rates equal to a secondary-level hospital that deals with mild to moderate cases complexity.

The last but not least important factor that hinders the process implementation, which increases the value and efficiency of healthcare in Brazil, is the distorted relationships between entities of the healthcare systems. One of the largest and most well-known distortions is the commercialization of medicines and devices. Service providers earn profits through the difference between the purchase values (actual prices) and the reimbursement values (list prices) of these items. This practice started decades ago as a way found by healthcare service providers to compensate for the low amounts paid for other care items (consultations, exams, hospitalization rates, surgeries, etc.). Over time such practice was consolidated among all entities of healthcare systems. It involved the input suppliers to such an extent that the reformulation of these financing relationships between payers and service providers has become something as complex as trying to reconcile the interests of all these participants (everyone wants to win, and no one gives up their share).

While it is not impossible to find a way to reorganize these relationships and make them less toxic, there will have to be a break in current compensation models and information processes, which creates uncertainty on all sides. For this reason, such changes will have to start as small pilot projects, with their successes and mistakes serving as lessons for future projects.

In short, I would say that I foresee considerable barriers to the implementation of a Value-Based Healthcare philosophy, as I have explained throughout this text. My opinions, herein expressed, could and should be the target of criticism and counterarguments, as I am generalizing issues that may not be as pessimistic as I am mentioning. Another criticism that I should receive is not suggesting solutions to such difficulties. And, if I do not, it is because I believe that the most significant problem to overcome will be the intention of simply reducing or controlling costs and increasing profits, which I have observed in most healthcare system participants (including those who provide inputs to the system). When this culture's priorities shift to a genuine concern for disease control and patient well-being, I will feel more optimistic about Value-Based Healthcare.

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OPINION ARTICLE
ARTIGO DE OPINIÃO

Health financing rifts mean growing risks for a global recovery*

Lacunas no financiamento da saúde significam riscos crescentes para uma recuperação global

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In the months ahead, the world is likely to experience the most rapid economic growth in the aftermath of any recession in the last 80 years. This swift economic turnaround, however, doesn't hide the fact that a sustained, inclusive global recovery from COVID-19, poses complex challenges that have yet to be resolved.

The return to growth is crucial for the recovery, but so is countries' ability to fund public investments. In the latest update of our paper, "From Double Shock to Double Recovery", we look beyond economic growth to highlight large disparities in the capacities of countries to maintain and increase key public investments, including health over 2021 to 2026 (Kurowski et al., 2021).

According to the IMF's latest macro-fiscal projections, 126 countries will increase their per capita general government expenditure (GGE) above pre-COVID levels in the next five years (IMF, 2020). Yet in 52 countries, per capita GGE is projected to remain below the levels of 2019 before the pandemic hit. We call the first group "GGE-growth countries" and the second "non-GGE-growth countries."

This distinction has salience for policy choices, as our paper shows. Further forms of diversity within each of the groups is also an important factor. For example, both groups include rich and poor countries. In addition, in both groups, countries show differences in the outlook across a wider range of fiscal parameters. For example, among both GGE-growth and non-GGE-growth countries prospects vary substantially for the length and depth of periods in which governments are expected to cut their spending. Growing debt service requirements will also differentially constrain countries' ability to invest in the welfare of people.

Many countries are expected to decrease their government health spending

Unaddressed, these disparities in the fiscal outlook will widen rifts in the ability of countries to finance their recovery from the COVID-19 health shock. At one extreme, there are some

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higher-income countries in the GGE-growth group – whose already-strong health financing capacities are poised to grow further in the years ahead. At the other end are some lower-income countries in the non-GGE-growth group, whose health spending is historically weak and is likely to further diminish.

