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Hospital Management Maturity Models: Literature Review

Modelos de Maturidade de Gestão Hospitalar: Revisão da Literatura

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Abstract: Previous researches show that hospital organizations have initiated improvement programs and invested considerably in the orientation and management of processes, using maturity models to improve structures and learning. In this context, the objective of the present paper is to analyze previous researches related to hospital management maturity models, using the Morton (1994) organizational dimensions' analysis model, adapted for hospital organizations. The Web of Science, Scopus, Spell, Scielo and BDTD platforms were used for this study. We screened 305 identified papers, published from January 2005 till December 2019, using search descriptors: "Maturity Model" and "Hospital management". We identified Forty-one articles as eligible for information extraction and analysis. The surveys are classified into five organizational dimensions: Strategy, Structure, Decision Making, Technology, and People. We found a predominance of the technology management dimension in 25 studies, based on the organizational dimensions. The research is essentially related to information systems, supply management and quality management. Although there are different models of hospital management maturity, it was found that the models developed for hospital organizations are mostly related to their technical / operational areas, but in a fragmented way. The present study contributes to a comprehensive literature review of hospital maturity and management models.
Keywords – Maturity Model; Hospital Management; Literature Review.

Resumo: Pesquisas anteriores mostram que as organizações hospitalares iniciaram programas de melhoria e investiram consideravelmente na orientação e gerenciamento de processos, usando modelos de maturidade para melhorar estruturas e aprendizado.

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Nesse contexto, o objetivo do presente artigo é analisar pesquisas anteriores relacionadas aos modelos de maturidade em gestão hospitalar, utilizando o modelo de análise das dimensões organizacionais de Morton (1994), adaptado às organizações hospitalares. As plataformas *Web of Science*, *Scopus*, *Spell*, *Scielo* e BDTD foram utilizadas para este estudo. Foram selecionados 305 artigos, publicados de janeiro de 2005 a dezembro de 2019, utilizando os descritores de pesquisa: "*Maturity Model*" e "*Hospital management*". Identificamos quarenta e um artigos como elegíveis para extração e análise de informações. As pesquisas são classificadas em cinco dimensões organizacionais: Estratégia, Estrutura, Tomada de Decisão, Tecnologia e Pessoas. Encontramos uma predominância da dimensão de gerenciamento de tecnologia em 25 estudos, com base nas dimensões organizacionais. As pesquisas estão essencialmente relacionadas a sistemas de informação, gerenciamento de suprimentos e gerenciamento de qualidade. Embora existam diferentes modelos de maturidade em gestão hospitalar, verificou-se que os modelos desenvolvidos para as organizações hospitalares estão principalmente relacionados às suas áreas técnicas / operacionais, mas de maneira fragmentada. O presente estudo contribui para uma revisão abrangente da literatura sobre modelos de gestão e maturidade hospitalar.
Palavras-chave – Modelo de Maturidade; Gestão Hospitalar; Revisão da Literatura.

Introduction

An organizational structure is defined by the ways in which work can be divided into, and the coordination of activities performed by the people who work together (Mintzberg et al., 2005). The speed of transformations and demands in contemporary work environments require considerable adjustments in the dynamics of organizational structures. Thus, the search for continuous improvement in process management has determined that organizations increasingly employ process management models to evaluate organizational maturity (Oliveira, 2015). The intention of this movement is to excel in competitiveness and sustainability, not only in the area of activity, but also in its way of working, the quality of its products and the efficient provision of services (Mani et al., 2010).

Although there are increasingly demanding approaches to developing maturity models, there is a wide gap in the effective implementation of maturity models in complex environments (Mettler, 2010). In this sense, it is understood that one of these sectors includes hospitals. According to Celestino (2002), hospitals are complex organizations, where knowledge and maturity are essential to achieve their primary goals: unveiling and restoring patients, providing well-being to these and their relatives, as well

as managing material, physical resources, and humans, sharing them appropriately. According to the author (2002, p. 1), "hospitals are among the most complex organisms to manage. In them are various services and simultaneous situations: hospital is hotel, laundry, medical services, cleaning, surveillance, restaurant, human resources, relationship with the consumer".

The maturity model has become an established and important instrument to guide organizational transition initiatives (Batenburg, Neppelenbroek, & Shahim, 2014). Maturity models are established on the principle of periodic growth stages, in which the changes of an organization over time, are organized in a continuous and calculable way, covering an established number of cumulative and orderly continuous stages, which can be described and related to an established level of maturity (Bhidé, 2000; Nolan, 1973; Rocha & Vasconcelos, 2004). Maturity moves through a different number of levels (Rocha & Vasconcelos, 2004), where the upper levels are based on the requirements established at the lower levels, usually in five levels (Bruin et al., 2005), described as: initial, managed, defined, measured quantitatively and managed optimally (Software Engineering Institute, 2010).

Vanhaecht et al. (2006) exposes that hospital organizations still face several challenges to transform, develop, implement and improve their processes and maturity levels. For Kirchmer et al. (2013), the hospital segment is a complex, dynamic and specialized ecosystem, and the establishment of thoughts through processes and its effective management requires the right tools and the support of a mature organizational culture. For Burmester et al. (2007) and Carvalho et al. (2019), it is necessary to establish a modern management model that supports decision makers, with the purpose of improving processes, systems and hospital management, considered as a complex organization. Thus, it should be put in front of relevant models for assessing organizational maturity and determine the points of improvement, gradually revealing the consecutive improvement of these organizations.

