FACTORS THAT IMPACT THE ADOPTION OF DATA AUTOMATION IN HEALTHCARE

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DOI: 10.53555/ecb/2022.11.02.051

Health is one of the most important criteria for the progress and advancement of any nation. Moreover, the use of an electronic system that manages data, information, and various processes enables health facilities to carry out their tasks and then evaluate their activity and reveal the efficiency of their operations and the success of their management at present and are considered evidence of dedication to an approach that guarantees the rights of the individual to health and information. (Andrade et al., 2012) Automation is the evolution of the automation of healthcare processes. This is made possible by the recent availability of cloud-based AI tools, such as machine learning, speech recognition, natural language processing, and computer vision. These companies allow the automation of tasks related to healthcare operations that were previously thought to be too complex or human-centric for machines to accomplish. Physicians, hospitals, and researchers use automation to reduce costs and improve the quality of care, as well as to help analyze patients and process data. Automation, artificial intelligence, and machine learning are all well-suited to handling massive amounts of data and managing repetitive tasks. As with any powerful tool, automation in healthcare is so complex that healthcare managers and executives must be educated on how automation interacts with healthcare to make the best use of technology and understand the challenges involved. If they want to succeed in the 21st century, healthcare leaders must be prepared to capitalize on automation trends. (Ruiz & Duffy, 2021)

The challenge faced by health authorities and therefore their facilities such as hospitals and various health centers in the application of electronic operations to deal with a unified electronic medical record is not simple or implementable between day and night, neither are the departments uniform sizes or nature of work nor the unified path and linking it to other tracks means that it is fully completed without obstacles or obstacles. Nor will the use be typical among the group of users, namely administrators, health practitioners, etc. (Ruiz & Duffy, 2021)

Therefore, identifying the problems quantitatively the needs at each stage, and the appropriate method for each process at each stage requires effort, time, and specialized work carried out by a homogeneous team that can overcome obstacles gradually and with accelerated calculated time and costs. If this is achieved, the effectiveness of the use of systems makes the benefit of data for the benefit of the patient large and sustainable. (Kortrijk et al., 2019) Private health facilities provide various services that improve the outputs of the health system in the Kingdom of Saudi Arabia. If information technology is used in these facilities with their various functions and levels between primary health care and even the third level of service (Tertiary Services), the quality of information that can be used will be high and useful to the health status of the patient (citizen or resident) and contribute to planning a better health situation for the Kingdom of Saudi Arabia in particular and the rest of the world in general. (Kortrijk et al., 2019; Law et al., 2010; Odiwuor et al., 2015) The capabilities of health facilities may differ in their use of information technology, some of them try to keep up with the conversation by installing integrated systems, and some of them are limited to simple basics such as programs that manage health services and a server to save them for use when needed. For these health facilities, with their medical care and services, to be an important source of health information, their operational systems and medical records must be composite and operated with a methodology that ensures that the facility, the patient, and the supervising government agencies benefit from them if necessary, transferred, exchanged and participated in them to benefit from them at the planning, organizational, direct or legal human rights level. (Damiano et al., 2010; Singh et al., 2020)

1.1. Statement of the Problem

Data automation in health care is of great importance in saving time and effort, as it extracts data and retrieves it automatically in a very short time, which serves direct patient care and access to the patient's record and analysis quickly and more simply. But an automated infrastructure to integrate medical data, as the database consists of structured data and unstructured data, which is the minimum requirement for successful operation, so all data processing and management tasks and the comprehensive data source must be considered to enable the application to perform its purposeful work. The effects of information technology problems must be analyzed, each problem must be classified, then determined and the extent of its impact on user interaction, receiving information, decision making. Because it is a problem that does not affect the patient, but it affects the provision of care to him, for example, a medical prescription with the wrong name or test results that were not cleared in the system.

This research problem is mainly focused on the question: what are the factors that impact the adoption of data automation in health care?

1.2. Research Objectives:

The current study mainly aims to identify the factors that impact the adoption of data automation in healthcare.

