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HUMAN RESOURCE MANAGEMENT PRACTICES AS DETERMINANTS OF TECHNICAL EFFICIENCY IN HOSPITALS

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INTRODUCTION

The complexity of organizations, specifically those that are considered vital and socially relevant, such as hospitals, demands more efficient and effective management, since there are multiple elements involved in their operations, a series of requirements and obligations, a regulatory structure, political and cultural aspects involved, among others (FIGUEREDO, 2022).

This management has been discussed from different management practices, be it financial, processes, people, among others. Among these, people management has been highlighted by the often urgent need to deliver satisfactory results, since it deals with life, death, health and illness (PACHECO; MAGALHÃES, 2023).

According to Knies, Leisink and Schoot (2020) there has been a growth in academic research involving human resource management since the 1990s and in the current context of the business world we are experiencing the era of digital transformation and that according to Kuznetsova *et al*. (2019) it is impossible to improve the efficiency of organizations without human resources, employees being the main engine and source of strength of any economic system. Therefore, since organizations are made up of people, there is no way they can survive without managing them.

Pham (2020) argues that human resources are the central core of social and economic development in any organization, country and territory in the world and Javadipour, Siavochani and Ghorbani (2020) go further when they assert that among organizationalresources, those focused on people management are the most fundamental assets in a company's success, thus demonstrating the importance of people for companies. Still on this subject, Sharma, Ramachadran and Kaur (2019) say that the success of the organization depends on the decisions made by human resource management.

Within this context, the emergence of human resource management (HRM) practices has accompanied the evolution of the complexity of companies. They design and implement strategies to improve the performance of organizations (TARAWNHE, 2020), as well as their importance in relation to the value, growth and development of organizations, which is confirmed by numerous empirical studies (LOBOS; MALÁTEK; SZEWCZYK, 2020) and aims to achieve organizational objectives and goals (ALSHEHHI; BHAUMIK; GANGELE, 2019).

It is important to note that organizations are increasingly learning and applying techniques to analyze production efficiency, which is one of the most important qualities that an entity should possess (MARIANO, 2007). Still on this subject, Wei and Ng (2012) say that efficiency is an important indicator for measuring performance, especially in an environment of rapid change such as the economy.

Alshehhi, Bhaumik and Gangele (2019) argue that a significant approach for organizations to pursue efficiency is through human resource management and add thatdespite the numerous factors that impact productivity in companies, employee performance is considered the biggest influencing factor. Still on this discussion, Wei and Ng (2012) argue that the efficiency of the organization can be improved when the company implements a set of human resources practices that are consistent and aligned with the strategy.

Within this organizational context are hospitals, the subject of this article. It is worth noting that according to Paiva *et al*. (2020, p. 235) "health professionals are among those most prone to illness and absence from work, due to the high workload, exposure to an unhealthy environment and conditions, demands for productivity and psychological distress".

Still on this subject, the *turnover* rate in hospitals is significant worldwide and as a consequence has generated a direct and indirect negative impact on the health sector (ZAHEER *et al.*, 2019). In addition, the exponential growth in healthcare costs and predictions of increasing future trends have drawn the attention of healthcare researchers (COLOMBI; MARTINI; VITTADINI, 2016). It is essential to reduce the consumption of excessive resources in the production of health services and to understand the determinants of inefficiency in health systems (ALTAWI; NIESSEN; KHAN, 2020).

Still on this discussion, Liu *et al.* (2019, p. 2) state that "hospitals are one of the main components of the health system and also an important driver of rising health costs, constituting the largest single component of health spending in many countries". As such, they demonstrate the need to monitor and control costs for efficient hospital management.

The analysis of hospital efficiency is an important issue in the field of health economics and, although there is a vast literature on the subject, few studies emphasize the identification of the determinants of hospital efficiency (LIU *et al.*, 2019). Research in the area has concluded that improving the quality of services and controlling the costs of health care institutions are the two main objectives of health policies in many countries (LI; MOHIUDDIN;LIU, 2019).

The studies by Gile, Samardzic and Klundert (2018) and Prado *et al.* (2019) and Al-Ayed (2020) show that human resource management in hospitals has an impact on organizational performance, and according to Buchelt, Frączkiewicz-Wronka and Dobrowoslska (2020), the various nuances of human resources in the health sector have grown greatly due to their strategic importance for the sector.In Brazil, despite research that correlates HRMP and performance in general, no studies were found on HRMP determinants and technical efficiency in hospitals using data envelopment analysis.

Therefore, understanding that hospitals are complex systems and have different sizes, structures, processes, people, technologies, management, among other variables, and given this contextualization, the following problem arises: Are human resource management practices a determining factor in the technical efficiency of hospitals?

Therefore, within this context of hospitals, HRMPs (human resource management practices) and efficiency, this article aims to analyze human resource management practices as determinants of technical efficiency in hospitals.

THEORETICAL BACKGROUND

Human resource management practices

The term practices comes from the verb praticar, which according to the Aurélio dictionary (1986, p. 1376) is "to carry out: to do, accomplish, commit, execute". So, initially,

it can be said that HRMPs are activities/actions that companies carry out in order to manage people. It's not just a conceptualization, but an execution of how to achieve a given organizational objective or goal through and with people.

In order to develop good human resource management in line with organizational efficiency, it is important to use practices, and the main tool for improving performance has been considered HRM (JASHARI; KUTOLVIC, 2020), also confirmed by Keny and Nnamdi (2019).

According to Aburumman *et al*. (2020) HRMP is defined as a set of distinct but interrelated activities, functions and processes aimed at attracting, developing and maintaining (or disposing of) a company's human resources. It will help to improve the knowledge, skills, motivation and *turnover of* employees. They are among the most important factors for increasing employee satisfaction and commitment to work, which contribute to increased productivity (ALSAFADI; ALTAHAT, 2021).

HRM practices are the primary means by which companies influence and shape the skills, knowledge and behaviour of their employees to achieve organizational goals (OTTO, 2020). According to Armstrong (2006) they are those concerned with the development of human resource strategies, policies and practices that affect all aspects of HR and employment management. It can therefore be seen that for efficient human resource management, practices need to be well selected, developed and applied to organizational needs, demonstrating their relevance to organizations.

Wood and Wall (2002), Dutra (2008), Bonache and Cabrera (2009) and Freitas (2010) show that HRMPs make little contribution in isolation and must be analyzed together to ensure that they form a consistent system, which makes it important to combine them to achieve organizational goals and objectives.

Various scholars and researchers in the field have been studying human resource management practices for years. There are various types in the literature, as cited by the authors in table 09:

Chart 01 - Human Resources Management Practices

Year	Author(s)	Practices
2000	Milkovich; Boudreau	- Human Resources Planning, Recruitment and Selection, Training and Development, Remuneration and Performance Assessment. They add: Career Management, Variable Remuneration, Profit Sharing, Competency-Based Remuneration, Benefits Programs, 360-degree and Competency-Based Assessment, Quality of Life at Work, *Outplacement,* HR Information Systems and HR Auditing.
2002	Dutra	- People Planning, Recruitment and Selection, Socialization, Repositioning and Relocation (movement), Training and Development, Career Management and Performance Evaluation (development), Remuneration, Rewards, Services and Facilities (appreciation). It adds: Communication, Trade Union Relations and Community Relations.
2003	Bohlander; Dessler	- Planning, Recruitment and Selection, Training and Development, Performance Evaluation, Remuneration, Health and Safety and LaborRelations.
2006	Gil	- HR Planning, Recruitment and Selection (procurement/aggregation), Job Analysis and Description, Planning and Internal Allocation (application), Training, Development and Organizational Change (development/enablement), Salaries, Benefits, Careers, Occupational Health and Safety, Trade Unions (compensation/maintenance), Performance Evaluation, Database, Management Information Systems and HR Auditing (control/monitoring). He adds: Quality Management and *Coaching*.
2008	Ivancevich	- HR Planning, Recruitment and Selection (acquisition), Performance Management and Evaluation, Remuneration, Assistance and Benefits (compensation), Training and Development, Career Planning (development),

		Quality of Life at Work (promoting safety and health).
2011	Marras	Recruitment and Selection (R&S); Training and Development (T&D); Compensation or Positions and Salaries (C&S); Occupational Health and Safety (HST); Personnel Department (DP); Labor Relations (RT); General Services (SG).
2022	Moreno	Headcount planning, job analysis and description, recruitment and selection, remuneration management, performance evaluation, training and development and career management.

