Medical and Healthcare Information Systems in Portugal: Short Literature Review

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Abstract. As the world comes to embrace technology, it becomes apparent that there is a progressive need to use information systems in all fields, especially in the medical one. While doctors and human resources will always be needed, technology can bring an enormous advantage. When using information systems an improvement can be seen while managing a hospital, diagnosing, and treating patients and even in reducing infection rates among hospital patients. There is a whole world for this new technology. Only, medical staff are not the keenest on this system, believing they would be replaced. Having this in mind it is important to have a balance between men and machine. This article aims to present a preliminary literature review that allows us to understand what medical and healthcare information systems are and how they are used.

Keywords: Medical · Healthcare · Information Systems

1 Introduction

Information systems is viewed has an integrated set of several components, including collecting, storing, and processing data [1]. However, they give information and knowledge as well. The development of this systems has been linked to changing needs in the healthcare industry. Governments all around the world are finding the need of a less doctor-centered healthcare, this can be implemented by information systems.

Information systems have the ability to manage healthcare costs, improve the care as well as decision support, this is helping doctors make an informed decision about a diagnosis, diminishing human error [2], not forgetting the ability to lower costs [3]. These are all big advantages for healthcare systems around the world seeing they are increasingly over pressured with the increase of patient's flow, and the aging population [2].

As a recent field with only about 60 years [4] under its belt, medical professionals are still on the fence about trusting the evolving information systems, while informatic

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systems have been accepted to reduce paperwork and administrative work [4]. Help for diagnosis and patient care as not been accepted as well due to the fact medical professional believe they would be replaced. This is a common misconception seeing IT would serve as an aid for providing better care for patients while reducing the pressure exerted on doctors to not make any mistakes [2].

It is important to understand the beginnings of this field as well as the challenges it faces now, and where this could lead us. This article then aims to analyze the current information systems trends and future perspective in the medical field.

2 Background of Health Information Systems

Medicine and healthcare have changed a lot in the last 60 years, with major improvements in the last 20 [3]. Major companies have gotten into the development of software and hardware for health care [5], especially the emerging field of medical information systems. However, to understand the now it is important to understand the background of health information systems.

In the end of the 1950's [6] the first signs of this field appeared when talks about using computers to automate some of the medical personnel work started to appear. But it took 5 more years for one of the firsts software's for medical information systems to be developed in California [7]. But at this time not a lot of companies helped hospitals get computers. Then in 1967 the International medical informatics association (IMIA) was created, and the first meeting happened in the following year [8]. During this decade, the medical staff was used primarily for managing inventory and billings, all in a single database [9]. However, research into simulating and modeling biological processes had started as well as the first attempts to find decision support [10] and diagnosis tools.

As stated by Collen [11], during the 70's, departments relating to medical informatics popped up around the world. One of the first being the one Amsterdam followed by the former Soviet Union, besides that, professors from several countries published a paper discussing the term medical informatics. About this time, it was estimated that 10% of computers in the US had some form of informatic systems [12]. Getting to 1980 the first ever degree of this field was created in the Stanford University. It was also in the 1980's that European funding started to appear for research in this area [13]. During that decade, most paper records started to get digitalized and computer records were created. This was a big step to make medical informatics known worldwide, creating conferences, furthering the research, and making the rules for this field.

Reaching the 90's this fields has consolidated its positions as a separate discipline where most medical related degrees included classes on this matter [13]. Telemedicine research starts, medical imaging keeps improving and electronic health records keep improving to include data protection and confidentiality, with the European Data Protection Act in 1998 [14], turning into the norm the use electronic health records [5].

When getting closer to the present, new study areas related to information systems appeared as bioinformatics, hospital management, among others. New and improved technology appears, imaging, modeling of tissue, diagnosis tools. However, it is here we start to see problems emerge where the resistance against such technologies is faced

by medical professionals [1], who mistakenly believe jobs would be lost, and older generations of patients who are not very trusting of things they do not understand.

Looking back at the past it can clearly be seen a big improvement over the years, with huge steps being taken in order to improve this area, with more and more research appearing. However, we must not forget that the level of medical information systems depends on the country as well as the socioeconomic context, as we see far more progress in first world countries [15].

3 Present

Nowadays, health information systems (HIS) have undergone a great development since its creation. This development allows us, not only to better manage healthcare data, but also to improve cost control, increase the timeliness and accuracy of patient care and administration information, among other things [1].

Currently, HIS has three main focuses, as we will see in the following subchapters.

