# Document Management and Process Automation in a Paperless Healthcare Institution

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## Abstract

Health care management is essential to the financial balance of institutions and the improvements of patient and organization documental processes. In order to achieve these aims, an important step is to observe the indicators that start to point out positive evidence when using document management and process automation in a healthcare institution, through Information and Communication Technologies in the e-Health system. The main purpose of this study was to gather data and indices about the issue under study through a literature review. Analysis of American, European, and Brazilian articles in academic or non-academic healthcare organizations indicates share and use of patient's data that can improve the performance of applied systems; analyses of processes; quality indicators of the provided service, and patient's quality of care and safety; diagnosis and prescription of medication; and decrease of data information errors. Thus, it achieved stage 7 in the Healthcare Informatics Management and Systems Society (HIMSS).

## Keywords

Hospital Administration, Health Information Management,
Health Economics

## 1. Introduction

Nowadays, understanding the management and the responsible and effective use of Information Systems (IS) in globalized information societies is a requirement for managers and other knowledge workers [1]. As in any other organization, both Information Technology (IT) and IS go through several hierarchical and functional levels in a hospital. Difficulties with internal and external communi-

cation in institutions have historically constituted the problems of hospitalization and ambulatory care units, or among several specialties and teams. The patient is usually cared by more than one doctor in the Primary Attention and by more than one expert in ambulatory care facilities and hospitals. Other realities that weaken communication between doctor and patient include turnover of staff in the services and patients' mobility, for instance, whether in public services, due to change of address, or in private services due to change of health insurance. Information should be combined within this complex and dynamic scenario so that patient's care can be continued.

With the new management models observed in both the private and the public health care networks, new information needs are observed with demands of integration, validations, and consolidations. The new management techniques, the continuous improvement of quality, the treatment of cases and risks may increase the demand for updated information and for systematized clinical data, which are often summarized and detailed. In addition to the primary use of data, there is an increase of the secondary use for different purposes due to all adjacent ethical and legal issues involved, which can contribute to system improvement.

Thus, in the event of information management, there were also contributions of the technological development to health projects, thus providing growth with consequent increase in knowledge share and health care qualification to the population.

Health IT systems, such as electronic health records and input of computerized medical requests, may improve quality and reduce costs. In general, they are projected to improve communication between different providers within a health organization. Furthermore, these technologies facilitate the implementation of goals and the use of tools to support decision, which can be valuable to prevent process errors.

Some institutions that performed the management have pointed out some advantages: the Brazilian Institute of Medicine [2] [3] defends standardization of computerized information of medical requests in order to decrease the amount of hospitalization errors. In addition, the American Recovery and Reinvestment Act (ARRA) from the United States has established, since 2009, financial funds so that hospitals may become significant users of health IT.

The Healthcare Information and Management Systems Society (HIMSS), which was founded in 1961, is a non-profit organization that mainly aims at improving healthcare through IT. It makes efforts to optimize health liabilities and care results [4].

Standardization is another successful initiative, made by some of these organizations, to incorporate the Electronic Medical Record Adoption Model (EMRAM) technologically in the health sector. It was developed by HIMSS Analytics in 2005 as a methodology to assess the progress and impact of electronic medical records for hospitals.

The EMRAM is a seven-stage process that allows you to analyze the standar-

dization stage of the organization's Electronic Medical Record (EMR), to trace its accomplishments, and to monitor its progress compared to other healthcare organizations in all the country. Organizations that reach stage 7—the highest in the scale—are known as achievers of all the necessary measurements regarding a paper-free environment and, mainly, the most effective treatment of information and automation management. Thus, they have the real and quality advantage to represent an advanced environment of patients' electronic record.

The HIMSS Analytics collects, analyzes, and distributes the main health IT data related to products, costs, metrics, trends and decisions of purchase. It also provides quality data and analytic experience for healthcare organizations, IT companies, government, financial and pharmaceutical bodies, and advisory companies.

