Power System Technology
ISSN:1000-3673

Received: 11-12-2024 Revised: 05-01-2025 Accepted: 01-02-2025

The Impact of Using Modern Technology in the Field of Health Informatics

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Abstract

The impact of contemporary technology on health informatics in the Saudi healthcare system is examined in this review. Technologies including Electronic Health Records (EHRs), telemedicine, artificial intelligence (AI), mobile health (mHealth), and big data analytics have become more widely used to enhance data management, patient safety, and service delivery as a result of the KSA Vision 2030, which is propelling digital transformation. The study

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emphasizes how these technologies improve clinical decision-making, accessibility, and efficiency. But it also highlights issues like labor training, data security, system interoperability, and regulatory limitations. Even though there has been a lot of progress, the assessment comes to the conclusion that in order to optimize the long-term advantages of health informatics in Saudi Arabia, strategic initiatives in infrastructure, policy, and capacity-building are necessary.

Keywords: Health Informatics, Digital Health, Electronic Health Records (EHR).

Introduction

The advancement of modern healthcare technology has led to major advancements in medical services globally, improving clinical judgment, operational effectiveness, and patient care services. **[1]** In line with Vision 2030 objectives, the Saudi Arabian health sector expands health services nationwide through the use of telemedicine, electronic health records, and artificial intelligence in its digital health system. These developments have led to the adoption of data-driven methods by hospitals and healthcare organizations, which have enhanced management and reduced human error. Despite the encouraging outcomes of using these technologies, healthcare practitioners encounter difficulties with system interoperability, digital security issues, and the requirement to adjust to new digital systems. **[1], [2]** The medical industry uses AI technologies to improve patient surveillance, analyze predictive data, and make diagnostic discoveries. **[3]** Machine learning algorithms are becoming more and more useful in radiography, pathology, and individualized treatment planning because they improve clinical results. Telemedicine is a fundamental framework for healthcare delivery that reduces the number of hospitals while providing continuous medical treatment to remote areas. In order to reap the full benefits of these technology solutions, their effective implementation requires both skilled medical professionals and well-established regulatory frameworks. **[2], [5]** In addition to better patient observation and predictive data analysis, the medical industry uses AI applications to bring diagnostic advances. Machine learning algorithms are becoming more and more useful in radiography, pathology, and individualized treatment planning because they improve clinical results. **[6]**

Tele-medicine is a fundamental framework for delivering healthcare that reduces the number of hospitals while providing ongoing medical treatments to remote areas. To achieve the full benefits of these technology technologies, their effective use requires both skilled medical professionals and well-established regulatory frameworks. **[4], [7]**

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In the age of swift technological development, the healthcare sector has seen revolutionary shifts brought about by the incorporation of contemporary technology into many facets of care management and delivery. **[8]** Improving the effectiveness, security, and caliber of healthcare services has made health informatics—an interdisciplinary field that blends computer science, information technology, and healthcare—a vital field. **[9]** Across the world, the use of contemporary technology in health informatics from telemedicine and electronic health records (EHRs) to artificial intelligence (AI) and big data analytics is changing the way healthcare is provided, tracked, and assessed. Improving patient engagement, facilitating data-driven decision-making, and streamlining healthcare operations are all made possible by health informatics. **[10]** Healthcare workers may now access and update patient data instantly thanks to technologies like electronic health records (EHRs), which greatly lowers the inaccuracies that come with manual record-keeping. AI systems can also help with diagnosis, forecast disease outbreaks, and provide tailored therapy suggestions. Particularly during public health emergencies like the COVID-19 pandemic, telehealth technologies have made healthcare more accessible by bridging geographic divides. All of these advances work together to provide a more responsive, economical, and outcome-focused patient-centered care paradigm. **[8], [11], [4]** Saudi Arabia's ambitious national development strategy, which places a strong emphasis on modernizing the healthcare system through digital transformation, is in line with the country's acceptance of contemporary technology in the field of health informatics. **[12]** With investments in e-health services, cloud computing, health information exchanges, and national platforms like "Sehhaty" and "Mawid," Saudi Arabia has made great strides toward digitizing its healthcare infrastructure under the direction of the Ministry of Health (MOH). These programs aim to increase data interoperability amongst institutions, guarantee continuity of treatment, and improve the quality of healthcare services. **[2], [10]** For instance, the Saudi Health Information Exchange (SHIE) facilitates the easy exchange of patient data between hospitals, minimizing effort duplication and facilitating the provision of integrated care.

