

UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
ESCOLA DE ENGENHARIA
PROGRAMA DE PÓS-GRADUAÇÃO EM ENGENHARIA DE PRODUÇÃO

**The Economic Enterprise Risk Management Innovation
Program for healthcare organizations: E²RM_{healthcare}**

ANA PAULA BECK DA SILVA ETGES

Porto Alegre, 2018

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Defesa de Tese de Doutorado submetida ao Programa de Pós-Graduação em Engenharia de
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Orientador: Prof. Francisco José Kliemann Neto, Dr.

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Esta tese foi julgada para a defesa de doutoramento pelo Orientador e pela Banca Examinadora designada pelo Programa de Pós-Graduação em Engenharia de Produção da Universidade Federal do Rio Grande do Sul.

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Resumo

A Gestão de Riscos Corporativos (ERM), a partir das publicações da ISO 31000 em 2009 e do guia do COSO em 2007, vem sendo aplicada e adaptada às especificidades de múltiplos mercados. O contexto hospitalar, caracterizado pela necessidade de avanços em sistemas e métodos gerenciais que permitam maior acurácia de informações e sustento na orientação à tomada de decisão, passou a, também, interessar-se pelo valor da ERM. Influenciado pelos programas de qualidade e segurança do paciente e de gestão de riscos assistencial, presentes na cultura hospitalar mundial, gestores estratégicos à frente de organizações de saúde começaram a procurar por metodologias que possam ser adaptadas à complexidade de um hospital e apoiem a implementação da ERM. A literatura prévia ao desenvolvimento desta tese não apresenta um modelo que consolida e orienta a operacionalização da ERM em organizações de saúde, mas destaca em múltiplas publicações a necessidade que os hospitais têm de atentar a metodologias que permitam gerir de forma proativa e estratégica seus negócios, que estão expostos a riscos internos e externos. Motivada pela lacuna descrita, esta tese explorou o mercado brasileiro e norte americano através de entrevistas, estudos de caso e survey, e propôs um modelo global de ERM para organizações de saúde: o E²RMhealthcare. Este sugere requisitos para a operacionalização global da ERM e é fragmentado em 4 níveis: *risk baseline*, *education*, *quantitative* e *governance* que orientam uma implementação gradual, considerando a maturidade de gestão da organização. Formas de como explorar as características do hospital e capital humano para exercer a ERM também foram estudadas, sendo proposto uma relação entre as equipes de avaliação de tecnologias de saúde hospitalar e de ERM no processo de criação de valor da organização através de um mapa de causa e efeito. Como destaque do negócio saúde, essa tese inova propondo o primeiro inventário de riscos corporativos orientado a organizações de saúde que foi validado por gestores de múltiplos países, identificando o risco de ataques cibernéticos como o principal. Por fim, o uso de métodos de análise multicriterial e de custeio por atividade são aplicados como soluções inovadoras para a priorização e avaliação econômica de riscos ao longo dos níveis Baseline e Quantitative do E²RMhealthcare. O avanço do E²RMhealthcare com estas metodologias incorporadas para um software com capacidade de inteligência artificial é deixado como sugestão de trabalhos futuros além da sua real aplicação em múltiplos casos.

Palavras chave: Gestão de Riscos Corporativos, ERM, Gestão da saúde, Economia da saúde, Análise de riscos em saúde.

Abstract

Since the ISO 31000 publication in 2009 and the COSO guide in 2007 Enterprise Risk Management (ERM) has been applied and adapted to the specificities of different business markets. The hospital context characterized by the demand for advances in management systems and methods that allow to improve information accuracy and to support the decision-making process, also became interested in the value of ERM. Influenced by quality and patient safety and healthcare risk management programs presents in the global hospital culture, managers at the top of healthcare organizations started to look for methodologies that can be adapted to the hospital management complexity to support the ERM implementation. The literature, prior to the development of this thesis, does not present a model that consolidates a guide to operationalize ERM in healthcare organizations. Although emphasizes, in multiple publications, the urgency for methodologies that enable proactive and strategic management of healthcare businesses, which are exposed to internal and external risks. Motivated by the described gap, this thesis explored the Brazilian and American healthcare market through interviews, case studies and survey, and proposed a global ERM model for healthcare organizations: E²RMhealthcare. It suggests requirements for global operationalization of the ERM and is organized in 4 levels: risk baseline, education, quantitative and governance that guide a gradual implementation, considering the maturity of the organization management. Different manners to explore the features of the hospital and human capital to operate the ERM were also studied, and it was proposed a relation between the hospital healthcare technology assessment teams and the ERM in the value creation process of the organization through a cause and effect map. Focusing on the healthcare business, this thesis innovates by proposing the first enterprise risk inventory aimed at healthcare organizations that was confirmed by risk managers from different countries. Cyber-attack was identified as the main enterprise risk in healthcare. Finally, the use of multicriterial analysis methods and activity-based costing are applied as innovative solutions for prioritization and economic assessment of risks throughout the Baseline and Quantitative levels of E²RMhealthcare. The progress of E²RMhealthcare with these incorporated methodologies for a software with artificial intelligence capacity is left as a suggestion for future studies, in addition to its actual application in multiple cases.

Keywords: Enterprise Risk Management, ERM, Healthcare Management, Healthcare economics, Risk analysis in healthcare.

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1 INTRODUCTION

Hospital management has been discussed in literature and pursued by hospitals that look for excellence in delivering their services to the society. The complexity inherent to multiple client environment and the diversity of services increases the demand for using practices that enable wide and effective management of healthcare organizations (BLAIR et al., 2001).

Since the publication of the book entitled “*Err is Human :: building a safer Health System*” by the Institute of Medicine of the United States (2000), the spread of the safety and quality culture encouraged the adoption of risk management practices in hospitals. Amongst the reasons leading to this seminal publication, it is worth mentioning the existence of high risks in healthcare environments due to the volume of employees, high degree of interdependence between areas (LEAPE & BERWICK, 2005, CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010), technological complexity and significant volume of standards and laws they are subject (GREEN, 2005, CARE, 2014). Aiming at regulating hospitals regarding safety and management, institutions such as the Joint Commission International (JCI), the American Society for Healthcare Risk Management (ASHRM), the World Health Organization (WHO) and the National Agency of Health Regulation (*Agência Nacional de Vigilância Sanitária - ANVISA*) started to employ efforts to improve patient's safety and hospital management.

The risk management standard, ISO 31000, defines risk as the effect of uncertainty in objects (PURDY, 2010, AVEN, 2011). Risk is defined, in other studies, as the possibilities of different outcomes for a certain situation and refers to the presence of the estimated variability, through distributions of probability or not, on an expected result (AVEN, 2012).

From the identification of the presence of risks in complex management environments, literature has proposed models that aim the management of enterprise risks. Among them there is the one described in the chapter eleven of PMBoK (PMI, 2015), which focus in managing project risks, proposing the use of qualitative and quantitative analysis. The model developed by the Committee of Sponsoring Organization of the Treadway Commission, which defines the key components for using Enterprise Risk Management (ERM), discusses fundamental principles and concepts and suggests a common language for risk classification (COSO; PWC, 2007). Despite widely spread, COSO does not suggest

tools conduct its deployment (SOUZA, 2011) being deemed as a theoretical model, of difficult real application in practice (CARON et al., 2013). There is still the Model for Identification and Management of the Risk Level of Companies (MIGGRI - *Modelo para Identificação e Gerenciamento do Grau de Risco de Empresas*), which, from the previous models, enables measurement for reaching this result (SOUZA, 2011).

The three models mentioned have methodologies that were developed and have been implemented in service companies and large manufactures. For the specific hospital environment, it is noticeable the existence of methods that use mainly COSO (CARE, 2014) to propose methodologies that pursue the expected performance aimed at the specifics of the context of institutions linked to human health (BAKER, 2010).

1.1 Theme and objectives

The development of risk management methods and ERM for hospital environments represents the focus theme of this thesis. The World Health Organization, through the International Classification for Patient Safety, translated the key concepts related to risk management in a hospital environment, suggesting a ranking hierarchy for types of risk involved in a hospital environment. JCI started to consider in its accreditation the execution of practices aimed at risk management in hospitals accredited by it. Carrol (2010), in *Risk Management Handbook for Healthcare Organizations*, consolidated practices and knowledge about the topic, encouraging the dissemination of existing guides. Hospital regulating institutions around the world have issued guides aiming at guiding hospitals in the adoption of practices to turn risk management a habit in hospital management. Among them are worth mentioning: the *Healthcare Insurance Reciprocal of Canada (HIROC)*; the *American Society of Healthcare Risk Managers (ASHRM)*; and the *National Health Service (NHS)*.

The HIROC in 2014 proposed the risk resource guide, *Integrated Risk Management for Healthcare Organizations*. It analyses previous models in order to conceptualize integrated risk management tools and methods. Thus, the result is a proprietary methodology, which has a risk management software for hospitals that show interest.

Amongst the contributions that differentiate the HIROC model from the others, it suggests a risk taxonomy, showing key types of risk which a hospital is subject to. In addition, agreeing with the use of the classification proposed in COSO, the taxonomy suggested by HIROC indicates consideration of 11 categories: Care; Working Environment;

Financial; Leadership; External Relations; Technology; Facilities; Regulatory; Education; Research; and Community Medicine. These categories allocate 118 types of risk present in a hospital environment. However, if there is no information on the severity, impact or frequency of the risks evidenced in the taxonomy and, regardless of the theoretical foundation on the awareness about the use of risk management practices being detailed in the document, the source of the classification suggested in the taxonomy is not clear.

ASHRM proposes an ERM encouraged by the concept that risk managers may be able to generate proactive changes in a hospital. This position is based on reviews of concepts on the topic and indicates that systemic use of ERM practices has as principle the education of employees aiming at aligning everybody to the strategy of the organization (ASHRM, 2006). Its first action is educating all employees regarding risk management concepts and the opportunities it rises in a hospital environment (ASHRM, 2006).

From the dissemination of the concepts involving management, the ASHRM (2006) model, mainly based on COSO (2007), suggests that risk plan strategic planning is unfolded, so that risks are linked to the strategic objectives. It uses a ranking of six risk categories: operational; financial; human; strategic; legal; and technological. Then, the organization must define the level of appetite and risk it is willing to accept for each of the categories.

Along the ASHRM (2006) suggestions are pointed that the identification of risks in the strategic unfolding must be continuous. Risks must be assessed regarding their impacts on the organization as a whole and, according to severity, plans must be established to manage them. There must be a person responsible for management who, according to existing possibilities, must avoid, accept, reduce or share critical risk. Intending at coordinating the progress of risk management actions, there must be a *Chef Risk Officer*, who should be an experienced professional, with a wide view of all categories and, mainly, of the correlations between hospital services and areas.

The NHS (2008) developed a guide aiming at providing guidance to use risk management practices in hospital environments (NATIONAL PATIENT SAFETY AGENCY (NPSA), 2008a). The guide is intended to answer four questions: what may present danger; how it may happen; with what frequency; and if any action is required. The guide suggests, with the cyclical use of these four questions, that hospitals implement their risk management models with a corporate approach, valuing the existing opportunities to work with the correlation between services and sectors. Risk assessment is focused, in this

guide, in qualitative analysis of severity from the crossover between occurrence impact and probability, not emphasizing the relation with strategic unfolding.

In addition to the guides and models suggested by the aforementioned institutions, some authors have developed studies on this topic. Among them Haney, Church, & Cockerill (2013) proposed an ERM model presenting as main differentiator the adaptation of widespread models to the specifications of Canadian healthcare environment. The authors explored the current barriers by trying to implement, in hospitals, models that were already in practice in other market niches, and their model was structured in five phases: (i) organizational risk network; (ii) corporate risk management framework; (iii) strategic planning and decision process; (iv) implementation; and (v) assessment.

The first phase focuses on the connection between operating managers of the hospital and the remaining *stakeholders*, so that by exchanging information it is possible to establish the operational risks and their impact on several stakeholders. The ERM framework is aimed at spreading the practices in the environment and answering questions about how risks are managed; how they are related to the decisions; and how they relate to the vision, the mission and the values. In the third phase the authors are aware that ERM is essential for the strategic decision making of the company, therefore the assessed risks must be associated to the strategic goals of the hospital. The implementation phase must be characterized by effective communication between the parties, documenting what is being done, the sense of urgency among the managers and everyone's engaged involvement. Finally, the assessment must have performance indicators that enable assessing risk mitigation in all levels, with effective cost reduction or improvement of the quality of operational services (HANEY et al., 2013). Regarding the importance of communication, Kaplan et al. (2016) suggest that its presence among multiple healthcare professionals and with the patient is essential for the clinical or management decision making, exposed to risks, to contribute to the capacity of adding value of a healthcare organization. It is noticeable the value of incorporating communication practices and adopting an information system when building the ERM.

In the pursuit of guidance for implementation, the model proposed by Haney et al. (2013) does not present a real case, neither it suggests tools that enable its effective implementation. Amongst the indications, the authors stress the importance of considering cultural and regional differences in the construction of an effective model.

Figure 1 consolidates the models proposed by the Canadian (HIROC), English (NHS) and North-American (ASHRM) in order to understand what is already carried out in enterprise and assistance risk management practices by these institutions.

Name	HIROC	NHS - NPSA	AHSRM	Haney et al. (2013)
Origin/Country	Canada	England	United States	Canada
Monetary quantification	In Parts	No	In Parts	In Parts
Definition of tolerance degree to risk	Yes	No	Yes	Yes
Use of CRO	Yes	Yes	Yes	Yes
Cultural/management/innovation change	Yes, the hospital culture will enable sustaining the ERM and integration of everyone.	Yes	Yes - the hospital culture will enable sustaining the ERM	Yes - the hospital culture will enable sustaining the ERM
Stratifications between areas	No - it identifies risks from strategic goals of the hospital without directing them to specific areas	It uses the word domain to indicate the types of risks: human resources, quality, marketing, strategy, finance. It does not make clear how it carries out the identification process, not making possible to conclude whether stratification is made per area in the search for domains or the search for domains is carried out in general.	Yes (Strategic Planning, Internal Audit, Risk Management, Budgeting, Acquisition Management and R&D) are areas that must get involved in the ERM process. It identifies risks per category (risk grouping - operational, clinical, strategic, financial, human capital, legal/regulatory, technology and hazard) and relates them to the areas.	Yes. The author proposes that, in order to be able to identify corporate risks in a hospital, it is key to identify with the working networks.
Process view	No, but it evidences the importance of having a relationship between assistance risk management and ERM. Therefore, an integration of strategic management with operational areas is required.	No	Only when dealing with the risk.	Yes

Figure 1 - Previous methods of risk management in hospitals

From the initial contextualization and mentioning of some studies already carried out, the main objective of this doctorate thesis is to proposal, considering the literature and international practical cases, an Enterprise Risk Management model for healthcare organizations.

The specific objectives are:

- (i) Identifying state-of-the-art literature on the topic and propose innovations aiming at ERM operationalization in healthcare organizations;

- (ii) Understanding and assessing the existence of ERM practices in hospitals in, at least, two countries with distinct economic and political characteristics;
- (iii) Identifying and ordering requirements, activities and methodologies that guide the gradual implementation of ERM in healthcare organizations;
- (iv) Proposing an enterprise risk inventory based on the literature and expertise of Brazilian and North American healthcare risk managers;
- (v) Identifying opportunities to share personal background of the healthcare organization for the feasibility of ERM activities, making the process more sustainable;
- (vi) Defining the map of value creation of ERM for the healthcare organization;
and
- (vii) Proposing solutions to rank risks and to conduct economic analysis oriented to estimate the economic impact of enterprise risks;

1.2 Methodological Procedures

This research has an applied nature, given it aims at solving the problem of implementing ERM in healthcare organizations (BOAVENTURA, 2009). Regarding the approach, there is a qualitative discussion, where data arising from case study procedures, participant observation, interviews and literature reviews are treated, generating essential information for the construction of the results. Regarding the goals, there is an exploratory research, which provides deepening in the topic that is close to uniqueness due to the level of novelty existing in literature basis and implementation cases in the world (YIN, 2005).

The methodological procedures of the thesis are fragmented in the structure of articles. The first article focuses in a qualitative study, mixed procedure exploratory, systematic review and case studies with seven Brazilian hospitals. The second article includes 8 semi-structured interviews with 8 hospitals in the United States and 7 Brazilian hospitals, followed by a qualitative analysis of data, with the Nvivo software for Mac and proposal of an ERM model for hospitals. The third article involved the data absorbed throughout the first and the second and was added with a review of the literature on Hospital-Based Health Technology Assessment (HB-HTA) and analysis of literature content and previous studies of this thesis. Its purpose is identifying how HB-HTA and ERM may share human capital and activities and, therefore, contribute to value creation in the hospital. Finally, the fourth article, through the analysis of content of the interviews conducted in

articles 1 and 2 and previous ERM guides followed by a survey applied to risk managers of hospitals, proposes an inventory of enterprise risks of healthcare organizations.

Figure 2 details the procedures to build the thesis and, in the sequence, there is the detail of the objectives of each article, respecting the objectives of the thesis previously mentioned.

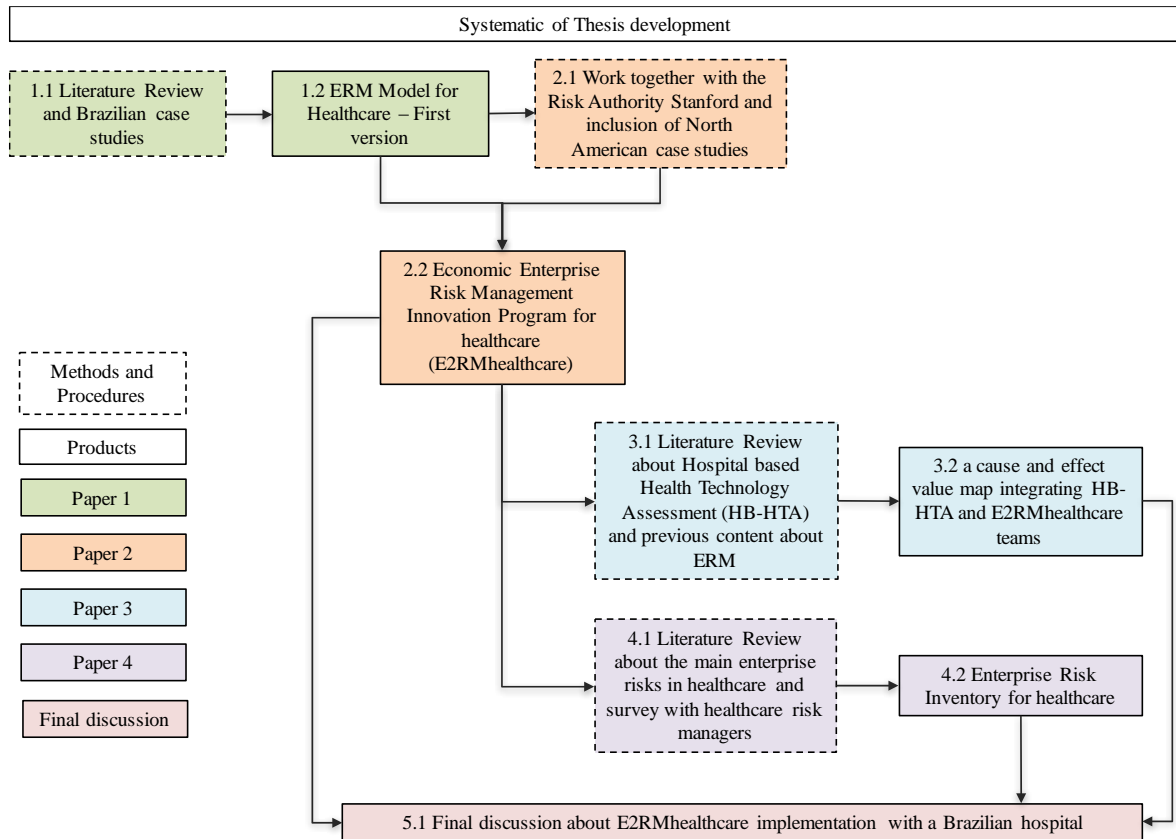


Figure 2 - Research method

The first article is comprised of procedures of systematic review of literature and semi-structured interviews followed by participant observation in seven Brazilian hospitals. Its purpose is developing a preliminary ERM model for hospital environments based on the literature and in the expertise of managers of Brazilian hospitals. The questionnaire used is described in the Appendix A.

Article two involved approaching a hospital risk management consulting company (The Risk Authority Stanford), identified in the systematic review of literature. With their support, eight hospitals in the United States were added to the study. Semi-structured interviews were conducted by the researcher and the consultant of the company using the questionnaire in Appendix B. The hospitals in Brazil were contacted again in order to refine and update some information. Qualitative data analysis was conducted with the Nvivo

software for Mac with the fifteen transcribed interviews. The purpose was responding to the objective established for this article, which is analyzing how hospitals in the United States and Brazil are structuring and implementing ERM processes in their management structures and then propose a review of the ERM model for healthcare organizations. As a result, the Economic Enterprise Risk Management for Healthcare (E²RMhealthcare) was proposed, followed by a guide of implementation activities, suggestion of managers that should be involved and complexity levels of each activity.

At this point, the thesis reaches its main purpose of proposing an ERM model aiming at meeting the complexity of healthcare organizations. However, it was identified throughout its development the need to go deeper into some specifics of the sector: opportunities to enable the implementation considering the human capital that the hospital may explore in other activities; showing how systemic use of ERM contributes to the creation of a safer environment, more likely to create value; and identification of the main corporate risks healthcare organizations are exposed to. Exploration of these specifics stresses of how E²RMhealthcare is developed in a manner that is oriented to healthcare organizations. It is believed that its adaptation to other markets may be feasible, however it demands greater detailing of how its operationalization should be conducted and what specific characteristics of each market need to be further explored. Articles three and four explored the highlighted specificities.

In the article three, the data sources of the interviews with the fifteen hospitals and the review on ERM were added with a review of the literature on HB-HTA. Then the multiple data sources were subject to a content analysis with Nvivo and also of multiple matrices identifying common characteristics and opportunities to share human capital. As main result, a matrix that correlates the implementation principles of E²RMhealthcare with those previously published of HB-HTA and details how the human capital of the hospital may be shared for the feasibility of these two processes (ERM and HB-HTA); and a cause and effect value map that identifies how the ERM and HB-HTA processes contribute to the value creation of the organization.

The article four explored the creation of an enterprise risk inventory. In order to do so, the data sources of the interviews were added with guidance on the types of risk of COSO, ASHRM, HIROC, NHS and AON to build an enterprise risk inventory of healthcare organizations with twenty-eight risks. In the inventory, each risk is defined, exemplified and

related to an impact form: financial, social, reputational or in the patient. The inventory may be seen in the Appendix C.

After the inventory was developed, a survey was created on Qualtrics system, and respondents were invited to indicate whether they strongly agree, agree, do not have an opinion, disagree or strongly disagree that such risk is an important corporate risk of healthcare organizations. A question was created for each of the twenty-eight risks (Appendix D). The survey was applied throughout the annual congress of ASHRM in Seattle, in October 2017 and, also, sent through direct mailing from the researchers to executives and risk managers of hospitals. Data analysis were conducted in SPSS and enable identifying the prioritization hierarchy of corporate risks of healthcare organizations, in addition to validating that the twenty-eight risks are recognized by the interviewees as important corporate risks of healthcare organizations. This information is an important input to conduct E²RMhealthcare and represents an innovative characteristic and applied specifically to the healthcare context.

Finally, using a case study in a Brazilian hospital in São Paulo and the consulting company (The Risk Authority Stanford) practices a discussion on conducting the implementation of E²RMhealthcare was presented. A risk ranking methodology using Multicriteria decision analysis and a suggestion to assess enterprise risks with real financial data through the application of Time driven activity-based costing methodology are presented.

It is worth mentioning that regarding this thesis, relating to the research project with the Brazilian hospital, the project was approved in the ethics and research committee of the hospital and submitted to *Plataforma Brasil*. The consulting company The Risk Authority Stanford agreed to collaborate with the research (Appendix E contains the agreement letter). The other companies involved in Brazil and the United States agreed to participate in the research and did not demand approval from ethics committees.

1.3 Limitations of the Study

Amongst the limitations it is worth mentioning the lack of deepening in the identification and review of clinical risks regarding the specificities of the study of medicine. This study encompasses solely the positioning and relation that clinical risk management has with ERM.

The thesis does not present application of the proposed model. Part of it was conducted in case studies and enabled some progresses and discussions presented throughout the study. However, its presentation in full is not explored in this document as well, due to the fact that it presents strategic and confidential information of the companies. This reason also contributed to, despite being a guidance of the proposed model, not performing the assessment of the economic impact of the presence of ERM in the healthcare organization; it was solely discussed.

Finally, the countries with greater involvement and exploration in this research were Brazil and the United States. Thus, generalizations for Europe, Asia, Oceania and Africa must be preserved. Updates of this study started with other continents may contribute to a state-of-the-art global ERM model for healthcare.

1.4 Structure of Thesis

This thesis is unfolded in seven chapters. The first chapter presented the topic, grounds, objectives, methodological procedures and limitations of the study. Then, chapters two, three, four and five present the articles comprised in this thesis. The chapter six presents the final discussion on the implementation of the proposed model. Finally, chapter seven contain the conclusions. All references used are presented at the end of the final conclusions. The Appendix F presents the actual publications from this research.

2 A PROPOSED ENTERPRISE RISK MANAGEMENT MODEL FOR HEALTH ORGANIZATIONS

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Abstract: Healthcare organizations are environments with high management complexity and subject to a constant exposure to risks. Enterprise risk management (ERM) has been studied and applied in different economic environments with the aim of improving organizational performance. However, the health sector still suffers from a lack of attention in this context, in particular with regard to the need for a high degree of financial transparency and for the establishment of process-orientated management, and this provides the motivation for the study described in this paper. An ERM model for health organizations is proposed, based on a systematic literature review and on seven case studies in Brazilian hospitals. An approach to economic risk assessment using indicators such as the cash flow at risk and the variability of costs and receipts from the proposed model is suggested. The health organizations involved in the case studies all interpret ERM as a source of information contributing to corporate governance, and the indicators listed provide constructive data for improvement-driven decision-making. Given the interest expressed by the organizations involved, further application and validation of the proposed model in subsequent studies is suggested.

Keywords: Enterprise risk management; Risk management and health; Corporate governance; Economic risk analysis.

2.1 Introduction

The widespread adoption of risk management (RM) practices in hospitals has been stimulated by the dissemination of a security and quality culture following the publication of the book entitled *To Err is Human: Building a Safer Health System* by the U.S. Institute of Medicine (2000). Among the motivations behind this seminal publication, a number stand out: the existence of high risks in health environments due to the large numbers of staff; the

high degree of interdependence between different areas of activity (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010); the technological complexity of the procedures involved in health systems; and the large numbers of standards and laws to which these procedures are subject (TROYER; BRASHEAR; GREEN, 2005). With the intention of developing a uniform approach to security and management across different healthcare systems, organizations such as the Joint Commission International (JCI) and the American Society for Healthcare Risk Management (ASHRM) have started to devote efforts toward the improvement of patient safety and hospital management.

Conveying value to patients must be the main objective of healthcare delivery in a health organization, with this value being defined as the results achieved for each dollar spent (KAPLAN; PORTER, 2011). Management that is balanced and guided by value must be among the strategic priorities for the leaders of a health organization: while the clinical body attributes value to the quality of its practices, the executive administration focuses on realizing the value generated by its financial resources (ORVIK, 2016). Porter (2016) presented the following unification of the two pillars of value perception: on the one hand, when value is perceived and continuously improved, patients and suppliers benefit and the economic sustainability of the hospital increases; on the other hand, when high quality is assured, value increases and economic results are generated (PORTER; LARSSON; LEE, 2016).

Enterprise risk management (ERM) is an approach to facilitating value-focused management that enables financial transparency and increases the efficiency of health enterprises, in particular by developing a management strategy driven by business values (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010; TROYER; BRASHEAR; GREEN, 2005). In the context of a hospital's corporate management, the implementation of ERM practices, although still at an early stage, has been described in the literature as a strategic approach to improving service quality (DAMODARAN, 2008)(HANEY; CHURCH; COCKERILL, 2013) and to guaranteeing the financial wellbeing of health organizations (GALLAGHER et al., 2006). When considering ERM as the subject of this study, the model developed by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) (COSO, 2007), which is responsible for the dissemination of ERM concepts, was selected. This model has influenced authors such as Damodaran (2009), Schiller and Prpich (2014), and Cagliano et al. (2015) in their development of studies exploring the economic assessments that are enabled by systemic and strategic RM.

Although it is widely used, the COSO model does not provide tools to facilitate its application (SOUZA, 2011, CAGLIANO; GRIMALDI; RAFELE, 2015), because it is considered a theoretical model that is difficult to implement in practice (CARON; VANTHIENEN; BAESENS, 2013; SCHILLER; PRPICH, 2014). With the aim of filling this gap, the Model for Identifying and Managing the Degree of Risk in Companies (MIGGRI) is based on the concepts of the economic management of risk presented by Damodaran (2009), together with the necessary tools, in order to evaluate the risk involved in an enterprise and in its business units.

In hospital environments, one of the reasons of using models based on ERM is to improve performance while taking account of those features that are specific to hospitals in contrast to other organizations (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010). The World Health Organization (WHO), through the International Classification for Patient Safety, has interpreted the main concepts related to RM in hospitals and has suggested a hierarchy categorizing types of risk. The JCI has started to consider as part of its accreditation procedure the execution of practices orientated around RM in accredited hospitals. Other regulatory organizations for hospitals around the world have laid down guidelines with the purpose of enforcing practices that will turn RM into a matter of routine for hospital managements. These organizations include the Healthcare Insurance Reciprocal of Canada (HIROC), the American Society of Healthcare Risk Managers (ASHRM), and the UK National Health Service (NHS).

The book *Risk Management Handbook for Healthcare Organizations* (CARROLL, 2009) also stands out. It aims to adapt the concepts of RM and ERM already employed in different business environments to the healthcare context and to provide some guidance to hospitals and managers who wish to implement ERM. This book highlights the improvements to risk investigation and the economic benefits that ERM can provide, but it does not present any sort of complete guide to ERM or the orientation that should be adopted with regard to its application. To remedy these deficiencies, the study described in this paper has as its main objective the development of a preliminary model of ERM for hospital environments. The specific objectives are to provide a theoretical basis for each step of the proposed model through a systematic literature review (SLR) and to develop the proposed model in collaboration with professionals practicing RM in Brazilian hospitals

Hospital management must take account of the complexity of a hospital's financial structure, with costs being concentrated on indirect resources and with multiple sources of

revenue (SOUZA, 2013). Improving the financial health of hospitals and developing methods that allow better management of such complex environments are essential tasks in the current economic climate, where both minimization of costs and improvement of quality are key aims (GALLAGHER et al., 2006; TROYER; BRASHEAR; GREEN, 2005). The main justification for the research reported here is the need to understand how hospitals have been organizing themselves to assist regulatory bodies and improve their performance.

2.2 Research Methodology

This research uses an SLR together with case studies to construct a realistic environmental model. In the first phase, the SLR is used to establish the theoretical basis of the model. In the second phase, case studies of JCI-accredited hospitals and other organizations are performed to assess how the ERM methods listed in the literature are implemented in practice. In the final stage, a preliminary ERM model is proposed based on the results from the first two phases.

For the SLR, the following guidelines adopted in the studies by (TRANFIELD; DENYER; SMART, 2003) and (KITCHENHAM; CHARTERS, 2007) were used: (i) definition of the research problem and selection of the search criteria (keywords); (ii) selection of the main sources for investigation; (iii) selection of major studies; (iv) critical evaluation of their results; and (v) synthesis. Thus, the research began in a number of databases using the keywords *enterprise risk management* and *hospital or health* for research published between 2005 and 2015 considering only articles in English, Spanish, or Portuguese. A total of 40 articles were found (4 in PubMed, 33 in Scopus, and 3 in Science Direct). Repeated papers were then eliminated and the titles of the articles were evaluated to exclude those focusing on themes that deviated from the objective of this study, such as clinical medicine or technical medical errors, neuroscience, use of ERM in research organizations that do not involve healthcare or movement of patients, and research on specific cases of implementation of technologies that have no goals related to ERM application. This left for analysis 26 articles that were aligned with the research objectives.

On the basis of this SLR, a preliminary model was developed in a modular form, with economic risks being measured through a procedural and value-oriented approach to ERM. Preliminary studies were also suggested to highlight the importance of each component of the model in facilitating ERM in health organizations.

With the objective of involving real hospitals in the construction of the model, JCI-

accredited Brazilian hospitals were contacted, since these were listed by a magazine *America Economica* (2014) as the best hospitals in Latin America. In addition, although they were not accredited, some other hospitals were also selected because they had RM teams. The group of hospitals selected for the study were heterogeneous in terms of geographical location, size (i.e., number of beds), revenue, and accreditations, in order to allow determination of whether these characteristics have any effect on RM. In total, seven health organizations were studied. Their characteristics are summarized in Figure 3.

