The Role Of Artificial Intelligence In Transforming Healthcare Leadership: A Systematic Review Of Current Trends And Future Directions

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Abstract

Objective: This systematic review aims to comprehensively examine the role of artificial intelligence in reshaping healthcare leadership in Saudi Arabia. **Methodology:** A systematic search was conducted across databases such as PubMed and Google Scholar to identify pertinent studies published between 2018 to 2022. Articles meeting specific inclusion criteria, including English language and focused examination of artificial intelligence in healthcare leadership, were selected. Additionally, chosen articles were required to

utilize established measurement scales and provide significant data on artificial intelligence's impact on healthcare leadership within organizational settings. Following initial screening and quality assessment, twelve studies were deemed suitable for synthesis. **Findings:** The analysis revealed a consistent association between artificial intelligence implementation and healthcare leadership dynamics. Artificial intelligence emerged as a beneficial factor in both mitigating challenges and fostering positive outcomes within healthcare leadership contexts. **Conclusion:** This review underscores the significance of artificial intelligence integration in healthcare leadership and administration. The research highlights the potential for artificial intelligence to effectively enhance and transform healthcare leadership practices, thereby shaping the future landscape of healthcare in Saudi Arabia.

Keywords: Artificial Intelligence, Healthcare Leadership, Transform, Saudi Arabia, Systematic Review.

Introduction

The significance of artificial intelligence (AI) in healthcare leadership is multifaceted and increasingly recognized due to its potential to revolutionize various aspects of healthcare management and administration. AI enables healthcare leaders to make more informed decisions by analyzing vast amounts of data quickly and accurately. Artificial Intelligence (AI) is becoming increasingly common in healthcare, with applications ranging from screening and triage to clinical risk prediction and diagnosis. As a clinical tool, AI has the potential to improve diagnostic accuracy and the efficiency of health services (Jassar et al., 2022; Shahbal et al., 2022; Alharbi et al., 2022).

The data-driven approach can enhance strategic planning, resource allocation, and operational efficiency within healthcare organizations. AI algorithms predict patient outcomes, identify high-risk individuals, and anticipate healthcare trends. Healthcare leaders leverage these insights to allocate resources effectively, proactively manage patient care, and optimize clinical workflows(Al-Jehani et al., 2021). AI-powered technologies, such as predictive analytics, personalized medicine, and virtual health assistants, enhance patient care delivery. Healthcare leaders implement AI-driven solutions to provide personalized treatment

plans, early disease detection, and remote patient monitoring, ultimately improving patient outcomes and satisfaction. AI automates repetitive tasks, streamlines administrative processes, and reduces operational costs. Healthcare leaders deploy AI-driven tools for scheduling, billing, inventory management, and other administrative functions, allowing staff to focus on delivering high-quality patient care(Wani et al., 2022; Alruwaili et al., 2022; Almutairi et al., 2022; Alotaibi et al., 2022).

AI fosters innovation in healthcare by facilitating the development of novel treatments, diagnostic tools, and healthcare delivery models. Healthcare leaders collaborate with AI researchers, startups, and technology companies to explore innovative solutions and stay ahead of industry trends. AI empowers healthcare professionals by augmenting their capabilities and enabling them to focus on complex tasks that require human expertise. Healthcare leaders support staff training and skill development to effectively integrate AI technologies into clinical practice and administrative operations. Healthcare leaders play a crucial role in ensuring the ethical and responsible use of AI in healthcare. They must address issues such as data privacy, algorithm bias, transparency, and accountability to maintain patient trust and uphold ethical standards in AI-driven healthcare systems(Chikhaoui et al., 2022; Al Ali et al., 2022; Alotaibi et al., 2022). The AI performs a transformative role for healthcare leadership.

Figure 1: Transformative Role of AI in Healthcare

Methodology

Literature Search

A comprehensive literature search was conducted to identify relevant studies investigating the role of artificial intelligence in influencing healthcare leadership in healthcare organizations. AI is a group of technologies rather than a single technology. Many of these technologies are rapidly operating in the healthcare sector, but the specific procedures and functions they support may vary widely. Some of the most important AI healthcare technologies and their applicability in healthcare are as follows(Wani et al., 2022):

