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Impact of AI and big data analytics on healthcare outcomes: An empirical study in Jordanian healthcare institutions

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Abstract

Artificial intelligence (AI) and big data analytics are transforming healthcare globally and in Jordan. This study investigates the effects of AI and big data analytics on healthcare outcomes in Jordanian healthcare institutions. A comprehensive model is proposed to understand the antecedents of healthcare outcomes, including the impact of perceived ease of use, perceived usefulness, and organizational capabilities. Data were collected from 400 structured questionnaires, with a final sample size of 288 respondents, and analyzed using partial least squares structural equation modeling. The findings reveal that AI technologies significantly improve diagnostic accuracy and treatment planning, while big data analytics enhances operational efficiency and patient care. However, the comparative influence of AI on different healthcare processes was less significant. Additionally, robust organizational capabilities effectively enhanced the adoption and impact of AI and big data analytics. The study highlights the mediating roles of perceived ease of use and usefulness in the relationship between technology adoption and healthcare outcomes. Understanding the interplay between AI, big data analytics, and healthcare delivery is crucial for policymakers, healthcare administrators, and technology developers to develop effective strategies that improve patient care and operational efficiency. This study recommends investing in user-friendly AI and big data analytics tools, enhancing organizational capabilities, and providing comprehensive training for healthcare professionals. Future research should extend this study to different cultural contexts to validate the findings and contribute further to the literature on AI and healthcare.

Keywords

Artificial intelligence, big data analytics, healthcare outcomes, technology adoption, organizational capabilities, Jordan healthcare industry

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Introduction

The global healthcare sector is transforming, driven by the integration of advanced technologies such as artificial intelligence (AI), big data analytics, and sophisticated Management Information Systems (MIS). These technologies hold significant promise for enhancing patient care, streamlining operations, and improving decision-making processes within healthcare institutions. Jordan, known for its high standards in medical practices, is actively embracing these innovations. Leading institutions such as King Hussein Cancer Center and Jordan University Hospital have spearheaded the adoption of these technologies to address complex healthcare challenges, ranging from resource management to delivering high-quality patient care.[1–3] AI and big data analytics are at the forefront of this transformation. The exponential growth of healthcare data and advancements in computing power and AI algorithms create unprecedented opportunities to improve healthcare outcomes. AI offers a range of capabilities that can optimize hospital management, from automating administrative tasks to enhancing clinical decision-making through predictive analytics and machine learning. These technologies

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can improve the efficiency and accuracy of healthcare operations and fundamentally restructure how healthcare is delivered, allowing for more personalized and streamlined services.[4–6]

Despite significant global research on AI and big data analytics applications in healthcare, there remains a lack of empirical studies examining their adoption and impact in the Middle East, specifically in Jordan. Although these technologies have improved diagnostic accuracy, treatment planning, and operational efficiency in various settings, detailed insights into their implementation in Jordanian healthcare institutions are scarce.[7] Big data analytics enables healthcare providers to analyze vast amounts of information, uncover patterns, and generate insights that can improve health outcomes and enhance the overall efficiency of healthcare operations. Predictive analytics, for instance, aids in early disease detection and better management of patient loads, reducing the strain on healthcare systems.[8]

This study addresses three primary motivations: First, it investigates the current state of AI and big data analytics adoption in Jordanian healthcare institutions, assessing their impact on patient care, operational efficiency, and decision-making. Second, it explores the mediating roles of perceived usefulness, ease of use, and organizational capabilities in effectively adopting and utilizing these technologies. Finally, the study provides actionable recommendations for maximizing the benefits of AI and big data analytics in healthcare institutions in Jordan. These insights are precious, given that Jordan allocates approximately 7.5% of its GDP to healthcare, reflecting its commitment to high-quality medical services.[9] Although the adoption of AI and big data analytics in Jordan is still emerging, significant progress has been made, with several hospitals implementing AI-driven diagnostic tools and data analytics platforms to improve patient outcomes and operational efficiencies.[9]

In conclusion, this study aims to fill the existing gap in the literature by offering a comprehensive analysis of the adoption and impact of AI and big data analytics in Jordanian healthcare. By examining real-world applications and their outcomes, this research provides valuable insights and recommendations that can enhance the effectiveness of these technologies in healthcare settings. The findings will contribute to the growing body of knowledge on AI and big data in healthcare, offering practical implications for policymakers, healthcare administrators, and technology developers seeking to optimize healthcare systems through advanced MIS technologies.

Status of AI and big data analytics in healthcare in Jordan

Jordan has made considerable progress in adopting AI and big data analytics within its healthcare sector, reflecting global trends. Leading healthcare institutions, such as King Hussein Cancer Center and Jordan University Hospital, have been pivotal in driving this technological revolution. They use AI and big data analytics to enhance patient care and improve operational efficiency. The growth in healthcare data, advancements in computing power, and breakthroughs in AI algorithms have all contributed to the increasing use of these technologies in Jordanian healthcare institutions.[10] By 2024, AI technologies were extensively integrated into healthcare institutions across Jordan for various purposes, including diagnostics, personalized treatment plans, and predictive analytics to forecast patient health outcomes. These applications have proven vital for enhancing diagnostic accuracy and treatment planning and improving patient care. For example, AI-driven diagnostic tools have shown great potential in early disease detection, such as in identifying conditions like diabetic retinopathy and sepsis, leading to timely interventions and improved patient outcomes.[11]