Source: Adapted by the author from Girardi (2009).

Looking at the table 01, it can be seen that although there are many classifications of human resource management practices, the majority are common. Another relevant point is that the adoption of one or other HRMP depends very much on the organization's culture and the value it places on people (FREITAS, 2010).

Human resource management practices in hospitals

The Brazilian health system is made up of public establishments (administered by a municipal, state or federal government entity) and private establishments (belonging to a legal entity under private law), which are organizations or institutions that provide health care services and care for individuals with the main objective of promoting health, treating diseases, preventing illnesses and improving people's well-being (ROCHA, *et al.,* 2018).

According to Brasil (2020), there are various types of health establishment, including: Health Posts, Basic Health Units (UBS), clinics, hospitals, emergency rooms,among others. Table 02 shows some of these and a brief conceptualization:

Table 02 - Some health establishments

Health establishments	Concept
Health centers	A unit designed to provide care to a given population, on a scheduled or unscheduled basis, by a mid-level professional, with the intermittent presence or not of a medical professional.
UBS	A unit for providing basic, comprehensive care to a population, on a scheduled or unscheduled basis, in basic specialties, with the possibility of offering dental care and care from other higher education professionals. Care must be permanent and provided by a general practitioner or specialist in these areas. It may or may not offer SADT (Diagnostic and Therapeutic Support Service) and 24-hour emergency care.
Polyclinics	A health unit that provides outpatient care in various specialties, including or not basic specialties, and may also offer other non-medical specialties. It may or may not offer SADT and 24-hour emergency care.
General Hospital	Hospital providing care in basic specialties, by specialists and/or other medical specialties. It may have an emergency service. It must also have medium-complexity SADT. May or may not have SIPAC (Integrated System for Assets, Administration and Contracts).
Specialized Hospital	Hospital designed to provide health care in a single specialty/area. It may have an Urgency/Emergency service and SADT. May or may not have SIPAC Generally a regional, macro-regional or state reference.
Hospital /Day- Isolated	Units specializing in short-term care that is intermediate between outpatient and inpatient care.
Mixed Unit	A basic health unit designed to provide basic and comprehensive health care, on a scheduled or unscheduled basis, in basic specialties, with the possibility of offering dental care and care from other professionals, with a hospitalization unit, under a single administration. Medical care must be permanent and provided by a specialist or general practitioner. It can provide urgent/emergency care and basic or routine SADT.

General emergency room	A unit designed to provide care for patients with or without a life-threatening condition, whose problems require immediate attention. They may or may not be hospitalized.
Specialized Clinic/Ambulatory	Specialized Clinic for outpatient care in only one specialty/area of care (Psychosocial Center/Rehabilitation, etc.)

Source: Fragment of the types of health facilities according to the Ministry of Health (2020).

As the object of the study is hospitals, the focus was on these health establishments, specifically the public ones that fully serve the Unified Health System (SUS). According to Ordinance no. 3390 of December 30, 2013:

> Hospitals are complex, technologically dense, specific, multi-professional and interdisciplinary institutions, responsible for caring for users with acute or chronic conditions that present the potential for instabilization and complications of their state of health, requiring continuous inpatient care and actions that cover health promotion, disease prevention, diagnosis, treatment and rehabilitation.

Hospitals have various classifications such as: size, complexity, administrative sphere, type of unit, legal nature, among others. For this study, hospitals were classified by size and complexity according to Brazil (2011), as shown in Table 03.

Table 03 - Classification of hospitals

Classification	Type	Concept
Size	Small	Capacity up to 50 beds
	Carrying doctor	Capacity between 51 and 150 beds
	Large	Capacity between 151 and 500 beds
	Special size	Hospital has more than 500 beds
Complexity	Medium complexity	It is made up of actions and services aimed at addressing the population's main health problems and illnesses, whose complexity in clinical practice demands the availability of specialized professionals and the use of technological resources to support diagnosis and treatment.
	High complexity	A set of procedures involving high technology and high cost, aimed at providing the population with access to qualified services, integrating them with other levels of health care.

Source: Prepared by the author according to data from the Ministry of Health (2011).

According to Fernandes (2017, p.25), the Brazilian health sector "can be considered one of the largest in the world and the government has a strong influence on the demand and supply of jobs in the health sector, with the Unified Health System (SUS) being its largest employer". The SUS was created by the 1988 federal constitution and represents a historic milestone for Brazil as it provides free, comprehensive, universal and resolutive care to all citizens (MACEDO, 2020).

For the proper management of the SUS, work management in public health in Brazil has been recognized from the outset. This management has become so relevant that the Ministry of Health created the secretary of work management and health education (SGTES), understanding that the employee is essential for the efficiency and effectiveness of the SUS, and this secretariat is responsible for drawing up public policies to improve the efficiency of services (SANTINI *et al*., 2017).

Studies have shown the importance of human resource management within hospitals, the subject of this article, however, there is still a shortage of studies with empirical evidence on the effectiveness of human resource management practices in these environments (YU; BAIRD; TUNG, 2018).

International research by Buchelt, Frączkiewicz-Wronka and Kaminska (2020) reveals that the increase in research relating the areas in recent decades has been due to the strategic importance of the human resources sector. Still on this subject, Alam *et al*. (2016) state that any national health system depends on efficient and effective human resources management.

As far as Brazil is concerned, studies were found on human resources practices in hospitals that are closely related to the subject of this article. Table 04 shows the main findings of these studies:

Box 04 - Some studies on human resources practices in hospitals

Year	Author(s)	Main finding(s)
2011	Nunes *et al*.	- Issues such as salary and appreciation need to be addressed in order to improve the organizational climate.
2013	Morici and Barbosa	- Several management and human resources processes need to be defined and implemented; - Lack of human resources policies and practices;
2017	Santini *et al*.	- They highlighted the complexity of the subject (HR) and the need for constant studies due to its importance for the SUS.
2018	Fernandes *et al.*	- People management practices are typical of private companies, meeting some health work guidelines, but not referencing the Unified Health System.
2021	Coelho Araújo, Freitas, Araujo	- Significant scarcity of studies on the subject of "Human Resources Management in Hospitals"
2022	Jorge, Silva and Caregnato	- Despite the various experiences and education programs for the development of human resources in health that have already been implemented, no articles were found describing these actions, highlighting the importance of offering this type of publication

Source: Prepared by the author (2023)

Table 14 shows that there is still a *gap* in research on the subject of human resources practices in Brazilian public hospitals and especially on the applicability of HRMPs in the hospital context, despite researchers reporting their importance.

Hospital technical efficiency and its determinants

According to Mareth (2015), understanding the determinants of TE can improve efficiency and organizational performance, bringing to organizational management the need to understand these variables that can impact on TE and Bohn *et al.* (2015, p.41) state that "environmental factors related to the initially estimated efficiency score should beinvestigated".

Within the context of technical efficiency are hospitals, the subject of this article. Hospital efficiency is crucial to the overall efficiency of any healthcare system, as concluded by researchers in the field (ALATAWI; NIESSEN; KAN, 2020) and optimizing the efficiency of the healthcare system has gradually become a central objective of healthcare system development (LI; MOHIUDDIN; LIU, 2019).

National policies around the world aim for effective, efficient and equitable health systems and it is estimated that around 20-40% of all health sector resources are completely eliminated due to inefficiency in health systems (ALATAWI; NIESSEN; KAN, 2020). Therefore, the study of efficiency in the segment becomes relevant.

The study was carried out using a non-parametric approach through Data Envelopment Analysis (DEA), which for many years has been the most commonly used technique for measuring technical efficiency in healthcare (ALATAWI; NIESSEN; KHAN, 2020). In recent years, researchers have increased their studies and it is a valuable efficiency

measurement and *benchmarking* tool for most organizations, especially in the healthcare sector (LIU *et al.*, 2019).

