



**Efficiency of public spending on primary health care: analysis of São Paulo's cities**

**Eficiencia del gasto público en atención primaria de salud: análisis de los municipios de São Paulo**

**Eficiência dos gastos públicos com atenção básica à saúde: análise dos municípios de São Paulo**

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**Abstract**

**Objective:** To analyze the efficiency of São Paulo's cities with spending on the Primary Health Care sub-function in the year of 2018 and its association with geographic location, population size, wealth generated in the city (GDP – Gross Domestic Product) and budget expenditures with this public policy.

**Methodology:** Exploratory descriptive and explanatory study with São Paulo's cities in six similar cluster whit combine population and GDP. It uses the settled expense as input, the Number of FHS (Family Health Strategy) Teams, FHS's Coverage Percentage, Number of Basic Health Units (BHU) and Percentage of Live Births of mothers who performed more than 7 doctor's appointments in the prenatal period as an output. The efficiency level of each city is shown on georeferenced maps. Pearson's correlation is used to estimate the levels of associations between quantitative variables.

**Results:** 102 cities have a maximum level of efficiency, distributed between the six groups. Cities with a lower number of inhabitants and GDP tend to be more inefficient. Efficiency has a low correlation with population size, GDP or health public spending. The cities with the lowest levels of efficiency are neighbors of São Paulo (Metropolitan Region) or small cities scattered throughout the state's territory.

**Theoretical Contributions:** The research identifies that the management (formulation, implementation and evaluation) of the primary health care policy must consider different programs that focus on its location in the cities' territory, population and wealth. There are references to the benchmarks for good practices in managing Primary Health Care policies.

**Keywords:** Unified Health System. Public Health expenditures. Basic Care. Data Envelopment Analysis. Technical Efficiency.

### Resumen

**Objetivo:** Analizar la eficiencia de los municipios de São Paulo con el gasto en la subfunción de Atención Primaria de Salud en el año de 2018 y su asociación con la ubicación geográfica, el tamaño de la población, la riqueza generada en el municipio (GDP - Producto Interno Bruto) y el gasto presupuestario en esta política pública.

**Metodología:** Estudio exploratorio descriptivo y explicativo con las ciudades de São Paulo en seis grupos (*clusters*) que combinan población y GDP similares. Utiliza como input el gasto liquidado, como salida el Número de Equipos de la FHS, Porcentaje de Cobertura de la FHS, Número de Unidades Básicas de Salud y Porcentaje de Nacidos Vivos de madres que tuvieron 7 o más consultas en el prenatal. Los mapas georreferenciados muestran la eficiencia de cada municipio. La correlación de Pearson se utiliza para estimar los niveles de asociación entre variables cuantitativas.

**Resultados:** 102 municipios tienen un nivel máximo de eficiencia, distribuidos en los seis clústeres. Los municipios con baja población y GDP tienden a ser más ineficientes. La eficiencia tiene una baja correlación con el tamaño de la población, el GDP o el gasto público.

**Originalidad/Relevancia:** los municipios con los niveles más bajos de eficiencia son vecinos de São Paulo (Región Metropolitana) o pequeñas ciudades dispersas por todo el estado.

**Aportes teóricos:** identifica que la gestión (formulación, implementación y evaluación) de la política de atención primaria en salud debe considerar diferentes programas que tengan en cuenta su ubicación en el territorio, población, riqueza y gasto municipal. Hay referencias a referentes de buenas prácticas en la gestión de políticas de Atención Primaria de Salud.

**Palabras clave:** Sistema Único de Salud. Gasto público en salud. Atención Básica. Análisis Envoltente de Datos. Eficiencia Técnica.

### Resumo

**Objetivo:** Analisar a eficiência dos municípios paulistas com os gastos na subfunção Atenção Básica à Saúde no ano de 2018 e sua associação com a localização geográfica, o tamanho da

população, a riqueza gerada no município (PIB - Produto Interno Bruto) e os gastos orçamentários com esta política pública.

**Metodologia:** Estudo exploratório descritivo e explicativo com os municípios paulistas em seis agrupamentos (*clusters*) de população e PIB similares. Usa a despesa liquidada como *input*, o Número de Equipes da ESF, Percentual de Cobertura da ESF, Quantidade de Unidades Básicas de Saúde e Percentual de Nascidos Vivos de mães que realizaram mais de 7 consultas no período pré-natal como *output*. Mapas georreferenciados mostram a eficiência de cada município. A correlação de Pearson é usada para estimar os níveis das associações entre as variáveis quantitativas.

**Resultados:** 102 municípios têm nível máximo de eficiência, distribuídos nos seis agrupamentos. Os municípios com baixa população e PIB tendem a ser mais ineficientes. A eficiência tem baixa correlação com o tamanho da população, PIB ou gastos públicos. Os municípios com os menores níveis de eficiência são vizinhos de São Paulo (Região Metropolitana) ou cidades de pequeno porte dispersas pelo território do estado.

**Contribuições Teóricas:** A pesquisa identifica que a gestão (formulação, implementação e avaliação) da política de atenção básica à saúde deve considerar programas distintos que levem em conta sua localização no território, população, riqueza e gastos dos municípios. Há referências para os *benchmarks* para boas práticas de gestão de políticas de Atenção Básica à saúde.

**Palavras-chave:** Sistema Único de Saúde. Gastos públicos com saúde. Atenção Básica. Análise Envoltória de Dados. Eficiência Técnica.

## 1. Introduction

The State is the main actor in public policies formulation, since one of its roles is to reduce social inequalities and contribute for individual's fundamentals rights enforcement (Boueri, Rocha & Rodopoulos, 2015). The Federal Constitution (FC) from 1988 defined public health policy as a State's duty and citizen's right. This policy is consolidated in the Unified Health System (UHS) in Brazil, with a gradual improvement in the proposition of planning and management models for the actions and health services (Almeida, 2013).

Recent alterations in the Federal Constitution provoked increase of the restrictions in the financial resources flow for the financing of this relevant public policy (Constitutional Amendment nº29, 2000; Constitutional Amendment nº 95, 2016). Tonelotto, Crozatti, Righeto, Escobar e Peres (2018) identified that the cities of the southeast and south regions presented the highest total and mediums spending values per inhabitant among the Brazilian cities. It was also identified that the north and northeast cities have the greater dependency from the federal transfer for funding activities related to public health. (Tonelotto *et al.*, 2018).

As a complex institutional arrangement (Lotta & Vaz, 2015), the UHS followed up the management modernization initiatives focusing in results and efficient increase (Varela, Martins & Fávero, 2012), as a way to integrate the initiatives from the three government spheres, possibly with the private initiative complementation (Almeida, 2013). In this context, evaluations of the use of resources *vis a vis* the results achieved by the state's action entered the public management agenda.

The budget execution is a relevant tool for public policy management and is rich to evaluate the performance of actions and services, as for efficiency and efficacy, as well as a study source to identify quality improvements on public spending (Varela *et al.*, 2012).

Considering still that the primary care is the front door to UHS, which assists most of the population, this article aims to describe and analyze the level of the efficiency in public spending applied to the primary health care sub function in São Paulo's cities, adopting the population, GDP and the health indicators identified with the Family Health Strategy (FHS).