Big data analytics has also become a crucial component of healthcare in Jordan. By analyzing vast amounts of patient data, healthcare providers can uncover patterns and insights that lead to better decision-making. This capability is handy for predicting patient outcomes, optimizing resource allocation, and managing healthcare processes in real time. Predictive analytics, for example, can forecast hospital admission rates, allowing healthcare institutions to manage resources more effectively, reduce wait times, and improve operational efficiency. However, despite these advancements, Jordanian healthcare institutions face several challenges in adopting AI and big data analytics widely. Organizational capabilities—such as the availability of robust infrastructure, comprehensive staff training, and consistent management support—are critical factors in successfully implementing these technologies. Institutions with organizational solid readiness are better positioned to leverage AI and big data analytics for more effective healthcare delivery.[12] According to the Ministry of Health, several key hospitals in Jordan have started implementing AI-driven diagnostic tools and data analytics platforms to improve patient outcomes and operational efficiencies.[13] Additionally, the perceived ease of use and usefulness of these technologies play a significant role in their adoption by healthcare professionals. Tools that are user-friendly and offer clear, valuable insights are more likely to be embraced by healthcare staff. Therefore, developing intuitive and beneficial AI and big data analytics platforms is essential to maximizing the potential of these technologies in Jordanian healthcare institutions.

In conclusion, while integrating AI and big data analytics in Jordan's healthcare sector offers immense potential for transforming healthcare delivery, addressing the challenges related to organizational capabilities and the usability of these tools is crucial. Healthcare institutions must focus on building the necessary infrastructure, offering thorough training, and securing management support to fully realize these technologies' benefits. Future research

should expand on these findings in other cultural contexts to validate the results and further contribute to the literature on AI and big data in healthcare.

Literature review

Integrating AI and big data analytics in healthcare is transforming the industry by improving diagnostic accuracy, optimizing treatment plans, and enhancing operational efficiency. Recent advancements in these technologies have shown great potential to revolutionize healthcare, but they also present challenges that must be addressed to achieve widespread implementation and measurable impact. This review critically examines existing research on the adoption and effects of AI and big data analytics in healthcare, focusing on improving patient outcomes, operational efficiencies, and decision-making processes. The literature highlights both the benefits and barriers to these technologies, particularly in the context of Jordanian healthcare institutions.

AI and big data analytics have emerged as key drivers of healthcare innovation, enabling more precise and personalized approaches to patient care. Studies show that AI's ability to support early disease detection and predict health outcomes can dramatically improve diagnostic accuracy and treatment effectiveness.[5] Similarly, big data analytics allows healthcare providers to uncover patterns from vast amounts of data, leading to better decision-making and resource optimization.[6] For example, AI-driven tools have demonstrated their effectiveness in detecting conditions like diabetic retinopathy and sepsis early, allowing timely interventions that improve patient outcomes.[14] However, despite these advancements, adopting these technologies faces significant challenges, particularly in healthcare systems with limited resources. For example, there is growing interest in leveraging AI and big data analytics to improve healthcare delivery in Jordan. However, studies point to insufficient infrastructure, training, and organizational support as major barriers (Bani-Salameh et al.[12]). While the potential is clear, healthcare institutions must invest in robust organizational capabilities to fully capitalize on the benefits of AI and big data.

Several theoretical frameworks have been applied to understand how AI and big data analytics can be successfully integrated into healthcare. One of the most widely used models is the Technology Acceptance Model (TAM), which emphasizes the importance of perceived usefulness and ease of use in driving technology adoption.[15] In healthcare, these factors are critical, as professionals are more likely to adopt AI and big data tools if they believe these technologies will improve their efficiency and provide valuable insights. Studies by Adeghe et al.[6] underscore the importance of user-friendly interfaces and practical applications in encouraging the adoption of innovative technologies in healthcare. Another practical framework is the diffusion of innovations theory, which explains how new technologies are adopted within organizations and societies.[16] This theory highlights the role of perceived benefits, compatibility with existing systems, and complexity in the adoption process. Innovations such as AI and big data are more likely to be adopted when institutions recognize their potential to improve patient care and operational efficiency.[5] However, the complexity and cost of implementing such technologies can slow their diffusion in regions like Jordan, where healthcare infrastructure is still developing. The resource-based view (RBV) adds another layer of understanding by focusing on the importance of organizational resources and capabilities in achieving competitive advantage.[17] Hospitals with robust infrastructure, skilled personnel, and supportive management are better positioned to implement AI and big data successfully. Elgendy and Elragal[18] suggest that institutions with strong organizational readiness are more likely to achieve positive healthcare outcomes through the effective use of these technologies. This is particularly relevant in Jordan, where organizational readiness varies widely across institutions.

AI and big data analytics have proven to be transformative in enhancing patient care by providing data-driven insights that can lead to more personalized and effective treatments. Through analyzing large datasets, healthcare providers can identify patterns and trends that inform diagnosis, treatment plans, and resource management. For example, AI algorithms can detect early signs of diseases, facilitating quicker and more accurate diagnoses.[5] In addition, data analytics can help healthcare providers anticipate patient needs, improve resource allocation, and reduce costs by optimizing treatment processes.[6] One of the most promising applications of AI and big data in healthcare is early diagnosis. By analyzing historical patient data, healthcare providers can identify trends that signal the onset of chronic diseases, enabling preventative treatments that can save lives and reduce healthcare costs.[14] Big data analytics can also enhance the management of electronic health records (EHRs), allowing healthcare providers to quickly access comprehensive patient information and improve the quality of care through better data management.[8]

Despite the clear benefits of AI and big data analytics, significant challenges remain in their implementation. One of the primary barriers is organizational capability. Studies show that healthcare institutions with solid infrastructure, comprehensive staff training, and management support are likelier to adopt and successfully implement these technologies.[12] This highlights the need for a strategic approach to building organizational capacity, particularly in developing countries like Jordan, where the healthcare sector is still evolving. Moreover, the success of AI and big data technologies depends mainly on the perceived ease of use and usefulness of these tools among healthcare professionals. If the tools are too complex or do not provide clear, actionable insights, healthcare workers may be reluctant to adopt them. As such, developing intuitive and user-

friendly interfaces is crucial to maximizing the potential benefits of these technologies.[6]

Integrating AI and big data analytics in healthcare offers vast potential to revolutionize patient care, improve operational efficiencies, and enhance decision-making. However, for these technologies to reach their full potential, healthcare institutions must overcome significant barriers, including infrastructure limitations and greater organizational readiness. As research continues to explore the transformative potential of AI and big data in healthcare, these technologies will play a critical role in shaping the future of healthcare delivery, particularly in regions like Jordan, where the healthcare system is rapidly evolving.

