DISSERTATION

at

IIHMR, Delhi

(Feb 15th to May 15th)

On the topic

"A Literature Review on the Role of Artificial Intelligence for Hospitals in India: Applications, Challenges, and Future Directions"

A Report

By

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PG/22/113

Under the guidance of

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PGDM (Hospital and Health Management)

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International Institute of Health Management Research, New Delhi

CERTIFICATE OF APPROVAL

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The following dissertation titled **"A Literature Review on the Role of Artificial Intelligence for Hospitals in India: Applications, Challenges, and Future Directions"** at **"IIHMR, Delhi"** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed, or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

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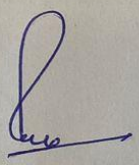

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I consider myself fortunate to have been allowed to undergo my Dissertation on the project **"A Literature Review on the Role of Artificial Intelligence for Hospitals in India: Applications, Challenges, and Future Directions"** under IIHMR. I want to extend my thanks to everyone who has helped me with this task.

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ABBREVIATIONS

S.NO.	ABBREVIATIONS	FULL FORM
1.	**AI**	Artificial Intelligence
2.	**ML**	Machine Learning
3.	**PRISMA**	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
4.	**MeSH**	Medical Subject Headings
5.	**NLP**	Natural Language Processing
6.	**EHR**	Electronic Health Records
7.	**XAI**	Explainable AI

ABOUT ORGANISATION

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Adjunct professor Dr Sutapa B Neogi is a public health specialist actively engaged in research and teaching at Indian Institute of Public Health- Delhi (IIPHD), Public Health Foundation of India (PHFI). An MBBS from Nil Ratan Sircar Medical College, Calcutta and MD in Community Medicine from Post Graduate Institute of Medical education and Research (PGIMER), Chandigarh, and Diplomate of National Board (DNB) in Maternal and Child Health, she has excellent academic credentials. She received the 'Kataria Memorial Gold Medal' for being the best outgoing student of PGIMER, Chandigarh. She has rich experience in public health and is particularly interested in implementation of projects that is relevant to national policies and programmes. She has authored several research papers and is a reviewer of many national and international journals. She is an associate Editor of BMC Pregnancy and Childbirth. She offers her technical services to various academic and research bodies in the country. Her goal is to mentor students who

can be change agents in future, those who can see through problems, explore them scientifically, be a link between disciplines (eg engineering and medicine, social science and medicine), generate synergy between research and programs and promote interdisciplinary research in the country by leading and being a part of an able team.

"A Literature Review on the Role of Artificial Intelligence for Hospitals in India: Applications, Challenges, and Future Directions"

ABSTRACT

Objectives

- To understand the applications of AI in the hospital sector in improving access, quality, and affordability.
- To analyze the challenges in implementing AI based applications in the hospital sector and how it can be improved.
- To discuss the prospects of AI in the hospital sector in India.

Research Question: What is the Scope of AI in hospital, and what are the challenges to implementing AI-based solutions in India's hospital sector?

Introduction

The sciences of artificial intelligence (AI) and machine learning (ML) are advancing rapidly in many industries, including healthcare. Artificial intelligence (AI) technologies, such as machine learning, natural language processing, and predictive analytics, are revolutionizing healthcare by helping with diagnosis, tailoring treatments, keeping an eye on patients, streamlining hospital operations, and improving public health(1). This study will focus on the role of artificial intelligence, its challenges and prospects in hospitals.

Methods

A systematic literature review was conducted with search terms 'AI' or 'ML' or 'deep learning' or 'hospital' and 'healthcare' or 'medicine' using PubMed, Research Gate and Google Scholar from 2014–2024.

Results

A total of 20 articles were included in this Literature review, selected based on the predefined eligibility criteria. These studies span various applications of AI in hospital, highlighting the challenges faced during implementation and discussing prospects. The included studies were published between 2014 and 2024 and were sourced from PubMed, ResearchGate, and Google Scholar. The primary focus areas of these studies are summarized below.

Conclusion

Through its applications, AI could revolutionize medical practitioners' workflow and patient care. It can help them by taking over administrative activities and supporting their expertise in medicine. Doctors are unclear of the potential implications of implementing AI.

AI has the potential to improve healthcare in the long run, but careful regulation—akin to that of medical behavior—is necessary. Along with additional research into the capabilities and limitations of AI's medical use, regulatory rules are required for the safe use and evaluation of this technology.

Keywords: artificial intelligence; clinical practice; deep learning; machine learning; review; system implementation, hospital.