For this analysis, it was utilized executed budget resources and the products created on the primary health care services, as the FHS team's number, the number of physical work units, population coverage assisted by the FHS and percentage of born alive, because they are indicators supported by the field of study, as will be seen ahead. The study seeks to respond to the following question: **what is the level of efficiency in public spending applied to the primary health care sub function, related to the health indicators of São Paulo's cities, categorized in clusters by population size and GDP in the year of 2018?**

It pursuits to contribute to society, in general, and to the community under the health policies management, in specific, how the public spending in the primary health care is being fulfilled at the state of São Paulo. The researches involving this theme may motivate the interest of players in the public sector for the application of new process management tools, as well as promote the production of new methodologies in health care or to improve those that already exists.

This article has five parts. At first, it are presented the context of the issue-situation, the goals and the justifications. As second, it are presented the considerations about the UHS, the health funding in Brazil and the efficiency of using resources. The third one deals with methodology. The fourth part, it are presented the results and the analysis of the data grouping method application, and the Data Envelopment Analysis methodology or just DEA. In the fifth chapter, it are made the final considerations.

## 2. Theoretical Reference

### 2.1 The Unified Health System (UHS)

As disposal in the 196° article of the Federal Constitution from 1988, health is a right for all and a state's duty, guaranteed by means of the social and economic policies that aims the decrease of the risks of diseases, other grievances and the universal and equal access for actions and services to its promotion, protection and recovery. The legislation n° 8.080, from 09/19/1990, substantiates the guidelines and principles of the system, and the legislation n° 8.142, from 12/28/1990, disposes about the community participation in UHS management and its intergovernmental transfers of financial resources within the health care area. Both of them are known as Organic Laws of Health for regulating the UHS within the Executive Power scope (legislation n° 8.080, 1990; legislation n° 8.142, 1990).

The UHS is organized in a regionalized and hierarchical way. About the regionalization, it is considered the division of geographic regions with priorities of actions and services as a criterion, specially by the epidemiological point of view, with the cities taking place as a strategic actor. The hierarchical way to organize, has increasing levels of complexity. In accordance with the Ministry of Health (MH), the basic actions, as vaccination and prenatal care, are offered by the cities; other actions, more complex, as organs transplant or surgeries in

general, that demands more financial and structural resources, are offered by the state government, based on the principle of regionalization (MH, 2000).

The UHS followed up the influence of the modernization initiatives of the public administration management with the focus on generate results and increase the efficiency with the use of resources (Varela, Martins & Fávero, 2012). The same health system must coordinate the demands of the health policies with the availability of financial resources in an integrative way with the three governmental spheres and, if necessary, complemented by the private initiative to attend the population demands (Almeida, 2013).

The Constitutional Emend nº29/2000 defines that the states must apply 12% and the cities 15% of their Liquid Current Revenue (LCR) to fund health (Constitutional Emend nº29, 2000). The Constitutional Emend nº95/2016 defines that the Union must apply, from the year 2018 till the year 2036, the applied value on the year 2017, plus monetary correction by the National Index of Values for the Wide Consumer (NIVWC) published by the Brazilian Institute of Geography and Statistics (BIGS) (Constitutional Emend nº95, 2016; Araújo, Gonçalves & Machado, 2017).

The UHS includes the basic units, the hospitals, the specialized centers, the servers, the planning processes and the plans. Within the scope of the federation's design, which was engendered in 1988, the decentralization determinate the Brazilian federalism when assigning the cities the character of an autonomous entity, providing a series of jurisdictions and management and implementation centrality in public policies (Arretche, 2002). The accountability of health services is shared by the three government's spheres: union, states and cities. As a central agency, the Health Ministry is the responsible for transfers and proposals of national policies. It formulates, plans and elaborates regulations, evaluates and use instruments for its management. To the National Counsel of Health Secretaries (NCHS), the UHS' actions are accountable of the agencies that composes it, for example, federal institutions, as the universities connected to the Education Ministry (EM) (NCHS, 2011).

The state's management is made through the State's Health Secretaries. The state manager must apply its own resources and those transferred by the Union, including on the cities. The state's govern formulates its policies in order to consist similar as the national one, organizing health assistance on its own territory (NCHS, 2011).

The cities formulate policies and execute actions and services of health limited by their territories. The main funding sources of the entire system are those transferred by the Union, as an induction factor to adopt defined policies on a federal level (Crozatti, Lima Jr, Lima, Oliveira & Righetto, 2020). For the three management levels, it's possible to establish partnerships with public agencies or private hiring to amplify the assistance (NCHS, 2011; Tonelotto, Crozatti & Righeto, 2020; Tonelotto, Crozatti, Righetto, Escobar & Peres, 2018). The cities have a highlight on the structure of health services offer, once they manage the Basic Health Units (BHU) with strong social participation, more effective on a local level and a front door to UHS (NCHS, 2011).

## 2.2 The Basic Care for Health

Basic care for health is the initial assistance for the UHS' user and for the health attendance networks, executed by programs and actions as a fulfillment to the principals of accessibility and universality. Its services are focused on protection, prevention, diagnoses and treatments of diseases. By those, it's possible to decrease spending with health assistance for the population at the long run, since it seeks, preferable, activities of prevention and detection of diseases in its initials stages (NCHS, 2011).

The Family Health Strategy (FHS), managed by the Health Ministry, NCHS and National Council of Cities Secretaries of Health (NCCSH), is the major policy of basic care in the country (HM, 2017). The FHS was conceived as a program and became the main axis of the public basic care services reorganization. It was named as a strategy, because it pursues to expand, qualify and consolidate the initial care to the health demands of the population and it's composed by a multi professional team of doctors, nurses, nursing technicians, community agents, pharmaceuticals, among others. As it focuses on integral care, develops actions of health, sanitary, epidemiological, environmental, work and pharmaceutical assistance surveillance, amplifying the access and use of medicines strongly related to treatments solvability (HM, 2012).

According to the article 3 from the ordinance 3.992, from December 2017 of the Health Ministry, the transference of federal financial resources from UHS was updated and separated in two parts: investments and defrayal. The first one receives the resources that are going to be transferred just for investments on basic care, specialized care, health surveillance, technologies development and on the UHS management. At the defrayal part, the transference of resources occurs accordingly to what is established on the financial work program as determinate action, focusing on basic care, pharmaceutical assistance, medium and high complexity, health surveillance and UHS' management (Ordinance nº 3.992, 2017; NCC – National Confederation of Cities, 2018). Thus, it is a prerogative of the manager or local managers, the establishment of structures, materials, hiring professionals and other services for the offer of basic care on health care for the resident population.

According to Varela *et al.* (2015):

“As the basic care is a sub function exclusive of each city, it is possible to hold accountable the city's public manager for the obtain results with the application of resources destined to this area. Although, by doing an evaluation of comparative performance, a manager may not be penalized for act in a municipality with unfavorable socioeconomic conditions for executing health services.”

The attribution of responsibilities by earnings or undesirable performances is a role of public authorities and the academy, who should consider the political management cycle (formulation, implementation and evaluation) as a way to identify, on local conditions, the demands for improvement of the production systems.

### **2.3 Studies About the Efficiency in Basic Care in Brazilian Municipalities**

The amount of published studies by Brazilian authors about the efficiency in public spending has been increasing in the past years. To substantiate this research, it has been chosen published papers from 2015, which propose to understand an object of study similar as in this article. Varela (2015, p. 77) found only two studies prior to 2015 that deal with the topic. One of them was published in 2003, other in 2008, years that the rules for funding politics on focus, as well as the institutional design, were significantly different from the modern ones. For this reason, we preferred to not include it in this paper. Whiling to facilitate the visualization, it will be described, in Table 1, the objectives, indicators used, analysis techniques and the main conclusions of those publications.