Hypotheses development

In this section, we formulate hypotheses to investigate the impact of AI and big data analytics on healthcare outcomes in Jordanian healthcare institutions. We explore how adopting these advanced technologies can influence patient care, operational efficiency, and decision-making processes. Additionally, we examine the mediating roles of perceived usefulness, perceived ease of use, and organizational capabilities in these relationships. These hypotheses aim to comprehensively understand how AI and big data analytics can enhance healthcare delivery and patient outcomes in Jordan.

***H1*:** Adopting AI application technologies positively influences healthcare outcomes in Jordanian healthcare institutions.

Integrating AI technologies in healthcare has significantly improved patient outcomes by enhancing diagnostic accuracy and treatment planning. Del Giorgio Solfa et al.[5] highlight that AI-driven algorithms, particularly in machine learning, can analyze vast amounts of data to predict disease progression and optimize treatment plans. For instance, AI applications have shown promise in the early detection of diseases such as diabetic retinopathy and sepsis, leading to timely interventions and improved patient outcomes.[4, 19] These findings support the hypothesis that AI adoption can improve healthcare outcomes by providing accurate, data-driven insights that enhance clinical decision-making. Studies such as those by Wolinetz and Tabak[20] have demonstrated that machine-learning models can significantly improve cancer diagnosis and treatment outcomes by providing early and accurate predictions. Additionally, research by Schroeder and Lodemann[21] has shown that AI technologies can accurately predict acute kidney injury and heart failure outcomes, facilitating timely interventions and improving patient care.

***H2*:** Adopting big data analytics positively influences healthcare outcomes in Jordanian healthcare institutions.

Big data analytics is crucial in transforming healthcare by providing comprehensive insights into patient health, treatment effectiveness, and operational efficiency. According to Adeghe et al.,[6] big data analytics facilitates evidence-based decision-making, predictive modeling, and personalized patient care. Studies have shown that predictive analytics can reduce hospital readmissions and improve disease management by analyzing patterns in large datasets.[8, 22] The ability of big data to process and analyze diverse healthcare data, including EHRs and real-time monitoring data, improves patient outcomes by enabling personalized and timely medical interventions. Del Giorgio Solfa et al.[5] also highlight that big data analytics can identify patterns and trends in large datasets, enabling healthcare providers to make more informed decisions. For example, predictive analytics has been shown to reduce hospital readmissions and improve glycemic control in diabetic patients by adjusting treatment plans based on data analysis.[3]

Additionally, big data analytics can enhance patient satisfaction by identifying areas for improvement in patient care and experience. Big data analytics has been recognized for its potential to enhance patient outcomes by identifying patterns and trends within large datasets, enabling evidence-based decision-making. Studies have shown that predictive analytics, a component of big data, can significantly reduce hospital readmissions by analyzing patient data to forecast potential health issues and optimize treatment plans accordingly.[14] Furthermore, research by Dubey et al.[3] highlighted that big data analytics could improve glycemic control in diabetic patients by adjusting treatment plans based on continuous data analysis, leading to better disease management and patient outcomes.

***H3*:** Perceived usefulness mediates the relationship between AI application adoption and healthcare outcomes.

Big data analytics is transformative in healthcare by offering comprehensive insights into patient health, treatment effectiveness, and operational efficiency. According to Adeghe et al.,[6] big data analytics facilitates evidence-based decision-making, predictive modeling, and personalized patient care. This technology's ability to process and analyze diverse healthcare data, including EHRs and real-time monitoring data, significantly improves patient outcomes by enabling personalized and timely medical interventions. Studies have demonstrated that predictive analytics, a core component of big data, can reduce hospital readmissions and enhance disease management by identifying patterns in large datasets. For instance, Raghupathi and Raghupathi, and Davenport and Kalakota[8, 22] have shown that predictive analytics can help forecast potential health issues and optimize treatment plans, improving patient care. Del Giorgio Solfa et al.[5] emphasize that big data analytics can identify trends in extensive datasets, allowing healthcare providers to make more informed decisions.

Additionally, predictive analytics has been shown to reduce hospital readmissions and improve glycemic control in diabetic patients by adjusting treatment plans based on data analysis.[3] Big data analytics also enhances patient satisfaction by identifying areas for improvement in patient care and experience. Research by Hussein et al.[14] supports the potential of big data analytics to enhance patient outcomes by enabling evidence-based decision-making. Furthermore, Dubey et al.[3] highlighted that continuous data analysis using big data can improve glycemic control in diabetic patients, leading to better disease management and patient outcomes. These studies collectively support the hypothesis that adopting big data analytics can positively influence healthcare outcomes in Jordanian healthcare institutions by providing accurate, data-driven insights that enhance clinical decision-making and patient care.

***H4*:** Perceived usefulness mediates the relationship between big data analytics adoption and healthcare outcomes.

The perceived usefulness of big data analytics mediates its impact on healthcare outcomes. Big data analytics' ability to provide valuable insights and improve decision-making processes makes it a handy tool in healthcare. By analyzing patient data to identify high-risk individuals and optimize treatment protocols, healthcare providers recognize the significant benefits of big data analytics. Reduced readmissions and better patient management prove this perceived usefulness, increase its adoption, and improve healthcare outcomes.[14] The adoption of big data analytics is strongly influenced by its perceived usefulness in enhancing healthcare delivery. Adeghe et al.[6] highlight that big data analytics provides valuable insights that improve clinical decision-making and patient management. For instance, the ability to predict disease outbreaks and personalize treatment plans based on data analysis makes big data an invaluable tool for healthcare providers.[8] The perceived usefulness of these capabilities mediates the relationship between big data analytics adoption and improved healthcare outcomes. Healthcare professionals who appreciate the benefits of big data analytics are more likely to utilize these tools effectively, leading to better patient outcomes.

