THE IMPACT OF HEALTH INFORMATICS ON RADIOLOGIST, LABORATORY TECHNICIAN, PHARMACIST-PHYSICIAN COLLABORATION, AND PATIENT OUTCOMES

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Abstract

Health informatics has revolutionized the way healthcare professionals collaborate and deliver care, with significant implications for patient outcomes. This abstract explores the impact of health informatics on the collaboration between radiologists, laboratory technicians, pharmacists, and physicians, and its influence on patient outcomes. The abstract provides an overview of the role of health informatics in facilitating communication, information sharing, and decision-
making among these healthcare professionals. It also discusses the potential benefits and challenges associated with
integration of health informatics in collaborative care, and highlight the importance of leveraging technology to improve
patient safety, treatment efficacy, and overall healthcare quality. The review concludes that, the professions of radiologists,
laboratory technicians, chemists, doctors, and patient outcomes have all been significantly impacted by health informatics.
Healthcare practitioners are now able to make better decisions thanks to the increased efficiency and accuracy of diagnostic
imaging and laboratory tests brought about by the integration of technology and data management systems. Electronic
prescribing and medication management systems have improved collaboration between chemists and doctors, guaranteeing
safe and efficient pharmaceutical use. The application of health informatics has also helped patients receive more
individualized care, better communication, and access to health information. All things considered, the use of health
informatics has changed the way that healthcare is delivered and may continue to enhance patient outcomes in the future.

Keywords: Health informatics, HER, HIE, impact, patient outcome.

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INTRODUCTION

The contemporary global landscape is undergoing significant transformations driven by advancements in technology and communication. Simultaneously, changes in policy, economics, demographics, and socio-environmental factors are exerting a profound influence on healthcare delivery systems. In contemporary times, the integration of information technology has become a customary practice within numerous enterprises. The term informatics refers to the utilization of computerized information systems for the purpose of addressing inquiries, resolving challenges, and facilitating decision-making processes [1, 2]. Healthcare information technology (HIT) refers to the utilization of computer hardware and software for the processing of information in the healthcare sector. It encompasses activities such as storing, retrieving, exchanging, and utilizing health care information, data, and knowledge to facilitate communication and support decision-making processes [3].

Health information technology encompasses a range of technologies that encompass basic charting as well as more sophisticated decision assistance and connection with medical technology. Health information technology (HIT) offers a multitude of prospects for enhancing and revolutionizing healthcare. These prospects encompass the reduction of human errors, enhancement of clinical outcomes, facilitation of care coordination, improvement of practice efficiencies, and the ability to track data over extended periods. Since the first publication of the Institute of Medicine's (IOM) study, there has been a rapid advancement and implementation of health information technology, accompanied by various levels of empirical data regarding its effect on patient safety [4].
The utilization of computerized physician order entry (CPOE) refers to the utilization of electronic or computer-based systems to input physician orders, which may include prescription orders, through a computer or mobile device platform. The initial purpose behind the development of computerized physician order entry systems was to enhance the safety of prescription orders. However, contemporary systems have expanded their functionality to encompass electronic ordering of tests, treatments, and consultations. The integration of CPOE systems with clinical decision support systems (CDS) is a common practice. This integration serves as a valuable tool for preventing errors by providing prescribers with guidance on optimal prescription doses, administration routes, and frequencies. Furthermore, certain CPOE systems possess the capability to remind the prescriber about patient allergies, and potential drug-drug or drug-lab interactions. In more advanced systems, the prescriber may also receive prompts regarding interventions that align with clinical guideline

recommendations, such as venous thromboembolism prophylaxis [4, 5].

The concept of sign-out or "hand-over" communication pertains to the systematic transfer of patient-specific information between healthcare providers, teams of providers, or providers and patients and their families. This procedure aims to promote the continuity and safety of patient care. The occurrence of sentinel incidents in the United States has been attributed to a significant breakdown in the transfer of patient information during handover processes [6, 7].

CPOE and CDS systems are widely recognized as highly advantageous health information technologies that have a significant impact on enhancing patient safety [4].

A study was conducted in 2018 in Iran to determine the use of health information technology in patient care management found that utilization of contemporary information and communication technology inside healthcare facilities enables enhanced accessibility and transmission of information, expedites the admission and discharge procedures for patients, fosters effective communication between different units within the hospital, and facilitates the provision of medical equipment to support operational processes and diagnostic procedures [8].

A systematic review aimed to critically evaluate the available information about the effects of HISs on the management of patient flow found that the implementation of HIS has had an impact on patient flow across different levels of care. However, additional study is needed to understand the specific mechanisms and reasons behind these effects [9].

