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Artificial Intelligence in Hospital and Healthcare Management: A Systematic Review of Applications and Challenges

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Abstract

The advancement of information technology and integration Artificial intelligence (AI) in business enhances the performance, accuracy and transparency. Healthcare sector is the one which benefiting more from the use of AI in clinical practice but also in hospital administration, health care operations, decision-making, human resource management, patient services and organisational strategy. A significant attention has been given to the clinical applications of AI, its implications for hospital and health care management requires greater systematic examination from a managerial perspective. The present study systematically reviews the existing literature on the application of AI in hospital and healthcare management, with a particular emphasis on organisational challenges and strategic implications. The reviews examine the use of AI in areas such as hospital operations, resource allocation, workforce management, patient relationship management, service delivery, administrative decision making using predictive analytics, financial management and quality improvement. The study further identifies organisational challenges associated with AI adoption, including technological infrastructure, data quality and governance, employee readiness, skill requirements, organisational resistance, implementation costs, privacy and accountability, transparency and ethical concerns. The present study also focuses on the problems associated with the adoption of AI in healthcare management which includes quality governance, employee readiness, skill requirements, and ethical concerns. It is observed that the AI can support organisations in improving operational efficiency, optimizing resource allocation, strengthening decision making skills, enhancing the performance. It is suggested that successful adoption not only depends on the technological capability but also on organisational readiness, leadership support, employee competencies, appropriate governing mechanism, strategic mapping. The study concluded that AI should be viewed as a strategic management resource rather than merely a technological or clinical intervention.

Keywords: Artificial Intelligence; Healthcare Management; Hospital Administration; Decision Making; Strategic Planning and Healthcare Services

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Abbreviations

WHO: World Health Organization; ML: Machine Learning; AI: Artificial Intelligence; DCT: Dynamic Capabilities theory; RBM: Risk Based Management; TOE: Technology Organization Environment.

Introduction

According to World Health Organization (WHO) reports, there will be a global shortage of health workers numbering in the millions over the coming decade. Due to the aging population, the number of people aged 60 and above is set to double by 2050. With the increase in population there is an increase in chronic diseases, ageing population, increase in the cost of hospital administration, disparities in access to quality healthcare, and limited access to care. Current challenges in the health sector are not limited to any single country or region. This chronic disease requires long term treatment, repeated hospital visits and systematic planning. We know that there is a shortage in doctors and most of the times doctors time in spent on entering the data into the systems, understand the large data bases from patient's health records, disease status, hospital visits, medication and other related. As long as the increase in diseased patients there is significant gap in healthcare demand and supply. The increase in these aspects necessitated the hospitals to adopt to new technologies to enhance the performance, maintain the patient data and timely delivery of healthcare. Technological adoption only reduces the burden of human activities and interference Ex. Diagnostic. The advancement and adoption of Artificial Intelligence and machine learning are the advanced technologies further increased the performance, optimize utilization of resources and better decision making by integrating all the aspects of health care. AI has its intrinsic ability to collects data from number of sources, learn and evolve over time, provide accurate predictions and becomes the most intelligent and suited to the present healthcare systems. AI potential is particularly offering improvement in areas such as diagnostics, personalised treatment pathways, operational efficiency and patient outcomes. Technological advancement like machine learning (ML) and natural language processing (NLP) are leading this transformation, enabling the extraction of valuable insights from both structured data, such as medical imaging, and unstructured data, including clinical notes and research papers.

Review of Literature & Theoretical Foundation

Agnihotri and Pandit, in their study titled "An Overview of the Application of Artificial Intelligence in Hospital Management in India: Impact, Challenges, and Future Potential," examined the applications and challenges of AI in Indian hospital management, particularly during the COVID-19 pandemic. The study highlighted AI's potential in predicting health threats, identifying COVID-19 hotspots, and improving healthcare management. However, the lack of comprehensive data was identified as a major barrier to effective implementation. The study emphasized the potential of AI in India while highlighting the challenges associated with its adoption.