Maturity models are recognized tools for the gradual and organized development of improvements in an organization's skills, processes, structures, or general conditions (Hammer, 2007), in addition to providing a means of evaluating each area independently of the others, as each hospital area it can evolve in disparate levels (Daclin et al., 2018). Several process maturity models have been recommended to guide organizations in targeting and improving their process capabilities (Röglinger et al., 2012; Van Looy et al., 2013; Tarhan et al., 2016). These models usually have a discrete sequence of

process maturity levels, within a given business domain, depicting a previous, desired, or characteristic evolutionary trajectory (Becker et al., 2009).

Blondiau et al. (2016) show the existence of a large number of researches regarding maturity models. However, these models are not essentially involved in the actual implementation of a maturity model in a hospital setting. In this perspective, Waring (2015) exposes the need to explore the usefulness of maturity models as a way of a differentiated assessment of implementation processes of hospital management systems. Due to the absence of a specific model for the hospital area, Tarhan et al. (2015) use a generic maturity model, the Business Process Maturity Model (BPMM), to assess the maturity and quality of hospital services.

Given the above considerations, the present paper aims to analyze previous researches related to maturity models for management of hospitals, using the analytical model of organizational dimensions proposed Morton (1994), adapted to hospitals. As highlighted by Frega et al. (2017), this research is justified due to the lack of maturity models able to meet the specificities of healthcare organizations, in a general point of view. The authors present in their research an exhibition with the most relevant articles found, revealing that 80% of publications regarding maturity models include the field of information systems, and only 5% covered the hospital management sector.

The current document is structured as follows: the second section presents the methodological procedures, the third presents the results of the literature research on the theme of maturity models and hospital management, and finally, the final considerations.

Research Method

From a qualitative approach, we used the bibliographic research, which according to Van den Akker et al. (2006), is a technique frequently used in exploratory or descriptive studies, cases in which the proposed object of study is little studied and implies an orderly set of procedures for finding solutions attentive to the object of study. The bibliographical analysis occurred through doctoral dissertations, master dissertations and scientific / academic papers that were published on the theme of

hospital management maturity models. To cover the largest possible number of publications, we do not consider the credibility of journals, the number of citations and the impact factor on our research scope.

The present study uses Web of Science, Scopus, Spell, Scielo and Brazilian Digital Library of Theses and Dissertations [BDTD] platforms, considered reliable platforms for accessing scientific publications, for gathering the publications, and the appropriate EndNote tool used to generate the desired information. Data were collected in national and international journals during the year 2019, using the following key words in Portuguese and English: "Maturity Model" and "Hospital Management". The result set consisted of 305 publications (dissertations and scientific papers) published from January 2005 till December 2019 that made up the corpus of analysis of the survey. The criterion for selecting the duration of the research time was based on limited knowledge before 2005. In the subsequent analysis, the descriptors were combined with other terms of interest, as shown in Table 1.

Table 1.
Keyword selection

Descriptors	Number Records Found
"Maturity Model"	71.000
"Hospital Management"	228.000
"Maturity Model" and "Hospital"	5.360
"Maturity Model" and "Healthcare"	7.950
"Maturity Model" and "Hospital Management"	305

To ensure that only relevant records were analyzed, some inclusion and exclusion criteria were established, such as: research objectives, research methods, focus and scope, and characteristics of model design. Decisions on the inclusion and exclusion are relatively subjective. In this regard, Tranfield et al. (2003) recommend that this phase is carried out by more than one researcher. Therefore, two researchers with experience in maturity models were involved at this stage. Inclusion and exclusion criteria were used in a gradual process, according to flow diagram shown in Figure 1.

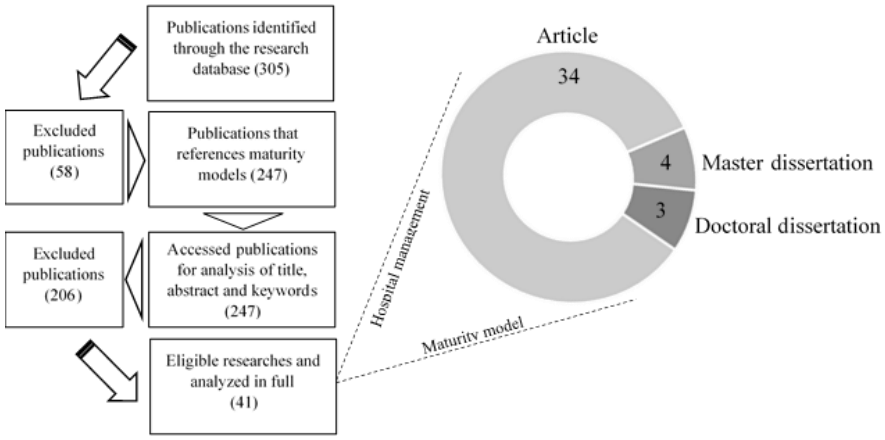

Figure 1. Flow diagram and article types related to maturity models
Source: Prepared by the authors.

