

Effects of Environmental Discontinuity on the Performance of Teaching Hospitals in Brazil

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Efeitos da Descontinuidade de Ambiente no Desempenho dos Hospitais de Ensino no Brasil
Efectos de la Discontinuidad Ambiental en el Desempeño de los Hospitales de Enseñanza en Brasil

This research investigates the possibility of the existence of an environmental discontinuity in federal public teaching hospitals due to their incorporation by the state-owned Brazilian Company of Hospital Services – EBSEPH. The difference-in-differences method was used with a quantitative approach. 51 hospitals were analyzed, being excluded 9 from the final sample. The results showed that there were signs of discontinuity in two of the three dependent variables, precisely the average revenue per patient (at 1%) and the mortality rate (at 10%).

Essa pesquisa investiga a possibilidade de existência de uma descontinuidade ambiental nos hospitais de ensino públicos federais em razão da incorporação da Empresa Brasileira de Serviços Hospitalares – EBSEPH. Utilizou-se, com abordagem quantitativa, o método difference-in-differences. Foram analisados os 51 hospitais, sendo excluídos 9 da amostra final. Os resultados demonstraram haver indícios de descontinuidade em duas das três variáveis dependentes, precisamente a receita média por paciente (a 1%) e a taxa de mortalidade (a 10%).

Este estudio investiga la posibilidad de la existencia de una discontinuidad ambiental en los hospitales públicos federales de enseñanza debido a la incorporación de la Empresa Brasileira de Servicios Hospitalares – EBSEPH. Se utilizó el método de diferencias en diferencias con un enfoque cuantitativo. Se analizaron los 51 hospitales, siendo excluidos, 9. Los resultados mostraron que había signos de discontinuidad en dos de las tres variables dependientes, precisamente el ingreso promedio por paciente (al 1%) y la tasa de mortalidad (al 10%).

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1. Introduction

The EBSEH (*Empresa Brasileira de Serviços Hospitalares*), or Brazilian Company of Hospital Services, was created as part of a movement that began in Brazil, in the 1990s, by President Fernando Henrique Cardoso, which aimed to reduce bureaucracy and reform the Brazilian public administration, causing a rupture with the neoliberal policy of former President Fernando Collor and instituting progressive market-oriented policies (Gonçalves *et al.*, 2017).

This plan had as guidelines many of the basic lines of the *New Public Management* (NPM) and was later adopted by several state governments (Sano & Abrucio, 2008). As Paula (2005) says, Managerial Public Administration – as it became known in Brazil, in its adapted model – would focus on administrative decentralization, discipline and parsimony in the use of resources, transparent performance indicators and greater emphasis on results, among others.

Naturally, this reform process also extended to the health sector, due to the growing increase in spending in most developed countries due to population aging and technological progress (Simonet, 2013b). Whether directly by the government, or on the hospitals' own initiative, the changes took place for financial or regulatory reasons through the willingness of legislators and regulators to improve the performance of hospitals (Schreyögg, 2019).

The situation also affected public teaching hospitals which, in the context of reforms, saw the scenario change with the creation of EBSEH. The company was created with the purpose of establishing contracts with hospitals, influencing management, financing and their objectives, including improving and monitoring their performance (Andreazzi, 2013, EBSEH, 2016).

The creation of EBSEH to better manage those hospitals was encouraged because over the years the health sector has become one of the fastest growing and most expensive sectors, in addition to representing a large part of a country's economy (Shukri & Ramli, 2015), as one of the service sectors (Rahimi *et al.*, 2017).

In addition to their importance, health organizations deal with an unstable environment due to the constant changes in lifestyle, demographic and technological factors that they have to face (Koumpouros, 2013). Bahadori *et al.* (2011) add that hospitals occupy a prominent place in health systems, and the evaluation of their performance is extremely important due to their contribution to the effectiveness of the system. But what would performance be in the hospital context?

