Impact of Artificial Intelligence on the Automation of Digital Health System

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ABSTRACT

Automating digital systems in healthcare plays a significant role in transforming the quality-of-care services delivered to patients across the board. This role is anticipated to be accomplished by the development and implementation of artificial intelligence in healthcare which has the potential to impact the provision of healthcare services. This paper sought to investigate the impact of adopting and implementing artificial intelligence on the automation of digital health systems within the different levels of healthcare. The general objective of the research study was to investigate the impact of artificial intelligence in the automation of digital health systems. The specific goals were to understand the concept of artificial intelligence and how it automates digital strategies, to determine the AI systems that have been developed and implemented in the healthcare systems, to establish the factors that influence the adoption of AI in healthcare, and to find out the outcomes of implementing AI in digital health systems. The research employed the descriptive research design. The study population included healthcare workers, policymakers, IT specialists, and management teams in the healthcare sector in the State of Kentucky. The sampling technique for the study was the purposive sampling technique. The study collected data using semi-structured interviews administered through Google Teams and Zoom. Data analysis was analyzed using the computer-assisted software for analyzing qualitative data, NVivo. The findings were that AI as a technological concept has the potential to impact the automation of digital health systems and is key to automating health services such as the diagnosis and treatment of illnesses and management of claims and payments. The study recommended that policy supports the application of artificial intelligence in healthcare, thus enabling the automation of several healthcare services and thus improving the delivery of care.

KEYWORDS

Quantitative Data, Digital Health, Automation, Healthcare Services, NVivo, Data Analytics.

1. INTRODUCTION

The automation of digital systems, especially in healthcare, plays a significant role in transforming patient care services [1]. With the complexity of healthcare systems posing numerous challenges to achieving efficient processes, digital transformation becomes the key to innovation and improvement. Artificial intelligence is considered one of the most disruptive and powerful innovations of modern computer science that has the potential to affect different sectors, thus influencing the way things are done. Artificial intelligence in the healthcare sector continues to be a subject of interest to scholars and policymakers due to the potential impact of the technology, especially when it comes to automation [2]. Therefore, it is imperative to establish artificial intelligence's influence on automating digital health systems technologies.
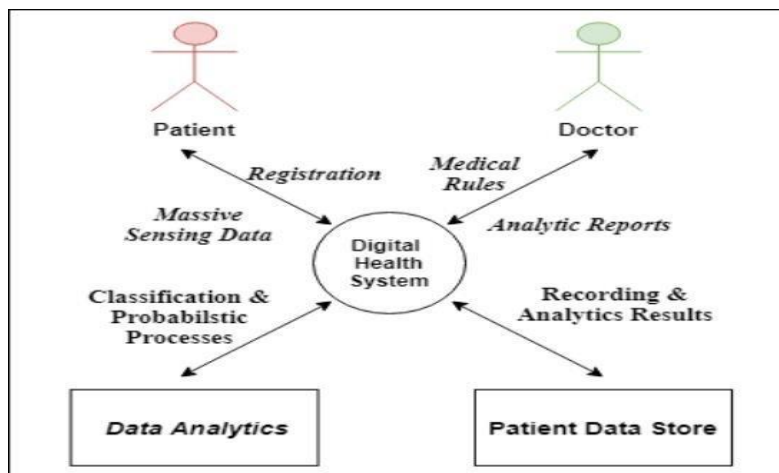
Fig 1. Digital Health Systems

Digital health systems seek to reform and modernize the provision of healthcare services, thus enabling the tackling of entrenched inefficiencies that impede quality healthcare at various levels [3]. Through the implementation of digital systems, healthcare providers usually have access to an advanced and tactile framework that empowers users by facilitating choice where information related to health services is more actionable and accessible, personalized, and transparent. It is important to note that digital health systems have been spreading across the globe and adopting a more holistic public health model that ensures the technological solutions remain affordable, safe, and accessible to all segments of the care-seeking population [4]. This paper sought to investigate the impact of adopting and implementing artificial intelligence on the automation of digital health systems within the different levels of healthcare.

2. BACKGROUND

Mitchell and Kan [4] investigated the impact of digital health systems and the future of modern technologies on the future of healthcare. The study sought to discover how digital health systems influence the provision of health-related services and the expected outcomes as the sector moves toward the ever-changing technological world. The authors revealed the increased use of tools such as telemedicine for conducting remote diagnostics, providing treatment, and implementing a protocol-driven approach that improves the quality of and access to care. Abishev et al. [3] investigated the application of digital health systems in the healthcare system of European nations and provided vital policy areas to focus on when implementing the technologies. The study revealed the importance of developing a policy that promotes the development and implementation of significant policy sections that facilitate using artificial intelligence in healthcare [5].

According to Davenport and Kalakota [7], the potential of artificial intelligence in the health sector continues to grow with the increased desire to integrate complex and advanced technological concepts in healthcare. The study sought to investigate the increasing application of artificial intelligence in healthcare concerning the different types of AI and entities that have already employed the technology. The findings were that the large-scale implementation of artificial intelligence in healthcare faces several challenges, including ethical issues. Bajwa et al. [1] investigated how artificial intelligence can transform the practices within the field of medicine by conducting a study on the overview of artificial intelligence in the health sector. The research revealed that artificial intelligence could potentially transform healthcare delivery. The

indicators included recent breakthroughs in the application of the technology and the blueprint for building reliable and effective AI systems for healthcare [7, 22].