AI Type	Applicability in Healthcare Sector
Machine Learning and Deep Learning	Among in-depth learning and emotional networks, machine learning is a mathematical way of incorporating data models and teaching models to 'learn' by training them with
Natural Language processes (NLP)	AI researchers have sought to understand human language. Speech recognition, text analysis, translation, and other language-related applications are all NLP applications. There are two types of NLP: Mathematical and Semantic
Robotic Process Automation (RPA)	RPA is used in healthcare to perform repetitive tasks such as prior authorization, updating patient records, and billing.
Explainable and Interpretable AI	Explainable AI (XAI) aids in communicating automated choices to affected patients in a clear and intelligible manner. In the fields of healthcare and biomedical sciences, XAI is garnering more scientific interest. The core logic and mechanics of a machine learning system are related to XAI.
Administrative Applications	This is required in healthcare because the average nurse spends 25% of her time on the job on administrative duties. It has applications in several healthcare systems, including applicant processing, clinical recording, income cycle management, and medical records management.

The search was performed using articles published and included in databases like Google Scholar and PubMed. An initial search of databases for research on, the 'artificial intelligence in healthcare organizations " resulted in 200 results while a search on 'AI and healthcare leadership" resulted in 400 while results for 'role of artificial intelligence in healthcare leadership' resulted in 330 results.

The search strategy employed the use of keywords to optimize the retrieval of relevant articles. The following search terms and their variations were used: "Role of Artificial Intelligence in healthcare," "Healthcare leadership and Artificial intelligence"

"influence of AI on healthcare " and "Healthcare and AI." The search was not limited by publication date however only the publications in the English language were accessed. The PRISMA diagram provides complete details for research identified, screened, and included in the systematic review.

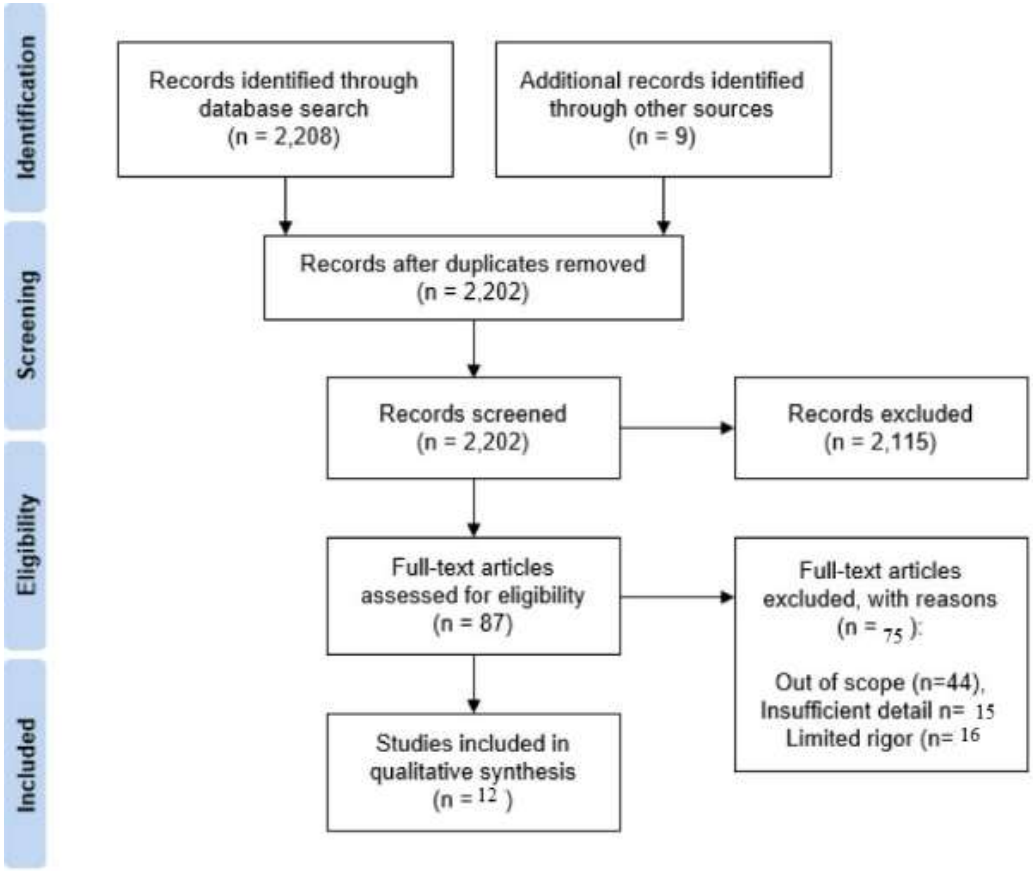

Figure 2: PRISMA Flow Diagram for Systematic Review

Inclusion/ exclusion Criteria

Studies were included in the review if they investigated the use of artificial intelligence in the Healthcare system and its influence on healthcare leadership.

