

Bibliometric Study on Planning and Control in the Health Environment

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Abstract— Research assists in the creation of new tools, ideas, processes, among others that aim to facilitate progress and social management. Certain areas need some special attention, such as the health sector, which works to achieve maximum standardization of processes, enhancing quality, as the consequences of a failure can be fatal. Thus, to assist in these processes, the general objective of this paper is to analyze the concepts focused on Planning and Control in health environments. For this, a bibliometric survey of articles available in two large databases - Scopus and Science Direct - was performed using keywords of the theme: "Health & Care & Planning and Control", between 2002 and 2019. Then, applied filters to determine the works that were, in fact, within the theme. Thus, a qualitative survey of the planning and control within the hospital scope and its characteristics was obtained.

Keywords— Bibliometric Analysis, Health, Planning and Control.

I. INTRODUCTION

According to Fernandes (1999), humanity has been worrying about the use of resources, trying to avoid waste, thus some contemporary concepts, such as production systems and management functions have gained space. The Production Planning and Control (PPC) function and its related systems aim to exercise production and its processes so that the requirements are met as efficiently as possible (BONNEY, 2000).

In the literature it is possible to find different levels of understanding and application of the PPC in the organizational context, such as strategic planning, construction of theoretical, empirical or managerial models to expose the nuances of these concepts and even proposals for organizational development (ESTENDER et al., 2017).

In addition, the literature also contains a wide range of work on PPC, often always focused on manufacturing areas (ESTENDER et al., 2017), such as the adequacy of the strategic, tactical and operational plans present in Tubino (1997) or the work presented by Burgess and Simons (2005) in the Petrochemical sector.

However, it is possible to see that this concept has difficulties to unfold in the service sector, even if it is a very conducive sector for planning and control, especially if we think about the management of health environments, because it contains complicated processes by itself, involving interdependent paths, one with a higher probability of present failure than the other (HUGHES, 2008).

Griffith et al. (2006) found that 75% of 2500 public hospitals in their survey had no significant improvement in nine performance indicators: (i) risk-adjusted mortality rate, (ii) risk-adjusted complication rate, (iii) safety index (iv) severity-adjusted length of stay, (v) adjusted discharge expense, (vi) change in assisted community, (vii) profitability, (viii) cash adjustment for debt and (ix) tangible assets for release adjusted.

In addition, Schoenbaum, Audet and Davis (2003) pointed out that health care costs and declining quality in hospitals are a growing problem in the United States, requiring urgent attention.

Recently, there have been advances related to PPC inserted in the health area, gaining greater visibility in approaches, especially with regard to demand forecasting and control of processes related to it, however to assist in bridging the actual application in healthcare environments techniques present in the literature, it is necessary to create mechanisms for their integration.

Thus, the general objective of this paper is to analyze the concepts focused on Planning and Control in health environments. It is expected, in a first moment, to make a quantitative survey, through a bibliometrics, of the existing works - from 2002 to 2019 - that used techniques focused on the Planning and Control in the Web of Science (WOS) and Scopus, highlighting details such as year of publication, magazine and countries in which they occurred and then an analysis focused on what concepts were introduced in the health environment.

The justification for this work is based on two main pillars, the first of which is the need for studies focused

on the health area, in order to help the managerial demands of the same and, finally, the importance of studies that integrate the academic area with existing practice in organizations.

1.1 Theoretical Reference

1.1.1 Production Planning and Control (PPC)

Every organization must recognize the customer's wishes and, through the planning and organization of its productive resources, serve the stipulated demand, this activity being the essence of the PPC (PUC-RIO, 2005).

However, this simplistically described process previously receives recurring interferences and unforeseen variations, which originate in demand, process performance and other factors outside the company (PUC-RIO, 2005).

Thus, it is necessary to work together the production resources in parallel, seeking to meet this variable of customers and products, because PPC is an information system that controls the interaction of an organization's productive resources through planning, which can be described as short, medium or long term (DAVIS; AQUILANO; CHASE, 2001).

For Davis, Aquilano and Chase (2001), the long-term PPC is related to times longer than one year and can create scenarios of three, five or even ten years and is related to the company's strategic planning.

The medium-term PPC covers the period from three to twelve months and must be reviewed and updated quarterly. Because it is linked to the tactical level, standards of use must be established, needs to be hired, resources used, services, among others (DAVIS; AQUILANO; CHASE, 2001).