These studies reveal the significant interest directed toward understanding and deciphering the impact of artificial intelligence in healthcare. Numerous studies have focused on applying artificial intelligence in digital health systems adopted in medicine [6]. However, very few have outlined artificial intelligence's underlying influence on the automation of digital health systems. Therefore, this study focused on the perceived impact of AI on the automation of digital systems developed for healthcare [3, 7]. This research study aimed to understand the concepts related to the automation of digital health systems using artificial intelligence, the factors that affect the development and use of AI systems in healthcare, and the outcomes that arise from the utilization of artificial intelligence towards automating digital health systems.

2.1. Research Objectives

The study comprised general and specific objectives that sought to respond to the research question. The study's general purpose was to investigate the impact of artificial intelligence in the automation of digital health systems.

The specific objectives of the study were:

  i.   To understand the concept of artificial intelligence and how it automates digital systems.
  ii.   To determine the AI systems developed and implemented in healthcare.
  iii. To establish the factors that influence the adoption of AI in healthcare.
  iv.   To determine the outcomes of implementing AI in digital health systems.

3. LITERATURE REVIEW

This section looked at the theoretical concepts that support the ideas of artificial intelligence and the automation of digital health systems. Adaptive automation, or AA as a theory, focuses on human-based computer systems with a component that divides labor or plays as the interface between machine agents and humans [8]. The idea of adaptive automation asserts that the flexible aiding of the human-based operation relies on the dynamic allocation of tasks, especially between the computer system and the inherent operator. However, the successful simulation of adaptive automation concepts hasn't been able to tackle all concerns associated with using adaptive systems. The future lies in the fidelity of the simulations of AA in real-world situations or scenarios, thus the translation of theoretical assumptions into practical reality.

Another theory related to AI implementation is the Artificial Intelligence Theory, based on the analogy of the human nervous system [9]. The basic theory of artificial intelligence focuses on the core of the human brain, which comprises multiple neurons interconnected by synapses. This theory, also known as the neural-like growing networks, is founded on the concept of having networks that have the structure of the neuron that are usually in the form of different classes. A critical theory that informs the potential relationship between artificial intelligence and the automation of digital health systems is the decision-making theory, which is concerned with the efforts of the management teams to achieve the efficiency and profitability of existing health systems [10]. This theoretical framework believes that automation is tied to an organizational strategy that seeks to operationalize digital methods within the healthcare framework.

4. FRAMEWORK

This section encompasses the methodological approach and framework adopted by the study to achieve the research outcomes. The researcher adopted a methodology used in collecting, compiling, and analyzing the data, thus answering the study questions [11]. This methodology included the research design, population, sample size, and sampling frame. The research philosophy for this study was the positivist philosophy that allows for the use of factual information collected using observation and testing as the most reliable method and source for new knowledge [12]. The positivist philosophical approach is based on research using the knowledge captured from the positive verification of visual experiences that relate to the objective reality and the ability of the participants to be aware of the underlying fact. The positivist approach offers the framework for assessing the research hypothesis using a conceptual framework.

The research design selected for the study was the descriptive research design. Research designs encompass the structure of the research study and the arrangement of the conditions that inform the collection and analysis of data [4, 21]. Therefore, the study selected a design that describes the phenomenon being investigated systematically and uses the facts most accurately. Descriptive studies provide a detailed account of the situation by describing and portraying the characteristics under investigation, thus providing clarity in the study phenomenon. According to Nassaji [13], descriptive research designs offer a technique for establishing the potential association or relationships between the study variables. In this case, the study applied the descriptive method as it allowed for the determination of the link between artificial intelligence and the automation of digital health systems.

A sample is taken from the target population's study population to gather data, analyze it, and draw conclusions. [14, 21]. In this case, the study population encompassed the individuals or groups of interest sampled into the research to derive valuable informational data. It is essential to determine the study population as it enables the generalization of findings based on the sampled population. The population included healthcare workers, policymakers, IT specialists, and management teams in the healthcare sector in the State of Kentucky. The sampling technique for the study was the purposive sampling technique that selected the participating persons or events deliberately; hence they provided relevant information related to the study topic [15]. Using the sampling technique, the researcher chose a sample size of 120 professionals based on the above categories.

Since the study relied on primary data to determine the potential answers to the study questions, the researcher selected a suitable data collection technique. It is important to note that primary data is usually collected using real-time data collection tools that capture the experiences and attitudes of the study participants [11]. The study utilized semi-structured interviews to collect data from the sampled population based on the specific objectives of the current research. The discussions were developed based on the strategies for developing qualitative interviews that include capturing all the desired questions, allowing the respondents to provide their version of the story, and ensuring that the discussion is not a survey [15]. The key informant interviews were structured in exploratory or informational online meetings using Zoom and Google Teams. Online discussions were critical due to the time and geographical limitations that would have affected the data collection.

