

Multivariate analysis techniques applied for the performance measurement of Federal University Hospitals of Brazil

Maria Gabriela Mendonça Peixoto^{a,*}, Marcel Andreotti Musetti^{b,1},
Maria Cristina Angélico Mendonça^{c,2}

^a Federal University of Viçosa, Institute of Exact Sciences and Technology, P.O. Box 22, Rio Paranaíba 38810-000, MG, Brazil

^b São Carlos School of Engineering, University of São Paulo, Department of Industrial Engineering, Trabalhador São-carlense Avenue, 400, Arnold Schmidt Park, São Carlos 13566-590, SP, Brazil

^c Federal University of Lavras, Department of Agroindustrial Management, P.O. Box 3037, Lavras 37200-000, MG, Brazil

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ABSTRACT

The presence of teaching hospitals represents a strategic role in improving the quality of life of the Brazil Unified Health System patients, based on the qualified training of health, medical and complementary professionals, which means efficiency in hospital production. Therefore, the purpose of this paper was to apply the multivariate analysis techniques of principal component (PCA) and clusters analysis in the performance measurement of Federal University Hospitals, aiming to contribute for the improving of Brazilian health care services. The research is descriptive, with exploratory purpose, being organized according to three stages of development, that is, the use of principal component analysis; in the second stage, the selection of inputs and outputs for the management of hospital organizations and; in the third, the use of clusters analysis technique, for the inputs and outputs defined. Results show that the groups' formation represented divergences between both techniques applied. Thus, it was verified that two hospitals, of twenty, remained alone in both clusters and PCA, demonstrating that these organizations differentiate from the others, regarding the similarity of their characteristics described by the original variables used in the analysis.

1. Introduction

The great influence that hospitals exert on the health care systems' efficiency of which they are a part, shows the important role they play in this environment they are inserted. Moreover, hospitals are of extreme value, dealing as they do with issues that need to be addressed immediately, while at the same time as they represented, regionally, a large part of health care spending (Ersoy, Kavuncubasi, Ozcan, & Harris Ii, 1997; Flessa & Dung, 2004). The process of managing and allocating scarce resources, by tackling the vulnerability inherent to patients' and financing needs, means that defining improvement priorities is one of the main challenges faced by hospitals and is essential given the importance they represent to health care systems, as well as the difficulties they face (Bell et al., 2004).

In this sense, Ozcan et al. (2010) point out that the efficiency of each hospital unit and achieving the planned objectives are the parameters used for distributing resources, as they are financed mainly by the

Ministry of Health, as well as by the Ministry of Education. To that end, teaching hospitals are generally based on three main dimensions, reflecting these institutions' mission and vocation, as the authors suggest, medical care, qualification of labor for the health system, and conducting research with the purpose of contributing to the generation and evaluation of new technologies for the health area.

Instability in the scale and characteristics of demand for hospital services can be considered a result of a series of factors that happen in a fast and unpredictable way. These include changes due to the advent of globalization and in relation to the living standards of the population, producing epidemiological and demographic changes at local and national levels, as well as regulatory changes and technological advances in the medical field. These phenomena, besides reflecting in the demand format, affect and limit the useful life of hospital infrastructure, often developed to last for more than 30 years (Neufville, Lee & Scholte, 2008).

Thus, in order for access rights to public health care services to be guaranteed by the Brazilian Unified Health Care System (*SUS – Sistema*

* Corresponding author at: Federal University of Viçosa, Brazil.

E-mail addresses: mgabriela@ufv.br (M.G.M. Peixoto), musetti@sc.usp.br (M.A. Musetti), mariacam@dga.ufla.br (M.C.A. Mendonça).

¹ São Carlos School of Engineering, Brazil.

² Federal University of Lavras, Brazil.