In Brazil, resolution 1821/2007 [5] of the Brazilian Federal Council of Medicine (CFM) approved technical digitalization standards and use of computerized systems for safekeeping and handling documents from patients' records and authorized the elimination of paper, exchanging it for health identified information. The main resolution points include the following items: patient's records can be digitalized, provided that all pieces of information of the original documents are digitally reproduced; the digital files from the patient's record digitalization should be controlled by the Electronic Management of Documents (GED); the use of computerized systems for safekeeping and handling patient's records and for exchanging health-identified information should eliminate the mandatory use of paper records, provided these systems fully satisfy the requirements of the Safety Assurance Level 2 (NGS2); digital signature and standardized digital certification should be used based on the Infrastructure of Brazilian Public Keys (ICP-Brazil) until digital implantation in the Brazilian Regional Council of Medicine (CRM) by the CFM—then, computerized systems have a 360-day deadline to incorporate this certificate; the CFM and the Health Informatics Brazilian Society (SBIS), upon specific agreement, should issue the seal of quality of computerized systems in agreement with the Certification Manual for Health Electronic Records Systems, which had been approved in this resolution; and microfilmed records can be removed, according to specific laws that regulate this area and after mandatory analysis of the Commission of Record Revision from the medical-hospital unit that created the file. However, there is not an authorization to eliminate paper in the occasion of using the Safety Assurance Level 1 (NGS1), due to lack of legal support.

This resolution also approves the Certification Manual for Health Electronic Records Systems, version 3.0 and/or another version approved by the CFM; authorizes digitalization of medical records, according to specific standards; and establishes permanent safekeeping for medical records that had been electronically filed in optical or magnetic medium and microfilmed, as well as the minimum deadline of 20 years for safekeeping medical records in papers [6].

Considering the relevance of the potential of document management and process automation for the practical success of healthcare organizations man-

agement, we have proposed to carry out this study in an attempt to offer more knowledge regarding the use of this technology to professionals of this area.

## 2. Objective

To identify the advantages of document management and process administration in a healthcare organization based on a literature review.

## 3. Method

Descriptive study, in which data management and automation processes were analyzed in health institutions. It was also an observational study, considering that the efficiency confirmation of processes was presented through statistical data. In addition, this is a technology-based study, because the efficiency of processes was presented through dedicated software like Enterprise Content Management (ECM), Enterprise Resource Planning (ERP), and database.

Literature review of publications on the advantages of management and automation of documents and processes in paperless health institutions was carried out by following retrospective studies. The theme of interest, the guiding question and title formulation; the search and selection strategies; the inclusion and exclusion criteria; the methodological quality assessment; and the data analysis and interpretation from these studies and publications were pre-established and outlined.

Research was conducted directly in electronic databases, such as: LILACS, PubMed, National Center for Biotechnology Information (NCBI) at the US, National Library of Medicine (NLM) and Articles of Health Affairs, for English papers. For Portuguese papers, research was conducted in the electronic databases Dedalus-Bibliographic Database of Universidade de São Paulo (USP) and Google Scholar.

The keywords used in the research were: "management and automation in paperless hospital", "medical record systems", "computerized", "efficiency", "organizational/statistics & numerical data", "electronic health records", "hospital administration", "hospital sem papel" and "gestão da informação".

## 4. Results

Firstly, the research results in electronic databases were not satisfying because it is a very recent theme. When we improved the search with terms from the methodology, we found different results, including six publications in studies, books, and government websites that were close to the theme under study.

After reading the articles, we found papers with similar purposes, which were carried out by: Hospital Infantil Sabará [7], Stroetmann *et al.* [8], Moncho [9], Schneider [10]), McCullough *et al.* [11] and Blaya *et al.* [12], which were then adopted as references for this article.

During the conduction of the first project at Hospital Infantil Sabará, in 2012, we found a 60% decrease in paper printing. This resulted in printing decrease of around 300 thousand sheets/month, due to the implementation of a sophisti-

cated and pioneer project called the Health Information System (HIS) [7]. Despite the great challenge, some results indicated a positive presence in the cost-benefit relation.

By using a methodology that focuses on techniques of economic evaluation and of Information and Communication Technologies (ICTs) use, Stroetmann *et al.* [8] based their research on choosing a proper economic concept and on searching a methodology that applied it. By organizing a wide range of health applications, the authors showed the advantages of ICTs in healthcare routine. The advantages included quality improvement and better access of all citizens to care, or even the prevention of unnecessary costs for the public budget.

An important lesson was that the implementation of e-Saúde should be done together with proper changes in the processes and organization, which is led by duly qualified people.

After Moncho [9] applied all HIMSS stages at Hospital Marina Salud de Dénia, in Spain, he achieved a paperless status and became the second hospital in Europe to reach this phase; therefore, the project that began in 2007 was concluded. Around 8000 physicians and nurses were released per hours/year.

One of the main factors to reach Stage 7 was the clinical and business intelligence program that seemed quite sophisticated in the analysis of care and operational efficiency quality (Figure 1), and thus became a data-driven organization [13].

Success depended on seeing the use of technology not as the final objective, but as the tool to transform care provision service.