Despite these encouraging advancements, there are still a number of obstacles to overcome before modern technologies can be fully integrated into Saudi Arabia's healthcare system. **[13]** These include staff opposition to technology change, cyber-security issues, technical obstacles, and the requirement that healthcare workers have continual training and education. **[5], [14]** To guarantee the ethical and safe use of digital health solutions, concerns about data privacy, patient consent, and regulatory compliance must also be properly handled. The availability of cutting-edge technologies is key to the success of health informatics, but so is the preparedness of healthcare organizations, personnel, and systems to use them efficiently. **[15]** It is

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crucial to regularly assess how contemporary technologies are affecting Saudi Arabian health informatics, given the dynamic and ever-changing nature of digital health. A review-based approach highlights both successes and opportunities for improvement, offering a thorough picture of how these technologies are impacting the healthcare landscape. **[16]** The purpose of this assessment is to examine how contemporary technologies are being used in the Kingdom's health informatics area, evaluate how they affect the provision of healthcare, and pinpoint existing issues as well as potential future developments. Through an analysis of government publications, industry statistics, and peer-reviewed studies, this article will shed light on the pros, cons, and consequences of the health informatics tools now in use. Data analytics systems, telemedicine platforms, mobile health (mHealth) apps, EHR systems, and AI and machine learning in diagnostics will all be highlighted. The study will also look at how these technologies are helping Saudi Arabia's healthcare system achieve its digital transformation strategy, improve patient outcomes, and meet national health goals.

In summary, a major step toward a more intelligent and effective healthcare system is the use of contemporary technology into health informatics. Policymakers, healthcare administrators, and practitioners must comprehend the effects and efficacy of these technologies as Saudi Arabia continues its embrace of digital transformation. By offering a systematic examination of the state of health informatics in Saudi Arabia today, with an emphasis on the function and significance of contemporary technology, this review paper aims to advance that understanding.

Objective of Study

In addition to identifying and analyzing the major technologies utilized in health informatics, such as AI, telemedicine, mobile health apps, big data analytics, and electronic health records, the study's primary goal is to investigate the current level of modern technology adoption in the field within Saudi Arabia's healthcare system.

Research Methodology

Research Design

With a focus on Saudi Arabia, this study uses a narrative review design to synthesize the body of research on the application and effects of contemporary technology in health informatics. By compiling and analyzing research data from numerous primary and secondary sources, this method enables a thorough examination of the subject.

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Area of Study

While not specific to any one institution, the review's scope is contextualized to the Kingdom of Saudi Arabia, taking into account the country's growing embrace of health technologies and continuing healthcare transformation under Vision 2030.

Criteria for Inclusion and Exclusion

Inclusion

- ✧ Peer-reviewed journal publications, review papers, official reports, and policy documents are among the requirements for inclusion.
- ✧ English-language studies released from 2013 to 2024.
- ✧ Articles addressing contemporary health informatics technology (such as blockchain, - AI, telemedicine, mobile health apps, EHRs, and big data).
- ✧ Studies that make particular reference to the healthcare system in Saudi Arabia or that compare and contrast the Gulf region.

Exclusion

- ✧ Full-text studies are not available.
- ✧ Publications that are not specifically about health informatics.
- ✧ Articles prior to 2012, unless they are considered groundbreaking.
- ✧ Opinion articles, editorials, and non-academic commentary.

Sources of Data

The researcher reached out to a number of electronic sources of data, some of them are PubMed, ScienceDirect, Web of Science, Saudi Digital Library (SDL) , Ministry of Health (Saudi Arabia) official documents and related documentation and reports from WHO and HIMSS reports.

Important Keywords

Most of the studies were searched on the basis of following keywords:

"health informatics", "e-health", "digital health"), ("modern technology", "telemedicine", "AI in healthcare", "EHR", "big data") AND ("Saudi Arabia", "KSA")

Some of the studies were rejected or excluded, as they don’t have the appropriate key word.

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Extraction of Data

The chosen literature's recurrent themes, patterns, and knowledge gaps were found using a thematic analysis approach. Topics were categorized into:

a. Technology types

b.Implementation domains

c. Measurable effects

d. Challenges and obstacles

e. Strategies and policies at the national level

As was suitable for a narrative review, this qualitative synthesis made it possible to present a narrative description of the findings rather than a statistical meta-analysis.