Therefore, the use of non-parametric methods, especially data envelopment analysis (DEA), has become common in empirical research because it can easily handle multiple input and output dimensions of health care indicators and is not easily affected by the model definition problem, which is common in econometric models (LI; MOHIUDDIN; LIU, 2019).

Table 05 shows the main findings of studies on hospital technical efficiency in Brazil. The studies are in chronological order in order to analyze their evolution over the years:

Box 05 - Some studies on technical efficiency in hospitals

Year	Author(s)	Main finding(s)
2003	Marine	- Relationships are obtained between technical efficiency, gross domestic product, population size and the average length of stay of municipalities.
2008	Cesconetto, Lapa and Calvo	- Data Envelopment Analysis makes it possible to estimate the ideal composition between multiple inputs and multiple products, indicating the ideal composition for each hospital; - The purpose of the study was to demonstrate the potential of the DEA approach for analyzing productive efficiency in the health sector, following the example of other applications developed in Brazil.
2010	Souza, Nishijima and Rocha	- The results suggest that the most efficient municipalities are those that hire more private hospital beds, that carry out the largest number of hospitalizations (economy of scale effect), that have a smaller population (congestion effect) and that have a shorter average hospitalization time.
2017	Silva *et al.*	- There is no statistically significant relationship between committed expenditure and hospital technical efficiency.
2018	Guazzelli	- Coredes with efficient institutions have the highest rates of socio-economic development, income generation and income distribution in Rio Grande do Sul.
2021	Garmatz, Vieira and Sirena	- The results of this research suggest that DEA has the potential to evaluate technical efficiency in hospitals when the production capacityof the establishment is assessed.
2022	Costa	- The results of the research lead us to conclude that, for Pernambuco, the legal nature affected the technical efficiency of the hospital units, as did the management model and size.

Source: Prepared by the author according to the studies (2023)

Table 05 also shows a significant number of studies on hospital technical efficiency in Brazil, according to searches carried out on the main research databases. It can be seen that there are several variables, whether social, financial or legal, which may (or may not) correlate with TE, demonstrating that it is a relevant area for the search for organizational results.

Regarding the measurement of hospital technical efficiency, the following RSL and *healthcare* studies were found: Hoollingsworth (2003), Worthington (2004), Kosko and Mutter (2008), Afzali *et al*, (2009), Hussey *et al., (*2009), Nguyen and Coelli (2009), Kiadaliriet *al.,* (2013); Azreena *et al (*2018), Hafidz et al (2018), Alatawi et. *al.,* (2019) and Kohl et *al.,(*2019). These studies are important for constructing variables to calculate the technical efficiency of hospitals. An analysis of these studies can be found in the chapter presenting anddiscussing the results.

METHODOLOGY

Research Design

This research, in terms of nature and design, is a *survey and* applied research respectively, based on a systematic review, questionnaires conducted preferably to people managers or directors, health secretaries or employees of hospitals in the state of Rio Grande do Norte that fully serve the Unified Health System (SUS). According to Martins and Theóphilo (2016, p. 58), this type of research "seeks to go beyond reporting distributions and relationships, and seeks to explain and interpret them".

The nature of this study (approach to the problem) is qualitative and quantitative. Initially, by carrying out RSL with a focus on content analysis to construct a questionnaire, it is a qualitative research and is quantitative because, according to FariasFilho and Arruda Filho (2015), it means translating opinions, responses and information collected into numbers in order to classify and analyze them.

As for the objectives or purposes, it can be considered descriptive, which according to Matias-Pereira (2019), aims to describe a certain population or establish a relationship between variables, thus justifying the use of statistical techniques to achieve the proposed objectives. It is also considered explanatory, as it aims to highlight and clarify which factors contribute or collaborate in some way to the occurrence of a particular phenomenon (VERGARA, 2016).

In order to relate the article's objectives to the methodology, table 06 presents a comparison of the data analysis techniques that were used.

Chart 06 - Objectives and statistical techniques used in the research

Objectives	Stages	Techniques/Data
a) Analyze the human resources management practices adopted by hospitals	List of HRMPs	Systematic literature review on Human Resource Management Practices (1)
	Develop and apply questionnaire on HRMP	Based on the results of (1), identify the HRMPs adopted in the hospitals (2).
b) Determine the technical efficiency of hospitals	List of variables (*inputs* and *outputs*) and determinants	Literature review on technical efficiency and determinants in hospitals (3)
	Measuring technical efficiency	DEA to measure TE, observing the results of (3), using DATASUS data.
c) Relate human resources management practices to the technical efficiency of hospitals	Analyze the determinants	From the results of (2 and 3), regression to analyze the determinants (4). Methodology section 3.5.2 and results section 4.3.

Source: Prepared by the author (2023).

According to table 06, the data was collected and processed in different ways according to the specific objectives. Therefore, the following sections describe the stages, collection procedures and data analysis techniques used to achieve the objectives.

Developing and applying questionnaires to hospital human resources managers

Based on the results of the RSL, the questionnaire was constructed. All the questions used were closed and for the last two sections a likert scale was used. Five-point scales were used for the degree of use of the HRMPs: "not used" to "permanently used" and for the importance of the human resources subsystems, 1 was used as "not important" and 10 as "very important". It should be noted that, according to the RSL of the PGRHs, 52 practices were found, but 17 were used for the questionnaire. Some practices were grouped together (same

concept, just different names) and the others were chosen from among those most cited and used by the hospitals in the RSL articles.

Initially, a pre-test was carried out in person to align the questions with 5 human resources managers, 3 from private hospitals and 2 from health services companies. According to Lakatos and Marconi (2017), this stage of the research consists of applying the instruments made and the techniques chosen in order to collect data.

After pre-testing and incorporating the adjustments suggested in the pre-test phase, the questionnaire was sent via the Brazil platform (Appendix B) for analysis by the Unisinos ethics committee and approved. The questionnaire was built using the *google forms* tool and the estimated application time was 4 minutes. The final questionnaire was divided into five sections: hospital data, respondents, management model, human resources management practices used and the degree of importance of the HRM subsystems. It is important to note that if the respondent marked that there were no human resources practices, the questionnaire was terminated.

The next stage was to plan the mailing to respondents. The population of this study is made up of public hospitals in the state of Rio Grande do Norte that are fully covered by the Unified Health System (SUS) and are classified as general, specialized or day hospitals. According to a table received from the Ministry of Health through the Department of Regulation, Evaluation and Control (DRAC), linked to the General Coordination of Health Information Systems on 25/06/2022 (information on each municipality, National Registry of Health Establishments - CNES, name of establishment, type of unit, legal data, specialty and number of beds available), in 2022 there were 150 public health establishments in the state affiliated to the SUS (70 general hospitals, 7 specialized hospitals, 3 emergency rooms, 69 mixed units and 1 day hospital).

It should be noted that according to the CNES, 22 types of health establishments are considered, including: Health centers/Basic health unit, Polyclinics, General hospital, Specialized hospital, Mixed unit, General emergency room, Specialized emergency room, Isolated clinic, Mobile river unit, Specialized clinic/Specialized clinic, Diagnosis and therapy support service unit, etc. However, for this study, as defined in the objectives, the population comprised only those classified as hospitals (specialized, day and general), with a total of 78 hospitals and of these, a questionnaire was applied to 57, which totals 73.08% of the population, as shown in Table 01.

Table 01 - Population and sample of hospitals

Types of Hospitals	Population	Sample	%
General Hospital	70	50	71,43%
Specialized Hospital	7	6	85,71%
Day Hospital	1	1	100%
Total	78	57	73,08%

Source: prepared by the author (2023)

Table 01 also shows that the questionnaire was applied to a sample of 71.43% of general hospitals, 85.71% of specialized hospitals and 100% of day hospitals.