Schreyögg (2019) classifies two strands in the literature on hospital performance: a strand of medical researchers, which focuses on quality of care and its processes and results; and another strand of researchers in the economic area. Studying hospitals regarding their performance aspect deserves particular attention due to the increase in demand for services and the high expectations of patients, which has been causing financial difficulties in countries around the world, such as Europeans (Eiff, 2012) and Asian countries (*World Bank*, 2010).

Several projects and various tools were employed and developed to improve performance and quality of care to overcome these challenges in healthcare organizations. However, due to the competitive market, it became particularly difficult for hospitals to remain operating alone in the

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PALAVRAS-CHAVE

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market, which encouraged them to cooperate with other organizations or to incorporate other hospitals. This multi-institutional arrangement process would be able to reduce costs (reduction of redundant activities) and increase efficiency due to economies of scale (purchases in greater numbers) (Schreyögg, 2019).

Büchner, Hinz and Schreyögg (2016) highlight that this type of system makes it easier for hospitals to hire employees, increase employees' skills through the exchange of information and expertise, have access to capital and financial services with more agility and greater bargaining power.

There are basically three types of multi-institutional arrangements: health systems, health networks and co-optation. Health systems consist of multiple hospitals that operate under the direction of a key organization (such as EBSEH and the focus of this paper); health networks are about strategic and contractual alliances between hospitals and other health organizations to provide a diversified range of services; co-optation is defined by a single link between organizations, such as the presence of a board member in two hospitals simultaneously (Schreyögg, 2019).

Büchner, Hinz and Schreyögg (2016) used the difference-in-differences method to examine financial indicators of German hospitals and showed that, one year after entering health systems, there was a positive effect on hospital performance, an effect that disappeared in following the following years, which leads to the conclusion that there is no clear evidence that this entry has a lasting impact.

When reviewing the effects of entry into health systems on hospital efficiency and performance, Schreyögg (2019) concludes that there is indeed an expected increase in efficiency, but the effects on financial performance are unclear, which compels further investigations. According to this same author, in general, surprisingly few studies have examined the effect of changes in applicable regulations on hospital performance, which is precarious when compared to other lines of research in health economics.

In addition to the lack of consensus regarding the effects of changes in the regulation of hospital performance and the comparatively low number of studies on the subject, there is still more scientific production on the subject in developed countries than in developing countries, a group that includes Brazil, according to the United Nations (2019).

Schreyögg (2019) goes further by stating that, when specifically dealing with the performance of hospitals that experience environmental discontinuity, the academic literature is inconclusive about its effects, which encourages further investigation.

It is believed, therefore, that the Brazilian case can be used as an example for other developing countries due to its similarities (Mimba *et al.*, 2007) and the considerable number of public teaching hospitals due to its territorial dimensions.

Considering the context of organizational changes that causes turbulence and the few studies on the subject, it is stated the following research problem: **how did the contractualization by the EBSEH affect the performance of teaching hospitals?** The present study has the general objective of analyzing how the contractualization by the EBSEH affected the performance of university hospitals.

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2. Theoretical Framework

2.1. Environmental Discontinuity

For 40 years, researchers have sought to understand how companies in increasingly unpredictable environments can manage the present and prepare for the future (Liebl, Schwarz, 2010). Organizational theorists who adopt the punctuated equilibrium perspective propose the existence of two distinct phases in the evolution of organizations: long periods of quasi-equilibrium, marked by small changes in activities and structure, and periods of disequilibrium in which new organizations emerge and existing ones are transfigured (Haveman, Russo, & Meyer, 2001).

These periods of imbalance receive different denominations, being called periods of crisis, turbulence and environmental discontinuity (Hambrick & Mason, 1984; Haveman, Russo, & Meyer, 2001; Domadenik, Prašnikarm, & Svejnar, 2016). This study adopts the nomenclature of environmental discontinuity, which, according to Hoppman, Naegelé and Girod (2019), consists of significant changes in a company's political, technological, social or economic environment.

It should be noted that, in situations of environmental discontinuity, the existing capabilities of a company can become obsolete, which demands the adaptation of strategic planning in order not to harm its performance (Hayne, 2022). This inability to adapt may result from organizational inertia, with top management teams having a vital role in preventing this effect. Despite its relevance, more studies are needed about the internal challenges and the dynamics in environmental discontinuity (Hoppmann, Naegelé, & Girod, 2019).