**Table 1***Similar studies published in national periodicals after 2015*

<b>Authorship and year</b>	<b>Objectives</b>	<b>Indicators</b>	<b>Techniques</b>	<b>Results</b>
Mazon, Freitas and Colussi (2021)	To analyze the technical efficiency of Santa Catarina's small size municipalities in public spending with health.	Spending per capita with AB; Spending per capita in ambulatory procedures in AC and MC; Ambulatory procedures rate of AC and MC; Inverse of the percentage of hospitalization for sensible conditions for basic care; Inverse of the percentage of live births with low birth weight; Inverse of the premature death rate by Non Transmissible Chronic Diseases (NTCD).	Data Envelopment Analysis	Existence of a high number of small size municipalities inefficient in the production of health results; association between the cities's size and the low level of efficiency.
Santos-Neto, Mendes, Pereira and Paranhos (2019)	Technical Efficiency in the seven municipalities of the health region of Bandeirante's route of São Paulo's state.	UHS' total spending per capita; Population coverage esteemed by the basic care team and the Gross Domestic Product (GDP) per capita; Proportion of hospitalization for sensible conditions for basic care (PHSCBC); Reason of medium complexity ambulatory procedures in the resident population; Reason of medium complexity clinical-surgical hospitalizations in the resident population; Reason of cytopathological exams of the cervix in women between 25 and 64 years old; Reason of tracking mammography exams performed in women between 50 and 69 years old; Proportion of live births of mothers with 7 (seven) or more prenatal consultations; Proportion of vaccines from the basic calendar of vaccination in children with the achieved vaccination coverage; and the cure proportion in new bacillary pulmonary tuberculosis cases.	Index of Technical Efficiency in Health (ITEH)	Municipalities with higher revenue available and higher spending per capita achieved better results in health indicators; some cities, even with a small structure, achieved better results than its neighbors, demonstrating efficiency on managing its structure.
Varela, Martins and Fávero (2015)	Technical efficiency of São Paulo's cities in the application of public resources in basic health care policy	Expenses in basic care; Nursing Actions and Other Health Procedures – Medium Level; Basic Medical Actions; Basic Dental Actions; Actions Executed by Other Professionals – Superior Level; Registered People by Family Health Program; Registered People by Picture Archiving and Communication System.	Data Envelopment Analysis	Efficiency level in the use of public resources for basic care, managed by cities, may be improved in view of proper identification of the federal actors that need better state capacity to assist the population with better equity and efficacy.

Lopes (2017)	Efficiency of public spending in health regions of the state of Minas Gerais.	Total of liquidated spending with the function health; Rate of child mortality; Rate of mother mortality. Data Envelopment Analysis	Data Envelopment Analysis	Many municipalities didn't attend the agreed goals on its totality and didn't delivered the mandatory Annual Report of Management (ARM), Unfulfilling the agreed contract and contributing with the inefficiency of its health region.
Tonelotto, Crozatti, Moraes and Righeto (2019)	Efficiency of two groups of high complexity hospitals of the state of São Paulo, managed by direct administration and other social organizations.	Liquidated values by the state of São Paulo; inverse rate of paid AIHs and quantity of hospital beds; Total quantity of hospital's AIH and inverse rate of patient's death in high complexity services.	Data Envelopment Analysis	Hospitals managed by Social Organizations pose themselves as more efficient, beyond presenting, comparatively, bigger size and bigger transferred values received from the state, as well as higher quantities of services performed.

Sources: research data.

Considering the quoted studies and recent references for the present study, it was assessed that the efficiency level in the use of public resources in health, managed by the municipalities, recently, it has been an attention focus for the academy, being able to be increased, in view of the proper identification of the state capacities, which should be developed in the process of improvement in UHS management.

### 3 Methodology

The present study can be categorized as descriptive and explanatory, because it describes characteristics of the municipalities in the efficient use of public resources and estimates the level of association (correlation) between the efficiency indicator and the size of the cities (population), the GDP and the respective spending (Köche, 2016). The analyzed data of those cities of São Paulo are just from the year 2018, since, in the research design opportunity and in the data collect, it was the year that presented the higher quantity of available data; the data of 2019 were incomplete and the 2020's data were made available extemporaneously for the development of the analysis.

The researched population is composed by 645 citizens from São Paulo's State, which they have relative autonomy already to manage the basic care on its own territory, as discussed previously (NCHS, 2011). In the data collect, it was notice that the municipalities of Buri, Caconde, Cristais Paulista, Cubatão, Nova Odessa, Pardo, Patrocínio Paulista and Sandovalina didn't have the declared value of the sub-function of liquidated spending in the sub-function of Basic Care at the year of 2018. Those cities were excluded from the data base of this study. But, there are municipalities that doesn't have FHS's team, thus there isn't the FHS's coverage percentage, and others that doesn't have BHU. That occurs in cities that offer its services through ways as, for example, FHSC (Family Health Support Center) teams or basic care teams, and their own health units are different, such as, health centers, a similar condition found by Lopes (2017). It was chosen to maintain those municipalities to analyze the reason why it was understood that the data weren't missing and that the municipalities didn't offered



health services with a similar structure as their pairs, at least in terms of designation (Lopes, 2017). After collecting the data, it was defined the sample of 636 cities, representing 98,6% of the population.

This work measures the technical efficiency through the data envelopment analysis (DEA), comparing the level of outputs production without the input increase between the decision-making units and identifies what are the benchmarks to the other units analyzed, in other words, those that best represents the relation between the products and inputs utilized in the process (Faria, Jannuzzi & Silva, 2008).

The chosen model was the variable returns of scales, oriented to output, in view that the public managers of the health area have a budget defined by uncontrollable variables, shall offer a better structure and the largest quantity possible of procedures and actions with quality standards (Varela, 2008). The scores that define efficiency are presented between 0% and 100% or 0 and 1 (Lobo & Lins, 2011). The Efficiency Level Indicators of each city (ELI) were calculated with the Rstudio software, version 13.0.

Lastly, the level of association analysis between de socioeconomic conditions and the technical efficiency in the sub function of basic care attention were approached by the analysis of the correlation between the population, GDP, total spending and spending per capita of each municipality with its respective level of efficiency indicator. Therefore, tests *t* were performed and those allow to estimate the association level between two quantitative variables. In this case, it was used the Pearson correlation coefficient (*r*), defining the level of the statistically significant linear relation between two variables (Fávero & Belfiori, 2017). The values for the coefficient *r* may variate since -1, for a negative correlation (inverse) perfect (when a variable decrease or increase, the other one increase or decrease, respectively) until +1 for a positive correlation (in the same direction), perfect (when a variable decrease or increase, the other one also decreases and increase), (Levine, Stephan, Krehbiel & Berenson, 2012).

To reduce the accentuated discrepancy effect in São Paulo's municipalities profiles, it was necessary to get them together by similarity for the analysis to attended one of the DEA method criteria (Boueri *et al.*, 2015). In analysis of the health area, Lopes (2017) indicates that the similar characteristics, such as demographic density and economic factors of the ELI, are determinants for the proper application of the technique. In a view that the technique of cluster formation of the cities finds a combination of elements that have lower internal discrepancies and higher external discrepancies (Fávero & Belfiore, 2017), the structural variables of the population and the nominal GDP of each municipality were used to identify those clusters of cities with similar economic and demographic characteristics. Those two variables were chosen because they compose a good match between size and local economic wealth (Lopes, 2017). By comparing the use of resources between similar cities makes the analysis fairer. This study was produced with the Stata 13.1 software.