Access to the hospitals, preferably to the human resources sector and hospital management, was gained in various ways: a) social networking group with organizational psychologists and human resources managers in RN, of which the thesis author is a member; b) Secretariat of Public Health of the State of Rio Grande do Norte (SESAP/RN), through the coordination of work management and health education; c) Municipal Health Secretary(s), through the list of e-mails and telephone numbers provided by COSEMS/RN (Council of Municipal Health Secretariats of Rio Grande do Norte); d) E-mails and telephone numbers of the hospitals in the list received from DRAC/Ministry of Health; e) HR Observatory of UFRN

(Federal University of Rio Grande do Norte); f) Friends and family members who work in hospitals or have acquaintances there.

The questionnaire link was initially sent by email, but the responses were low, so the strategy was changed and it was sent by private WhatsApp, initially to hospital managers/analysts/personnel assistants/directors, and if they didn't respond, to other hospital employees who understood the PGRH or to municipal health secretaries. It is important to note that the questionnaires were sent to all 78 hospitals and the application process lasted 4 months (December 2022 to March 2023), with responses being obtained from 57 hospitals (73.1%).

Primary and secondary data were therefore used to achieve this thesis objective. The primary data was collected by means of a questionnaire to hospitals that serve the SUS and the secondary data, the PGRH, through the RSL.

DEA Model and Regression Analysis

This section defines the units of analysis, study variables (*inputs* and *outputs*), descriptive statistics, the DEA model and the regression model. The units of analysis - DMUs - are the 57 medium and high complexity hospitals described above. The variables (*inputs and outputs*) identified through the literature review with data available from DATASUS are shown in Table 07.

Table 07 - Identification of variables

Summary	Acronym	DATASUS Description
Inputs		
Beds	L	Number of sus beds
Team	E	Total number of staff
Doctors	M	Total number of doctors
Nurses	En	Total number of nurses
Non-health professionals	PNS	Number of non-health professionals
Health professionals	PS	Total number of health professionals
Cost of Services	CS	Cost of professional services - hospital production
Total Cost	CT	Total cost: hospital + outpatient
Outputs		
Hospitalized patients	PI	Number of inpatients
Outpatients	PA	Number of outpatients
Hospitalization days	D	Number of days of hospitalization
Mortality rate	TM	Mortality rate
Procedures	P	Types of procedures performed

Source: Prepared by the author(2023)

Based on this identification, data was collected from DATASUS and CNES for the 57 hospitals (general, specialized and day hospitals) in the state of Rio Grande do Norte for the year 2022. As seen in the previous topic, the variables were selected according to previous RSL studies of 11 articles.

With regard to the main characteristics of the hospitals in the sample, Table 02describes the *inputs* and *outputs*. During the study period (2022), 57 hospitals were analyzed with 4773 beds available for care by the Unified Health System. These hospitals had professional service costs (hospital production) of R$23,137,730.50 and total costs of R$153,661,716.87, as shown in Table 02.

Table 02 - *Inputs and outputs* of the hospitals in the sample (n=57)

Variables	Average	DP	Min	Max
Inputs				
Beds (number)	55,8	61,6	1,0	385,0
Team (number)	313,8	411,2	19,0	2.159,0
Doctors (number)	68,9	125,7	1,0	768,0
Nurses (number)	35,3	43,0	1,0	169,0
Non-health professionals (number)	54,1	47,4	1,0	207,0
Health professionals (number)	258,6	371,6	13,0	1.952,0
Cost of Services (R$)	405.925,1	844.802,4	0,0	5.539.072,0
Total Cost (R$)	2.695.819,6	5.049.096,0	2.419,7	34.606.765,1
Outputs				
Hospitalized patients (number)	1.661,8	2.812,5	0,0	17.743,0
Outpatients (number)	119.503,9	121.661,4	0,0	551.706,0
Days hospitalized (number)	9.891,1	18.271,8	0,0	107.042,0
Mortality rate (rate)	6,1	6,8	0,0	23,7
Procedures (types)	24,8	13,3	2,0	62,0

Source: Prepared by the author (2023)

Still on table 02, during this period 1411 types of procedures were carried out, with a total of 94725 patients hospitalized for 553,902 days. These results were produced with a workforce of 14,738 health professionals, including 3,927 doctors, 2,013 nurses and 8,798 other professionals such as nursing technicians and assistants, physiotherapists, nutritionists, etc. The zeros shown in the table refer to data not identified in DATASUS, corresponding to four hospitals in the sample. The next section presents the DEA model used in this study.

DEA model

To calculate the DEA, 4 hospitals were excluded from the sample because the following data was not identified in DATASUS: costs of professional services, number of inpatients, number of days of hospitalization and mortality rate. Therefore, the technical efficiency of the 53 hospitals was calculated.

The variables chosen for the calculation were*:* beds, number of doctors, number of nurses and total cost. This choice was based on the three categories of input variables, such as: capital investments, labor and operating expenses (OZCAN;NAYAR,2008), as well as being a job that involves people.

The *outputs* used were: outpatients and average days of hospitalization per patient (dividing the number of days of hospitalization by the patients). It is understood that the fewer days the patient stays, the better for both the patient and the hospital. The final DEA model with the 04 *inputs* and 02 *outptus can* be found in Table 08, which summarizes the variables chosen and shows that the output variables (outpatients and average days of hospitalizationper patient) are not controllable by them.

Table 08: Variables for calculating efficiency and regression

Variables	Acronym	Source data
Inputs		
Beds	L	DATASUS, CNES
Doctors	M	
Nurses	En	
Total Cost	CT	
Outputs		
Outpatients	PA	DATASUS, CNES

Average days of hospitalization per patient	IntPac	
Explanatory		
Beds (number)	L	DATASUS, CNES
Doctors per Team (number)	PROP	
Beds per Team (number)	Lequip	
Complexity (medium or high)	Complex	
Has an HRMP	P_PGRH	*Survey*
Number of PGRH	Q_PGRH	
Management Model Public Governance	Management	
Technical training	TT	
Behavioral training	TC	
Climate survey	PC	
Performance evaluation	AD	
Rewards, incentives and benefits	RIB	
Human Resources Indicators	IRH	

Source: prepared by the author (2023)

The final model was built using VRS (Variable Return on Scale) with an *input* orientation to maintain output and optimize inputs (BANKER; NATARAJAN, 2010). Itshould be noted that the model was chosen because, according to Macedo, Nova and Almeida (2009, p.90): "whenever the *outputs* are not controllable by the managers, an input orientation should be chosen".

The results were categorized and compared in different ways, such as: efficient and inefficient, efficiency by complexity, efficiency by size and health region, efficiency by use of PGRH. The classification by complexity (medium and high) was carried out according to CONASS (2011): medium complexity includes specialized medical services, urgent and emergency care and more advanced equipment. On the other hand, high-complexity hospitals (generally large ones), in addition to the aforementioned specificities, have high costs, state- of-the-art technology and specific ICU (Intensive Care Unit) beds. For classification purposes, hospital data was consulted in DATASUS for the year 2022.

Regression analysis

After calculating the TE scores of the 53 hospitals in the sample, the correlation between the explanatory variables was analyzed in order to exclude those with a linearrelationship. As no correlations were found between the variables, they were standardized to ensure that the regression was carried out with comparable coefficients.

Two regression models (I and II) were used to test the hypotheses (Chapter 1), i.e. to analyze the influence of explanatory variables on variations in the technical efficiency of hospitals in the state of Rio Grande do Norte (see Equations 1 and 2). Nine variables were removed from Model II in order to improve the explanatory power of efficiency, based on more significant determinants. The criteria for exclusion were as follows: a) variables with a higher correlation between them, b) those with a higher ViF (Variable Inflation Factor) and c) those with a higher *p-value*.

Model I:

$$TE = f(PROP, L/EQUIP, COMPLEX, RIB) \quad (1)$$

where:
TE is the level of technical efficiency measured in this study;
PROP is the proportion of doctors per team;
L/EQUIP is the number of beds per team;
COMPLEX is a dummy variable equal to 1 if the hospital is high complexity and 0 if medium complexity (category excluded);
RIB is a dummy variable equal to 1 if the hospital uses the HRMP called rewards, incentives and benefits, and 0 if it does not (excluded category).