Initially, a set of results was obtained using different keywords in the searched databases. From the results obtained, only researches referred to maturity models were analyzed. The researches that did not refer to maturity models have been eliminated. This procedure reduced the number of potentially irrelevant research in databases. Subsequently, the results have been revised based on the titles, abstracts and keywords, classified in two ways: (i) checking whether the document meets the criteria for inclusion in the study; and (ii) are related to maturity and hospital management models.

From this process, a final sample of 41 surveys was reached. Of these, 82.93% are dispersed in a wide range of articles; 7.32% are doctoral dissertation and 9.76% master dissertation. These publications were read in full, generating a short description, to assess its focus on models of maturity and hospital management, and the relevance to the research questions.

Data Analysis Procedures – Organizational Dimensions

In practice, managing a hospital organization, whose main component is the care of people with security and reliability, including dissimilar technologies, people with numerous knowledge, integrated

and modern structures, requires complex, relevant and differentiated strategies (Williams et al., 2019). Thus, the analysis model considers the object of study, maturity models related to hospital management, and their interdependence with the organizational dimensions. In other words, an analysis protocol was developed so that the two researchers with experience in maturity models could identify among the eligible publications a theme or a central research axis, classifying them based on the model of analysis of organizational dimensions (Strategy; Technology; Structure; Decision making; and People) proposed by Morton (1994) adapted for hospital organizations.

The present study adapted to hospitals the model of organizational dimensions proposed by Morton (1994). Therefore, the dimensions characterized in this research are: Strategy, Structure, Decision Making, Technology and People. It is understood that the potential of hospital organizations regarding performance can be observed by the dimensions: strategy, structure and technology; regarding the attributes of effectuation (ability to be effective), verified from the dimensions: decision making and people.

In view of this, we highlight Cleverley and Harvey (1992), who mentioned that the performance of hospital organizations is related to the strategies, and the disposition of resources and deadlines distributed among people. To the ability be effective, Angeloni (2003) states that people exercise relevant roles for problem solving in decision-making processes. The author notes that the decision-making, either individually or in a team, needs a high level of quality and above all, must consider the role technology plays on it. On the other hand, according to Paulk (2009), it is indispensable the investment in technologies to maintain and enhance the performance of hospitals. The introduction of new technologies must inevitably be aligned with organizational strategies.

It should be noted that the main point of this model is based on the fact that all the dimensions are related and there is a mutual influence between them. Added to this the external environment, which changes the conditions of each of element and influences the operation of the hospital organization. The model is presented in Figure 2.

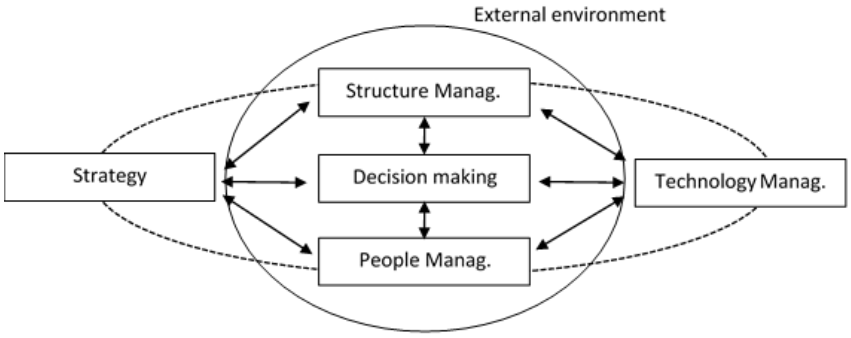

Figure 2. The organizational dimensions
Source: Adapted from Morton (1994).

Dimensions according to which hospital organization stands are:

a) Strategy: how the hospital interprets the group of potential users (patients, community, etc.) and is positioned in front of them;
b) Technology Management: Set with which the hospital organization provides its services, related to technology and its operation, the best practices of each process carried out, the services actually rendered;
c) Structure Management: distribution of time and available resources among the experts who coexist in the hospital organization;
d) Decision Making: cognitive and decision process by which it is found a solution to problems;
e) People Management: inter-relations of power between people.

Based on the developed model, outlined in the organizational dimensions, we categorized the maturity models through the variables identified in the eligible publications. Publications related to the theme will be discussed in the next section.

Analysis and Discussion of Results

According to Caralli and Knight (2012), maturity models are available to meet many organizational challenges. These models provide information to address the structured problems, identifying benchmarks to evaluate the capabilities, and road maps to implement improvements. After reading the 41 studies that form the corpus study, the primary approaches have been identified and grouped together in a synthesis (Table 2), and subsequently described in broad perspective of its contents.