Health Organizations	Number of beds	Classification	Medical School	Number of staff	Accreditations
A	660	Private	Yes	3900	ONA 2 e Gaúcho Program of Quality and Productivity
B	842	Public	Yes	6000	JCI
C	380	Private	No	3150	JCI
D	346	Private	No	2400	JCI e ONA
E	292	Private	Yes	930	-
F	615	Private	Yes	12000	American Association of Blood Banks, American College of Radiology, College of American Pathologists, Foundation for Accreditation of Cellular Therapy, ISO 14001, JCI, OHSAS 18001
G	451	Private	No	6000	JCI, Accreditation Canada International, ISO 14001, OHSAS 18001, CARF-Accredited

Figure 3 - hospitals interviewed

Individual interviews were conducted with the employees involved in the implementation of RM and with the executive directors; in four cases, on the suggestion of the hospital, in addition to the financial director or enterprise risk manager, the clinical risk manager was also interviewed. The interviews were conducted by the researchers personally and had a duration of two hours. The questionnaire used was prepared on the basis of the results of the SLR and the previous experience of the authors, who have been working with ERM for the last five years. At the end of each interview, the preliminary model was shown to the interviewee, and the opinion of the latter about the ERM was obtained. The interviews were complemented by direct observations by the researchers, allowing them to gain some understanding of the routine RM practices at the hospitals involved in the study. Contact was maintained with the main professionals involved so that any ERM action at each hospital could be captured as it occurred. It should be noted that although some hospitals have medical care RM departments, in others the initiative for implementing ERM has come from

the executive board (legal and financial), in the context of the organization's strategic planning and involving staff from a number of disciplines.

The information obtained was documented on a spreadsheet to facilitate its analysis. This information was separated into the following classes: general information; risk management; ERM; economic evaluation; and opinion. In this documentation, an attempt was made to link the views expressed by the interviewees with the theoretical results found previously, with suggestions about the preliminary theoretical model being highlighted. On the basis of the case studies, it was possible to evaluate how Brazilian hospitals are dealing with ERM in practice, compared with the results previously published in the literature.

2.3 Results and discussions

In this section, the results obtained in each of the phases described above are presented and discussed.

2.3.1 Systematic Literature Review

The SLR allowed identification of what has been documented on ERM. From the 26 articles that were analyzed, it could be seen that ERM was used mainly in American hospitals (20 papers), with some use in Canada and England (2 papers each) and Australia (1 paper). (One paper did not fit with the research topic, since it was focused on veterinary hospitals.)

From the studies found in the SLR, it was possible to observe the presence of the following phases suggested in COSO (2008) and in ISO 31000 (PURDY, 2010) as being common to all implementations of ERM: contextualization; technical analysis of risk; economic risk assessment; and treatment and monitoring of risk. However, it should be noted that none of the models of ERM described in any of these studies focused on health organizations.

2.3.2 ERM Contextualization

The relationship between ERM, corporate governance, and strategic management of hospitals is considered to be the starting point for proactive management with an orientation toward performance improvement in health organizations (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010). Under the assumptions of corporate governance, one task of ERM is to provide monitoring of strategic settings and thereby contribute to the economic sustainability of an institution, which is a fundamental aspect of value creation (CORE; HOLTHAUSEN; LARCKER, 1999).

For ERM to be applied in a value-focused way in association with financial and service efficiency as part of executive management (ORVIK, 2016), it must be possible to monitor interrelated decisions that are of interest to shareholders and investors.

To achieve this situation of management autonomy that allows the generation of information for governance, the position of the ERM team in the organizational hierarchy should be immediately below executive board level. It must have direct connections with the other large-scale structures into which the hospital is stratified, including legal, financial, healthcare, and quality, among others, so that management is procedural in nature, covering the interconnections between the different hospital activities (KICKLIGHTER; MILLER, 2011).

With the ERM department being positioned below corporate management, it is thus given autonomy to exercise its role of managing processes across the corporate management structure. In addition to this positioning, the literature indicates that the ERM team should be managed by a Chief Risk Officer (CRO) with expertise in strategic positioning of the business, knowledge of the tactical and operational processes involved, and good ability to interact with different levels of the organizational hierarchy.

The following subsections describe ERM in terms of three modules based on the stages described in ISO 31000: technical analysis of risk; economic risk assessment; and treatment and monitoring of risk.

2.3.3 Technical Analysis of Risk

The relevance of procedural structure is due to the strong presence of risks at points of interconnection between different parts of the hospital structure, such as communication between teams (GALLAGHER et al., 2006). When hospitals are organized into departments, the risks in individual departments do not arise in isolation (CARROLL, 2016): risks in one department are related to those in other departments, and this interdependence must be analyzed synergistically as part of strategic management (HANEY; CHURCH; COCKERILL, 2013).

Therefore, it is suggested in the literature that, when the processes are mapped, those aspects that might be bottlenecks in the treatment flow should be identified. Such aspects are characterized by the involvement of multiple professionals, the use of highly complex equipment, or the need for scarce resources (TEOH; CHEONG, 2008). Identification of risks should be focused on these bottlenecks, taking account the factors suggested in COSO

(2008). Thus, the first stage of this risk analysis technique does not involve any economic risk assessment.

2.3.4 Economic Risk Assessment

It is pointed out in the literature that when structuring the ERM in procedural form, it is necessary to pay attention to the flow of value among hospital areas and manage this in order to incorporate any possible variability of healthcare costs (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010; GALLAGHER et al., 2006; REMUS, 2008) . The way in which value is delivered to the patient is determined by the various stages of the cycle of care in the hospital (KAPLAN; PORTER, 2011b).

It is worth including in the ERM a procedural approach that has previously been suggested for business units (DAMODARAN, 2008, SCHILLER; PRPICH, 2014), with the addition of modules to facilitate operationalization of ERM in complex environments such health organizations that are characterized by multiple clients and processes (REMUS, 2008).

With the objective of achieving ERM based on value, Celona et al. (2010) at the Medical Center of Stanford University proposed a procedural model that considers the value flow in terms of a trade-off between value creation and value protection. According to these authors, overprotection of an organization can lead to opportunities being missed, while, on the other hand, when investing in opportunities, risks must be managed because they may affect the financial health of the hospital. Therefore, the implementation of an ERM must involve a balance between benefit and cost, as indicated by, Courson (2007), Hillard (2012), and Haney et al. (2013).

Celona et al. (2010) believe that for implementation of ERM, the following are essential: (i) a top-down approach directed at value; (ii) a focus on security based on identification of risk events; (iii) a decision analysis addressing systemic risks and correlations among different areas of value creation arising from the opportunities identified by the practice of RM; and (iv) implementation of an indicator of appetite for risk. For these authors, the value flow in a hospital is designed to meet any event that may have an economic impact on the organization as a whole. With regard to point (iv), it should be noted that defining a degree of appetite for risk is important because it provides a parameter of comparison for the hospital, facilitating evaluation of its performance with reference to a previously established standard (COURSON, 2008).

However, although the model of Celona et al. (2010) is based in value and economic outcome, it has been criticized because it does not indicate how a financial manager should evaluate the risk in a hospital or estimate the variability in cost arising from risk events.

2.3.5 Treatment of Risk Monitoring

Following the analysis and evaluation stages, the ERM procedure is completed with the treatment and monitoring of risks. With regard to this aspect, it is important to emphasize the need for participation of all those involved in the hospital's organization, and therefore the need for employees to be trained and educated about ERM (MILLER; MIGINSKY; CONNELLY, 2012). It is also worth highlighting here the need for an organizational culture based on educating professionals in ERM, as pointed out by Haney et al. (2013) and Bruney and Salter (2014), who have shown that for ERM to be effective it should be constructed by those directly involved in the activities of an organization.

The existence of connection with governance can be seen by considering together the reasons that stimulate the implementation of ERM: financial transparency (TROYER; BRASHEAR; GREEN, 2005, CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010) the need for rapid innovation with regard to a hospital's procedures the possibility of medical errors and the consequent need for legal protection (GALLAGHER et al., 2006); the possibility of corruption among professional staff (BURNABY et al. 2011); an increase in the number of elderly patients (KICKLIGHTER; MILLER, 2011); and the management of family members with various religious and cultural backgrounds. Information about financial transparency, the presence of corruption, and medical errors is highly relevant when establishing institutional governance.

2.3.6 Motivations and Theoretical Justification for ERM Implementation

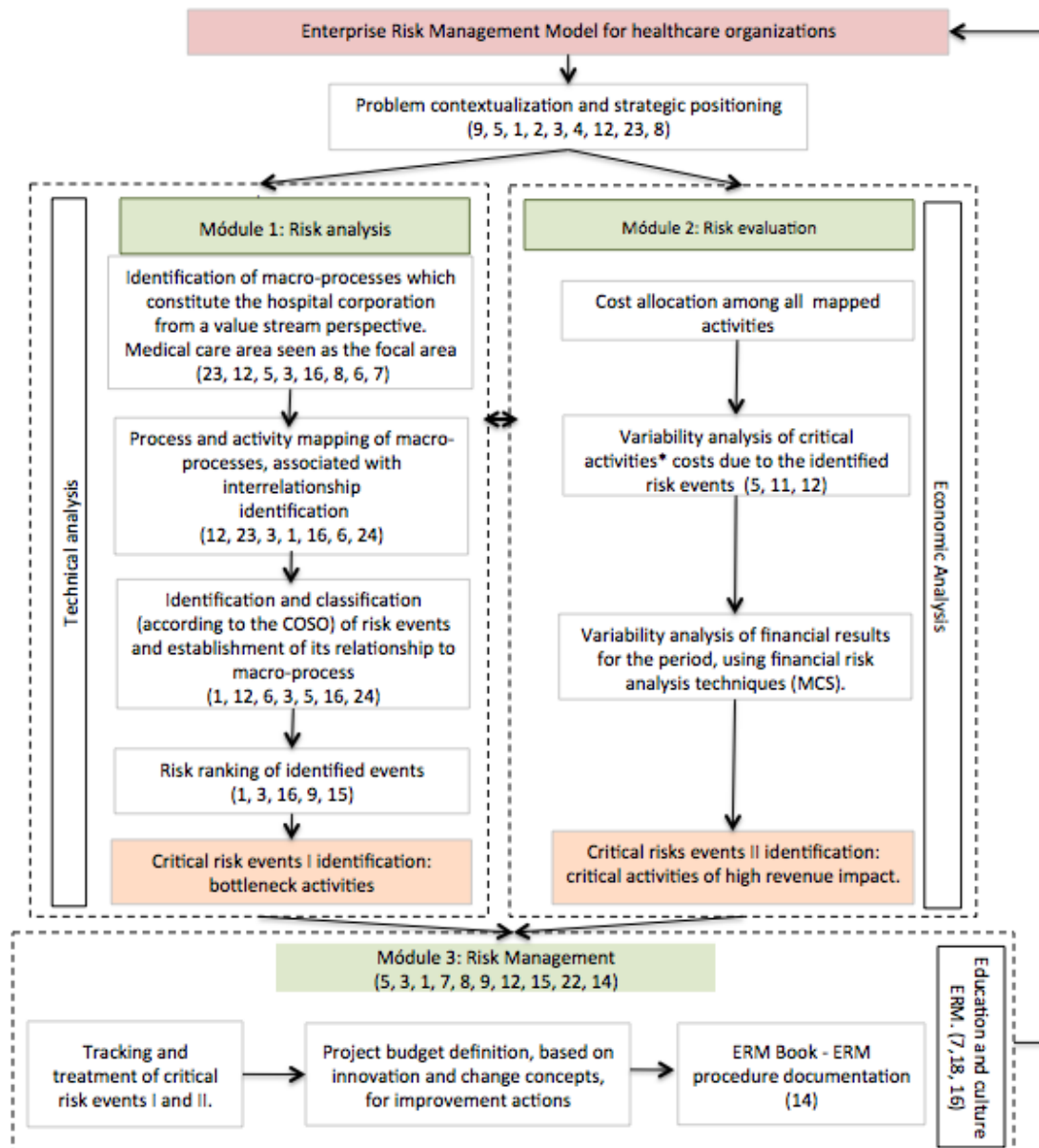
Figure 4 Fi illustrates the characteristics described in the text and listed as premises or justifications for the ERM implementation. The characteristics listed by authors as motivating or influencing investment in ERM have been classified as justifications. The characteristics identified as favoring the facilitation of ERM have been categorized as premises.

Characteristics	Description	Authors
Benefit x Cost	Justifications	(TROYER; BRASHEAR; GREEN, 2005), (REMUS, 2008), (KICKLIGHTER; MILLER, 2011), (HANEY; CHURCH; COCKERILL, 2013)
Future opportunities		(TROYER; BRASHEAR; GREEN, 2005), (COURSON, 2008), (GALLAGHER et al., 2006), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010)
Improvement of the Information Flow		(GALLAGHER et al., 2006), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010), (MILLER; MIGINSKY; CONNELLY, 2012)
Financial transparency		(TROYER; BRASHEAR; GREEN, 2005), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010)
Synergy among teams	Premises	(TROYER; BRASHEAR; GREEN, 2005), (TEOH; CHEONG, 2008), (GALLAGHER et al., 2006), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010), (KICKLIGHTER; MILLER, 2011), (MILLER; MIGINSKY; CONNELLY, 2012), (HANEY; CHURCH; COCKERILL, 2013).
Culture and education		(TROYER; BRASHEAR; GREEN, 2005), (COURSON, 2008), (TEOH; CHEONG, 2008), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010), (SODOMKA; SPAKE; RUSH JR, 2010), (HANEY; CHURCH; COCKERILL, 2013)
ERM book		(KICKLIGHTER; MILLER, 2011)
Process and value flow vision		(TROYER; BRASHEAR; GREEN, 2005), (COURSON, 2008), (GALLAGHER et al., 2006), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010), (KICKLIGHTER; MILLER, 2011), (HANEY; CHURCH; COCKERILL, 2013)
Risk Events in interconnections		(REMUS, 2008), (TEOH; CHEONG, 2008), (GALLAGHER et al., 2006), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010), (KICKLIGHTER; MILLER, 2011),
Profile of degree of acceptance of risk		(REMUS, 2008), (CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010), (KICKLIGHTER; MILLER, 2011)).

Figure 4 - Premises and justifications for ERM implementation

2.4 Theoretical model proposition

The initial model shown in Figure 5 was based on an SLR of the literature on the guidance laid down in COSO (2008) and ISO 31000.



- | | | |
|---------------------------------------|-----------------------------|------------------------------|
| 1 - Bruney and Salter (2014) | 8 - Remus (2008) | 18 - Gaffey (2009) |
| 2 - Oppenber (2013) | 9 - Courson (2007) | 19 - Abke (2009) |
| 3 - Haney et al. (2013) | 11 - Woodruff (2005) | 20 - Dónnell (2013) |
| 4 - Hillard (2012) | 12 - Celona et al. (2010) | 21 - Maley et al. (2006) |
| 5 - Kicklighter and Miller (2011) | 14 - Kazucata et al. (2006) | 22 - Sodomka et al. (2010) |
| 6 - Burnaby, Hass and O'Reilly (2011) | 15 - Troyer et al. (2005) | 23 - Gallagher et al. (2009) |
| 7 - Teoh e Chong (2008) | 16 - Miller et al. (2012) | |

Figure 5 - ERM Model based on Literature

2.4.1 Contextualization and Strategic Positioning

With regard to the model structure relating ERM to the strategic positioning of the hospital, the literature confirms that this connection is essential (KICKLIGHTER; MILLER, 2011). It is in this context that the suggestion is made that the ERM department be positioned

immediately below the level responsible for strategic decision-making in the organizational structure.

This department should be formed by professionals from multiple disciplines who together have mastery of the routine procedures of the hospital and knowledge of the organization's tactical and strategic positioning. The model suggests that this team be managed by a CRO who, according to the literature guidelines, has easy communication with the different levels of the hierarchy, as well as sufficient leadership capacity to act across corporate management and gather essential information for decision-making by the corporate management based on ERM.

2.4.2 Module 1: Technical Analysis of Risk

Following the guidelines from Gallagher et al. (2009) and Celona et al. (2010) for managing risks by targeting better value management, a picture of the processes involved in the functioning of the health organization is proposed in terms of their responsibilities and functions and of the interactions among them. Figure 6 illustrates such an organizational structure based on the proposal by Celona et al. (2010). Basing this structure on value and processes allows risks to be thought of in a corporate way and not as being isolated in departments (HANEY; CHURCH; COCKERILL, 2013). In addition, the flow of information is identified and mapped in conjunction with the activities. This facilitates an overview of the process and permits the identification and management of risks linked to business strategy.

The placement of the medical care process as central is relevant since it represents the industry to which the organization belongs. The other processes exist in relation to the feasibility of medical care. The main function of a health organization is to provide appropriate assistance to patients while ensuring both quality and safety. Consequently, the process-based view aims to identify risks for each process and especially at the interconnections between these processes, as can be seen from the SLR and illustrated in Figure 2 as a premise for the operationalization of ERM. Therefore, identification of risks will occur at the level of the activities involved in each process, as well as the activities involved at the interconnections, as shown in Figure 6.

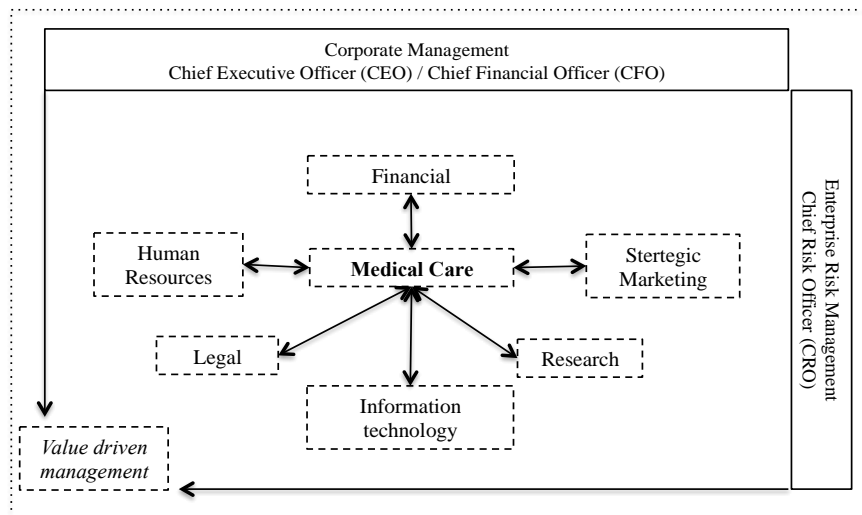


Figure 6 - ERM process structure

Some studies and guidelines suggest that a health organization should be divided into various processes related to value: medical assistance; research and teaching; people management; information technology and systems; strategic marketing; financial and administrative; and legal (ASHRM 2006; NHS 2008). The value-based flows established from these processes may involve activities that require the collaboration of teams from different processes. The possibility of risks caused by disruptions to these flows emphasizes the need to consider synergy among the teams to carrying out ERM, and the need to identify connection points between different areas as well as potential bottleneck activities. Thus, the hospital should approximate from what Bromiley (2014) and Eckles (2014) have indicated as being extremely relevant in the ERM, namely, considering risk as a whole and not in isolation in specific sectors (ECKLES; HOYT; MILLER, 2014, BROMILEY et al., 2015;).

The next step involves mapping the risk events in the flow activities. Staff in positions involving decision-making and at operational levels must be surveyed to allow a systemic analysis and the creation of adequate typologies of risk. This procedure begins with the identification of risks related to the bottleneck activities, which are critical, and to the connection points, which can be critical (COURSON, 2008; MILLER; MIGINSKY; CONNELLY, 2012). At the end of this activity, those risks that are linked with critical points of the flow are defined and mapped, indicating criticalities.

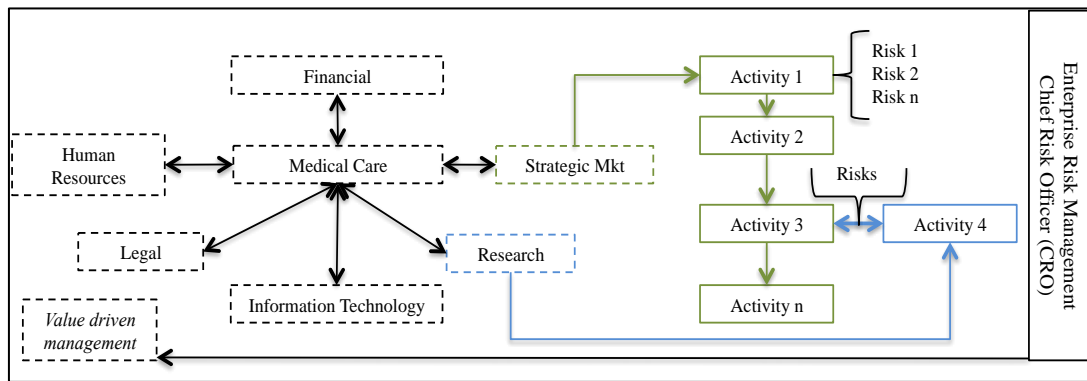


Figure 7 - Risk identification among activities

The prioritization considers probability and impact through risk analysis methods suggested by COSO (2007) and the studies considered in the SLR. Among the most common methods is the use of probability and impact matrices. Knowledge from experts is used for these methods, as can be seen in the studies by Malekdar (2012), Bahrami et al. (2012), and Penning-Rowsell et al. (2014). Finally, as a result of this analysis, the critical risks are identified and are found to be represented most strongly at the intersection between probability and impact, linked to critical activities of the hospital processes. Through this result, it is possible to observe the inter-relationships between different areas and processes, as well as the enterprise risks. This analysis model was also used in previous studies, including ASHRM (2006), NHS (2008), Haney et al. (2013), and Celona et al. (2010).

2.4.3 Module 2: Economic Risk Assessment

Influenced by the importance of value creation, ERM implementation carries in its structure an interaction between protection and creation of value, or between the benefit of managing risks over the cost of management (TROYER; BRASHEAR; GREEN, 2005). The search for financial transparency also provides a justification for the use of ERM and thus encourages the best treatment of costs and revenues.

To evaluate risks from an economic perspective, the processes identified in Module 1 must be measured in terms of economic factors. The results of Module 1 suggest the use of *activity-based costing* (ABC) for the mapped flows. In adopting this method for the distribution of indirect costs, it is acknowledged that multiple products consume the same activities and resources of the company structure in different proportions (COOPER; KAPLAN, 1991). Thus, when using ABC, the cost of a product or service is determined more accurately, especially when it is formed from a portion of indirect resources (COOPER; KAPLAN, 1991).

Waters et al. (2001) drew conclusions regarding the relevance of financial unit costs of hospital services through ABC from a study of a hospital in Peru. They emphasized the importance of this approach for providing the best pricing of services and gathering arguments as a basis for negotiating with governments concerning support for public health systems. Kastberg and Siverbo (2007), in addition to working with current expenditures by activity, expanded the concept and used it to analyze activities in Swedish hospitals. They demonstrated that the implementation of such methods in the financial management of a hospital streamlines the consumption of resources and consequently improves the hospital's results.

The use of ABC enables identification of the cost of critical activities, which can be expensive with only a few risks attached, or can be less costly with many associated risks (WATERS et al. 2001). This approach is necessary because a small risk event in an expensive activity may represent a significant monetary variation, while the presence of many risks in a less expensive activity can represent a significant variation in the process cost. All those risks linked to critical activities are defined as critical risks II, and a variation is projected in the cost likely to arise, given that the risk events and the associated costs are known, which allows the total variability that may occur in the hospital cost to be estimated.

Working in this way is a step forward compared with previous studies that, in spite of stressing the importance of considering economic factors in ERM implementation, did not indicate how to operationalize the measurement of the process in a cost-effective way. This model, through Modules 1 and 2, and by proposing the management of the hospital according to processes, enables proactive assessment of variability in the hospital finances, allowing anticipatory action of managers and thus favoring better economic performance. Risks are identified according to the criticality of processes, allowing the triggering of actions for prevention and ensuring greater knowledge about the future results of the health organization.

Following this, the appetite for risk is stipulated, or the cost variation that the organization accepts is specified (COURSON, 2008; KICKLIGHTER; MILLER, 2011). In this regard, the financial and strategic management of the hospital must be involved to determine how much value the hospital is willing to offer, assuming some risks while, on the other hand, preventing financial breakage due to the need to protect value.

2.4.4 Module 3: Treatment and Monitoring of Risks

Using the results of the technical analysis and the economic risk assessment, the hospital must analyze which risks have the greatest effect. The health organization should seek to mitigate hazards and exploit the opportunities present for each risk event (BROMILEY et al., 2015).

When identifying critical risks from an economic and technical point of view, there is a need to develop plans for systematic monitoring. Those responsible for the risk stability of named critical risks I (technical) or II (economic) must be identified in order to maintain the expected performance of the hospital. When considering the procedural perspective and the identification of critical points and activities, the use of the concept of continuous improvement and the management of innovation and change are indicated in order to improve procedures and consequently reduce the criticality of risks. Finally, documents on ERM should be developed into an ERM book to educate the professionals involved and disseminate the ERM culture throughout the hospital.

The cycle of phases described in the proposed model, as previously mentioned, follows the stages of COSO and ISO 31000. What is sought in this model is a precise matching of the system to the environment, which requires a differentiated approach to its management as well as a means for addressing the uncertainty associated with people's lives.

2.5 Case Studies

The case studies involved seven Brazilian health organizations. Personal visits were undertaken, and at each of these organizations the healthcare and corporate risk managers were interviewed; if such positions did not exist, the financial and administrative directors were interviewed instead. The interviews were complemented by examinations of systems, spreadsheets, and reports generated by the RM of the organizations, in order to understand how ERM was established.

The interviews focused on understanding the positioning of ERM in hospitals and on interpreting how organizations structure ERM, considering the method's main phases: contextualization and strategic positioning; identification and technical analysis; economic assessment; and treatment and monitoring.

2.5.1 ERM Positioning in Hospitals

The organizations with ERM in progress are A, C, and F. About one year ago, these

hospitals invested in developing ERM practices, but none implemented a particular model or provided results for assessment. It is worth noting that all of these hospitals claimed to include initiation of ERM as part of their strategic plans. The motivation for this was improvement of the financial sustainability of the organizations, in line with the view of Porter (2010, 2016), according to which the economic success and the transmission of value within a health organization depend on ensuring the quality and safety of the healthcare service. Organizations E, B, and C took the view that ERM should be at the center of the hospital culture, emphasizing the importance that has been given to this task.

On the basis that discussion of ERM in organizations should be based on strategic goals, it was possible to divide the hospitals into two groups depending on how ERM was conceived: either as a process oriented to both strategic and departmental management or as a process oriented to strategic management alone.

In the first group, the models have a more qualitative character and less capacity for economic measurement; risks are identified from strategic planning, estimated in terms of economic impact and probability without detailed analysis, prioritized through matrices, and treated and monitored through action plans that involve the areas responsible for risks. In this format, ERM is allocated in parallel with the administrative management of the organization, it has the power to take strategic decisions, and it considers the processes and the interconnections among the departments of the corporate structure. This format was perceived and valued by organizations A and D.

The view that the ERM should be oriented to both strategic and procedural management, according to the model proposed in this study, is based on studies by Gallagher et al. (2009), Celona et al. (2010), Haney et al. (2015), and others. This was seen in organizations B, C, E, F, and G. Among them, we can highlight C, F, and G. Private organizations emphasize the need to be managed by processes in order to allow the hospital to function more efficiently. It should be noted that this second form for structuring of ERM also includes the modular logic of the first format. There is a need to link with the strategic management, to tie risks to strategic objectives but manage them by processes.

Therefore, as Figure 6 illustrates, ERM involves management across the corporate structure. It has autonomy and aims to identify risks at points of interconnection between processes as well as risks related to costly activities that can limit the generation of value within the organization.

In exploring the operationalization of process-oriented ERM, the importance of viewing the healthcare process as central is emphasized. The interviewees from organizations B, C, E, and G stated that the business of the hospital is healthcare, although it receives support from other areas, such as legal, financial, and research, to deliver to the patients the best model of health service. This is how the business adds value and sustains itself economically. In this sense, the positioning of healthcare RM as an important pillar of ERM was validated in a unanimous vote; it is involved in ERM and, like other processes, must deliver results to managers and the strategic board.

2.5.2 Relationship between ERM positioning and the ERM Model proposed

This subsection describes how institutions are positioned in relation to a few points in each phase of RM. Figure 8 illustrates the analysis performed, noting when the feature is present in the organization.

Contextualization of ERM		Autonomy and decision power	Below the executive management and with CRO	Related to Compliance and Auditing	Motivated by the improvement of processes	Includes the healthcare risk management	Works in parallel with the healthcare Risk Management	Valued by the institution
Strategic and departmental ERM	A		x	x	x		x	
	D		x	x	x		x	
Strategic ERM by processes	C	x	x	x	x	x		x
	F	x	x	x	x	x		X
	G	x	x	x	x	x		x
	B		x	x	x		x	
	E		x	x	x		x	x

Figure 8 - ERM context in hospitals

It is noteworthy that only in hospitals with ERM based on processes can the healthcare RM be absorbed by ERM. However, the interviewees were unanimous in their opinion that this should always happen. This contradiction can be explained by the fact that in all the organizations, ERM starts from the healthcare RM, as it is set up and encouraged by the institutions that regulate the hospitals. Therefore, ERM starts after the establishment of a culture of ensuring the quality of care and safety of patients, which provides a basis for the specific characteristics and distinct objectives of the ERM.

The positioning of the ERM structure should also be highlighted. In all hospitals, when ERM is established within the existing structure, it is related to the area of compliance and

auditing, below the executive administration and motivated by the improvement of processes in a systemic approach.

In the identification module and the technical analysis of risk module, the identification and dissemination by hospitals of an RM culture was investigated. The use of reputable guides on the subject and the recognition of the need for such a culture in the institutions that regulate the hospitals were also incorporated in the scope of this part of the study. Figure 9 illustrates this aspect of the study for the hospitals.

ERM identification and technical analysis	Linked to Strategic planning		Spread in the hospital culture	Use of risk committees by the hospital and risk owners	Encouraged by JCI, Anvisa or OMS	Proactive Risk identification with the use of COSO	Corrective Risk identification with the use of COSO	Involvement of multidisciplinary professionals
Strategic and departmental ERM	A	x		x	x		x	
	D	x			x		x	x
Strategic by processes ERM	C	x	x	x	x	x	x	x
	F	x	x	x	x	x	x	x
	G	x	x	x	x	x	x	x
	B	x		x	x		x	x
	E	x				x		x

Figure 9 - ERM identification and analysis in hospitals

Significantly, in practice, RM is still reactive. In spite of the interviewees who mentioned the importance of managing the organization with an orientation to value and to guaranteeing the expected performance, management actions still take place on a reactive basis. Again, this practice may have started originally with healthcare RM, which is based on notification of risk events that have already occurred. Only hospitals G and F in this study support healthcare RM proactively, while hospitals F and C can manage only corporate and business risks proactively.

The connection with strategic planning deserves attention. This was brought up in the interviews as an essential factor in the evaluation of ERM. The importance of autonomy and the relationship between ERM and senior management were mentioned. Without a close relationship, the value given to ERM is easily lost in the routine of teams, which must be multidisciplinary in nature to meet the demands of ERM. For this bond to exist, it is necessary to establish risk owners who may be inspired through goals.

The economic risk assessment module emphasizes the difficulty of knowing the real costs for all hospitals. In this regard, six of the interviewees mentioned the goal of

implementing the ABC method in the upcoming years to improve the allocation and management of costs. Migration to ABC requires mapping of processes, which is a starting point for the establishment of management by processes. With regard to this aspect, only the hospitals that direct strategic ERM according to processes are able to assign variability to costs. The others consider the economic risk assessment only from the perspective of variable income.

ERM Economic Assessment	Difficulty of knowing the real costs		Designed as a variability and revenue function	Essential for the existence and dissemination of ERM	Essential for the value creation of the health organization	Rises the financial transparency	Encourages the processes rationalization	Linked to the strategic deployment and goals
	A	x						
Strategic and departmental ERM	A	x	x		x	x	x	x
	D	x	x			x		
Strategic by processes ERM	C	x		x	x	x	x	x
	F	x	x	x	x	x	x	x
	G	x		x	x	x	x	x
	B	x		x		x		
	E	x		x	x	x	x	x

Figure 10 - ERM economic assessment in hospitals

Another relevant point is the relationship between the economic assessment and the dissemination of ERM. Some interviewees (F, C, G, B, and E) noticed that the ERM can only receive universal attention from everyone when its monetary parameters are widely known. Knowledge of economic variation by all those involved offers an incentive for the streamlining of processes and makes the hospital more efficient. Finally, the increase in financial transparency is mentioned as an objective for all hospitals when adopting ERM practices.

The implementation of ERM models generates multiple strategic factors for those interested in contributing to the corporate governance of health organizations. With regard to this aspect, the treatment and monitoring of risk modules investigated how the hospitals achieved continuous improvement on the basis of the information generated by ERM. Figure 11 presents some specific aspects examined in each study.

Treatment and Monitoring of ERM		Generates a budget for the improvements	Generates plans for the short, medium and long term	Assign goals to committees and owners of risks	Generates information for corporate governance	Must be documented and allow easy access to all	Present in educational and training programs	Should feed strategic goals for the organization
Strategic and departmental ERM	A			x	x	x	x	x
	D	x		x	x			x
Strategic by processes ERM	C	x	x	x	x	x	x	x
	F	x	x	x	x		x	x
	G	x	x	x	x	x	x	x
	B			x	x	x		x
	E			x	x			x

Figure 11 - ERM Treatment and Monitoring in hospitals

The wealth of information provided by the ERM must justify the action plans aimed at continuous improvement. Some hospitals mentioned the need to establish a budget (F, D, C, and G) and timescale (F, C, and G) on the basis of which these plans can be discussed at a strategic level and effectively carried out in future exercises. Considering the need for the administrative board's approval to implement the projected actions, hospitals recommend the allocation of operational owners to risks and actions.