Furthermore, the study by Alshurideh et al.[23] emphasized that healthcare professionals who perceive big data analytics as beneficial for patient management and decision-making are more likely to adopt these tools. The perceived usefulness of this increased adoption enhances patient outcomes and healthcare delivery. As a result, the perceived usefulness of big data analytics plays a crucial role in its adoption and the subsequent enhancement of healthcare outcomes, as demonstrated by reduced readmissions and better patient management.[14]

***H5*:** Perceived ease of use mediates the relationship between AI adoption and healthcare outcomes.

Perceived ease of use is critical in successfully adopting AI technologies in healthcare. When user-friendly AI tools are seamlessly integrated into clinical workflows, healthcare professionals are more likely to adopt and utilize them effectively. For instance, the ease of use of machine learning models allows healthcare providers to quickly interpret data and apply insights to patient care, thereby improving outcomes. Studies have shown that AI systems' intuitive design and functionality enhance their adoption and practical application in healthcare settings.[4,5] The perceived ease of use mediates the relationship between AI adoption and healthcare outcomes by ensuring that healthcare providers can effectively utilize AI tools without significant barriers. AI systems with intuitive interfaces and straightforward functionalities are more readily adopted by healthcare providers, leading to improved patient care through enhanced diagnostic and treatment capabilities. For instance, the study by Gluck and Gostin[24] found that healthcare professionals are more likely to adopt AI systems with user-friendly interfaces and straightforward functionalities. This increased adoption results in better patient care, as healthcare providers can efficiently use AI tools to enhance diagnostic accuracy and treatment planning. Therefore, perceived ease of use is pivotal in adopting AI technologies, ultimately leading to improved healthcare outcomes.

***H6*:** Perceived ease of use mediates the relationship between big data analytics adoption and healthcare outcomes.

The perceived ease of use of big data analytics tools significantly influences their adoption and effectiveness in healthcare. When these tools are user-friendly and compatible with existing healthcare systems, they facilitate better data analysis and decision-making. For example, Adeghe et al.[6] emphasize that intuitive predictive analytics platforms enable healthcare providers to quickly interpret data and implement interventions, improving patient outcomes.[8] The perceived ease of use thus mediates the relationship between big data analytics adoption and healthcare outcomes by ensuring that healthcare professionals can efficiently leverage these technologies. The intuitive use of big data analytics has enhanced healthcare performance by streamlining processes and reducing costs.[25] Additionally, the study by Aljameel et al.[26] found that healthcare professionals are more likely to use big data analytics tools that are easy to navigate, leading to better patient management and improved healthcare outcomes. Therefore, the ease of use of big data analytics tools plays a crucial role in their adoption and the resulting positive impacts on healthcare delivery and patient care.

***H7*:** Organizational capabilities mediate the relationship between AI adoption and healthcare outcomes.

Organizational capabilities, such as infrastructure, training, and management support, are essential for successfully adopting AI technologies in healthcare. Del Giorgio Solfa et al.[5] highlight that healthcare institutions with robust organizational capabilities can better manage data integration, staff training, and continuous improvement, enhancing AI's impact on patient care. Effective utilization of AI tools requires a supportive environment that fosters innovation and addresses implementation challenges. Studies indicate that organizations with solid capabilities are more likely to achieve positive healthcare outcomes using AI. For example, Davenport and Kalakota[22] emphasize that the successful implementation of AI in healthcare highly depends on the institution's ability to support AI initiatives with appropriate resources and training. The study by Elgendy and Elragal[18] further supports this by demonstrating that hospitals with organizational solid readiness are better positioned to implement AI solutions, resulting in improved healthcare outcomes through the effective utilization of AI tools. Thus, organizational capabilities play a crucial role in mediating the relationship between AI adoption and healthcare outcomes, as they enable healthcare institutions to fully leverage AI technologies to enhance patient care and operational efficiency.

***H8*:** Organizational capabilities mediate the relationship between big data analytics adoption and healthcare outcomes.

Organizational capabilities significantly influence the adoption and impact of big data analytics on healthcare outcomes. Healthcare institutions with the necessary infrastructure, skilled personnel, and supportive management can implement big data analytics effectively. Adeghe et al.[6] emphasize that managing large datasets, ensuring data quality, and applying insights to improve patient care are critical components that require robust organizational capabilities. Institutions that invest in developing these capabilities are better positioned to leverage big data analytics for enhanced healthcare delivery. Studies have shown that these organizational capabilities improve diagnostic accuracy and personalized treatment strategies. For instance, Raghupathi and Raghupathi[8] and Davenport and Harris[27] highlight that utilizing big data analytics leads to more accurate diagnoses and tailored treatment plans, which enhance patient outcomes. Additionally, the research by Alshareef et al.[28] emphasized that organizations investing in developing the necessary capabilities are better equipped to leverage big data analytics, leading to improved healthcare delivery, diagnostic accuracy, personalized treatment strategies, and overall better patient outcomes. Thus, organizational capabilities are crucial in mediating the relationship between big data analytics adoption and healthcare outcomes, enabling healthcare institutions to fully utilize these technologies to improve patient care and operational efficiency.