Table 2.
Categorization of studied maturity models through the organizational dimensions

		Dimensions							
Articles Published	Publication year	Strategy	Technology management	Structure management	People management	Decision making	Theme addressed	Scope	Number of variables
Priestman (2007)	2007		X				Electronic registration	Information management	6
Van de Wetering and Batenburg (2009; 2010)	2009/10	X	X	X			Image archiving	Information management	5
Rocha (2011)	2011	NA					Information system	Information management	-
Weyns and Höst (2012)	2012	X	X	X	X		Information technology	Information management	4
Rohner (2013)	2013		X	X	X		Electronic registration	Information management	3
O'Neill (2013)	2013		X				Information technology	Information management	8
Setiawan et al. (2014)	2014		X				Information system	Information management	3
Van de Wetering and Batenburg (2014)	2014	X	X		X	X	Image archiving	Information management	5
Carvalho et al. (2015)	2015	NA					Information system	Information management	-
França (2015)	2015			X		X	Information technology	Information management	4

Carvalho and Rocha (2015)	2015	NA					Information system	Information management	-
Gomes et al. (2016)	2016			X	X		Information system	Information management	3
Carvalho et al. (2019)	2019		X				Information system	Information management	6
Williams et al. (2019)	2019		X				Information infrastructure	Information management	8
Lombarts et al. (2009a; 2009b)	2009/10	X	X	X	X	X	Quality management	Quality management	7
Wagner et al. (2014)	2014		X				Quality management	Quality management	7
Tarhan et al. (2015)	2015		X				Quality management	Quality management	5
Moradi et al. (2016)	2016	X	X	X	X	X	Quality management	Quality management	8
Naidoo and Fields (2019)	2019		X				Processes improvement	Quality management	4

Dimensions

Articles Published	Publication year	Strategy	Technology management	Structure management	People management	Decision making	Theme addressed	Paper Scope	Number of variables
Mettler and Blondiau (2012)	2012	X	X	X			Intra and inter professional management	Teamwork	3
Blondiau (2017)	2017	X	X	X			Intra and inter professional management	Teamwork	3
Mettler and Rohner (2009)	2009		X		X		Relationship with suppliers	Supplying management	3
Plomp and Batenburg (2009)	2009	X	X		X	X	Supply management	Supplying management	5
Mettler (2011)	2011		X				Relationship with suppliers	Supplying management	4
Oliveira (2015)	2015			X	X	X	Supply management	Supplying Management	5
Tontini et al. (2016)	2016		X			X	Supply management	Supplying management	4

Mattos (2017)	2017		X				Supply management	Supplying Management	4
Chassin and Loeb (2013)	2013		X		X		Service management	Service management	3
Kirrane (2009)	2009	X			X	X	Service management	Service management	7
Von Wangenheim et al. (2013)	2013	NA					Telemedicine	Service management	-
Van Dyk and Schutte (2013)	2013		X				Telemedicine	Service management	3
Schriek et al. (2016)	2016			X	X	X	Patient care	Service management	5
Cleven et al. (2014)	2014		X		X	X	Organizational management	Governance	5
Batenburg et al. (2014)	2014	X				X	Governance	Governance	3
Mallek-Daclin et al. (2017)	2017	X	X			X	Implementation of field hospitals	Governance	3
Daclin et al. (2018)	2018			X			Implementation of field hospitals	Governance	5
Van Zwienen (2019)	2019	X					Enterprise architecture	Governance	19

Dimensions

Articles Published	Publication year	Strategy	Technology management	Structure management	People management	Decision making	Theme addressed	Scope	Number of variables
Blondiau et al. (2013)	2013	NA					Maturity model deployment	Maturity model deployment	-
Waring (2015)	2015	NA					Maturity model deployment	Maturity model deployment	-
Blondiau et al. (2016)	2016	NA					Maturity model deployment	Maturity model deployment	-
Kerpedzhiev et al. (2019)	2019	NA					Maturity model deployment	Maturity model deployment	-
Number of Publications	41	12	25	12	13	12			

NA: Not applied. Source: Prepared by the authors.

Table 2 presents the categorization of the maturity models, according to the categorized organizational dimensions. It can be observed that the Technology Management dimension has the highest number of publications (60.98%) among the eligible papers. It should be noted that the dimensions' Strategy, Structure Management, People Management and Decision Making obtained a homogeneous categorization.

It was found that the addressed themes, among the 41 selected and analyzed publications from the years 2005 to 2019, are mainly related with management and information technology (24.39%), followed by supply management (14.63%), quality and implementation of maturity models (9.76%), followed by other areas of the hospital sector.

Grouping the publications in macro scopes, we can see that 34.15% address information management, 14.63% address supplier management, 12.20% service management, governance and quality management, 9.76% the implementation of the maturity model, and 4.88% teamwork (Table 2).

The results show average values of 5.15 in relation to the number of dimensions surveyed, and the work with the largest number of variables has 19 dimensions, while the smallest one addresses three dimensions in the model.

Finally, through the results presented, it is possible to observe the need to expand the number of studies aimed at the implementation of specific maturity models for the hospital area. In the following session, we present an analysis of the published papers.

Publications about Hospitals Management Maturity Models

A maturity model has become an established and important tool to guide organizational change initiatives. The need to support the implementation of maturity models of a broad and specific way to hospital organizations, essentially became indispensable (Conwell et al., 2000; Becker et al., 2009; Pöppelbuß et al., 2011).

According to Bruin et al. (2005), the successful implementation of a maturity model is directly intertwined with the way the model was developed and tested. Thus, Mettler and Rohner (2009) address

the lack of systematic and widespread procedure on how to design and implement maturity models. The authors present a maturity model for evaluation of relationship management of hospital with suppliers, in order to identify the strengths and weaknesses of the management activities of these relationships. The model is composed of three dimensions (object, process and people), described in terms of three levels (operational, tactical and strategic) of increasing complexity.