Scheneider [10] reached stage 7 in the EMRAM, by centering his research in the university hospital Universitätsklinikum Hamburg-Eppendorf, which became one of the 15 units in the entire world with this attribution that reached the maximum level of distinction given by HIMSS in the end of 2012. Since
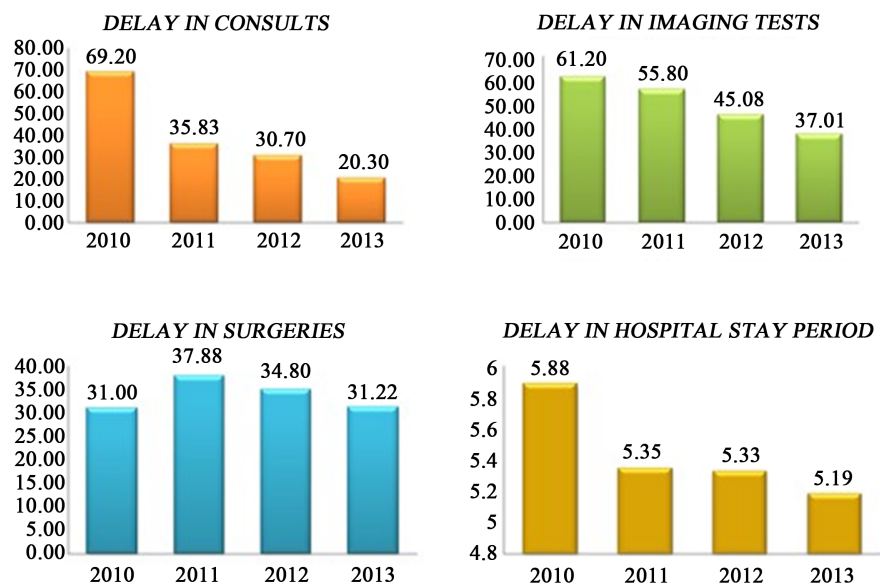


Figure 1. Operational Efficiency of Hospital Marina Salud, Spain.

2005, the hospital has been a reference regarding the evaluation of developments

and advantages of the patient's electronic process. In only 3 years, an IT system was implemented in the entire hospital, which enabled that continued care service could be fully provided through a patient's electronic medical record. Paper became then a superfluous item. The advantages are observed in several levels: due to IT systems, the patient's health records are now issued more quickly, with a higher standard.

In addition, gains were also observed in the time that employees spend consulting files to find exams performed in hospital units during previous visits, since all data are now available online.

For patients, the most obvious benefit was a quicker provision of service. Doctors can now access the patient's clinical history more quickly; also, technology facilitated the perception of waiting periods that each patient had to pass until treatment.

McCullough *et al.* [11] conducted a review of published articles that somehow had pieces of evidence in the results regarding the adoption of ICT use.

Data analysis of 3401 non-federal North-American critical care hospitals, from 2004 to 2007, resulted in three sources: American Hospital Association's (AHA), HIMSS, Centers for Medicare and Medicaid Services (CMS) Hospital Compare.

Results suggested that the current health IT returns were mainly focused on academic medical centers. The change in health registration quality was compared with the computerized adoption of medical requests input in different configurations. The conclusion of primary health IT value which depends on the context, with larger effects in academic hospitals, had implications for the IT federal health policy and, particularly, for funds and reimbursements provided by the ARRA. With the adoption of more sophisticated Health Electronic Records (RES) and systems to insert electronic medical prescriptions, these academic institutions have achieved more functionality and training not only of the clinical staff, but also of the technical one.

Blaya *et al.* [12] evaluated organizations associated with academic and non-academic environments. The first evaluations suggested that the following functions had a positive impact on developing countries: ability to track patients through the beginning of treatment, to monitor the adherence and to find patients at risk of follow-up loss; tools to decrease the time of information communication inside and between institutions; tools to label or register samples and patients; ability to monitor in electronic media and to remind patients of the healthcare needs or treatment; collection of clinical or research data, which used Personal Digital Assistant (PDA) applications; and, finally, reductions of errors in laboratorial data and medications.

## 5. Discussion

### 1) Information Technology and Standardization

The IT success depends on seeing technology is not as a final objective, but as a tool to transform care service. It should be seen as the center of efforts to im-

prove results and to strengthen security and economy.