Finally, the short-term PPC deals with the production of the next four weeks, associated with the operational level, which is focused on the decisions of flexibility of the production process, time of production shift, demand fluctuation for its portfolio, variation among others (DAVIS; AQUILANO; CHASE, 2001).

Even with this segmentation, market prospects may not be clear, so correcting distortions requires continued monitoring and review of customer needs assessments. However, making predictions of demand is not a simple activity, involving a range of information analysis with the help of various techniques (PUC-RIO, 2005).

Expanding these concepts into the area of services, specifically health, more research is needed on the relationships between different activities, as well as the exchange of information and knowledge management within and between different hierarchical levels of health care order to develop the quality of health care (SVENSSON; HEDMAN, 2018).

1.1.2 Planning and Control in the health environment

Within a health organization, there are different professions from different functions and departments, which together organize health care. The goal is to provide high quality health care using the limited resources available (SVENSSON; HEDMAN, 2018).

Designing and organizing healthcare processes will involve planning and control activities. This design and organization process will also entail setting goals for activities and planning what to do, how to do it, when to do it, and who to do what, such as operations management (SVENSSON; HEDMAN, 2018).

Care management and planning include resource sizing, planning, programming, monitoring and control (HULSHOF et al., 2012). Health planning and management can, for example, be directed to planning operating rooms, planning nurses' needs and scheduling patients (CARDOEN, DEMEULEMEESTER and BELIEN, 2010).

However, there are characteristics of the health sector that lead to less effective management and planning (HANS, VAN HOUDENHOVEN; HULSHOF, 2012), which are:

- Health care consists of professional organizations with professions that lack communication, cooperation, collaboration and knowledge integration, and also sometimes have conflicting interests;
- Information systems used in healthcare are often not integrated, where necessary information is not available and knowledge cannot be integrated;
- Many hospital departments are autonomous and managers cannot see beyond departmental boundaries, leading to fragmented planning and management;
- Managers generally think that more resources will be applied to management. However, these resources will be taken from patient care;
- Management roles are often poorly defined;
- Activity scheduling is not based on production plans.

Thus, we have a current panorama of really worrying health, which increasingly needs the help of external tools, focused on asset management and especially in the planning and control of processes.

1.1.3 Current health picture

Brazilian hospitals have a problem of size, thus suffering with a shortage of beds. Of the 6,774 existing hospitals nationwide, 88% contain less than 150 beds (ASSOCIAÇÃO NACIONAL DE HOSPITAIS PRIVADOS – BRASIL, 2013). For Pedrosa (2013), a hospital is not operationally viable when it has less than this amount.

In addition, according to a survey, about 829 Brazilians die daily in public and private hospitals for failures that, for the most part, could have been prevented. Thus, three Brazilians die every five minutes (INSTITUTO DE ESTUDOS DE SAÚDE SUPLEMENTAR – BRASIL, 2017).

The failures occupy second place in the ranking of most common deaths in Brazil, second only to cardiovascular diseases, responsible for the death of approximately 950 Brazilians per day. Even so, hospital failures are still far from other common causes of death, such as cancer (480 to 520 deaths / day), violence (164 deaths / day) and traffic accidents (129 deaths / day) (SOCIEDADE BRASILEIRA DE CARDIOLOGIA, 2017).

Thus, asset management in healthcare environments can contribute, among other things, to better management performance, be it in equipment, people or capital, as well as greater accuracy to detect failures in operations (HEALTHCARE MANAGEMENT, 2019).

Thus, any assistance from the academic point of view is welcome in this area, since the hospital landscape is worrying. Thus, there is bibliometric analysis that is part of scientometrics developed to measure production-based scientific performance (GODIN, 2006; VERBEEK et al., 2002) and provides information on different aspects of scientific performance by examining "physical units" or bibliographic units or substitutes for either "(BROADUS, 1987).

II. MATERIALS AND METHODS

This research, according to Turrioni and Mello (2012), can be classified as basic in nature, containing an exploratory bias and a qualitative approach, by using number of articles and analysis of terms present in the works.

The methodology of the present work was divided into two stages: (i) selection and (ii) analysis. In the selection part, the following steps were followed:

- Search for the term "Health & Care & Planning and Control" in the WOS and Scopus databases with the time interval filter from 2002 to 2019;
- We found 22 papers in WOS and 39 papers in Scopus;
- After a brief reading of the summary of each work, it was possible to see that not all articles found fit the theme, obtaining 19 articles in WOS and 25 articles in Scopus;
- Once obtained, a comparison was made to see if there were no repetitions between the bases. Thus,

there were 10 equal articles, totaling 34 papers on the subject.