Implementation of maturity models in hospitals, according to Mettler and Blondiau (2012), contribute to the formation of strategic, organizational and technical skills, considered indispensable for the development of structures and interrelated processes systematically. Blondiau et al. (2013) point out in their research the challenges encountered during the project development and the implementation of three maturity models for different areas of improvement in hospitals, between the years 2009 and 2012. The first project was aimed at developing a maturity model to be used as a benchmark to measure the effectiveness and reliability of supply management procedures of a hospital (Mettler and Rohner, 2009); The second, from a social perspective and technique, can be used to identify performance gaps and systematic improvements in the relationship management process with suppliers, facilitating new forms of collaborative learning (Mettler, 2011); and the third, emphasized the measure, assessing the quality of intra- and inter-organizational collaboration of hospitals (Mettler and Blondiau, 2012). According to the authors each measurement process begins with the questions "what" and "why" something must be measured; therefore, one of the challenges is how to decide when it is advantageous to use a measuring tool, such as a maturity model (Blondiau et al., 2013). Maturity models can be employed essentially prior to project implementation and implementation, providing a value and process and business maturity framework (Freixo and Rocha, 2015).

Waring (2015) exposes the need to explore the usefulness of maturity models as a way of differentiated assessment of the implementation of health systems processes. The author reports that successive UK governments have tried to integrate systems and establish levels of maturity in the national health service, but without success. Regardless of the strong emphasis on the development of maturity models highlighted in the literature, Blondiau et al. (2016) demonstrate that in practice, the developers of these models often are not engaged primarily in the actual deployment of a maturity model

in environments that undertake services of health. The challenge of implementation becomes the responsibility of hospital managers and health policy makers.

Daclin et al. (2018) demonstrated in their research a maturity model for the evaluation of the implementation process of field hospitals in times of crisis. This is a critical management model, in a context of crisis, when deploying a field hospital. The structure of maturity for field deployment model consists of five levels of increasing levels of complexity and five major axes, which are: organization's mission (assessment of the situation, implementation, operation and removal), logistics, interoperability (data sharing), daily life (medical Waste Management) and resource management. Furthermore, due to the complexity and their use in times of crisis, Mallek-Daclin et al. (2017) established a method based on a maturity model in the structure and organization of field hospitals. The result is a structure and organization of a maturity model that provides the main axes (Governance – decision making; Logistics – support; and Care – medical services) to be considered and developed in a field hospital, as well as different levels of maturity and its definition, allowing hospital organizations are positioned relative to the development shaft.

The hospital management model viewing efficiency, according to Souza et al. (2009), requires priority controls, information systems associated with costing, value assignment of services and decision making. From this perspective, Batenburg et al. (2014) demonstrated in their studies the creation of a maturity model containing fourteen different sizes and five levels of maturity, based on the Dutch hospital management practices. The proposed model is to evaluate and monitor the size, divided into three elements, called Governance, Risk Management and Compliance Management (GRC). This model addresses a systemic way to obtain quality information and operation of hospital management and its governance.

Oliveira (2015) in his research plan mentions the use of the constructs of *National Quality Foundation* (FNQ) (2013) *Management Process Excellence Model* (MEG) and *Process Enterprise Maturity Model* (PEMM), and their proposed evaluation factors. Hammer (2007) applied maturity model to macroprocesses of supplies and hospital pharmacy. With such a feature, Tontini et al. (2016) highlight the need to evaluate and develop maturity models to reduce costs and improve reliability in the process of purchasing and supply management in hospitals and metal-mechanical companies. The maturity

model proposed by the authors includes the following dimensions: materials' management, procurement planning, selection and evaluation of suppliers and purchasing process. In the same vein, Plomp and Batenburg (2009) show the issue of maturity in purchasing management applied to three Dutch hospitals. The authors present a maturity model with five dimensions (Strategy and Policy, Monitoring and Control, Organization and Processes, People and Culture and Information Technology). The study confirmed a positive relationship between the maturity of the acquisition processes and the performance of acquisitions.

Designed to measure aspects of organizational management, especially the cultural and structural nature, Cleven et al. (2014) presented a maturity model derived algorithmically, based upon empirical data from 129 hospitals in Switzerland. The five maturity levels were made by the following dimensions: Organizational culture; Strategic aspects of the multi-functional management processes; Decision process and structure; Practices and formalization of processes; Information systems. As it can be observed, this study emphasizes the management processes.

For Jaramillo et al. (2015), well-managed organizational environments contribute to interact with each other teams, stimulating cooperation and motivation authentically. Cooperation within hospitals is a crucial factor in the provision of medical services of high quality and efficient processes. In this context, Blondiau (2017) showed in his maturity model it is appropriate to the management gradual improvement initiatives in inter-hospital setting, allowing communication between different professional groups, providing a unifying concept of maturity. The maturity model is composed of three dimensions: quality of cooperation, designing and implementing maturity models in hospitals, and interdepartmental cooperation in hospitals. For the author, the particular model does not address all the relevant issues related to cooperation within the hospitals, but provides a basis for future research in this field.

The conviction of decisions and management practices through the proper use of management models and information systems, contributes to improve the quality of hospital services (Pereira et al., 2012). The quality of services in the hospital may affect the maturity models used for the development processes (Areda et al., 2015).

