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Research Article

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Health Information System: A Primer

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Abstract A health information system (HIS) refers to any system that manages healthcare data. It is an important component of the healthcare system. It manages the data collected and stored in a healthcare facility such as private and public clinics, hospitals, and doctor's private chambers. It is a technology-driven system that makes the process of sharing protected health information between organizations and providers hassle-free. It offers a win-win situation for both the patients and the healthcare providers as far as care delivery services are concerned. This paper provides a primer on health information system.

Keywords health, health information systems, medical information systems, health IT

1. Introduction

Healthcare is one of most knowledge-driven industries. It is a continually evolving sector where the quality of patient care relies on the tools, support, and knowledge health facilities and organizations have at their disposal. The amount of healthcare data created increases daily. Without a robust system, the data has little value.

Health and healthcare are not the same thing. Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or sickness. Public health programs ensure that the health of the population is maintained and track progress toward established community health goals. Healthcare is a service provided by an individual or an organization. The healthcare system is helping to cure diseases, extend our lives, and improve the wellbeing of our communities. Healthcare organizations increasingly use digital systems in step with general trends across industries. Health technology's ability to improve patient outcomes and experiences has led to rapid and impactful changes.

Information systems are often regarded as the means of managing information or data. Healthcare information systems is a broad term generally used when referring to electronic systems designed to manage healthcare data. It is growing field at the intersection of healthcare and information technology. The lack of robust and effective HIS often results in a significant gap between what policy-makers, health professionals, and researchers need to know to improve the health of the population and allocate scarce resources optimally.

2. What is health information systems?

A health information system (HIS) refers to an electronic system designed to manage healthcare data. Such systems are digital systems with open data that comes from different sources and that is ethically used. These include systems that collect, store, manage, and transmit patient records. HIS enables patients to get seamless and coordinated treatment from healthcare providers. It collects data from the health sector and other relevant sectors, analyses the data and ensures their overall quality, relevance, and timeliness, and converts data into information for health-related decision-making. Data is an essential element of HIS and it is usually an expensive resource.

The HIS has been covering both the medical and administrative aspects of healthcare since the 1960s. Its evolution is shown in Figure 1 [1].