Ali O, et al. [1], in their study titled "A Systematic Literature Review of Artificial Intelligence in the Healthcare Sector: Benefits, Challenges, Methodologies, and Functionalities," examined AI applications through a systematic review of 1,988 initially identified articles, of which 180 were selected for detailed analysis. The findings indicated that AI can improve diagnostic accuracy, operational efficiency, treatment planning, patient consultation, and health monitoring. The authors also highlighted concerns relating to data privacy, security, and ethical implementation. The study provided a classification framework for understanding AI benefits and challenges, but further research is needed to examine its implications for hospital administration and strategic management.

Abdelmohsen and Al-Jabri, in their study titled "Artificial Intelligence Applications in Healthcare: A Systematic Review of Their Impact on Nursing Practice and Patient Outcomes," examined the impact of AI on nursing efficiency and patient care. Following PRISMA guidelines, the authors reviewed literature identified through PubMed, Google Scholar, and Web of Science. Their findings indicated that machine learning, natural language processing, and robotic process automation could improve diagnostic accuracy, clinical documentation, patient safety, and operational efficiency. However, data privacy, workflow integration, and methodological inconsistencies remained important challenges. The study primarily focused on nursing practice and patient outcomes, leaving scope for further investigation into hospital-wide organizational and managerial implications.

Mohajer-Bastami in their study titled "Artificial Intelligence in Healthcare: Applications, Challenges, and Future Directions: A Narrative Review Informed by International, Multidisciplinary Expertise," examined AI applications across medical and surgical specialties, allied health professions, and biomedical research. The review highlighted applications in diagnosis, surgical navigation, risk prediction, personalized medicine, drug discovery, and clinical research. Major challenges included algorithmic bias, limited interpretability, legal uncertainties, and unequal access to AI technologies. The authors emphasized clinical validation, responsible implementation, effective regulation, and digital education. However, further attention is required

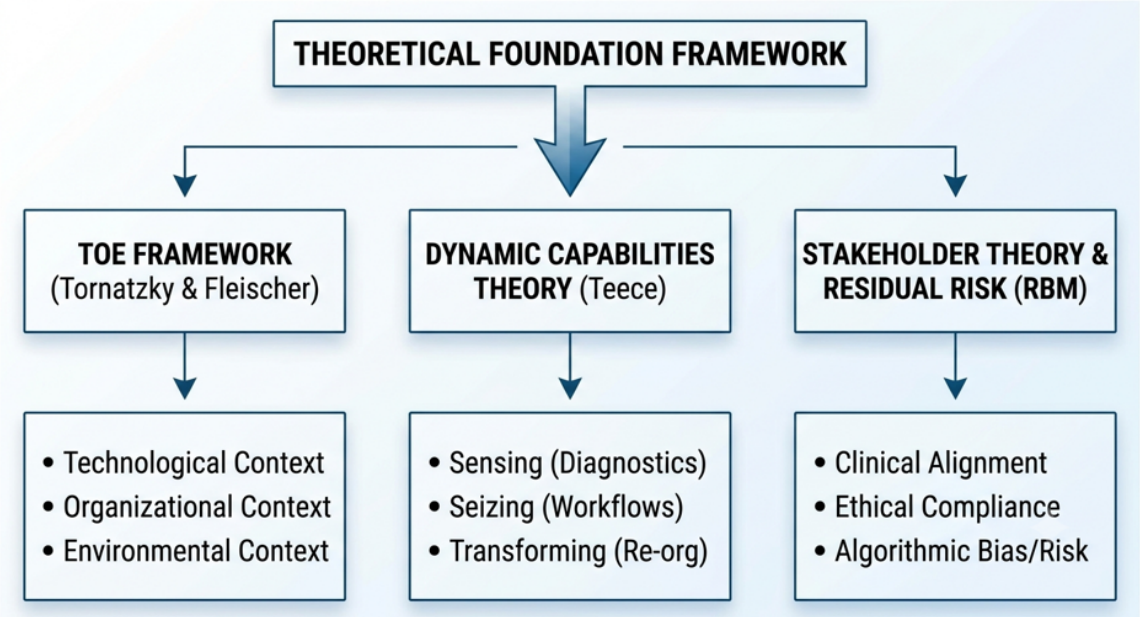
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to understand the organizational and strategic implications of AI adoption in hospital management.