Impact of Health Informatics on Radiologist:

The email list of the European Forum for Radiologists (EUFORA) emerged as an early radiology application in the aftermath of the public Internet's inception. The email list was linked to a web-based image database known as CONRAD. Following the submission of a case by a member of the mailing list, an automated email was disseminated to all other members of the list, prompting them to contribute their thoughts. The photos might be promptly accessed by utilizing the provided hyperlink. During that particular timeframe, a number of comparable online services emerged, mostly aimed at enhancing communication among radiologists at a global scale, serving both professional and educational objectives [10].

Radiologists face the demand to enhance the value of medical imaging by delivering interpretations that are well-informed, precise, beneficial, and efficient. This challenge arises due to the growing size and complexity of imaging studies, necessitating the prompt and effective communication of information. There is a need for improvement in the efficiency, speed, and cost-effectiveness of both the radiology department and the

radiologists. Medical imaging informatics (MII) encompasses a range of procedures that are essential for radiologists to achieve these objectives. MII refers to the process of developing, applying, and evaluating information technology (IT) in the context of clinical medical imaging. This encompasses the interfaces between information technology systems and individuals. In practical terms, the integration of MII is already evident at a fundamental level within the field of radiology. This integration begins when a healthcare provider contemplates the necessity of requesting an imaging study and continues throughout the entire process, encompassing the utilization of pictures and their subsequent interpretation to formulate an effective treatment plan for the patient [11-13].

The components of Medical Imaging Informatics (MII) encompass more than just Picture Archiving and Communication Systems (PACS) and Radiology Information Systems (RIS), although these are the most prominent aspects. Radiologists played a significant role in the development and advancement of Picture Archiving and Communication Systems (PACS) and Radiology Information Systems (RIS) throughout their evolutionary process. As the utilization of basic Picture Archiving and Communication Systems (PACS) and Radiology Information Systems (RIS) becomes commonplace in radiology practices, there is a potential risk of radiologists shifting their attention away from the field of informatics. The responsibility for this task is typically assigned to either the IT department, the radiology administration, or a certified imaging informatics professional (CIIP). In order to effectively manage their existing workload and sustain financial stability, radiologists frequently have a strong inclination to focus exclusively on the interpretation of imaging findings. They maintain visual focus and verbally transcribe the content depicted in visuals; any elements that deviate from this pattern are assigned to others [10-13].

Despite the considerable challenges, the radiological community is actively making preparations for the forthcoming changes that will ensue after the existing constraints have been overcome. According to a report from an industry website, attendees of the 2019 Radiological Society of North America (RSNA) conference were repeatedly exposed to the abbreviation "AI," which stands for artificial intelligence. During the conference, vendors identified the principal advantage of using machine learning and artificial intelligence (AI) in the field of radiology, which is the production of more distinct images that are user-friendly and can facilitate improved decision-making by clinicians in patient care [14, 15].

The RSNA organization maintains the stance that new technology ought to be regarded as a tool utilized by radiologists, rather than a potential danger to

their employment. According to Dr. Charles Kahn, the current chair of the radiology informatics committee at RSNA, advancements in technology are expected to enhance the process of selecting imaging treatments and protocols. Additionally, these technological developments are anticipated to facilitate improved diagnostic capabilities for physicians, as well as enhance the ease of communicating diagnoses to both radiologists and patients [15].

It is foreseeable that these aforementioned alterations will transition the field of radiology from primarily focusing on diagnostic purposes to a more treatment-oriented form of imaging specialization. In addition to the assessment of illness progression through morphological evaluation, the inclusion of functional measurements will be crucial in determining the severity of the disease and monitoring the effectiveness of treatment, distinguishing between individuals who respond positively to treatment and those who do not [10].

Ultimately, IT and health informatics in general have the potential to enhance the interaction between radiologists, physicians, and patients, enabling more efficient and direct communication channels between radiologists and patients. Facilitating patient access to radiologists to obtain explanations about diagnostic findings has the potential to enhance the recognition and appreciation of the vital role played by radiologists. The inclusion of portals facilitating access to radiological results is anticipated to become a mandatory necessity.

Impact of Health Informatics on Laboratory Technician:

Over the past five decades, laboratory computing has emerged as a pioneering field in the development of health information systems applications. The integration of laboratory IT systems has become an essential requirement for the effective delivery of clinical services and the management of laboratory operations. This claim is supported by the reality that laboratory systems tend to be the most advanced systems within health organizations globally. The health informatics landscape is undergoing significant changes because of the advancement of increasingly complex electronic patient record systems. As a result, there is a risk of pathology computers lagging behind in this evolving domain [16].

However, there is a current need for novel strategies in information management to effectively address the evolving requirements of healthcare delivery [17] :

1) The integration of pathology services into broader organizational entities, such as managed clinical networks comprising many laboratories .