Many countries have acknowledged the need of combining efforts to develop standards that may be adopted by all people. Hence, the International Organizations for Standardization (ISSO), the HIMSS and the HIMSS Analytics, among others, gather members from several countries to develop standards that can be used anywhere in the planet, regardless of regional differences. The digital era is indeed changing the world we live. Many factories have used technological innovations to gain quality.

Several studies have provided evidence that health IT could improve clinical quality, partly due to the error reduction after its adoption [14] [15].

Yu *et al.* [16] have analyzed the relation between computerized input of medical requests and quality of processes in 3364 North-American hospitals. According to their results, hospitals that had implemented the medical electronic prescription overcame those that had not done it. This type of studies provides crucial information for IT function and valuation in health.

Parente and McCullough [17] and McCullough *et al.* carried out a different approach when they analyzed the change of quality in individual hospitals after the adoption of Health Electronic Records (RES). They observed a sample in the North-American territory of 2707 hospitals, from 1999 to 2002, and found that the use of these records was associated with small, yet significant, reductions in infections due to medical care. They also found evidence of selection bias after adoption of health IT.

An alternative hypothesis is that the health IT value depends on content/context. Therefore, the RES and computerized systems of doctors may be more valuable to patients with multiple co-morbidities and higher disease severity. Therefore, these patients would require coordination by many doctors and would demand a larger variety of prescriptions and laboratory tests.

The results of Parente and McCoullough study suggest that achieving substantial advantages in national scale could require a long process and should go beyond the purely academic environment. It would be best if context/content information, associated with combination of patient's data, could help diagnosing and better evaluating diseases [17].

Health systems from the European Union are a fundamental part of Europe's social infrastructure. However, nowadays, Health Information Technology (HIT) has been the basis of health in this community. Correct approach, data evaluation and respective implementation of a health process could improve quality, access and efficiency in health care services. There is a potentially high impact; however, it has been difficult to measure it, especially some of its benefits. Many times, the evaluations present only one perspective, like financial perspective or of a group of interested subjects.

The e-Health implementations, associated with IT tools in developing countries like Brazil, could be verified because such systems improve communication between institutions, help organizing and managing medications and help monitoring and detecting patients that could abandon their care. The evaluations of

personal digital assistants and mobile devices, persuasively, show that such devices could be more effective to improve data collection period, as well as their quality.

Information systems, like RES, cell phones and hand computers (also called m-health), can be of great value to provide health care services in many configurations.

When these systems are used to monitor supplies, they can save lives by providing accurate and opportune information for strategic planning. In acknowledging this potential, the World Health Organization (WHO) has published a manual about RES implementation for developing countries [18], and many agencies have supported the e-Saúde [19] efforts financially.

Nevertheless, the evaluations are essential to ensure these systems are safe and advantageous, and not a waste of scarce resources. Tools (PDA and mobile devices) to store and communicate these data with low rates of error corresponded to the first steps for success in developed countries; therefore positive evaluations should lead their use in the developing world.

These results, at some extent, allow assuming that, in other countries, especially European countries, the adoption of ICTs with emphasis on the HIMSS scale has reached its objectives and, therefore, achieved success. In Brazil, we are still beginning the process of adoption, but we have already had satisfying results with consolidated data.

**2) Management and administration in a paperless health institution, with their respective indicators and controls**

Since the main purpose was standardizing health information systems and making interoperability and integration possible, the university hospital Universitätsklinikum Hamburg-Eppendorf was the first European hospital to reach the maximum stage of maturity of its electronic clinical process, with a structure that is almost free of paper. This hospital received the maximum distinction stage attributed by the HIMSS Analytics Europe, which is an American HIMSS-based program that has been adjusted to the characteristics of the European reality. Since 2005, the hospital has been a reference regarding the evaluation of developments and advantages of the patient's electronic process. The university hospital Universitätsklinikum Hamburg-Eppendorf reached stage 7 of the EMRAM in the end of 2012, after reaching stage 6 and becoming one of the 15 units in the whole world with this attribution.

At a first moment, such hospital insured transition of the information system to a new platform, and then in a progressive manner, it integrated specific departments and now only few processes escaped integration. The use of paper was reduced to punctual areas. For instance, electrocardiogram results are still printed, because the system is not completely integrated; however, the printed paper is used only to digitalize and, thus, enter in the central system.

This hospital institution started to produce 40 to 50 GB of information on a daily basis. It spares 2.5 million sheets of paper per year. In addition, gains are registered in the time that employees spend consulting files to find exams per-

formed in hospital units during previous visits, because data are available online now.