After this first step, the second step consisted of a deeper analysis of these articles in two parts:

1. After surveying the total number of articles, comparisons were made about (i) years of publication, (ii) countries of origin, (iii) higher education institutions involved, (iv) published journals, and (v) most cited publications in the given time interval;

2. Finally, an individual analysis of all articles was made, in order to determine their application and, thus, to survey which concepts of Planning and Control were introduced in the health environment.

III. RESULTS AND DISCUSSION

3.1 Selection

After searching for the term "Health & Care & Planning and Control" in the chosen databases and applying the filters, obtaining 34 articles between 2002 and 2019, it was necessary to read the full content to evaluate if all works really incorporated the theme.

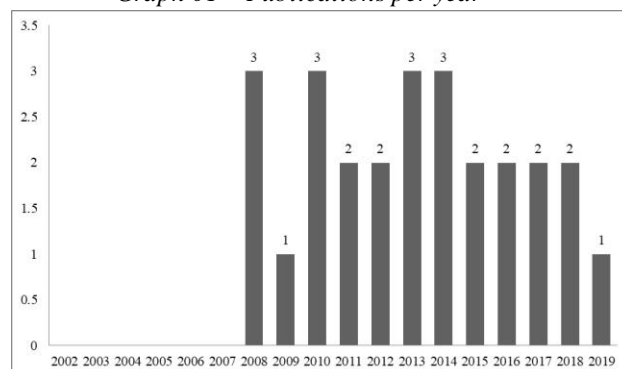
After this filter, it was possible to realize that 8 of these articles were not in conformity and was discarded, resulting in a definitive total of 26 papers. It is noteworthy that articles that addressed the theme, that is, did not necessarily discuss a PPC application in health, but made mention of them were kept, because they are aligned with the objective, even indirectly. Thus, from this, it was possible to continue the work, classifying the articles found.

3.2 Articles Analysis

3.2.1 Publications per year

Firstly, the articles found were arranged over the determined time interval, i.e., from 2002 to 2019. Graph 01 illustrates their occurrence, according to the amount expressed per year.

Graph 01 – Publications per year



Source: Authors.

It is possible to separate the years into two major blocks, which are: (i) from 2002 to 2007 and finally (ii) from 2008 to 2019. As regards the first period of time, there was no return in either base on the subject.

This is because the scope of health, inserted in the area of services, has recently begun to gain attention with regard to the use of quality management assistance, since the application of such techniques was not a priority, making it difficult their penetration into services, and not creating relevant publications.

The second block of time, focused on 2008 to 2019, is when we see this paradigm changing, as we have the first publications in the first year of the segment, with a total of three works, representing 11.54% of all works found. Of course, due to the low number of articles found in total, it is not possible to affirm a consolidation of this concern in the health field; however the following years kept publications focused on the theme, with fashion in two publications per year, with highs in 2008, 2010, 2013 and 2014, and with casualties only in 2009 and 2019, with just one article. It is noteworthy that, due to the moment this research was done, the reality about 2019 may change.

3.2.2 Publications by country

After the annual survey, an analysis was built now for the countries of origin that made the publications focused on the PCP in the health area. Table 01 shows the ranking of the five countries with most papers.

Table 01 - Number of Publications by Country

Region	Publications	Percentage
Netherlands	7	26.92%
Italy	6	23.08%
USA	5	19.23%
UK	2	7.70%
Germany	2	7.70%

Source: Authors.

We can see that the Netherlands leads the ranking with 7 out of 26 publications found on PPC in health, while Italy, the United States, the United Kingdom and Germany complete the ranking with 6, 5, 2 and 2 papers out of 26, respectively. It is also noted that due to the low number of works, the difference between the first and fifth ranking is not very large, only 5 works, or 19.23% of the 26 found, which shows an opportunity and even, need to develop more work focused on this theme.

3.2.3 Publications by institution

Following, it was possible to rank the five higher education institutions that are linked to the publications on PPC in health, as shown in Table 02.

Table 02 - Higher education institutions with most publications

Institution	Country	Publications	Percentage
Harvard Public School of Health	USA	3	6.67%
Maastricht University	Netherlands	3	5.56%
University of Amsterdam	Netherlands	2	5.56%
Erasmus University	Netherlands	2	5.56%
Complutense University of Madrid	Spain	2	4.44%

Source: Authors.

