



InterPARES Trust Project

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Introduction

This report concerns the research proposal to iTrust 2016 made by the University of Porto with the title "*Monitoring the information management (IM) function in hospitals*", which is being conducted in the context of the information management service of a Portuguese large-scale hospital (1100 beds), under the PhD program in Information and Communication in Digital Platforms. The report presents the research, which includes a description of motivation and of the scientific framework, contextualized in the health sector, organized into 8 corresponding sections to the following: (1) research question; (2) goals; (3) literature; (4) research groups and projects; (5) periodic listing for research and publication; (6) construction of the analysis model; (7) the work operation method and (8) references.

The research focuses on the position of the information management function in the strategic decision, considering clinical information management in a hospital setting. The study perspective is based on information science, focusing on the management of clinical information supported on three essential premises: (i) the importance of current and retrospective healthcare information to the healthcare process; (ii) the high reuse potential of healthcare information and (iii) the strategic importance of the information management function in healthcare.

Considering the focus of the present study it is important to note in the last about 20 years the increasing enthusiasm with the adoption of information technology (IT) in Health care, motivated by the expected benefits regarding the organization of administrative processes, as well as quality and costs of health care. This excitement phase was followed by a need to rationalize costs and maximizing the use of existing resources, demanding the verification of the expected benefits of the acquisition and implementation of IT, which resulted in various IT assessment studies on health care. Besides the increasing maintenance costs and acquisition of IT, the results show that there are other factors in health care that must be addressed as a result of the mismatch between IT and work processes. These factors pose risks to patients and health care staff demand a holistic approach to performance assessment in healthcare information management, i.e. not limited to technological aspects but considering human and organizational factors of work processes, focusing on ensuring decision making support in health care information management.

In the health care context, there are two key aspects that it should be noted concerning the existing literature and the connection of results of research studies with the decision making process. Although the literature reports a large number of studies on the use of information technology in health care and its impact on organizational performance and patient safety, the results do not always contribute to the institutions' definition of an information strategy, i.e. sustained in information governance principles. In the healthcare context it is important to consider that the work processes in the clinical settings are in constant adaptation and change, highly influenced by any external or internal decision, which does not allow a strict control of all the variables that need to be considered in a use case analysis (ex. the health care professional who performed the task, application downtime, flow of patients, etc.). Whether due to the complexity of the contexts of use, regarding use cases analysis of clinical workflow, or due to the focus on a particular technology, usually the results reported in the literature are limited to the institution in which the use case analysis is performed, since the fieldwork method is difficult to replicate in other health institutions. Often studies point out limitations in the adoption of conclusions or recommendations by other institutions, considering the influence of organizational, human, functional and technological factors in healthcare information management. The uncertainty of success in implementing the recommendations produced, points out to the critical exercise in the decision making in information management, which not always is based on the actual information needs of the organization. The framework of this study in Information Science, benefiting from an interdisciplinary perspective, integrating areas such as information behaviour, usability and interaction, process management and information systems, health care management and medical informatics, will contribute to conduct the study considering a need of systematization of results. In this sense, the work focuses in supporting decision making in information management, based on the informational activities and the organization of work processes, so that results can address the information needs of those involved.

The study aims to define a framework for an analysis of informational activities in an hospital, based on performance indicators to be established within the study. The purpose of the informational activities monitoring tool is to support the various levels of decision making, considering the information management in an hospital setting. The goal of this research project is that the model implemented in one hospital may be replicable in other contexts of health care, and the method used in this research to develop the monitoring policy can be implemented in other areas of activity. In this sense, the study points out the

contribution of information management work to the strategic decision, based on the information needs of stakeholders.

1 Research question

The project focus on the importance of the IM function in healthcare, pointing out benefits of professionalizing information management activities in the organization. The research addresses the following research question:

How may the development of the information activities monitoring instrument, based on performance indicators, contribute to the improvement of information management in healthcare?