2) 2) The expanded involvement of primary and community care within the wider healthcare system.
3) The introduction of novel methodologies for service delivery, such as point-of-care testing (POCT), has emerged as a significant development in the field .
4) Increased accessibility to the information repository that underpins evidence-based medicine for healthcare professionals, patients, and the general public .
5) The comprehensive management of all facets of clinical services.
There is a growing call for patients to have direct access to test findings in order to facilitate self-management of their healthcare. Laboratory IT specialists are currently facing substantial obstacles due to numerous emerging advancements. The aforementioned factors encompass the rise of advanced electronic record systems, digital imaging systems, high throughput gene sequencing, companion diagnostics, financial limitations, hospital mergers, laboratory integration, expansion of the Internet, and increased consumer access to data. These factors are collectively prompting a comprehensive reassessment of the manner in which pathology services are delivered [18].
Current laboratory information management systems (LIMS) now facilitate [16]:
1- Documentation of every request for all ***examinations***.
2- The integration of laboratory information management systems (LIMS) with automated analytical instruments through online, real-time connection .
3- Tracking and managing workflows efficiently.
4- Creation of worksheets for manual testing.
5- Automated verification of test outcomes .
6- The real-time capture of quality control data .
7- The electronic transmission of clinical results to healthcare professionals
8- The utilization of decision support technologies with the purpose of improving clinical outcomes .
9- The utilization of data analysis is crucial in various fields such as audit, clinical risk management, disease surveillance, and epidemiology. These areas encompass activities such as cancer registration, screening programs, communicable disease reporting, and external quality assessment (EQA) data management. However, it is important to note that the effective implementation of data analysis often necessitates the involvement of informaticians with specialized knowledge and programming skills.
One consequence of modern laboratory systems

is the reduction of paper usage within the laboratory, which is in stark contrast to the clinical parts of hospitals. Instead, laboratory operations align more closely with the advanced information technology systems found in primary care in the UK. The existing systems record and transmit all test requests, sending them to automated analytical instruments in real-time, and then receiving the test findings [19, 20].

Impact of Health Informatics on Pharmacist-Physician Collaboration:

The adoption of CPOE has been proven to yield numerous advantages for patients and healthcare practitioners, notably a decrease in medication mistakes and avoidable adverse drug events. CDS software is often regarded as the primary factor contributing to the observed advantages [21-23].

Physicians were discovered to depend on pharmacists for their technical competence in hospital CPOE systems when seeking help with medication-related duties. This phenomenon was observed to persist in a setting where a highly developed CPOE system is being utilized. Pharmacists attributed the heightened burden resulting from technical inquiries to deficiencies in physicians' understanding of the system and the insufficient time allotted for training [24].

CPOE systems provide the ability to uphold professional norms and limits by imposing limitations on actions based on one's profession or level of expertise [25]. The limited capacity to modify or optimize prescriptions, in contrast to the flexibility offered by paper charts, was discovered to augment the communication burden for the pharmacist. Pharmacists' endorsements, formerly recorded on paper drug charts, have been discovered to have a subtle impact on medical prescribing. These endorsements are carried out with the aim of enhancing patient care. The pharmacist would previously inform the physician of low-risk errors using a different colored pen or a designated place on the chart [26]. In such cases, the pharmacist would make necessary corrections that they were capable of addressing. In the context of CPOE, this was not always feasible, and instead necessitated the transfer of the duty to the physician. The increase in communication demands emphasizes the necessity for systems to possess adaptability and be specifically tailored to accommodate established work procedures, to ensure effective pharmacist-physician collaboration and enhance patient outcome [27].

Impact of Health Informatics on Patient Outcomes:

Several researches have examined the effects of deploying an electronic medical record on healthcare quality and patient safety. The majority of these studies have found positive outcomes. Campanella et al., conducted a comprehensive meta-analysis that examined the influence of electronic health records on healthcare quality and patient safety. This study, which

encompassed a total of 47 papers, is considered one of the largest and most up-to-date in this field. The findings demonstrated a clear preference for the utilization of electronic medical records. The meta analysis revealed that organizations that adopted electronic health records experienced a 30% increase in guideline adherence (RR= 1.33; 95% CI: 1.01 to 1.76; p=0.049), a 54% decrease in medication errors (RR=0.46; 95% CI: 0.38 to 0.55; p<0.001), and a 36% reduction in adverse drug reactions (RR=0.66; 95% CI: 0.44 to 0.99; p=0.045). The meta-analysis yielded no significant effect on overall mortality [28].

Health Information Exchange (HIE) is the process of sharing clinical and administrative data among different healthcare facilities, data repositories, and entities such as payers, patients, providers, and others. This sharing is done in accordance with nationally established standards. The significance of HIE has garnered attention from several national agencies, including the Department of Health and Human Services (DHHS), because of its potential to enhance the quality of healthcare. In March 2010, DHHS granted $162 million to promote the utilization of HIE in 16 states [29-31].