In educational institutions there are two peculiar situations, and a priori there is a parallel directly linked with the countries exposed in the previous subsection, since the Harvard Public School of Health belongs to the United States, while the second, third and fourth place are from the Netherlands. However, the second point is that the Complutense University of Madrid stood out with two works and was fifth in the ranking, but it belongs to Spain, which did not appear in the ranking of countries, even the United Kingdom and Germany appear with the same amount of articles. This happened by an arbitrary choice in determining the draw.

It is also possible to notice that Italy, Germany and the United Kingdom did not have institutions that represented them in this ranking, but they have publications, but were distributed more evenly among the institutions, leaving them out of the five with the most papers.

3.2.4 Publications by journal

Journal publications were also surveyed and ranked by number, as shown in Table 03.

Table 03 - Journals with the most publications

Journal	Publications	Percentage
Health Polices	6	23.08%
Computer Science Information Systems	5	19.23%
Health Services and Management Research	4	15.39%

Public Health, Environmental and Occupational Health	3	11.54%
Health Care Sciences & Services	3	11.54%

Source: Authors.

It can be seen, as in the previous topics, that the ranking with the five largest can capture most of the publications, since the occurrence of works was only 26, so we see the journal with the largest number of publications - Health Policies - comprising 6 articles and the five with more articles 21 of the 26 papers surveyed.

Moreover, an interesting analysis to be made is that, of these five, four journals have the main theme focused on health, which is relatively expected, since part of the theme starts from this principle, but also shows that the need to look for management tools came from the inside out. In addition, the non-health journal - Computer Science Information Systems - addresses computer problems, showing how computer mathematics is linked to the application of PPC in health.

3.2.5 Papers with more citations

To raise the number of citations of the 26 articles, Google Scholar was used, entering each of them in the search and thus recording the respective numbers of citations. Following the pattern presented so far, the articles with the most citations are in Table 04.

Table 04 – Most cited papers

N	Paper	Journal	Year	Citations
1	Reduced Costs for Staphylococcus aureus Carriers Treated Prophylactically with Mupirocin and Chlorhexidine in Cardiothoracic and Orthopaedic Surgery	PLOS One	2012	52
2	Societal output and use of research performed by health research groups	Health Research Policy and Systems	2010	44
3	How do strategic decisions and operative practices affect operating room productivity?	Health Care Management Science	2011	38

4	Big data logistics: a health-care transport capacity sharing model	Procedia Computer Science	2015	35
5	Assessing health and economic outcomes of interventions to reduce pregnancy-related mortality in Nigeria	BMC Public Health	2012	33

Source: Authors.

All articles appearing in the ranking presented are between 2010 and 2015. A priori, observing the years after 2015, it is to be expected, since they are more recent articles that have not had time to be cited, but before 2010 does not appear in this ranking and this is probably because they are more introductory articles that are still exploring the topic.

It is worth mentioning the first article in the ranking entitled “Reduced Costs for Staphylococcus aureus Carriers Treated Prophylactically with Mupirocin and Chlorhexidine in Cardiothoracic and Orthopaedic Surgery” since it has a relatively large number of citations, although it does not have a great disparity with the fifth, maintaining a difference of 19, being the same year. However, his theme is interesting because it showed how benchmarking between hospitals can help lower costs and also highlights a hospital that has an entire Planning and Control department.

3.2.6 Concepts of Planning and Control in health

Regarding the concepts present in the works found, it was necessary to apply a last filter, since, as previously stated, some articles addressed the theme and, thus, they were not exactly applications and benefits of these concepts. Thus, with the 26 papers found, an individual selection was made to distinguish the applications from the other article formats. This division is illustrated by Figure 01.

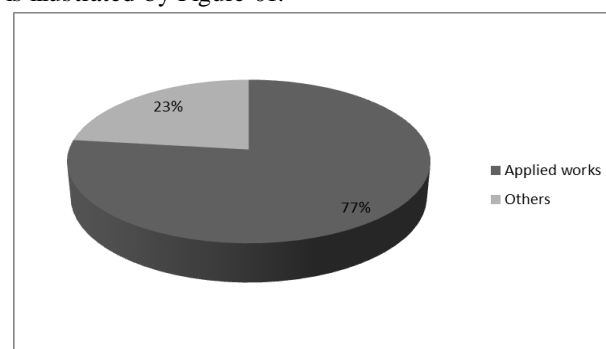


Fig. 1: Division between paper types

Source: Authors.