The existence of multidisciplinary groups distributed throughout the hospital contributes to the feasibility of treatment actions and improvement. These groups commonly take the form of committees.

Finally, the importance of education and dissemination of ERM culture in the organization's routine was mentioned. For this reason, information about the improvements achieved and handouts explaining concepts and risk mapping on intranets and notice boards within easy reach of the relevant professionals were cited as illustrations of success in hospitals A, C, G, and B.

Thus, the ERM cycle is completed, linking monitoring to strategic management and guiding decisions directed at continuous improvement of healthcare processes. Furthermore, the information generated can be translated into monetary values that can then be fed into analysis by interested parties and are also important for successful corporate governance in the hospital.

2.5.3 Review of the proposed Model

Through these case studies, a model of ERM for healthcare organizations was consolidated, reviewed by experts, and given a firm theoretical base. As shown in Figure 12, the ERM structure should be situated below strategic management, together with areas of compliance and auditing. This positioning in the hierarchical structure became clear after the interviews. In hospitals that are actively developing ERM, this governance model has made possible the autonomy necessary for ERM because it plays a role in managing operational information and provides competitive differentials for senior management.

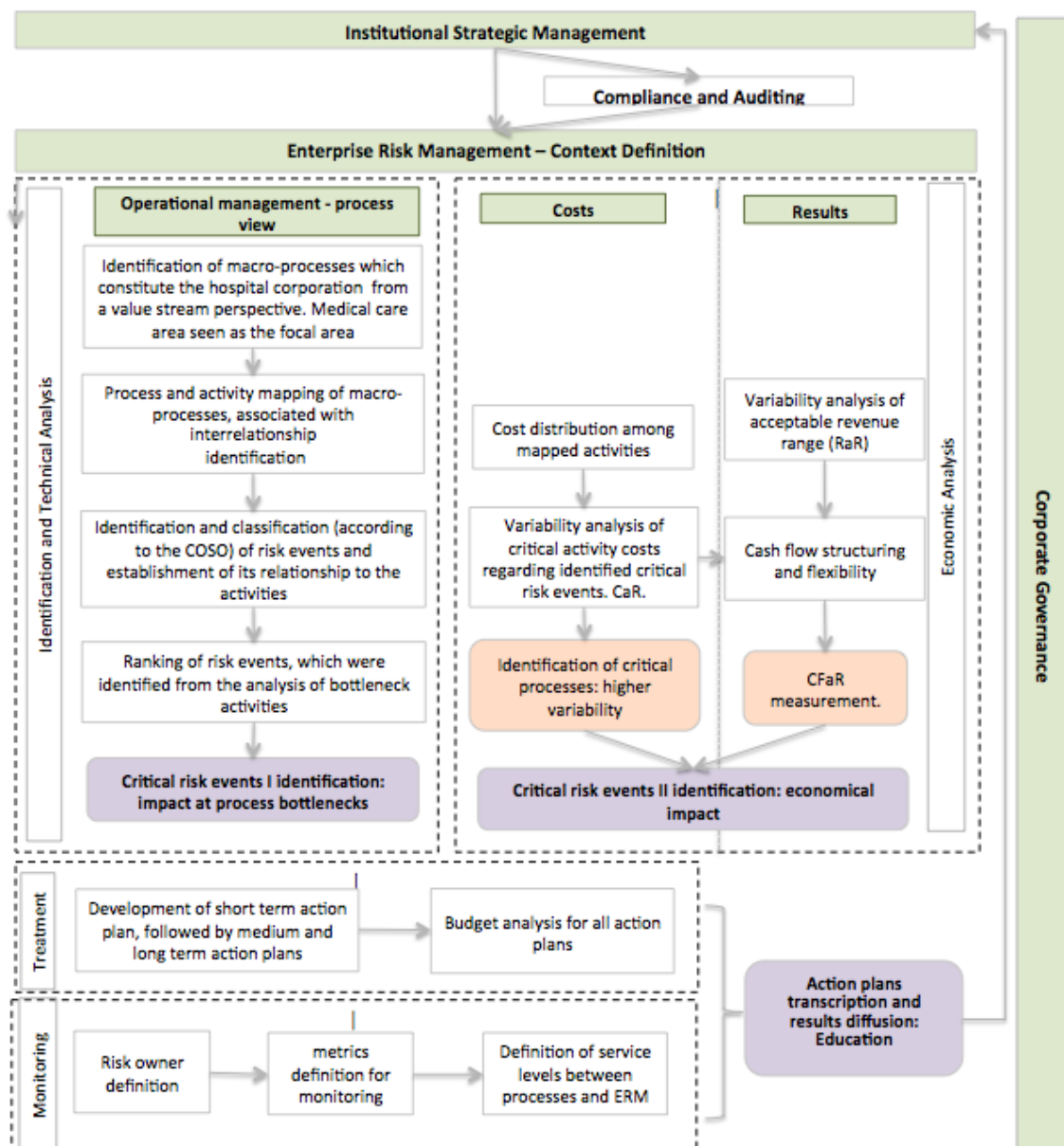


Figure 12 - ERM Model for health organizations

In the economic assessment module, a number of issues were raised. The first refers to

the inclusion of variable revenue, where the main information that managers want to receive is an estimate of the variability of the results in terms of the difference between revenues and costs. Therefore, the use of ABC was seen as making a positive contribution to the organization of healthcare by all respondents, who were aware that, in current cost center structures, there is a lack of precise information. Thus, study of the variability of costs was validated and encouraged by the case studies. To deliver results on variability, the variability of revenue was added to the costs. This approach was inspired by the practice in those hospitals in which ERM models related to both strategic and departmental management, because these identify risks associated with the revenue from the strategic objectives.

The proposed model examines what has been sought and done by organizations to provide complete management with regard to a health organization's enterprise risks. As products of economic assessments, the following indicators are delivered: the indicator cost at risk (CaR), which enables identification of the processes that most influence the variability of total costs; the revenue at risk (RaR), indicating the value placed on risk with regard to revenue; and, finally, the result, cash flow at risk (CFaR), which represents the organization's cash flow under risk, defined as the difference between revenues and costs. For this reason, an evaluation was made of how much the working capital can either compromise or contribute to the result of an organization in a given period. This evaluation can be done using Monte Carlo simulation, which considers the information on risk variability in the cash flow.

As additional information and relevant to strategic decision-making, at the end of the economic assessment, the calculated CFaR must be compared with the CFaR strategy defined by the organization, which represents the appetite for risk. The appetite for risk was emphasized in the case studies because it was considered the definitive strategic factor in the ERM results. The appetite for risk also has an impact on the value that ERM represents in the hospital. From the case studies, it was possible to identify that the organizations that take more risks are looking first for new methodologies that can help them be more competitive and can enhance their ability to deliver good patient experience. The way to assess risks, the level of detail, the proportion of employees that will be involved, the investment, and the risk education that will be incorporated into the organizational structure are all related to the hospital's appetite for risk. When this is higher, the tendency is to believe in the value of ERM and to try to incorporate it into the hospital culture as rapidly and as sustainably as possible. If the appetite for risk is smaller, then, although managers still believe that it is

important, they are waiting for some benchmarking and further inspiration to decide on how much can be invested and on the proportion of professionals' involvement. At the same time, given that this topic is new for this business environment, it remains a challenge to find ERM in health organizations for benchmarking and to identify the main risks involved in healthcare, and this is a topic that deserves further exploration by researchers and health managers.

Once again, it is possible to see the connection between ERM and strategic management, which can take advantage of operational information from the model to better guide actions for improvement. Trotta et al. (2013) emphasized this by proposing the construction of a balanced scorecard (BSC) to evaluate the performance of educational programs in hospitals. The need to assess aspects that are subjective and also related to the quality of teaching and processes led these researchers to recommend the use of methodologies such as the BSC to evaluate performance focused toward continuous improvement of the educational system in the health sector. The budget complements the plans, which must be structured in such a way as to produce an appropriate design for the required actions.

The final module concerns monitoring. In this regard, the interviews revealed the importance of integrating ERM, the operational managers involved in each process, and the strategic management. The definition of risk owners is essential so that the CRO only follows and monitors the implementation of the actions by the risk owners. The latter must be professionals with leadership roles in the processes for which the risks are being analyzed. To establish the relationship with control, there should be structured agreements between each process and ERM.

Finally, ERM should be disseminated throughout the hospital culture. The case studies have reinforced this perception, since the interviewees mentioned the need to ensure that employees are wedded to the use of ERM. For this reason, training, documentation, and periodic dissemination of results should be established to help integrate the model into the organization.

Is important to highlight that the model described here was constructed based on results described in the health literature and results of case studies and is oriented to application in health organizations, where tacit knowledge and the involvement of many professionals ensure successful care of patients. However, the main concepts and phases involved, the

position of ERM in the organizational structure, and the techniques for implementation of ERM that are described here could also be applied to similar business environments in which a variety of professionals with high tacit knowledge are involved, such as universities and innovation companies.

2.5.4 Tools, Techniques and Methods applied to the ERM

As a second product of the case studies, the main tools, techniques, and methods that health organizations have used in their RM practices were examined. Figure 13 shows the tools, techniques, and methods used in each phase of the proposed ERM model, together with the phases suggested by ISO 31000.

Phases of ERM - ISO 31000	Phases Models ERM – health organizations	Tools, techniques, and methods	A	B	C	D	E	F	G
Contextualization	Enterprise Risk Management and Contextualization	Brainstorming	x		x	x	x	x	
		Strategic planning analysis	x		x	x	x	x	x
		Matrix Strengths, Weaknesses, Opportunities and Threats	x		x	x	x	x	
		Matrix Severity Urgency and Trend	x			x			x
Risk identification and analysis	Identification and technical analysis	Brainstorming	x	x	x	x	x	x	x
		London Protocol	x						
		Ishikawa	x	x	x		x		x
		5-why	x				x		x
		Failure Mode and Effect Analysis (FMEA)	x	x	x	x	x		x
		Matrix rank		x	x	x			x
		Severity Levels Definition		x		x	x	x	
		Root cause analysis	x	x	x	x	x		x
		What if							x
		Layer of Protection Analysis (LOPA)							x
Risk Assessment	Economic Assessment	Cost analysis in occasional events	x	x	x	x	x	x	x
		Revenue Analysis	x		x	x	x	x	x
		Appetite for risk - acceptable variability			x				x
		Analysis of criticality from an estimation of financial impact			x		x	x	
Treatment	Treatment	Action Plans Definition	x	x	x	x	x	x	x
		Preparation of budget for the action plans							x
Monitoring	Monitoring	Definition of Risk Owners in each process		x	x			x	x
		Risk Maps	x	x	x	x	x	x	x
		Metrics links to strategic goals and objectives			x	x			x
		Dissemination of results and education	x	x	x				x

Figure 13 - ERM Tools and techniques

The operationalization of this conceptual model essentially concerns how, to what purpose, and by whom the techniques illustrated in Figure 11 are used. Analysis of Figure 11 also reveals how little the tools and methods of economic assessment are used. In spite of the organizations' emphasis on the need for better management and sustainability of financial health, the metrics of control and management practices do not target this. When the interviewees were asked about this, their responses unanimously mentioned the difficulty of establishing economic parameters for the processes involved.

With regard to motivational factors, among the seven case studies, only one showed no

interest in being the subject of a study to validate the preliminary model through implementation in its corporate governance structures. The gains in financial transparency, procedural management, and visualization of flaws and opportunities in a proactive way were mentioned by managers of the other six hospitals involved. Nonetheless, among private organizations, a greater commitment and dedication to this issue can be noted in their declarations of the need for financial sustainability provided by effective processes in their structures.

2.6 Conclusions

Motivated by the application of ERM to health environments, this study has proposed a conceptual model of ERM for health organizations, which explores the importance and how should be valued this theme by health organizations. The current literature on the subject has been analyzed and managers of a number of hospitals in Brazil have been interviewed.

The need for health institutions to seek value from quality assurance is clear from both the literature and the interviews, which justifies the proposed establishment of an ERM model that integrates the technical and economic management of healthcare processes. ERM is applied across the board and is subjected to the strategic positioning of the organization and with autonomy to manage on the basis of processes, providing informational support to corporate governance. Opportunities and gaps are identified proactively, and the multiple disciplines and inter-relations involved in the routine of health organizations are taken into account.

The quest for economic sustainability and financial transparency is identified as an essential and motivational factor for investment in ERM. By contrast, the difficulty in establishing better economic parameters for the organization, again emphasizing the importance and appropriateness of the suggested model, is also noted. Although this study has a theoretical foundation, the proposed model is aimed at applications in real healthcare environments. In this context, the interest from six out of seven interviewees in the practical validation of the model through analysis and operationalization of its application in participating hospitals is gratifying.

The main techniques for implementation of ERM in healthcare have been explored and documented in the framework of this study. On the basis of the results presented here, risk managers from different hospitals can look for appropriate techniques that enable them to

conduct ERM in their organizational structures, depending on the level of detail and complexity that a hospital is ready to accept.

In terms of application of the model, one thing that could be explored further with regard to complementing the implementation of ERM in a health environment is to define the main risks involved in this business market. The identification of enterprise risks is a starting point for RM. However, the risk factors that are common to all health organization have yet to be ascertained. Research on different hospitals implementing and using this new ERM model can help answer this question with the aim of furthering ERM investment and implementation.

In addition, this study has provided a new guidance framework for the application of ERM. Although the environment considered here was that of a health organization, future work could be aimed at adapting the method to similar business environments with a high level of complexity and involving multiple professionals with tacit knowledge. In this way, this new approach could provide a common state-of-the-art ERM orientation for different markets and managers.

3 ERM FOR HEALTH CARE ORGANIZATIONS: AN ECONOMIC ENTERPRISE RISK MANAGEMENT INNOVATION PROGRAM (E²RM_{HEALTH CARE})

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Abstract: In recent years, healthcare organizations have looked to Enterprise Risk Management (ERM) for novel systems to obtain more accurate data on which to base risk strategies. This study proposes a conceptual ERM framework specifically designed for healthcare organizations. We explore how hospitals from the United States and Brazil are structuring and implementing ERM processes within their management structure. This study incorporates interviews with 15 chief risk officers (eight from the United States, seven from Brazil) with qualitative data analysis using Nvivo. The interviews confirm that adopting ERM for healthcare organizations has gained momentum and become a priority, and that the demand for risk economic assessment orientation is common among healthcare risk managers. We propose an ERM Model for healthcare (E²RM_{healthcare} – Economic Enterprise Risk Management in Healthcare) divided into four maturity levels and complemented by an implementation timeline. The model is accompanied of a guideline to orient the ERM gradual implementation, including orientation to perform risk economic assessment.

Keywords: Enterprise Risk Management; Healthcare management; Risk analysis; Risk Education; Corporate Governance.

3.1 Introduction

In 2016, Porter et al., asserted that the overarching goal of healthcare organizations should be achieving better value in healthcare. The authors measured value as health outcomes achieved per dollar spent (PORTER; LARSSON; LEE, 2016). Value increases when organizations focus on outcomes, such as by adopting systematic processes to improve

efficiency (KAPLAN, ROBERT S. HASS, DEREK A. WARSH, 2016). Process improvement at the care management level results in cost reduction and consequent increases in future value (MCBAIN et al., 2016).

Enterprise Risk Management (ERM) is a process that sets the strategy and framework for risks across an organization (DAMODARAN, 2008). Effectuated by the entity's board of directors and managers, ERM is designed to identify potential events that may adversely impact the organization (AVEN; AVEN, 2015). Likewise, ERM seeks to manage and monitor risks within a defined risk appetite, and to provide reasonable assurance that the entity's strategic objectives can be achieved (COSO, 2007). ERM enables a robust, quantitative understanding of risks and communicates the impact of those risks at all levels of the organization (BROMILEY et al., 2015).

However, effective ERM implementation is hardly straightforward. The complexity of the health organizations' environments, including technology, multiple stakeholders, multidisciplinary employees, and a high volume of people and laws, demands careful implementation of ERM to the healthcare environment (CARROLL, 2009). The operationalization of ERM is also a challenge because it demands a transparent organizational culture—one that is open to change and prepared for cooperative process improvement between departments (BROMILEY et al., 2015).

Previously, Etges et al. (2016) developed an ERM model for healthcare organizations based on case studies from Brazilian hospitals. As a developing economy, Brazil naturally has different healthcare problems than more developed nations. In Brazil, limited financial resources in hospitals cause unsafe situations for patients and others (COUTO; PEDROSA; ROSA, 2016). The discussions about management, internal control, and ERM practices are novel in Brazil. In contrast, in North America there have already been numerous initiatives on these subjects. Studies conducted by institutions such as the Joint Commission International (JCI) and the American Society for Healthcare Risk Management (ASHRM) have dedicated efforts toward the improvement of patient safety and health management. By analyzing interviews with risk managers in North America and in Brazil, this current study proposes a new ERM model based on a diverse range of ERM experience.

We propose a conceptual ERM framework specifically designed for healthcare organizations. Our study explores how healthcare organizations can evaluate their existing ERM practices and bring about a culture that enhances the organization's value and patient

experience. The specific objectives are: (i) to understand the current state of ERM in healthcare organizations, (ii) to develop guidelines for the implementation of an ERM model and (iii) to propose a time line towards complete implementation.

3.2 Research methodology

This study is exploratory in nature. It aims to discover and consolidate how ERM is being implemented by healthcare institutions. The research methodology is comprised of three steps: (i) semi-structured interview with healthcare organizations’ Chief Risk Officers from USA and Brazil; (ii) qualitative data analysis; and (iii) proposal of a conceptual ERM framework with guidelines and timeline to implement ERM in healthcare organizations.

This research is based on case studies from Brazil (seven) and the USA (eight). Hospitals in Brazil were identified using a list from the magazine *America Economia* (2014) as “the best hospitals in Latin America”. The JCI-accredited hospitals were selected and contacted. Some non JCI-accredited were also selected because they had risk management teams in their management structure. For comparison with Brazil, nine hospitals in the United States were contacted. These hospitals were chosen because they each had national quality accreditation as well as established risk management teams in place. Data from 8 of these 9 hospitals was used. (Data from the ninth hospital was not included due to incompleteness, barring comparison.) The researchers sought a heterogeneous sample, using data from different types of institutions. These included private and public hospitals, academic and non-academic hospitals, and from a range of sizes. Figure 14 details the main characteristics of the healthcare organizations interviewed.

Organization	Health Organizations	Revenue (R) US\$	Employees (Ey)	Beds (Be)	Accreditations	Country
A	39	> \$3BN	More than 10.000	More than 1.000	Joint Commission and others	USA
B	3	> \$3BN	More than 10.000	500<=Be<=1.000	Joint Commission and others	USA
C	6	> \$500M ; < \$3BN	More than 10.000	More than 1.000	Joint Commission and others	USA

D	4	> \$500M ; < \$3BN	Less than 5.000	500<=Be<= 1.000	Joint Commission and others	USA
E	10	> \$500M ; < \$3BN	More than 10.000	500<=Be<= 1.000	Joint Commission and others	USA
F	15	> \$3BN	More than 10.000	More than 1.000	Joint Commission and others	USA
G	1	> \$500M ; < \$3BN	5.000<=Ey< =10.000	Less than 500	Joint Commission and others	USA
H	3	> \$500M ; < \$3BN	5.000<=Ey< =10.000	Less than 500	Joint Commission and others	USA
I	1	< \$500M	Less than 5.000	500<=Be<= 1.000	Brazilian internal certification	BRA
J	1	< \$500M	5.000<=Ey< =10.000	500<=Be<= 1.000	Joint Commission and others	BRA
K	1	< \$500M	Less than 5.000	Less than 500	Joint Commission and others	BRA
L	2	< \$500M	Less than 5.000	Less than 500	Joint Commission and others	BRA
M	1	< \$500M	Less than 5.000	Less than 500	Brazilian internal certification	BRA
N	7	> \$500M ; < \$3BN	More than 10.000	500<=Be<= 1.000	Joint Commission and others	BRA
O	7	< \$500M	Less than 5.000	Less than 500	Joint Commission and others	BRA

Figure 14 - Health organizations characteristics

A questionnaire was developed based on the existing ERM guides in the literature (COSO and ISO 31000) (COSO, 2007; PURDY, 2010). The researchers formulated, discussed and came to a consensus on all the questions that formed part of the final questionnaire. The questionnaire was used during all the semi-structured interviews with Chief Risk Officers from Brazil and United States between May 2016 and February 2017.

At some of the study hospitals the interviewees were Chief Financial Officers or Compliance Officers who performed the function of a Chief Risk Officer. Seven interviews were conducted in person. The other interviews were conducted using Webex-Cisco Systems. Most of the interviews had a duration between one and two hours. In Brazil, the interviews were conducted in Portuguese, and in the USA, the interviews were conducted in English. Where required by the institutions, an ethics committee approval was obtained (this occurred in three of the study hospitals.)

The interviews were transcribed and added as text to NVivo. The researcher that did all the Portuguese and English interviews, translated the Portuguese interviews to English. The data from the interviews were evaluated through qualitative data analysis (NVivo software for Mac and NVivo 11 Pro for Windows). Each interview was considered a “source” in the software analysis. Nodes were created using themes from existing ERM guides COSO and ISO 31000. Then, additional nodes were created based on interview data and researchers’ previous knowledge about ERM. Complex nodes were further subdivided. The authors coded the interviews and performed the analysis.

The data analysis was used by the study authors to develop an ERM model. First, the authors gained knowledge on the current state of ERM from the studied healthcare organizations. Then the authors combined their professional expertise in ERM research and in healthcare risk management to create a framework for ERM implementation.

3.3 Discussion and results

3.3.1 Current State of ERM for the studied healthcare organizations

The interview data was organized into seventeen nodes, based on existing ERM guidelines and further classified as explained above. Nodes and sub-nodes are shown in Figure 15. Excerpts from the interviews are also shown for each node.

Node number	Node	Sub-node	Sentences from interviews
1	Compliance, controllership, corporate governance and audit		"The ERM process has a strong relation with the hospital’s capacity to have information transparency with the board, physicians and other stakeholders."
2	ERM Process and Strategy		"ERM is seen as a process, doesn't have a department or a Chief Risk Officer, but is discussed with the board and linked to the strategic plan". "The enterprise risk identification is always aligned and discussed with the strategic plan."

3	Risk assessment		"Like in a private institution, the hospital has a financial perspective for everything that happens, but it is a challenge for managers to measure the economic risk impacts. This issue the main goal for ERM next year."
4	Risk assessment	Difficult to treat financial data	"The economic measure is something that the hospital values a lot, but has not systematically been implemented."
5	Risk assessment	Insurance and legal	"The hospital doesn't use a structured economic analysis, but economic measure of risk is associated to insurance. We are willing to pay large insurance premium to protect the company, but don't measure the benefits that ERM represents financially."
6	Risk assessment	Reputation risk measure and patient satisfaction	"The hospital reputation is an important factor considered when identifying and to treating risks".
7	Risk assessment	Risk appetite	"In terms of economics analysis, we only define a risk appetite."
8	Risk communication		"People need to comprehend the importance of communication to create risk management." "Finally, the information resulting from ERM is available on the intranet portal to be used by any employee who wants to access it".
9	Risk context	Guides and structure	"The hospital is stratified in big areas: marketing, clinical, finance, legal, human resource, IT and maintenance for risk management."
10	Risk context	ERM and Clinical	"Clinical risk is one component of all the ERM process. Clinical risks must be recognized like the main component of ERM system."
11	Risk context	Proactive	"ERM is everybody looking out for the organization and working to anticipate actions to minimize events that can impact the organization. ERM helps the corporate level to recognize that they can contribute with the organization capacity to identify opportunities and hazards and, in sequence, to act proactively with the health management routine."
12	Risk culture and education		"The hospital shares the ERM results with the board directors, but there is no structured education program for ERM, only for Clinical Risk Management." "We believe that it is only possible to have ERM when the ERM concepts are being shared, by education programs, between the employees, but it is not happening yet." "Nowadays ERM is not valued as much as it should. It is at an early stage. To achieve this value, the best way is to use theoretical content and practical activities."
13	Risk Identification and analysis		"The Chief Risk Officer interview managers with the aim to identify what can impact the organization in a negative or a positive perspective. The interviews are made individually. The identified risks are classified considering their criticality (high, medium, and weak)." "Enterprise risk identification happens during the strategic plan meetings and is documented on risk books and on the strategic plan."
14	Risk Identification and analysis	Engagement employee methodologies	"The use of an ERM process, crossing all the hospital is really important. It is necessary to involve different employees with different training and all of them need to

			think of the hospital as a system and not only their department." "Methodologies to engage employees with different backgrounds and functions contribute to the learning process and, in sequence, to bring ERM to the culture of the hospital."
15	Risk investment and technology		"The use of a budget for risk management practices is another important point. Improvement plans demand money, and if the board is not interested in investing, it is not possible to create and apply what is being planned."
16	Risk Treatment and Monitoring		"Every year ERM roadmaps are built and departments receive demands to answer questions on certain risks. The answers are being discussed during the year." "The risk owner has the responsibility for actions and improvements that can be built through ERM practices".
17	Risk Treatment and Monitoring	Action plans and KPIs	"The Chief Risk Officer controls all risks, but is not responsible for them. He needs to motivate department managers to take actions and mitigate the risks that can negatively impact the hospital and maximize the risks that bring opportunities. This control is done using action plans that can be discussed by managers and Chief Risk Officer."

Figure 15 - Nodes detailed

A frequency analysis was performed for the study. Chart 1 illustrates how often each node was found in the interviews. The x-axis shows the nodes (nodes are numbered as in Fig 15) ordered horizontally by frequency encountered, and the y-axis refers to frequency. The most frequently discussed topics included ERM process and strategy, risk culture and education, risk identification and analysis and risk assessment. This analysis was later used to guide the proposed ERM model toward the primary areas of interest for Chief Risk Officers.

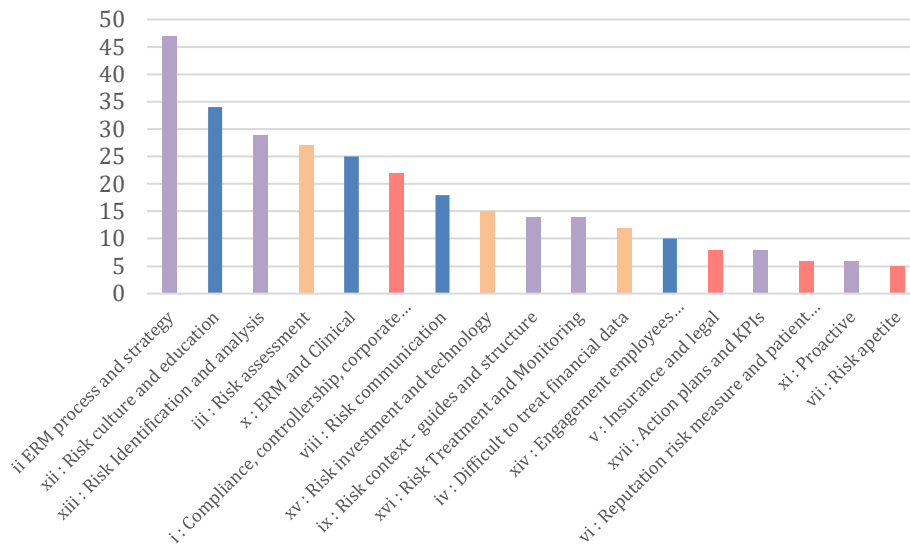


Chart 1- Nodes frequency

Chart 2 illustrates the timing of implementation of ERM and clinical risk management (CRM) in the study hospitals. In Chart 2 below, the x-axis refers to the year, and the y-axis indicates the cumulative number of healthcare organizations that have implemented each process.

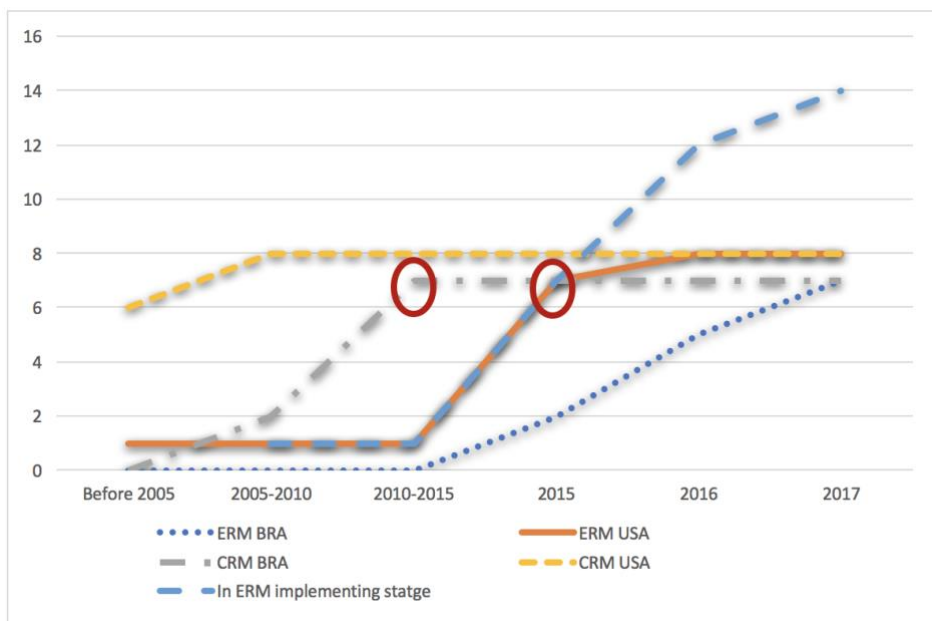


Chart 2 - ERM and clinical risk management implementation timeline

As seen in Chart 2, there has been a significant increase in healthcare organizations implementing ERM in the past decade. Certain external factors may explain the timing of this trend towards ERM. For example, in Brazil, the government began publishing

guidelines from Anvisa¹ (RDS 36) in 2012 to regulate quality and safety departments in hospitals. This energized the development of clinical risk management in hospitals. In a parallel fashion, state-owned businesses in Brazil were motivated to create their own ERM departments in response to changing government policies. The creation of an anti-corruption law (12.846) in 2013 motivated changes to improve information transparency. Federal investigations of major Brazilian companies for corruption during 2015 and 2016, further stimulated corporate interest in the benefits of ERM.

In the USA, the timing of ERM implementation is likely the result of other unique factors. To begin with, the rising cost of healthcare expenditures in the USA seems to have played a significant role. The United States is the country that spends the highest amount of money on healthcare – \$3.2 trillion in 2015 (NATIONAL CENTER FOR HEALTH STATISTICS, 2017). Private health insurance payors are responsible for 33% of this cost. They have implemented cost control rules such as “Pay for Performance System” or “Hospital Value-Based Purchasing.” Pay for Performance systems have accelerated improvements not only in safety but also in the financial, legal and management realms. Value-based payment programs demand that institutions become better managed, more transparent and deliver safer medical care (AON, 2014). In order to adapt to outcome-based payment systems, hospitals are turning to ERM. As one interviewee commented *“ERM in health is behind other business environments because of the way we are paid for our services. Historically we were compensated with a fee-for-service model. Only now we are transferring to quality-based payment (or paid for performance). With this change we will start to be forced to understand better how to ever improve our quality.”*

Furthermore, one interviewee commented on the connection between ERM and health organizations’ capability to ensure good patient experience, *“Patient experience and patient satisfaction are measures that need to be monitored just as much as finance. To perform well on those measures, it is necessary to manage the hospital in an integrated way. ERM contributes to improving patient experience by engaging management in a strategic way.”*

¹ Anvisa is the Brazilian Health Regulatory Agency that protect and promote public health, by exercising health surveillance over products and services, including processes, ingredients and technologies that pose any health risk.

3.4 Framework to guide E²RM_{healthcare} application

Using data from the interviews in this study, we were able to propose a new ERM framework. This framework is built on previous work, such as in Etges et al. (2016). Specifically, our new proposed ERM framework is constructed to be more applicable and more practical for healthcare organizations. It is separated in four levels: baseline, education, quantitative and governance, innovating from the previous model. The levels incorporate the areas of focus as identified by the studied organizations' managers. They allow an institution to adopt ERM methods tailored to its specific organizational needs. The model, Economic Enterprise Risk Management for Healthcare (E²RM_{healthcare}), is presented in Figure 16.