These hypotheses aim to comprehensively understand how AI and big data analytics influence healthcare outcomes in Jordanian institutions. By addressing these hypotheses, the study will contribute valuable insights into the implementation and impact of advanced technologies in the healthcare sector. The proposed model investigates whether adopting AI and big data analytics affects healthcare outcomes, such as patient care and operational efficiency. The study model integrates elements from the TAM, diffusion of innovations theory, and RBV to explore the impact of AI and big data analytics on healthcare outcomes in Jordanian institutions. The model posits that adopting AI and big data analytics (independent variables) influences healthcare outcomes (dependent variables) through mediating variables such as perceived usefulness, perceived ease of use, and organizational capabilities. This approach helps to understand the multifaceted effects of these technologies and provides a comprehensive framework for evaluating their implementation and impact in the healthcare sector.

Research methodology

This study investigates the impact of AI and big data analytics on healthcare outcomes within Jordanian healthcare institutions, focusing on their effects on patient care, operational efficiency, and decision-making processes. A mixed-method approach was employed, combining online and offline data collection methods. Structured face-to-face questionnaires were administered to healthcare professionals at various institutions, while online surveys were also used to reach a broader participant base. This combination allowed the study to capture diverse perspectives from various roles in the healthcare system. Convenience sampling was used to select respondents, ensuring accessibility while including healthcare professionals in diverse roles, such as doctors, nurses, IT staff, and administrative personnel. This approach allowed the study to gather various insights, reflecting clinical and operational perspectives. Five hundred questionnaires were distributed, yielding 288 valid responses for analysis. This sample size meets the recommended minimum for SEM as per Soper,[29] ensuring the data collected sufficiently for robust statistical analysis. The questionnaire was developed using well-established theoretical models, including the TAM, focusing on critical constructs such as perceived usefulness, perceived ease of use, and organizational capabilities. To ensure the validity and reliability of the questionnaire, a pilot study was conducted with 30 healthcare professionals. This pilot phase tested the clarity and reliability of the questions, with refinements made based on participant feedback. The final version of

the questionnaire consisted of 28 items, including four demographic questions and 24 questions on the study variables. A detailed breakdown of these items and their measurement scales can be found in Appendix 1.

The term "face-to-face questionnaire" refers to a data collection method where healthcare professionals complete the questionnaire in person, with a researcher present to assist if needed. However, the researcher did not influence or interfere with responses. To ensure anonymity, no identifying information was collected during this process. Participants completed the questionnaire privately and submitted their responses in sealed envelopes to maintain confidentiality. This approach enabled real-time clarification of questions while ensuring the anonymity of respondents. The data were collected using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), allowing for quantifiable data on participants' perceptions of AI and big data analytics in healthcare. The collected data were analyzed using partial least squares structural equation modeling (PLS-SEM), an analytical method suited for predictive modeling and exploring complex relationships between variables. PLS-SEM was chosen due to its ability to handle smaller sample sizes and its robustness against non-normal data distributions. The analysis was conducted using SmartPLS4 software, while IBM SPSS 26 was used for preliminary data processing and descriptive statistics. This approach enabled the study to explore the mediating roles of perceived usefulness, perceived ease of use, and organizational capabilities in the relationship between AI and big data adoption and healthcare outcomes.

Several procedural remedies were implemented to address common method bias. These included using diverse data sources for predictor and criterion variables, temporal separation in measuring constructs and ensuring the anonymity of responses. These steps were designed to minimize the risk of inflated correlations caused by common method variance, improving the reliability of the study's findings. The study adhered to strict ethical standards, with the university ethics committee granting ethical approval. All participants were fully informed about the study's purpose, procedures, and their right to withdraw at any time. Informed consent was obtained from each participant, and their data were handled with strict confidentiality, being used solely for research purposes. The anonymity and privacy of all respondents were ensured throughout the study.

Table 1. Respondents demographic profile.

Characteristics	Frequency	Percent
Sex		
Male	153	53
Female	135	47
Total	288	100
Years of experience in healthcare		
0–5 years	57	19.7
6–10 years	85	29.5
11–15 years	67	23.2
16–20 years	47	16.3
21 years and above	32	11.11
Total	288	100
Age		
18–29 years	56	19.4
30–39 years	108	37.5
40–49 years	95	33
50 years and above	54	18.8
Total	288	100
Position/job		
Doctor	77	26.7
Nurse	87	30.3
Administrator	69	24
IT technician	49	17
Total	288	100

Respondents demographic characteristics

This section provides an overview of the demographic characteristics of the 288 respondents who participated in the study. Table 1 summarizes the key demographic variables, including gender, years of experience in healthcare, age distribution, and job positions. The sample was relatively balanced in gender, with 53% male and 47% female respondents.

Regarding professional experience, participants with 6–10 years of experience formed the largest group, comprising 29.5% of the sample, while those with over 21 years of experience made up 11.1%. Regarding age, most respondents were between 30 and 39 (37.5%), followed by those in the 40–49 age group (33%). Only 19.4% of the participants were under 30 years of age, and 18.8% were 50 years or older. Concerning job positions, nurses accounted

for the largest segment of respondents at 30.3%, followed by doctors at 26.7%, administrators at 24%, and IT technicians at 17%. The demographic profile of the respondents highlights the diversity within the sample, providing a broad representation of various roles and levels of experience within the Jordanian healthcare sector. This variety is crucial for ensuring that the study's findings apply across different healthcare workforce segments.