Included publications focusing on artificial intelligence in the healthcare sector and healthcare leadership.

Studies were excluded if they were not relevant to the topic of artificial intelligence, healthcare leadership, and the role of AI in

healthcare leadership, another reason for exclusion was duplicate publications and non-scientific research.

Data Extraction

To gain a better understanding of the similarities and general direction of the research, data related to the author, research design, objective, results, and conclusion used in the study were noted and extracted from original articles.

Systematic Analysis of Research

Sr	Author /Year of Publication	Research Topic/Title	Objective	Role of AI	Research Design/Methodology	Results	Conclusion
1	(Nasseef et al., 2022)	Artificial intelligence-based public healthcare systems: G2G knowledge-based exchange to enhance the decision-making process	This research investigates the effects of using an artificial intelligence-driven public healthcare framework to enhance the decision-making process using an extended model of Shaft and Vessey (2006) cognitive	A positive and significant relationship was also found between AI·D and AI.PSP	The cognitive Fit Model was validated based on empirical data collected using an online questionnaire distributed to healthcare organizations in Saudi Arabia. The main sample participants were healthcare CEOs, senior managers/managers, doctors, nurses, and other relevant	The study examines how the AI is helpful for healthcare leaders and the AI-based public healthcare systems can enhance problem-solving performance and the decision-making process in the presence of G2G.KE and EBDM.	64% of healthcare leaders demonstrated that they have started using AI health applications over the COVID-19 crisis.

			fit model in healthcare organizations in Saudi Arabia		healthcare practitioners under the MoH involved in the decision-making process relating to COVID-19.		
2	(Chikhaoui et al., 2022)	Artificial Intelligence Applications in the Healthcare Sector: Ethical and Legal Challenges	This research aims to present the main studies investigating AI based-healthcare applications worldwide especially in Saudi Arabia.	Machine Learning (ML), Deep Learning (DL), and Artificial Neural Networks (ANN)	A six step research process was adopted from identifying of problem to results compilation.	The findings showed that AI should not only lead to better health but also save manpower and simplify the healthcare processes. The respondents agreed that AI helps reflect human intellectual competencies and pushes its limits	The findings suggest a broader—and potentially more successful—use of AI in the health sector in Saudi Arabia. 100% of medical professionals are familiar with the current use of AI in the healthcare sector, and 70% of respondents think that AI could successfully replace doctors with minimum errors. More than 70% of the

							respondents agree that AI's advantages outweigh its threats, but a small number of respondents are concerned about AI's algorithm
3	(Al-Jehani et al., 2021)	Development of artificial intelligence techniques in Saudi Arabia: the impact on covid-19 pandemic.	Based on its 'Vision 2030' initiative, it has launched the Kingdom's greatest and most aspirant change plan. This paper demonstrated the developed AI techniques of Saudi Arabia.	TAWAKKALNA application, Medical Robots, Doctor B2 Robots, TABAOD application	Literature Review	Health care systems in Saudi Arabia recently begun to depend on AI applications, because they can store and addressing tremendous patient data, improving the quality of medical care, improving decision-making, and reducing costs.	The speed, that AI is being implemented across different fields will surely trigger the revolution that will be aligned with the aspirations of Saudi Arabia's vision 2030
4	(Wani et al., 2022)	Utilization of Artificial Intelligence in Disease Prevention:	The purpose of this review is to	Protecting human Autonomy,	Literature Review	AI will play a significant role in the healthcare industry. Precision medicine, which is	AI can assist healthcare staff in expanding their

		Diagnosis, Treatment, and Implications for the Healthcare Workforce	identify the potential machine learning applications in the field of infectious diseases and the general healthcare system.	Promoting human wellbeing and Safety, transparency, Explainability, fostering responsibility and accountability, ensuring inclusiveness and Equity, Responsive and Sustainable		widely known for much improvement in healthcare, is fueled by this capability	knowledge, allowing them to spend more time providing direct patient care and reducing weariness.
5	(Almalki et al., 2021)	A multi-perspective approach to developing the Saudi Health Informatics Competency Framework	The aim of this study was to develop a HI competency framework to guide SCFHS to introduce a HI certificati	Healthcare informatics, AI technologies	A two-phase mixed methods approach was used in this study. To further validate and contextualize the competency framework, multiple focus groups and expert	The work will provide valuable benefits to the SCFHS in supporting planning activities for health informatics professional classification within the Kingdom of Saudi Arabia.	The study developed the Saudi Health Informatics Competency Framework (SHICF) that is based on an iterative, evidence-based approach, with validation