2 Objectives

The study pursuits the following objectives:

- (i) understand the impact of the IM function in healthcare activities;
- (ii) analyse and explain the production and use of healthcare information in a hospital (healthcare to patients, research and other access requests);
- (iii) characterise the informational structure of São João Hospital Centre (SJHC) to support the production and use of healthcare information;
- (iv) identify performance indicators that characterize the organizational information model in a hospital;
- (v) develop a monitoring model of the information management performance based in the context of the clinical activity of a central hospital and
- (vi) apply the monitoring model developed in v. to assess its contribution to the decision making process in information management and its implementation. (*)

(*) Objective number vi will only be addressed after November 2017 and therefore it is not included in the iTrust project results.

3 Bibliographic review (work in progress)

The research study focus in the informational activities of stakeholders in a hospital context, considering organizational, functional and human factors influencing production and reuse of health information. In this sense, we adopt an interdisciplinary perspective based in information science studies, exploring contributions of scientific and disciplinary areas, namely ***information behaviour, usability and interaction, process management and information systems, healthcare management and medical informatics***. The bibliographic review is based on the same interdisciplinary perspective, privileging studies that focus on the analysis and systematization of factors that characterize health information management in the context of healthcare, whether for statistics purposes and comparison between institutions, performance evaluation or evaluation of patient safety, to build a guiding framework of the scientific literature to explore.

To explore the literature, we have been performing searches using Google Scholar, *PubMed* and *Web of Science* in order to identify keywords and Mesh Terms to refine searches and state a *query* to support the literature review. Although the definition of the search strategy and of the exclusion criteria is still in progress the current results have been systematized on table 1.

The selection of papers will be based on the abstract and access to full text, considering the relevance to the present study, with especial care about the method used, concerning data collection and analysis. As a result of the work in progress we present the analysis of 8 papers already included in the literature review during the exploratory searches phase (tables 2 to 5).

Google Scholar	Pub Med - Mesh Terms	Web of Science
Benchmarking	benchmarking	decision making
composite indicators	documentation	health evaluation
data envelopment analysis (DEA)	efficiency, organizational	health information systems
decision making	electronic health records	healthcare management governance
eHealth	patient care management organization & administration	healthcare performance
electronic health records	quality improvement organization & administration	inpatient quality indicators
Evaluation	quality indicators, healthcare / standards	
Governance	quality indicators, healthcare / statistics & numerical data	
health information technology	Total Quality Management / methods	
hospital information systems		
information culture		
organisation factos		
patient safety		
process assessment		
quality indicators		
Technology Acceptance Model (TAM)		
user satisfaction		

Table 1 - Key words and Mesh Terms used in the searches performed on Google Scholar, PubMed and Web of Science to identify relevant literature and refine the query that will support the literature review.

Adler-Milstein, J., Ronchi, E., Cohen, G. R., Winn, L. A. P., & Jha, A. K. (2014). Benchmarking health IT among OECD countries: better data for better policy. Journal of the American Medical Informatics Association, 21(1), 111-116.	
Focus	Describes the ICT benchmark project in Health carried out by the OECD in seven pilot countries in order to allow comparison and foster learning among countries. Defines four areas of benchmark : (i) provider-centric electronic records; (ii) patient-centric electronic records ; (iii) health information exchange and (iv) tele-health, identifying features common to different countries. Given the increasing investment and enthusiasm in the use of ICT in Health , stresses the need for eHealth strategies defined by individual countries to be supported in IT impact of policies and results of its adoption , to ensure that the investment results in improvements in the quality of care .
Contribution to the present study	Demonstrates that it is possible to develop and apply benchmark measures with regard to Health IT, concerning the challenges posed by the different application contexts and the strategic options in IT adoption. Results indicate difficulties in motivating countries to collect the data, reinforcing that the politics underlying the benchmark measures must focus on the effective use of resources and results obtained. It does not limit the application of the benchmark to the possibility of establishing comparisons between countries and institutions, strengthening internal factors of motivation, placing the focus on the definition of an information strategy. The fact that the study focus on the use of functional core indicators will overcome different interpretations of each context, since it is easier to find consensus among different countries regarding the activities supported by IT than regrading what constitutes the electronic health record . In this sense, it reinforces our proposal that indicators should be defined taking into account the effective use of information in the context of care so that you can measure the effects of investment in information resources and in the organization, as well as in the definition of the processes.
Beuscart-Zépher, M. C., Borycki, E., Carayon, P., Jaspers, M. W. M., & Pelayo, S. (2013). Evolution of human factors research and studies of health information technologies: the role of patient safety. Yearb Med Inform, 67, 77.	
Focus	Focus the impact of regulation and patient safety initiatives in human factors, namely, conducting usability studies with a focus on IT in Health, to improve the process of prevention / error detection induced by IT . The study aims to identify fundamental dimensions of usability and design principles likely to impact patient safety , regardless of the usage scenario .
Contribution to the present study	The fact that this study point out the use of combined methods , adopted by usability studies and clinical simulation , identifying features and functions in IT and aspects on workflows associated as error facilitators, is an important contribution to the current study regrading the analysis techniques to be used and expected results. The study points to the difficulties in describing and modelling contexts of use , stressing the need to categorize context in dimensions to be considered , regardless of the organization, to ensure the reuse of analysis technique in different contexts. These aspects are particularly important in our study, since it promotes the identification of mismatches between IT and work processes which allows the identification of indicators that can be replicated in other contexts.