Model II:

$$TE = f(L, PROP, L/EQUIP, COMPLEX, P\_PGRH, Q\_PGRH, MANAGEMENT, TT, TC, PC, AD, RIB, IRH) \quad (2)$$

where:
L is the number of hospital beds;
P_PGRH is a dummy variable equal to 1 if the hospital has a PGRH and 0 if it does not (category excluded);
Q_PGRH is the number of PGRH that hospitals have;
MANAGEMENT is a dummy variable equal to 1 if the hospital has a public governance management model, and 0 if it does not (category excluded);
TT is a dummy variable equal to 1 if the hospital carries out technical training as an HRMP, and 0 if it does not (category excluded);
TC is a dummy variable equal to 1 if the hospital carries out behavioral training as an HRMP, and 0 if it does not (category excluded);
PC is a dummy variable equal to 1 if the hospital carries out a climate survey and 0 if it doesn't (category excluded);
AD is a dummy variable equal to 1 if the hospital has a performance evaluation and 0 if it does not (category excluded);
IRH is a dummy variable equal to 1 if the hospital has technical training as an HRMP, and 0 if it does not (category excluded).
PROP, L/EQUIP, COMPLEX and RIB are defined in Equation 1.

Models I and II were estimated using OLS and *Tobit.* R software was used to process the models. According to Stock and Watson (2010), least squares regression is a statistical method used to model the relationship between a dependent variable and one of the independent variables. *Tobit* regression is used when the dependent variable is only analyzed within a certain numerical range caused by a form of censoring in the observations (technical efficiency is 0 to 1, for example), i.e. equal points at a limit value. It aims to get around the problem of censorship by using statistical techniques that make it possible to make inferences for the entire population without loss of quality (GREENE, 2002).

We chose to use least squares regression because it allows us to analyze and quantify the relationship between variables, make predictions and statistical inferences about the data. In addition, the method provides information on the statistical significance of the estimated coefficients and the quality of the model's fit to the observed data (WOLLDRIDGE, 2009).

The decision to use *tobit* regression was suggested by studies that also looked at the determinants of technical efficiency (CHANG, 1998; MOREIRA, 2011; LANDIVAR, 2012; PONTES, 2016; ANSCHAU, 2020). The research by Zhang, Fu and Li (2017), Liu *et al*.

(2018), Zhu *et al.* (2019). Shuai and Fan (2020), reveal that the model is suitable for exploring the determinants of efficiency scores.

ANALYSIS OF RESULTS

Characterization of respondents

With regard to the characterization of the respondents (table 09), the main functions performed at the hospital are: Administrator (35.09%), Human Resources Professional (manager, analyst or assistant) with 21.05% and Nurse with 8.77%.

Table 03 - Characterization of respondents

Function	**Frequency**	**%**
Human Resources Professional	12	21,05
Administrator	20	35,09
Nurse	9	15,78
Health Secretary	5	8,77
ATS	4	7,02
Others	7	12,29
Total	**57**	**100**
Time in the job (years)	**Frequency**	**%**
Up to 5	38	66,67
Between 5 and 10	3	5,26
Between 10 and 15	7	12,29
Between 15 and 20	3	5,26
More than 20	6	10,52
Total	**57**	**100**
Maximum Degree	**Frequency**	**%**
High School	1	1,75
Graduation	19	33,33
Specialization	33	57,90
Master's Degree	1	1,75
Doctorate	3	5,26
Total	**57**	**100**

Prepared by the author (2023)

Their role is important, as they are professionals who belong to the staff and are relevant to the hospital's operations. The others mentioned in the responses were social workers (03), psychologists (02) and an executive secretary and hospital pedagogue. With regard to time, 66.67% have been in the job for up to 5 years and 33 respondents (57.90%) have a specialization degree as their highest qualification.

Analysis of the HRMPs of the hospitals surveyed

With regard to the use of human resources practices by hospitals, the majority (68.4%) use them (see table 04). It is important to remember that if the answer to this question is no, the questionnaire ends. As a result, of the 39 hospitals, 87.2% have a human resourcesdepartment, 51.3% of which develop and monitor practices and 35.9% of which have other duties. It should be noted here that the organization does not need to have a human resources department to carry out practices.

Table 04 - Existence of PGRH/Department

Are there any HRM practices in the	**Frequency**	**%**

hospital?		
Yes	39	68,4
No	18	31,6
Total	**57**	**100**
Is there an HRM department in the hospital?	**Frequency**	**%**
Yes, but he has other duties	14	35,9
Yes, there is a specific one	20	51,3
No	5	12,8
Total	**39**	**100**

Source: Prepared by the author (2023)

In order to analyze the human resources practices most used, the sum of those who answered frequently and permanently was added up, so the ones with the highest percentage, according to table 05, were: performance evaluation (69.23%), followed by integration, socialization and awareness-raising and hygiene, health and worker safety (both with 58.98%). Those not used were: recruitment (56.41%), remuneration policies (51.28%) and selection (48.72%).

Table 05 - Frequency of use of PGRHs (%)

PGRH	Not used	Raram.	Event.	Frequent.	Perman.	%
Recruitment	56,41	15,38	12,82	7,69	7,69	100
Selection	48,72	17,95	23,08	2,56	7,69	100
Integration, socialization and awareness-raising	2,56	12,82	25,64	48,72	10,26	100
Remuneration policies	51,28	12,82	17,95	12,82	5,13	100
Technical Training	7,69	15,38	28,21	25,64	23,08	100
Behavioral Training	7,69	23,08	25,64	28,21	15,38	100
Personnel department, labor and union relations	23,08	23,08	20,51	17,95	15,38	100
Climate survey (recognition, environment and working conditions)	20,51	20,51	28,21	20,51	10,26	100
Performance evaluation	7,69	7,69	15,38	15,38	53,85	100
Communication policies	5,13	15,38	25,64	30,77	23,08	100
Hygiene, health and worker safety	10,26	7,69	23,08	23,08	35,90	100
Rewards, incentives and benefits	28,21	20,51	25,64	12,82	12,82	100
Career Plan	30,77	7,69	20,51	12,82	28,21	100
Policy to reduce social differences and manage diversity	30,77	7,69	30,77	15,38	15,38	100
Social responsibility	15,38	12,82	23,08	23,08	25,64	100
Job analysis and description	23,08	10,26	20,51	25,65	20,51	100
Human Resources Indicators	15,38	20,51	12,82	25,64	25,64	100

Source: Prepared by the author (2023)

With regard to the number of practices used, according to table 06, the majority (46.5%) use up to 5 human resources management practices and 25.8% up to 2 practices.

Table 06 - Number of practices used

Number of PGRH	Frequency	%
Up to 2	10	25,6
Between 3 and 5	18	46,2
Between 6 and 8	5	12,8
Between 9 and 11	1	2,6
Above 12	5	12,8
Total		**100%**

Source: Prepared by the author (2023)

Analysis of technical efficiency in the hospitals in the sample

This section presents the results of part of the second objective, which is to calculate the technical efficiency of the sample of hospitals, the object of the research. Appendix C contains the results of the technical efficiency of the 53 hospitals in the state of Rio Grande doNorte. Of this total, 17 (32.07%) were classified as efficient (TE *score* equal to 1, i.e. 100%), with the remaining 36 (67.92%) as inefficient. According to Table 07, the overall average efficiency of the hospitals analyzed is 60.68%.

Table 07 - Classification of inefficiency

Item	Efficiency scores	
	VRS	
Average	60,68%	
DP	36,82%	
TE Interval	n	%
Efficient (=1)	17	32,07
Weak inefficiency (0.8 to 0.99)	6	11,32
Moderate inefficiency (0.6 to 0.79)	5	9,43
Strong inefficiency (0 to 0.59)	25	47,17
Total	**53**	**100**

Source: Prepared by the author (2023)

Table 07 also shows that 25 hospitals are below the 59% efficiency level, corresponding to 47.17% of the sample. This percentage with a score below the 41% efficiency level shows that they are operating at a relatively low level of efficiency and consequently there is a need to improve the hospitals considered to be highly inefficient (0 to 0.59).