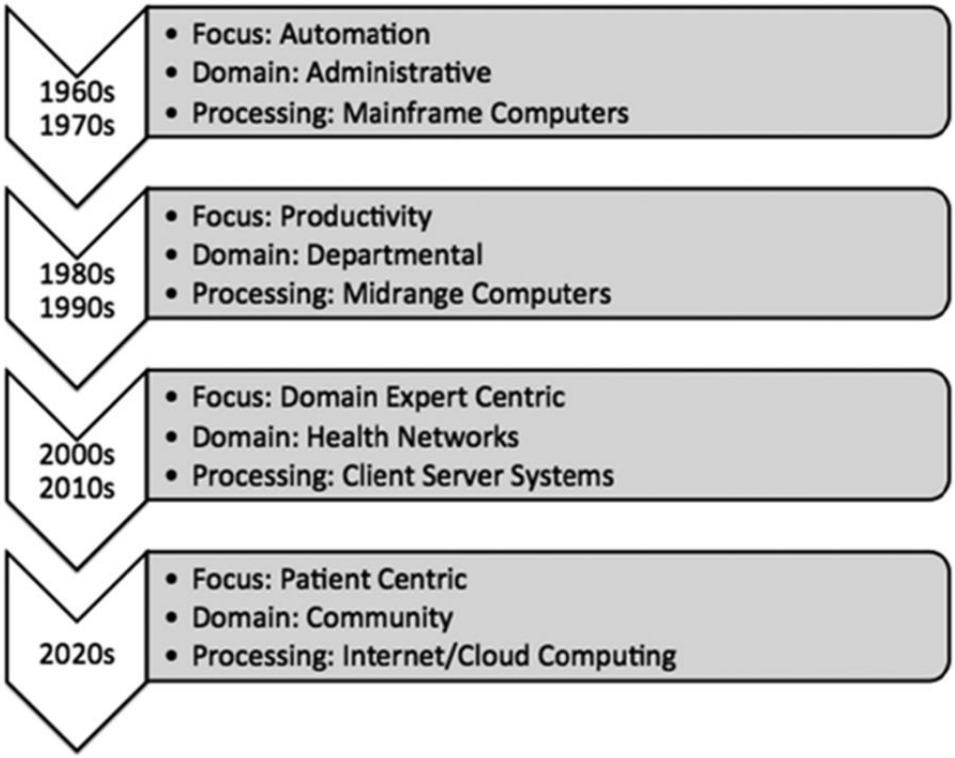

Figure 1: Evolution of health information systems [1].

Electronic records transform healthcare facilities' operations by digitally storing all patient records, providing instant access for medical staff and improving doctor-patient interactions.

Branches of health information systems include primary care information systems, hospital information systems, mobile information systems, and public health information systems. Information systems for health can be improved by prioritizing the following areas: governance; multisectoral management; technology infrastructure; standards and interoperability; automatization and interoperability of electronic health records; privacy, confidentiality, and security of data; data and information processing; knowledge management and sharing; innovation; and risk management [2].

An effective and integrated health information system is the foundation of a strong health system and key to making effective, evidence-based health policy decisions. It is needed to inform decision about where the health problems are. If the health of a population is improving or getting worse, sound judgements can be made with HIS [3].

3. Types of Health Information Systems

Health information systems (HIS) are essential to support decision making and planning to improve health policies that can promote global health development. There are different types of health information systems including [5,6]:

- *Electronic Medical Record* (EMR): Clinical technology tools such as electronic medical records are highly specialized and designed to be used widely. EMR is an electronic medical record of a patient that is stored inside the clinic systems and does not get removed. This record can include the following information: allergies, medications, family history, diagnosis, surgery information, test results, treatments, and progress notes. It replaces the paper version of a patient's medical history. The electronic health record includes more health data. It also is designed to share data with other electronic health records so other healthcare providers can access a patient's healthcare data.
- *Electronic Health Record* (EHR): EMR and EHR systems replace paper patient records. The two terms are almost used interchangeably. EHR is a health record residing in an electronic system specifically

designed for data collection, storage, and manipulation, and to provide safe access to complete data about patients. It is a complete overview of your patient health history. EHR offers many benefits compared to paper records: accessibility, support for multiple views, improved communication between providers, communication with patients, data aggregation, access to knowledge bases, and integration with decision support tools. An electronic medical record system improves the quality of patient health care as the same information is shared across all departments, avoiding any medical errors.

- *Practice Management Software*: This type of system manages the daily operations of a practice, such as scheduling and billing. Healthcare providers, from small practices to hospitals, use practice management systems to automate many of the administrative tasks.
- *Clinical Information System* (CIS): This is designed to rapidly capture, store, process, and transfer information across decision-makers. It analyzes data from various clinical and administrative systems to help healthcare providers make clinical decisions. It is mostly used by hospitals in the labs, pharmacies, radiology, and ICU. Its main benefits is that it allows communication across different systems.
- *Practice Management Software* (PMS): This is used by allied healthcare professionals, such as psychologists, physiotherapists, and nurses. PMS helps to manage the day-to-day operations of a clinic, such as online booking, billing, patient reminders, and other administrative tasks.
- *Patient Portals:* A patient portal provides online access to the patient's personal information, including previous appointments, medical history, diagnoses, and more. With a smart device, the patients can have secure online access to their medical records, scheduling doctor appointments, communicating with the doctor, checking medical bills, and processing payment online.
- *Clinical Decision Support* (CDS): This analyzes data from clinical and administrative systems. CDS tools are designed to break down a large amount of digital data and suggest "next steps" for treatments. The aim is to assist healthcare providers in making informed clinical decisions.
- *Remote Patient Monitoring* (RPM): This is also known as telehealth. RPM provides medical sensors that can transmit patient data to healthcare professionals.
- *Master Patient Index:* This type of platform connects separate patient records across multiple databases. It is completely automated, reduces the possibility of errors, and improves the safety of the information. The most important benefit of Master Patient Index is the ease of access to patient's details.
- *Pharmacy Management System:* This software includes all data related to a patient's prescriptions and is found in a number of pharmacy settings including hospital and long-term care.