The following sub-objectives support the key objective:

- Identify the most benefits of implementing data automation in healthcare.
- Identify the most common challenges of data automation in health care.

1.3. Research Questions:

The research seeks to answer what are the factors that impact the adoption of data automation in health care. From this question, other sub-questions arise:

- What are the benefits of implementing data automation in healthcare?
- What are the common challenges of data automation in health care?

1.4. Research Methodology:

This section discusses the research methodology used in this current study. It covers these two main parts: Research design and research sampling**.**

1.4.1. Research Design:

A quantitative research method is used for assessing the factors that affect the adoption of data automation in health care among healthcare staff. It utilized a survey to collect data from the target population. According to Creswell and Creswell (Creswell & Creswell, 2017), quantitative research is defined as the research type that could explain the phenomena by using collected numerical data that is analyzed using a mathematical approach, specifically a statistical approach. This study aims to examine the effects of the factors that may affect the adoption of data automation in healthcare among healthcare staff. Thus, applying quantitative research design is the best way to understand the phenomena regarding the influential factors on the adoption of data automation.

1.4.2. Research Sample:

The target population of this study includes all healthcare staff who work in government hospitals and primary healthcare centers in Riyadh, Saudi Arabia. This is to ensure the provision of comprehensive and integrated health care as quickly as possible and to maintain the quality and confidentiality of data. The questionnaires were designed using Google Forms and were delivered to the respondents by email from October to December 2023.

1.4.3. Data Collection Method and Instruments:

The research utilized a quantitative research method to assess the factors impacting the adoption of data automation in healthcare. The data collection instrument used was a survey questionnaire. The questionnaire was designed using Google Forms and delivered to the target population, which includes healthcare staff working in government hospitals and primary healthcare centers in Riyadh, Saudi Arabia. The survey was conducted via email from October to December 2023.

1.4.4. Data Analysis Procedure:

The collected data from the survey questionnaire will be analyzed using a mathematical and statistical approach. The quantitative research design allows for the analysis of numerical data to explain the phenomena under study. The data analysis procedure will involve summarizing and organizing the collected data, followed by statistical analysis to identify patterns, trends, and relationships between variables. Descriptive statistics, such as frequencies and percentages, will be used to summarize the data. Inferential statistics, such as correlation analysis or regression analysis, may be employed to examine the relationships between the factors impacting the adoption of data automation in healthcare. The findings will be interpreted and presented in a clear and concise manner to address the research objectives.

1.5. Research Outline

Chapter 1: Introduction

In this chapter, we will provide an introductory overview of the topic and we will determine our objectives, the problem of the study, and the study questions.

Chapter 2: Literature Review

In this chapter, we will discuss the previous research and find the gaps between it.

Chapter 3: Methodology

The research adopts a quantitative approach, utilizing a survey to assess factors influencing data automation adoption among healthcare staff in Riyadh. Data collected via Google Forms will be analyzed using statistical methods.

Chapter 4: Results and discussion

In this part of the research results and discussion, a questionnaire will be distributed, and after taking the results, they will be analyzed and included.

Chapter 5: Recommendations and Conclusion

In this final chapter, we present recommendations based on the study's findings for enhancing data automation adoption in healthcare. We conclude by summarizing key insights and their implications for future research and practical applications .