Table 2 Systematization of focus and contribution of the works of Adler-Milstein et al. (2014) and Beuscart-Zépher et al. (2013).

Devaraj, S., Ow, T. T., & Kohli, R. (2013). Examining the impact of information technology and patient flow on healthcare performance: A Theory of Swift and Even Flow (TSEF) perspective. Journal of Operations Management, 31(4), 181-192.

Focus	Presents an analysis of the role of IT in a clinical work process and its consequences for improving efficiency and hospital performance. It points out that the fact that the organization of work processes is a variable influenced by IT, affecting the quality of care and financial performance, it should have a weight in terms of strategy. In order to understand whether IT investment results in benefits, the authors reinforce synergies with the operations management, using flow management tools to examine investment in IT in hospitals depending on how patients and their clinical information flow in the processes. The authors use data from a hospital to establish a link between the organization's performance (production data, complications, mortality and organizational characteristics) and investment in IT, in order to verify the assumptions made regarding the relationship between IT investment and quality of work processes.
Contribution to the present study	The study states the facilitating role of IT in clinical decision support, contributing to better management of processes of care (waiting time, identification of relevant examinations to be performed, etc.) as well as in clinical decision support). Despite the numerous studies that reinforce this relationship, they point to difficulties in defining the way that an organization should follow to develop the IT function for effectiveness and efficiency in its performance. By focusing the study on the analysis of processes, anticipating problems and barriers in the production and use of information, it reinforces the purpose of our study of systematization of data to enable the identification of relevant indicators. The study reinforces the need to address IT investment as an opportunity to redesign work processes in order to achieve the improvements. The authors point out future research to identify IT features that meet the footsteps of a work process, identifying critical points costs, time-consuming, error facilitators and waste.
Houben, S., Frost, M., & Bardram, J. E. (2015, February). Collaborative Affordances of Hybrid Patient Record Technologies in Medical Work. In Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (pp. 785-797). ACM.	
Focus	Analyses clinical settings with hybrid information systems that adopt the Electronic Health Record (EHR) and maintain the use of paper-based medical records. The authors point out limitations in the integration between the digital and paper concerning the work processes, highlighting the convenience of using paper-based records to promote collaborative work in the context of care due to its mobility and portability.
Contribution to the present study	The hybrid context analysis using EHR and paper-based records is an important contribution to this study following the socio- technical information systems perspective we adopted, considering the informational activities in electronic or paper and the level of fitness and user satisfaction in a process . Bearing in mind that investment in IT with the dematerialization, regarding the decision-making based on information management, is one of the critical aspects to put into discussion in this study, it is important that the monitoring policy to be implemented allows organizations to take advantage the coexistence of formats , encouraging the dematerialisation of processes safely and to the extent that organizations can anticipate the improvements in organizational performance.

Table 3 Systematization of focus and contribution of the works of Devaraj and Kohli. (2013) and Houben, Frost and Bardram (2015).