The 17 hospitals considered to be efficient (see table 08), despite having a lower average number of beds, doctors and nurses, treated more outpatients and had a lower averagetotal hospital cost and a lower average number of inpatient days than the inefficient hospitals. It is also important to note that both had high dispersion in the variables, demonstratinggreater heterogeneity between them.

Table 08 - Analysis of efficient and inefficient

	Efficient (n=17)		Inefficient (n=36)	
	Average	DP	Average	DP
Input				
Beds	26,18	61,43	32,83	39,73
Doctors	54,82	184,02	82,72	95,04
Nurses	17,64	31,47	47,33	45,53
Total cost (average)	R$ 2.568.168,37	8269453,99	R$ 3.041.803,16	2939547,69
Output				
Outpatients	174.492,29	171650,62	99.777,22	87585,50
Average days of hospitalization	23,45	71,63	32,16	39,87

Source: Prepared by the author (2023)

Table 09 shows the analysis of technical efficiency by complexity of the hospitals in the sample. Medium-complexity hospitals had a higher average efficiency (73.99%) than high-complexity hospitals (34.92%).

Table 09 - Efficiency by complexity

Complexity	n	Average efficiency %	Standard deviation %

Average	34	73,99	31,13
High	19	34,92	33,12

Source: Prepared by the author (2023)

Table 10 shows the analysis of technical efficiency by hospital size. Smaller hospitals showed average efficiency (60.68%) close to medium-sized hospitals (60.46%) and higher than large hospitals (47.33%).

Table 10 - Efficiency by size

Size	n	Average efficiency %	Standard deviation %
Small	33	60,68	36,82
Medium	16	60,46	37,53
Large	04	47,33	41,47

Source: Prepared by the author (2023)

Table 11 shows efficiency by health region in RN. The Rio Grande do Norte/RN regionalization master plan divides the state into 8 health regions: 1st (Southern Agreste Regional), 2nd (Western Regional), 3rd (Mato Grande and Saline Regional), 4th (Seridó Regional), 5th (Trairi and Potengi Regional), 6th (Upper West Regional), 7th (Metropolitan Regional) and 8th (Vale do Açu Regional).

Table 11 - Efficiency by health region/RN

Data	HEALTH REGIONS/RN							
	1a.	2a.	3a.	4a.	5a.	6a.	7a.	8a.
Total number of hospitals	4	11	4	8	1	6	15	4
Overall average efficiency	52,75	78,73	44	62,5	27	76,67	42,47	84,75
% of efficient hospitals 100%	25	36,36	0	20	0	66,66	20	75
Efficient (=1)	1	4	0	2	0	4	3	3
Weak inefficiency (0.8 to 0.99)	0	3	0	2	0	0	1	0
Moderate inefficiency (0.6 to 0.79)	1	2	1	1	0	0	0	0
Strong inefficiency (0 to 0.59)	2	2	3	3	1	2	11	1
% of hospitals below 50% efficiency	50	18,18	75	37,5	100	16,16	66,66	25

Source: Prepared by the author (2023)

It is worth noting that in the state of RN, 93 municipalities do not have private health services and are exclusively dependent on the SUS, according to data from CNES (2022).

According to a survey published by FIERN/CONECTAR (2022), 79% of the people of Rio Grande do Norte consider health to be their main problem.

Finally, table 12 shows the average efficiency related to the use of human resources practices by hospitals. The positive frequencies (permanently and frequently) and the negative frequencies (not used and rarely) were grouped together to analyze TE by frequency of use.

Table 12 - Efficiency analysis using the PGRH

Practices	Permanently/ Often	Average efficiency%	Not used/ Rarely	Efficiency Average %
Recruitment	6	76	28	48,8
Selection	4	83,7	26	39,8
Integration, socialization and awareness-raising	23	65,2	6	57,5
Remuneration policies	7	90,9	25	54,1
Technical Training	19	57,6	9	60,0
Behavioral Training	17	53,4	11	74,1
Personnel department, labor and union relations	13	58,4	18	45,6
Climate survey (recognition, environment and working conditions)	12	68,6	16	47,1
Performance evaluation	27	55,6	6	55,3
Communication policies	21	59,4	8	40,8
Hygiene, health and worker safety	23	57,2	7	41,3
Rewards, incentives and benefits	10	75,6	19	54,9
Career Plan	16	43,0	23	54,8
Policy to reduce social differences and manage diversity	12	66,5	15	65,3
Social responsibility	19	59,1	11	43,5
Job analysis and description	18	52,9	13	55,9
Human Resources Indicators	20	48	14	53,4

Source: Prepared by the author (2023)

It can be seen that, in general, hospitals that permanently/frequently use human resources practices have a higher average efficiency than those that don't. Of the 17 practices listed in Table 23, only five (29.41%) had a lower average TE when compared to those that did. Of the 17 practices listed in table 23, only 5 (29.41%) had a lower average TE when compared to those that used: technical and behavioral training, job analysis and description, human resources indicators and career plans. The other 12 HRMPs (70.59%) had higher average TE when they were used, among the highlights: Remuneration policies (90.9%), Selection (83.7%), Recruitment (76%), Rewards, incentives and benefits (75.6%) and climate research (68.6%).

Analysis of the determinants of hospital technical efficiency

The results of the last objective of the thesis are presented below, which is to relate human resource management practices to the technical efficiency of the hospitals studied**.** In addition to HRMPs, we also chose to relate internal structural variables of the hospital, collected using data from DATASUS. Knowing the variables that influence hospital efficiency

is relevant to finding alternatives for improving management and results (SANTELICES *et al*, 2013).

The aim of this study was to assess internal factors which, according to Alves, Mareth and Korzenowski (2021, p.14), "are elements within health units that managers are able to control". Table 13 shows the econometric results of Models I and II using the OLS and Tobit approach. Several tests were carried out with combinations of the various variables (multicollinearity condition). Models I (with four variables) and II (using thirteen variables) showed R2 of 0.5219 and 0.4565, respectively.

Table 13: Determinants of technical efficiency - OLS and tobit regression

	Modelo I				Modelo II			
Variáveis	OLS		Tobit		OLS		Tobit	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
PROP	-1,23643	0,000825***	-1,5692	0,000711***	-1,7225868	0,00262**	-1,7225868	0,000898***
L/EQUIP	0,78749	0,000138***	1,0300	0,000189***	0,9247854	0,01085*	0,9247854	0,003535**
COMPLEXIDADE	-0,25681	0,001634**	-0,3040	0,003056**	-0,3347799	0,01440*	-0,3347799	0,012059*
RIB	0,20342	0,028983*	0,3552	0,006287**	0,3591156	0,13949	0,3591156	0,058118
LEITOS					0.0004572	0,78559	0,0004572	0,684296
POSSUI_PGRH					0,0585350	0,78466	0,0585350	0,728166
QTIDADE_PGRH					0,0285055	0,37083	0,0285055	0,650043
GESTÃO					-0,0004111	0,68928	-0,0004111	0,99728
TT					0,0298354	0,73122	0,0298354	0,821472
TC					-0,0031113	0,96766	-0,0031113	0,981207
PC					0,0085650	0,97117	0,0085650	0,961039
AD					-0,1379205	0,46369	-0,1379205	0,536155
IRH					-0,0618167	0,60232	-0,0618168	0,722783

*p < 0.10; **p<0.05; p**<0.001

Source: Prepared by the author (2023).

The variables that showed statistical significance and were considered determinants of TE were: PROP, L/EQUIP, COMPLEXITY and RIB. The other variables were not significant, the positive ones (BEDS, POSSUI_PGRH, QTIDADE_PGRH, TT and PC) and the negative ones (MANAGEMENT, TC, AD and IRH). Variables with a positive relationshipmean that the average TE varies accordingly, for example: hospitals that have (POSSUI_PGRH) and use a greater quantity of PGRH (QTIDADE_PGRH) have a higher average TE. Variables with a negative relationship mean that the average TE varies inversely, for example: hospitals that use performance evaluation (AD) and human resources indicators (IRH) have a lower average TE.