			on program that meets local healthcare needs and is aligned with the national digital health transformation strategy.		panel meetings were undertaken with the key stakeholders.		from key stakeholders.
6	(Alswailem et al., 2021)	COVID-19 Intelligence-Driven Operational Response Platform: Experience of a Large Tertiary Multihospital System in the Middle East	The aim of the study is the intelligence-driven operational response platform for COVID-19.	A 3-phase Situation Awareness (SA) model was used to capture stakeholders' needs and expectations, identify data sources, and design and develop multidisciplinary	Case Study method	The results and main lessons learned from the rapid delivery of a user-centric COVID-19 multihospital operations intelligent platform in King Faisal Specialist Hospital and Research Center (KFSH&RC	Digital health solutions have been identified as promising approaches to address these challenges.

				visualizations to support digital health operations in a large tertiary multihospital system in the Middle East.			
7	(Abdullah & Fakieh, 2020)	Health Care Employees' Perceptions of the Use of Artificial Intelligence Applications: Survey Study	The aim of this study was to explore health care employee perceptions and attitudes toward the implementation of artificial intelligence technologies in health care institutions in	AI can process a vast amount of data in an accurate, rapid, and efficient way by using complex statistical and computing algorithms	An online questionnaire was published, and responses were collected from 250 employees, including doctors, nurses, and technicians at 4 of the largest hospitals in Riyadh, Saudi Arabia.	The results also showed that technicians were the most frequently impacted by artificial intelligence applications due to the nature of their jobs, which do not require much direct human interaction.	The Saudi health care sector presents an advantageous market potential that should be attractive to researchers and developers of artificial intelligence solutions.

			Saudi Arabia				
8	(Morley et al., 2022)	Governing Data and Artificial Intelligence for Health Care: Developing an International Understanding	The aim of this study is to review current health data and AI governance mechanisms being developed or used by Global Digital Health Partnership (GDHP) member countries that commissioned this research, identify commonalities and gaps in approaches, identify examples of best practices, and understa	Organizations and initiatives such as the FG-AI4H of the WHO/ITU, the GDHP, and the GPAI could lead international conversations and produce practical tools for implementing AI-driven technologies for health care	Data were collected through a scoping review of academic literature and a thematic analysis of policy documents published by selected GDHP member countries.	There was a broad range of maturity in health AI activity among the participants, with varying data infrastructure, application of standards across the AI life cycle, and strategic approaches to both development and deployment.	AI-driven technology research and development for health care outpaces the creation of supporting AI governance globally. International collaboration and coordination on AI governance for health care is needed to ensure coherent solutions and allow countries to support and benefit from each other's work.

			nd the rationale for policies.				
9	(Khan et al., 2021)	The Role of Digital Technology in Responding to COVID-19 Pandemic: Saudi Arabia's Experience	The aim of the study to sort out the role of digital technology in responding to COVID-19.	Tawakkalna application was proven to be a successful method in fighting the COVID-19 pandemic in the KSA	This was uncontrolled before–after the study following a mixed-method approach for data collection. National and regional data were extracted from the Health Electronic Surveillance Network (HESN), a centralized public health collection system for quantitative and statistical data. Quantitative and qualitative methods have been utilized in studying data derived from tech media	The Saudi authorities utilized different technological tools to aid in managing and combating the COVID-19 pandemic. In the case of Al Madinah Al Mounawarah, after the implementation of several technologies, the most important being Tawakkalna, the number of active daily cases decreased by 61%.	The use of the Tawakkalna application was proven to be a successful method in fighting the COVID-19 pandemic in the KSA. This vital and essential experience warrants the use of different digital technology that offers a personalized profile displaying the person's status

10	(Hejazi et al., 2022)	Attitudes and Perceptions of Health Leaders for the Quality Enhancement of Workforce in Saudi Arabia	This study aimed to understand the current healthcare workforce quality and future expectations from the attitudes and perceptions of health leaders	-	A qualitative research was carried out using semi-structured interviews consisting of 24 different questions. Participants of the study were healthcare leaders from different backgrounds and governmental institutions	Thematic analysis and N-Vivo program yielded 5 main themes: (1) workforce competency, (2) health transformation, (3) leadership, (4) workforce planning, and (5) healthcare quality	Health leaders are satisfied with the current direction of workforce competency and planning, yet fragmentation of the system and poor accessibility may need further enhancement. Furthermore, misutilization of services and the uncertainty of the future and talent pool are potential barriers for capability building
11	(Al Fadeel et al., 2021)	Artificial Intelligence in Patient Care in Riyadh, Saudi Arabia 2019-2020	To describe the awareness and Perception of uses of artificial intelligence	AI technologies	Cross-Sectional study. Data was collected by a questionnaire filled by health care physicians in king Khaled University	58% of physicians were either denied access to AI or AI was not available in the facility where they work. Access to artificial intelligence was not statistically different among	There's no significant difference in the attitude and acquaintance of physicians towards Artificial intelligence in relation to