Thus, it was possible to see that 77% of the articles found were related to applications of PCP in health, which corresponds to 20 of the 26 studies found, while the remaining 6 fell into the Other category. This category encompassed the other types of studies, including literature reviews and analysis of possible applications.

Thus, the 20 articles were cataloged and their characteristics were raised. Table 05 shows these works, divided between reference and a brief explanation of each one, showing where Planning and Control interacted with health in each case.

Table 05 – Quality tools in health

Authors	Explanation
Baars e Van Merode (2008)	Evaluated the requirements for implementing a hospital Care Planning and Control tool and its relationship with IT.
Silvestro e Silvestro (2008)	It proposed a Planning and Control model to increase the efficiency of the Strategic List, which is responsible for managing the scales between nurses and doctors at a UK hospital.
Cannavacciuolo, Ponsiglione e Delfino (2009)	It analyzed the technical infrastructure bias of Health Planning and Control Systems and presented a case study focused on the allocation of unit costs in operating rooms.
Mostert <i>et al.</i> (2010)	It developed a quantitative approach to assess social production and research use by health research groups and to assist in their planning.
Villa e Bellomo (2010)	Analyzed models of improvement in Planning and Control proposed in industrial management and adapted some projects for the health sector.
Fruggiero, Iannone e Riemma (2011)	Built a hierarchical structure for the medium and short term Planning and Control of healthcare delivery systems, for standardization, rationalization and effective measurement of assets.

Peltokorpi (2011)	It analyzed the synergistic effect of strategic decisions and operative management practices on operating room productivity with a multiple case study.
Van Rijen <i>et al.</i> (2012)	It determined whether treating a particular surgery affects patient care costs through benchmarking with another hospital's Planning and Control department.
Salvatore, Boscolo e Tarricone (2013)	It sought the long-term economic balance between quality and cost of health services through a publicly accessible Planning and Control system.
Barsanti e Nuti (2013)	It described how health access equity indicators according to socioeconomic conditions can be excluded from performance evaluation in the context of Strategic Health Planning and Control.
Drupsteen, Van Der Vaart e Pieter Van Donk (2013)	It investigated which integrative Planning and Control practices are used in hospitals and their effects on patient flow.
Nuti e Seghieri (2014)	It outlined the first steps of a long-term approach to proactively addressing geo-focused planning and control in health care.
Ramos <i>et al.</i> (2014)	Analyzed milk production in an intensive system to classify processes into a Value Stream Map.
Benhajji, Roy e Anciaux (2015)	It introduced a patient-centered multi-agent system for health care, specifically in Hospital Flow Planning and Control.
Mehmood e Graham (2015)	Contributed to big data focused on the development of technical tools in Network Planning and Control, exploring improvements in transport capacity sharing.
Nap (2016)	Monitored scanner data

	traffic between servers to improve logistics control and management perception in a hospital.
Shohet e Nobili (2017)	Implemented performance indicators to evaluate the maintenance, Control and Planning of a clinic.
Thomas Schneider <i>et al.</i> (2018)	Allocated ward beds for emergency services using demand forecasting in a hospital.
Svensson e Hedman (2018)	It analyzed the challenges that hospital health care faces related to capacity management knowledge and control of activities performed.
Bellandi <i>et al.</i> (2019)	Described critical issues for elements of good practice in the transition from the current medical to electronic process.

Source: Authors.

IV. CONCLUSION

The article built a bibliometrics that consisted of analyzing the concepts of Planning and Control used in health environments, from 2002 to 2019, using the bases of Scopus and Web of Science, thus achieving its objective.

In addition, it was possible to expose some years in which there was no research related to this theme, more specifically between 2002 and 2007, showing how the importance given to management resources in health is relatively new. In addition, it was possible to expose other aspects such as countries, magazines and institutions that presented more representativeness of the concepts of Planning and Control in health.

With regard to these concepts, it is possible to notice that, besides not being standardized for a given situation, there are still few studies on the subject, since 20 applications over 18 years express an average of 1.11 articles per year. Thus, it is necessary to search other sources or keywords to research on the subject and also encourage the incentive to this theme.

For future work, therefore, a deepening of the subject is recommended, as well as a bibliographic research to better explore the peculiarities and the evolution of the concepts over the years.

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