CONCLUSION/CONTRIBUTIONS

Analyzing the HRMPs of the hospitals surveyed, 68.4% use human resources management practices and of these (39 hospitals), 87.2% have an HRM department, with 35.9% having other duties and 51.3% being specific to developing and applying HRMPs.

Human resources practice is important for a hospital, with healthcare professionals playing a crucial role in providing quality services and patient care. Proper management of these human resources enables the hospital to achieve better results, promote a healthyworking environment and ensure professional satisfaction (PHAM, 2021).

By attracting, developing and retaining talented professionals, promoting a healthy working environment and managing performance and conflict effectively, a hospital can improve efficiency, productivity and staff satisfaction, resulting in better health outcomes for patients (AMARNEH; MUTHUVELOO, 2020; ALOYYAN;ALYAHYA;OMAR, 2021).

Regarding the number of practices used, 46.2% answered that they use between 3 and 5 practices. This result was lower than the number of practices used in the studies, which showed 5.11 per study.

It is important to point out that the number of HRMPs is relevant to an organization, but it should be noted that the practice needs to be consistent and aligned with the institutional profile and objectives. There is no specific number of human resources practices because they can vary depending on size, segment, culture and other specific characteristics, but as we have seen they play a strategic role in the success of an organization, contributing to the achievement of objectives (TRENTINI; 2021; BERNARDINO;SANTOS, 2020).

Table 21 showed positive results when it came to analyzing the technical efficiency of using HRMPs. The average TE of hospitals that use the PGRH permanently/frequently was 63.00%, compared to 52.48% when they don't or rarely use them. Twelve HRMPs (70.59%) out of a total of seventeen had a higher TE than hospitals when they were used. The following HRMPs stand out: remuneration, selection, recruitment and rewards policies, incentives and benefits.

This positive relationship between HRM and organizational performance and efficiency is found in studies such as: Wei and Ng (2012); Chadwick, Ahn and Kwon (2012); Gile, Samardzic and Kludert (2018); Plotow (2018), Alshessi, Bhaumik and Gangele (2019) and Rodrigues and Barbosa (2021).

Finally, with regard to the determinants of technical efficiency, Table 29 presents the results of the research hypotheses, as well as the answer to the question: Are HRMPs determinants of hospital technical efficiency?

The hypotheses Hospitals with a PGRH have a higher average TE and Hospitals with a greater number of PGRH have a higher average TE were not confirmed, showing that hospitals with or without a greater number of PGRH are not determinants of TE, but they did show a positive result (see table 30).

The hypotheses that hospitals that use technical training (T&D) have higher average TE and hospitals that use performance evaluation (AD) have higher average TE were also not confirmed. The human resources management practices T&D and AD were not significant and are therefore not determinants of TE for hospitals. The former showed a positive relationship and the latter a negative one. Even though they were not significant, it is important for hospitals that use performance evaluation to review their policies, since their relationship with the sample is inversely proportional.

With regard to the hypothesis that hospitals that use IBR have higher average TE, it was confirmed that IBR is a determinant of hospital technical efficiency. Hospitals that use it have higher average TE (0.20342 or 20.34%) when compared to those that don't. Therefore, in response to the problem, PGRH were not a determinant of TE in general, but they did show a positive relationship and RIB, as well as being significant, represents important data for public health managers in the state of Rio Grande do Norte to consider policies for its adoption in hospitals that serve the SUS.

Still on the results of table 22, the variable proportion of doctors per team showed negative statistical significance (-1.23643) and was a determining factor, showing that the more doctors/team, the lower the average ESR of the hospital. Studies by Cheng *et al.* (2015) and Alves, Mareth and Kozernowisk (2021) confirm this, while Ibrahim et *al.* (2018) and Campanella *et al.* (2017) do not.

The variable beds per team proved to be a determining factor for ES with positive significance (0.78749) and complexity was also negative (-0.25681), revealing that high-complexity hospitals have, on average, 25.68% fewer ES when compared to medium-complexity hospitals. The study by Alves, Mareth and Kozernowisk (2021) confirms this and Santelices *et al.* (2013) does not.

BIBLIOGRAPHICAL REFERENCES

ABURUMMAN, O. *et al*. The impact of human resource management practices and career satisfaction on employee's turnover intention. **Management Science Letters**, [*S. l.*], v. 10, 2020

AISHEHHI, T.; BHAUMIK, A.; GANGELE, S. Influence of human resource management on organization efficiency and effectiveness within ADNOC in UAE. **Lincoln University College**, [*S. l.*], v. 10, p. 92-97, 2019.

AL-AYED, S. I. The impact of strategic human resource management on organizational resilience: an empirical study on hospitals. Verslas: Teorija ir praktika. **Business**: theory and practice, [*S. l.*], v. 20, p. 179-186, 2019**.**

ALATAWI, A. D.; NIESSEN, L. W.; KHAN, A. M. Determinants of technical efficiency in public hospitals: the case of Saudi Arabia. **Health Economics Review**, [*S. l.*], v. 10, p. 1-11, 2020.

ALSAFADI, Y.; ALTAHAT, S. Human resource management practices and employee performance: the role of jobs satisfaction. **Journal of Asian Finance, Economic and Business**, [*S. l.*], v. 8, n. 1, 2021.

ARMSTRONG, M. **A handbook of human resource management practice**. 10th ed: Kopan Page, 2009.

BANKER,R.D; NATARAJAN,R. Evaluating contextual variables affecting productivity using data envelopment analysis. **Operations Research**.v.56,2010.

BOHLANDER, George et al. **Human resource management**. São Paulo: PioneiraThompson Learning, 2003.

BOHN, L. *et al*. The determinants of the efficiency of public spending on security in the municipalities of Minas Gerais: an analysis based on the DEA methodology. **Economic Analysis of Law Review**, [*S. l.*], v. 6, 2015.

BONACHE,J;CABRERA,A. Direccion de personas. Prentice: evidence and perspectives for the 21st century. **Prentice Hall**,3 edition,2006

BRAZIL. Ministry of Health. **Types of health establishment**. Available: http://tabnet.datasus.gov.br/cgi/cnes/tipo_estabelecimento.htm. Accessed on 14/06/2021, 2020.

BUCHELT, B.; FRĄCZKIEWICZ-WRONKA, A. F.; DOBROWOSLSKA, M. The organizational aspect of human resource management as a determinant of the potential of polish hospitals to manage medical professionals in healthcare 4.0. **Sustainability**, [*S. l.*], v. 12, 2020.

CESCONETTO,A. LAPA,J.S;CALVO,M.C.M.Evaluation of the productive efficiency of SUS hospitals in Santa Catarina, Brazil.**Cad. Saúde Pública**. v.24, 2008

COELHO ARAUJO, V.G;FREITAS,W.R.S; ARAÚJO,E.G.Gestão de recursos humanos em hospitais: análise da produção científica brasileira. IV Simpósio Sul-Mato-Grossense de Administração. **Annals [...],** 2021.

COLOMBI, R; MARTINI,G; VITTADINI, G. Determinants of transient and persistent hospital efficiency: the case Italy**. Health economics**, 2017.