4. Applications

Health information systems are used in the following applications:

- *Mobile Health Information System:* This provides nurses in both urban and rural areas with smartphones pre-loaded with relevant and reliable clinical information, giving them access to critical data at the point of care. It enables mobile health (mHealth) to provide healthcare services accessible regardless of time and place with patients can continuously be connected through their smart mobile devices. Many companies and healthcare institutions are launching mHealth programs for remote patient monitoring, which is leading to an increase in the adoption of IT solutions for remote patient monitoring services [6]. A typical mobile HIS is shown in Figure 2 [7].
- *Routine Health Information Systems:* This is a subset of health information systems that involves the regular collection of data and reporting from health facilities. For example, routine data from health facilities providing rehabilitation services are essential for decision-making.
- *Community Health Information System:* This is an integrated, patient-centric, web-based application that assists all stakeholders in healthcare management. It is a single sign-on portal that allows users to query an interconnected database of medical research, healthcare providers, regulations, nurses, and physicians.

- *Hospital Information Systems:* HIS serves a critical mission in hospitals. The system that facilitates the activities of a hospital and takes into consideration the functions of a healthcare facility. It is generally used by hospitals or large clinics whereby they enter data regarding their patients. Data from patients can be extracted and manipulated for purposes of managerial oversight, audit, and research [8]. The major factors driving the growth of the global hospital information systems market are rapid growth in demand for efficient management of large volume of data generated and its availability for medical practitioners when required. The various components of hospital information system are shown in Figure 3 [6].

Figure 2: A typical mobile health information system [7]

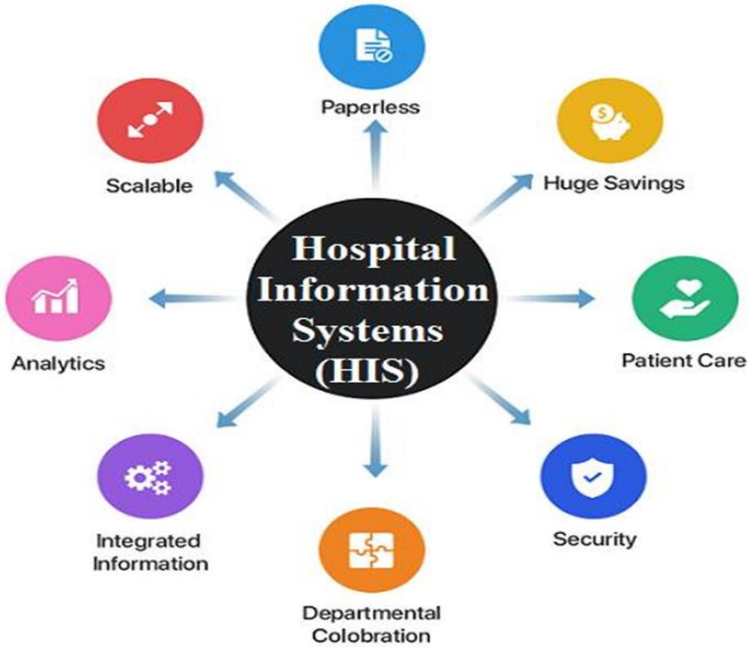

Figure 3: The various components of hospital information system [9]

4. Benefits

Many healthcare benefits are available from effectively implemented health information systems. HIS save clinics money and lead to better patient care. Health education, health screening, and prevention of disease all benefit from the integration of HISs. In recent years, there has been a growing recognition of the potential benefits of HIS, including the following [10,11]:

- *Reduced Costs:* The most important consideration when choosing a HIS is the system's overall cost. Removing paper from the process and going digital can reduce costs for an organization. HIS can help to reduce costs by streamlining and consolidating administrative processes and improving resource utilization. You can make your healthcare service better for your patients while saving lots of money.
- *Saving of Time:* Besides saving money, HIS also helps in saving time. By making all the patients' information computerized and personal activities automated, HIS saves a significant amount of time in making patient care coordinated and hospital management seamless.
- *Improved Quality of Care:* HIS can help improve the quality of care by providing more timely and accurate information. Providing patients with easy access to their medical records allows them to be actively engaged in their treatment, dramatically improving health outcomes. With HIS, the efficiency of the healthcare professionals increases. Their work becomes easier and more organized. As a result, they focus on giving better care to the patients and improving their engagement and satisfaction.
- *Improved Coordination:* By consolidating patient information and using HIS, healthcare facilities can significantly improve patient outcomes through enhanced coordination. The Department of Health and Human Services has recommended that patients searching for new doctors should look for offices that use EHR to receive coordinated care. That coordination comes from the ease of data sharing achieved using EHRs.
- *Improved Performance Analysis:* HIS allows for the simplified collection, consolidation, and analysis of data, meaning they can evaluate employee performance data more easily.
- *Reduced Prescription Fraud:* By allowing for easier communication between providers and consolidating patient health records into one easily-accessed location, HIS plays a crucial role in reducing prescription fraud.
- *Ease-of-Use*: Healthcare practitioners are not usually trained in using health information systems; so choose a system with an intuitive design that is user-friendly for your staff is essential.
- *Data Analytics:* With the aid of technology, you can gather, aggregate, and analyze data. This analysis can improve individual patient care, provide insight on how to manage population health, and reduce costs.
- *Collaborative Care:* The healthcare ecosystem includes many types of providers—hospitals, specialists, pharmacy, insurance, etc. To ensure continuity of care, it is necessary to be able to quickly and securely transfer data.
- *Improved Patient Safety:* With the help of HIS, you can get easy access to patient data and save all the information and share it across multiple databases to improve the safety of the patients.
- *Better Patient Care:* By collecting patients' information (such as diagnosis reports, medical history, allergy reactions, etc.), HIS gives healthcare providers with a complete and orderly framework that helps them better interact with their patients and deliver care in a more efficient way. HIS improves the satisfaction level of the patients. When patients can rely on your service, you get more patients and get a great return on investment.
- *Circumvention of Medical Errors*: Since HIS maintains less paperwork and makes everything computerized and automated, you get error-free reports and information.
- *Automation:* Automating routine clerical tasks allows you to concentrate more on the quality of patient care.
- *Performance Analysis*: HIS helps to analyze the data easily and minimize paperwork. It is easy to analyze the data which is in digital format. HIS professionals ensure that the electronic data that medical professionals manage is maintained and exchanged accurately and efficiently.

- *People-centered Care:* The information that people need to protect and manage their own health is a fundamental element of an effective people-centered healthcare system. Patients and clinicians desire technology that facilitates access to and use of health information and communication tools leading to quality, person-centered care.

Some of these benefits of HIS are displayed in Figure 4 [1].

