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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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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).

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

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

	2016							2017						
DMUs	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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