DEMO, G.; FOGAÇA, N.; COSTA, A. C. Policies and practices of people management in organizations: scenario of national first-line production and research agenda. **Cadernos EBAPE.BR**, Rio de Janeiro, v. 16, 2018.
DUTRA, J. S. **Gestão de pessoas**: modelo, processos, tendências e perspectivas. São Paulo: Atlas, 2002.
FARIAS FILHO, M. C.; ARRUDA FILHO, E. J. M. **Planejamento da pesquisa científica**. 2. ed. São Paulo: Atlas, 2015.
FIGUEREDO, A.R.F.A**. Estratégias em organizações complexos: um estudo no hospital universitário Polydoro Ernani de São Thiago**.Dissertação (Mestrado em administração) - Universidade Federal de Santa Catarina, Florianópolis, 2022.
FISCHER, A. L. **The configurations of human resource management practices adopted by a group of Brazilian companies and their relationship with organizational performance.** 2015. Thesis (Doctorate in Business Administration) -- Business Administration Course, University of São Paulo, São Paulo, 2015.
FREITAS, W.R.S. **Gestão de Recursos Humanos:** análise das melhores práticas adotadas pelas universidades estaduais paulistas. Dissertation (Master's degree in production engineering). São Paulo State University. Bauru, 2010.
GARMATZ,A; VIEIRA,G.B.B; SIRENA,S.A. Evaluation of the technical efficiency of teaching hospitals in Brazil using data envelopment analysis. **Ciência & Saúde Coletiva**. v.26, 2021.
GIL, A. C. **Gestão de pessoas**: enfoque nos papéis profissionais. São Paulo: Atlas, 2006.
GILE, P. P.; SAMARDZIC, M. B.; KLUDERT, J. V. The effect of human resource management on performance in hospitals in sub-saharan Africa: a systematic literature review. **Human Resources for Healt**, [*S.l.*], v.16, 2018.
GREENE, W.H. Econometric analysis. 5. ed. London: **Prentice-Hall**, 2002.
GUAZZELLI,G.P. **Relationship between technical efficiency and socioeconomic indicators**: a study of general hospitals in the coredes of Rio Grande do Sul. Dissertation (Master's degree in economics). Vale do Rio dos Sinos University, Porto Alegre, 2018.
IVANCEVICH, J. M. **Human resource management**. 10th ed. New Delhi: McGraw Hill, 2008.
JASHARI, A.; KUTTLOVIC, E. The impact of human resource management practices on organizational performance case study: manufacturing enterprises in Kosovo. **Business**: Theory and Practice, [*S. l.*], v. 21, 2020.
JAVADIPOUR, M.; SIAVOSHANI, M. H.; GHORBANI, M. G. Pathology of human resource management system in Iran's ministry sports and youth. **Annals of Applied Sport Science**, [*S. l.*], v. 8, n. 3, 2020.
KENY, V.; NNAMDI, S. O. Employ productivity and organizational performance: a theoretical perspective. **Munich Personal RePEc**, [*S. l.*], 2019.
KNIES, E.; LEISINK, P.; SCHOOT, R. V. People management: developing and testing a measurement scale**. The international journal of human resource management**, [*S. l.*], v. 31, p. 705-737, 2020.
KUZNETSOVA, M. A. *et al*. Intellectual capital and human resources as objects of accounting and control. **International Journal of Economics and Business Administration**, [*S. l.*], v. 7, p. 343-353, 2019.
LI, B.; MOHIUDDIN, M.; LIU, Q. Determinants and differences of township hospital efficiency among Chinese provinces. **International Journal of Environmetal Research and Public Health**, [*S. l.*], v. 16, p. 1-16, 2019.
LIU, J et. al. Determinants of efficiency growth of county-level public hospitals-evidence from Chongqing China. **BMC Health Services Research**. v.19, 2019.

LlEBFRlED, K; MCNAIR, C. **Benchmarking**: a tool for continuous improvement. Rio de Janeiro: Campus, 1994
LOBOS, K.; MALÁTEK, V.; SZEWCZYK, M. Management practices in area of human resources and monitoring results as determinants of SME'S success in Poland and The Czech Republic. **Business Administration and Mangement**, [*S. l.*], v. 23, n. 2, p. 114-125, 2020.
MACEDO, D.F. A importância do sistema únicio **de** saúde brasileiro para o enfrentamento **de** emergências **de saúde** pública.**Revista de administração hospitalar e inovação em saúde**.v.17, 2020
MACEDO,M.A.S; NOVA,S.P.C.C; ALMEIDA, K.Mapping and bibliometric analysis of the use of data envelopment analysis (DEA) in management accounting studies.**Revista Contabilidade, Gestão e Governança.**v.12, 2009
MARETH, T. **Technical efficiency in dairy farms**: research synthesis and an application in the South of Brazil. 2015. Thesis (PhD) -- Department of Industrial Engineering, Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, 2015.
MARIANO, E. B. Basic concepts of production efficiency analysis. In: SIMPÓSIO DE ENGENHARIA DE PRODUÇÃO, 14., 2007. Proceedings **[...].** 2007.
MARINHO, Alexandre. Evaluation of technical efficiency in health services in the municipalities of the State of Rio de Janeiro.**RBE**. v. 57, 2003.
MARRAS, J.P. **Administração de Recursos Humanos**: Do operacional ao estratégico. 13. ed. São Paulo: Saraiva, 2009
MARTINS, G. A.; THEÓPHILO, C. R. **Metodologia da investigação científica para ciências sociais aplicadas**.3. ed. Rio de Janeiro: Atlas, 2016.
MATIAS-PEREIRA, J. **Manual de metodologia da pesquisa científica**. 4. ed. rev. and current. São Paulo: Atlas, 2019.
MILKOVICH, G. T.; BOUDREAU, J. W. **Administração de recursos humanos**. São Paulo: Atlas, 2000.
MORENO,L.P. **Nuevos Casos en dirección y Gestión de recursos humanos**: 25 cases of human recruitment accompanied by the solutions proposed by their authors. Madrid-Buenos Aires, 2012.
MORICI, M.C. **Recursos humanos em hospitais do sistema único de saúde**: entre a assistência e a gestão.Dissertação (Mestrado em administração).Universidade Federal de Minas Gerais. Belo Horizonte, 2011
OTOO, F. N. K. Mensuring the impact of human resource management (HRM) practices on pharmaceutical industry's effectiveness: the mediating role of employee competencies. **The International Journal Emerald Publishing Limited**, [*S. l.*], 2020.
OZCAN, Y.A; NAYAR,P. Data envelopment analysis comparison of hospital efficiency and quality. **Journal of Medical System**. v.32, 2008.
PACHECO, J,F; MAGALHAES,L.E.R. Humanization in hospital management: a look at professionals and patients. **Revista Visão: Gestão Organizacional**.v.12, 2023.
PAIVA, L. G. *et al*. Factors associated with sickness absenteeism among health workers: a scoping review. **Avances en Enfermería**, Bogotá, v. 38, n. 2, p. 234-248, 2020.
PHAM, T.N.M. The relationship between human resource management practices, work engagement and employee behavior: A case study in Vietnam. **Journal of Asian Finance, Economics and Business**. v.8, 2021.
PLOTHOW, C. B. **The relationship between perceived HRM practices and individual outcomes**: the mediating role of work engagement. 2018. Thesis (Doctorate) -- Business Administration Course, University of São Paulo, São Paulo, 2018.
ROCHA, T.A.H. National register of health establishments. **Ciências & Saúde Coletiva**. v.23, 2018

SANTINI, S.M.L.*et. al.* From 'human resources' to work management: an analysis of the literature on work in the SUS. **Trab.Educ.Saúde**. v.15, 2017.
SHARMA, D.; RAMACHANDRAN, S.; KAUR, M. Evaluation framework of human resource management effectiveness in organizations. **International Journal of Recent Technology and Engineering**, [*S. l.*], v. 8, 2019.
TARAWNHE, K. I. A. Business ethics in human resources management practices and its impact on the organizational performance. **School of Business, Mutah University, Alkarak, Jordan**, [*S. l.*], v. 21, p.402-411, 2020.
VERGARA, S. C. **Research projects and reports in management**. 16. ed. São Paulo: Atlas, 2016.
WEI, L. Q.; NG, Y. C. Efficiency of Chinese enterprises: does human resource management matter? **Applied Economics Letters**, [*S. l.*], v. 19, p. 35-39, 2012.
WOOD, S.J.; WALL, T.D. Human resource management and business performance. In P.B. Warr (Ed.), ***Psychology at work*.** Harmonsworth: Penguin, 2002
YU, Y.; BAIRD, K. M; TUNG, A. Human resource management in Australian hospitals: the role of controls in influencing the effectiveness of performande management systems. **The International Journal of Human Resource Management**, [*S. l.*], p.1-29, 2018.
ZAHEER, S. *et al.* Turnover intention of hospital staff in Otario, Canada: exploring the role of frontline supervisors, teamwork, and mindful organizing. **Human Resources for Health**, [*S. l.*], 2019.