Hung, S. Y., Chen, C., & Wang, K. H. (2014). Critical Success Factors for the Implementation of Integrated Healthcare Information Systems Projects: An Organizational Fit Perspective. Communications of the Association for Information Systems, 34(1), 39.	
Focus	Focus on the study of the relationship between adaptation to organizational factors and the success of the information system in an hospital, identifying critical success factors . Points out differences in the negotiation and customization capabilities of the IT function of the institution's size, focusing on five critical issues: adaptation of technological systems , processes adaptation, organizational strength, top management support and capacity of key team members . The article describes the questionnaire technique and data analysis to validate the importance of adaptation to the organization of the processes and data.
Contribution to the present study	The identification of critical organizational factors in the implementation of an integrated information system in healthcare is an important contribution to this work and the aspects to be considered for the monitoring tool developed to mitigate the differences in context and allow replication of good practice. Given the high number of clinical software in hospitals the organizational adaptation to the adoption of integrated information technology will be one of the critical aspects in the research study, considering the analysis of informational activities and clinical processes that we intend to perform.
Johannes, T. H. Y. E., Straede, M. C., Liebe, J. D., & Hübner, U. (2014). IT-Benchmarking of Clinical Workflows: Concept, Implementation, and Evaluation. EHealth2014–Health Informatics Meets EHealth: Outcomes Research: The Benefit of Health-IT, 198, 116.	
Focus	Presents a proposal to improve the procedures applied to benchmarking methodology in healthcare , through the inclusion of clinical workflows indicators. The authors propose four clinical workflow processes descriptors and identified general and specific indicators . The study had the participation of 199 CIO of German hospitals concerning the contribution of benchmark information to : (i) have an overall perspective ; (ii) advances in IT, (iii) prepare negotiation with management and (iv) argue a new IT project.
Contribution to the present study	Confronts the benchmark indicators used in 2011 in which the e1 indicators put the focus on IT (implementation status of functional structural IT functions, CIO satisfaction and context factors) not considering the clinical workflows, which are more relevant but more difficult to measure. The research question added by the authors in order to understand how can IT support clinical workflows be benchmark meets the objectives of the present study and the authors identified as benchmark variables: (i) the availability of data and information throughout the process; (ii) the availability of relevant functions to the process; (iii) the level of integration and (iv) the level of distribution of data and information. The fact that the study points out limitations in the approach taken with the measurement of support clinical work based on the opinion of CIO and IT personnel, limited to technical issues features rather than usability, is important to the present proposal, including aspects of usability and interaction with technology, considering all the informational activities in providing care, as well as the totality of information resources available.

Table 4 Systematization of focus and contribution of the works of Hung, Cheng and Wang (2014) and Johannes et al. (2014).

Mukred, A., Singh, D., & Safie, N. (2013). A review on the impact of information culture on the adoption of health information system in developing countries. Journal of Computer Science, 9(1), 128-138.	
Focus	Identifies and explores factors of information culture that influence the attitude of citizens towards IT in the context of healthcare, pointing out that the high IT investment in health requires the need to adopt a holistic perspective, in order to foster the maturity of the information culture and increase the level of technology adoption and innovation. It presents a literature review concerning the concept of information culture, exploring its use in healthcare, noting that the information culture level is determined by factors such as awareness of information needs and knowledge and ability to analyse traditional and electronic informational resources. It highlights the key role of information culture for sustainable performance, allowing the creation of an environment in which professionals are aware of the importance of knowledge and their attitudes using IT.
Contribution to the present study	Points to IT as a facilitator for effective use of information, emphasizing the weight of organizational and environmental factors, and puts the focus on the need to create the necessary environment for a health organization to be able to interpret , evaluate and use their information resources efficiently. Places a focus on the study of information behaviour , considering the person's activity to identify their information needs , search, produce , use, share , transfer or even ignore the information.
Paré, G., & Sicotte, C. (2001). Information technology sophistication in health care: an instrument validation study among Canadian hospitals. International Journal of Medical Informatics, 63(3), 205-223.	
Focus	Development and validation of a monitoring tool to characterize the profile of a hospital on the use of IT, aiming to (i) provide a diagnostic tool for hospital managers and (ii) allow the comparison with other similar institutions. Describes the results of 20 interviews with IT experts in Health, which identified technologies and applications and allowed a discussion of specific aspects, focussing on functional processes they support. Addresses the issue of IT sophistication in technology, functional dimensions and integration, characterized in four areas of activities, ie 1. to provide care, 2. support, 3. materials and infrastructures management and 4. administrative management, marking the need to conduct an operational characterization of IT to measure the benefits of its introduction.
Contribution to the present study	Although the study 's focus is on IT, exploring the concept of IT sophistication , the results show the need to incorporate features which ensure greater representativeness and validity of the monitoring tool . The review of models in the literature and proposed variables for characterizing information systems , based on the information management studies , management of health and medical informatics , as well as the methodological approach which formed the basis for the development of monitoring tool , reinforce the importance of an interdisciplinary perspective.

