

HEALTH INFORMATICS APPLICATION IN HEALTHCARE AND HOSPITALS

Abstract

The healthcare sector as a whole will produce significantly more data than other important businesses in the forthcoming years. As a result of this information explosion, which is motivated by the desire to improve Patient's health, health informatics emerged as a multidisciplinary professional discipline that examines and explores the efficient applications of medical data, information, and knowledge for scientific investigation, problem-solving, and decision-making. Due to the advancement of medical technology and the requirement to protect sensitive data, health informatics will be a need of the hour. This chapter covers the application of health informatics in the healthcare sector and its significance, uses, challenges in implementation and possible future trends. This chapter also underlined the need of future research in this field and practical strategies for maximizing health informatics benefits and safeguarding patient privacy.

Keywords: Medical Informatics, Bioinformatics, Artificial Intelligence, Electronic Health Records, Internet of Medical Things.

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I. INTRODUCTION

The field of health informatics is relatively young if compared to other fields of medicine but its impact on healthcare and hospitals is relatively high. In today's technology-friendly environment healthcare professionals are also encountered with computer applications to a large extent. However, the discipline of health informatics incorporates more than just the use of computers in healthcare; it also involves the processing of enormous amounts of data in hospitals and healthcare. Health informatics not only helps healthcare professionals to provide better care but also helps in cost reduction, process optimization and better adaptation to changing patient needs. Health informatics has the potential to reshape the way we cater for our patients and deliver care to meet all the needs of the expanding population in the future.

Information science, computer science, and healthcare are all intermingled in the multidisciplinary subject of health informatics. The discipline of health informatics is growing rapidly and will continue to do so for years to come. Data, information, knowledge, and wisdom, as well as the fundamental components of health informatics such as algorithms, clinical process modeling, and medical decision-making, need to be explained to students.

This is clear that the application of health informatics is wide It can be used for:

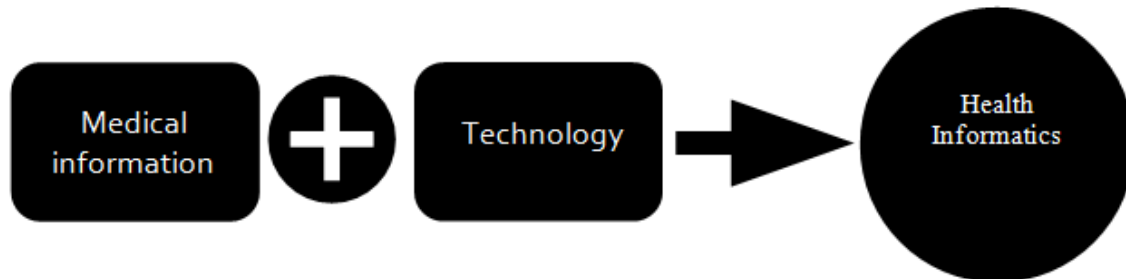
1. Improvement of patient portals.
2. Creating cloud-based healthcare systems.
3. Making personalized care plans.
4. Develop new medical technology.
5. Improve the efficiency of healthcare systems.
6. Proper implementation of HMIS (Hospital Management Information System).
7. Centralizing Medical Records.
8. To support Digital health mission in India or developing countries.
9. Improve the quality of medical care.
10. Data transfers become easy after the implementation of 5G.
11. Use of Artificial Intelligence (AI) to support decision-making.
12. Interdepartmental coordination improvement
13. Reduction of operation cost.

II. DEFINITION OF HEALTH INFORMATICS

Healthcare is an information-intensive field where a lot of data is generated daily. Imhoff (2001) defined "Health informatics as the process of creating and evaluating systems and procedures for the collection, managing, and analysis of patient data with the use of knowledge from research studies."

As discussed, earlier the information processes and applications across multiple healthcare sectors determine the scope of health informatics, a branch of healthcare that is still in its formative stages and lacks distinct boundaries. Some examples of these processes and types involve Clinical decision support systems (CDSS), which constitute new logical extensions of the electronic health record and may deliver historical and current information

using Internet protocols to plan treatments, optimize resource use, and minimize costs. (Norris 2002).



Several definitions of health informatics that are regularly referenced have been cited by Bernstam (2010):

1. "Science of information, using the definition of information as data with meaning. The study of the application of information science to the field of biomedicine is known as biomedical informatics. Some of this information is knowledge, but not all of its contents.
2. "scientific discipline concerned with resources, devices, and formalized methods for optimizing the collection, retrieval, and administration of medical information for resolving issues and taking decisions"
3. "The use of computers, communications, and information technology and systems in all areas of medicine, including medical treatment, medical education, and medical research"

III. HISTORY OF HEALTH INFORMATICS

Information technology has been pervasive in the field of Medicine for only about three decades but its roots began in the 1950s (Sabbatini2013). Since the earlier days, we have experienced advances in technology, including, personal computers, high-resolution imaging, the internet, mobile technology and wireless, and their impact on healthcare. In the beginning, there was no strategy or vision as to how to advance healthcare using information technology. Now, we have the involvement of multiple federal and private agencies that are plotting future healthcare reform, supported by health information technology.