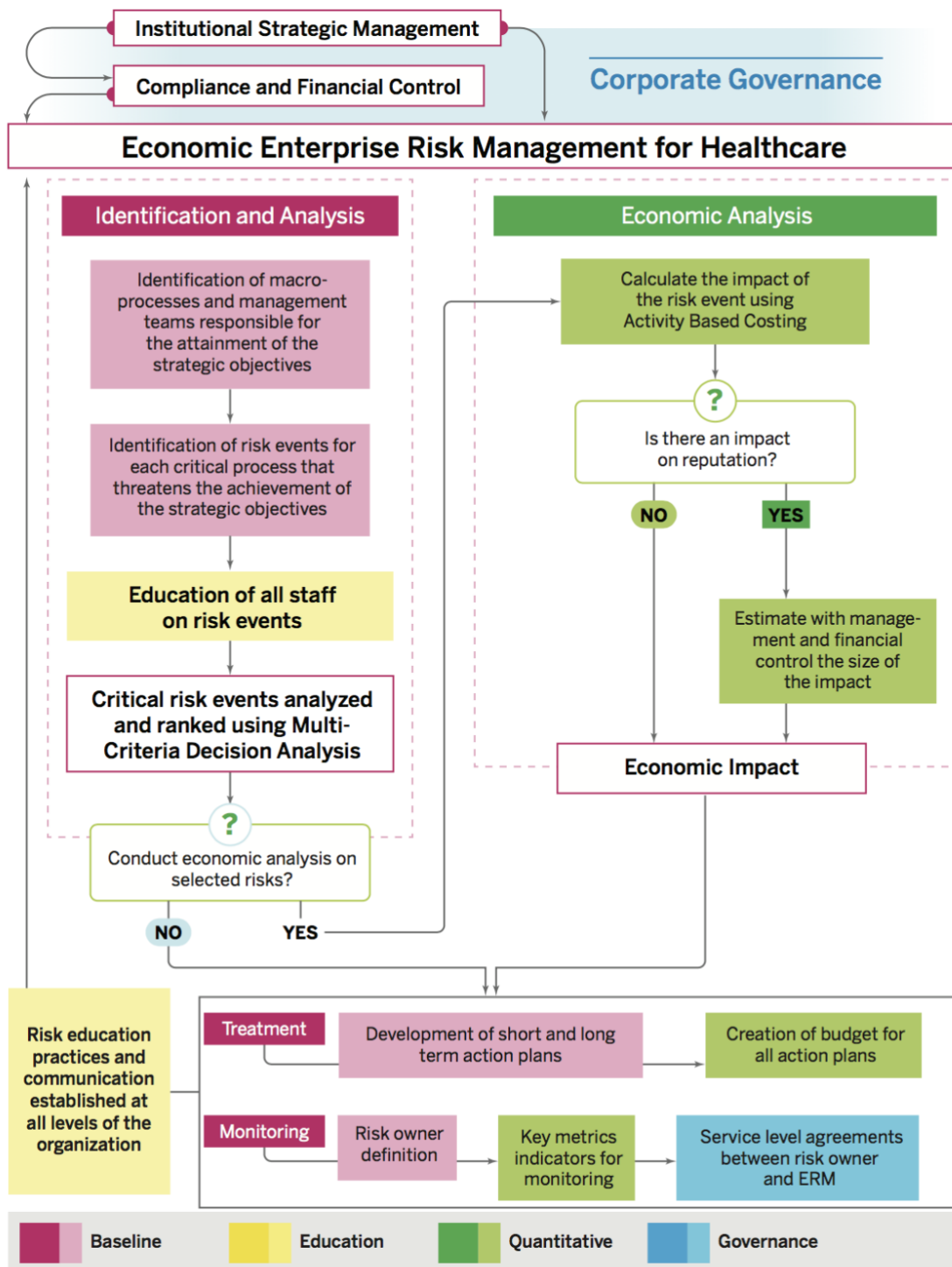


Figure 16 – E²RM_{healthcare} – Economic Enterprise Risk Management in Healthcare

3.4.1 Baseline

At the baseline level, a healthcare organization focuses on the identification, analysis, and ranking of its risks by using multi-criteria decision analysis, such as Analytical Hierarchy Process (AHP). This methodology allows for the ranking of risk events relative to each other. It contrasts with a more common approach of ranking risks individually using

an ordinal scale. The advantages of multi-criteria decision analysis include a more accurate risk analysis and more consistent results.

The use of AHP to prioritize factors, risks or important criteria in healthcare have been applied by different authors (AJAMI; KETABI, 2012) (SUN et al., 2015) (ABBASI et al., 2017). In addition, different Multi criteria decision making methods (MCDA) are receiving more attention in healthcare during the last years with successful application, how is suggested on the systematic review developed by Wahlster et al. (2015) and present on the discussion developed by Morton (2014). Our different approach here is to apply MCDA oriented to enterprise decision making process in healthcare, associating risks with strategic goals and actions and using friendly interface with managers. Through this application health organizations create an opportunity to manage enterprise risks oriented to achieve with success the strategic goals, contributing with organization value creation flow.

The baseline level also includes the formulation of action plans for certain risks and communication with the Board of Directors. Risks heatmaps are developed to contribute with the organization capability to transmit and involve employees on risk management culture.

3.4.2 Education

At the Education level, a healthcare organization concentrates on developing material and tools to increase the level of ERM knowledge amongst all employees and the Board of Directors. One of the studied healthcare institutions recommended the elaboration of a risk inventory. A risk inventory that contains a detailed description of risk events and specific examples should contribute to creating a shared understanding of risks and improve communication between departments.

The risk inventory contributes to create a common risk language among different health units from the same organization and to compare risks between different organizations. During the interviews, managers suggested that is difficult to input a common dimension for risk when is necessary to manage different health units. The risk inventory advance from COSO factors or other macro risks groups, because achieve an orientation on the risk level to help managers to think about risk in a common dimension.

3.4.3 Quantitative

At the Quantitative level, the healthcare organization works on determining the economic impact of selected risk events using financial data. The use of cost management

methodology like Activity Based Costing (ABC) or Time-driven activity based costing (TDABC) can be used to measure the direct and indirect impact of risk events on the healthcare organization.

The TDABC is applied to measure process in an economic perspective identifying opportunities to turn process more efficient, through the reduction of resources used in each activity, and consequently costing less (KAPLAN et al., 2014). Considering that the value based healthcare (VBHC) theory suggest that value increases when organizations focus on outcomes, such as by adopting systematic processes to improve efficiency, is possible to associate the opportunity to apply TDABC oriented to assess value creation in an organization (KEEL et al., 2017). In special because if explored together, they enable the identification of the value chain involved with the patient experience creation.

Economic measures like value at risk (VaR) or cash flow at risk (CFaR) and the use of simulation techniques, like Monte Carlo simulation, can be applied to estimate the variability in cost and revenue. Budget for risk treatment should be developed and include return of investment (ROI) calculations.

3.4.4 Governance

Lastly, at the Governance level, the healthcare organization focuses on the quality of information transmitted to its stakeholders to improve the corporate governance process. The enterprise risk manager is elevated in the organizational hierarchy to address weaknesses at different corporate levels and improve the strategic decision making process.

3.5 Guidelines for E²RM_{healthcare} application

Figure 17 below is a guide for the implementation of E²RM_{healthcare}, with recommended concepts at each level that range from fundamental to innovative. This guide demonstrates that a healthcare organization can work at the Baseline level with advanced activities and/or at the Governance level with basic activities.

	Level	Guidelines	Oversight and Participants
fundamental to innovative	B	Identification of hospital macro-processes and process leaders	Enterprise risk manager and process owner
		Description of risk events performed	
	M	Analysis of risk events using risk ranking methodology	
		Production of risk heatmaps and matrices	
		Development of short term action plans	
	A	Establishment of multidisciplinary teams responsible for management of risk events	
fundamental to innovative	B	Reporting of risk heatmaps and risk ranking results	Enterprise risk manager and process owner
	M	Creation of risk education programs for all employees	Enterprise risk manager and information technology manager
		Use of intranet and other platforms to share enterprise risk management insights	
	A	Exploration of software and technology for communication	
		Investment in innovation and research to improve ERM process	Enterprise risk manager, research and innovation manager and financial manager
	fundamental to innovative	M	Use of risk inventory to guide risk identification and analysis
B		Determination of metrics and indicators for risk monitoring	
A		Cash Flow at Risk (CFaR)	Enterprise risk manager and financial manager
		Creation of risk treatment budget using Rol analysis	
		Probabilistic economic analysis of risks	
		Development of reports for the Board of Directors that include financial data	Enterprise risk manager
fundamental to innovative	B	ERM part of hospital decision making process	Enterprise risk manager and Board of Directors
	M	Compliance responsibilities with ERM	Enterprise risk manager, compliance officer and legal counsel

B = Basic
 M = Medium
 A = Advanced

Figure 17 - Guidelines to implement E²RM_{healthcare}

In a further analysis, the fifteen organizations were classified for each level as “Not Commenced”, “Novice”, “Partially Implemented”, or “Cutting-Edge” based on the activities suggested in Figure 17. The Baseline level shows the largest number of organizations with “cutting-edge” practices. Interestingly, Quantitative represents the biggest opportunity for improvement with 50% of the organizations not having commenced their work in that phase

and not a single organization having reached the “Cutting-Edge” classification. During the interviews there was also a consensus objective to develop economic risk assessment. Therefore E²RMhealthcare should be considered an important contributor to the development of quantitative risk methods as it is the first model to propose activities and methodologies to assess risks with real financial data for healthcare enterprise risks. Table 1 shows the results of this analysis.

Organizations	E ² RMhealthcar levels			
	BASELINE	EDUCATION	QUANTITATIVE	GOVERNANCE
A	Cutting-Edge	Partially Implemented	Not Commenced	Partially Implemented
B	Cutting-Edge	Cutting-Edge	Partially Implemented	Cutting-Edge
C	Cutting-Edge	Cutting-Edge	Novice	Partially Implemented
D	Cutting-Edge	Partially Implemented	Not Commenced	Novice
E	Cutting-Edge	Partially Implemented	Novice	Partially Implemented
F	Cutting-Edge	Cutting-Edge	Partially Implemented	Partially Implemented
G	Cutting-Edge	Partially Implemented	Not Commenced	Novice
H	Partially Implemented	Partially Implemented	Novice	Partially Implemented
I	Partially Implemented	Novice	Not Commenced	Not Commenced
J	Partially Implemented	Novice	Not Commenced	Novice
K	Partially Implemented	Novice	Not Commenced	Novice
L	Novice	Novice	Not Commenced	Novice
M	Novice	Novice	Not Commenced	Not Commenced
N	Cutting-Edge	Partially Implemented	Partially Implemented	Cutting-Edge
O	Partially Implemented	Partially Implemented	Novice	Partially Implemented

Table 1- Organizations status in each E2RMhealthcare level

In terms of the application, it is important to highlight that the four levels can be implemented in parallel. Figure 18 proposes a timeline for E²RM_{healthcare} implementation.

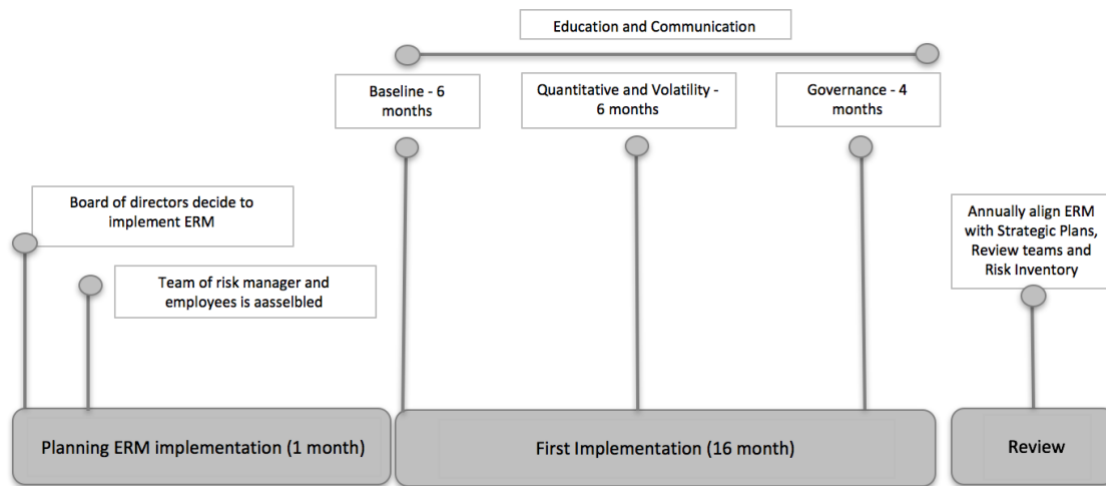


Figure 18 - E²RM_{healthcare} Implementation Timeline

This timeline suggests that a health organization can implement all four levels of the ERM process over a seventeen-month period. However, the goal of the E²RM_{healthcare} framework is not to measure success based on levels achieved. Rather the best ERM program for a healthcare organization depends on its management and maturity, and its capability to use analytics to access accurate financial data. Finally, the Board of Directors and enterprise risk manager should annually review the goals and risks and assess the success of the ERM program.

3.6 Conclusions

ERM has been previously explored in the literature and by different industries (BROMILEY et al., 2015; FRASER; SIMKINS, 2016). Researchers are beginning to examine the application of ERM to healthcare organizations (ETGES et al., 2018a). The present study examines how healthcare organizations from USA and Brazil are structuring and implementing the ERM process in their management structure. The authors were motivated by the progress made in non-healthcare industries to develop high reliability organizations and to create organizational value.

Based on interview data from healthcare leaders, the study proposes a conceptual framework to implement the ERM model in healthcare through E²RM_{healthcare}. The interview results confirm that in healthcare organizations ERM is recently becoming a key strategy. Certainly, further research is needed to better understand the adoption of ERM in healthcare and to improve its implementation.

This study takes an important step toward that goal, by organizing the implementation of ERM into four discrete levels in the E²RM_{healthcare}. Performing all four levels is the state of the art ERM, where the healthcare organization has systemic ERM processes, educational programs shared by all employees, financial data and the ability to routinely report risks to stakeholders. Similarly, a less mature organization can achieve ERM goals by engaging in some of the proposed levels and still create organizational value and improve health outcome per dollar spent.

To continue the development of ERM in healthcare, the authors propose to apply this model to multiple case studies from multiple countries. In addition, in a sequential paper, the authors propose to publish a global risk inventory specific for healthcare organizations.

This research has some limitations. Given the complexity of variables affecting healthcare organizations in any other country – political, financial, environmental – the results of the present study may not be generalizable. To apply the conclusions to Europe, Asia and Oceania, ERM research from those continents must be added. In addition, considering the heterogeneous characteristics of the organizations interviewed, conclusions about a specific size or class of organizations were not explored.

4 PROPOSITION OF A SHARED AND VALUE-ORIENTED WORK STRUCTURE FOR HOSPITAL-BASED HEALTH TECHNOLOGY ASSESSMENT AND ENTERPRISE RISK MANAGEMENT PROCESSES

A similar version is being submitted to the International Journal of Technology Assessment in Health Care

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Abstract: Healthcare organizations have invested efforts on Hospital-based Health Technology Assessment (HB-HTA) and Enterprise Risk Management (ERM) processes for novel systems to obtain more accurate data on which to base strategic decision. This study proposes to analyze how HB-HTA and ERM processes can share personal resources and skills to achieve its principles with results oriented to value. Previous literature about ERM and data from interviews with healthcare managers were joined with a new HB-HTA literature review to compose the research data sources, which were submitted to a qualitative data analysis using Nvivo. The analysis was oriented to identify the association between ERM and HB-HTA application; to propose a cause and effect value map sharing ERM and HB-HTA resources; to identify common principles of HB-HTA and ERM; and to propose, in a matrix, the capability to share personal resources between HB-HTA and ERM teams. The HB-HTA literature review resulted in seven papers. The common principles and personal background suggested for HB-HTA and ERM teams allowed to build a matrix to identify how both teams can work in an integrated manner. The value creation capability behind this integrated work structure is expressed in a cause and effect value map. Educational programs shared by all employees, financial data and the ability to routinely report risks and technology information to stakeholders are identified as common objectives for ERM and HB-HTA processes. The identification of common principles, objectives and capabilities between ERM and HB-HTA suggested on this study advances with the literature from both research areas. The opportunity to share personal resources between HB-HTA and ERM also contributes to the implementation of those processes in hospitals with less financial resources, approaching its own management to be more efficient with the care chain.

Keywords: Enterprise Risk Management; Healthcare management; Risk analysis; Risk Education; Corporate Governance.

4.1 Introduction

Hospital-Based Health Technology Assessment (HB-HTA) involves a multidisciplinary team working to develop methodologies to turn the healthcare system more efficient, innovative and value-oriented (SAMPIETRO-COLOM et al., 2015, PEREIRA; RABELLO; ELIAS, 2017) In 2016, Porter et al., asserted that the overarching goal of healthcare organizations should be achieving higher value in healthcare. Value increases when organizations focus on outcomes, such as by adopting systematic processes to improve efficiency (KAPLAN, ROBERT S. HASS, DEREK A. WARSH, 2016).

However, to prospect value, it is necessary to involve all the patient value chain that starts at the strategic level and demand teams with specific background to develop robust analysis to guide decisions. The HB-HTA team must have the capability to guide proactive decisions for C-suite and operational/clinical managers, which makes it strategic and economically sustainable considering the value creation demand (ATTIEH; GAGNON, 2012)

Another important process that contributes to value creation capability in hospitals is Enterprise Risk Management (ERM) (BROMILEY et al., 2015). ERM programs facilitate strategy selection, choosing a strategy calls for a structured decision-making process that analyzes risks and aligns an organization's resources with its mission and vision (DAMODARAN, 2008). Effected by the entity's board of directors and managers, ERM is designed to identify potential events that may adversely impact the organization (AVEN; AVEN, 2015). Likewise, ERM seeks to manage and monitor risks within a defined risk appetite, and to provide reasonable assurance that the entity's strategic objectives can be achieved (COSO, 2007). ERM enables a robust, quantitative understanding of risks and communicates the impact of those risks at all levels of the organization (BROMILEY et al., 2015). For the specific healthcare business environment Etges et al. (2018a), after a systematic review and case studies with 7 hospitals, suggested a theoretical framework to implement ERM (ETGES et al., 2018a).

However, effective and practical ERM and HB-HTA implementation is hardly straightforward. The complexity of health organization environments, including technology, multiple stakeholders, multidisciplinary employees, and a high volume of people and laws, demands careful implementation in the healthcare environment (CARROLL, 2009). The operationalization is also a challenge because it demands a

transparent organizational culture — one that is open to change and prepared for cooperative process improvement between departments (BROMILEY et al., 2015). Another barrier is approving enough investment to hire the right human capital with the background to develop the activities expected by ERM and HB-HTA (PEREIRA; RABELLO; ELIAS, 2017). Both are emergent processes or units in healthcare (ETGES et al., 2018b).

Sampietro –Colom et al. (2015) suggested 15 guiding principles for HB-HTA good practices. Using its research as a reference for HB-HTA principles, is possible to make an association with ERM healthcare literature (ETGES et al., 2018a), for example the necessity to hire the correct professionals, to align the unit with hospital strategy and to allocate financial resources. Moreover, both demand a multidisciplinary team working to guide strategic decisions to prospect value.

This study proposes to identify how HB-HTA and ERM processes can share personal resources and skills to achieve its principles with more sustainable and allowed results oriented to value. The specific objective is to propose a conceptual cause and effect value map that integrates ERM and HB-HTA.

4.2 Research methodology

This study is exploratory in nature. It aims to demonstrate how HB-HTA and ERM teams can work integrated, contributing to the health organization value creation process. The research methodology is comprised of three data sources: data from semi-structured interview with healthcare organizations' Chief Risk Officers or Chief Operational Officers from USA and Brazil used by Etges et al. (2018b) (ETGES et al., 2018b); data from the papers used by the systematic review about ERM in healthcare published by Etges et al. (2018a) (ETGES et al., 2018a) and a literature review about previous HB-HTA application conducted for this study. In sequence, a qualitative content analysis was performed using Nvivo to cross ERM and HB-HTA data. The content analysis was oriented to propose four results: (i) the association between the Etges et al. (2018) ERM framework and HB-HTA application orientations; (ii) the proposition of a cause and effect value map sharing ERM and HB-HTA objectives and skills; (iii) the identification of HB-HTA and ERM common principles; and (iv) the proposition through a matrix of the capability to share personal resources between HB-HTA and ERM teams.

The literature review about HB-HTA good practices and guidelines was conducted on Pubmed through the keywords: HB-HTA or “hospital-based health technology

assessment". 25 papers were identified and reviewed. At the end, 7 papers were included on this study. The criteria for eliminating papers were: non-connected with HB-HTA or not exploring how HB-HTA should be conducted in practical applications. The review extracted from the papers the main HB-HTA objectives, requirements and barriers expressed by authors when detailing HB-HTA implementations.

The framework to guide ERM application proposed by Etges et al. (2018b) as the Economic Enterprise Risk Management Innovation Program ($E^2RM_{\text{healthcare}}$) and the HB-HTA literature review material were submitted to a content analysis. All the interviews transcriptions data used by Etges et al. (2018b) and the papers identified during the HB-HTA review were added to the software Nvivo. Firstly, the $E^2RM_{\text{healthcare}}$ levels were detailed being updated to define how HB-HTA and ERM activities can be shared according to literature.

In sequence, joining the ERM and HB-HTA guiding principles, a cause and effect value map integrating them was developed. This value map expresses how both processes contribute with the health organization capability to follow its own strategy and create value, highlighting their common objectives and skills.

The third analysis identified in the data sources from literature the common principles of ERM and HB-HTA teams. A matrix was proposed identifying the literature from HB-HTA and ERM that suggested each principle and how the principles can be associated.

Finally, the 15 principles to perform HB-HTA suggested by Sampietro –Colom et al. (2015) and the $E^2RM_{\text{healthcare}}$ guide framework were joined in a matrix, identifying the common personal background that can be used by health organizations to operationalize HB-HTA and ERM with more sustainability.

4.3 RESULTS AND DISCUSSION

4.3.1 HB-HTA application literature review

Seven papers focused on HB-HTA were analyzed. The review identified the principles, objectives, activities, success factors and human capital background suggested to be incorporated in a HB-HTA team.

Authors	Title	Year	Journal	Objective
(SAMPIETRO-COLOM et al., 2015)	Guiding principles for good practices in HB-HTA Units	2015	International Journal of Technology Assessment in Health Care	Describing the criteria for good practices appropriate for HB-HTA and also present how European HB-HTA units are performing regarding these criteria.
(PEREIRA; RABELLO; ELIAS, 2017)	Hospital-Based Health Technology Assessment in Brazil: an overview of the Initial Experiences.	2017	International Journal of Technology Assessment in Health Care	Describing the results from an in-person survey carried out in 2012 aimed at describing the situation and the experience of the first Brazilian NATS in their initial period of implementation, which occurred from 2009 to 2011.
(MARTELLI et al., 2017)	Hospital-based health technology assessment in France: A focus on medical devices	2017	Therapie	The aim of this work was to formulate several recommendations for a blueprint for hospital-based HTA for Medical Devices in France.
(GAGNON et al., 2014)	Hospital-Based Health Technology Assessment: Developments to Date	2014	PharmacoEconomics	Providing an overview of the current experiences of hospital-based HTA worldwide. It also identifies key issues that could inform decision-makers who are considering implementation of hospital-based HTA in their jurisdiction
(DEMIRDJIAN, 2015)	A 10-Year Hospital-Based Health Technology Assessment Program in a Public Hospital in Argentina	2015	International Journal of Technology Assessment in Health Care	Describing the first hospital-based health technology assessment (HTA) program in a public hospital in Argentina, and report some clinical, educational, economic and organizational results after 10 years of its implementation
(MARTELLI et al., 2015)	Introduction of Innovative Medical Devices At French University Hospitals: an Overview of Hospital-Based Health Technology Assessment Initiatives	2015	International Journal of Technology Assessment in Health Care	Exploring hospital-based HTA activities in French UHs for the introduction of innovative medical devices for individual use and comparing these systems with the conceptual models proposed by the Hospital-Based HTA Sub-Interest Group. Thus,
Attieh, R., Gagnon, M.	Implementation of Local/Hospital-Based Health Technology Assessment Initiatives in Low and Middle-Income Countries	2012	International Journal of Technology Assessment in Health Care	Reviewing the implementation of health technology assessment (HTA) at local and hospital levels in low and middle-income countries

Figure 19 - HB-HTA papers

According with the reviewed literature, it is possible to highlight that those authors agree that the HB-HTA contribution to the decision making process is essential and its

alignment with the organizational values and strategies is fundamental for that; The use of a systemic HB-HTA process is important to engage it on the hospital culture and routine; Educating employees about the theme, its importance and responsibilities is essential to add HB-HTA to hospital culture; economics, clinical and management background are important to conduct the activities; accessing money to implement it is an important barrier; and the stakeholders' engagement in the process to assess it is extremely important.

4.3.2 The Framework to guide E²RM_{healthcare} application and its association with HB-HTA apply orientations

Considering the differential of the ERM model proposed by Etges et al. (2018b), which suggests activities to apply ERM fragmented in four levels: baseline, education, quantitative and governance, this research highlights opportunities to integrate ERM with HB-HTA in each level.

4.3.3 Baseline

At the baseline level, a healthcare organization focuses on the identification, analysis, and ranking of its risks by using multi-criteria decision analysis (MCDA), such as Analytical Hierarchy Process (AHP). This methodology allows for the ranking of risk events relative to each other. It contrasts with a more common approach of ranking risks individually using an ordinal scale. The advantages of multi-criteria decision analysis include a more accurate risk analysis and more consistent results.

The use of AHP to prioritize factors, risks or important criteria in healthcare have been applied by different authors (ABBASI et al., 2017, AJAMI; KETABI, 2012, SUN et al., 2015). In addition, different MCDA are receiving more attention in healthcare during the last years with different success application, how is suggested on the systematic review developed by Wahlster et al. (2015) (WAHLSTER et al., 2015) and present on the discussion developed by Morton (2014) (MORTON, 2014). Our different approach here is to apply MCDA oriented to enterprise decision making process in healthcare, associating risks with strategic goals and actions and using friendly interface with managers. Through this application health organizations create an opportunity to manage enterprise risks oriented to achieve with success the strategic goals, contributing with organization value creation flow. The HB-HTA team usually is able to incorporate these methodologies during the technology assessment process and can share knowledge and resources to conduce these activities.

The baseline level also includes the formulation of action plans for certain risks and communication with the Board of Directors. Risks heatmaps are developed to contribute with the organization capability to transmit and involve employees on risk management culture. All the organization context, strategic objectives and value should be included on the ERM process to turn it aligned with the hospital culture. For the HB-HTA team, this necessity is not different. It is suggested that this is an important moment where both teams working together can turn more effective the use of board agenda and, in special, to receive value from all employees.

4.3.4 Education

At the Education level, a healthcare organization concentrates on developing material and tools to increase the level of ERM knowledge amongst all employees and the Board of Directors. One of the studied healthcare institutions recommended the elaboration of a risk inventory. A risk inventory that contains a detailed description of risk events and specific examples should contribute to create a shared understanding of risks and improve communication between departments.

With the objective to make education happens, HB-HTA and ERM teams may work together. HB-HTA units should be willing to improve in the light of its experience and be open to learn and innovate (SAMPIETRO-COLOM et al., 2015). Sharing the teaching and researching capability that are common at the HB-HTA team with the vision to engage employees on risk management can turn the education process easier. In addition, HB-HTA team is always update about the strategic risks that are being discussed, turning the technology assessment aligned with the hospital board plans.

4.3.5 Quantitative

At the Quantitative level, the healthcare organization works on determining the economic impact of selected risk events using financial data. Cost management methodologies as Activity Based Costing (COOPER; KAPLAN, 1991) or Time-driven Activity-based Costing (KAPLAN; ANDERSON, 2007a) can be considered to measure the direct and indirect impact of risk events on the healthcare organization. Economic indicators as Value at Risk (VaR) or Cash Flow at Risk (CFaR) and the use of simulation techniques, as Monte Carlo simulation, can be applied to estimate the variability in cost and revenue. Budget for risk treatment should be developed and include Return of Investment (ROI) analysis.

At this level, the interaction with HB-HTA team can be strongly positive. The cost analysis and economic valuation background focused on healthcare business is fundamental to develop the quantitative level focused on economic risk assessment.

4.3.6 Governance

Lastly, at the Governance level, the healthcare organization focuses on the quality of information transmitted to its stakeholders to improve the corporate governance process. The enterprise risk manager may work near to the organizational C-level, being able to communicate them weaknesses at different corporate levels and improve the strategic decision-making process. Achieving governance sharing resources and innovation with the HB-HTA process contributes with the governance quality that can be achieved. It is another important acquirement, in which the joint work between ERM and HB-HTA, can contribute to the health organization management oriented to value.

4.4 A cause and effect value map sharing ERM and HB-HTA objectives and skills

Based on the information absorbed with the literature reviews, Figure 20 expresses the cause and effect value map integrating ERM and HB-HTA processes identifying the common objectives and skills.

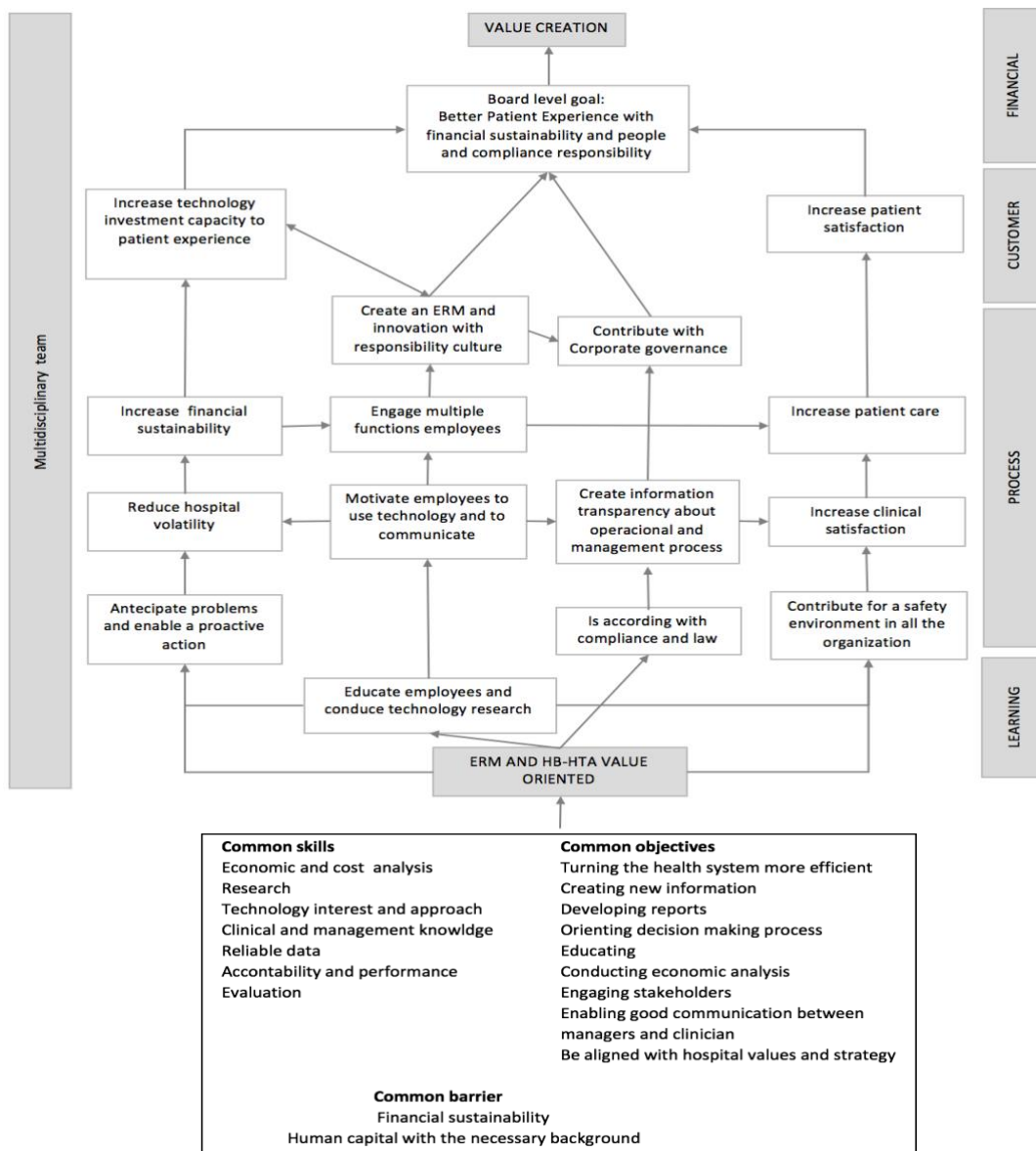


Figure 20 - Cause and effect value map integrating ERM and HB-HTA team

The cause and effect value map started by the common skills and objectives between ERM and HB-HTA teams and details how both processes contribute to the hospital capability to create value. The process begins with implementation of education programs, advancing to process investments aiming at providing greater efficiency, through a risk and technology culture with compliance responsibility, and resulting in achieving patient satisfaction, which increases financial sustainability.

The patient experience is an important hospital objective, one interviewer highlighted: *“To have a good experience, the patient needs to be part of the process, the institution needs to be transparent.”* When patients are actively engaged in decision making, they have better outcomes and less expensive care (KAPLAN, ROBERT S. HASS, DEREK A. WARSH,

2016). Advances in technology systems also consider the inclusion of the patient at all times and quick transmission of patient information to the employees who are involved with the patient's care, thus making the healthcare process more efficient. The ERM and HB-HTA teams can contribute to the health culture to improve the institutional capability in order to deliver better quality, safety and technology to the patient.

Therefore, establishing leadership is important in both teams. Someone must guide the pace of employee engagement, HB-HTA and ERM leader. Compliance achievement is also aimed by board directors and is related to ERM and HB-HTA activities that are promoting more engagement among employees, which consider legal requirements and information transparency.