Table 5 Systematization of focus and contribution of the works of Mukred, Singh and Safie (2013) and Paré and Sicotte (2013).

4 Construction of the research model

The concepts that support the research have been identified considering the research question. Thus we identify three concepts as essential to the research: (1) health information management, (2) informational activities monitoring and (3) information management optimization.

The identification of relevant dimensions to consider for each of the concepts was carried out using exploratory questions derived from the research question in order to understand the most relevant dimensions and components of the information management function and informational activities in a health care organization. In this sense the research model was based on the need to consider the probability that each of these dimensions has to influence the information management function and performance of informational activities. Considering the traditional management models in healthcare organizational context we aim to articulate dimensions, pertaining to indicators that are traditionally related with human resource management (human), information technology management (technological) and top and service directions management (functional).

The dimensions will be explored in components and indicators, considering the independence of each element in the application context, in order to enable its application in health organizations according to the type of organization, size and nature. The definition of the components and indicators will be part of results of the research study.

5 Methodology

The project combines qualitative and quantitative research approaches, in order to explore a socio-technical perspective. The work is planned in three different stages:

- a) **Literature review** on measure or assessment models or methodologies (ex. Balanced Scorecard and benchmarking) applied to information management, in the healthcare and other sectors, and critical analysis of case studies which focus on the analysis of information management activities in healthcare, pointing out critical aspects that may contribute to the present study;
- b) Build a process map for the IM function in a hospital, which characterizes the information model, identifying **key performance indicators** that reveal how these processes perform, using qualitative and quantitative research techniques, based upon the: (a) analysis of informational activities performed in daily healthcare practice context (process modelling); (b) analysis of paper and electronic based healthcare records and; (c) collection and analysis of the contribution of the various professional groups (clinical and non-clinical) (focus group technique).
- c) Development of a **monitoring instrument of the informational activities**, based on the performance indicators identified, in order to contribute to the identification of critical aspects and to support the decision making process in IM.

Bibliography

- Adler-Milstein, J., Ronchi, E., Cohen, G. R., Winn, L. A. P., & Jha, A. K. (2014). Benchmarking health IT among OECD countries: better data for better policy. *Journal of the American Medical Informatics Association*, *21*(1), 111-116.
- Beuscart-Zépher, M. C., Borycki, E., Carayon, P., Jaspers, M. W. M., & Pelayo, S. (2013). Evolution of human factors research and studies of health information technologies: the role of patient safety. *Yearb Med Inform*, *67*, 77.
- Devaraj, S., Ow, T. T., & Kohli, R. (2013). Examining the impact of information technology and patient flow on healthcare performance: A Theory of Swift and Even Flow (TSEF) perspective. *Journal of Operations Management*, *31*(4), 181-192.
- Hung, S. Y., Chen, C., & Wang, K. H. (2014). Critical Success Factors for the Implementation of Integrated Healthcare Information Systems Projects: An Organizational Fit Perspective. *Communications of the Association for Information Systems*, *34*(1), 39.
- Houben, S., Frost, M., & Bardram, J. E. (2015, February). Collaborative Affordances of Hybrid Patient Record Technologies in Medical Work. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (pp. 785-797). ACM.
- Johannes, T. H. Y. E., Straede, M. C., Liebe, J. D., & Hübner, U. (2014). IT-Benchmarking of Clinical Workflows: Concept, Implementation, and Evaluation. *EHealth2014–Health Informatics Meets EHealth: Outcomes Research: The Benefit of Health-IT*, *198*, 116.
- Mukred, A., Singh, D., & Safie, N. (2013). A review on the impact of information culture on the adoption of health information system in developing countries. *Journal of Computer Science*, *9*(1), 128-138.
- Paré, G., & Sicotte, C. (2001). Information technology sophistication in health care: an instrument validation study among Canadian hospitals. *International Journal of Medical Informatics*, *63*(3), 205-223.