LITERATURE REVIEW

2.1. Introduction

The healthcare industry is undergoing a transformative shift driven by the increasing availability and utilization of data. Data automation, the process of using technology to automate data-driven tasks, has emerged as a key strategy for healthcare organizations to improve efficiency, reduce costs, and enhance patient care. While the potential benefits of data automation are substantial, its adoption in healthcare is not without its challenges. This literature review aims to explore the factors that impact the adoption **of data automation in healthcare, drawing insights from a selection of relevant studies.** Phichitchaisopa and Naenna (Phichitchaisopa & Naenna, 2013) identified a range of factors affecting the adoption of healthcare information technology (IT), including performance expectancy, effort expectancy, facilitating conditions, and perceived usefulness. Jensen et al. (Jensen et al., 2015) highlighted the role of technical advances in facilitating the adoption and integration of patient-reported outcomes (PROs) in clinical care. Wiljer and Hakim (Wiljer & Hakim, 2019)emphasized the need for rewiring healthcare professions to embrace artificial intelligence (AI) and data-driven approaches to enhance patient care. These studies provide valuable insights into the complexities of technology adoption in healthcare and the factors that influence successful implementation. The healthcare industry is undergoing a rapid transformation driven by the increasing availability and utilization of data. Data automation, the process of using technology to automate data-driven tasks, has emerged as a key strategy for healthcare organizations to improve efficiency, reduce costs, and enhance patient care. However, the adoption of data automation in healthcare is not without its challenges. According to Chen, Lin, and Wu (Chen et al., 2020), healthcare organizations face several challenges in adopting data automation, including:

- Lack of data literacy: Healthcare professionals often lack the necessary skills and knowledge to understand and utilize data effectively. This can lead to resistance to data automation initiatives and hinder the implementation of data-driven decision-making.
- Data quality issues: Healthcare data is often fragmented, inaccurate, and incomplete. This makes it difficult to integrate data from disparate sources and use it for meaningful analysis.
- Cultural resistance: Healthcare professionals may resist data automation due to concerns about job displacement, privacy, and the potential for data breaches.
- Technological complexity: Data automation systems can be complex and difficult to implement and maintain. This can be a barrier for smaller healthcare organizations with limited resources.

Feibert and Jacobsen (Feibert & Jacobsen, 2019) identified six key factors that impact technology adoption in hospital bed logistics:

1. Relative advantage: The perceived benefits of adopting data automation must outweigh the perceived costs.
2. Compatibility: Data automation systems must be compatible with existing systems and workflows.
3. Complexity: Data automation systems should be easy to learn and use.
4. Trialability: Healthcare organizations should have the opportunity to test data automation systems before making a full commitment.
5. Observability: The benefits of data automation should be visible and measurable.
6. Change readiness: Healthcare organizations must be prepared to manage the organizational and cultural changes associated with data automation. By addressing these factors and implementing a strategic approach to data automation, healthcare organizations can reap the benefits of improved efficiency, reduced costs, and enhanced patient care.

2.1.1. Adoption of Technology in Healthcare

Adoption of technology in healthcare has been on the rise in recent years, with the aim of improving patient outcomes and reducing healthcare costs. One area where technology has been particularly impactful is in the adoption of electronic health records (EHRs). EHRs allow healthcare providers to access patient information quickly and easily, reducing the risk of medical errors and improving patient safety. Additionally, EHRs can help providers identify patterns in patient data, leading to more personalized and effective treatment plans. Another area where technology has been adopted in healthcare is in telemedicine. Telemedicine allows patients to receive medical care remotely, reducing the need for in-person visits and improving access to care for patients in rural or underserved areas. Telemedicine has also been used to monitor patients with chronic conditions, allowing for early intervention and preventing hospital readmissions. Overall, the adoption of technology in healthcare has the potential to improve patient outcomes, reduce healthcare costs, and increase access to care for patients. (Alfallaj et

al., 2022a; Herman et al., 2020a; Jedwab et al., 2023a; Mishra et al., 2022a; Williams et al., 2021)

2.1.2. Adoption of Technology in Healthcare in KSA

The adoption of technology in healthcare in the Kingdom of Saudi Arabia (KSA) has been influenced by various factors. A study on the adoption of Mobile Health Applications (MHAs) in the KSA context found that the Unified Theory of Acceptance and Use of Technology (UTAUT) framework highlighted the positive gains associated with the acceptance of MHA quality, leading to a decrease in the number of health costs in different health centers. This indicates that the adoption of MHAs has the potential to positively influence the quality of health service provision in KSA. Another study focused on the status of digital dental technology (DDT) adoption in Saudi Arabian undergraduate dental education, revealing that 64.4% of the surveyed dental schools in KSA had implemented DDT in their curricula. However, the study also identified factors such as lack of expertise, untrained faculty and staff, and cost as barriers to the incorporation of DDT into the curricula.