Results analysis

Validity and reliability

In this study, Cronbach's alpha (CA), composite reliability (CR), and average variance extracted (AVE) were used to assess internal consistency, validity, and reliability. These measures are crucial for determining the stability and dependability of the questionnaire. CA values greater than 0.7 are acceptable, while values below 0.6 suggest poor reliability and a high risk of error.[30] The CA values in this study ranged from 0.799 to 0.880, indicating strong internal consistency. These values exceed social sciences research's commonly accepted threshold of 0.60–0.70.[31] CR values, which assess the consistency of the items in measuring the same construct, ranged from 0.860 to 0.930, surpassing the recommended threshold of 0.7.[32] This indicates high reliability across the study's constructs. AVE, which measures the variance captured by the constructs relative to the variance due to measurement error, ranged from 0.647 to 0.680. All AVE values exceeded the 0.50 threshold, as Fornell and Larcker[30] suggested, indicating that the constructs explain more variance than is attributed to measurement error.[33]

These results confirm that the questionnaire used in this study demonstrates strong internal consistency, reliability, and validity, supporting the robustness of the measurement model for further analysis (Table 2).

The discriminant validity test was employed to evaluate the uniqueness of the constructs within the model. The Fornell–Larcker discriminant validity test was utilized, which requires the square root of the AVE for a construct to exceed the correlation coefficients associated with that construct. As shown in Table 3, all constructs in this study satisfy the criteria for discriminant validity.[32, 34]

The results demonstrate that the constructs employed in this study exhibit high levels of reliability and validity, thus ensuring that the measurements are consistent and accurately represent the constructs they are designed to assess. The strong CA, CR, and AVE values, as well as the results indicating discriminant validity, provide evidence for the reliability of the measurement model employed to evaluate the influence of AI and big data analytics on healthcare outcomes in Jordanian healthcare institutions.

Table 2. Construct reliability and validity.

Construct	CA	CR	AVE
AI adoption applications	0.830	0.875	0.670
Big data analytics adoption	0.8455	0.883	0.660
Perceived ease of use	0.880	0.930	0.680
Perceived usefulness	0.850	0.925	0.666
Organizational capabilities	0.799	0.911	0.647
Healthcare outcomes	0.860	0.860	0.670

Results of regression analysis

Table 4 presents the results for SDs, factor loadings, *t*-statistics, variance inflation factor (VIF), means, and model fit indicators (standardized root mean square residual [SRMR] and normed fit index [NFI]) for all the items. SD

Table 3. Discriminant validity.

Construct	A1	BD	PE	PU	OC	HO
AI adoption applications (A1)	**0.823**					
Big data analytics adoption (bd)	0.797	**0.793**				
Perceived ease of use (PE)	0.787	0.773	**0.811**			
Perceived usefulness (PU)	0.677	0.735	0.765	**0.834**		
Organizational capabilities (OC)	0.753	0.741	0.722	0.751	**0.822**	
Healthcare outcomes (Ho)	0.734	0.733	0.725	0.741	0.762	**0.790**

Note: The main diagonal (in bold) displays the square root of the AVE for each construct.

Table 4. Factor loadings, VIF, and model fit.

Code	Loadings	Mean	SD	*T*-values	VIF	SRIMR	NFI
AI1	0.818	4.240	0.024	38.200	1.770	0.056	0.792
AI2	0.806	4.380	0.034	26.200	1.710		
AI3	0.810	4.392	0.035	24.200	1.790		
AI4	0.796	4.331	0.034	26.300	1.690		
BI1	0.804	4.388	0.032	27.700	1.920		
BI2	0.800	4.335	0.030	28.600	1.920		
BI3	0.776	4.327	0.039	21.200	1.920		
BI4	0.776	4.278	0.036	24.500	1.960		
PE1	0.791	4.274	0.036	23.700	1.850		
PE2	0.808	4.039	0.035	25.000	2.080		
PE3	0.886	4.130	0.021	48.200	2.750		
PE4	0.840	4.176	0.028	33.400	2.190		
PU1	0.828	4.130	0.031	29.400	2.200		
PU2	0.790	4.274	0.038	21.300	1.910		
PU3	0.843	4.198	0.022	42.400	2.300		
PU4	0.863	4.251	0.023	41.700	2.490		
OC1	0.808	4.282	0.034	26.800	1.960		
OC2	0.806	4.289	0.032	28.700	1.880		
OC3	0.776	4.365	0.039	22.700	1.740		
OC4	0.804	4.309	0.037	23.400	1.990		
HO1	0.786	4.275	0.037	24.900	1.760		
HO2	0.817	4.240	0.032	28.200	2.060		
HO3	0.819	4.384	0.033	27.500	2.020		
HO4	0.840	4.426	0.032	28.800	2.220		

reflects how much variation exists from the mean, indicating the spread of the data distribution. Factor loadings represent the degree of correlation between the variables and the identified factors. According to Hair Jr et al.,[32] factor loadings should ideally be above 0.708 for a well-fitting model, and items with loadings between 0.4 and 0.7 should be reconsidered. This study's factor loadings ranged from 0.776 to 0.886, indicating a robust model fit. VIF values are essential for identifying multicollinearity among the independent variables. To avoid multicollinearity issues, VIF values should be below 3.3.[30] The VIF values in this study ranged from 1.690 to 2.750, indicating no multicollinearity concerns.

The model fit values show that the SRMR is 0.056, and the NFI is 0.792, suggesting the model fits well. The SRMR

Table 5. Regression and mediation results.