Unless governments raise the priority assigned to health in their budgets, low-income countries (LICs) in the non-GGE-growth group, will see their average per capita government spending on health drop almost 12% between 2019 and 2026 to an average of $12 (Figure 1). This brings their average health spending to levels less than half what would have been expected for 2026 under trends prior to COVID-19 (Figure 1). For the lower-middle-income countries (LMICs) among the 52 non-GGE-growth countries, per capita general government spending on health will fall by nearly 10% between 2019 and 2026 to an average of $82, instead of growing to $114, as would have been expected under pre-COVID trends.

So why don't these countries direct more resources to health? In the wake of COVID-19, few can doubt the importance of such investments. But many of these countries simply can't afford to spend adequately on health.

For most countries at the lower end of the health-financing spectrum, a return to past growth trends in per capita government spending on health is an almost impossible task. On average, to keep their health spending growing at pre-pandemic rates, non-GGE-growth LICs, for example, would have to double the share of their government expenditure dedicated to health, from 10% pre-COVID to 20% in 2026; and non-GGE-growth LMICs from 8.1% pre-COVID to 13.5% in 2026 (Kurowski et al., 2021).

Shortfalls in financing of COVID-19 vaccines, preparedness, and response capabilities

Exceptional health financing commitments are needed in LICs and LMICs to return to pre-pandemic growth trends in per capita government spending on health; yet even these levels would still be insufficient to finance investments necessary to halt the current pandemic and prevent future ones.

An analysis of spending needs and available resources for COVID-19 vaccines makes this clear. In LICs, the projected net growth in health spending during 2021 and 2022 will amount on average to only 45% of the countries' cost share of a COVID-19 vaccine roll out (including the logistical costs of vaccine distribution but excluding support from COVAX). If LICs do not return to pre-pandemic growth rates in government health spending, this share will be on average only 28 percent with non-GGE-growth countries among them lacking any incremental resources to invest in the COVID-19 vaccine roll-out.

Similarly, the expected net growth in government health spending in LMICs over the same period will cover only 66% of these countries' cost share for the vaccine rollout. If countries do not return to pre-pandemic growth rates in government health spending, this share will be on average only 43 percent.

With the expected delays or inability to mobilize sufficient funds for a timely and effective rollout of vaccines, countries will be unable to halt the transmission of the coronavirus and the emergence of new variants.

Likewise, countries' capacity to invest in strengthening preparedness and response for future pandemics will continue to fall short. The projected net growth in government health spending in LICs and LMICs by 2026 will cover only about three-quarters of the necessary annual investment to strengthen and maintain public health preparedness and response capabilities. If LICs and LMICs do not return to pre-pandemic growth rates in health spending, this share will be on average just above 60 percent.

Universal health coverage – A tough job just got tougher

Emerging rifts in health financing capacities are expected to have even more far-reaching destructive effects. This is be-

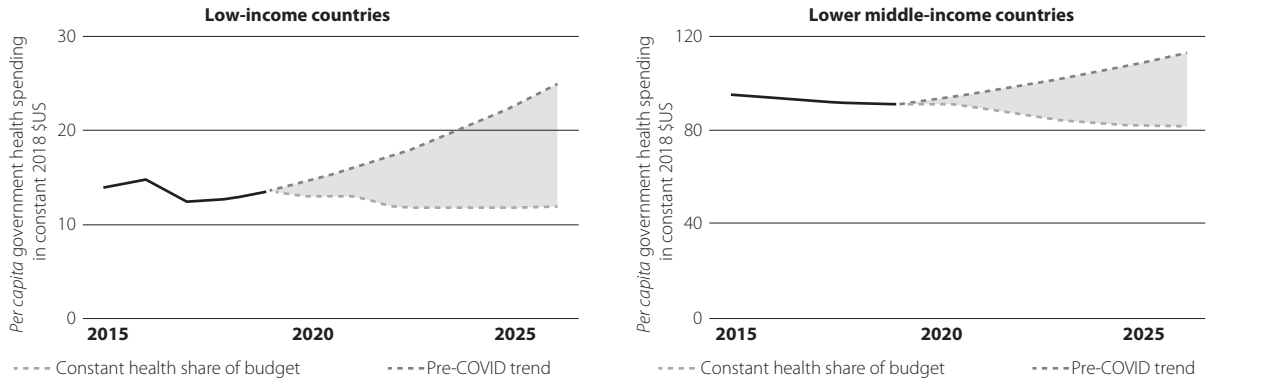

Figure 1. *Per capita* government health spending, non-GGE growth LICs and LMICs (in constant 2018 $US).