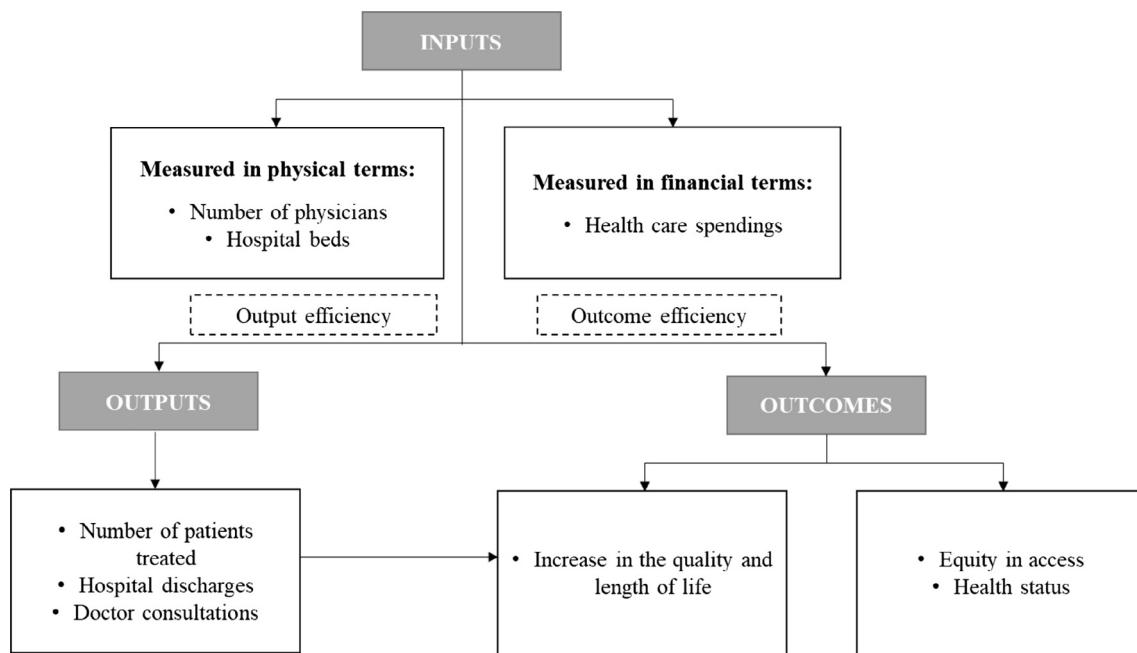


Fig. 1. Process of transforming resources – inputs in outputs and results.
Source: Adapted from Joumard et al. (2010)

Único de Saúde), a valid alternative involves the support on resource allocation methodologies that respect local, municipal and regional needs, as well as the equality criterion (Rosas, Bezerra & Duarte-Neto, 2013). On the other hand, considering the strong social appeal of health organizations, Meyer Júnior, Pascucci and Murphy (2012) point out the great need of transferring the peculiarities inherent to the scenario marked by hospital characteristics, to management theories and practices.

Analyzing the process of measuring hospital efficiency, which enables these organizations to better understand the effectiveness of their management practices, is of great interest to the entire health care sector. To optimize medical resources' allocation, hospitals are supported by performance management and organizational efficiency analysis, important support bases for decision-making processes (Chuang, Chang & Lin, 2011). Another strong appeal reinforcing the importance of evaluating performance in health organizations around the world lies in the constant increase of costs incurred by these organizations, in addition to what the health care sector represents in relation to the countries' Gross Domestic Product (GDP) (Sinimole, 2012).

Considering the scenario presented for health education organizations, there is an essential and characteristic aspect, in line with its strong social appeal, which emphasizes the importance of effective control of its operations. In this sense, it should be mentioned that these are organizations whose objective is not only to save lives, but to act in prevention, as well as to provide a better life quality and to foster the formation of qualified professionals in the medical and complementary fields. Thus, the importance of the use of tools that help in the management of organizational efficiency in these organizations, is accentuated.

Therefore, the purpose of this paper was to apply the multivariate analysis techniques of principal components and cluster analysis in the performance measurement of Federal University Hospitals – Brazilian HUFs (*Hospitais Universitários Federais*) participating in the National Program for Restructuring Brazilian Federal University Hospitals (*Programa Nacional de Reestruturação dos Hospitais Universitários Federais – REHUF*), aiming to contribute for the improving of Brazilian health care services.

2. Management processes in hospital organizations

In the conception of Jones and Northrop (2005), the management of organizations seeks to make the most of the inherent capacity of a production line, resulting in the best positioning of the organization, through support in the necessary areas of action for a given scenario. In this way, managing hospital sector' organizations, based on health care processes, refers to the search to offer, in the best possible way, high quality health care services (Fala, Clayton & Masciantonio, 1995; Jamshidi, Ramezani, Razavi, & Ghalichi, 2017).

Although capacity planning, in the health care area, as pointed out by Ettelt, Nolte, Mays, Thomson, and World Health Organization (2008), represents government levels in health systems, differences in the way this is done on national, regional and local levels are poorly defined in most countries. As Rechel, Wright, Barlow, and Mcnee (2010) point out, in order to find the balance between sufficient capacity and fair price, making it possible to meet future health care needs, it is essential to seek for better ways of planning and operating hospital capacity, bearing in mind the growing global trend for new hospitals.

In healthcare organizations, the decision-making processes in operations management come under the responsibility of a wide range of professionals (Byrkjeflot & Kragh Jespersen, 2014; Vissers & Beech, 2005). Such a scenario can be characterized under the vision of a dual management, involving both managers and business administrators, as well as clinical professionals, creating ambiguous roles and responsibilities, which are not fully defined and may end up overlapping (Aletras, Kontodimopoulos, Zagouldoudis, & Niakas, 2007; Vissers & Beech, 2005). In this context, among the actors involved in managing these organizations, Vissers and Beech (2005) mention managers, physicians, nursing staff, paramedics, and the management team.

According to Langabeer (2008), health care services represent a set of outputs, such as current production and provision of health care services, resulting from the transformation of resources and assets such as labor and capital, represented by money, technology, people, space, equipment and information. According to the author, this is a management process guided by the search for better results, through the intensive use of quality and process improvement techniques, as well as

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