The municipality of São Paulo, presents incomparable population values and GDP regarding others, formed a group with just one component, transforming itself in an outlier. As being 100% efficient, comparing to itself or to the other municipalities of the state, it was decided to exclude the capital of the state in this study. Thus, after those considerations, it remains six groups with a total of 636 similar municipalities among themselves and different among other groups in terms of population and GDP.

It wasn't used as a reference for the clusters, the health regions defined by the state's health secretariat, owing to the inconsistency of those in the basic care management policy on a municipality's level (SES, 2021; NCHS, 2011; Varela *et al.*, 2015). At the table 2, the variables used in this study are detailed.

**Table 2**  
*Input and Output Variables of the Technical Efficiency Model*

TYPE	VARIABLE	DESCRIPTION	SOURCE
<i>INPUT 1</i>	Spending with basic care	Total expenses settled with the sub-function of primary health care	SIOPS
<i>OUTPUT 1</i>	Quantity of FHS teams	Quantity of FHS teams, composed by doctor, nurse, nursing technician or assistant and community health agents, may having a team of oral health attached, composed by a dental-surgeon, dental office assistant and oral hygiene technician	SCNES
<i>OUTPUT 2</i>	Percentage of FHS coverage	Estimated population coverage by the FHS teams, given by the population coverage percentage by those teams regarding the population estimate	SCNES
<i>OUTPUT 3</i>	Quantity of BHU	Total quantity of BHU per municipalities	SAGE
<i>OUTPUT 4</i>	Percentage of live births (NV) of mothers with more than 7 prenatal consultations	Number of live births of mothers with 7 (seven) or more prenatal consultations	DATAUHS

**Source:** research data.

## 4 Results and Analysis

To better analyze the dispersion of the selected variables, the maximum, minimum, medium and standard deviation values of the variables used in this study were calculated for all the municipalities, as demonstrated in Table 3.

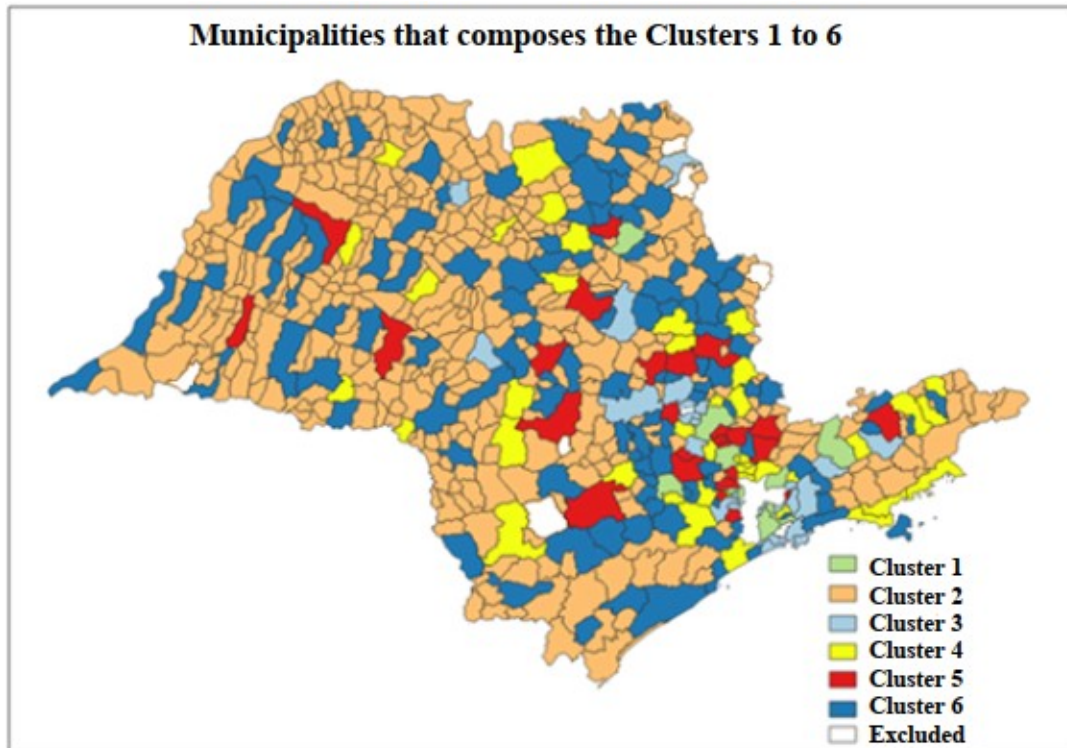
**Table 3**  
*Descriptive Statistics of variables used in DEA model*

Variable	Minimum	Maximum	Medium	Median	Standard deviation
Expenses with Basic Care (R\$)*	33,8	377.714	18.428	8.220	35.671
FHS Teams (Quantity)	0	93	6	6	12
FHS Coverage (%)	0	100	67	76	34
Live Births (%)	53	100	83	84	8
Total of BHU (Quantity)	0	77	7	4	9

\*In thousands of reais.

**Source:** research data.

The results show that there is a large dispersion among the data, due to the great heterogeneity in various characteristics of each cities, as the financial and demographic aspects, sustaining the decision for the identification of the groups of municipalities by population and GDP similarities. After the application of the clustering technique described above, it were identified six groups of municipalities. Those received numbers from 1 to 6 and had their geographic location indicated in the figure 1, below.



**Figure 1** Territorial localization of the municipalities that composes the groups 1 to 6 formed by the cluster technique with population and GDP

Source: research data.

The municipalities of the Group 1, 10 cities, are those with the greatest population (average of 732 thousand inhabitants), produce the highest economic wealth (average of 29,634 billion of reais) and are located next to the capital of the state. The population and GDP sums of those cities are bigger than the sum of all the cities together. The Group 2 was formed by 413 cities, by those who have the lowest population averages (27 thousand), the lowest GDP (average of 601 millions of reais) and are distributed in all over the state's territory. The Group 3 has 27 municipalities, it's the second with a highest population average (306 thousand) and GDP (7,8 billions of reais). The Group 4, with 42 municipalities, is the fourth in population average (94 thousand inhabitants) and GDP (1,8 billions of reais). The Group 5 counts with 27 municipalities, the third in average classification (151 thousand and 3,9 billions, respectively, for population and GDP). The Group 6 brought together 17 cities and it was the fifth with the highest averages (40 thousand inhabitants and 740 millions of reais for population and GDP, respectively).

Then, it was calculated the efficiency scores to each city internally in each group and it was formed the efficiency range according to the Savian and Bezerra's (2013) criterion inspiration. It was considered efficient, those cities with scores equals to 1; weak inefficient, those with scores between 0,999 and 0,900; moderately inefficient, those scores between 0,899 and 0,800; strongly inefficient, those scores between 0,799 and 0,700; and severely inefficient those scores between 0,699 and 0,000.