The cause and effect value map also detail how it is necessary to achieve financial sustainability in order to make investments to turn the care chain more effective. At this point, this study shows how ERM and HB-HTA can share personal resources, contributing to the creation of a better healthcare environment and, in sequence, to the hospital value creation. The union of some common activities contributes to the financial sustainability to include both teams in hospitals structures.

4.5 HB-HTA and ERM common principles

For understanding how ERM and HB-HTA share common objectives and demands, the literature review about HB-HTA, the previous ERM in healthcare systematic literature (ETGES et al., 2018a) and the current interviews were used. It is possible to highlight that guiding a better decision-making process through technical analysis is the main objective of both process. At the ERM perspective, more embracing, using internal and external information; and at the HB-HTA perspective, more focused on hospital technology capability to improve decisions oriented to quality and patient experience and research contribution with the society.

In addition, authors from both sides, and, especially, managers interviewed expressed that one important barrier is accessing enough money to invest and operationalize those teams in the hospital (ATTIEH; GAGNON, 2012). This last issue contributes to one objective of this research focused on identifying activities where ERM and HB-HTA team can share background and effort to contribute to hospital value creation. Figure 21 illustrates common ERM and HB-HTA principles that are expressed in literature.

	Authors	Principles					
		Education	Reporting good information	Economic evaluation	Engaging stakeholders	Common communication – clinical and executive	Alignment with hospital culture and values
References ERM	(OPPENBERG, 2013)		x		x		
	(HANEY; CHURCH; COCKERILL, 2013)	x	x		x	x	x
	(KICKLIGHTER; MILLER, 2011)			x			x
	(TEOH; CHEONG, 2008)	x			x		
	(REMUS, 2008)	x		x			x
	(COURSON, 2008)	x					x
	(WOODRUFF, 2005)		x		x		
	(CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010)	x	x	x	x	x	x
	(TROYER; BRASHEAR; GREEN, 2005)	x		x			x
	(MILLER; MIGINSKY; CONNELLY, 2012)		x		x	x	
	(SODOMKA; SPAKE; RUSH JR, 2010)	x					
	(GALLAGHER et al., 2006)		x		x	x	x
	References HB-HTA	(ATTIEH; GAGNON, 2012)	x	x	x	x	
(PEREIRA; RABELLO; ELIAS, 2017)			x	x	x	x	
(MARTELLI et al., 2017)		x	x	x	x	x	x
(SAMPIETRO-COLOM et al., 2015)		x	X	x	X	X	x
(DEMIRDJIAN, 2015)		x	x	x	x	x	x
(MARTELLI et al., 2015)			x	x	x		
(GAGNON, 2014)	x	x	x	x	x	x	

Figure 21 - ERM and HB-HTA literature analysis to identify common requirements

Based on Figure 21 it is possible to assume that education, reporting good information, economic evaluation, engaging stakeholders, common communication and alignment with hospital culture and values are highlighted for more than 50% of HB-HTA and ERM authors. Engaging stakeholders is mentioned by 80% of authors. These results confirm that although ERM and HB-HTA teams have different positions and functions in the hospital, they need to develop similar activities to achieve their specific objectives with the vision to contribute to hospital decision-making process. Exploring these common

points, sharing personal resources may contribute to the hospital sustainability to develop both processes in its own structure.

4.6 Capability to share personal resources between HB-HTA and ERM teams

The manner as ERM and HT-HBA processes can work sharing responsibilities, professionals and activities, making both units more effective and sustainable was consolidated in the sequent analysis. The guiding framework of E²RM_{healthcare} and the nine prerequisites for setting-up and running HB-HTA suggested by Sampietro-Colom (2015) were inter-associated. In addition, the common personal resources to perform the processes activities were detailed, identifying how the personal background can be shared by them and when each professional is responsible, performer or information user of each activity. Figure 22 express the results.

		Correlation between ERM levels and HB-HTA principles		Leaders		Shared human resources and background	
Level		Sampietro-Colon Guideline	ERM Guideline	ERM leader	HB-HTA leader	Analyst with economic background	Analyst with clinical background
Baseline	To identify hospital macro-processes and process leaders	A,B,C,D,E,F	NA	R	I		
	To analyze risk events using risk ranking methodology			I		P	I
	Risk heatmaps and matrices must be developed			I	I	P	
	Short action plans can be created			R	R	P	P
	To establish multidisciplinary teams responsible for management risk events			R	R	P	P
Education	To report risk heatmaps and risk ranking results	E,H	NA	R	I	P	P
	To create risk education programs for all employees			R/P	R/P		P
	Communication softwares and technology can be incorporated			P	R	P	P
	Investment in innovation and research to improve process			R	R	P	P
Quantitative	Use of risk inventory to guide risk identification and analysis	B,H,I	NA	P		P	P
	Determination of metrics and indicators for risk monitoring			R	I	P	P
	Use of Activity based costing analysis to measure risk impact			R	I	P	P
	To create a risk treatment budget			R/P		P	P
	To apply sensitivity analysis and probabilistic risk methods			R		P	P
Governance	Development of reports for board of directors that include financial data	B,C,G,I	NA	R	R	P	P
	ERM part of hospital decision making process			R	I	P	P
	Compliance responsibilities with ERM			R	I	P	P
	Financial resources should be cover operational costs and ensure and appropriate place of work			R	R	P	
A	To clearly state HB-HTA goal and scope, reflect the hospital context, and take into account the informational need of hospital decision makers	NA	Baseline	I	R		
B	The HB-HTA reports should be performed systematically using good methods and appropriate tools in a way that can be transferable	NA	Quantitative and Baseline	I	R	P	P
C	To involve stakeholders using transparent and good communication	NA	Baseline and Governance	R	R	P	P
D	To align HB-HTA mission, vision and values with the hospital strategy and to allow good governance to the HB-HTA unit	NA	Baseline	R/P	R/P		
E	There should be clear leadership at the top of the HB-HTA unit as well as a communication policy/strategy	NA	Baseline and Education	I	P	P	P
F	Criteria for the selection of technologies to be assessed should be clearly stated	NA	Baseline	I	R	P	P
G	HB-HTA units should collaborate with others HTA organizations	NA	Governance	I	R	P	P
H	Well-defined human resources, recruitment policies, and career development plans should be established	NA	Education and Quantitative	R	R		
I	Financial resources should be sufficient to cover operational costs and ensure and appropriate place of work	NA	Quantitative	R	R	P	P

R= Responsible, P = Performer I = Information user

Figure 22 - ERM and HB-HTA guidelines interaction and human capital sharing

Considering the personal resources identified, the literature and interviews, it stands out that there is not a unique profile. The economic analyst may have different academic education (economics, engineering, account, others), but needs to be introduced to the healthcare business, be able to build economic models and perform HTA and risk analysis. For the clinical analysts it is expected that independently of his own base University background, one can be educated to conduct HTA, to be engaged in the enterprise management activities and acquainted with quality, safety and risks programs.

As a last common characteristic, engaging in research processes and activities is also expected for both processes. In HB-HTA it is fundamental, considering the responsibility to publish and validate outside the hospital the effective of new technologies. For ERM, it is expected to be able of sharing risk innovation with other centers, open space to develop risk benchmarking studies and to advance in group with solutions to avoid and explore risks.

Considering the opportunity to innovate and to improve the organizational technology capability, it is understood that the use of this integrated structure can be useful on organizations composed by multiples business units (group of: hospitals, clinics, insurers, others). For these organizations, the implementation of ERM and HB-HTA processes working integrated contributes to maintain the investments of all the organization aligned with strategic goals, financial responsibility and oriented to create value to the group.

4.7 Conclusions

The identification of common principles, objectives and capabilities between ERM and HB-HTA processes suggested in this study advances the literature from both research areas. Its application in a health organization with multiples business units opens an opportunity to use the guidelines to analyze in a practical case study the economic impact of having these processes integrated. In addition, the principles and guidance to implement $E^2RM_{\text{healthcare}}$ are presented in four levels, which makes its implementation a systemic process that can be crossed with the HB-HTA previous principles known in the literature.

Educational programs shared by all employees, financial data and the ability to routinely report risks and technology information to stakeholders are identified as common objectives for both processes. The opportunity to share human capital between HB-HTA and ERM also contributes to the implementation of these processes in hospitals with less financial resources, approaching its own management to be more efficient with the care chain.

5 DEVELOPMENT OF AN ENTERPRISE RISK INVENTORY FOR HEALTHCARE

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Abstract: The first phase of an enterprise risk management (ERM) program is the identification of risks. Accurate identification is essential to a proactive and effective ERM function. The authors identified a lack of such risk identification in the literature and in practical cases when interviewing the chief risk officers from healthcare organizations. A risk inventory specific to healthcare organizations that includes detailed risk scenarios and risk impacts currently does not exist. Thus, the objective of this research is to develop an enterprise risk inventory for healthcare organizations to create a common understanding of how each type of risk impacts a healthcare organization. ERM guidelines and data from 15 interviews with chief risk officers were analyzed to create the risk inventory. The identified risks were confirmed through a survey of risk managers from a range of global healthcare organizations during the ASHRM conference in 2017. Descriptive statistics were developed and cluster analysis was performed using the survey results. The risk inventory includes 28 risks and their specific risk scenarios. Cyberattack was ranked as the principal risk by the respondents, followed by sentinel events and risks associated with human capital management (organizational culture, use of electronic medical records and physician wellness). The data analysis showed that the specific characteristics of the survey participants do not impact an individual's opinion of the importance of the risks identified. A personal background in risk management (clinical or enterprise) was a characteristic that showed a small difference in the perceived importance of the risks from the proposed risk inventory. In addition to defining specific risk scenarios, the enterprise risk inventory presented in this research can contribute to guiding the risk identification phase of an ERM program and thereby support the development of a risk culture.

Keywords: Enterprise risk management; Healthcare management; Risk inventory; Healthcare; Risk identification; Risk analysis

Introduction

Enterprise risk management (ERM) programs have been implemented in organizations across various industries with the aim of minimizing the negative effects of uncertainty in achieving corporate objectives while at the same time promoting its potential positive effects (AVEN; AVEN, 2015; DAMODARAN, 2008). As stated in the most recent guidelines, ERM programs facilitate strategy selection. Choosing a strategy calls for a structured decision-making process that analyzes risks and aligns an organization's resources with its mission and vision (COSO, 2017). In the healthcare industry, the ERM process has been explored by risk managers to improve the organizational value creation process and develop a safer environment (CARD; WARD; CLARKSON, 2014; WOODRUFF, 2005).

ERM guidelines, including ISO 31000 (PURDY, 2010, ISO, 2018) and COSO (COSO, 2004, COSO, 2017), outline an ERM process that includes several common phases: identification, analysis, assessment, monitoring and control. Adequately performing the first phase, risk identification, is a requirement to build a proactive and effective ERM process (CARROLL, 2016, CAGLIANO; GRIMALDI; RAFELE, 2015). In the same way that Cox's (2008) research explores how risk matrices can be used in the ERM process during the risk analysis phase, this research takes a deep dive in the risk identification phase. The ability to identify and define risks correctly is indispensable to subsequently enable the effective use of risk analysis tools (CAGLIANO; GRIMALDI; RAFELE, 2015, ETGES et al., 2018a).

The risk identification process needs to be proactive, to involve multiple employees, and to create value for and protect the organization (COSO, 2007, BRINER et al., 2010). In previous research that explored how ERM is conducted in healthcare organizations, it was established that the guidelines that currently exist are not practical because they only include a list of risk domains (ETGES et al., 2018a). The development of an enterprise risk inventory that includes specific risk events, details of the risk scenarios and descriptions of how each risk impacts the organization was identified as a gap for healthcare organizations.

The guidelines by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) were the first to define risk factors by industry, but they do not explore risk events in detail. In 2014, the American Society of Healthcare Risk Management (ASHRM) proposed risk domains for healthcare organizations, but again, risk events and scenarios are not described in detail (ASHRM, 2014). Other institutions, such as Healthcare

Insurance Reciprocal of Canada (HIROC) (HIROC, 2014) and the National Health Service in England (NHS) (NPSA, 2008) have developed risk taxonomies that include clinical risks and enterprise risks. In 2014, AON Corporation published the Healthcare Industry Report (AON, 2014) based on collaborative research with various healthcare organizations that proposed ten common healthcare risks: regulatory/legislative changes; failure to attract or retain top talent; economic slowdown/slow recovery; increasing competition; damage to reputation/brand; failure to innovate/meet customer needs; lack of technology infrastructure to support business needs; political risk/uncertainties; workforce shortages; and cash flow/liquidity. Unfortunately, and similar to other existing guidelines, this report does not define each risk in sufficient detail for multiple individuals in an organization to have a common understanding of the risks the organization faces. This means that every healthcare organization must develop its own enterprise risk identification process.

The authors previously interviewed 15 hospital risk officers from Brazil and the USA and presented a novel model for healthcare risk management, the Economic Enterprise Risk Management innovation program for healthcare: $E^2RM_{\text{healthcare}}$ (ETGES et al., 2018b). This previous research identified qualitative differences in individual risk perception capabilities among risk managers from large and small hospitals based on personal background and whether the hospitals were associated with a school of medicine. To complement the published model, the authors reviewed the data again and conducted a new survey in order to develop an enterprise risk inventory for use at the beginning of the risk identification phase.

Thus, the main objective of this paper is to develop an enterprise risk inventory for healthcare organizations in order to create a common understanding of how each type of risk impacts a healthcare organization. Additionally, it aims to determine whether the length of time working with ERM, the number of employees at the hospital and the presence of a school of medicine impact the perceived importance of the enterprise risks identified.

5.1 Research Methodology

This study can be classified as exploratory, as it analyzes the literature and data collected from interviews to increase the knowledge about ERM (SELLTIZ; WRIGHTSMAN; COOK, 1976). Thus, a survey was constructed and administered, data from the survey responses were collected, and a quantitative analysis was performed. Figure 23 illustrates the three phases: survey development, survey application and data analysis.

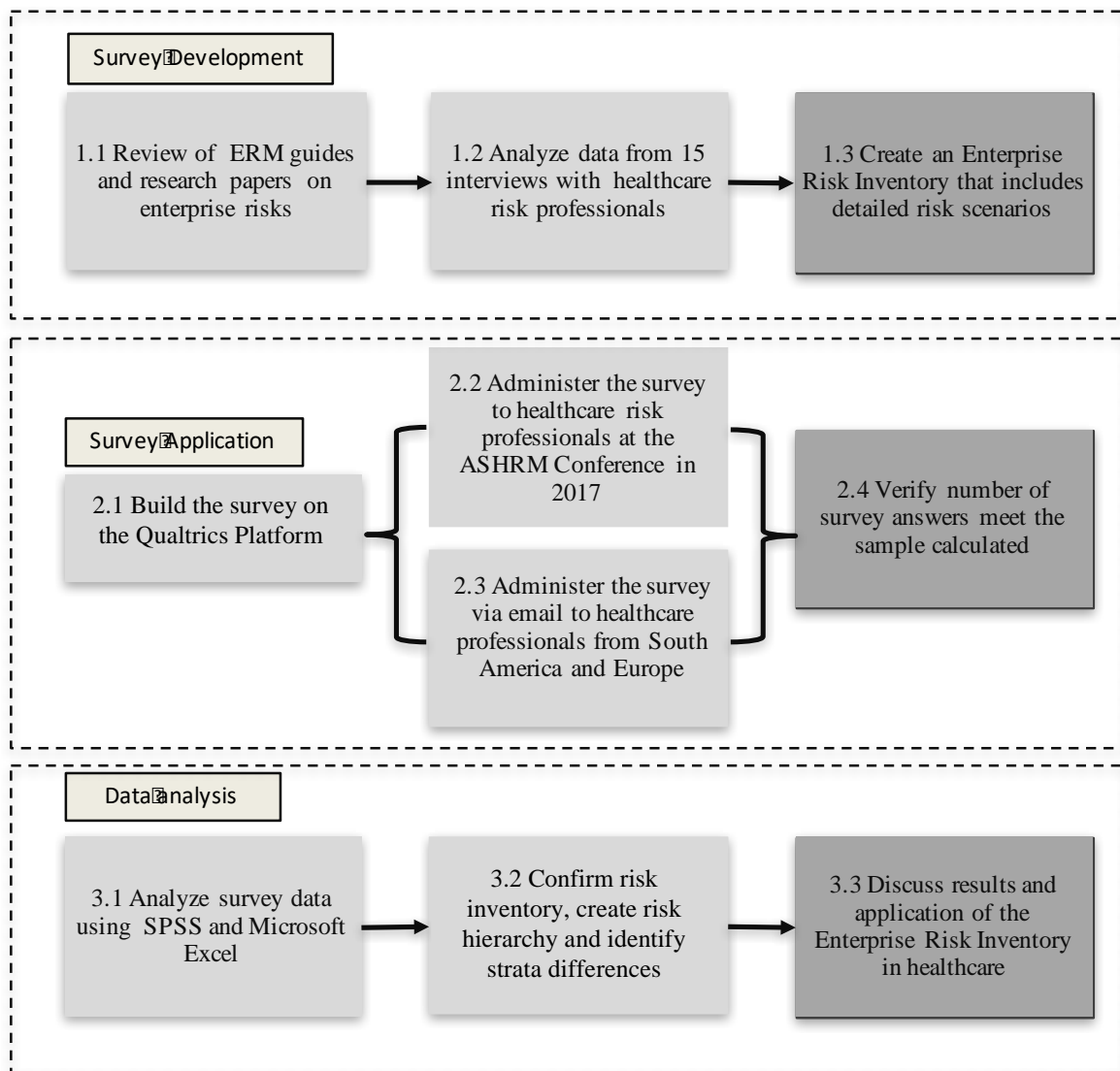


Figure 23 - Research methods

5.1.1 Survey Development

To construct the survey, two steps were taken. First, data from 15 interviews with risk professionals from various healthcare organizations in Brazil (7) and the United States (8) were analyzed. Hospitals in Brazil were identified using a list from the magazine *America Economica* (2014) as “the best hospitals in Latin America”. JCI-accredited hospitals and hospitals with risk management teams in their management structure were selected and contacted. US hospitals with national quality accreditations as well as established risk management teams were also contacted. Data from a ninth US hospital, however, were not included due to incompleteness, which prevented comparisons. The resulting sample was heterogeneous, as it included data from different types of organizations: private and public hospitals, academic and non-academic hospitals, and a range of sizes. The main characteristics of the healthcare organizations interviewed are presented in Figure 14.

Second, the content of the guidelines developed by COSO (2007), ASHRM (2014), HIROC (2014), NHS (2008) and AON (2014) were assessed, as they were mentioned by the participants as being important to the creation of their ERM programs.

The software NVIVO was used to analyze the combined content of the interviews and guidelines. The researchers used the software to identify the risks listed by the participants to develop a first enterprise risk inventory list based on repetition of the risks by the participants and the literature. In sequence, two external risk management consultants, one Brazilian and the other from USA, both of whom had more than 10 years of experience in healthcare risk management, discussed the risk inventory with the two first authors of this study. The inventory was agreed upon by the authors, including the name of the risk, the concept that it described, and a detailed risk scenario. The risk scenarios considered real examples that occurred in recent years in hospitals throughout the world that were shared on global media.

Subsequently, the survey was built using the Qualtrics platform. The survey was made available online, and the participants were asked to choose if they strongly agree, somewhat agree, neither disagree nor agree, somewhat disagree or strongly disagree when asked about the importance of each risk identified. The complete questionnaire can be found in Appendix D through an online link.

5.1.2 Survey Application

A stratified approach was used to calculate the minimum number of surveys that needed to be completed. Two variables for stratification were defined: length of time working in risk management and type of risk management (clinical or enterprise). These variables were selected based on the results presented by Etges et al. in previous research (ETGES et al., 2018b). The 15 interviews were analyzed to develop an ERM model oriented toward healthcare organizations. The model also presented the differences between clinical and enterprise managers and those related to length of working time in risk management. For each stratum variable, two classes were identified: (stratum 1) number of years working in risk management – less than seven years and more than seven years; and (stratum 2) type – clinical risk management and enterprise risk management. The total number of strata is therefore four. To calculate the minimum number of questionnaires per group, a normal distribution was used. The formula to calculate the number of questionnaires per group is defined in equation 1:

$$n = z_{\frac{\alpha}{2}}^2 \frac{CV^2}{ER^2} \quad (1)$$

$z_{\frac{\alpha}{2}}^2$ = significance level to be applied in the estimation;

CV^2 = coefficient of variation;

ER^2 = the permissible relative error, that is, the percentage error in the estimate that we were willing to accept.

Assuming a significance level of 5%, $z_{\frac{\alpha}{2}}^2 = 1.96$, with a moderate CV and a low ER, we calculated 16 completed surveys per group and a total of 64 completed surveys for the four groups combined.

In October 2017, the American Society of Healthcare Risk Management's annual conference took place in Seattle. The survey was distributed at the conference during ERM workshops and at the exhibit hall, where only people participating in the conference had access. In parallel, emails were sent to various healthcare risk professionals in Brazil and United States who worked at tertiary hospitals and occupied a risk management position. The survey was open from October 10, 2017 to January 5, 2018.

5.1.3 Data Analysis

The survey data were extracted from Qualtrics and analyzed using SPSS and Microsoft Excel software. The descriptive statistical analysis was used to create a risk ranking and analyze differences between the strata. The risk ranking was first analyzed based on the Likert scale.

The second, third and fourth analyses utilized a binary reference. The answers "strongly agree" and "somewhat agree" were classified as agreeing that the risk is an important enterprise risk in the healthcare industry. The answers "strongly disagree", "somewhat disagree" and "neither agree nor disagree" were classified as not agreeing that the risk is an important enterprise risk in the healthcare industry. The second analysis combined different sample strata (time working in risk management and type of risk management background, clinical or enterprise). The third analysis compared the survey results between participants who worked in organizations with more than 1000 employees to those who worked in organizations with fewer than 1000 employees. The fourth analysis compared the respondents' opinions from organizations with and without a school of medicine.

Cluster analysis was performed to allocate the risk professionals to groups based on their answers regarding the perceived importance of each risk. The cluster classification was performed in the software SPSS in two steps following Favero et al. (2009). First, the hierarchical algorithm nearest neighbor was applied to the data, which enabled the number of clusters to be defined through an analysis of the resulting dendrogram. Second, based on the number of clusters previously defined, the non-hierarchical algorithm K-means was used to establish the members of each cluster. The nearest neighbor algorithm used the Euclidian distance as the distance measure, while the K-means algorithm used the square of the Euclidean distance. Additionally, the K-means algorithm was configured to (i) use random seeds when defining the initial centroids, and (ii) repeat the analysis 100 times and return the most frequent result.

5.2 Results

The results are presented below. First, the development of the survey and the risk inventory are explained. Second, the survey application is described, and finally, the data from the survey responses are analyzed and discussed.

5.2.1 Survey development: Risks and origin

Twenty-eight risks were selected for inclusion in the risk inventory. Figure 24 below shows the risks that were identified for each guideline. Five additional risks were added: disputes with insurance companies regarding reimbursements; security – active shooter; financial batch claim emanating from reimbursement reforms; use of social communication networks; and union strikes.

#	Risks	Guideline and Participants					
		COSO	ASHRM	HIROC	NHS	AON	Participants
1	Board governance – poor communication or lack of direction	x	x	x	x		
2	Business Interruption Due to Natural Catastrophe	x	x		x		
3	Clinical batch claim		x		x	x	
4	Conflicts due to organizational hierarchy	x	x	x		x	
5	Cyber security	x					
6	Deficiency in development of technology and innovation	x	x	x		x	

7	Dependence on insurance companies			x			
8	Dispute with insurance companies on reimbursements						x
9	Electronic Health Record (EHR)		x	x			
10	Environment Protection Agency or similar				x		
11	External media communication		x	x		x	
12	Financial batch claim emanating from reimbursement reform						x
13	Fraud committed by a provider	x	x	x	x		
14	Government instability	x	x			x	
15	Loss of accreditation			x	x		
16	Non-compliance with laws and regulations	x	x	x	x		
17	Loss of Occupational Safety and Healthcare Administration (OSHA in USA)		x	x	x		
18	Organizational culture	x	x	x	x	x	
19	Physician wellness		x	x		x	
20	Relation between the School of Medicine or Residency program and hospital			x			
21	Active Shooter						x
22	Sentinel events		x	x	x		
23	Supply chain		x	x			
24	Talent retention	x	x		x	x	
25	Terrorism		x			x	
26	Unethical conduct	x	x	x		x	
27	Union strike						x
28	Use of social communication networks						x

Figure 24 - Risk inventory origin

A document that includes risk descriptions, risk scenarios, and risk impacts was developed to constitute the healthcare enterprise risk inventory. One of the objectives of the inventory was for the interviewees to have a common understanding of each risk so that meaningful results and comparisons could be obtained. Another objective of the risk

inventory was to educate risk managers and other interested professionals. The complete risk inventory is presented in Appendix C through an online link.

One concern that was raised in the interviews with the risk managers related to the lack of a common definition of a defined risk. The ERM guidelines currently in place do not offer sufficiently detailed definitions to allow for proper comparisons. For example, regarding the risk of fraud, stealing money from Medicare is fraud, but taking a photograph of a medical record is also fraud. With no explicit definition, individuals may think of the risk of fraud in different ways. A large organization must create a taxonomy to develop a common understanding of identified risks. The risk inventory created should help guide risk managers and other users from different levels, backgrounds, positions, and locations. In addition, if different organizations use the same inventory, it will be possible to develop risk benchmarks around the business aspects of healthcare.

Another new element that the risk inventory provides is the association of each risk with the dimension that the risk impacts. The dimensions used are the patient, for risks that impact the patient’s care or the patient’s family; financial, for risks that impact the organization’s finances; legal or regulatory, for risks that are associated with lawsuits or regulations; reputation, for risks that can impact the hospital’s image; and social, for risks that can affect the region around the hospital or a large number of people.

Finally, the risks are categorized by group using the ASHRM domains and COSO factors as guidelines. The groups are important for the risk analysis and risk assessment phases. Figure 25 below lists the enterprise risk events, their groups, the risk descriptions and the impact dimensions.

Risk	Risk group	Short description	Risk impact				
			Patient	Financial	Reputation	Legal	Social
Board governance – poor communication or lack of direction	Financial	Relationship with shareholders and the board of the organization; transparency in the information and results, capacity to prosecute governance. Mergers and Acquisitions. Conflict of Interest		x	x		
Business Interruption Due to Natural Catastrophe	Operational	Occurrence of internal or external events, which make it impossible for an organization to maintain its critical activities. Natural disasters must be allocated to this event. Earthquake or Hurricane.	x	x			x

Clinical batch claim	Clinical	With the increase of technologies and multiples techniques applied to patient to treat diseases, the batch claims have increased in size and frequency. Batch claims are frequently related to poor delivery of clinical service.	x	x	x		x
Conflicts due to organizational hierarchy	People	Responsibilities, leadership and respect among the employees and functions. The relationship between the decision-making process and hierarchy. The medical hierarchy needs to be balanced in favor of teaching, learning and patient safety rather than the exercise of power (WALTON, 2006).	x				
Cyber security	Information Technology	Invasion of an internal or external hacker that causes damage to the information security of the organization or its operational capacity. The use of ransomware is frequently present.	x	x	x	x	x
Deficiency in development of technology and innovation	Clinical	Lack of technologic innovation or development of innovations that do not meet the organization's needs. It is related organization's ability to possess, dominate and use technological resources that have an effect on its operations. Effects on the quality of clinical procedures and patient experience, as well as valuation of the institution towards insurers can be perceived.	x	x	x		
Dependence on insurance companies	Financial	Negotiations with one health insurance company that accounts for 30% of the billing. The insurance company wants to reduce reimbursements for many medical tests and procedures.	x	x			
Dispute with insurance companies on reimbursements	Financial	An insurance company disputes the drugs, devices, or procedures used by the providers and hospital. The insurance company denies coverage.	x	x		x	
Electronic Health Record (EHR)	Information Technology	Difficulty in obtaining information due to error in communication, loss of processing power or difficulty in operating the Hospital's system.	x			x	
Environment Protection	Compliance	Government agency comes to investigate and fines the hospital or a department of the hospital.	x	x	x	x	x

Agency or similar							
External media communication	Information Technology	Healthy external marketing and media communication about the hospital and close relations. Organizational information being shared before the formal process and department of the hospital. The information timing can't be the correct, or the information credibility can cause future problems.	x		x	x	
Financial batch claim emanating from reimbursement reform	Political	Financial risk for healthcare organizations associated with bundled services or healthcare outcomes.		x	x		x
Fraud committed by a provider	Financial	Insurance plan fraud committed by a doctor or a group of doctors through prescriptions. In addition, important medicines or equipment stolen from the hospital can also be considered like a fraud.	x	x	x	x	x
Government instability	Political	Reduction in the country's healthcare budget	x	x			x
Loss of accreditation	Compliance	Loss of an important certification or accreditation.	x	x	x	x	
Non-compliance with laws and regulations	Compliance	A clinical trial is taking place without the proper Institutional Review Board (IRB) approval. Patients die while part of the research.	x	x	x	x	x
Loss of Occupational Safety and Healthcare Administration (OSHA in USA)	Compliance	The effect that working laws represent in how employees are being contracted. Any change in the formal orientations represent an effect for the hospital management.	x	x		x	
Organizational culture	People	The healthcare organization needs to be able to share and implement its culture among all the employees. New and old employees need to work conducted by the same values and principles independently of their own religion or origins.	x				
Physician wellness	People	50% rate of burnout amongst physicians discovered after taking a physician wellness survey that measures burnout and professional fulfillment.	x	x		x	
Relation between the School of	Clinical	Interface between the SoM and the health service that may lead to interference of the university	x		x		x

Medicine or Residency program and hospital		model to the business or, on the other hand, value the institution due to the teaching quality.					
Active Shooter	Operational	Assault and active shooter threats to patients, families and hospital employees.	x		x	x	x
Sentinel events	Clinical	Sentinel events, near miss events, incidents or medical error that can cause lawsuit.	x	x	x	x	
Supply chain	Operational	Materials and equipment control and management. Political problems with countries that supply resources for hospitals.	x	x			x
Talent retention	People	Loss of a team of providers that are specialized in certain types of procedures. It can happen in function of bad recruitment processes, or bad human resources management.	x	x	x		x
Terrorism	Political	Terrorism attack close to the hospital.	x	x	x	x	x
Unethical conduct	Operational	Problems related with unethical employee conduct whether or not involving patients. Personal information, images or objects can be used without the approval of patient. Internal problems between employees can result in organization impact.	x	x	x	x	x
Union strike	Political	Union strikes among different classes of employees that can affect the hospital capacity to be operated.	x	x	x	x	
Use of social communication networks	Information Technology	Problems with confidential information being communicated through social media. A VIP: executive, actor, etc. Information is released on Facebook, what's app or other.	x	x	x		x
Total/impact			26	22	18	15	15

Figure 25 – Risk inventory – group and impacts

5.2.2 Survey application

After the risk inventory was completed, the survey was developed. For each risk, the participants were asked if they strongly disagreed, somewhat disagreed, neither disagreed nor agreed, somewhat agreed or strongly agreed that the risk is an important enterprise risk in the healthcare industry. The survey was anonymous. To create strata and analyze the responses, additional questions were asked to determine the credentials of the participants and the type of institution in which they work. The questions were used to determine the

participants' position, years working in that position, number of employees in the company, and whether a school of medicine was present. This information was used to develop the sample strata. Figure 26 presents an example of the risk questions on the platform.

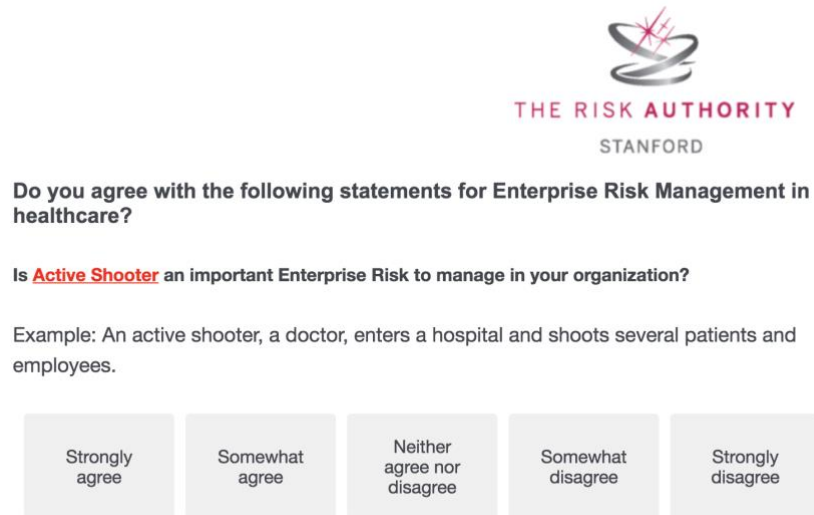


Figure 26 - Risk inventory survey example

A total of 69 risk professionals started the survey, and 53 completed surveys were obtained during the period of study. This sample did not reach our 5% confidence interval target; however, it is still under the 10% confidence interval (required sample size of 44 interviews).

5.3 Data Analysis

The survey data were exported to a CSV file, and the software SPSS was used to conduct the analysis. A total of 28 participants believed that their organization had a very or moderately effective ERM program. Thirty-eight participants worked in non-for-profit organizations, and 35 were from organizations with a school of medicine or a residency program. Twenty-seven participants were chief risk officers or executive professionals, and 26 were clinical risk managers. A total of 19 participants had worked fewer than 7 years in risk management, and 34 had more than 7 years' experience working in risk management. Finally, 26 participants worked in organizations with fewer than 1000 employees, and 27 worked in organizations with more than 1000 employees.