Lombarts et al. (2009a; 2009b), as part of the research project on "Methods for Evaluating Responses to Quality Improvement Strategies (MARQuIS)", which focuses on aspects that relate to

hospital patients in Europe, develops a scheme to level of quality improvement (maturity) in European Union hospitals. The developed model addresses seven dimensions: Policy, planning, documents (20 items); Leadership (36 items); Structure (19 items); Quality improvement actions in general (8 items); Specific quality improvement activities (20 items); Patient involvement (6 items); Accountability (4 items). This model addresses the particular issue of improvement actions and quality control.

Mettler and Blondiau (2012) propose a *Maturity Model in Hospital Cooperation* [HCMM]. The HCMM can be a basis for measuring the quality of cooperation between a specific hospital and its business partners. This model queries a total of 36 benchmarks, reflecting three distinct organizational dimensions relevant to the ability to cooperate. The first variable, Strategic Layer, measures a hospital's ability to cooperate with external partners. The second variable, Organizational Layer, measures the ability to cooperate within the hospital (i.e. between different departments, wards, etc.). Finally, the third variable, known as the Information Layer, measures the technical capabilities of a hospital to provide the necessary cooperation for an internal and external efficient and effective infrastructure.

Von Wangenheim et al. (2013) define a quality model to guide the development and evaluation of the maturity storage telemedicine systems and routing processes. The organizational maturity, defined based on six points that allow maturity, is evaluated from the level "Level 0 - Immature Organization, up to scale level 5 – Innovative Organization". The definition of joint (dimensions) of basic and extended processes, were taken from Appendix "A" of the rules ISO / IEC 15504-7, which defines an exemplary model of organizational maturity designed for organizations in the software industry. From this perspective, Van Dyk and Schutte (2013) present a telemedicine maturity model involving professionals from five different countries in South Africa. The telemedicine service maturity model proposed by the authors provides a framework designed in three dimensions. First, five areas are defined (variable domain), which provides a holistic view of all the factors that impact the implementation of telemedicine services. Second, the variable telemedicine service is five processes at the micro level, an intermediate level and a process for domain macro level. The third variable is the maturity range, which provides parameters for measuring maturity. The maturity model can be used to measure, manage and optimize the capabilities of a health system, and in so doing, improve the quality and effectiveness of telemedicine initiatives (Van Dyk, Fortuin, & Schutte, 2012).

In addition to these models, we can add the maturity model proposed by Van de Wetering and Batenburg (2014) to explain the quality and performance of the *Filing System and Image Communication* (PACS). The presented maturity model establishes five complementary organizational dimensions: Strategy and policy; Organization and processes; Monitoring and control; Information Technology; People and culture. The survey was conducted with a sample of 64 hospitals that use PACS, i.e. 70% of all hospitals in Netherlands. The researchers recommend that hospitals should follow the model of maturity of PACS, as a strategic perspective of maturity planning to drive a continuous process of change and adaptation.

Although not specifically addressing maturity models, Wagner et al. (2014), developed an instrument for evaluation of quality management systems of hospitals. This instrument measures aspects of organizational management, patients (clients), hospital procedures and people management.

Tarhan et al. (2015) show in their studies a generic maturity model, *Business Process Maturity Model* (BPMM), proposed to assess the quality and maturity of a health institution. The presented maturity model addresses five dimensions: Process management; Business management; Work management; Work performance; Organizational support. The authors demonstrate the lack of a specific maturity model for hospital area.

Although not referring to the specific issue of maturity in hospital processes, Moradi et al. (2016) compare the level of organizational maturity in hospitals with the status of implementation of quality management systems. This study was conducted in 32 hospitals located in Tehran with more than 200 beds. Research shows that there is no significant difference in organizational maturity among hospitals at different levels of implementation of quality management systems, and the average level of organizational maturity can be considered between average and good.

For hospital organizations to present the desired results with respect to the provision of health services to the population, it is necessary that hospital managers conduct periodic evaluations to measure management efficiency (Trivelato et al., 2015). Kirrane (2009) experienced in a department of intensive care of a large university hospital, a maturity model developed with seven dimensions (Risk Management, Collaboration and communication; Guidelines, policy, practical development, external benchmarking, business efficiency and reporting; Leadership and staff empowerment; Research), each

described in terms of four levels of increasing complexity. This model was developed exclusively for the provision of critical care services, using primarily an information system in the clinical area.

With such a feature, Van de Wetering and Batenburg (2009, 2010) developed a maturity model by an information system, to provide services in the management or image archiving. The maturity model of *Picture Archiving and Communication Systems* (PACS) consists of five aspects, identified as: Infrastructure; Process; Capacity of the clinical process; Integrated innovation management; PACS optimized network. The model aimed to achieve synergistic effects in a "film less" environment, particularly for managing digital radiology as a costly enterprise.

Chassin and Loeb (2013) propose a maturity model of hospital service reliability. They developed a conceptual and practical framework for assessing the readiness of hospitals and progress for high reliability. The model contains fourteen components and stages of maturity of the reliability of the offered services. The structure of the maturity model is described based on three dimensions: Leadership (consisting of six components); Safety culture (consisting of five components); Robust process improvement (consisting of three components). Each stage of the model provides hospitals specific guidance on what actions they need to take to move toward a high reliability.