**Table 4**

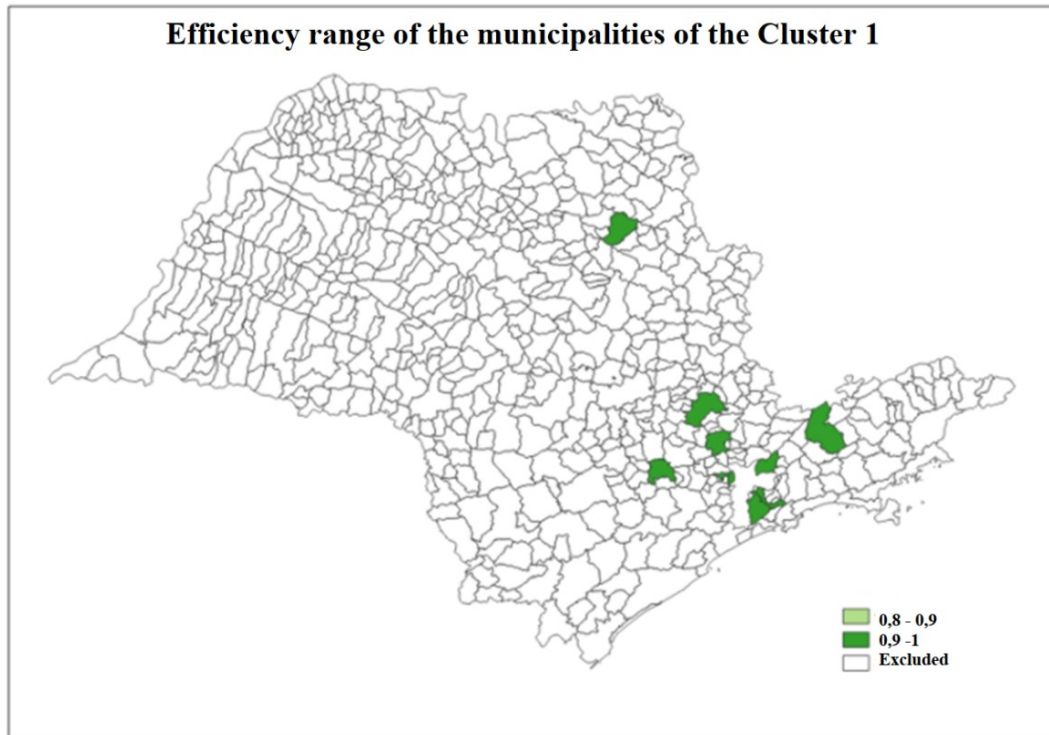
*Quantity of cities of the Groups from 1 to 6 per efficiency level by Savian and Bezerra's criterion (2013)*

Group	Efficient	Weak inefficient	Moderately inefficient	Strongly inefficient	Severely inefficient	Sum
1	7	3	0	0	0	10
2	32	147	159	60	15	413
3	10	9	6	1	1	27
4	17	14	9	2	0	42
5	11	10	4	2	0	27
6	25	64	25	3	0	117
Sum	102	247	203	68	16	636

**Source:** research data.

By the indicated criteria, 102 cities (16,0%) of the state of São Paulo achieved the maximum score of efficiency, becoming benchmarks to others in the use of basic health care resources in 2018. 287 municipalities (45,1%) were classified as moderately, strongly or severely inefficient. In this last ones, 234 cities (36,8% of the total and 56,7% of the Group) are from Group 2, the smallest and with a lowest GDP. These data are evidences that the municipalities with smallest populations and GDP tend to be inefficient, and that the efficiency in the use of resources of basic care is a contemporary challenge.

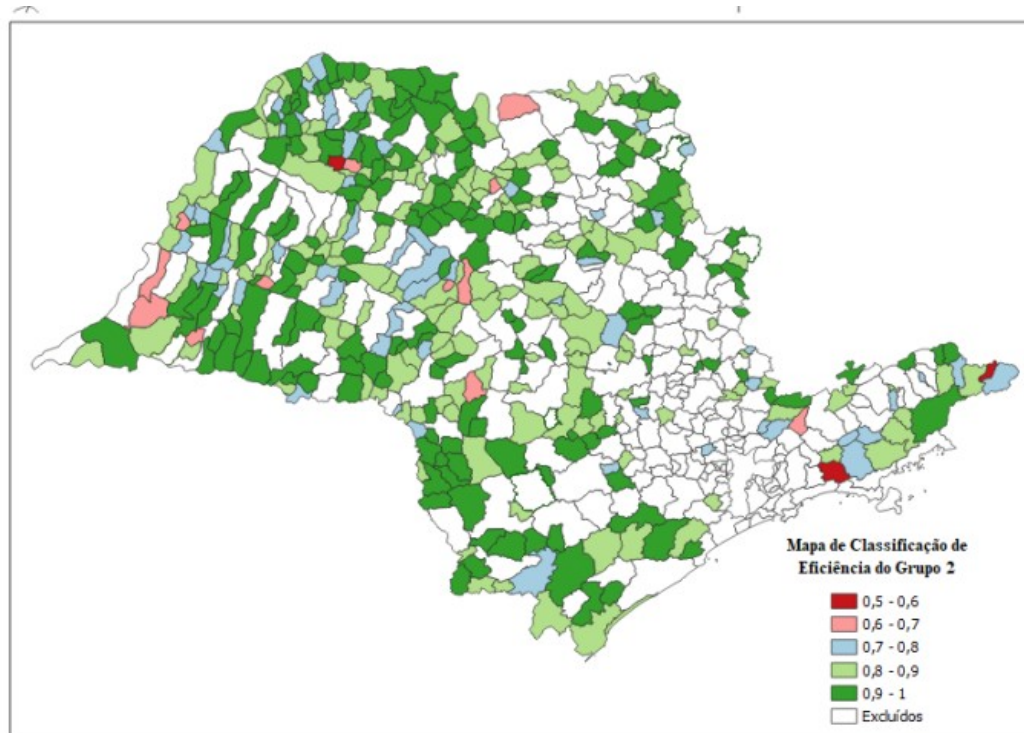
To facilitate cities' indications that formed the Groups 1 to 6 and per physical limits of the text, table 2 to 7, following, demonstrate geographic localization and efficiency range of every municipality.



**Figure 2** Localization and efficiency range of the municipalities of the Group 1

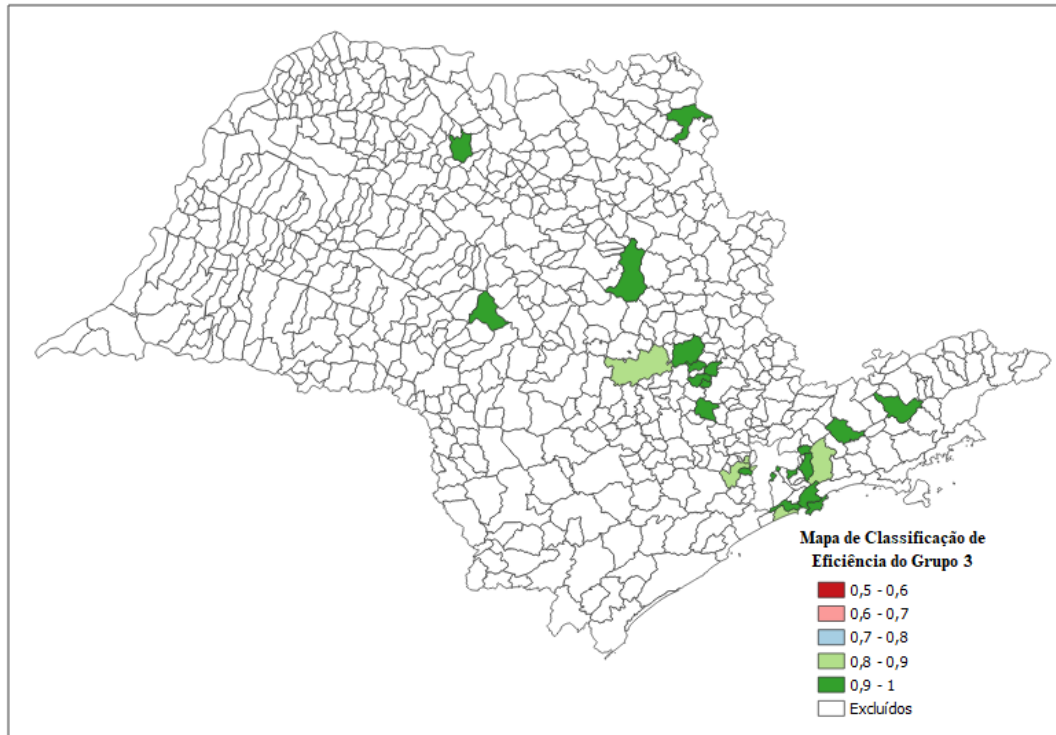
Source: research data.