The first analysis aimed to develop a ranking of the 28 risks. Chart 3 shows the risk ranking ordered by the perceived level of risk importance. The y-axis refers to the frequency with which each risk was identified, and each color bar shows one of the alternative choices.

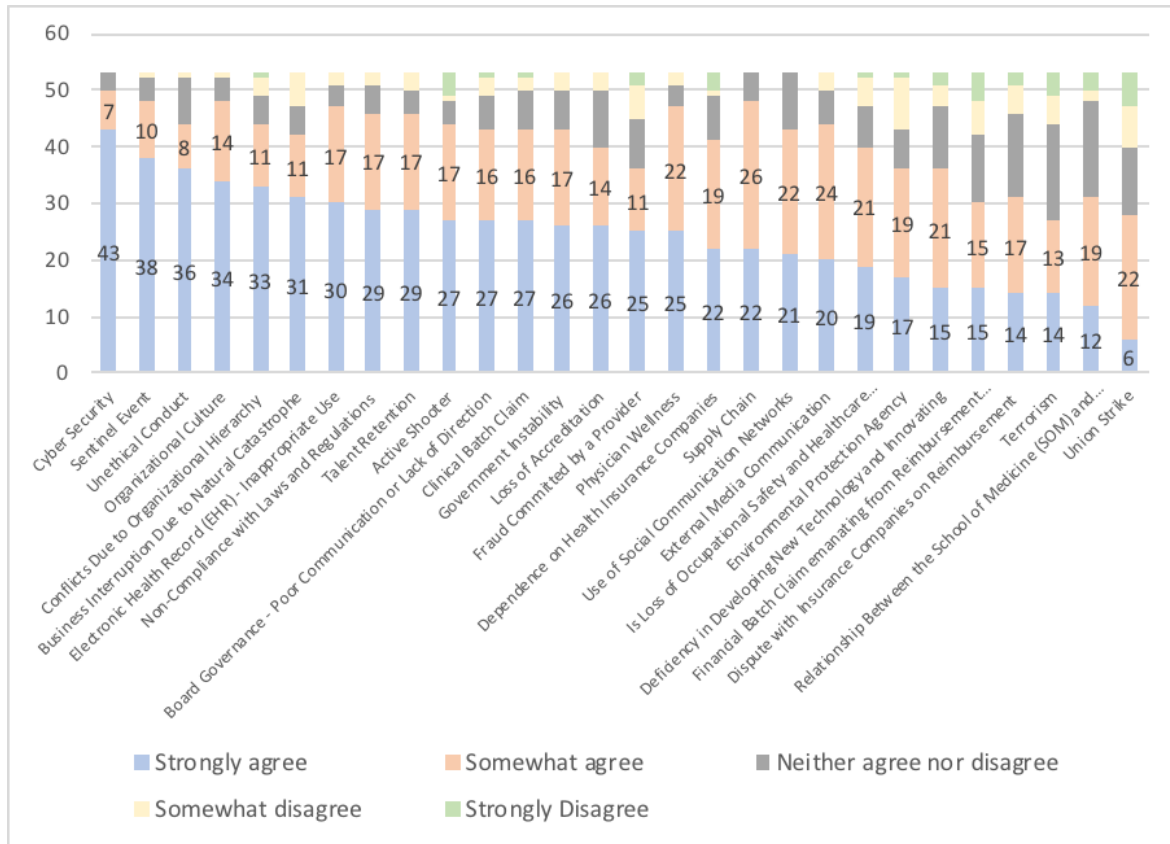


Chart 3 – Risk ranking according to the 53 participants

Cyber security was ranked first, which highlights the importance that risk managers have placed on cyber issues. The second highest ranked risk was “sentinel event”. This result was expected, given the number of international regulations and rules to monitor and control sentinel events.

The sentinel events, unethical conduct, organizational culture, and conflicts due to organizational culture risks demonstrate the importance of employee management in the healthcare industry. These risks are associated with an organization’s ability to manage human capital in alignment with respect for the values, rules and objectives established by organizational leaders.

The second analysis (Chart 4) shows the differences in the answers for the four groups representing the strata detailed in the methods section. The y-axis represents the percentage of each group that agree that the risk is an important enterprise risk: i) chief risk officers with more than 7 years working in risk management, 18 participants; ii) chief risk

officers with fewer than 7 years working in risk management, 9 participants; iii) clinical risk managers with more than 7 years working in risk management, 10 participants; and iv) clinical risk managers with fewer than 7 years working in risk management, 16 participants.

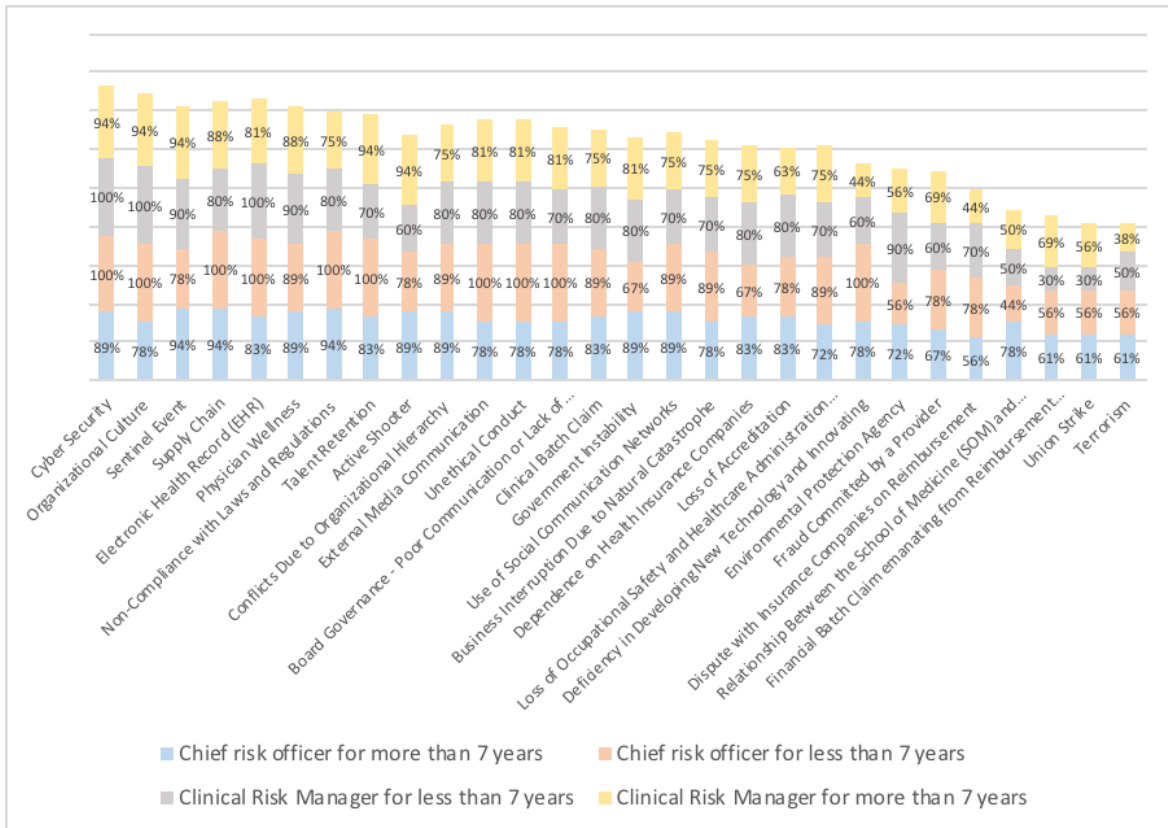


Chart 4 - Type of risk management and time working in risk management

Chart 4 shows that chief risk officers tend to agree more than clinical risk managers regarding the risks that they consider to be important. The average percentage in which chief risk officers answered that they strongly agreed or somewhat agreed on the importance of each risk was 83% (the blue and orange bars in Chart 5). In contrast, the percentage for clinical risk managers was 73% (the gray and yellow bars in Chart 5). When considering the type of risk management, the difference in the average percentage with regard to years of experience is small: 76% for more than 7 years and 78% for fewer than 7 years working in risk management.

The results shown in Chart 5, the third analysis, are similar those in the second analysis. The y-axis represents the percentage of participants from each group that agree that the risk is important. The chart shows that the size of a healthcare organization has no impact on risk professionals' perception of risks: the average percentage in which respondents from organizations with fewer than 1000 employees (27 participants) answered that they strongly

agreed or somewhat agreed on the importance of each risk was 77% (yellow bar). On the other hand, the same percentage for the group from companies with more than 1000 (26 participants) employees was 76% (gray bar).

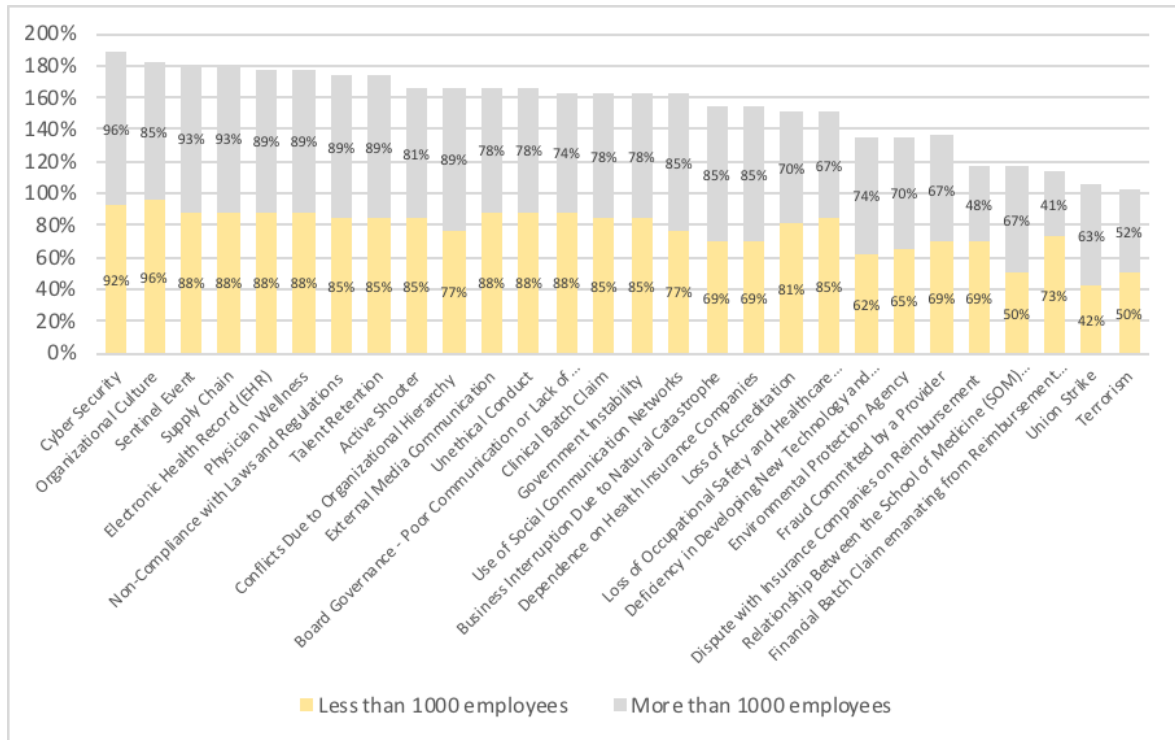


Chart 5 - Differences between participants from hospitals with fewer and more than 1000 employees

With regard to the presence of a school of medicine, it is possible to identify small differences in the perceptions of risks between the two groups. In general, the managers from organizations without a school of medicine or residency program (18 participants) tend to agree slightly more about the importance of each risk than those with a school of medicine or residency program (35 participants), on average 6% more. However, for the following risks, the opposite is true, i.e., those who work in an organization with a school of medicine or residency program agree more about the importance of the following risks: security – active shooter, government instability, use of social media networks, deficiency in developing new technology and innovation, relation between the school of medicine and hospital and union strikes. Chart 6 shows the results, with the y-axis indicating the percentage of participants who agree about the importance of the risk from each group.

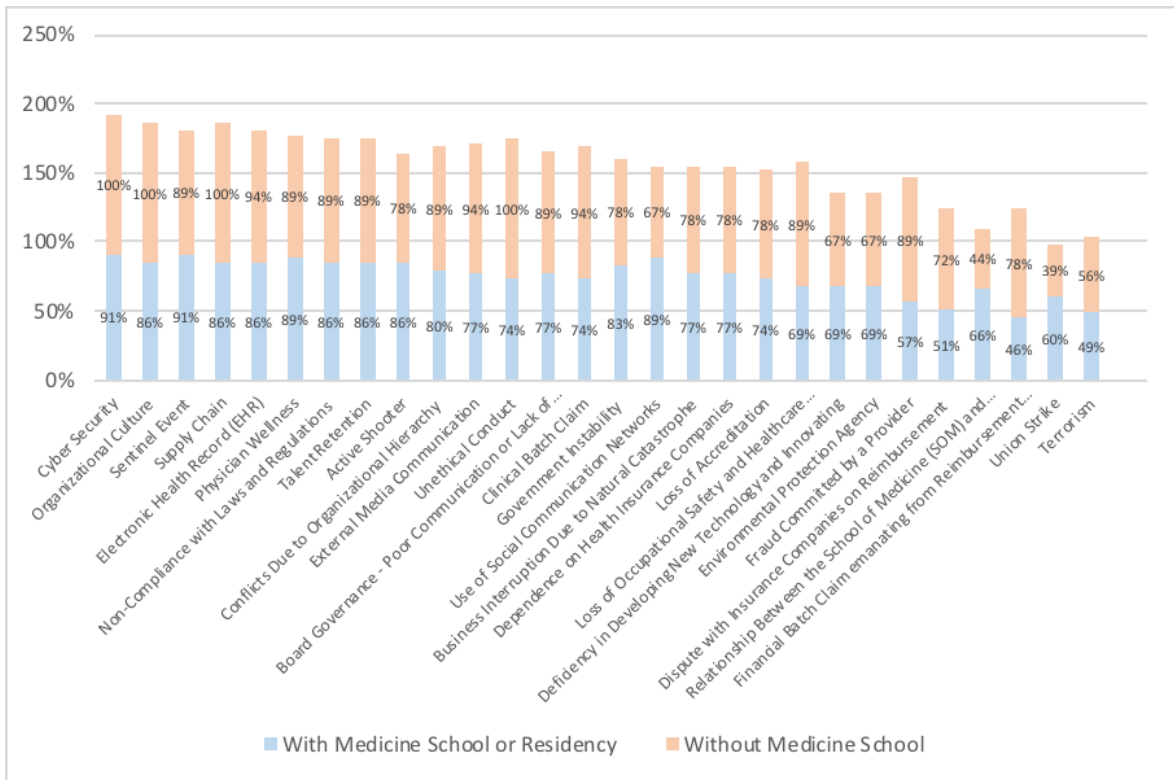


Chart 6 - Difference between with and without Medicine School

The cluster analysis defined four different groups, as shown in Figure 27.

Number of Cases in each Cluster

Cluster	1	15.000
	2	34.000
	3	1.000
	4	3.000
Valid		53.000
Missing		.000

Figure 27 - Number of cases per cluster

The K-means algorithm was used to establish which participants were included in each of the four clusters. Figure 28 shows the results.

Case Number	Cluster	Distance
17	4	7.659
21	4	9.309
23	4	7.394
6	3	.000
2	2	8.886
4	2	6.735
5	2	9.196

Case Number	Cluster	Distance
39	2	11.399
41	2	5.686
42	2	9.645
43	2	5.366
44	2	7.195
46	2	10.550
47	2	6.422

7	2	6.615	50	2	5.461
8	2	5.874	52	2	6.633
9	2	6.131	53	2	6.242
10	2	6.537	37	2	8.783
11	2	6.927	38	2	9.007
12	2	8.148	1	1	10.223
13	2	8.315	3	1	11.056
14	2	8.841	22	1	13.069
15	2	7.964	25	1	8.844
16	2	6.633	28	1	9.005
18	2	5.666	29	1	10.025
19	2	7.694	31	1	9.911
20	2	12.066	33	1	7.960
24	2	8.969	35	1	12.624
26	2	7.694	36	1	10.444
27	2	7.179	40	1	9.997
30	2	11.298	45	1	9.036
32	2	7.398	48	1	7.046
34	2	6.769	49	1	7.779
			51	1	11.854

Figure 28 - Cluster membership

Clusters 1 and 2 include 92% of the sample. The remaining 8% is divided among cluster 3 (one member) and cluster 4 (three members). Case 6 is a single member of cluster 3, which can be explained by the fact that the individual is a health insurance broker focused on clinical insurance. The members of cluster 4 are clinical risk managers working in not-for-profit companies with established ERM processes.

Subsequently, ANOVA was used to identify which questions had statistical significance to the establishment of participant group membership. Figure 29 presents the results.

Questions	Cluster mean square	df	Error mean square	df	F	sig.
Clinical Batch Claim	27.262	3	2.234	49	12.204	.000
Conflicts Due to Organizational Hierarchy	28.863	3	2.493	49	11.577	.000
Dependence on Health Insurance Companies	47.235	3	2.074	49	22.777	.000
Dispute with Insurance Companies on Reimbursement	33.268	3	2.987	49	11.136	.000
Environmental Protection Agency	32.966	3	3.428	49	9.617	.000
External Media Communication	16.074	3	2.019	49	7.960	.000
Fraud Committed by a Provider	67.311	3	2.077	49	32.411	.000
Non-Compliance with Laws and Regulations	20.580	3	1.552	49	13.257	.000
Loss of Occupational Safety and Healthcare Administration (OSHA in USA)	23.920	3	3.024	49	7.911	.000
Physician Wellness	16.601	3	1.559	49	10.650	.000
Sentinel Event	16.908	3	1.143	49	14.797	.000
Board Governance - Poor Communication or Lack of Direction	19.512	3	2.992	49	6.522	.001
Active Shooter	23.871	3	4.210	49	5.670	.002
Financial Batch Claim emanating from Reimbursement Reform	30.082	3	5.108	49	5.889	.002
Cyber Security	5.239	3	.970	49	5.401	.003
Unethical Conduct	11.637	3	2.165	49	5.376	.003
Supply Chain	6.196	3	1.380	49	4.491	.007
Union Strike	18.470	3	4.808	49	3.841	.015
Business Interruption Due to Natural Catastrophe	13.759	3	3.754	49	3.666	.018
Relationship Between the School of Medicine (SOM) and Hospital	13.718	3	3.886	49	3.531	.021
Electronic Health Record (EHR)	7.338	3	2.234	49	3.285	.028
Terrorism	14.222	3	5.269	49	2.699	.056
Organizational Culture	4.998	3	1.915	49	2.610	.062
Loss of Accreditation	8.363	3	3.252	49	2.571	.065
Government Instability	7.226	3	2.971	49	2.432	.076
Deficiency in Developing New Technology and Innovating	8.506	3	4.223	49	2.014	.124
Talent Retention	5.491	3	2.781	49	1.974	.130
Use of Social Communication Networks	2.744	3	2.176	49	1.261	.298

Figure 29 - Analysis of variance of cluster members

Figure 29 shows that only 13% (7) of the questions were not significant to the identification of cluster members. This result indicates that the risks integrated in the enterprise risk inventory captured each risk's perceived importance during the survey application because the analysis indicates that the majority of the risks were significant to the cluster formation.

Furthermore, the final analysis shows that all 28 risks were confirmed through the survey. More than 50% of the managers somewhat agreed or strongly agreed that all the risks are important enterprise risks in the healthcare industry, and this percentage is higher than 70% for 20 risks (all risks above loss of occupational safety and healthcare administration in Chart 8). This represents an important advance in healthcare risk research

and for practical application. Chart 7 shows the results, with the y-axis indicating the percentage of participants who agreed or disagreed that the risks are important.

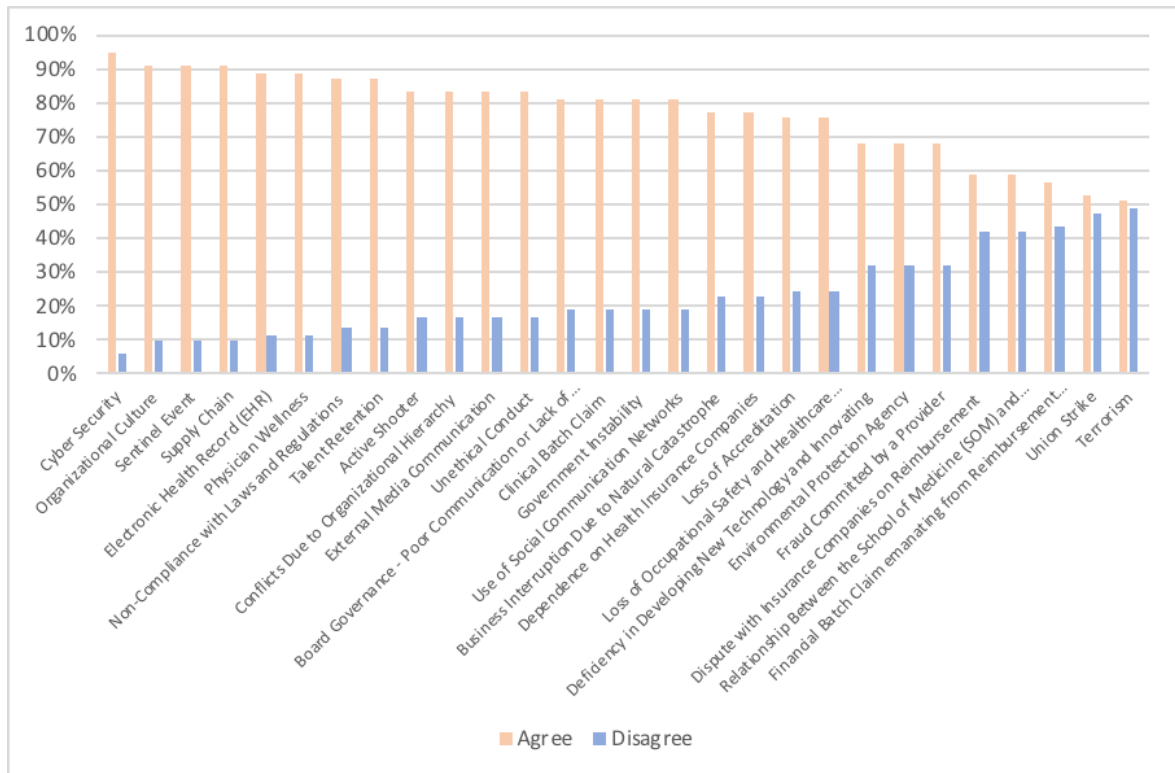


Chart 7 - Agree x disagree - risk inventory confirmation

The final analysis was performed to examine the free text written by the participants in response to an additional comments question. One item was mentioned by many participants: the importance of managing the impact of a hospital's external image. The risk inventory does not include reputation as a risk but rather as an impact. However, two additional risks were reported. First, the participants mentioned investments in outpatient care and their connection to the hospital's capability to deliver a positive patient experience. The second risk mentioned was the growth in healthcare technology that has enabled home healthcare throughout the world. This risk impacts the support patients receive from the hospital after hospitalization.

5.4 Discussion

ERM is applied across the board and is subject to the strategic positioning of organizations, which have the autonomy to manage processes and provide informational support when making strategic decisions (ETGES et al., 2018a). When conducting ERM program, it is important that employees with different expertise and from different positions

work together to incorporate the specific characteristics of the market in which the program will be implemented (BROMILEY et al., 2015; CAGLIANO; GRIMALDI; RAFELE, 2015) (ETGES et al., 2018a). Therefore, it is particularly important for individuals with diverse expertise and experience to have a common understanding and specific definitions of risk events (ANTHONY COX, 2008). The results of this study show that having a personal background in risk management (clinical or enterprise) was a characteristic that showed a small difference in the perceived importance of the risks from the proposed risk inventory. These results highlight the necessity for clinical risk managers to work closely with chief risk officers to create a risk culture across the entire organization (CARROLL, 2016; CELONA, JOHN; DRIVER, JEFFREY; HALL, 2010; ETGES et al., 2018a). The length of time working in risk management and the number of employees in an organization do not show substantial differences with regard to the answers in Chart 4 and Chart 5. The cluster analysis also confirmed these results, as participants' background had no influence on cluster membership. Both types of backgrounds were found in participants in all 4 clusters.

With regard to the small difference in how risk managers from organizations with and without a school of medicine agree with the risk results, an argument made during the first phase of the interviews (15 managers) deserves attention. A possible explanation is that organizations associated with schools of medicine are more exposed to students posting on social media than organizations that have formal contracts with employees (KIND et al., 2010). Additionally, schools of medicine connect organizations to government funding, which can lead to instability. Hospitals associated with schools of medicine and residency programs also must contribute to research and innovation capability (CHERVENAK; MCCULLOUGH, 2005).

When ASHRM started to include ERM in its own principles in 2011, one objective was to connect ERM concepts from other industries to the traditional risk management concepts present in healthcare organizations (OPPENBERG, 2013). The developed risk inventory innovates in the risk identification phase of ERM by highlighting ways that enterprise risks affect patient care. Of the 28 risks identified, 26 can impact patient care or the patient's family. ERM teams in healthcare organizations need to develop transparent processes that include the clinical impact of risks, irrespective of whether the initial risk event was clinical. This approach would help make patient care and the patient experience the focus to guide the strategic decision-making process.

With regard to the other characteristics explored among the study participants, it is possible to assume a near consensus regarding risk perceptions independent of the type of risk management performed or the length of time working in risk management, as demonstrated by the cluster analysis. Although we were not able to identify participant characteristics that lead to membership in clusters 1 and 2, the presence of clinical risk managers, chief risk officers, and employees with different levels of experience working in risk management led us to conclude that the length of time working in risk management as well as the participants' background had no influence on cluster membership. Therefore, as the previous descriptive statistics analysis suggests, it is possible to assume that risk perceptions are not directly associated with the length of time working in risk management and the type of risk management performed (clinical or enterprise). This result can be explained by the fact that a risk manager in a healthcare organization is involved in many areas: accounting, actuarial sciences, the healthcare business, information technology, and people management, among others (CARROLL, 2016; ETGES et al., 2018a). Thus, the organizational structure does not greatly affect the way that risk managers think about risk. Some interviewees reported that it is individuals' responsibility to stay current on the innovations in risk management and to be completely engaged in the cause.

Cyberattack-related risk was identified as the number one enterprise risk for healthcare organizations, and this result is supported by the attention and investment allocated to combatting hackers. The last report developed by AON suggests that healthcare organizations are increasingly purchasing data breach coverage to protect their sensitive patient information (AON INPOINT, 2017). This is mainly driven by the HIPAA legislation, which outlines data privacy and security provisions for safeguarding medical information and that now holds organizations responsible in the event of a breach (AON INPOINT, 2017).

The year 2017 will be remembered for the large number of cyberattacks targeting healthcare organizations. Hackers accessed hospital databases throughout the world, interrupting operations and stealing data from millions of patients and thousands of companies. The National Health Service in England and Scotland announced in May 2017 that it would spend €60,000,000.00 per year on the NHS' cyber system to improve its security (O'DOWD, 2017). By August 2017, the healthcare sector reported 233 breach incidents to the US Department of Health and Human Services in which more than 3.16 million patient records were breached (DAVIS, 2017). These events align with the results

found in this research and justify the investments in research and the dollars spent to improve information systems to keep hospital data safe.

Patient data security in hospitals that operate with high levels of technology is fundamental to delivering high quality and safe care to patients. The identification of cyberattacks at the top of the risk ranking reflects the importance that healthcare risk managers are placing on this risk by allocating time and other resources.

Sentinel events are a specific characteristic of healthcare organizations, which have been encouraged by international institutions such as JCI to reduce sentinel events through safety and quality practices (JCI, 2014) (VALENTIN et al., 2006). Human errors represented a starting point for advances in the clinical risk management literature since the publication of *To Err is Human* (KOHN; CORRIGAN; DONALDSON, 2000) and “Crossing the Quality Chasm” by the Institute of Medicine (CORRIGAN, 2005). These publications suggest that between 3.7%-16.7% patients suffer an adverse event, and it is estimated that a half of these events could be prevented through better risk management practices. These events and the attention paid to this issue by international institutions were highlighted during this research, as the participants confirmed the importance of all risks associated with employee management and human relations in healthcare organizations.

Addressing clinical teams’ emotional exhaustion is essential to ensuring a high level of patient safety (WELP; MEIER; MANSER, 2016). Indeed, Wallace et al. (2009) concluded that physician wellness might not only benefit the individual physician, it could also be vital to the delivery of high-quality healthcare. The authors suggest that physician wellness may be an organizational indicator of quality (WALLACE; LEMAIRE; GHALI, 2009). The sequence of risks noted as important in the survey, including unethical conduct, the organizational culture, and conflicts due to the organizational culture are associated human capital management. The fact that healthcare organizations are sustained by human capital is clearly an important issue for risk management (CHERVENAK; MCCULLOUGH, 2005). According to some of the interviewed managers, this highlights the necessity of having a well-described risk inventory and a defined risk management process to minimize interpersonal conflicts based on the existence of a document that establishes rules for professionals (ETGES et al., 2018b). The hierarchy among employees in a healthcare organization and professionals’ dependency on such employees deserve attention when implementing a proactive and strategic risk management process because only by engaging all professionals in ERM can a risk culture be created and a safer

environment achieved (TEOH; CHEONG, 2008; TROYER; BRASHEAR; GREEN, 2005)(HANEY; CHURCH; COCKERILL, 2013; SODOMKA; SPAKE; RUSH JR, 2010).

5.5 Conclusion

The results provide important progress for the strategic healthcare management process and ERM programs. In addition to defining specific risk scenarios, the enterprise risk inventory presented in this research can be used to educate professionals, guide the risk identification phase in future ERM programs, and thereby contribute to the development of a risk culture.

Establishing cyberattacks and the risks associated with human capital management (organizational culture, use of electronic medical records and physician wellness) at the top of the risk ranking is an important contribution of this research. Cyber security is at the top of the risk list for most industries, including healthcare. Employee wellness is also a theme that has been growing in importance in many industries. There are now opportunities to investigate and develop solutions to manage and assess those risks for healthcare organizations.

The results also demonstrate that the qualitative characteristics of risk managers from large organizations, the length of time working in risk management, and the presence of a school of medicine do not alter the perceived importance of the risks. Clinical risk managers and chief risk officers have small differences of opinion on the risks, but not enough to group them in the same cluster. This finding enables us to conclude that the personal background of each employee is a more important factor than the organization's structure or the employee's own risk perception capability.

For future research, the authors suggest evaluating the benefits of using the risk inventory at the beginning of the risk identification phase, that is, during the baseline phase of the E²RMhealthcare. To demonstrate the value of the risk inventory, a comparative study that explores the ability to disseminate an ERM program in an organization should be conducted.

6 E²RMhealthcare SUGGESTIONS FOR APPLICATION

This section has the objective to discuss how two important steps of the E²RMhealthcare application happens. A project conducted with a Brazilian hospital and the interaction with the Risk Authority Stanford, which was involved in other papers, were fundamental to develop this final discussion.

Considering the four levels suggested by the E²RMhealthcare, it is possible to highlight that two new methodologies are being proposed: a risk ranking considering the use of Multi-Criteria Decision Analysis (MCDA) to analyze enterprise risks at the Baseline level; and the use of Time-driven Activity based Costing (TDABC) to assess risks at the Quantitative level, suggesting and TDABC adaptation: Time-driven Risk Activity based Costing (TDRABC). This section is fragmented in these two areas to explain and exemplify how they can be conducted in a health organization.

However, all the information about risks, finances and hierarchies presented on this section are only supposed to illustrate the methodologies. The real information is not being expressed because of its strategic and confidential data nature for the companies.

6.1 Risk Ranking considering MCDA – Baseline level

For the risk ranking starting it is suggested the use of the risk inventory (chapter 5 – Appendix C). In addition, the first challenge is discussing with hospital managers if it is necessary to include more specific risks in the inventory or not.

At the hospital studied, meetings with the clinical risk manager and the chief risk officer were held with the objective of agreeing whether the inventory was completed for the current moment of the hospital. It is important to highlight that this hospital has worked with an ERM process, then, during the entire E²RMhealthcare project the current process was used and discussed, which is recommended in future similar cases. After the meetings, the researcher and the managers agreed that the hospital should work with the inventory in Portuguese, not only literally translating the words, but also using a vocabulary localized to Brazil. In addition, three new risks were added: *Qualificação e competências adequadas*, *fusões e aquisições* and *flexibilidade para mudanças e capacidade de expansão*.

The previous ERM matrix used by the hospital has 72 risks, identifying the possibility to work with 31 risks is considered a positive achievement. Another issue that was a theme of discussion is concentrated in better integrating the clinical risk manager and

the chief risk officer. At this point, the fact that the inventory highlights if the risk impacts the patient was valued and useful for the discussion between the managers.

With the list of risks defined, it was necessary to prepare the use of MCDA. The method selected was the Analytical Hierarchy Process (AHP). It is suggested to have one AHP matrix for each risk group: clinical, compliance, financial, operational, political, human resources and information technology (presented at the chapter 5). For each of them, a group of people must be selected to be interviewed about the risks. People selection may consider its familiarity with the group of risks, for example: for information technology, the technology chief should be involved, as well as other professionals that works with Hospital-based Health Technology Assessment (HB-HTA).