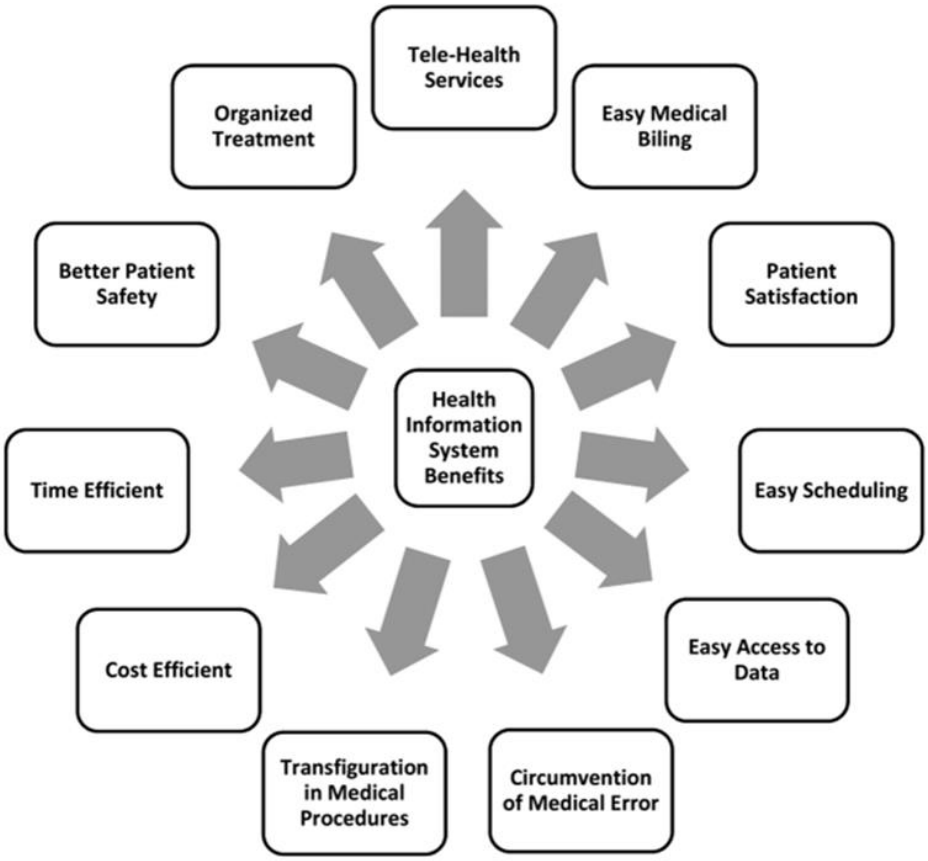

Figure 4: Benefits of health information system [1].

5. Challenges

The challenges mainly involve our health care system's documentation requirements, collaboration between vendors, consideration of workflow, and patient concerns around privacy and adoption of new technologies. Since patient data is highly sensitive, any HIS must ensure the accuracy of data collected and patient confidentiality. Health care data must not be stored without proper protective measures in place. This need for privacy and data protection existed in the era of physical documents, and has evolved alongside the technologies employed by hospitals and other care providers. In order to achieve interoperability, portability, and data exchange, healthcare information systems must employ standards. Systems that conform to different standards cannot communicate with one another.

Other challenges include the following [7]:

- Multiple legacy systems, which use different standards, are still in use in many organizations. Agreement is needed on the use of standards and that consensus will require focus to achieve the concept of "one patient, one record."
- Most EHRs are built on legacy technologies and are not as interactive digital platforms. It will be important to retrofit or reconfigure the current structure with what is needed.
- While most EHRs were built to support billing and coding, they have not been optimized to support these features. The burden of administrative tasks can be reduced through transparency of payer coverage rules and administrative interoperability.

- Evaluation and management documentation guidelines will need to be refined so that clinicians can fully use new information systems.
- The sharing of data among EHR vendors has progressed but still presents a challenge. Vendors and users will need to assist with the adoption of information standards to enhance interoperability.
- Health information technology and informatics resources will be needed to help build, test, implement, manage, and evaluate these systems.
- The costs associated with new systems, their updates, and implementation of new capabilities are usually a challenge to an organization's bottom line.
- It is reasonable to expect that some patients may have privacy and trust concerns when using a HIS with advanced AI capabilities.
- To enable true interoperability, standards and their universal adoption are needed.
- The national healthcare information system is complex, inefficient, incompatible, competitive, and isolated.
- Sometimes those who need health systems the most are those who have least access to it.

About the Authors

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7. Conclusion

The healthcare information system is the future of healthcare centers. If you are interested in being deeply involved in HIS, you can build your knowledge base in a master's-level program. You should learn as much as possible about the way these solutions are used today. For more information on healthcare information system, see the books in [12-16].

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