In cities of the Group 1, the largest and wealthiest of them, respectively Barueri and São José dos Campos, are municipalities with the lowest efficiency indicators, both with 0,961 followed by Sorocaba, with 0,998. Those that presents the maximum efficiency level, equals to 1: Campinas, Guarulhos, Jundiaí, Osasco, Ribeirão Preto, Santo André and São Bernardo do Campo. 70% of those cities are efficient, indicating that the efficiency is related to the volume of the demand for services, in other words, bigger structures results in economic scale, in offers of basic health attention services and, consequently, in efficiency.



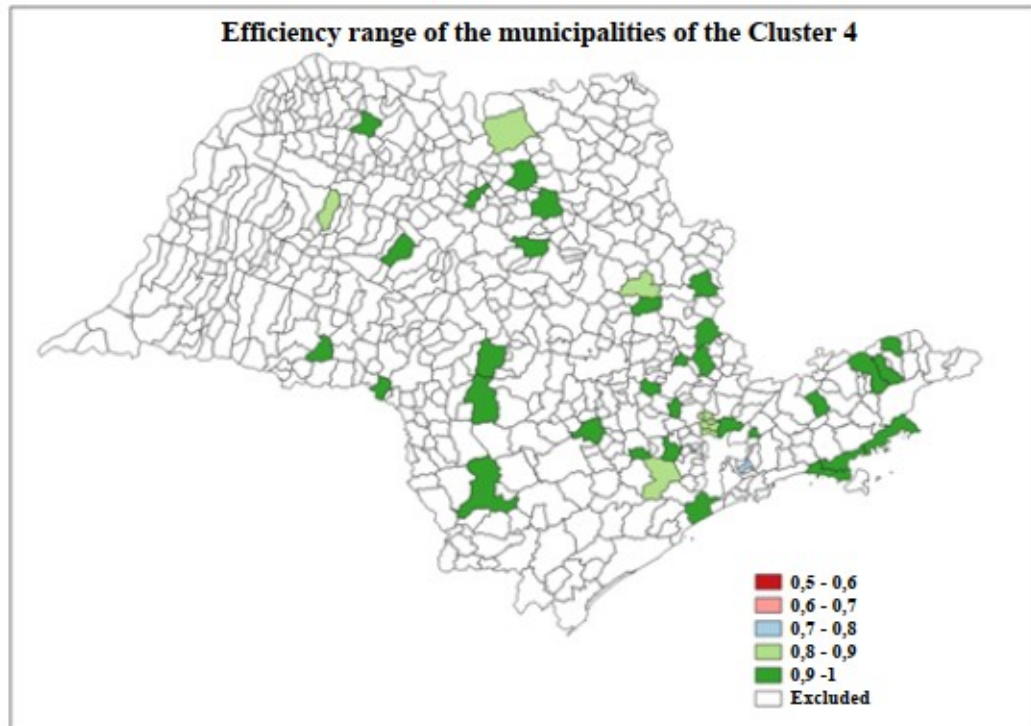
**Figure 3** Localization and efficiency range of the municipalities of the Group 2  
**Source:** research data.

The Group 2, with the municipalities with the lowest values of GDP and population, are in the rural area of the state. Is evaluated in this sense, how prevalent, in the state of São Paulo, are those small size cities with low GDP. 43,3% (179) of them are efficient or weak inefficient. Of over 3,6 millions of citizens of the state of São Paulo (7,6% of the state's population) that inhabits in this cities, 53% (1,9 million) of its population lives in moderately, strongly or severely inefficient municipalities, in the use of resources of basic health care.



**Figure 4** Localization and efficiency range of the municipalities of the Group 3  
**Source:** research data.

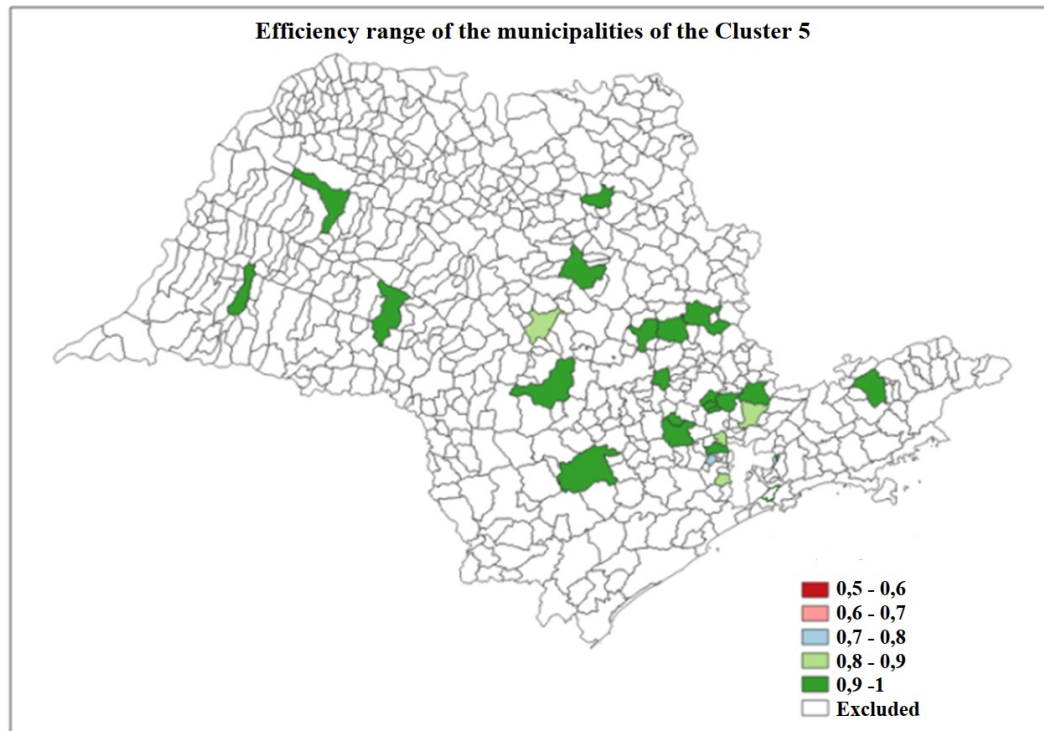
The cities of the Group 3 are medium size in population and GDP terms. 10 among the 27 are efficient. Other 09 of them are weak inefficient. In other words, 70,4% (19) of the municipalities, with an average of 306 thousand inhabitants, presented a high level of efficiency or weak inefficiency in the use of resources in basic health care in the state of São Paulo.



**Figure 5** Localization and efficiency range of the municipalities of the Group 4  
 Source: research data.

The Group 4 is composed by 42 municipalities that has an intermediary quantity of inhabitants and an intermediary GDP value among all the 636 analyzed cities. They are dispersed across the state, between the metropolitan region and the rural region. 73,8% of them (31) are efficient or weak inefficient in the use of basic health care resources.