The following are some of the more noteworthy developments related to health information technology:

1. Computer
2. Internet
3. Mobile technology
4. EHR
5. Artificial Intelligence

IV. SIGNIFICANCE

Health informatics is made up of three fundamental elements: Information, knowledge, and data.

Following are some reasons why health informatics is important:

1. Health informatics aids in maintaining data updates and understanding complicated medical information.
2. Make data retrieval simple and ensure the accuracy of the data.
3. Health informatics facilitates the adaptation of clinical knowledge to unique patient conditions.
4. Data is structured and conveys your messages easily.
5. Because health informatics is founded on statistical and scientific data, it is simple to search for accurate and dependable information.
6. Clinical data may be easily retained, interpreted, and used in future clinical decisions. health informatics and it also quantitatively stores clinical data.

V. USES OF HEALTH INFORMATICS

Healthcare is a multifaceted system. The goal is to prevent, diagnose, and treat health-related disorders or impairments in patients. There are numerous health experts (physicians or nurses), health facilities (clinics, hospitals for providing medications and other diagnosis or treatment & technology), and a funding institution in the healthcare system. Dentistry, medicine, midwifery, nursing, psychology, physiotherapy, laboratory, and many more health professions are represented as health professionals. Depending on the severity of the condition, healthcare is necessary at various levels. In the healthcare business, several sources of big data include hospital records, patient medical records, medical examination findings, and devices connected to the Internet of Medical Things. Biomedical research also creates a substantial amount of big data that is important to public healthcare. To get relevant information from this data, it must be properly managed and analyzed. Information exchange between individuals and healthcare organizations, or information broking, is a key component of health informatics. Lab findings, x-ray results, immunization status, drug allergy status, consultant's comments, and hospital discharge summaries are a few examples of medical information that needs to be shared among various stakeholders in the healthcare system. By using information technology to speed up data flow and analysis, medical informatics may increase productivity and knowledge.

VI. IMPLEMENTATION OF HEALTH INFORMATICS

Doing A SWOT analysis before the implementation of health informatics can be an important part of the implementation process. When we take a closer look at this matter, it becomes abundantly evident that accountable communication is necessary for the safe and efficient design, development, implementation, and use of various health information technology systems. To design a robust health informatics system in the healthcare domain it is mandatory to identify changing requirements of stakeholders and incorporate recent advancements like artificial intelligence into this field.

This will empower patients to gain more reliable health information and also improve the quality of care delivered to them. Hospital administrators will be empowered by this technology because now they will be able to decentralize planning and management but at the same time, they will be able to keep track of the work. Multiple domains can be covered under health informatics such as Applied health informatics, Nursing Informatics,

bioinformatics and Public Health informatics. Patients are the main beneficiaries of the successful implementation of health informatics as they can now use healthcare facilities to the full extent. They can make online appointments, get reminders about appointments, check lab results online and they can easily retrieve health information. The use of social media platforms is also increasing. Various hospitals and healthcare professionals do live sessions on their social platforms and educate people. Doctors, Nurses and other support staff also benefited from this in many ways listed in Table 1.

Public health professionals are also benefited as data sources are available to them easily and they are reliable. Surveillance of disease becomes easy as there can be real-time data generation and analysis.

Table 1: Steps in Analysis of Data

Various Data sources	Clinical information Administrative information Financial information Geographic information
Extraction	Extract Organise Match Analyze
Statistical processing	Machine learning Artificial Intelligence Statistical tools (SPSS)
Output	Reports Article Case study

Data is first collected from various sources and then the required information is extracted, organized, and analyzed. After this statistical processing of data is done and output in the form of reports, case studies and articles are generated. Huge Indian healthcare system must harness "big data" in healthcare and assess a complicated mix of data, including computerized medical records and sensor data. This allows professionals to access and study healthcare big data to establish quality, and best practices, assess treatment methods, and identify patients in danger (Muni Kumar 2014).

Table 2: Various stakeholders benefited by the use of health informatics

S. No	Stakeholders	Benefits of Health Informatics
1	Patients	<ul style="list-style-type: none"> • The biggest and first beneficiary patients can search Online health information which allows for the selection of a doctor, hospital, or insurance plan. • Smartphone technology, which may be utilized for internet access, fitness and health

		<p>apps, and other items.</p> <ul style="list-style-type: none"> • Web portals for storing private medical data, scheduling appointments, reviewing test results, conducting e-visits, ordering medication refills, etc. • Online polls and surveys for patients • Web 2.0 social networking sites, live conferences, podcasts, blogs, and chat rooms online. • PHRs, or personal health records. • Remote monitoring and telemedicine
2	Physicians and Nurses	<ul style="list-style-type: none"> • Electronic drug administration record (eMAR) and barcoding of medicines • Patient online portals for convenient access, secure e-mail and e-visits, etc. • Web-based Physician portals; • Electronic health records (EHRs), • Smartphones with integrated medical applications and remote access to EHRs, telemedicine, • Virtual continuing medical education (CME), • e-prescriptions, • Registries of disease
3	Support Staff	<ul style="list-style-type: none"> • Patient enrolment becomes easy • Electronic appointments are more accurate • Electronic coding and billing methods improve • EHRs • Web-based credentialing • Web-based claims clearinghouses • Home care monitoring • Practice management software • Online educational resources and CME • Disease registries
4	Public Health	<ul style="list-style-type: none"> • Incident reports are generated on time • Surveillance programs become easy and Meaningful. • It becomes easy to establish coordination between different public health departments • Telemedicine • Health information exchanges become easy with EHR • Remote monitoring and reporting using IOMT technology
5	Hospitals	<ul style="list-style-type: none"> • Electronic health records (EHR) • Electronic medical coding and billing using the International Classification of Disease