3.1 How to Manage, Store and Transmit Health Data

One of the most developed areas of information systems in the medical field is managing the data. Data is constantly being produced in healthcare, ranging from prescriptions, exams and even billing. That being said, data collection allows healthcare workers to have an easier access and management of patient data by storing it electronically [16]. Which would create a faster and more convenient way of gathering patient records without wasting time in manually looking for them.

Transmitting health records could also assist in an easier connection between medical staff and patients, by allowing a faster spread of a patient's important information [2]. Electronic records would also assist in providing correct data between several medical organizations, improving the patient's chances for a better treatment [2].

Nonetheless, there are still issues regarding the electronic storage of data, most of which involving laws and patient safety. By using electronic records, medical data is more likely to get hacked and stolen than by keeping the records in paper [2]. Patients' rights and confidentiality are also a reason of concern, when medical records are kept electronically and shared in different healthcare organizations, since not all people agree in sharing all their information with different associations.

SClínico is a Portuguese clinical information system, created by SNS (Serviço Nacional de Saúde – National Health Service). The system allows medical personal to register patient data electronically in a shared database [17, 18].

PDS (Healthcare Data Platform - Plataforma de Dados da Saúde) allows medical workers from the SNS to have access to their patients' information database. With its use, it's possible to reduce the number of unnecessary duplicated exams and help professionals obtain the most important information regarding their patients [18, 19].

3.2 How to Help with Decision Support

Decision support is a big focal point in the development of HIS, as it would allow a wide range of improvements, such as patients' safety and cost control. These enhancements

could be reached with the use of drug safety software, that would alert inappropriate dosing or recommend cheaper medicine options [2]. Another benefit would be the incorporation of decision support systems, which would provide a quick diagnosis with the use of the patient record [16].

Even though HIS brings amazing benefits to the medical field, the systems still have their pitfalls. For example, the workflow of the healthcare staff would need to be adapted to the system, resulting in wasting time training the medical team. The integration of a poor safety or managing software could also turn into a problem, causing inappropriate alerts, which would exhaust the personnel, who might begin to distrust and ignore the systems due to its lack of accuracy [2].

An example of the HIS's help in decision support is the online screening of the SNS. The National Health Service created an online page that allows patients to evaluate their symptoms and receive information and advice regarding their health [20]. Still, the results of the online check-up aren't one hundred percent trustworthy, as the evaluation mustn't replace one done by a professional worker.

3.3 How to Assist in Long Distance Patient Care

With the development of the internet, more and more forms of communication between doctors and patients have appeared. With the use of internet and its resources, the healthcare system can create a connection network that links several medical workers, to easily discuss patient care options and schedule appointments [2, 16].

Bearing in mind the transmission of patient information, the future HIS could also allow a quicker spread of the patient's symptoms and vital signs, making it possible for the doctor to communicate with the patient in-real time [2, 16].

Hospital da Luz has its own app (MY LUZ), with which the patients can manage health entries, control payments, check exams results and have online appointments with their doctors [21].

4 Current Difficulties

Despite HIS great evolution over the years, it hasn't efficiently been incorporated into healthcare systems yet. Many investors wonder what could be the cause for HIS's lack of integration in hospitals and why do the technologies keep failing when they show such amazing potential.

In spite of all its advantages and verified results, HIS still isn't used on a larger scale. The main reasons for the lack of use may be:

4.1 HIS Doesn't Have Much Support

The absence of HIS use can be co-related to its lack of support. That can be explained since hospitals don't want to waste time and money by exchanging their usual system and work ethics [1].

This difficulty could be potentially solved with the help of the government, by encouraging hospitals to keep their information in a digital database, as it would improve the transmission of the correct information no matter where the patient is taken care of.

4.2 Information Confidentiality

Medical information is highly sensitive, requiring an enormous level of security and confidentiality. With HIS, data as a higher risk of security breaches, medical data leaking or patients' data being exploited, when compared to paper records. The apparent risk of patient privacy being breached is a cause for concern, making them less inclined to share information [1].

4.3 Medical Staff is Afraid to Lose Their Jobs

In tune with the previous point, the lack of use of HIS can be linked with the fact that medical professionals feel that healthcare systems may take away their jobs, especially systems with a focus on decision support. When combining the lack of integration of HIS with professionals' fear of losing their jobs, healthcare systems gain a poor reputation that delays their implementation [1].

4.4 Patients Don't Trust It

Associated with the previous point, patients have trust issues regarding HIS, influenced by the opinion of the medical personal. The opinion of the professionals, then combined with the risk of their medical information leaking, makes the general public apprehensive to share sensitive personal information [1].