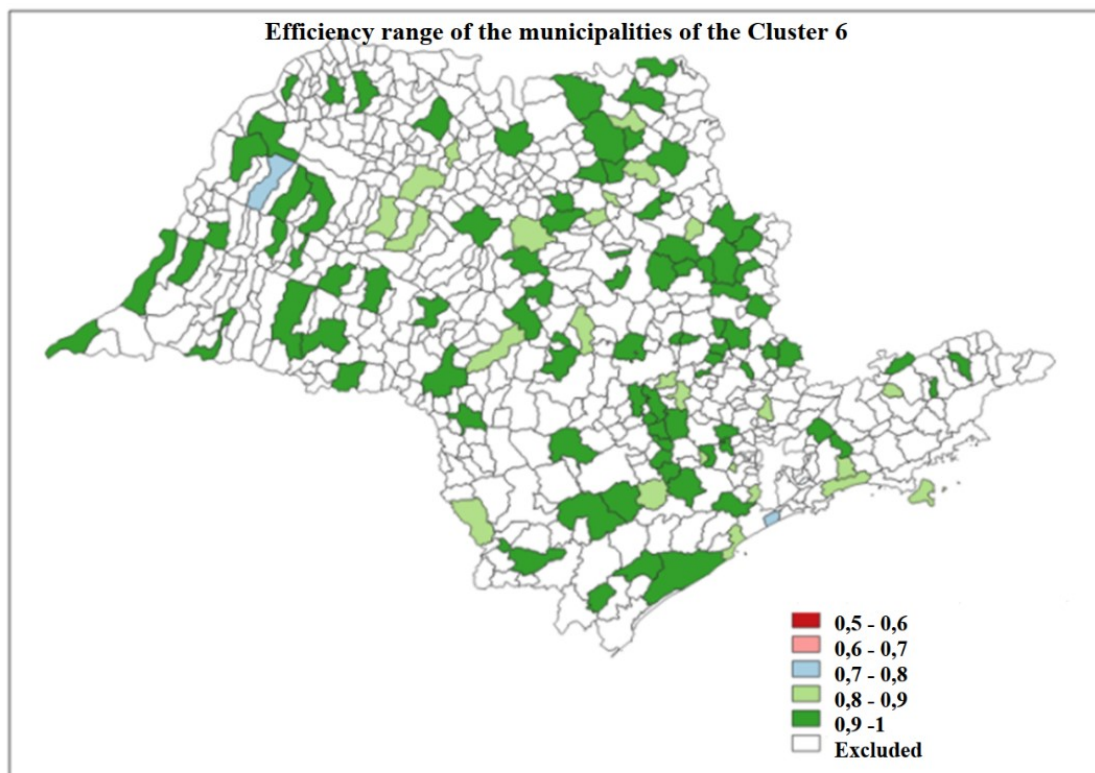




**Figure 6** Localization and efficiency range of the municipalities of the Group 5

Source: research data.

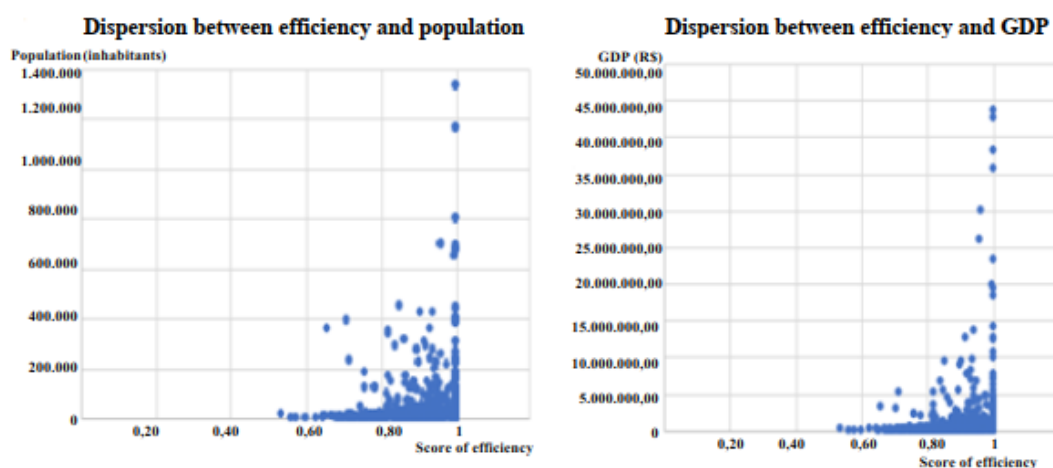
The Group 5 is formed by the municipalities with the third highest population and GDP averages. 27 of the cities that composes this group, 77,8% (21) are efficient of weak inefficient. The remaining 6 presented to be moderately inefficient (4), or strongly inefficient (2).



**Figure 7** Localization and efficiency range of the municipalities of the Group 6  
Source: research data.

The Group 6 has cities with characteristics similar to the Group 2; is composed by 117 municipalities. 89 (76,1%) are efficient or weak inefficient. On figure 7, it may be notice that the cities are quite scattered throughout the state's territory, with most of them in the rural area.

Following, it analyzes the association level between the efficiency indicator and the population, between the GDP and the total and per capita spending. Initially, figures of dispersion were used to visualize those relations.



**Figure 8** Dispersion between efficiency and population, and efficiency and GDP  
Source: research data.

As it's possible to observe, the spots match the efficiency indicators (X axes), and the population and GDP indicators (Y axes) aren't organized in a linear way or similar to a straight line, which would demonstrate a higher association level. The table 5, below, shows the  $r$  coefficient among the quoted indicators.

**Table 5**

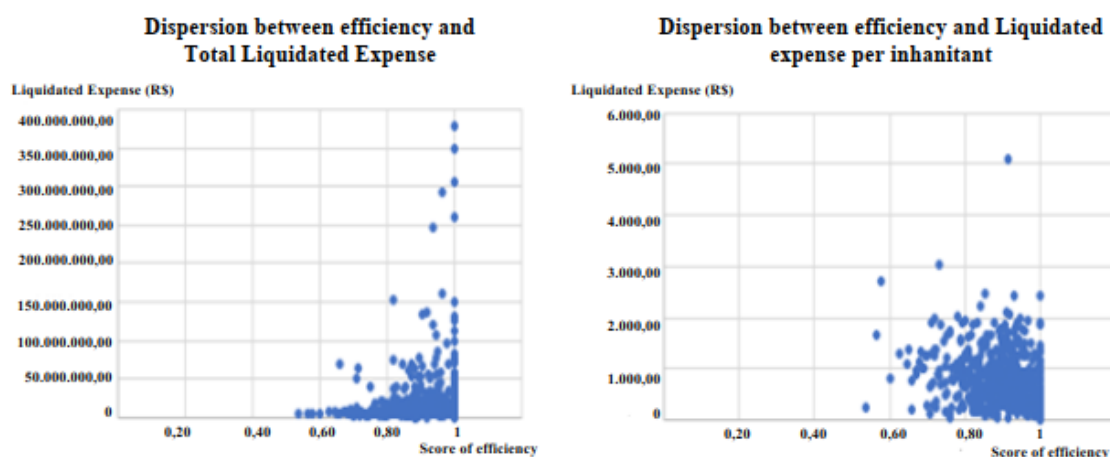
*Summary of Pearson's correlation results between the efficiency indicator, population and GDP of São Paulo's municipalities*

Correlated Variables	Coefficient Value ( $r$ )	Conclusion
Efficiency vs Population	0,2002	The variables are statistically independents.
Efficiency vs GDP	0,2144	The variables are statistically independents.