These findings highlight the ongoing efforts to adopt and integrate technology in the healthcare sector in KSA. The studies emphasize the potential benefits of technology adoption, such as improved healthcare quality and cost reduction, while also acknowledging the challenges and barriers that need to be addressed to facilitate the effective integration of technology into healthcare practices in the country. Overall, the research provides valuable insights into the current status of technology adoption in healthcare in KSA and the factors that influence its implementation. (Alfallaj et al., 2022b; Herman et al., 2020b; Jedwab et al., 2023b; Ohia et al., 2021; Okour et al., 2019a)

2.1.3. Types of Healthcare Technology

Healthcare technology encompasses a wide range of tools and systems that are designed to improve the delivery of healthcare services. These technologies can include electronic health records (EHRs), telemedicine, and blockchain applications. EHRs allow for the digital storage and management of patient health information, enabling healthcare providers to access and share information more efficiently. Blockchain technology has also been increasingly explored in healthcare for applications such as sharing electronic medical records, remote patient monitoring, and supply chain management, offering benefits such as enhanced security and data integrity. These technologies play a crucial role in modernizing and improving the healthcare system, offering benefits such as improved access to care, enhanced patient outcomes, and cost savings. However, their adoption also presents challenges, including issues related to data security, interoperability, and user acceptance. As healthcare continues to evolve, the effective integration of these technologies will be essential in driving improvements in the delivery and quality of care. (Herman et al., 2020c; Koppel, 2022a; Mishra et al., 2022b; Okour et al., 2019b; Ramzan et al., 2023)

2.1.4. Definition of Data Automation

Data automation refers to the use of technology to manage and process data with minimal human intervention, increasing efficiency and reducing the possibility of human error. This process involves the implementation of algorithms and software tools to collect. By automating data management tasks, businesses can save time and resources, allowing staff to focus on more critical tasks and improving overall productivity. (Bjørner, 1970; Koppel, 2022b; Liu et al., 2015; Previtali & Banfi, 2018; Ramanan et al., 2020)

2.2. Positive Factors Impacting the Adoption of Data Automation in Healthcare:

Data automation is rapidly transforming the healthcare industry, offering a multitude of positive benefits that drive its adoption. Healthcare organizations are increasingly recognizing the potential of data automation to improve efficiency, reduce costs, enhance patient care, and augment decision-making.

2.2.1. Improved Efficiency and Productivity:

Data automation streamlines workflows and help automate repetitive tasks, and reduces manual data entry, freeing up valuable time for healthcare professionals to focus on direct patient care and strategic initiatives. Mohammed, Mohammed, and Mohammed (Mohammed et al., 2022) highlight the role of artificial intelligence (AI) in automating routine tasks, such as scheduling appointments, processing insurance claims, and generating reports, leading to significant gains in efficiency and productivity.

2.2.2. Reduced Costs and Resource Optimization:

Data automation can significantly reduce healthcare costs by automating expensive manual processes and optimizing resource allocation. Chakraborty, Bhatt, and Chakravorty (Chakraborty et al., 2021) emphasize the impact of the Internet of Things (IoT) adoption on healthcare organizations'

agility and flexibility, enabling them to optimize resource utilization and reduce operational costs.

2.2.3. Enhanced Patient Care and Quality:
Data automation empowers healthcare providers with real-time access to patient data, facilitating better-informed decisions, personalized treatment plans, and improved patient outcomes. Nazareno and Schiff (Nazareno & Schiff, 2021) discuss the potential of automation and AI to enhance patient care by enabling predictive analytics, risk assessment, and personalized interventions.