Hypothesis	Path coefficients (PC)	SD	*T*-statistics	*P*-values	Supported
Ho1	0.382	0.087	3.88	0.000	Yes
Ho2	0.351	0.082	2.724	0.005	yes
Ho3	0.576	0.083	5.863	0.000	Yes
Ho4	0.364	0.081	3.251	0.002	Yes
Ho5	0.482	0.089	3.68	0.000	Yes
Ho6	0.371	0.086	3.144	0.001	yes
Ho7	0.486	0.088	5.874	0.000	Yes
Ho8	0.364	0.086	3.557	0.000	Yes

measures the discrepancy between observed and predicted correlations, with values closer to 0 indicating a better fit. The NFI compares the χ^2 value of the model to that of the null model, with values closer to 1 indicating a better fit.[35]

The regression and mediation results in Table 5 indicate significant positive effects of AI and big data analytics on healthcare outcomes. For instance, AI adoption applications (path coefficient [PC] = 0.382, $p < 0.000$) and big data analytics adoption (PC = 0.351, $p < 0.005$) significantly influence healthcare outcomes, supporting hypotheses H1 and H2. Perceived ease of use (PC = 0.576, $p < 0.000$) and perceived usefulness (PC = 0.364, $p < 0.002$) significantly mediate these relationships, affirming hypotheses H3 and H4. Organizational capabilities (PC = 0.486, $p < 0.000$) also play a significant mediating role, supporting H7 and H8. These findings underscore the importance of these advanced technologies and organizational factors in enhancing healthcare outcomes in Jordanian healthcare institutions.

Discussion

This study provides significant insights into the role of AI and big data analytics in driving healthcare advancements within Jordanian institutions. The findings underscore the value of these technologies in improving healthcare delivery, particularly in enhancing patient care and operational efficiency. In line with the journal's focus on the digital healthcare revolution, this research highlights how AI and big data are reshaping the healthcare landscape in Jordan, contributing to more efficient healthcare systems and improved patient outcomes. The data revealed a positive relationship between AI adoption and healthcare outcomes, supporting H1. AI technologies enhance diagnostic accuracy, enabling healthcare professionals to detect diseases earlier and provide more personalized treatment plans. This aligns with global research recognizing AI as a transformative tool for improving clinical decision-making and patient care.[4, 5, 36] In the context of Jordan, where healthcare institutions face resource allocation and patient care management challenges, AI offers valuable solutions for optimizing medical services, particularly in specialized areas like diagnostics.

However, the anticipated varying influence of AI across different healthcare processes was not supported, leading to the rejection of H2. Unlike previous studies that found AI's impact to differ across various healthcare applications, this study suggests that AI's effect may be more consistent across clinical and operational processes.[37] This could indicate that AI in Jordanian healthcare is more standardized, focused primarily on diagnostics and treatment planning rather than administrative or operational areas. This finding points to the need for further research to explore how AI can be more effectively utilized across different facets of healthcare beyond diagnostics. Big data analytics adoption significantly positively affected healthcare outcomes, supporting H3. Big data enables healthcare providers to make data-driven decisions that improve patient care and operational efficiency. For example, hospitals can identify trends that inform better patient management and resource allocation by analyzing large datasets. This finding echoes the conclusions of earlier studies[3, 8] and reinforces the notion that big data is crucial in creating more responsive and efficient healthcare systems. In Jordan, where healthcare institutions are increasingly digitizing their operations, big data can be pivotal in optimizing healthcare delivery, particularly by identifying patient needs and streamlining hospital workflows.

The study also highlighted the importance of organizational capabilities in facilitating the adoption of AI and big data analytics, affirming H4. Institutions with strong

infrastructure, skilled personnel, and leadership support are better positioned to implement these technologies effectively. This finding is consistent with the RBV, which emphasizes that organizations with superior resources and capabilities are more likely to gain a competitive advantage.[17] For Jordanian healthcare institutions, investing in organizational readiness, such as training healthcare staff and upgrading technological infrastructure, is critical to fully realizing the potential of AI and big data.

This study's findings align closely with the growing global discourse on the digital healthcare revolution. AI and big data are not just tools for improving operational efficiency; they are catalysts for transforming healthcare systems, particularly in regions like Jordan, embracing technological innovation to overcome healthcare challenges. AI's ability to enhance diagnostic precision and big data's role in predictive analytics create opportunities for Jordanian healthcare institutions to leap forward regarding healthcare delivery. For example, AI-driven diagnostic tools can help healthcare providers deliver more precise, timely care, reducing the burden on an overstretched system. Big data analytics, on the other hand, enables hospitals to predict patient admission rates and optimize resource allocation, leading to better patient care and reduced operational inefficiencies. Together, these technologies are pushing Jordanian healthcare institutions toward a more data-driven, patient-centered model of care, which is at the heart of the digital healthcare revolution.

Contributions and implications

This study makes several significant contributions to both theory and practice. First, it enriches the literature on AI and big data analytics in healthcare by focusing on their specific impact on the Jordanian healthcare system. While previous research has highlighted the general benefits of these technologies,[6, 7, 38–42] this study provides a more nuanced understanding of how AI and big data influence healthcare delivery and patient care in a developing context. This regional focus offers valuable insights into the role of these technologies in healthcare systems that have been underexplored, particularly in the Middle East. Second, the study emphasizes the importance of perceived ease of use and perceived usefulness as critical factors in adopting AI and big data technologies. The findings demonstrate that these perceptions significantly mediate the successful implementation of these technologies, aligning with the TAM.[15] This underscores the need for healthcare technology developers to create intuitive and valuable tools that healthcare professionals can easily integrate into their workflows, ensuring higher adoption rates and more effective utilization. Third, the research highlights the vital role of organizational capabilities—including infrastructure, skilled personnel, and management support—in driving the adoption and impact of AI and big data analytics. The study, grounded in the RBV,[17] suggests that healthcare institutions with strong organizational resources are better positioned to leverage these technologies to improve patient outcomes. This insight provides a practical roadmap for healthcare institutions to focus on building internal capacities that enable effective technology adoption.

Furthermore, the study proposes a comprehensive model integrating AI adoption, big data analytics, perceived ease of use, perceived usefulness, and organizational capabilities, offering a framework for future research. This model is a foundation for further academic inquiry and provides practical guidance for healthcare administrators and policymakers seeking to enhance healthcare delivery through advanced technologies.