People are invited to answer paired comparisons about the risks from the group thinking about likelihood and severity in two different moments. The Figure 30 shows an example of how to build the questions that invite the interviewers to answer about likelihood for the group information technology. This example uses the Qualtrics platform, which works online and enables managers to be engaged in the ERM process, with AHP, using a friendly platform, ending the impression that it is not easy to apply quantitative methodologies to people that have different backgrounds and functions.

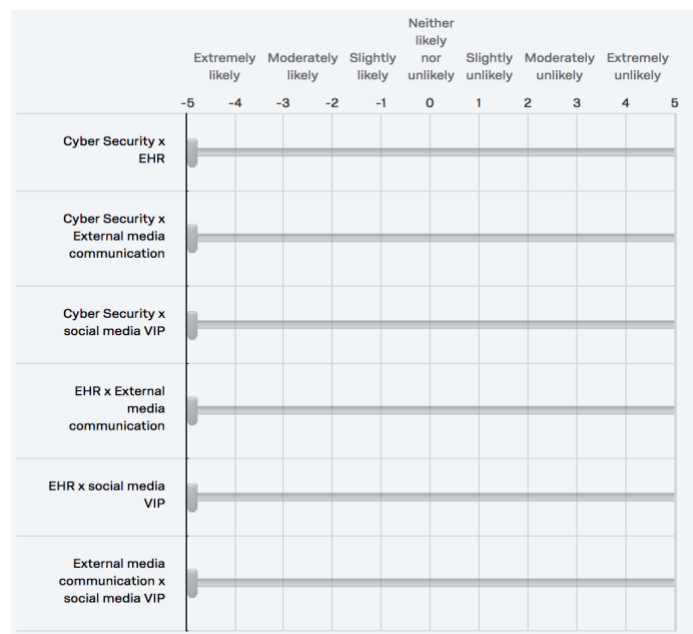


Figure 30 - Example of AHP for a group of risks

After the paired comparisons, the researcher or risk analyst can develop the AHP risk matrices. Two final matrices will be developed for each risk group, one with likelihood and

another with severity. If the risk analyst identifies a huge difference in the paired answers from two or more people, the risk manager should contact respondents again to achieve a consensus about the paired comparisons. To build the AHP matrixes the Saaty Scale (SAATY, 2008) must be used. The Figure 31 exemplifies how the final matrix with the likelihood and severity vectors may be presented.

	Severity	AHP - Likelihood
Cyber Security – ransomware	16%	18%
Electronic Health Record (EHR) – loss of power	50%	9%
External media communication	13%	24%
Use of social communication networks – VIP patient	20%	49%

Figure 31 - Information Technology risk group - final AHP matrix

With this matrix and considering the strategic objectives of the hospital, it is a duty of the chief risk officer to analyze which risk is more critical at the current moment. For example, if the hospital is implementing an EHR system, even though it has a low likelihood (9%), at this moment it should be considered critical. Maybe in one year it will not be anymore. It is the moment when the chief risk manager can add value to the ERM process by integrating it more with the actual organizational culture.

After his definition, a validation with C-suite for all the risk groups can be conducted and the actions plans, connecting risks and strategic goals, developed. It is important to appoint: a risk owner that has to report the action status to the chief risk officer; a deadline to finish the action and an indicator with a visual capability to control. The Figure 32 shows an example.

Strategic goals	Risk Group	Main Risk	Risk Owner	Actions	Indicator	Deadline
Financial Strength	Financial	Dependence of insurance companies	-	-		-
Technology Innovation	Information Technology	Cyber Security	-	-		-
Employee Experience	Human Resources	Provider Wellness	-	-		-
Strategic Planning and Financial Strength	Compliance	Loss of accreditation	-	-		-

Figure 32 - Enterprise risk action plan

In addition to the action plan, the quantitative analysis can be conducted using TDABC for critical risks of each risk group. The next section details how it can be applied.

6.2 TDRABC applied to assess enterprise risks in healthcare

To measure the economic impact of the risk, after the presentation of the model it is being suggested the use of Activity-based costing methodologies, in special TDABC during the chapter 3 and 4. Before starting to detail how it can be used, some characteristics about the method are summarized.

TDABC identifies opportunities for making processes more efficient by reducing the resources used in each activity (KAPLAN et al., 2014). TDABC was proposed as an improvement on activity-based costing because it renders ABC faster and easier to update by transforming all cost drivers into a single cost driver – time. Since it was first proposed, TDABC has become a frequent accounting method in clinical settings (KEEL et al., 2017b). In a literature consulting conducted during the development of this thesis by Pubmed and Sciece Direct, it is possible to suggest that after the TDABC publication in 2007 (KAPLAN; ANDERSON, 2007b), it started to be more frequent in healthcare studies. Figure 33 shows the frequency of papers exploring the theme of Activity based Costing (ABC), Simplified Activity based Costing (SABC) and TDABC in healthcare before and after 2007. However, cost analyses for risks in healthcare were not identified.

	TDABC	ABC	SABC	TOTAL
After 2007	12	7	3	22
Before 2007	0	6	2	8
TOTAL	12	13	5	30

Figure 33 - The use of TDABC in healthcare studies

Considering that all enterprise risks are connected to different processes and activities that will happen if the risk affects the hospital, this study proposes to advance the environment where TDABC has been applied in healthcare to enterprise risks. This advance enables to measure the economic impact of enterprise risks in healthcare.

In order to apply TDABC to measure the economic impact of enterprise risks, a sequence of seven activities, that represents the adaptation of TDABC to TDRACB, is suggested: (i) risk event process map fragmented in macro process: clinical treatment, legal and regulatory, human capital and reputation; (ii) time equation estimation for each risk event process; (iii) identifying departments involved in risk process and estimating the cost of resources for each department; (iv) estimating the capacity in hours of each department involved; (v) calculating the Capacity Cost Rate (CCR) in \$/h; (vi) designing the time and cost equations; and (vii) calculating the total cost of each risk event process (Figure 34).

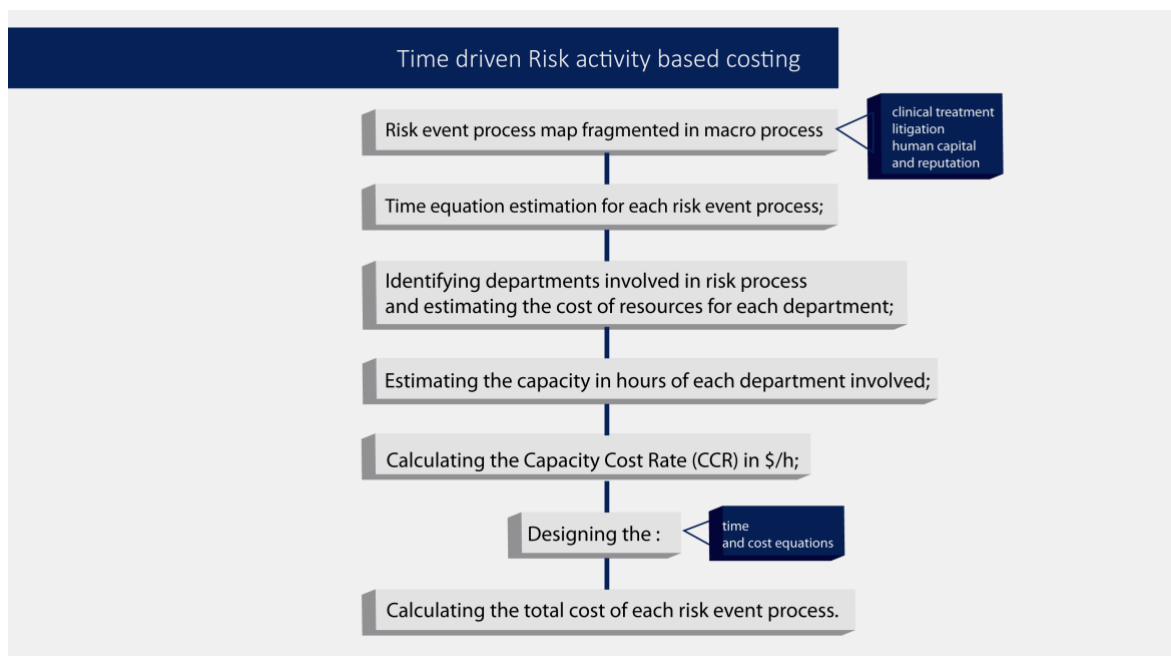


Figure 34 - TDRABC

Using the example of how the treatment at The Risk Authority Stanford is conducted when a Cyber-attack risk happens, the process map considering the four macro-processes is

expressed bellow (Figure 35). Each color represents a different macro-process: clinical treatment (blue), legal and regulatory (green), human capital (purple) and reputation (orange) helping to manage the activities.

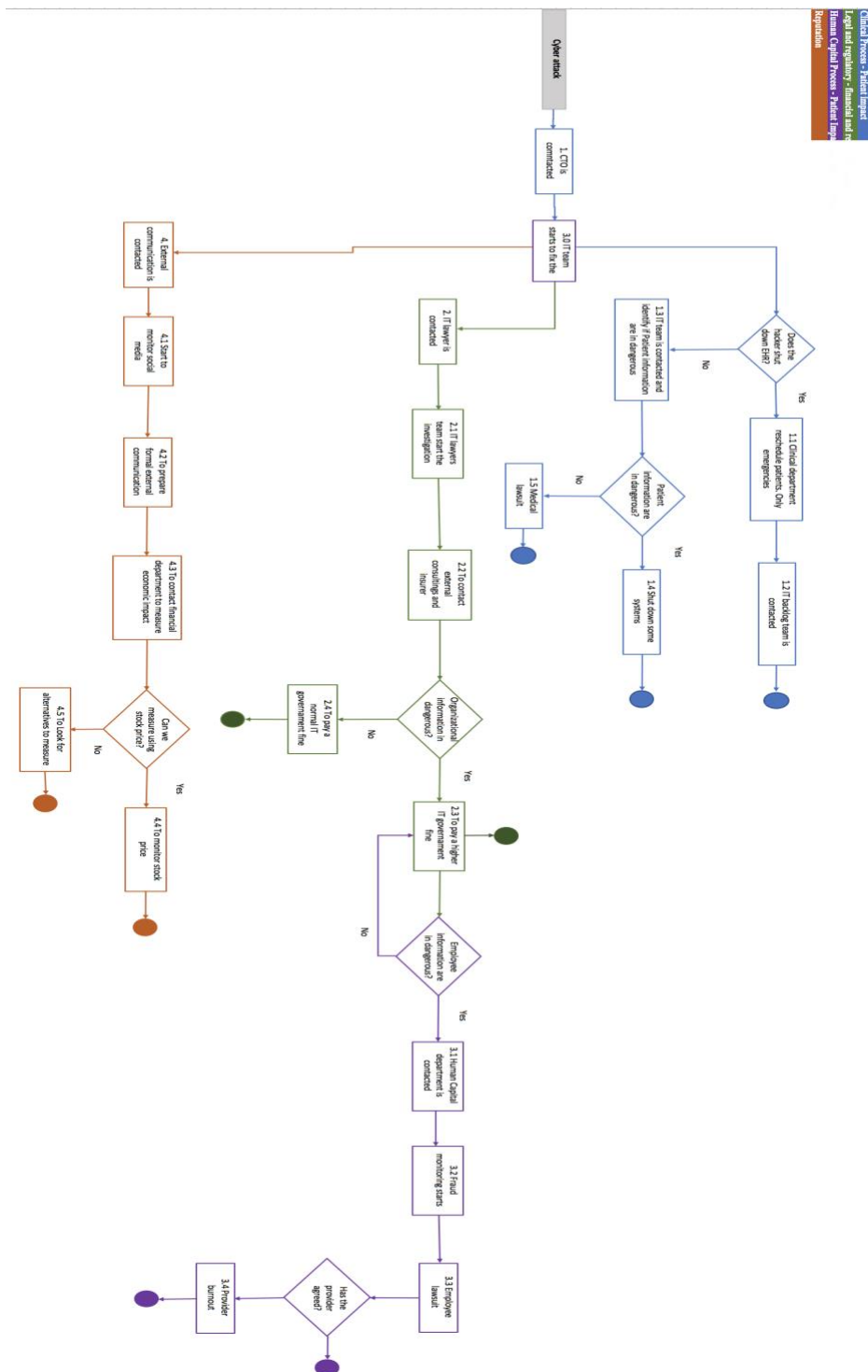


Figure 35 - risk event process map based on The Risk Authority Stanford procedures

At the next step, the departments involved, and the time spent in each activity of the process can be estimated. It is also necessary to identify all financial resources allocated to

each department and to estimate the department capacities. Then this flow of activities is displayed with fictitious values.

The capacity estimation can be calculated in different manners according to department characteristics. For example: hospitalization departments may have the capacity associated to the number of beds that are available twenty-four hours per day; a surgery department has the capacity associated to the combination of the number of surgery rooms, open hours for working, and clinical team available. In addition, an expected idleness can be considered. The Figure 36 shows some examples for capacity calculation.

Department	Total capacity (I) (hours)	Production capacity (P) (hours)
Hospitalization A	24h x 20beds x 30days = 14.400	14.400 x 0,9 = 12.960
Surgery	18h x 7rooms x 30days=3.780	3780 x 0,78=2.948,4
Exams	12h x 6physicians x 22 = 1584	1584 x 0,85=1.346,4
I = 100% efficient and P = considering an expected idleness		

Figure 36 - Capacity estimation example

With the capacity calculated and financial resources allocated to each department, it is possible to measure the CCR for each department, Figure 37.

Department	Resources costs	I	P	CCR 100% EFFICIENT	CCR WITH IDLENESS
Hospitalization A	\$300.000,00	14.400 (h)	12.960 (h)	20,83 (\$/h)	23,14 (\$/h)
Surgery	\$500.000,00	3.780 (h)	2.948 (h)	132,27 (\$/h)	169,60 (\$/h)
Exams	\$240.000,00	1.584 (h)	1.346 (h)	151,51 (\$/h)	178,30 (\$/h)

Figure 37 - Example of CCR calculation

The CCR is fundamental to design the cost and time equations. The time equation uses the TDABC equation, expresses on equation 2.

$$C = \sum \beta_i \times CCR_i = \beta_1 \times CCR_1 + \beta_2 \times CCR_2 + \dots + \beta_n \times CCR_n + y \quad (2)$$

Where:

- a) C: Unitary cost of risk process;
- b) β_i : time used in each department involved on the process;

- c) CCR_i: CCR from each department;
- d) i: number of departments involved;
- e) y = Other direct costs associated to the process.

In order to make the equations structure easier, it is suggested to build a matrix with the resources, the total cost of each resource, the capacity and CCR in the columns and one activity in each row. The time spent in each activity with the different resources should be added in the center. In addition, a fragmentation to identify the class of the resource, for example, structure, technology or human resources, can be created to enable analysis about the origin of the cost in each risk event. The Figure 38 shows a map example considering the risk process for a cyber-attack.

Activity	Description	People									Technology	Total Cost															
		Physician		Manager		IT department		Clinical Department		Legal department			External relations department		Financial department		Human Resources		Board		Software						
		Financial Resources (month)	Capacity (month)	Physician	Manager	IT department	Clinical Department	Legal department	External relations department	Financial department			Human Resources	Board	Software	Financial Resources (month)	Capacity (month)	Physician	Manager	IT department	Clinical Department	Legal department	External relations department	Financial department	Human Resources	Board	Software
		\$	\$/h	\$	\$/h	\$	\$/h	\$	\$/h	\$			\$/h	\$	\$/h	\$	\$/h	\$	\$/h	\$	\$/h	\$	\$/h	\$	\$/h	\$	\$/h
1.0	CTO is contacted			5	10																	1	10	\$ 3.214			
1.1	Clinical department reschedule patients. Only emergencies																							10	\$ 3.873		
1.2	IT backlog team is contacted			3	2	10	10																	20	\$ 5.428		
1.3	IT team is contacted and identify if Patient information are in dangerous					10	40																	10	\$ 7.836		
1.4	Shut down some systems						50																	40	\$ 8.050		
1.5	Medical lawsuit			1				5	5														5		\$ 4.745		
2.0	IT lawyer is contacted					10	10			10																\$ 6.300	
2.1	IT lawyers team start the investigation									50														20	\$ 14.911		
2.2	To contact external consultings and insurer					10				30														20	\$ 11.280		
2.3	To pay a higher IT government fine									50													10		\$ 19.286		
2.4	To pay a normal IT government fine						50		30														10		\$ 20.371		
3.0	IT team starts to fix the problem						70		30																	\$ 18.091	
3.1	Human Capital department is contacted						10																4		\$ 1.840		
3.2	Fraud monitoring starts						30		40														4	20	\$ 16.614		
3.3	Employee lawsuit								40														4		\$ 11.909		
3.4	Provider burnout			1	15				15														4		\$ 8.041		
4.0	External communication is contacted								15	2														30	\$ 5.677		
4.1	Start to monitor social media									2														30	\$ 1.391		
4.2	To prepare formal external communication									2																\$ 453	
4.3	To contact financial department to measure economic impact									2	4															\$ 1.564	
4.4	To monitor stock price										4												3	30	\$ 3.549		
4.5	To Look for alternatives to measure									2	4												3	30	\$ 4.002		
Total Cost		\$	750	\$	12.917	\$	40.800	\$	2.000	\$	90.000	\$	2.267	\$	3.333	\$	1.920	\$	16.000	\$	8.438	\$	178.424				

Figure 38 - Example of map to design time and cost equations for a cyber-attack risk

By using the map, it is possible to multiply the time spent with each resource per each CCR in each activity and, finally, to calculate the total cost involved in each risk process. One value connected to apply TDRABC is focused on the rich information that can be identified. For example, to explore the activities that are more expensive and why are

more expensive, can suggest to a manager, that these activities and main resources need to be studied to be conducted with efficiency. Chart 8 illustrate how is possible to identify that, which the x-axis contains the activities.

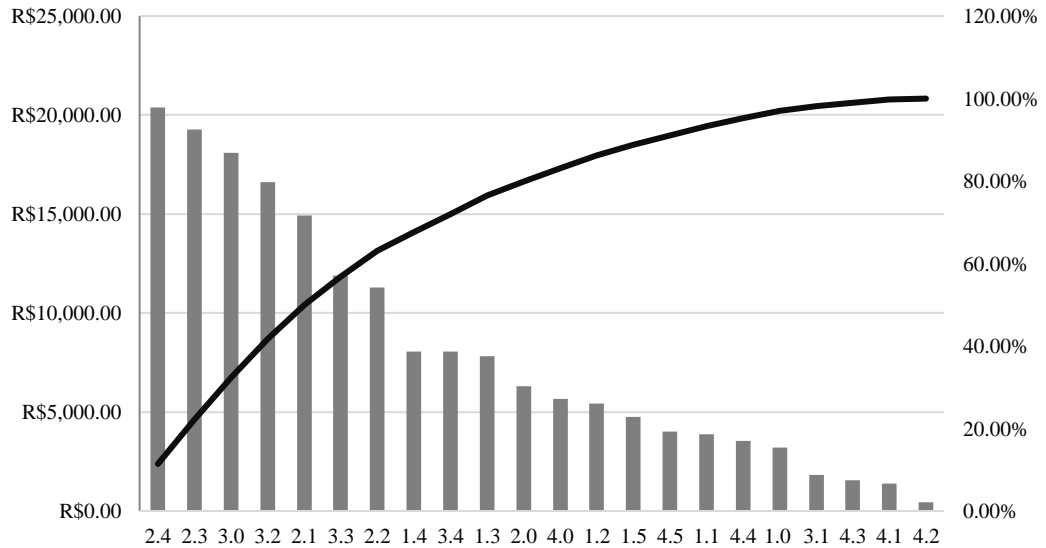


Chart 8 - Cost per activity

Using the chart 9 it is possible to identify that the activities connected with fine payments (2.4 and 2.3), to fix the problem and to monitor fraud (3.0 and 3.2), cost more than \$15.000,00. If we analyze the resources more used on these activities, it is possible to highlight that IT department and legal are responsible for the higher cost (Chart 9).

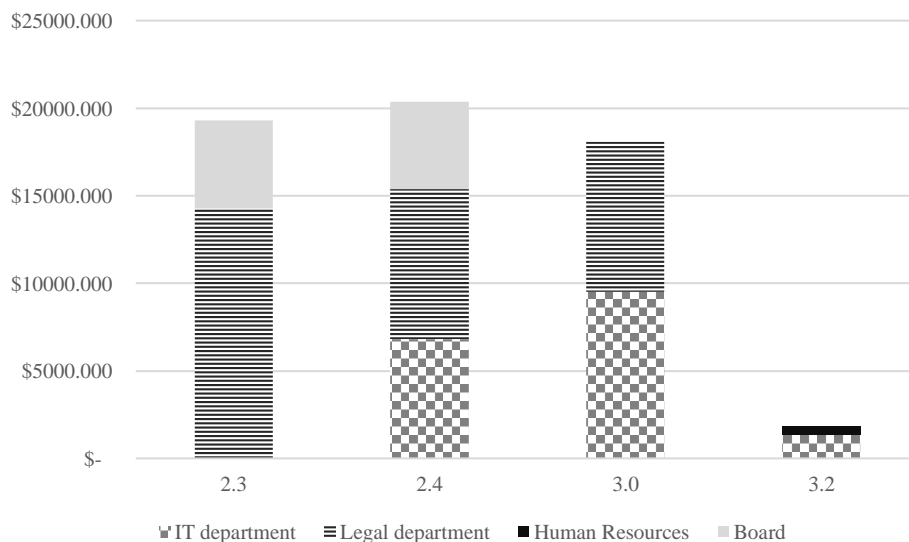


Chart 9 - The cost origin of each risk

With this information, the next question is: could we do it with more efficiency and control and, consequently, cheaper? If risk events happens, the company can be better prepared to manage the risk, spending less money and as a result, the financial impact can be smaller. The ERM department is responsible for guiding and controlling the correct processes to treat the main enterprise risks. In addition, the possibility to design all the activities enable to include the regional regulations and compliance aspects to the process, creating an information transparency, that can be useful to protect the company in future lawsuits.

Analysis between risks and origin of cost can be conducted. The Charts 10 and 11 illustrates examples of charts that can help the analysis process.

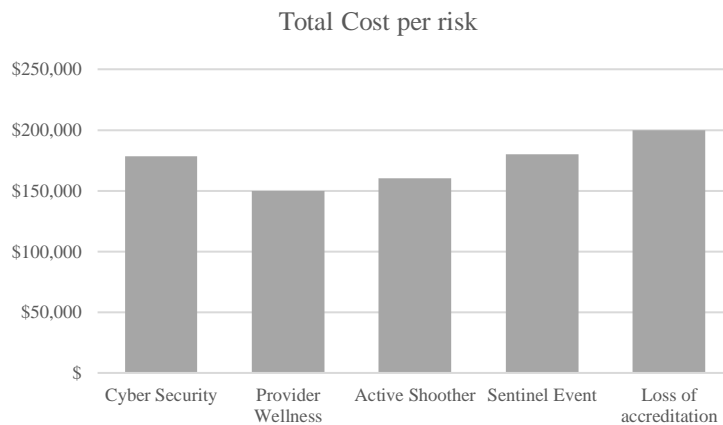


Chart 10 - Total cost per risk

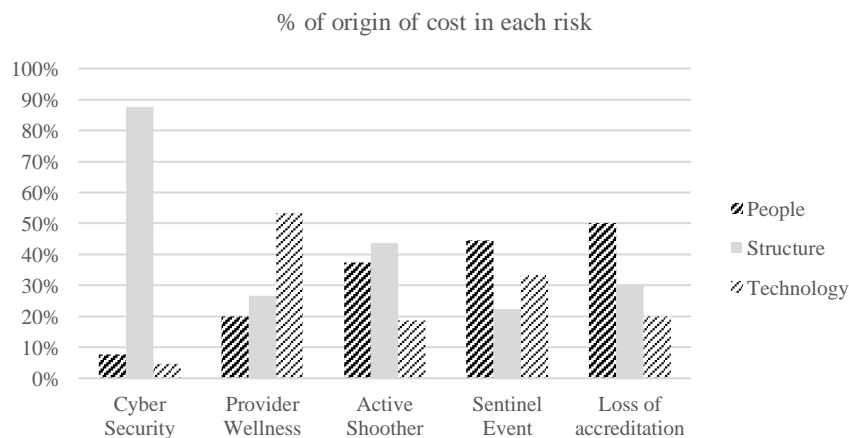


Chart 11 - Examples to orient risk cost analysis

Finally, with the information of how much cost to treat one enterprise risk in healthcare is, it is possible to compare the investment in ERM with the cost metric. Chart 12

shows the relation between investment in ERM in the hospital and the cost of treating each one of the risks estimated through TDRABC.

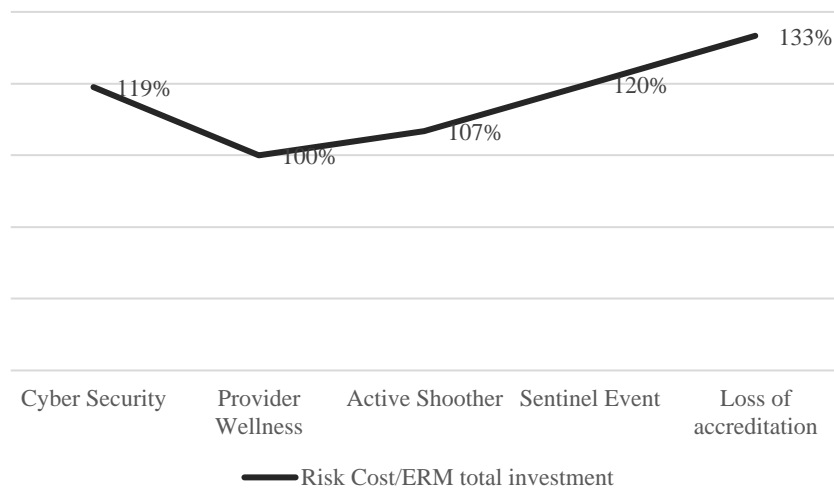


Chart 12 - Percentage of risk cost relation to ERM investment

By using analysis as this one above, it is possible to identify that the investment in ERM can be returned if only one of the risks happens. This information is useful to justify the implementation of the ERM process in special because the possibility that in one year the hospital can be exposed to more risk is real.

6.3 Conclusions about the discussion

This section expressed examples of how MCDA and TDRABC can be used to rank and assess risks in healthcare, innovating from previous literature and cases. Their application in ERM in healthcare projects is being conducted in different hospitals, and it is expected by the author of the thesis that after the development of multiple cases, it will be possible to publish effective guidance about their use in ERM analysis in healthcare. Finally, developing a software tool to guide MCDA and TDRABC for risk analysis in healthcare is a future project that may innovate the current solution to measure risks in healthcare.

In special for TDRABC software application with multiples companies and researchers can create a learning routine about the better processes to treat risks and, using machine learning, in future projects, it can teach future companies about the most effective manner to treat the risks. The solution also can integrate regional compliance aspects, adding value to the company that look for enterprise risk protection and information transparency with regulations. It represents an important innovation to insurance market around the world that are continuously looking for new solutions to measure the real economic impact of important and recurrent risks as, for example in 2018, cyber-attacks.

7 CONCLUSIONS

Considering the importance that ERM has received during the last years in different markets reported by authors mentioned along the development of this document, this thesis advances on ERM solutions for healthcare business. Attending the principal objective, the $E^2RM_{\text{healthcare}}$ was suggested exploring different levels of ERM that can be applied by the organizations. The levels are not punitive and look for turning the ERM a gradual implementation process, according to organizational maturity. The consideration of literature reviews and international cases to develop this model attends some specific objectives and was fundamental to contribute with the literature about the theme and to propose practical solutions to the market.

Others specific objectives of this thesis were achieved through a sequence of research procedures. Literature reviews, case studies, interviews and a survey were used to study the state of the art about ERM in healthcare content and to develop the background necessary for advancing.

The identification of how ERM teams can share resources and human capital with HB-HTA teams represents an important contribution for health organizations. The literature agrees with the importance of including these structures in the hospital routine, but to turn it sustainable is a challenge yet. The research pointed that the high level of background in specific areas demanded by both could be better explored, when shared. The opportunity to share personal resources between HB-HTA and ERM also contributes to the implementation of those processes in hospitals with less financial resources, approaching its own management to be more efficient with the care chain. The research by the answer of how ERM and HB-HTA contributes to organizational value creation oriented the proposition of the value map, expressing how ERM contributes to create a safer and more effective environment.

In regard to the specific characteristics of healthcare environment, the enterprise risk inventory for healthcare can be mentioned as a meaningful contribution that helps health risk managers to start an ERM process. The inventory highlights important questions from the actual market that looks for solutions, as cyber security. It also represents an opportunity to orient future researchers, which for each main risk identified could be developed specific solutions to improve healthcare organizations capability to be safer and more effective. In addition, to identify that only personal background in risk management (clinical or

enterprise) was a characteristic that showed a small difference in the perceived importance of the risks from the proposed risk inventory endorses how the personal education of the risk manager is important and deserve attention.

The consideration of cases in different countries also added value to this research. Despite the fact that two countries studied have different economic situations and health systems, the necessity and search for ERM solutions is common in both. Identifying an alternative to orient the risk analysis and to assess enterprise risks with real financial data is a gap reported by the majority of interviewers. Like an answer for that, the E²RM_{healthcare} innovates in how to analyze and to assess risks. The risk ranking methodology based on MCDA methods represents an opportunity to turn the risk analysis more effective and based on comparisons substantiated, without turning the process difficult to engage managers. And the proposition of TDRABC is an innovative TDABC adaptation for risk economic analysis. Exploring the use of both methodologies (MCDA and TDRABC) will be relevant to assume that they can contribute with general literature and practices about ERM around the world and in different markets.

The use of the model in real cases is essential to advance and turn the orientations about ERM more adjusted to the actual market. When TDRABC works together with a risk inventory previously identified to the market, as is suggested here for healthcare, is expected that with multiple applications will be possible to estimate common activities and resources conducted by different organizations in the same market. This fact turns easier to measure the costs associated to each risk. If, it is possible to orient the process to treat the risk, using high technology, to change the data base for resources and to measure the costs related to risks treatment in each organization is facilitated. The methodology learns with each real application, and with the previous learning can educate the next customer; it is machine learning codes applied to improve the organizations capability to assess enterprise risks. This future technology advance can allow opportunities to develop a strong and replicable product based on E²RM_{healthcare} to conduct ERM implementation based on high quality of real financial data to assess enterprise risks.

The development of artificial intelligence algorithms to assess risks and technologies in healthcare is identified as a future research area, which deserve attention by researchers and, in special, by global insurance market. The development of guidelines to orient the application of TDRABC and similar costs modeling for new technologies in healthcare have been the focus of current studies. As soon as information technology advances to allow

systems to support the application of activity base costing methods in health technology assessment studies it will be possible to develop big data on actual cost. This will allow cost comparisons by countries, health systems or disease; performance of economic evaluations with a higher quality of data; and the capability to develop artificial intelligence to identify standard processes of treatment and cost benchmarking in a global perspective.

At the beginning of this research the healthcare gap of models suggesting tools and methods to implement ERM was identified. This fact makes the $E^2RM_{\text{healthcare}}$ to represent an innovation to healthcare management. Different companies from healthcare market have demonstrated interest about parts of the model to improve and/or implement their own risk manager processes. It is expected by the author of this thesis, that with the background that can be developed by different projects using the concepts developed here, it will be possible to join, in a future publication, all this expertise, adding an important value to this current proposition: practical questions from hospitals, insurers, clinicians or other agents in healthcare market that deserve special practices not identified yet. Although, this demand years of different applications and projects, being the main reason to don't be an objective during this thesis and only a final important suggestion.

Finally, it is understood that other business that are also based on process conducted and with high level of human capital, could use the $E^2RM_{\text{healthcare}}$ as an ERM orientation. For that, it is suggested to explore the specific risks (risk inventories) and operational characteristics of different markets to turn the E^2RM able to be applied in different markets. This point add value to the proposition developed during this thesis, because highlights that the new $E^2RM_{\text{healthcare}}$ also contributes with general ERM research and represents a research opportunity to be continued by future academics.

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APPENDIX A
QUESTIONÁRIO PARA PESQUISA DE DOUTORADO DO PROGRAMA DE
PÓS GRADUAÇÃO EM ENGENHARIA DE PRODUÇÃO DA UNIVERSIDADE
FEDERAL DO RIO GRANDE DO SUL

TEMA DE PESQUISA: GESTÃO DE RISCOS CORPORATIVOS EM
AMBIENTES DE SAÚDE

1. Identificação da Instituição de Saúde:

- 1.1 Nome do Hospital: _____
- 1.2 País e Estado: _____
- 1.3 É um hospital escola? (Com faculdade de Medicina) _____
- 1.4 Quanto leitos possui o hospital? _____
- 1.5 Qual o faturamento do hospital? _____
- 1.6 Quantos funcionários possui o hospital? _____
- 1.7 O Hospital possui alguma acreditação de órgão regulamentador?