Following the collection of the data, compilation and analysis were conducted, thus interpreting the desired outcomes from the information. Qualitative data is usually non-numerical; hence, the qualitative analytic reasoning process was applied [16]. By relying on inductive reasoning, the researcher interpreted and structured the meanings derived from the qualitative data. The study

used the narrative analysis approach that focused on recognizing the extent to which the study variables interacted and the association's potential outcomes. This technique enabled the detection of the main narrative themes that could be identified from the accounts provided by the study participants based on their interaction with the study variables within a practical setting [17, 18]. Using the computer-assisted software for analyzing qualitative data, NVivo, the study was able to code, sort, and retrieve data, thus integrating both linking and modeling. The following process was utilized in analyzing the qualitative data:
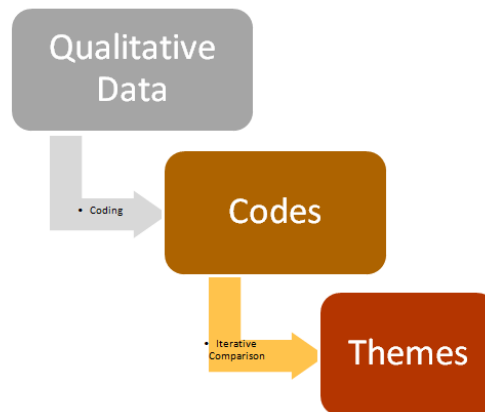

Fig 2. Thematic Analysis

5. REVIEW

The research study sought to establish the impact of artificial intelligence on the automation of digital health systems. Specifically, the study investigated the variables, i.e., understanding the concept of artificial intelligence and how it automates digital strategies, to determine the AI systems that have been developed and implemented in the healthcare systems, and establishing the factors that influence the adoption of AI in healthcare. Other variables were to determine the outcomes of implementing AI in digital health systems. This section presents the analytical findings and the results of the operationalization of independent variables using the selected research design. Data analysis was done by synthesizing the information collected within the NVivo software that coded, sorted, cleaned, and analyzed the data. The use of narrative analysis enabled the study to discover several themes that underlined the thematic areas for the research.

These themes include the conceptualization of artificial intelligence and the automation of digital health systems, the development, and implementation of AI systems in healthcare, variables impacting artificial intelligence's adoption in healthcare [18], and outcomes associated with the performance of AI in the healthcare sector.

5.1. Artificial Intelligence and the Automation of Digital Health Systems

The study sought to understand the concept of artificial intelligence and how it can automate the digital strategies adopted in the healthcare sector. Some of the respondents agreed that AI, as a disruptive concept, had the potential to automate systems within healthcare.

"Our hospital began implementing artificial intelligence systems, and the results have been evident. We were able to automate several activities" (IT Expert 1)

Also, the automation of digital systems is a critical aspect of ensuring the improved delivery of healthcare.

5.2. Development and Implementation of AI Systems in Healthcare

The study sought out which AI systems have been developed and implemented in healthcare recently. Several artificial intelligence systems have recently been introduced in healthcare to perform a range of tasks considered repetitive.

"An example of AI systems we have tested and used include the PathAI technology that assists in making accurate diagnoses and the Buoy Health that checks symptoms, diagnoses and treats illnesses using algorithms" (Medical Doctor 2)

5.3. Factors Influencing the Adoption of Artificial Intelligence in Healthcare

The study sought to establish the factors that affect the adoption artificial intelligence in healthcare. From the findings, the significant factors that tend to affect the adoption of artificial intelligence in healthcare include healthcare staff's acceptance and resistance levels, technical competence among practitioners, technological compatibility, availability of resources, and competitive pressure.

5.4. Outcomes Associated with the Implementation of AI in the Healthcare Sector

The study sought to understand the outcomes that are associated with the use of artificial intelligence systems in the delivery of healthcare services. Some of the results established included using AI to automate the diagnosis and treatment of illnesses and undertake several administrative applications such as managing claims and payments, filing, and retrieving records. "At our organization, we have deployed AI in several areas with significant results, including data records, diagnosis, and treatment…." (Management Executive 3).

6. DISCUSSION AND CONCLUSION

The objective of the investigation was to determine how artificial intelligence on the automation of digital systems in healthcare. Artificial intelligence has significantly influenced the outcomes of implementing AI systems within the health sector. With the evolution in the area of spark, BigData, and real-time processing, the findings were that AI as a technological concept has the potential to impact the automation of digital health systems and is considered a critical specialized element in improving the delivery of healthcare services [3, 19, 20]. Also, artificial intelligence systems such as PathAI and Buoy Health that have been adopted recently have assisted in automating a few health services, particularly diagnosis and treatment. Some notable factors that influence the adoption of AI systems in healthcare include technological compatibility, technical competence among healthcare staff, and the availability of resources.

In terms of outcomes, AI was established to be a key asset in automating the diagnosis and treatment of illnesses, managing claims and payments, and organization of health data records. Therefore, the application of artificial intelligence in healthcare enhances the automation of healthcare services that improve care delivery.

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