França (2015) carried out a research aimed at understanding the maturity level of services provided in hospitals by information technology area, using the *Knowledge Discovery in Databases* tool to qualify them. It was used the model *Capability Maturity Model Integrated* [CMMI] to identify and certify the services maturity levels, consisting of 34 cases belonging to each of the four domains: planning and organizing; acquire and implement; deliver and bear; and monitor and evaluate.

The maturity model proposed by Schriek et al. (2016) seeks to identify a care pathway in 11 hospitals, based on the facilitator's quality of care, risk reduction, increased patient satisfaction and efficiency in the use of resources in service of health. The maturity model developed to measure a care pathway, was based on the generic maturity model *Care Pathway Maturity Model* (CPMM) for process management. To evaluate and improve the level of maturity of a particular care pathway, the MEPC model was developed with five components: Project; Owners and performers; Infrastructure; Performance Management; Culture. Similarly, Mattos (2017) elaborated a generic model, based on literature review, but to help pharmaceutical supply centers present in hospital units to evaluate the

quality of services provided and the maturity of their pharmaceutical supply processes and distribution of medicines internally in a hospital unit. The maturity assessment model for managing a central pharmaceutical supply has four components: Programming; Acquisition; Storage; Distribution.

Carvalho et al. (2019) point out that the hospital sector is a very complex organization, with oriented knowledge in order to ensure the well-being of patients, improve operational efficiency and primarily ensure the quality of service delivery. The authors mention that implementing a maturity model in hospital practice can help managers identify strengths and weaknesses in order to determine which hospital organization maturity stage is and how it can continuously evolve to a higher degree maturity. Hospital information systems management generally considers possible inaccuracies in their implementation processes. It can be concluded that usually, the systems are going through a maturation process (Rocha, 2011). To characterize these potential inaccuracies, O'Neill (2013) developed a mechanism to characterize the extent of the capacity of the hospital information technology, on an individual basis and on an enlarged basis, using a method of inquiry based on the gradual approach of a given problem in the hospital sector in Ireland. For the author, the use of appropriate evaluation tools is highly recommended, and maturity models exist for many of the different domains of hospital information systems. The maturity model was developed based on the following dimensions: Clinical; Administrative systems; Patient management; Clinical support; Technology; Internal Integration – Administrative; Internal Integration – Clinical; External Integration. The survey showed that 79% of respondents expressed that they were not planning to implement a maturity assessment model and only 14% were using a model. At that point of view, Queiroz et al. (2013) emphasize the importance of investments in the hospital sector in information systems that demonstrate the ability of monitoring, measurement and evaluation of results. The authors mention that management knowledge in hospital organizations tends to be instituted in a slow manner, due to the medical predominance in strategic positions, without proper management knowledge.

With a specific focus on the area of information technology, Rocha (2011) discusses the use of four different maturity models for the management of information systems and technology in healthcare. The author presents concepts associated with maturity models and discusses certain maturity models applied to information and technology management system in the hospital. The *Model Maturity for*

Healthcare Electronics incorporates all service providers associated to the health care process, adaptable to any provider at any level of maturity; The *Maturity Model for Electronic Medical Record* allows us to identify the distinct stages of maturity of the electronic medical record, from auxiliary departmental systems to environments with medical records paperless; The *Maturity Model for Information Systems and Technology* (IST), describes the five stages to the development of IST in hospitals, and to evaluate and compare the different levels of maturity; Finally, the *Maturity Model for Electronic Patient Record*, available for portable electronic devices, the main source of information about the patient.

Weyns and Höst (2012) have developed a maturity model to evaluate and improve reliability of the management processes of information technology, when managing emergencies. The maturity model is defined with four levels of continuous improvement, and twenty-two attributes divided into four categories: Results; Information technology management; Cooperation; Organizational issues. A case study was conducted in two Swedish hospitals, and the results considered valuable for an organization quickly identify its main strengths and weaknesses in the field of management of information technology reliability.

Rohner (2013) presents a maturity model for building and improving hospital identity management infrastructures. The maturity model of health professional's identity management, was created to manage, quantitatively and qualitatively, the identities of patients and professionals. The model includes the dimensions: Responsibility, Organization and Technology. Similarly, we can add the model of electronic medical records of maturity of the patient, directed to the management system of all information related to patients (Priestman, 2007).

Carvalho et al. (2015) present a method to identify and describe the main influencing factors that should be used at different stages of a comprehensive maturity model for hospital information systems management, due to several limitations existing in current models of maturity in the health field. Carvalho and Rocha (2015) mention that current maturity models related to control of hospital information systems management are in an incipient stage of development, being inaccurate and lacking tools to establish and present organized maturity levels. At that point of view, Katuu (2016) mentions in his research the existence of 40 individual health information systems in South Africa, with over 50%

not sticking to any national or international standard. The author highlights the need to implement one system with implicit requirements for managing health records.

Gomes et al. (2016) designed a framework for different management approaches, in order to strengthen the results of investment in information systems and information technology in the healthcare industry. The authors test a conceptual model to identify if the success of a project is a direct result of the influence of a maturity model. The model was set with forty-eight attributes, divided into three categories: Organizational maturity; Project management; Project success. Gomes and Romão (2018) state that the use of health information systems has been recognized as having significant importance in improving the efficiency, cost-effectiveness, quality and safety of medical care. The authors mention that a broad maturity model applied to the health sector can contribute to the quality of information and knowledge management this.