**Source:** research data.

In this way, it is accepted  $H_0: r = 0$ , for which there is no correlation between the variables tested in the analysis before the alternative that would indicate the existence of the correlation ( $H_1: r \neq 0$ ) (Figueiredo Filho & Silva Junior, 2009; Levine *et al.*, 2012). In other words, it can be affirmed that the result for the correlation analysis between efficiency and population, and efficiency and the GDP does not exist, meaning that the variables does not have a straight correlation. There is no association between the value of the efficiency score and the socioeconomic data of the population size and GDP of the cities. That demonstrate that the economic wealth and the amount of people with potential to use the service does not interfere on the efficiency level, generated by the basic health care in the cities of the state of São Paulo.

Another statistic test of correlation accomplished refers to the identification of the statistic association level between the value of the expense and the efficiency indicator. Following the same previous steps, it was analyzed the Person's correlation ( $r$ ) between the efficiency indicator and the total value of the liquidated expense with basic care in the year of 2018 to every city and the correspondent efficiency indicator, as well as between the average amount of the liquidated expense per inhabitant of each municipality and the same efficiency indicator. This test ponders the municipality size with its economic capacity for spending in basic care.



**Figure 9** – Dispersion between the efficiency indicator and the total amount of the liquidated expense in the year of 2018 as well as the efficiency indicator and the medium amount of liquidated expense per inhabitant, in the year of 2018

Source: research data.

The Figure 9 demonstrate the non-straight dispersion between the analyzed variables. It can be notice, in X axle, the efficiency indicators and, in Y axle, are the total value of liquidated expenses and the averages of the liquidated expenses per inhabitant, both of them in the year of 2018, by the São Paulo's cities.

The Table 6 presents the coefficient value  $r$  for the correlation of the variables. Soon after that, it was realized the  $t$  test, which indicated that the variables do not present a level of a straight correlation, meaning that they are not statistically associated.

**Table 6**

*Summary of the Pearson's correlation results between the efficiency indicator, the total amount of liquidated expense and the liquidated expense per inhabitant of São Paulo's municipalities, in the year of 2018*

Correlated Variables	Coefficient Value ( $r$ )	Conclusion
Efficiency vs Total of Liquidated Expense	0,2028	The variables are statistically independents.
Efficiency vs Liquidated Expense per inhabitant	-0,2626	The variables are statistically independents.

Source: research data.

This analysis indicates that the increase of the total and average amount of spending per inhabitant in basic health care doesn't have a straight correspondence to the improvement of the efficiency in this kind of spending. Internal and external factors express the choices made on management path of the health service in focus, results of contingencies and resolutions by the authorities of each cities, that determinate the efficiency level. The low correlation level presented above, analyzed with the efficient municipalities identified on figures 2 to 7, indicates that the cities have distinctive conditions to provide basic health care services, working better in some of them and not in others.

## 5. Final Considerations

The data of this study shows that the population size and wealth production, as well as the total and average amounts of spending in basic health care per inhabitant are not statistically associated to the efficiency indicators. In contrast, the analysis for groups of municipalities in figures 2 to 7 demonstrate that the cities with smaller population and GDP were classified as moderately, strongly or severally inefficient.

In all of the groups of cities, there is a reasonable variability on the efficiency indicator found by the DEA technique, and the calculated Pearson's correlations ( $r$ ) turned out to be low. This statement evidence that nether the produced wealth on the cities, related to the public revenue and to the resource's application (Slomski, 2005), or the inhabitant's amount are necessarily attached to the efficient use of basic health care services; small municipalities tend to be inefficient.

The results show that the offer for basic health care services with efficiency in the cities of São Paulo are not all bad and they could reach better levels. It is worth mentioning that the municipalities that are at the other end of the efficiency line, those that achieved the lowest efficiency levels, are part of the periphery of greater São Paulo or are the small towns with lower GDP. This finding opens up an opportunity for discussions regarding the economical

characteristic in the use of public resources: aspects of scale economy due to the size of the population and/or the formation of large clusters of less favored citizens, indicates influence on the low level of efficiency of the municipalities in group 2.

The low level of correlation found between the coefficient of efficiency and population size indicators, GDP, total spending and per inhabitant indicates that the size and wealth are not fit for defining a municipality as efficient or not, in the use of its resources on basic health care. Nor is the geographic location.

Management factors of this resources must determinate the efficiency level of each cities, beyond a simple financial resource's application. The management of the networks of basic care, considering the formulation, the planning and execution of the policy, it can make a difference on the efficiency level of health resources. It is necessary to evaluate how the management processes in the respective health departments of the municipalities are related to the efficiency in the use of executed resources in local budgets.

With a qualified and capable management in health, it is possible to improve the analyzed indicators in this research, by actions and programs that allows to increase the coverage and effectiveness on basic health care that privileges the FHS. The managers can review the need to hire new health teams, focus on training those professionals and monitor their development with proper monitoring, improving the quality of the assistance provided by those teams (Medici, 2011).

As for managing the basic health units and/or structuring new teams, it would be ideal to increase coverage. To manage is to carefully monitor the change in the epidemiological profile that determines the needs of the population, so it can direct the teams of professionals for the demand. If the municipality does not present adequate conditions for this leap in quality in the management of basic health care, or for the construction and maintenance of the BHUs, for example, an action that seeks to shorten the time of institutionalization of the state's capacities is the creation of a consortium among the municipalities, so those gaps are filled quicker (Julião, 2018).

There are many issues to be develop to increase the indicators of live births of mothers with more than 7 prenatal consultations. The prenatal care is determinant for prevention and detection of an early pathology in mothers and fetuses, so it is necessary to engage the UHS' users for this self-care practice. For that, it can be organizing events with social participation about the promotion of health and the importance of children's vaccination. It may be done actions for family and reproduction planning and to stimulate mothers to return to the health clinics for their following prenatal consultations.

In order to improve efficiency in health, there are other interventions that can be done, such as the implementation of more intensive use of information technology or partnerships with social organizations and partnerships public-private (PPP), the creation of consistent human resources policies and improving the management of materials and medications (Medici, 2011).

Taking in consideration the formulation, implementation and evaluation sequence, the management of policies (Secchi, Coelho & Pires, 2019) must be the main agenda of the cities departments, with an effective participation of the local and regional health councils, as well as the state's health department. In the same way, it must be considered the complexity of the institutional arrangement in public health policies (Lotta & Vaz, 2015). We emphasize that the evaluation of public policies is relevant to help improve indicators, from the evaluation of budget execution to indicate where to allocate resources, to the identification of actions and programs that can be offered to society.

It's worth mentioning that a limitation of this study is the quantitative approach, restricting the analysis of the indicators to statistical data only, preventing the analysis of the quality of services with qualitative data. Another limitation was the availability of data in government information systems. The analysis period was the most recent, from 2018 until the date of collection, which presented the largest amount of existing data of the selected indicators and, even so, missing data were observed.

As a suggestion for future investigations into the efficiency of public spending on health, other regions of Brazil, other sub-functions or even comparisons between states should be analyzed. In addition, it's also important to assess how the transfer of financial resources, from the union and the state, influence the levels of dependence and efficiency of the municipalities, as provided for in the legislation, and to analyze whether there are signs of waste, generated by the diversion of resources that interfere in the execution of the services.

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