			among providers in Medical health care settings.		Hospital and King Saud Medical City in Riyadh.	the three professional groups. About 51% of those physicians rarely or never use AI. Out of 105 (64%) of the doctors chose excellent to the relationship between acquaintance and attitudes towards the AI. (16%) of the physicians chose moderate and finally (20%) of them chose poor.	their gender, categories or years of experience.
12	(Jassar et al., 2022)	The future of artificial intelligence in medicine: Medical-legal considerations for health leaders	Artificial Intelligence (AI) is becoming increasingly common in healthcare and has potential to improve the efficiency and quality of healthcare services.	AI technologies	Literature Review	Continued advances of AI in healthcare may offer significant benefits to healthcare providers and patients. AI utility in transforming healthcare delivery to encourage its appropriate use in medical settings for healthcare leaders.	As AI continues to evolve in healthcare, appropriate guidance from professional regulatory bodies may help the medical field realize AI's utility and encourage its safe use. As the options for AI in medicine evolve, physicians and health

							leaders would be prudent to consider the evolving medical-legal context regarding use of AI in clinical practices and facilities

DISCUSSION

The present systematic review aimed to thoroughly investigate the role of artificial intelligence and its influence on healthcare leadership in the healthcare administration of Saudi Arabia. The review synthesized findings from a range of studies, including those conducted by (Nasseef et al., 2022), (Chikhaoui et al., 2022), (Al-Jehani et al., 2021), (Wani et al., 2022), (Abdullah & Fakieh, 2020), (Morley et al., 2022), (Khan et al., 2021), (Al Fadeel et al., 2021), (Jassar et al., 2022), (Almalki et al., 2021), (Alswailem et al., 2021) .

The AI is helpful for healthcare leaders and the AI-based public healthcare systems can enhance problem-solving performance and the decision-making process in the presence of G2G.KE and EBDM (Nasseef et al., 2022). The findings of the research conducted by Chikhaoui suggest a broader—and potentially more successful—use of AI in the health sector in Saudi Arabia. 100% of medical professionals are familiar with the current use of AI in the healthcare sector, and 70% of respondents think that AI could successfully replace doctors with minimum errors. More than 70% of the respondents agree that AI's advantages outweigh its threats, but a small number of respondents are concerned about AI's algorithm (Chikhaoui et al., 2022). It was found that the Healthcare systems in Saudi Arabia recently began to depend on AI applications, because they can store and address tremendous patient data, improving the quality of medical care, improving decision-making, and reducing costs (Al-Jehani et al., 2021). Artificial intelligence is playing a significant role in the performance and success of healthcare leaders. AI will play a significant role in the healthcare industry. Precision medicine,

which is widely known for much improvement in healthcare, is fueled by this capability. AI can assist healthcare staff in expanding their knowledge, allowing them to spend more time providing direct patient care and reducing weariness (Wani et al., 2022).

The KSA health framework is based on AI supported technologies to achieve the vision of 2030, the study developed the Saudi Health Informatics Competency Framework (SHICF) that is based on an iterative, evidence-based approach, with validation from key stakeholders (Almalki et al., 2021). Therefore, digital health solutions have been identified as promising approaches to address these challenges (Alswailem et al., 2021). The Saudi health care sector presents an advantageous market potential that should be attractive to researchers and developers of artificial intelligence solutions (Abdullah & Fakieh, 2020). AI-driven technology research and development for health care outpaces the creation of supporting AI governance globally. International collaboration and coordination on AI governance for health care is needed to ensure coherent solutions and allow countries to support and benefit from each other's work(Morley et al., 2022).