cause they may force cash-strapped countries into difficult either/or choices in health investment. Funding response and preparedness priorities at the cost of other essential health services would pose grave risks for a full, sustained health and economic recovery from COVID-19. The initial COVID-19 health shock weakened non-pandemic health services in many settings, as health-system resources were redirected to the pandemic response. The Global Financing Facility (GFF), which supports the continuity of essential health services as part of COVID-19 response efforts, has been sounding the alarm of this secondary health crisis for vulnerable populations. Regaining losses in progress toward universal health coverage (UHC) is critical for human capital development and a full return to inclusive growth.

The original "Double Shock, Double Recovery" paper laid out the choices that countries have in managing their government funds to meet spending needs for health and economic recovery. The latest data indicate, however, that in many lower-income countries, choices are increasingly constrained, and the financing of a full health recovery from their own resources - increasingly out of reach.

The sustainability of Brazil's UHC progresses in the post-pandemic

The COVID-19 pandemic will have long lasting impacts on health service delivery and health financing in Brazil. In addition of being one of the most affected countries in terms of COVID-19 cases and deaths, Brazil's unified health system (*Sistema Único de Saúde*, or SUS) experienced large disruptions in service delivery in 2020 and 2021. Only in 2020, there was a reduction in 19,2% in the number of SUS procedures when compared to 2019 (with a reduction of 45% in elective surgeries and 30% in transplants) (Rache et al., 2021). The situation is particularly critical for non-communicable diseases (NCDs) services, restrictions on receiving patients in hospitals, the transfer of beds for COVID-19 treatment, and patients' fear of seeking medical help have decreased the number of NCDs related procedures considerably. Preliminary assessment points to a 20 percent increase in the number of deaths from NCDs because of the disruptions caused by the COVID-19 crisis. These will put additional pressures in the system over the next years, particularly in a scenario of fiscal constraints with public health budgets expected to return to pre-pandemic levels (in 2020 and 2021 combined the federal health budget increased by R$90,3 billion - approximately US$16,2 billion).

Brazil, as many other middle-income countries (MICs), will face the challenge to manage fiscal constraints and increased demand for health services. The pandemic has exacerbated some structural weakness of the SUS, which is often is often seen as overcrowded and unable to offer anything beyond limited access to hospital and specialist care. World Bank report shows scope to improve efficiency of public spending, particularly at hospital level (potential savings of R$ 12,3 billion) and to a lesser extent at primary health care (PHC) level (potential savings of R$ 9,3 billion) (World Bank, 2017). Efficiency gains could be obtained, for example, from improving integration of health service delivery, changes in providers' payment mechanisms, and the expansion of SUS PHC coverage (Araujo, Lobo, and Medici, 2021).

Acting on common interests

Rifts in countries' capacity to finance health were large before the pandemic – and they are widening further in its wake, creating a fault line that threatens COVID-19 recovery and health security for all. The good news is that, in contrast to geologic rifts, human action can bridge the health financing divide and prevent much of the damage it may bring. Coordinated global action that reverses the recent stagnation in development assistance for health will have positive effects far beyond the lower-income countries that benefit from it first.

It won't be easy to boost development assistance for health at a time when some wealthy donor countries are also struggling. But high-income countries, too, have a vital interest in reinforcing a global recovery that remains fragile. The World Bank Group, with the IMF, WHO, and WTO have formed a task force to accelerate access to COVID-19 vaccines, therapeutics, and diagnostics by leveraging trade solutions and multilateral finance. Only together, countries can bridge the health financing rifts to build a healthier, more secure, more prosperous future for all.

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