The system of document management and process automation provides that the university hospital Universitätsklinikum Hamburg-Eppendorf profits with sub-systems, which still exist to provide answers to the needs in specific areas. It is the case of the central laboratory, where an average of 7 million analyses is done through the structure every year. An automation chain makes samples run, follows them to the correct place and produces results, which, in the last analysis, are firstly validated by technicians and then by doctors, with extremely lower deadlines than the usual ones before process automation. The platform being used is Sorian, which integrates system to central information, and obtains data regarding the time the analyses had been requested, when they began being processed and when the results arouse. Medical consults throughout the year marked 2.6 million and the number of hospital personnel's complaints changed to zero.

The Hospital Marina Salud de Dénia, which is the second European hospital to achieve complete paperless status and reach stage 7 in the HIMSS Analytics, marks the conclusion of a project that began in 2007. Therefore, it showed that digitalization not only is possible, but it is essential for the future of healthcare.

Its starting point no longer was a deadline, but the comprehension that technology can improve quality and accessibility of healthcare. Thus, digitalization was not the purpose in improvement strategy, but its underlying mechanism. It is known that document digitalization is a hard task of great dimensions, and hospital organizations are complex, but the Cerner Millennium RES system has been used since 2009, and the digitalization process began 14 months later. Information can be accessed digitally not only from 209 beds, but from the entire network of centers and medical practices, which include 150 thousand patients.

It is worth noting the need of consolidating cultural understanding that technology may help improving results and ensuring patient's safety by avoiding the duplication of data and errors caused by contraindications. When the organization assumes the view of a paperless hospital organization as a reality, it may achieve efficiency gains to reinvest in the service. Hospital Marina Salud, through workflow rationalization, released around 8 thousand clinical and nursing bodies/hours per year. The Cerner Millenium system modernized hospital bed management and, therefore, decreased average of stays in 10%, thus increasing the period of stay.

Generalized participation of the organization is important, especially from doctors in the heart of the project, since it will enable a system that supports workflow.

Health results improve by using automatic warnings, which promote the adoption of recommended practices and prevent possible adverse effects. Doctors may also access reference information on bedside, with quicker decisions. Automation of complete medication circuit, from prescription to administration, reduces possible errors in distribution.

Hospital Marina Salud de Dénia does not have medical records in the nursing units anymore. All doctors open online requests and they are supported by a support system for intelligent clinical decision. The staff documents its clinical grades on-line and the results and thoughts are released automatically for all healthcare providers. The Department of Medical Imaging is completely digital and it provides online images throughout the entire hospital network. One of the main factors that contributed to reach stage 7 in the HIMSS Analytics was the performance of a clinical and business intelligence program that is highly sophisticated for analyzing the quality of care and efficiency; thus, it became an organization of "data input".

Moncho [20] states that half of the hospitals in the United States is currently at stage 6 and only 0.7% is at stage 7 in the HIMSS Analytics.

In Brazil, a last research about the use of ICT, published by the Center of Studies on Information and Communication Technologies (CETIC.br), points that only 49% of the hospitals use technology to perform diagnoses and solve health problems, and only 40% use the systems to prescribe medication. Thereupon, the crucial clinical information to create knowledge is still only on paper. It shows that there is still an important step to take in a sense to use these pieces of information for making decisions in order to optimize the medical area.

Infrastructure and automation are not enough. Today, hospitals have computers and internet. The research shows: 94% of the institutions use computers and 91% have Internet access. Nonetheless, the use of technology is still restricted to basic operational routine services, like registering patients.

Technology is currently a great ally in the improvement and optimization of health services with an essential role in hospital management and exchange of information in operational processes. For such, it should only use technology for patient's management and treatments.

Hence, some technology companies already possess electronic records, which enable interaction of the clinical staff. Hospitals using this tool not only gain productivity, but also knowledge distribution and error minimization. Thus, with well-consolidated internal processes that use tools for patient's management, the institutions have rich information to make decisions.

With clinical and operational improvements, the service becomes more efficient. Management is essential; however, it is only achieved if basic is equipped. Recalls are exciting; however, more advances is necessary so that resources may be appropriate to the current scenario [21]. As an example, Hospital Infantil Sabará, in São Paulo, is implementing a pioneer and sophisticated project from the Hospital Information System (HIS) without paper printing.

With regard to Brazil, the country has many difficulties, considering it invests a low amount of money in health, and there are serious management issues and poor use of public funds.

IT may help regulating the demand for health services, with scheduling of consults and improvement of hospital management by using informatics [22]. It could build a care service that does not provide services only in episodes, but

that provides services to the patients' entire life [23].

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