Lanfranchi G, et al. [2], in their study titled "Artificial Intelligence Adoption in Healthcare: A Systematic Review of Implementation Challenges and Health Services Implications," examined the technological, organizational, economic, regulatory, and professional factors influencing AI adoption in healthcare. The study highlighted organizational readiness, data privacy, infrastructure limitations, professional autonomy, and coordination between clinical and IT specialists as significant implementation challenges. The authors developed an integrative framework connecting external conditions with internal organizational and user readiness. The review emphasized interdisciplinary collaboration, institutional preparedness, and strategic planning to support successful AI implementation. Nevertheless, further research can examine how these factors influence AI adoption across specific hospital management functions and healthcare institutions.

Theoretical Foundation

To systematically analyse the deployment, operational integration, and organisational implications of Artificial Intelligence (AI) in Healthcare management, this study grounds its analysis in three complementary theoretical lenses.



Research Gap

The reviewed studies demonstrate that artificial intelligence has considerable potential to improve healthcare delivery, diagnostic accuracy, patient management, and operational efficiency. However, the literature also identifies persistent barriers involving data privacy, technological infrastructure, organizational readiness, professional acceptance, and regulatory compliance.

The key research gap is the limited integrated understanding of how AI applications, organizational challenges, and strategic management considerations interact across hospital and healthcare management functions. The present study addresses this gap by systematically synthesizing existing evidence on AI applications, organizational barriers, and strategic implications for healthcare institutions [3].

Technology-Organization-Environment (TOE) Framework

(The Technology–Organization–Environment Frame work, 2011) is a prominent model developed to assess organisations' technology readiness and adoption capabilities to sustain in a competitive environment. Developed by Tornatzky and Fleischer (1990), this model provides a framework for evaluating how healthcare enterprises assimilate complex technological innovations. In the present study, we focus on how healthcare enterprises assimilate complex technological innovations to achieve organisational and societal goals.

The main pillars of TOE Technological Context, Organisational Context, and Environmental Context in hospitals focus on factors such as AI compatibility, data

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quality, technological infrastructure, and perceived benefits. In contrast, organisational context centers on management support, organisational readiness, employee capabilities, and resource availability. The environmental perspective includes regulatory norms, competitive pressures, healthcare policies and external technological capabilities. Keeping in view of all these things TOE and AI in healthcare focuses adoption of AI helps organisations capabilities, organisational preparedness and environmental conditions collectively influence the implementation and effective use of AI in hospital and healthcare management [4].

Dynamic Capabilities Theory (DCT) Provides

Dynamic Capabilities theory (DCT) provides a strategic perspective for understanding how hospitals develop and reconfigure their resources and capabilities in response to changing technological advancements. For hospitals, AI offers significant opportunities that, with appropriate investment and implementation strategies, can transform or reconfigure existing processes. DCT helps not only with adoption but also with how hospitals translate AI capabilities into improved managerial processes, innovation, operational efficiency, and long-term organisational performance (Teece, 1997) & (Teece D. J., 2007) .

Dynamic capabilities theory includes sensing, seizing, and transforming, which help organisations identify emerging opportunities, mobilise resources to capture them, and reconfigure existing resources and processes in response to technological and environmental changes.

Sensing: The meaning of sensing is predicting something in advance. In line with the above, AI uses predictive analytics and real-time healthcare data to identify emerging patient needs, changes in patient demand and disease trends, resource constraints, and operational bottlenecks.

Seizing: Leveraging AI-enabled decision-support systems to allocate healthcare resources, optimize workforce and infrastructure, improve patient flow, and support timely managerial and clinical decisions.

Transforming (Reconfiguring): Redesigning hospital workflows, administrative processes, workforce capabilities, and service delivery models by integrating AI with existing organizational practices and developing effective human–AI collaboration.

Stakeholder Theory and Risk- Based Management (RBM)

To address organizational resistance and ethical governance, Freeman's (1984) Stakeholder Theory is integrated alongside Risk-Based Management paradigms. Hospital AI deployment directly impacts heterogeneous stakeholders—clinicians, administrators, patients, IT engineers, and regulatory bodies—each possessing distinct, often conflicting performance metrics and risk tolerances [5].

AI Applications in Healthcare

Diagnostic & Imaging Intelligence: Machine Learning (ML) and Deep Learning (DL) architectures—particularly Convolutional Neural Networks (CNNs)—have achieved clinician-grade performance across radiology, pathology, and oncology screening. Research highlights AI's ability to reduce false-negative rates and accelerate triage in high-throughput departments.