The potential advantages associated with HIE encompass enhanced care quality, efficiency, and patient safety. It enables seamless communication between healthcare providers, improves public health monitoring, and facilitates the measurement of care quality, such as the identification of infectious disease outbreaks. Additionally, HIE can lead to reduced healthcare expenses. Nevertheless, there is a lack of research on the clinical results of HIE. A comprehensive study of the impact of health information technology on the quality, efficiency, and costs of healthcare analyzed 257 papers, but none of them focused on HIE as it is now considered [32].

While health informatics has been widely adopted in other fields, its implementation in the health sector has been somewhat slower. The utilization of these technologies will yield several health benefits, enhance service quality and expedite information retrieval, augment patient contentment, improve system efficiency, and lower expenses. Using these technologies in the health sector will expedite the shift toward a more promising future. Healthcare organizations must be ready to embrace new systems and overcome the problems they present [8].

(HISs) have been implemented by healthcare providers to enhance the efficiency of patient movement in different healthcare environments. In emergency care, the automatic push notification system was employed to tackle ED congestion, minimize LOS, and alleviate patient load by delivering current information and enhancing patient navigation. Dashboard systems were implemented to synchronize ambulance services and

enhance the availability of emergency services across several hospitals [33, 34].

The advancements in health informatics during the past 5 years have had a noticeable impact on patient outcomes, particularly in the following domains.

1) Minimized inaccuracies by utilizing shared ***medical information***:

Efficiently managed electronic health records (EHRs) guarantee that patients receive the appropriate medication on the initial attempt, hence mitigating the occurrence of allergic reactions. These systems can be configured to alert a healthcare professional when they are about to order a test that a patient has already undergone, or if the test is expensive for the patient. The enhanced gathering and mechanization of EHRs mitigate adverse consequences resulting from human fallibility. Primary care providers are increasingly using EHR to store information on a patient's medications, allergies, and potential interactions. This information can be retrieved to identify potential issues when a new medicine is provided, particularly in emergency scenarios or when the patient is unconscious [20].

2) Enhanced efficacy via synchronization

In the past five years, there has been a significant surge in the volume of medical data generated, utilized, modified, and accessed by various healthcare organizations, including clinicians, hospitals, insurance companies, and patients. Consequently, more individuals are required to handle these records. Efficiently managing all these tasks has been a pivotal aspect of enhancing patient care, and the field of informatics has played a significant role in achieving this improvement. Clinicians who utilize this technology and integrate data into their everyday workflow have enhanced provider and patient contentment [35].

3) Enhanced patient engagement and adherence facilitated by online portals.

As portal platforms become more accessible, a growing number of patients are assuming a proactive part in the management of their health. This is a crucial aspect of patient-centered care. Portals additionally offer patients the opportunity to acquire knowledge, monitor their meds, and effectively handle their symptoms. They offer a more streamlined method of engaging with medical professionals, facilitating improved communication and ultimately resulting in enhanced results. Furthermore, there is an increasing patient need for the ability to obtain their own healthcare information. The increased utilization of EHRs has resulted in greater individual engagement, allowing for increased involvement of family and friends, as well as facilitating the sharing of information and resources among individuals with similar medical conditions . Accessibility is a crucial element in enhancing patient compliance, which ultimately leads to improved patient

outcomes. EHRs have significantly enhanced the convenience of healthcare transactions, including e-prescribing (ordering prescriptions in advance for pick-up), filing insurance claims directly from the provider's office, and accessing medical files or prescriptions remotely, even while away from home or on vacation [36].

4) Enhanced decision-making assistance

Clinicians and healthcare practitioners make a substantial volume of healthcare-related decisions on a daily basis. EHRs enable healthcare professionals to make more streamlined and impactful decisions on patient care, resulting in enhanced outcomes. They accomplish this by:

Enhancing the consolidation, examination, and dissemination of patient data Delivering notifications and prompts. Providing corroborating evidence to inform diagnostic and treatment choices. Integrating data from different medical devices using customized applications not only offers useful information

about a patient's health but also provides crucial clinical decision support to prevent harm to the patient [37].

CONCLUSION

In conclusion, health informatics has had a significant impact on the roles of radiologists, laboratory technicians, pharmacists, physicians, and patient outcomes. The integration of technology and data management systems has improved the efficiency and accuracy of diagnostic imaging and laboratory testing, leading to better decision-making by healthcare professionals. Collaboration between pharmacists and physicians has been enhanced through electronic prescribing and medication management systems, ensuring safe and effective medication use. Additionally, patients have benefited from improved communication, access to health information, and personalized care through the use of health informatics. Overall, the adoption of health informatics has transformed the delivery of healthcare and has the potential to continue improving patient outcomes in the future.

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