For the purposes of this study, the privatization process of federal public teaching hospitals is considered to trigger a process of environmental discontinuity, due to the various changes in the organizational environment, with new top managers, a new hierarchical structure and the establishment of new performance indicators.

The privatization of public teaching hospitals to private, for-profit or non-profit hospitals, has been one of the strategies adopted by governments whose hospitals are facing financial problems (Ramamonjariavelo, Weech-Maldonado, Hearld, Menachemi, Epané, & O'Connor, 2015). The study by Ramamonjariavelo *et al.* (2020) highlights some points emphasized by the literature as possible motivators of this change, such as increased efficiency, reduction of operating costs, recruitment of new managers and employees, renovation of infrastructure, among other factors. The authors point out that, although part of the literature argues that privatization can force hospitals to discontinue certain services to the population or harm the quality of their performance, this option would be a way of keeping them running and that, if they are not privatized, they could close.

Turning to empirical studies on the subject, Thorpe, Florence and Sieber (2000) investigated the impact of changes in relation to the type of control of hospitals regarding their financial performance and found no significant change in *total margin* after privatization to an institution. non-profit private. In the study by Villa and Kane (2013), the authors also did not find a significant variation after privatization in *the total margin*, but observed a 6.1% increase in *the operating margin*.

Other studies have found an association between change and hospital performance. Bazzoli *et al.* (2000), when studying the nine performance indicators in North American hospitals, showed that hospitals in moderately centralized health systems perform better than those in other types of institutional arrangements. Carey (2003) demonstrates the existence of a positive association between entry into a health system and cost efficiency. Büchner *et al.* (2015), using the difference-in-differences, reported that the technical efficiency of German hospitals entering healthcare systems increased in the fourth year.

3. Methodology

3.1. Universe and Sample

The research universe consists of federal teaching university hospitals, totaling 51 organizations whose data were available for the analyzed period. The only institution disregarded was the University Hospital of UNIFAP, as it is still under construction and pending operation, despite having already been contracted in the period.

3.1.1 Sample organization for the difference-in-differences method

The difference-in-differences method estimation is the most common and oldest quasi-experimental research design and consists of the analysis of variance in results before and after treatment (difference 1) and between the control and treatment group (difference 2) (Goodman-Bacon, 2021).

In order to carry out the procedure as planned for detecting the environmental discontinuity, the sample also used federal university hospitals that were not incorporated by the EBSERH as a control group. They are:

Table 1. - Federal University Hospitals not Incorporated by EBSERH

Hospital Universitário da UNIFESP	Hospital Universitário Clementino Fraga Filho
Instituto de Atenção à Saúde São Francisco de Assis	Instituto de Puericultura e Pediatria Martagão Gesteira
Maternidade Escola da UFRJ	Instituto de Ginecologia da UFRJ
Instituto de Neurologia Deolindo Couto	Instituto de Psiquiatria da Universidade do Brasil
Instituto de Doenças do Tórax	Instituto do Coração Edson Saad

Therefore, excluding the federal university hospitals presented above, the analysis was performed according to **Table 5**, below.