Clinical Decision Support Systems (CDSS): Natural Language Processing (NLP) models extract unstructured patient narrative data from Electronic Health Records (EHRs) to flag early sepsis markers, predict 30-day readmission risks, and personalize pharmacotherapy regimens.

Operational & Resource Optimization: Operational AI applications utilize predictive analytics for bed capacity management, operating theater scheduling, emergency department length-of-stay forecasting, and nurse rota planning. Studies confirm that AI-driven queue management reduces non-clinical waiting times and improves resource utilization rates.

Disease Progression Prediction: AI algorithms analyse patient medical histories, diagnostic reports, and clinical records to predict disease progression and identify potential complications. These predictions support early intervention, personalised treatment planning, and improved patient monitoring.

Patient Admission Forecasting: AI-based predictive models estimate future patient admissions by analysing historical hospital records, seasonal trends, and healthcare demand. These forecasts help hospital administrators plan bed availability, staff deployment, medical supplies, and emergency services.

Hospital Readmission Risk Assessment: AI systems identify patients who may be at risk of readmission by examining previous hospitalisations, medical conditions, treatment histories, and discharge records. This information supports discharge planning, follow-up care, and continuity of healthcare services.

Resource Allocation and Operational Planning: Predictive analytics helps hospitals anticipate resource requirements, optimise staff schedules, manage bed occupancy, and improve patient flow. These applications can reduce operational inefficiencies and support the effective utilisation of available resources.

Evidence-Based Managerial Decision-Making: AI-generated predictive insights support hospital administrators in budgeting, performance evaluation, capacity planning, and strategic resource allocation. Integrating predictive analytics

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into management practices can strengthen institutional preparedness and improve the quality of administrative decisions.

Organizational Challenges & Implementation Barriers

Despite technical efficacy, institutional integration remains constrained by socio-technical friction:

Interoperability and Data Fragmentation: Legacy health informatics architectures lack standardized data formats, creating data silos that impede real-time AI inference.

Algorithmic Transparency & The "Black Box" Problem: Clinician skepticism remains a major barrier. Deep neural networks often lack explainability (XAI), creating clinical hesitation due to liability concerns, opaque reasoning pathways, and potential automated bias.

Change Resistance & Cultural Realignment: Medical professionals frequently express anxiety over professional autonomy degradation, workflow disruption, and administrative overhead associated with verifying AI recommendations.

Strategic, Ethical, and Policy Implications

Liability and Governance Frameworks: Current regulatory architectures struggle to demarcate malpractice liability between algorithm vendors, healthcare institutions, and attending physicians when AI recommendations yield adverse outcomes.

Data Security and Privacy Safeguards: Continuous model retraining requires massive datasets, creating tension with patient privacy mandates (e.g., HIPAA, GDPR). Techniques such as Federated Learning (FL) and differential privacy are emerging as technical solutions to secure cross-institutional collaboration.

Equity and Algorithmic Bias: Studies highlight that AI models trained on unrepresentative historical demographics risk perpetuating or exacerbating health disparities across marginalized populations.

Synthesis and Research Gap Identification

While the literature extensively documents localized algorithmic accuracy (e.g., diagnostic model performance), critical gaps persist (Table1 and 2):

Research Axis	Current Literature Focus	Identified Research Gap (This Review Addresses)
Scope of Study	Clinical diagnostic capabilities (Radiology/Pathology)	Holistic integration across hospital operational and managerial decision structures.
Theoretical Rigor	Empirical, descriptive case studies lacking structural grounding	Multi-theoretical synthesis evaluating technological, dynamic capability, and governance dimensions concurrently.
Implementation	Technical feasibility and isolated pilot validations	Enterprise-wide scalability, workflow realignment, and organizational friction metrics.

Table 1: Comparison of current literature and the research gaps addressed by this review regarding AI integration in healthcare, focusing on scope, theoretical rigor, and implementation.