Practical implications

This study offers several practical implications for Jordan's healthcare administrators, policymakers, and industry stakeholders. First, the apparent positive impact of AI and big data analytics on healthcare outcomes suggests that healthcare institutions should prioritize investments in these technologies to enhance operational efficiency and patient care. By leveraging AI, healthcare providers can deliver more accurate diagnostics and personalized treatment plans, leading to better patient outcomes and increased satisfaction. Second, the findings underscore the importance of designing user-friendly and valuable tools to facilitate the adoption of these technologies. Developers should focus on creating intuitive systems that healthcare professionals can easily incorporate into their daily practices, ensuring that the potential benefits of AI and big data analytics are fully realized.

Third, organizational capabilities are critical in ensuring the adoption and use of AI and big data analytics. Healthcare institutions must invest in robust infrastructure, provide comprehensive staff training, and maintain strong management support. By enhancing these internal capabilities, organizations can maximize the potential of these technologies to improve healthcare delivery. Lastly, policymakers have a key role in fostering the adoption of AI and big data analytics across the healthcare sector. They can create an environment that facilitates technological advancements by allocating resources, encouraging innovation, and supporting training programs. Such support will strengthen Jordan's healthcare system, making it more adaptive and capable of leveraging cutting-edge technologies. The findings of this study offer meaningful contributions to both theory and practice. The results suggest that investing in AI and big data technologies can substantially improve patient care and operational efficiency for healthcare institutions. However, these benefits depend on organizational solid capabilities, such as well-trained staff and adequate infrastructure, to support the adoption of these technologies.

From a theoretical perspective, this study expands the literature on AI and big data adoption in healthcare, particularly in the Middle East, where research on these technologies has been limited. The study calls for further research into the specific applications of AI and big data beyond diagnostics, particularly in administrative and operational processes, to understand their potential in healthcare fully. Additionally, future research should investigate the long-term impact of big data analytics on healthcare delivery, especially in resource-constrained settings like Jordan. Understanding these technologies' sustainability and continued influence will provide crucial insights for optimizing their use and guiding future technological and policy developments in healthcare.

Study limitations and future research

While this study provides valuable insights, it has several limitations that should be addressed in future research. Firstly, the focus on Jordanian healthcare institutions may limit the generalizability of the findings to other contexts. Future research should consider replicating this study in different countries and cultural settings to validate the results. Secondly, the study used a convenient sampling method, which may introduce bias and affect the sample's representativeness. Future studies should employ rigorous sampling methods to ensure a more representative sample. Thirdly, this study primarily focused on the impact of AI and big data analytics on healthcare outcomes. Future research could explore other factors influencing healthcare delivery, such as the role of traditional healthcare practices, economic conditions, and environmental factors.

Additionally, while this study examined the direct and mediating effects of AI and big data analytics, future research could explore the moderating effects of variables such as healthcare professionals' demographics, experience, and cultural background. This could provide a more nuanced understanding of how different factors interact to influence healthcare outcomes. Lastly, the rapid evolution of AI and digital technologies means that the findings of this study need to be updated frequently. Future research should continue to monitor and analyze the impact of emerging technologies on healthcare delivery to provide up-to-date insights and recommendations for industry stakeholders.

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Appendix 1 Regression and mediation results.

Variables	Code	Questions/measures	References
AI adoption (AI)	AI1	AI technologies are extensively used for diagnostic purposes in my healthcare institution.	Davenport and Glaser (2022); Roppelt et al. (2023); Mouloudj et al. (2024); Aldwean and Tenney (2024)
	AI2	AI applications are used to personalize patient treatment plans in my institution.	
	AI3	AI technologies are employed for predictive analytics to foresee patient health outcomes.	
	AI4	AI-driven decision support systems are utilized to aid clinical decision-making.	
Big data analytics adoption (BI)	BI1	Big data analytics are used to predict patient outcomes in my healthcare institution.	Edu and Agozie, (2022); Al Teneiji, et al. (2024); Ghaleb et al., (2024); Bani-Salameh et al. (2021)
	BI2	Big data analytics are employed to optimize resource allocation in my institution.	
	BI3	Big data analytics help identify trends and patterns in patient data for better management.	
	BI4	Big data analytics monitor and improve healthcare processes in real time.	
Perceived ease of use (PE)	PE1	Learning to operate big data analytics tools is easy for me.	Adeghe et al. (2024); Niñerola et al. (2021); Aljameel et al. (2021)
	PE2	AI technologies are easy to use in my daily healthcare tasks.	
	PE3	Big data analytics tools are user-friendly in my healthcare institution.	
	PE4	I find it easy to become skillful at using AI technologies.	
Perceived Usefulness (PU)	PU1	AI technologies improve my job performance in healthcare	Raghupathi and Raghupathi (2014); Adeghe et al. (2024); Giorgio Solfa et al. (2023)
	PU2	Big data analytics enhance my efficiency in patient care.	
	PU3	AI technologies make it easier to provide high-quality patient care.	
	PU4	Big data analytics provide valuable insights that improve healthcare outcomes.	
Organizational capabilities (OC)	OC1	Our organization has the necessary infrastructure to support AI technologies.	Elgendy and Elragal (2014); Davenport and Kalakota (2019); Del Giorgio Solfa et al. (2023)
	OC2	Our organization invests in training staff to use AI and big data analytics effectively.	
	OC3	There is strong management support for implementing AI technologies in my organization.	
	OC4	Our organization can handle and analyze large datasets.	

(continued)

Continued.

Variables	Code	Questions/measures	References
Healthcare outcomes (H)	HO1	The use of AI technologies has improved patient care in my healthcare institution.	Raghupathi and Raghupathi (2014); Del Giorgio Solfa et al. (2023)
	HO2	Big data analytics have enhanced the operational efficiency of my institution.	
	HO3	AI technologies have led to better patient satisfaction in my institution.	
	HO4	Big data analytics have reduced the occurrence of medical errors in my institution.	