4.5 Lack of Communications Between Platforms

Nowadays there is a large number of information systems concerning healthcare, each single one with a wide variety of functions, uses and databases. While the extensive information gathered with the different platforms appears to be beneficial, the lack of connection between databases affects the availability to access records at any place [2, 18].

4.6 Expensive to Invest

While the incorporation of HIS can be extremely beneficial to healthcare, but the cost to implement it on a large scale is quite exorbitant. A wide application of HIS still requires an understanding of how it will work and where it will be applied, that can cause businesses not to invest in HIS implementation [2].

5 Future - Opportunities and Challenges

The constant development of medicine and all the technologies associated with it has led to a significant revolution in healthcare. Medical care has an evolutionary tendency to be increasingly preventive and patient-centered, this is possible through the improvement of the quality and availability of health information technologies, making it possible to have more intelligent, adaptable, and cost-effective medical services [22].

Health information technologies are still poorly suited tools due to a multifaceted environment, in which it is difficult to satisfy all the needs inherent to the patient, professionals and organizations. There is a need for technological change that can take all these factors into account and achieve interoperability between different systems [16].

Some examples of future opportunities and challenges in health information systems are:

The study, development and application of systems that allow health information exchange (HIE) between all hospitals through Electronic Medical Records (EMR) [16, 23]. HIMSS is a non-profit organization that helps companies work towards an electronic healthcare environment, consisting of the Electronic Medical Records Adoption Model (EMRAM) that incorporates methodology and algorithms to automatically score hospitals worldwide regarding their Electronic Medical Records (EMR) capabilities [16]. This model has 8 levels (0–7) that measure the adoption and use of electronic records (EMR) functions. The "HIMSS" level 7, allows continuous electronic information exchanges, allowing a fully functional electronic record that shares patient data with local health units, being accessible to the user and health professionals [24]. It also has the characteristic of being a continuous learning health system (LHS) which allows the use of data to improve care, quality, and safety. At this level, paper graphics and clinical decision support systems are not used 90% of the time [24]. "HIMSS" level 7 has already been reached by a Portuguese hospital - Hospital Cascais Dr. José Almeida, sharing the vanguard with a restricted elite of 3 hospitals in Europe and 6% in the USA, with its expansion being a future perspective [16, 25].

The evolution of data sharing between providers and the patient himself through a cloud, which alerts hospitals to an evolution in terms of management, security, storage, analysis, and interpretation of the data obtained [26].

Cybersecurity is also an important factor since computer attacks against hospital systems containing personal data are increasingly recurrent, which causes some fear in end-users to provide their data and personal information to third parties [22].

Consider the patient as a user, that is, the patient has access to his data, being able to edit or even delete them, having greater control over his records. This innovation can bring some associated risks to hospitals since the patient can function as a communication facilitator by being an active participant, or as an interfering participant, that is, not communicating the necessary data making the relationship between the health professional and the user [16].

Aggregation of data in order to cross organizational boundaries, with a very high number of benefits, however, organizational challenges also increase, due to the growing number of health organizations involved.

The growing development of intelligent devices capable of responding to electronic signals, such as bracelets with wireless communication devices that can exchange information with hospital computers, such as specific patient data or monitoring vital signs in real-time, which becomes to have numerous advantages from the point of view of hospital resources, reducing diagnostic tests and other procedures, and clinically.

The use of robots that are integrated into an HIE system to dispense medication or perform hospital disinfection.

6 Conclusion

Currently, healthcare has the future perspective of providing increasingly predictive and patient-centered medical care, this will be possible due to the real-time monitoring of the patient's health, the use of developing technologies such as smart devices, computers more powerful, intelligent processing and storage of data, and the interconnection of the entire healthcare ecosystem [22].

The globalization of the computer technology business associated with health is one of the main trends, currently, anyone is a potential consumer of data, and the possibilities of the IT market are still limitless. The main producers of these technologies include the USA, Japan, France, Great Britain, Germany, and Singapore, among others [5].

The implementation of HIS is not a constant work, there are several factors that change over time to which HIS must adapt, there is a need for a long-term perspective, that is, HIS must be seen as a journey that must be fulfilled in order to reach the goal, a future in which the wealth of data allows safe, efficient and high-quality care [16]. The increasing use of HIS is inevitable, and its variety will proliferate in the coming years, as we migrate to ubiquitous computing environments, however, there are ethical and even receptive aspects on the part of health professionals that cannot be forgotten because they are sources of gaps for this type of systems [27].

The future is promising for HISs that can support the provision of integrated patient-centered health care, that produce environments that are richer in data and more integrated models of care and information exchange with other professionals.

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