Artificial Intelligence in Hospital and Healthcare Management: A Systematic Review of Applications, Organizational Challenges, and Strategic Implications

S. No.	Dimensions	Mean	t-value	Df	Sig. (2-tailed)	95% CI Lower	95% CI Upper
1	AI Applications in Clinical Management	3.7218	90.372	513	<0.001	3.6409	3.8027
2	Hospital Administrative Management	3.4086	73.818	513	<0.001	3.3178	3.4993
3	Operational Efficiency	3.3969	73.511	513	<0.001	3.3061	3.4877
4	Healthcare Service Quality	3.179	76.484	513	<0.001	3.0973	3.2606
5	Predictive Analytics and Decision-Making	2.0759	44.725	513	<0.001	1.9847	2.1671
6	Organizational Readiness	3.1712	75.848	513	<0.001	3.0891	3.2533

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7	Workforce and Professional Challenges	3.7354	163.273	513	<0.001	3.6905	3.7804
8	Data Privacy and Cybersecurity	3.9222	126.152	513	<0.001	3.8611	3.9833
9	Technological and Implementation Challenges	3.7685	127.751	513	<0.001	3.7105	3.8264
10	Strategic Management Implications	3.251	85.121	513	<0.001	3.1759	3.326
11	Governance and Regulatory Compliance	3.7471	130.582	513	<0.001	3.6907	3.8035

Table 2: One-sample t-test results showing mean scores, statistical significance, and 95% confidence intervals for dimensions of AI integration in healthcare management (df = 513; $p < 0.001$).
Source: Primary data; SPSS output.
Note: Sample size (N) = 514; test value = 0; df = 513. The reported significance value of .000 in SPSS is presented as $p < 0.001$.

The above table presents the one-sample t-test results for AI applications in hospital and healthcare management, organizational challenges, and strategic implications, based on 514 observations. The results indicate that all eleven dimensions have statistically significant mean scores, with $p < 0.001$. Among the dimensions, Data Privacy and Cybersecurity recorded the highest mean score (3.9222), followed by Technological and Implementation Challenges (3.7685), Governance and Regulatory Compliance (3.7471), and Workforce and Professional Challenges (3.7354). These findings highlight the importance of data protection, technological infrastructure, regulatory compliance, and workforce-related issues in AI implementation.

Regarding applications, AI Applications in Clinical Management recorded a mean score of 3.7218, indicating a comparatively high score for the clinical application dimension. Hospital Administrative Management (3.4086), Operational Efficiency (3.3969), and Healthcare Service Quality (3.1790) also recorded positive mean scores. However, Predictive Analytics and Decision-Making registered the lowest mean score (2.0759), suggesting comparatively lower ratings for this dimension. Organizational Readiness (3.1712) and Strategic Management Implications (3.2510) indicate the relevance of institutional preparedness and strategic planning for successful AI adoption. The 95% confidence intervals for all dimensions remain above zero, consistent with the statistically significant test results. Overall, the findings emphasize the potential applications of AI in healthcare management while highlighting the need to address organizational, technological, professional, and regulatory challenges [6].

Conclusion

Artificial Intelligence (AI) is emerging as an important technological and strategic tool in hospital and healthcare management. The systematic review highlights its applications in clinical management, hospital administration, predictive analytics, operational efficiency, and healthcare service quality. AI can support disease prediction, patient admission forecasting, readmission risk assessment, resource allocation, and evidence-based managerial decision-making. These applications offer opportunities to improve healthcare delivery, strengthen institutional performance, and enhance the utilisation of available resources.

However, the adoption of AI presents significant organizational challenges, including data privacy and cybersecurity risks, high implementation costs, technological integration difficulties, workforce skill gaps, and regulatory concerns. The review also emphasizes the importance of organizational readiness, employee training, transparent decision-making, and ethical governance in ensuring effective implementation. Addressing these challenges requires sustained investment in digital infrastructure, capacity building, data management, and appropriate regulatory mechanisms.

The strategic implications of AI extend beyond automation to include institutional planning, service innovation, operational improvement, and sustainable healthcare development. Healthcare organizations should therefore adopt a balanced approach that integrates AI capabilities with professional expertise, managerial judgement, and patient-centred values. The successful integration of AI in hospital and healthcare management ultimately depends not only on technological advancement but also on organizational preparedness, responsible governance, and the ability to translate AI-generated insights into meaningful improvements in healthcare services.

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