2. A Gestão de Riscos

- 2.1 Existe um departamento de gestão de riscos no hospital?
- 2.1.1 Quantas pessoas trabalham nesse departamento?
- 2.1.2 Qual a formação dos profissionais que trabalham nesse departamento?
- 2.1.3 Este departamento envolve outras áreas do hospital para gerir riscos? Quais?
- 2.1.3.1 Como é feita a interação entre as áreas e a equipe da gestão de riscos?
- 2.1.3.2 Existem acordos de nível de serviço entre as áreas e a equipe de gestão de riscos?
- 2.1.3.3 Existem processos mapeados do fluxo de informação da Gestão de Riscos no hospital?
- 2.2 Existem mapas de risco?
- 2.3 Há interação com profissionais de outras áreas (como engenharia e administração)?

3. A Gestão de Riscos Assistenciais

- 3.1 A gestão de riscos efetuada é focada somente no aspecto assistencial?
- 3.2 No que diz respeito à gestão assistencial, é usada alguma tipologia ou guia internacional como orientação?

3.3 A gestão de riscos assistencial está vinculada ao planejamento estratégico do hospital?

3.4 A gestão de riscos assistencial dissemina informações e indicadores e distribui relatórios por todo o hospital?

3.4.1 Quem utiliza esses indicadores e informações?

3.4.2 Há uma periodicidade nas revisões de indicadores e metas?

3.4.3 Os indicadores proporcionam um monitoramento de riscos e desenvolvimento de Planos de ação?

3.5 A notificação de riscos pode ser feita por quem no hospital?

3.5.1 É utilizado um *software* para notificações?

3.5.2 Qual a periodicidade de análise e divulgação de análises das notificações no hospital?

3.5.3 As análises efetuadas são qualitativas e quantitativas?

3.5.4 Entre as técnicas abaixo, alguma é utilizada para análise e gestão de riscos?

Brainstorming ()

FMEA ()

FTA ()

Relação probabilidade e impacto ()

Matriz Ranking ()

AHP ()

MAUT ()

Matriz SWOT ()

Matriz GUT ()

Planos de ação ()

Outras: _____

–

4. A Gestão de Riscos Corporativos

4.1 A gestão de riscos efetuada também abrange aspectos corporativos?

4.2 No que diz respeito à gestão de riscos corporativos, é usado algum modelo de referência? (COSO, PMI, ISO 30000)

4.3 A gestão de riscos corporativos está vinculada ao planejamento estratégico do hospital?

4.4 Existe um *Chief Risk Manager*?

4.4.1 Qual a formação do *Chief Risk Manager*?

4.5 A gestão de riscos corporativos visualiza o hospital por processos para identificar riscos?

4.5.1 Quais os principais processos (grandes áreas) que o hospital é dividido para implementar a gestão de riscos corporativos?

4.5.2 Como são identificados riscos corporativos? Utiliza-se alguma referência ou tipologia?

4.6 A gestão de riscos corporativos dissemina informações e distribui relatórios por todo o hospital?

4.6.1 Quem utiliza esses indicadores?

4.6.2 Há uma periodicidade nas revisões de indicadores e metas?

4.6.3 Os indicadores proporcionam um monitoramento de riscos e desenvolvimento de Planos de ação?

4.7 A notificação de riscos pode ser feita por quem no hospital?

- 4.7.1 É utilizado algum *software* de notificações?
- 4.7.2 Qual a periodicidade de análise e divulgação de análises das notificações no hospital?
- 4.7.3 As análises efetuadas são qualitativas ou quantitativas?
- 4.7.4 Entre as técnicas abaixo, alguma é utilizada para análise e gestão de riscos corporativos?

Brainstorming ()

FMEA ()

FTA ()

Relação probabilidade e impacto ()

Matriz Ranking ()

AHP ()

MAUT ()

Matriz SWOT ()

Matriz GUT ()

Planos de ação ()

Outras: _____

- 4.8 Como se estabelece a relação da gestão de riscos assistencial com a gestão de riscos corporativos?

5. A mensuração econômica a partir da gestão de riscos

- 5.1 A definição de criticidade de riscos está relacionada com a métrica monetária? (risco crítico = risco com elevado impacto econômico)

- 5.2 É feita alguma mensuração econômica de impacto de riscos?

- 5.2.1 Como é feita a mensuração econômica?

- 5.2.2 A mensuração econômica utiliza a distribuição de custos, para isso, qual o sistema de custeio existente no hospital? Como são utilizadas as informações do sistema de custeio para fins de análise de risco?
-

- 5.2.3 Há alguma análise de cruzamento entre investimento em gestão de riscos e redução de custos do hospital?

- 5.2.4 Entre a gestão de riscos assistenciais e a gestão de riscos corporativos, alguma apresenta maior facilidade de mensuração econômica?
- 5.2.5 Quem faz a mensuração econômica?
- 5.2.6 Quem utiliza a informação gerada pela mensuração econômica?
- 5.2.7 Entre as técnicas abaixo, alguma é utilizada para a mensuração econômica de riscos?

Simulação de Monte Carlo ()

Análise de Cenários ()

Análise de Sensibilidade ()

Valor em Risco ()

Opções reais ()

AHP ()

NCIC ()

Árvore de Decisão ()

Variação de custos ()

Variação de VPL ()

Outras: _____

- 5.3 Existe um parâmetro de aceitação de Risco ou variação de custo aceitável? (Apetite ao risco, grau de exposição risco)

6. Opinião

- 6.1 Há uma disseminação de aprendizado gerado a partir de notificações de riscos?

- 6.2 Há envolvimento de todos os funcionários?

- 6.3 A gestão de riscos é valorizada pela instituição?

- 6.4 A gestão de riscos tem gerado resultados?

- 6.4.1 Estes resultados são mensurados economicamente?

- 6.5 Qual a principal vantagem da existência da gestão de riscos para o hospital?

- 6.6 Existe uma relação entre proteção e criação de valor ao adotar-se práticas de gestão de riscos corporativos?
- 6.7 Resultados gerados pela gestão de riscos são documentados e apresentam fácil acesso aos funcionários?
- 6.8 Há interesse por parte da instituição em participar da continuidade da pesquisa permitindo o uso do hospital para a aplicação e validação de um modelo preliminar de gestão de riscos corporativos?

APPENDIX B

QUESTIONNAIRE FOR A PhD RESEARCH (PPGEP/UFRGS and TRA)
RESEARCH THEME: ENTERPRISE RISK MANAGEMENT IN HEALTH
ORGANIZATIONS

Researchers: Ana Paula Beck da Silva Etges and Veronique Grenon

Professors Advisors: Francisco José Kliemann Neto, PhD and Joana Siqueira de
Souza, PhD

7. Identification:

7.1 Hospital Name: _____

7.2 Country and State: _____

7.3 Does the hospital have Medicine School? _____

7.4 How many beds does the hospital have? _____

7.5 What is the hospital revenue? _____

7.6 How many employees does the hospital have? _____

7.7 How many hospitalizations does the hospital have? _____

7.8 Does the hospital have an accreditation? (for example: JCI) _____

7.9 Does the hospital work with multiple centers or specific centers? (Cancer hospital,
children's hospital, or all specialties integrated).

8. The ERM – contextualization

By establishing the context, the organization articulates its objectives, defines the external and internal parameters to be taken into account when managing risk, and sets the scope and risk criteria for the remaining process (ISO 31000, 2009).

8.1 Is there an enterprise risk management department in the hospital?

8.1.1 How many employees does this department have?

8.1.2 What is the professional training of these employees?

8.2 Is there a Chief Risk Manager/Officer? What is his professional training?

Reports directly to CFO

8.2.1 Do the CRO and the ERM process have relation with compliance, controllership and corporate governance? If yes, please indicate the intensity of relation: (0= none, 1 = weak, 3 = moderate, 5 = Strong, 7 = very Strong)

ERM and Controllership: _____

ERM and Compliance: _____

ERM and Corporate Governance: _____

ERM and Audit: _____

8.2.2 Does this department involve other hospital departments to manage risks? If yes, which department is involved? Are there employees that assume ERM functions within their department? For example IT

8.2.2.1 How does the interaction happen between the risk management team and others department's teams? Do you use time or activities agreements between the teams?

8.3 With regard to ERM, does it use a reference model? (COSO, PMI, ISO 30000)

8.4 How does the hospital value the ERM process?

8.5 How is the ERM related to the hospital strategic planning? How does this relation happen on a daily basis?

8.6 How does the relationship work between ERM team and Quality / Care risk team (providers)? Is there a periodicity of information shared and discussion?

8.7 How many sentinel events do you have roughly in (1 year)?

8.7.1 About Care risk teams, is there any risk typology (terminology) applied? (WHO, JCI, HIROC, other, ...)

8.7.2 Does the Care risk team generate KPIs that feed the ERM analysis? If yes, please, if possible, share with us an example.

8.7.2.1 Does the Care risk KPI generate action plans that ERM team control? If yes, who manage these actions plans: Care risk team manager or CRO?

8.8 Check if those tools are used for risk contextualization. Please, let us know if there is any other.

Brainstorming: ____

Strategic planning analysis: _____

Matrix Strengths, weaknesses, opportunities and threats: _____

Matrix Severity, Urgency and Trend: _____

Other: _____

9. Risk Identification and analysis

Risk identification represents the phase which the Organization should identify sources of risk, areas of impacts, events and their causes and their potential consequences. The aim of this step is to generate a comprehensive list of risks based on those events that might create, enhance, prevent, degrade, accelerate or delay the achievement of objectives (ISO 31000, 2009).

Risk analysis involves developing an understanding of the risk. It provides an input to risk evaluation and to decisions on whether risks need to be treated, and, the most appropriate risk treatment strategies' methods (ISO 31000, 2009).

- 9.1 How does the identification phase happen? Do you use a terminology and classification?
- 9.2 How is the risk identification proactive?
- 9.3 Is the risk identification encouraged by an external institution? Are you expecting to receive a certification?
- 9.4 Does the ERM team view the hospital by process / department to identify risks? What are the key processes (big areas) that the hospital is divided in to operationalize ERM?
- 9.5 What methodologies do you apply during the risk identification phase? Who is involved in this process?
- 9.6 How do you treat communication issues (between areas) as one of the major risks for ERM process?
- 9.7 Is the risk identification spread in the hospital culture? How long?
- 9.8 Does the ERM team make qualitative risk analysis? If possible, please, share with us an example.
- 9.9 Check if these tools are used for risk identification or analysis. Please, let us know if there is any other.

Brainstorming: _____

Ishikawa: _____

London Protocol: _____

5-why: _____

Failure Mode and Effect Analysis (FMEA): _____

Matrix ranking (Impact x likelihood): _____

Severity Levels Definition: _____

Root cause analysis: _____

What if: _____

Layer of Protection Analysis (LOPA): _____

Process Mapping *AS IS* - *TO BE*: _____

Others: _____

10. Risk assessment

The purpose of risk assessment is to assist in making decisions, based on the outcomes of risk analysis, about which risks need to be treated and the priority for treatment implementation. Decision should take into account the wider context of the risk and include consideration of the risk borne by parties other than the organization that benefits from the risk (ISO 31000, 2009).

- 10.1 Is the definition of critical risk related to economic aspect? (Critical risk = risk with high economic impact).
- 10.2 Is there any measure of economic impact of risks? How is this economic measure done?
- 10.3 Who is responsible for the risk economic measure?
 - 10.3.1 If the economic measurement uses cost distribution, how those costs are identified? (Hospital costing system, ABC, TDABC, Cost centers).
 - 10.3.2 Does the economic measure use revenue information or costs only?
- 10.4 Is there any analysis about investment in ERM and/or cost reduction from hospital? It is done periodically? Who is responsible?
- 10.5 Who uses the economic information generated by ERM? What is their aim using it?
- 10.6 Does the risk assessment raise financial transparency for the stakeholders?
- 10.7 Does the risk assessment encourage the process rationalization? How does it happen?
- 10.8 Is the risk assessment linked with the strategic deployment and goals? How does the control of this relation work?

- 10.9 Is the risk assessment in ERM process essential for the value creation of the health organization? Why?
- 10.10 Is there an appetite for risk defined?
- 10.11 Check if those tools are used for risk assessment. Please, let us know if there is any other

Monte Carlo Simulation: _____

Scenarios analysis: _____

Sensibility analysis: _____

Value at Risk or Cash Flow at Risk: _____

Real Options Analysis: _____

Analytical Hierarchy Process: _____

Non-traditional Capital Investment Criteria: _____

Decision Tree Analysis: _____

Cost analysis in occasional events: _____

Revenue Analysis: _____

Appetite for risk – acceptable variability: _____

NPV variability: _____

Others:

Risk treatment and monitoring:

The purpose of risk treatment involves selecting one or more options for modifying risks, and implementing those options. Risk monitoring should be planned part of the risk management process and involve regular checking or surveillance. It can be periodic or ad hoc (ISO 31000, 2009).

- 10.12 Does the risk analysis or assessment generate short, medium and long term actions plans? Who is responsible for the management and operations of it?
- 10.13 Does the hospital approve a budget for the improvements identified by ERM?
- 10.14 Does the CRO assign goals to committees and owners of risks? Is it related to performance or payout structure?

- 10.15 How does the dissemination and education about ERM happen?
- 10.16 Has ERM generated positive results? In your opinion, what is the principal advantage provided by ERM process?
- 10.17 In your opinion, what do you like to add or make different to improve ERM process?
- 10.18 The hospitals are interested in being a case study for an applied research about ERM Model for Health Organizations? Who must be contacted?
- 10.19 Check if those tools are used for risk monitoring a treatment. Please, let us know if there is any other

Action Plans Definition: _____

Preparation of budget for the actions plans: _____

Definition of Risk Owners in each process: _____

Risk Maps: _____

Metrics links to strategic goals and objectives: _____

Dissemination of results and education: _____

Other: _____

APPENDIX C
ENTERPRISE RISK INVENTORY
E²RMhealthcare

1. Active shooter

Assault and active shooter threats to patients, families and hospital employees.

Impact:

Reputation

Patient

Social

Example: An active shooter, a doctor, enters a hospital and shoots several patients and employees. The doctor opened fire inside a hospital where he used to work, killing a woman and wounding six people before turning the gun on himself. Streets are closed and terrorist activity is considered but it is discovered that the shooter has no relation with a terrorist group. Patients inside are part of the crime scene, and need treatment for post-traumatic shock disorder.

2. Board governance – poor communication or lack of direction

Relationship with shareholders and the Board of Directors of the organization; lack of transparency in the information and results, and capacity to prosecute governance. Can be related to a merger or an acquisition or a conflict of interest.

Impact:

Reputation

Financial

Example: A hospital receives an investment from a group of companies to build a new unit in their hospital. One investor is under investigation by law and therefore cannot make new investments. The hospital will be investigated, because it is among the investor patrimony.

The hospital finances are affected, the new building project is delayed, and the hospital needs to wait for a judgement before proceeding with the project.

3. Business Interruption Due to Natural Catastrophe

Occurrence of external events, which makes it impossible for the organization to maintain its critical activities. This includes natural disasters: earthquake, hurricane, tornadoes, flood.

Impact:

Financial

Social

Example: A natural disaster occurs and destroys part or all of a hospital. Patients are consequently obligated to seek treatment in other hospitals. The financial impact is large due to business interruption. The insurance policy is triggered but the limit of the insurance policy is not high enough to cover the losses. In addition, equipment and technological resources are lost, further degrading future revenue streams.

4. Clinical Batch Claim

With the growing use of technologies and multiple alternatives to treat patients, batch claims have increased in size and frequency. Batch claims are frequently related to misfeasance in delivery of clinical service. For regions where the expression “batch claim” is not applied, this risk suggests failures that happen during clinical treatment and cause a large volume of patient claims related to each other. Claims are filed against the hospital as well.

Impact:

Reputation

Patient

Social

Financial

Example: A nationwide fungal meningitis outbreak is linked to contaminated steroids produced by a pharmacy. Thousands of people were injected with the drug and were affected. Of those injected, several hundred people were diagnosed with meningitis, fungal

infections, and/or abscesses, and other injuries. Sixty-four of those people died as a result of their infections. The pharmacy is bankrupted, hospitals that administered the steroids are suffer reputational and financial losses, and patients are harmed.

5. Conflicts Due to Organizational Hierarchy

Responsibilities, leadership, and respect among the employees and functions. The relation between the decision-making process and hierarchy. The medical hierarchy needs to be balanced in favor of teaching, learning, and patient safety rather than the exercise of power (WALTON, 2006).

Impact:

Patient

Example:

In a woman enters a hospital for a plastic surgery procedure. After the local anesthetic, she suffers cardiac arrest, but the anesthesiologist is no longer in the OR. The surgeon attempts to save the woman. The woman dies before the anesthesiologist can be found.

OR

The physician and professor responsible for a surgery team leave the hospital after a long surgery. They fail to inform the team of their absence. During this period, the patient starts to experience complications. The team looks for fast solutions, but without guidance from the professor, it hesitates to take more aggressive action to save the patient. By the time they realize it's necessary to act on their own, it is too late. The patient has died.

6. Cyber Security

Internal or external hacker penetrates a hospital's IT system and causes damages to the information security of the organization, its operational capacity, and its finances.

Impact:

Reputation

Patient

Social

Financial

Example: Over the course of a year and a half tenure, an employee uses her position in the hospital to gain access to patient's names, addresses and Medicare numbers to sell their information in the open market. When the hacking came to light, the hospital suffered reputational loss as well as financial loss due to decrease in customer confidence. Additionally there were significant expenses to resolve claims and upgrade IT security.

OR

Hackers accessed hospital databases around the world, interrupting operations and stealing data from millions of patients and thousands of companies. Information and Technology consultants are involved to solve fast the problem and try to minimize losses.

7. Deficiency in Developing New Technology and Innovating

Lack of technological innovation or development of innovations that do not meet the organization's needs. It is related to the organization's ability to possess, master, and use technological resources that improve its operations. This impacts the quality of clinical procedures and patient experience.

Impact:

Reputation

Patient

Financial

Example: A new technology is available to treat a specific disease, but acquiring the technology requires funds and time for training the providers. The hospital cannot fund this investment for at least 12 months. As a result, the hospital will not have the new technology available as a treatment option, and patients may seek care in a competing hospital.

8. Dependence on health insurance companies

Negotiations with one health insurance company that accounts for 30% of the billing. The insurance company wants to reduce reimbursements for many medical tests and procedures.

Impact:

Financial

Patient

Example: A hospital has 80% of its billings with two insurance companies (A and B), split 35% for company A and 45% for company B. Negotiations on reimbursements between the hospital and insurance company B are taking a long time. For an entire month, the hospital does not receive income from the patients that have coverage with insurance company B. In addition, new patients insured with insurance company B chose a different hospital, thus the hospital loses the income associated with new patients.

9. Dispute with insurance companies on reimbursement

An insurance company disputes the drugs, devices, or procedures used by the providers and hospital. The insurance company denies coverage.

Impact:

Financial

Patient

Provider

Example: A patient insured by a health insurance company (company B) was admitted for surgery. The patient spent 10 days in the hospital. At the time of billing, the insurance company denies coverage for some drugs and diagnostic procedures that the patient received during his stay. The insurance company argues that the drugs and procedures were never covered by the patient's plan. The hospital enters into the discussion with the insurance company, the patient, and the provider team regarding who will ultimately assume the expenses. The patient is impacted financially and worried about future medical care. The hospital is also impacted financially. Finally, the provider may also suffer financial loss if the provider is not allowed to administer the drugs or perform the procedures in the future.

10. Electronic Health Record (EHR) – inappropriate use

Difficulty in obtaining information due to error in communication, loss of processing power, or difficulty in operating the hospital's system.

Impact:

Patient

Example: An EHR system is implemented at a hospital, requiring all physicians, technology professionals, ethicists, administrative personnel, and patients to use the appropriate technology. However, several employees are not engaged with the EHR system and do not log treatments appropriately. This exposes patients to potential failures such as double medicine doses, double exams, and visit control.

11. Environment Protection Agency or Similar

Government agency comes to investigate and the hospital is subject to fines.

Impact

Financial

Patient

Social

Reputation

Example: A group of patients with a disease that has a high level of contamination is in a hospital. The “clean team” has not received special orientation about the possibility of an epidemic and applies the standard disposal methodologies to discard highly infectious bio-hazard waste materials. The neighboring community has to be evacuated to avoid a big contamination after some of the waste is disposed in the normal trash system. The hospital pays a penalty and is committed to treating for free all new cases of the disease. The surrounding region is notified about the failure, causing a bad reputation for the hospital.

12. External media communication

Poor marketing and media communication from the employees of the hospital. Organizational information is leaked before the hospital has released a formal communication and the information is erroneous.

Impact:

Reputation

Patient

Example: The hospital is about to launch a revised treatment protocol based on a new technology. The external communication department has organized a formal event and advertisement to be sent to the television companies and newspapers. An employee at the hospital that knows about the new technology discusses it with a journalist prior to the official launch. The informal interview appears with wrong information in the media. The hospital needs to correct the interview, and won't achieve the expected positive impact. The hospital loses credibility with the public, and this impacts its reputation.

OR

A sentinel event happens in the hospital and a patient expires. Before a formal communication with external media is released, the involved department chair communicates with the media, and the news is shared and reaches many people. The hospital's reputation is impacted and the hospital loses credibility with patients.

13. Financial Batch Claim Emanating from Reimbursement Reform

Financial risk for healthcare organizations associated with bundled services or healthcare outcomes.

Impact:

Reputation

Social

Financial

Example: A group of 100 patients organize a class action against a healthcare organization because they feel that the level of care has been sacrificed to achieve hospital financial goals. They believe that the most advanced medical diagnostic tests were not administered in an effort to contain costs and this affected their quality of care. The hospital's reputation dwindles as patients seek treatment elsewhere. The hospital also loses the income associated with those patients.

14. Fraud committed by a provider

Insurance plan fraud committed by a provider or a group of providers illegally prescribing prescription drugs. Medicines or equipment stolen from the hospital.

Impact:

Reputation

Patient

Social

Financial

Example: Physicians using Medicare in the United States to prescribe unnecessary medical services. The owner of more than 30 Miami-area skilled nursing and assisted living facilities commits fraud that resulting in losses of \$1 billion dollars. The financial impact to the hospital and the government is large. The healthcare organization loses its reputation and barely survives. The fraud directly impacts the patients because the patients undergo unnecessary procedures and are given unnecessary medicines. There is a class action against the organization.

During 3 years a Brazilian group of physicians conducted an illegal sale of weight loss medicines and anabolic. Thousands of people were involved and millions of dollars were deviated. At the end of the investigation, 3 physicians were arrested.

15. Government Instability

Reduction in the Country's Healthcare Budget.

Impact

Financial

Patient

Social

Example: The government decides it should no longer provide financial support to states to fund the Medicaid program. The financial burden is assumed in part by the hospital, its insurers, and patients.

16. Loss of Accreditation

Loss of an important certification or accreditation.

Impact

Financial

Patient

Reputation

Example: A hospital receives an accreditation audit and the recommended changes must be put in place within a certain period. During that time, the hospital does not fulfill all the accreditation expectations because of financial hardship. The accreditation authority reduces the accreditation level of the hospital. As a result, some patients that have alternatives to use other hospitals do so.

OR

Medical center accreditation is denied after discovering a noncompliance with 29 standards. The accreditation suggests a possible Hepatitis B exposure at the hospital affecting 650 patients. The hospital reacts quickly and in 15 days receives a contingent accreditation, awarded after the organization successfully abated an immediate threat to life situation through direct observation or other method.

17. Non-compliance with laws and regulations

A clinical trial is taking place without the proper Institutional Review Board (IRB) approval. Patients die while part of the research.

Impact:

Reputation

Patient

Social

Financial

Example: A group of researchers is seeking patients for a clinical trial. The clinical trial consists of administering a new and cheaper drug to patients that suffered from cardiac arrest. The IRB's approval is pending two elements: 1) one provider needs to provide certain documents, and 2) there needs to be a formal training session for all the physicians that will administer the new drug. A patient is admitted to the ER and has just suffered a heart attack. The physician responsible for this patient administers the trial drug. The patient expires. The hospital is sued and found liable. The hospital indemnifies the family of the patient. The media is made aware and reports the event in the news. Patients are losing their trust in the hospital and some decide to seek care elsewhere. This impacts the future revenue of the hospital.

18. Occupational Safety and Healthcare Administration (OSHA/USA) or Similar
Laws that impact how employees are being contracted for employment. Any change in the formal policies will affect hospital management.

Impact:

Financial

Patient

Example: A general work law is modified. At the same time, all companies, including hospitals, change their contractual agreements with employees. Nurse and clinical teams' compensation is affected and this impacts the healthcare organization and patients.

OR

A clinical nurse has a young patient. Though she has already worked a 12 hour shift, she stays longer to ensure the care of the child. Although laws exist mandating the maximum number of hours that the clinical employees must work, it is very difficult to control because of the multiple jobs that the clinical teams can be working at the same time. The nurse

ultimately works for over 36 hours, becomes exhausted, and makes a mistake while administering medicine. The patient dies.

OR

A nursing assistant is trying to lift a patient. He has not been taught the proper form for this, and injures himself. At the same time, he drops the patient, injuring the patient. The patient is directly affected by the employee's lack of training, and financial impacts consequently occur through penalties and workers compensation injuries.

19. Organizational Culture

The healthcare organization needs to share and implement its culture among all the employees. New and old employees need to work by the same values and principles independently of their own background or origin.

Impact:

Patient

Example: A hospital has been investing in safety and quality programs over the last several years. The focus of the investments has been new technologies and acquisition of the best surgical teams, but necessary educational programs for clinicians are not being explored. Basic primary care with patients is not occurring, and although the hospital is working with the best technologies and employees, they are not engaged in a culture of safety and quality, and this results in medical error.

20. Physician Wellness

Physician burnout resulting in turnover, depression, and suicide as well potential harm to patients.

Impact:

Patient

Financial

Example: 5% of physicians have left an organization in one year. This is more than in previous years. A physician wellness survey is administered to measure and address burnout and professional fulfillment and it is discovered that a higher proportion of physicians that left had indicated they were burnt out. The hospital loses talent and consequently the associated income.

OR

A surgeon is over tired and depressed, but she performs surgery as her job requires. During the surgery, a minor mistake becomes a fatality and the patient dies. The surgeon feels blamed for the event and unsupported by the hospital. She quits her job and changes career.

21. Relationship Between the School of Medicine (SOM) or Residency Program and Hospital

Interface between the medical school or residence and the health service that can lead to interference of the university model in the hospital business or, on the other hand, to add value to the health institution due to the quality of teaching.

Interface between the School of Medicine and the health service that may lead to interference with the university business model or, on the other hand, to value the health institution due to the teaching quality.

Impact:

Patient

Social

Reputation

Example: A school of medicine has the responsibility to teach students and they also contribute to the workforce in the hospital. The practical exercises for the students are essential, but if it is not well structured can expose patients to failure. The residents and the medical students are learning. They are integrated with the clinical team but must be

involved in well-guided and supervised programs. Some research proves how teaching hospitals, if well managed, can sustain better outcomes.

A professor of surgery and oncology and chief of thoracic surgery at a well reputed hospital writes a paper that compares the outcomes for lung cancer patients at teaching hospitals versus nonteaching hospitals using the National Inpatient Sample database. The professor concluded that the mortality was better with fewer complications at teaching hospitals. The study evaluated 1.5 million Medicare patients experiencing three commonly treated health problems: heart attacks, heart failure and pneumonia from 2009 to 2010, the study found that there was a 10 percent reduced risk of mortality by being treated in a teaching hospital. The risk is related with how to manage the relationship between the teaching programs and the clinical responsibility to maximize positive patient outcomes and financial results.

22. Sentinel Events

Sentinel events, "never events", or events that are related to medical error and may indicate the beginning of a lawsuit.

Sentinel events, never events, or events that have relation with management process or medical error that can cause a lawsuit.

Impact:

Reputation

Patient

Financial

Example: A newborn is kidnapped from the hospital. The patient (mother) files a lawsuit. The hospital settles the case, pays a penalty and loses its accreditation with the Joint Commission (JCI). The event is reported in the news, and impacts the hospital's reputation. It is estimated that in coming months, women will seek an alternative hospital to deliver their baby.

23. Supply Chain

Materials and equipment control and management. Political problems with countries that supply resources for hospitals.

Impact:

Social

Financial

Example: The government blocks a container with medical material that will provide hospitals from a specific region of the country for 3 months. The hospital material stock is running low. The hospital finds a new distributor at a much higher cost.

24. Terrorism

Terrorist attack at a hospital.

Impact:

Reputation

Patient

Social

Financial

Example: A terrorist puts a bomb in a famous hospital due to their treatment program for political refugees. Patients and employees die and the financial consequences for the hospital are grave.

25. Talent retention

Loss of a team of specialist providers who perform certain procedures. The loss of the team is due to a misalignment with the human resources department.

Impact:

Reputation

Patient

Social

Financial

Example: A hospital with a large center for cardiac transplantation loses its main cardiac transplant surgeon. The surgeon had asked for more personnel and her request was not granted. The surgeon left the hospital and started to work at a nearby hospital. The hospital she left suffered financial consequences as patients chose to follow her to the new hospital. The original hospital may not be able to recruit another transplant surgeon for a year, and is now in direct competition with the surgeon's new hospital.

26. Unethical conduct

Problems related with an employee's unethical conduct involving or not involving patients. Personal information, images or objects are used or shared without the approval of patient.

Impact:

Reputation

Patient

Social

Financial

Example: An OBGYN worked for many years at a major academic hospital in the USA, and used a camera pen strung around his neck to secretly record women during examinations. A female colleague became suspicious of his behavior and eventually brought it to the notice of authorities. The physician was found liable and the hospital had to settle. In addition, the patients' information was leaked to the public, causing outrage and embarrassment on the part of the patients. The lawsuit and damages adversely impacted the hospital's reputation and finances. The hospital paid the settlement and revenue was lower in the next year because patients found care elsewhere.

27. Union Strike

Union strikes among different types of employees that can affect the hospital capacity to operate.

Reputation

Patient

Financial

Example: Following failed negotiations, members of a nurse union that represent 50% of the nursing workforce have decided on a one-day strike. This threat has led the hospital's management to prepare a contingency plan. The nurses would be locked out for 5 days and replaced by temporary nurses. Temporary nurses are 1.5 x more expensive to hire. This will disrupt patient care, therefore lowering the treatable volume of patients. The situation also increases the potential for adverse outcomes in the hospital.

28. Use of Social Communication Networks

Problems with confidential information being communicated through social media in relation to a public person, an executive, an actor, etc. Information is released on social media platforms with world-wide distribution and reach.

Impact:

Reputation

Social

Example: The wife of an ex-president dies in a high-quality hospital. A physician posts on social media that the ex-president's wife has died and people share the news on different social media apps before a formal communication can be released by the hospital and the clinical team. The physician that sent the message was dismissed, but the hospital now has a reputation for breaching confidentiality and patients are reluctant to seek care there.

APPENDIX D

Risk Inventory Survey

https://stanforduniversity.qualtrics.com/jfe/form/SV_5cqyep0MOuZ91yd

APPENDIX E



THE RISK AUTHORITY

January 18, 2018

To whom it may concern,

I am writing to certify that I, employed by The Risk Authority Stanford, have contributed to the development of the PhD thesis of the student Ana Paula Beck da Silva Etges.

If you require any further information regarding Mrs. Beck da Silva Etges, feel free to get in touch with me.

Sincère Regards,

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TOMORROW'S RISK MANAGEMENT TODAY

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APPENDIX F

Atuais publicações a partir da tese apresentada - <http://lattes.cnpq.br/2142304563601810>

Artigos completos publicados em periódicos

ETGES, ANA PAULA BECK DA SILVA; DE SOUZA, JOANA SIQUEIRA; KLIEMANN NETO, FRANCISCO JOSÉ; FELIX, ELAINE APARECIDA
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<https://www.tandfonline.com/doi/abs/10.1080/13669877.2017.1422780?journalCode=rjrr20>

DA SILVA ETGES, ANA PAULA BECK; GRENON, VERONIQUE ; DE SOUZA, JOANA SIQUEIRA ; KLIEMANN NETO, FRANCISCO JOSÉ ; FELIX, ELAINE APARECIDA .
ERM for Health Care Organizations: An Economic Enterprise Risk Management Innovation Program (E 2 RM health care). VALUE IN HEALTH REGIONAL ISSUES (PRINT), v. 17, p. 102-108, 2018.

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Referências adicionais : Brasil/Português; Inst.promotora/financiadora: Hospital de Clínicas de Porto Alegre

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Economic Enterprise Risk Management in healthcare E2RMhealthcare, 2017. (Congresso, Apresentação de Trabalho)
Referências adicionais : Estados Unidos/Inglês. Meio de divulgação: Vários; Local: Estados Unidos; Cidade: Seattle; Evento: ASHRM annual conference; Inst.promotora/financiadora: ASHRM

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Referências adicionais : Brasil/Inglês; Local: São Paulo; Cidade: São Paulo; Evento: Quali Hosp; Inst.promotora/financiadora: FGV São Paulo

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Referências adicionais : Brasil/Português; Local: PUCRS - Faculdade de Engenharia; Cidade: Porto Alegre; Evento: Semana da Engenharia 2016;

ETGES, A. P. B. S.; SOUZA, S. Joana; ROOS, E. C.

Gestão de Riscos Corporativos em diferentes ambientes de negócio: Lacunas e Oportunidades, 2016.
(Simpósio,Apresentação de Trabalho)

Palavras-chave: Gestão de Riscos Corporativos, Avaliação de desempenho, Gestão econômica

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