Table 2. - Hospitals used for *difference-in-differences*

Treatment group	HU Maria Aparecida Pedrossian; HU Júlio Müller; HU de Brasília; HU da UFGD; Hospital Universitário da UFPI; HU Professor Alberto Antunes; HU Professor Edgard Santos; Maternidade Climério de Oliveira; Hospital Universitário Walter Cantídio; Maternidade Escola Assis Chateaubriand; HU da UFMA; HU Lauro Wanderley; Hospital das Clínicas da UFPE; HU da Un. Federal do Vale do São Francisco; Hospital Universitário Ana Bezerra; Hospital Universitário Onofre Lopes; Maternidade Escola Januário Cicco; Hospital Universitário da UFS; Hospital Universitário Getúlio Vargas; HU Betinna Ferro de Souza; Hospital Universitário João de Barros Barreto; HU Cassiano Antônio Moraes; Hospital das Clínicas da UFMG; Hospital das Clínicas da UFTM; e Hospital Universitário de Santa Maria (Total = 25 hospitals)
Control group	HU Alcides Carneiro; HU Júlio Maria Bandeira de Mello; Hospital Universitário de Lagarto; Hospital de Doenças Tropicais; Hospital de Clínicas da UFU; Hospital Universitário Antônio Pedro; Hospital Universitário Gaffrée Guinle; HU Prof. Polydoro Ernani de São Thiago; Hospital Universitário Dr. Miguel Riet Corrêa Jr.; HU da UNIFESP; HU Clementino Fraga Filho; Instituto de Atenção à Saúde São Francisco de Assis; Instituto de Puericultura e Pediatria Martagão Gesteira; Maternidade Escola (UFRJ); Instituto de Ginecologia (UFRJ); Instituto de Neurologia Deolindo Couto (UFRJ); e Instituto de Psiquiatria da Universidade do Brasil (Total = 17 hospitals)
Hospitals not included	Hospital das Clínicas da UFG; Hospital Universitário da UFSCar; Hospital Universitário de Juiz de Fora; Hospital Escola da UFPEl; Hospital de Clínicas da UFPR; Maternidade Victor Ferreira do Amaral; Instituto de Doenças do Tórax (UFRJ); e Instituto do Coração Edson Saad (Total = 8 hospitals)

The selection criteria for hospitals were as follows:

- treatment group hospitals – were selected due to the incorporation date as the contract with EBSEH was signed in 2013;
- control group hospitals – were selected considering that in the period of analysis they were not contracted by the EBSEH (this includes hospitals that were not contracted by the EBSEH at all, such as HU Clementino Fraga Filho (UFRJ), and hospitals that were contracted in periods subsequent to the analysis, such as the Hospital de Clínicas of the UFU; and
- hospitals that were not included - they were excluded from the analysis due to the unavailability of data (eg Instituto de Atenção à Saúde São Francisco de Assis - UFRJ) or due to the contract with EBSEH on a different date from 2013, but still within of the period of analysis (eg Hospital de Clínicas, UFPR).

3.2. Performance Indicators

Regarding the variables available for the analysis of the environmental discontinuity, the study by Brizola *et al.* (2011) was used as reference. The variables that were found to be valid for use, considering their characteristics of data availability and relevance to the object of the study are the *mean value of AIH (hospital admission authorization)*; the *average length of stay*; and the *death rate*.

As for the availability of data, the Brazilian literature uses the data provided by the federal government to calculate other indicators considered relevant, since they are evidenced by the EBSEH itself through its Budget and Financial Information Panel (EBSEH, 2021) and other bases maintained directly by the Ministry of Health, such as DATASUS and CNES.

Specifically, regarding the variables used, it is important to emphasize that they are available with monthly observations for the analyzed period and allow the demonstration of the discontinuity, in general aspects, faced by hospitals. The following table demonstrates the data sources used:

Table 3. - Data collection sites for selected hospital financial performance variables

<i>data source</i>	Source Description
<i>DATASUS</i>	It provides data on the financial and budgetary execution of health systems obtained through SIOPS, in addition to consolidating data from other sources. Its website is < http://www2.datasus.gov.br/ >
<i>Budget and Financial Information Panel - EBSEH</i>	The panel provides information on university hospitals based on <i>Business Intelligence</i> (BI) concepts with data mainly from SIAFI. This tool is provided for in article 54 of the EBSEH Internal Regulation and its maintenance is one of the competences of the company's Budget and Finance Department.
<i>CNES</i>	Maintained by the Ministry of Health, by its Health Care Secretariat, the database maintains data on health facilities, such as beds, equipment and contracts. Its website is < http://cnes2.datasus.gov.br/ >

With the definition of indicators that serve as a basis for measuring the performance of hospitals, we proceed to explain the methodological procedures that involved the detection of discontinuity in the environment.