Developed to measure the complexity of hospital information systems, a maturity model proposed by Carvalho et al. (2019) has six stages of growth and progression of maturity (Adhocracy; Starting foundations; Operational performance; Democratic cooperation, Entrepreneurial opportunity, Integrated relationships). It has as objective help to identify and modify the quality of hospital information systems. To certify the desired level of quality of hospital information, Setiawan *et al.* (2014), through the application of ISO27001, evaluated the reliability and security of the medical records information system in a public hospital in Indonesia, assigning the level of maturity 2 with the classification of "repeatable but intuitive." At this level, the processes are described as using procedures and executed by different practitioners.

The *Healthcare Lean Assessment* [HLA], designed as a monitoring tool to provide a diagnosis of the implementation processes at different levels of maturity of Lean Sprint, was developed by Naidoo and Fields (2019) to assist 74 South African public hospitals managers in the implementation of Lean. According to the authors, the HLA tool helps to evaluate each process maturity model, strengthen an approach of continuous improvement, and provide control measures and corrective action. The model includes the Management and Support stages (knowing Lean), Manufacturing (understanding Lean), Patient Flow (thinking Lean) and Organization (Lean culture).

Based on the principles of continuous improvement of the *Capability Maturity Model* (CMM), Williams et al. (2019) developed the *Infrastructure Maturity Model* (IMM) to address the concerns of managers and physicians about investments in information infrastructure in the digital transformation of hospital organizations. The instrument intends to enable hospitals to assess the maturity of their infrastructure in terms of digital transformation, aligning with business outcomes and supporting the desired level of clinical and operational competence. Rated on a model of eight levels (Administrative, Tactical, Fixed, Mobile, Outsourced, Integrated, Contextualized and Orchestrated), the IMM plays the refinement of information processes used on the premises.

Van Zwienen (2019) presents a process for customizing corporate architecture maturity models for hospital organizations. The *Dynamic Architecture Maturity Matrix* (DyAMM) model was used as a reference architecture, validated in the context of seven Dutch hospitals and adapted to the specific domain of hospitals. The *Enterprise Architecture Maturity Model* (EAMM) consists primarily of checkpoints, and then 19 stages are included in the maturity matrix of that model.

Based on a maturity development model, proposed by de Bruin *et al.* (2005), Kerpedzhiev et al. (2019) developed a *Capacity Framework* (CF) that allows hospital professionals systematically to coordinate resources related to bed management. The authors consider the development of this structure as the basis for the creation of a specific maturity model for hospital bed management.

Carvalho et al. (2016; 2017) state that although hospital maturity models reveal several limitations, they facilitate organizational management, including the management of information systems.

Conclusions

The present study aimed to analyze researches related to maturity model in hospital management. The literature analysis showed that most publications present maturity models oriented towards the development or management of information systems. Few are concerned about the development of a general maturity model in the hospital sector, and most of them lack specific maturity models for this

complex segment. The number of publications that study both, maturity models and hospital management, is scarce, highlighting the need to explore this research area.

In this context, Gomes and Romão (2018) state that maturity models should not be directed only to trivial functions, such as supplier evaluation or software development. Maturity models should be used as a means of benchmarking, self-assessment, change management, and organizational learning. The evolution of the maturity of these processes and protocols in hospital management improves the organization's profitability, making them more efficient.

The present study demonstrates that the 41 selected and analyzed publications, published between 2005 and 2019, and categorized in this study as models of maturity through the established organizational dimensions, are essentially related to the technology management dimension, while the other dimensions (Strategy, Structure management, People management and Decision making) achieved homogeneous results. Regarding the thematic approached, the area of management and information technology remains with the highest reference percentage.

It was noted that Maturity Models developed for hospital organizations are mostly related with technical / operational areas, but in a piecemeal fashion. The literature shows that most hospital organizations direct their efforts to the implantation of models of maturity, and less than their evolution.

It is understood the need to expand researches related to the development of comprehensive maturity models for hospital management, through one or more theoretical lenses, properly identifying their components and proposing paths of progression that should be used. There is a consensus that generic maturity models are unsuitable for such organizations, recommending that they should be tailored to the specific needs of complex organizations, such as hospitals. Tarhan et al. (2015) show the absence of a proper maturity model for the hospital area, in order to evaluate the stage of maturity and quality of services provided by an organization of this segment.

The study also makes a significant contribution in terms of qualitative research, through a comprehensive review, analysis and synthesis of the literature on maturity models in hospital organizations. The primary emphasis on bibliographic research, mainly using the specific implementation of maturity models in hospitals, illustrates the emerging nature of this area of knowledge and the need to develop it further.

The information obtained in the research contributes at the managerial level to a better understanding of hospital managers as to the effective maturity models available that can reference the development and implementation of models that represent the specificity of hospital organizations.

The present study contributes to a comprehensive literature review of hospital maturity and management models. Thus, this research has contributions to researchers, professionals, universities and research institutions. This study provides an understanding for professionals who wish to use the models of maturity and hospital management jointly.

Conflict of Interest

No potential conflict of interest was reported by the authors.

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