The use of the Tawakkalna application was proven to be a successful method in fighting the COVID-19 pandemic in the KSA. This vital and essential experience warrants the use of different digital technology that offers a personalized profile displaying the person's status. The Saudi authorities utilized different technological tools to aid in managing and combating the COVID-19 pandemic. In the case of Al Madinah Al Mounawarah, after the implementation of several technologies, the most important being Tawakkalna, the number of active daily cases decreased by 61%(Khan et al., 2021). Health leaders are satisfied with the current direction of workforce competency and planning, yet fragmentation of the system and poor accessibility may need further enhancement. Furthermore, misutilization of services and the uncertainty of the future and talent pool are potential barriers for capability building(Al Fadeel et al., 2021).

AI will significantly impact healthcare delivery, especially in precision medicine. Despite initial challenges, confidence exists in AI's mastery of diagnostic and therapeutic domains. Healthcare leaders need training to effectively utilize AI. Automation of radiology and pathology tasks is expected, along with growth in speech and text recognition. While integration challenges persist, widespread AI adoption is anticipated in the next decade, augmenting rather than replacing human physicians, who may

transition to roles emphasizing empathy and communication.

Implications

Artificial intelligence (AI) has a profound impact on healthcare leadership, revolutionizing management and administration across various fronts. Through data-driven decision-making, AI enables leaders to leverage vast amounts of healthcare data, improving strategic planning and operational efficiency. Predictive analytics empower leaders to allocate resources effectively and optimize workflows by anticipating patient outcomes and healthcare trends. Additionally, AI facilitates personalized medicine, tailoring treatment plans to individual patient needs, thereby enhancing the patient experience and improving outcomes.

Recommendations

The review will help the healthcare leaders' of KSA to learn and integrate AI technologies to healthcare system. By automating repetitive tasks and streamlining administrative processes, AI enhances operational efficiency, allowing healthcare staff to focus on delivering high-quality care. Furthermore, AI fosters innovation in healthcare delivery, transforming workforce dynamics through automation and decision support. Importantly, AI-driven interventions lead to improved patient outcomes, such as early disease detection and timely interventions, while addressing ethical considerations ensures trust and integrity in healthcare delivery. Overall, the effective integration of AI into healthcare leadership practices holds significant promise for driving positive outcomes and shaping the future of healthcare delivery.

Addition in Existing Literature

This review contributes to existing literature by offering insights for healthcare leaders on the critical analysis and integration of AI technologies within the healthcare system of Saudi Arabia (KSA). It encourages careful consideration and adoption of AI to enhance the effectiveness and efficiency of healthcare services. The focus is on the strategic implementation of AI to support diagnostic, therapeutic, and operational advancements. The review aims to guide leaders in navigating the complexities of AI integration. Ultimately, it seeks to foster a technologically advanced healthcare environment in KSA.

Impact and Contributions

This review is poised to make a significant impact, particularly among healthcare professionals and leaders keen on implementing AI-based technologies in Saudi Arabia's healthcare sector. It will serve as a valuable resource for understanding the significance and functions of AI within the healthcare system, ultimately aiding in the realization of the healthcare vision for 2030 in Saudi Arabia.

Limitations

AI and healthcare leadership are closely linked in striving for excellence within the healthcare system. However, despite the limitations of this systematic review, there are also limitations associated with AI. Artificial intelligence (AI) offers significant promise in revolutionizing healthcare leadership, but it also presents notable challenges that healthcare leaders must navigate. Firstly, AI algorithms heavily rely on data quality, and biases within training data can lead to skewed outcomes, necessitating careful consideration to ensure fairness. Additionally, the lack of interpretability in many AI models poses a barrier to trust and validation, potentially hindering adoption. Furthermore, the limited generalizability of AI models across diverse patient populations and settings requires thorough assessment to ensure accurate and reliable results. Legal and regulatory hurdles, including data privacy and compliance issues, add complexity to AI implementation, while integration into existing healthcare systems demands substantial resources and effort. Ethical concerns, such as patient privacy and algorithmic bias, require careful navigation to uphold trust and integrity. Moreover, the risk of automation bias underscores the importance of integrating AI insights with clinical judgment. Lastly, the substantial costs associated with AI implementation necessitate careful evaluation of cost-effectiveness and resource allocation. Despite these challenges, addressing these limitations with thoughtful strategies is crucial to realizing AI's full potential in advancing healthcare leadership and improving patient outcomes.

Conclusion

The systematic review help to conclude that artificial intelligence holds immense potential to transform healthcare leadership by enabling data-driven decision-making, improving patient care, enhancing operational efficiency, fostering innovation,

empowering the workforce, and addressing ethical considerations. Effective integration of AI technologies into healthcare leadership practices can drive positive outcomes and shape the future of healthcare delivery in Saudi Arabia.

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