3.3. Detection of Environment Discontinuity

The literature is still not certain as to whether the effects are positive or negative, and some papers use the methodological approach of difference-in-differences, propensity score matching or instrumental variables to analyze each situation (Schreyögg, 2019).

For the regression analysis, it was proceeded to the composition of three econometric models where the three different dependent variables for each model were considered.

The difference-in-differences method model used, adapted from Büchner, Hinz and Schreyögg (2016), has the following basic structure:

$$Y_{it} = X_0 + X_1 \text{SYSTEM}_i + X_2 \text{POST}_t + X_3 \text{SYSTEM}_i \text{POST}_t + X_4 Z_{it} + e_{it} \quad (\text{Eq. 1})$$

Apart from the already explained dependent variables, which represent the performance of hospital *i* in month *t*, the study considers the dummy variable *SYSTEM_t* with value 1 if the hospital entered the EBSEH in the period and 0 in negative cases; the *dummy* variable *POST_t* assumes a value of 1 from the year following the entry of hospitals into the health system and 0 before and in the year of entry.

Next, the interaction coefficient between the two *dummies* listed above is presented, which is the $SYSTEM_tPOST_t$, whose function is to indicate potential changes in the performance of hospitals after joining the EBSEH in relation to hospitals that were not incorporated, therefore belonging to the group of control. This coefficient is responsible for capturing the effect sought.

Z represents the control variables used in the models, which are two: the first corresponds to the number of employees and the second to the number of beds in hospital i in month t . The error term e is assumed to be of zero mean and normally distributed.

It is emphasized that, as a temporal delimitation, monthly observations were used from January 2008 (oldest data available in the DATASUS database) to December 2015, organized as follows: the year 2013, as the year with the highest number of contracts, was considered the treatment period for the hospitals in the sample. Therefore, the study considered the months of 2014 and 2015 as post-treatment and the months from 2008 to 2012 as pre-treatment.

This delimitation is necessary due to the availability of data, since some hospitals were contracted between the years 2016 and 2019, making them, if considered, to belong to the treatment group. The two-year window was arbitrated following studies such as Büchner *et al.* (2016). Even if the period of panel data is longer (extends to 2019), the assumption is that the results found in the diff-in-diff persist once the environmental discontinuity persists. Büchner *et al.* (2015), for example, report effects of contractualization on efficiency after four years of entry into health systems.

It is necessary to emphasize that the year 2020 caused another environmental discontinuity that is not subject to analysis in this study. The COVID-19 pandemic caused several crises that led to closures, mergers and restructurings (Nguyen, Malik, Budhwar, 2022; Schaedler, Graf-Vlachy, König, 2022). Consequently, it caused changes in hospital data and, therefore, data after the event are not used.

4. Results Analysis

4.1. Environmental Discontinuity

As discussed in the methodology, environmental discontinuity was calculated for three distinct variables, namely *average revenue per patient*, *average length of stay* and *mortality rate*. It was expected to identify the variation in these indicators in relation to the contracting or not of university hospitals by the EBSEH. The table below shows the first test performed.

Table 4. - Environment discontinuity for the average revenue per patient

Variables	Coef.	IF
C	-946.72**	380.17
Sys	360.05	243.49
Post	-16.62	33.46
Syspost	-103.91***	39.33
LogEmpreg	533.17***	104.37
LogLeitos	527.36***	134.86

Note. n = 3,761; *p<0.1; **p<0.05; ***p<0.01

The test demonstrates that there is statistical significance at 1% in the interaction coefficient responsible for identifying the environmental discontinuity, that is, it can be interpreted from the results of the statistical test that the variable *average revenue per patient* was negatively affected in the hospitals that contracted with the EBSEH in the analyzed period, which indicates a change in the efficiency of fundraising by hospitals when they became part of the EBSEH health system.