Discussion

Saudi Arabia's healthcare system is not an exception to the profound changes brought about by the incorporation of contemporary technology into health informatics. Within the framework of Vision 2030, which prioritizes digital transformation and the enhancement of healthcare services, KSA has made significant progress in implementing health information technology (HITs) to improve patient safety, efficiency, data management, and care accessibility. **[17], [9], [18]** The literature on the many aspects and effects of contemporary technologies, including telemedicine, mobile health (mHealth), artificial intelligence (AI), electronic health records (EHRs), and big data analytics, in the Saudi healthcare industry is summarized in this review.

The deployment of integrated hospital information systems (HIS) and electronic health records (EHRs) is one of the most notable technology implementations in the Saudi healthcare system. **[19]** Centralized data interchange between healthcare providers has been made possible by government efforts like the National Health Information Center and the "Seha" platform. **[11], [15], [20]** According to numerous studies, EHR systems have increased continuity of treatment, decreased prescription errors, and improved data accuracy. However, a number of issues still exist, such as system interoperability throughout institutions, healthcare professionals' reluctance to adapt, and worries about cybersecurity and data privacy. **[21]**

Additionally, telemedicine has become very popular, particularly after the COVID-19 pandemic. Patients in remote locations may now obtain specialized care thanks to telehealth systems like Seha Virtual Hospital and Mawid, which also cut down on wait periods and travel expenses. Research shows that telemedicine services have decreased healthcare delivery costs and increased patient satisfaction. **[22], [23]** However, there are still certain drawbacks, like patchy internet in rural areas, low digital literacy among certain groups, and medico-legal concerns with online consultations. **[2], [15], [7]** Radiology, pathology, and predictive analytics for

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managing chronic diseases are among the healthcare decision-making processes in Saudi Arabia that are gradually incorporating artificial intelligence (AI) and machine learning (ML) technology. Clinical process optimization and diagnosis accuracy have demonstrated the potential of AI systems, albeit they are still in their infancy. Clinical decision systems (CDSS) aided by AI have been piloted in a few hospitals, but full-scale implementation is limited by issues such a shortage of qualified staff and inadequate regulatory frameworks. **[23]**

In KSA, chronic illnesses like diabetes and hypertension are common, and they are being monitored more and more with mobile health (mHealth) solutions, especially wearable technology and health applications. Patient involvement and real-time health tracking are supported by the connection of these apps with health data systems. According to studies, those who use these technology exhibit better self-care practices and drug adherence. Their broader adoption is nevertheless hampered by issues with user trust, language difficulties, and inadequate app evaluation. **[9], [14], [23]** The use of analytics and big data in customized medicine and public health planning is another important technical trend. Saudi healthcare organizations are starting to investigate data mining techniques in order to detect illness trends, predict outbreaks, and optimize resource allocation due to the enormous amounts of patient data that are created every day. Big data analytics, for instance, was essential for monitoring the spread of COVID-19 and organizing immunization efforts. However, scalability of infrastructure, data standardization, and ethical issues with data use are problems that many organizations face. **[24]** Despite these developments, a number of intersecting issues hinder Saudi health informatics' ability to make the best use of contemporary technology. Human resource constraints, like a lack of health IT experts and gaps in physician training, continue to be significant obstacles. The equality and efficacy of implementation are further impacted by organizational resistance to change and digital disparities between urban and rural communities. Additionally, research indicates that although many systems are technically sound, there are frequently insufficient evaluation tools to determine the true clinical and financial impact of these innovations. **[25], [6]**

An additional crucial topic of discussion is the legal and regulatory landscape. Even with the numerous guidelines released by the Saudi Health Council and the Ministry of Health, a cohesive regulatory framework for health informatics—particularly with regard to AI and patient data—is still developing. For data ownership, consent, and breach obligations to be addressed, stronger legal frameworks are required.

Conclusion

The effectiveness and caliber of healthcare service in Saudi Arabia have already been demonstrated to be improved by contemporary technologies. But in order to reach

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their full potential, interoperability, workforce development, data governance, and patient-centered design need to be strategically prioritized. This momentum must be maintained by the government's continued digital health initiatives as well as focused expenditures in infrastructure and education. It is imperative that future research prioritizes user-based studies and quantitative assessments of technology results to make sure that digital health solutions meet clinical and social needs.

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