2.2.4. Augmented Decision-Making and Clinical Insights:
Data automation facilitates data collection, analysis, and visualization, providing healthcare professionals with actionable insights to support informed decision-making. By automating data-driven tasks, organizations can gain valuable insights into patient populations, treatment trends, and resource utilization, leading to improved clinical decision-making and resource allocation. (Alhakami et al., 2021; Caesar et al., 2020; Dautov et al., 2019; Helm et al., 2022; Shankar, 2022)

2.2.5. Positive Impact on Healthcare Professionals:
Data automation can alleviate the burden of administrative tasks, allowing healthcare professionals to focus on their primary responsibilities of providing patient care. This can lead to increased job satisfaction, improved morale, and reduced burnout among healthcare workers. (Afulani et al., 2021; Gkliati & Saiti, 2022a)
To effectively harness the positive factors driving the adoption of data automation in healthcare, organizations should consider the following recommendations:

- Identify clear goals and objectives: Clearly define the specific goals and objectives for data automation initiatives to ensure alignment with organizational strategies and patient care priorities.
- Invest in data infrastructure: Establish a robust data infrastructure that supports data collection, storage, integration, and analysis to enable effective data automation, user-friendly, and scalable to meet future needs. (Gkliati & Saiti, 2022b; Lomotey et al., 2019; Mori et al., 2022; Yildiz et al., 2022)
- Embrace a data-driven culture: Foster a culture that values data and encourages the use of data-driven insights for decision-making and continuous improvement.
- Provide training and support: Provide comprehensive training and support to healthcare professionals to ensure they have the skills and knowledge to utilize data automation effectively. (Gkliati & Saiti, 2022b; Lomotey et al., 2019; Mori et al., 2022; Yildiz et al., 2022). By implementing these recommendations and embracing the positive factors driving data automation adoption, healthcare organizations can reap the benefits of augmented decision-making, ultimately leading to a more transformed and data-driven healthcare landscape. (Lomotey et al., 2019; Mori et al., 2022)

2.3.1. Technical Complexity and Integration Challenges:
The complex nature of healthcare data and the diverse range of existing systems create significant integration challenges. Mohammed et al. (Mohammed et al., 2022) highlight the difficulties in integrating data automation systems with legacy healthcare information systems (HIS) and electronic health records (EHRs), leading to data silos and inefficiencies.

2.3.2. Data Quality and Security Concerns:
Healthcare data is sensitive and prone to errors and inconsistencies, raising concerns about data quality and security. Chakraborty, Bhatt, and Chakravorty (Chakraborty et al., 2021) emphasize the importance of data governance and data integrity measures to ensure the reliability and security of data used for automation.

2.3.3. Resistance to Change and Job Displacement Fears:
Healthcare professionals may resist the adoption of data automation due to concerns about job displacement and the potential for automation to replace human expertise. Nazareno and Schiff (Nazareno & Schiff, 2021) discuss the impact of automation on worker well-being, emphasizing the need for effective communication and training to address these concerns.

2.3.4. Cost Considerations and Return on Investment:
The initial investment in data automation technology and the ongoing costs of maintenance and support can be significant, making it challenging for healthcare organizations to justify the adoption. Organizations need to carefully evaluate the potential return on investment (ROI) to make informed decisions about data automation initiatives. (Heun-Johnson et al., 2023a; Onyebuchi et al., 2022)

2.3.5. Lack of Data Literacy and Expertise:

Healthcare professionals often lack the necessary data literacy and expertise to effectively utilize data automation tools. This can hinder the adoption and utilization of data automation, as professionals may struggle to interpret data, develop predictive models, or integrate automation into their workflows. (David Odera, 2023; Heun-Johnson et al., 2023b; Kimiafar et al., 2023) To address the negative factors that impact the adoption of data automation in healthcare, organizations should consider the following recommendations:

- Adopt a strategic approach: Develop a comprehensive data automation strategy that aligns with organizational goals, identifies clear objectives, and prioritizes initiatives based on feasibility and potential impact.
- Invest in data governance: Implement robust data governance practices to ensure data quality, consistency, and security, laying the foundation for effective data automation.
- Address change management: Develop a comprehensive change management plan that addresses employee concerns, provides training and support, and fosters a culture of acceptance and adaptability.
- Evaluate costs and ROI: Conduct thorough cost-benefit analyses to evaluate the potential ROI of data automation initiatives, considering both tangible and intangible benefits.
- Promote data literacy: Provide healthcare professionals with comprehensive training and support to enhance their data literacy and expertise, enabling them to effectively utilize data automation tools. (Kimiafar et al., 2023)

By addressing these negative factors and implementing a strategic approach to data automation, healthcare organizations can overcome the challenges and reap the substantial benefits of data-driven healthcare, transforming care delivery, improving patient outcomes, and enhancing the overall healthcare experience. (Kimiafar et al., 2023; Onyebuchi et al., 2022)

2.3. Gaps in the Literature Reviews:

1. The literature reviews focus primarily on the positive factors that impact the adoption of data automation in healthcare, with limited discussion of the negative factors.
2. The literature reviews provide a general overview of the factors that impact data automation adoption, but they do not delve into specific strategies for overcoming these challenges.
3. The literature reviews do not adequately address the role of human factors, such as perceptions, attitudes, and skills of healthcare professionals, in influencing data automation adoption. (Frison et al., 2020; Koltai et al., 2014; Lyell & Coiera, 2017)

2.4. Data Automation in Healthcare KSA:

Saudi Arabia has been working to digitize its healthcare system, including implementing electronic health records (EHRs), clinical workflow management systems, and patient-focused virtual care options. Additional opportunities exist to increase adoption of digital solutions like remote monitoring of chronic diseases, electronic triaging in hospitals, virtual consultations, and self-service options for appointments and tests. These technologies could generate major cost savings and improved patient outcomes. For example, wider adoption of remote monitoring for chronic conditions like diabetes could help reduce costly emergency visits. (*KSA Value Pools Interactive – Desktop*, n.d.; المركز الوطني للمعلومات الصحية, n.d.)

Saudi Arabia can accelerate realizing the benefits of digital health through steps like introducing incentives for providers to use virtual care, developing healthcare professionals' digital capabilities, involving clinicians in technology integration decisions, and setting national targets for adoption. The country has already made some progress, such as establishing standards around telemedicine reimbursement. Additional policies could promote interoperability between digital systems and reward technologies that improve outcomes. For example, Germany has created a list of approved digital therapeutics eligible for insurance reimbursement. (*2021-11-11-001.Pdf*, n.d.; *Health Care in the Kingdom of Saudi Arabia*, n.d.)

Significant potential exists to increase workflow automation in Saudi healthcare, which currently has low adoption rates. Solutions like electronic referrals, patient flow management software, robotic process automation, and nurse mobile connectivity could generate major efficiency gains. One estimate suggests 30-40% of health sector work could be automated by 2030, freeing up professional capacity. As automation expands, professionals can spend more time on critical thinking, decision-making, and empathetic patient interactions. (*2021-11-11-001.Pdf*, n.d.; *Health Care in the Kingdom of Saudi Arabia*, n.d.; *KSA Value Pools Interactive – Desktop*, n.d.; المركز الوطني للمعلومات الصحية, n.d.)

2.5. Conclusion:

Data automation presents a transformative opportunity for healthcare, offering significant

potential to improve efficiency, reduce costs, and enhance patient care. However, the adoption of data automation in healthcare is not without its challenges. Healthcare organizations must address a range of factors, including technical complexity, data quality concerns, resistance to change, cost considerations, and lack of data literacy, to successfully implement and utilize data automation effectively. By adopting a strategic approach, investing in data governance, addressing change management, evaluating costs and ROI, and promoting data literacy, healthcare organizations can overcome these challenges and harness the power of data automation to revolutionize healthcare delivery and improve patient outcomes. (Caesar et al., 2020; Creswell & Creswell, 2017; Lyell & Coiera, 2017; Nazareno & Schiff, 2021; Shankar, 2022)

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