Following, **Table 5** presents the results for the *average length of stay variable* for the same period:

Table 5. - Environmental discontinuity for the average length of stay

Variables	Coef.	IF
C	7.38***	1.79
Sys	-2.05	1.58
Post	-0.01	0.12
Syspost	-0.06	0.14
LogEmpreg	0.62	0.39
LogLeitos	0.01	0.52

Note. n = 3,760; *p<0.1; **p<0.05; ***p<0.01

As the results demonstrate, there is no statistical significance for the variable of interest (*Syspost*), which implies that the influence of the EBSEH on the hospitals it contracted had no impact on the *average length of stay variable*, and therefore there is no distinction between the contracted hospitals and those not contracted.

Finally, **Table 6** shows the results for the period, considering the *mortality rate variable*.

Table 6. - Environmental discontinuity for mortality rate

Variables	Coef.	IF
C	10.93***	1.47
Sys	-0.63	0.99
Post	-0.27**	0.12

Syspost	0.24*	0.14
LogEmpreg	-0.87**	0.38
LogLeitos	-1.56***	0.49

Note. n = 3,136; *p<0.1; **p<0.05; ***p<0.01

Although the variable of interest is statistically significant only at 10%, unlike the variable *average revenue per patient*, the result points to a higher mortality rate for contracted hospitals when compared with non-contracted hospitals.

What can be inferred from the results of the three variables analyzed together is that in two of them there was a considerable enough impact to make the contracted hospitals (treatment group) stand out from the group of non-contracted hospitals (control group), there being, therefore, support to confirm the hypothesis of environmental discontinuity.

These results are in harmony with those obtained in the studies by Bazzoli *et al.* (2000), Carey (2003), Büchner *et al.* (2015), for example, when finding a noticeable effect on financial performance when a hospital becomes part of a health system (as is the case with EBSEH). The results indicate, therefore, that the hospitals that were contracted by the Company suffered noticeable stress in their organization and management to the point of configuring the discontinuity of the environment.

5. Conclusions

It should be noted that the transition from autonomous management by universities to shared management is a recent phenomenon that has gradually prompted further studies on the subject. Despite extensive discussion regarding the content of the law that created the state-owned company, it should be noted that the literature was still divergent on the expected effects of the suggested changes (Andreazzi, 2013).

The international literature also added to the reservations about the transition from a completely autonomous model to the format in health systems, demonstrating that the impacts on hospital performance were not always as expected and pointing to mixed and inconclusive results. The fact that few studies address the problems of developing countries increased this need (Schreyögg, 2019).

Considering the unique circumstances of the Brazilian experience, with the imposition of challenges due to its predisposition to present low institutional capacity, limited involvement of stakeholders, high level of corruption and high level of informality (Mimba *et al.*, 2007), it was considered pertinent to carry out a thorough investigation on the subject, but not without its challenges.

The national context implied some limitations that are listed and must be considered when extending the results to other studies. Brazil has a small number of teaching hospitals within the scope of the Federal Government, with a total of 51, in which 1 hospital is not yet operational and 10 of them have not contracted with EBSEH. This small number makes it difficult to generalize about the findings, however, with recent changes and the standardization of organizational structures in all hospitals, it was considered relevant to proceed with the analysis.

As for the environmental discontinuity, the tests carried out showed that the variables of *mean value by patient* and *mortality rate* underwent variations that imply that the changes that occurred in the hospitals with the incorporation by the EBSEH were significant. Although the *average length of stay* variable did not present the same result, it was considered that the discontinuity could be verified.

It can be argued that the results demonstrate a deterioration in the services provided by hospitals in the highlighted period. It should be considered, however, that this type of impact is expected due to the environmental discontinuity. What should be noted for future periods is that these changes were supposed to be in the process of stabilization. What will make future studies more difficult is the other major process of organizational crisis caused by the COVID19 pandemic.

Now that this discontinuity has been established, and therefore the objective is satisfied, it is expected that this study, of an exploratory and quantitative nature, will serve as a basis for future research that explores this relationship in the context of the Brazilian public sector.

As specific recommendations, the suggestion is that qualitative studies seek to carry out research on multiple cases to understand, in fact, how the influence of the discontinuity of the environment in hospital operations occurs.

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