		(ICD) <ul style="list-style-type: none"> • HIMS to monitor outcomes, length of stay, disease management, etc. • Wireless technology • Patient and physician Modules for easy information access • E-prescribing • Telemedicine
6	Insurance Companies	<ul style="list-style-type: none"> • Digital claims transmission became easy • Pattern Analysis through data analytics • Physicians record Management. • Management information system for quality improvement initiatives • Monitor clinical guidelines adherence • Monitor formulary adherence by staff. • Encourage the use of claims-based personal health records and information transfers • Enhance patient safety by reducing prescription mistakes to reduce litigation

VII. CHALLENGES IN HEALTH INFORMATICS IMPLEMENTATION

A sophisticated adaptive health system approach called health informatics has the potential to improve healthcare delivery but also includes novel challenges and unforeseen implications some of which are mentioned below:

1. **Financial and structural hurdles:** Healthcare infrastructure in developing countries is irregularly distributed and resources are very limited due to this there are difficulties in the implementation of health informatics on a grassroots level. Rural communities are more likely to have these problems. It should be mentioned that the direct costs associated with implementing and maintaining health informatics are extensively substantial and need long-term commitments.
2. **Ethics and Legal problems:** New explicit and comprehensive legislative laws are necessary for the implementation of health informatics. Keeping data private is essential for healthcare and hospitals. Patients registered in healthcare systems must have faith in those associated with the duty of protecting their data. While nations wait for a framework to adopt health informatics in their healthcare systems, the absence of necessary regulations might postpone the beginning of implementation.
3. **Lack of trained staff:** A well-trained workforce is a critical aspect of achieving long-term growth. There are insufficient well-trained health informatics staff, and their geographic spread is inadequate to match the demands and knowledge required for health informatics implementations in rural and semi-urban areas.
4. **Privacy concerns:** The Health Insurance Portability and Accountability Act (HIPAA) of 1996 was first enacted to ensure the portability, privacy, and security of personal health information (PHI), which was predominantly paper-based at the time. To properly

address the electronic transfer of PHI, HIPAA laws were revised in 2009 and again in 2013. This Act has prompted healthcare institutions to reconsider the privacy and security of healthcare information. This will be discussed in further depth in the chapter on privacy and security. There have been several privacy breaches and stolen identities in healthcare businesses in recent years.

VIII. FUTURE TRENDS

Given the relatively recent development of health informatics, forecasting the future is challenging, though multiple trends are worth noting. Healthcare delivery approaches such as accountable care will be an experiment worth monitoring. We foresee increased patient-centred medical treatment and accompanying technology, such as mobile medical applications and tailored genetic profiles. Both patients and doctors will continue to rely on mobile technology as an essential medical platform. As more research in health informatics is published, it is hoped that new ideas and technologies will be examined more often and objectively. More artificial intelligence in medicine will be involved, which will assist in enhancing medical quality and health informatics data. The key area of concentration is patient-centered care, and health informatics will be crucial to providing each patient with secure, dependable, and individualized treatment. Health informatics will support the practice of precision medicine. Health informatics and artificial intelligence will be combined, which will aid in the analysis of big data produced in the healthcare industry.

IX. SUMMARY

The advancement of information and technology is reshaping the healthcare industry and developing new channels for information access and sharing. These adjustments aim to enhance patient care. The healthcare industry is likewise affected by these technological advances. The main focus of medical informatics is the study of massive, aggregated data in healthcare settings to improve and develop clinical decision support systems or evaluate medical data for both quality assurance and accessibility of healthcare services. In my perspective, the future of health informatics will include a human-machine alliance that might ultimately lead to symbiosis. As more data becomes available, machine learning-based algorithms may develop and reveal areas where human interpretation is difficult. This can improve the detection of the illness, speed up the procedure, and minimize decision-making ambiguity. The possibility of combining data from several health informatics domains to enable the development of precision medicine may be the major hurdle for health informatics. To overcome this hurdle data sharing across various domains should be encouraged while privacy of the data must be maintained. There is a vast scope for research in this domain and students and researchers should be encouraged to pursue research in the health informatics domain. There may be several benefits of employing Health informatics technology for our healthcare requirements, but nothing in life is flawless, especially a new kind of technology that has yet to achieve its full potential. When choosing health informatics and other such technologies, we must be vigilant and establish effective data protection methods.

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