INTRODUCTION

In the last ten years, the use of artificial intelligence (AI) in healthcare has grown significantly. AI applications have been specifically used to extract information from clinical data and support medical professionals in a variety of clinical tasks, including risk assessment, disease diagnosis, triage or screening, and surgery. The term "Artificial Intelligence" was coined by John McCarthy at an AI conference in Dartmouth College but the idea of machine that thinks dates back to ancient Greece(2). The growing capacity of artificial intelligence (AI) to convert the ambiguity and complexity of data into useful, if not perfect, clinical judgments or recommendations has the potential to revolutionize health care procedures(3).

Due to its enormous potential to increase access, quality, and affordability AI is becoming more popular. According to Accenture analysis, the market for AI health is predicted to expand at a compound annual growth rate of 40%, or $6.6 billion, by 2021. The market for health AI will expand by more than 10x2 in the next five years alone(3).

AI is already incorporated in other sectors like financial service, commerce, and science. Now, it is also being used and studied more and more in the healthcare industry. Unfortunately, the application of AI in healthcare is not widely accepted and there are barriers to its implementation(4). The development of artificial intelligence and machine learning techniques and applications is essential for improving diagnosis speed, accuracy, and ease of use in the field(5).

India is among the many countries in the world without enough qualified medical personnel to provide adequate care for their citizens. The population that is primarily underserved can benefit from healthcare services provided by emerging technologies like artificial intelligence (AI). By relieving them from routine duties related to administration, the use of cutting-edge AI solutions increases the efficiency of healthcare workers(6).

Despite potential benefits, there are several obstacles that must be overcome before AI can be fully incorporated into the healthcare industry. These include concerns about data security

and privacy, moral and legal dilemmas, interoperability and integration problems, scalability and accessibility issues, and the complexities of interacting with humans and AI(1).

The aim of this review is to highlight the applications, challenges, and prospects of AI in Healthcare.

Rationale

Understanding the applications of AI in hospital sector, identifying the challenges to its implementation in the sector and discussing its prospects. This review aims to contribute to the ongoing discussions by analysing the existing literature and identifying gaps in addressing this critical challenge.

METHODS

Search Strategy

The literature review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines(7) to identify relevant articles on AI applications, barriers and prospects in hospital that had been implemented in clinical practice with search terms 'AI' and 'hospital' or 'ML' or 'deep learning' and 'healthcare' or 'medicine' using PubMed, Research Gate and Google Scholar from 2014–2024. The initial search yielded a total of 2000 articles. After removing duplicates, 1200 articles remained. The titles and abstracts of these articles were screened for relevance, resulting in 100 articles for full-text review. Each full-text article was assessed against the inclusion and exclusion criteria, leading to the final selection of 30 articles for inclusion in the literature review.

We restricted the scope of our search to peer-reviewed journal publications written in English that were released between 2014 and 2024. We used key terms like "Artificial Intelligence", "Machine Learning", "AI in Hospital", "Hospital information management system", "AI in hospital", "AI applications", "Prospects of AI", "AI and Machine Learning", "Challenges in AI implementation", "AI implementation", "Uses of AI in Hospital".

We Utilized Boolean operators (AND, OR NOT) to refine the search and ensure relevant results. Additionally, MeSH terms (Medical Subject Headings) specific to the topic were used.

The primary objective was to identify relevant articles discussing the applications, challenges, and prospects of artificial intelligence (AI) in hospital.

Eligibility Criteria

Inclusion Criteria:

- Studies focusing on the application of AI in the hospital sector in India.

- Studies addressing the challenges in implementing AI-based applications in hospital sector in India.
- Articles discussing the prospects of AI in hospitals.
- Peer-reviewed journal publications.
- Studies published between 2014 and 2024.
- Articles written in English.

Exclusion Criteria:

- Studies not focused on AI applications in hospitals in India.
- Articles not peer-reviewed.
- Publications in languages other than English.
- Studies published before 2014.
- Articles without full-text availability.

Study Selection Process

Reviewer screened the articles in two phases:

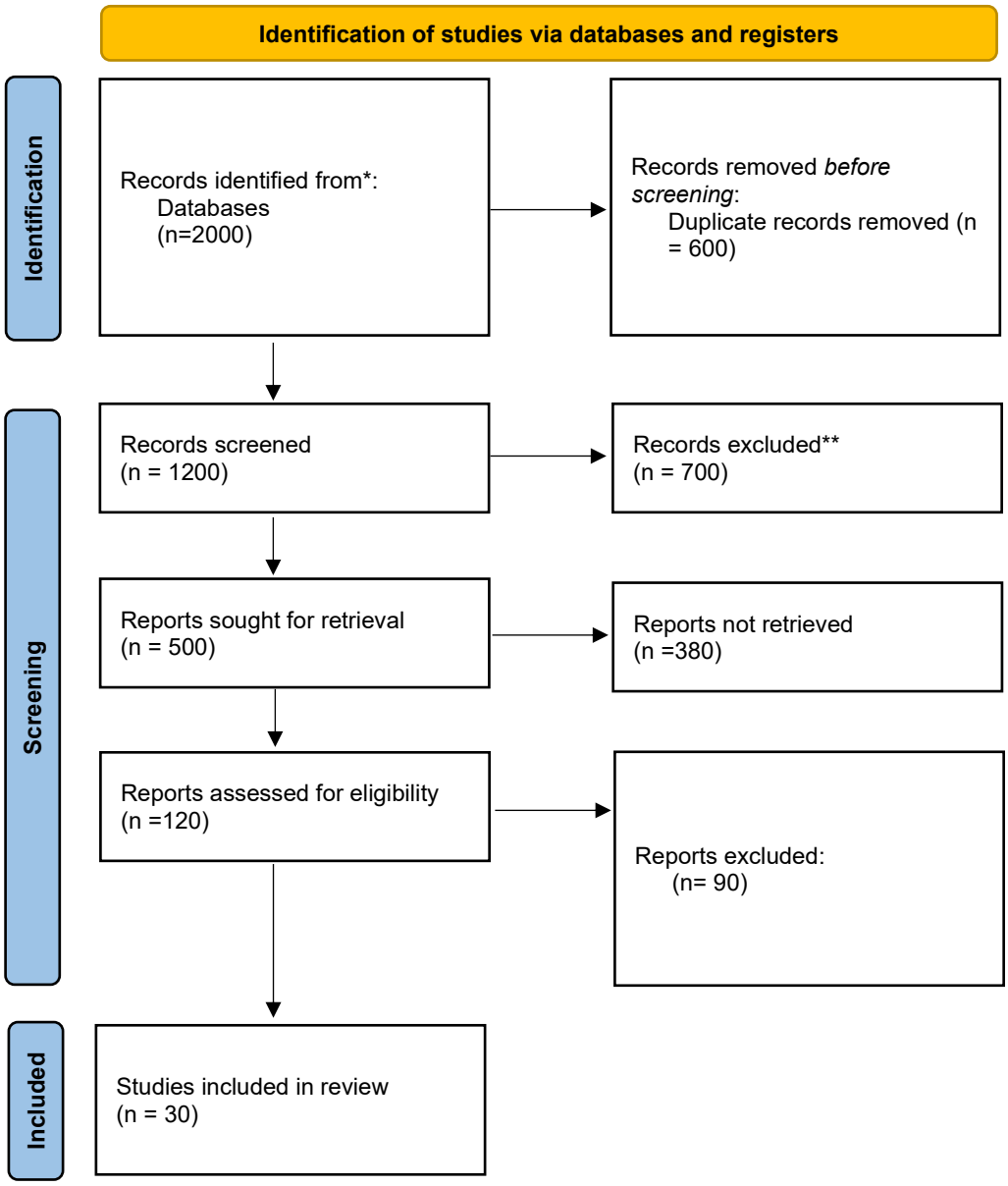
1. **Initial Screening**: The discovered publications titles and abstracts were reviewed by the reviewer to ascertain their applicability to the goals of the study. The full-text review stage was accessed by articles that, according to their titles and abstracts, satisfied the inclusion criteria. Articles highlighting applications, challenges and prospects of AI in hospital setting were accepted.

2. **Full-Text Review**: The reviewer verified the eligibility of the chosen articles by going over their complete texts. Using this research strategy, the authors retrieved 30 articles.

Study Design

This review follows a systematic approach, adhering to the PRISMA guidelines to ensure comprehensive and reproducible findings(7).

PRISMA 2020 flow diagram for Systematic review:



Data Extraction and Management

Data was extracted from the selected articles using a standardized extraction form. The form captured the following information:

- Author(s) and year of publication
- Title of the study
- Objectives of the study

- AI applications discussed
- Challenges identified
- Future directions and prospects
- Key findings and conclusions

Data Synthesis

The extracted data was synthesized to identify common themes and trends related to the applications, challenges, and future directions of AI in the hospital sector in India. The findings were grouped into three main categories:

1. Applications of AI in hospitals
2. Challenges in implementing AI-based solutions
3. Future directions and prospects for AI in the hospital sector

The synthesis aimed to provide a comprehensive overview of the current state of AI in Indian hospitals, highlighting both the potential benefits and the obstacles that need to be addressed for successful implementation.

This systematic literature review followed a rigorous and transparent process to identify, select, and analyze relevant studies on the role of AI in the hospital sector in India. By adhering to predefined eligibility criteria and employing a structured data extraction and synthesis approach, the review aimed to provide valuable insights into the applications, challenges, and future prospects of AI in enhancing healthcare delivery in India.

RESULTS

A total of 30 articles were included in this systematic review, selected based on the predefined eligibility criteria. These studies span various applications of AI in hospital, highlighting the challenges faced during implementation and discussing prospects. The included studies were published between 2014 and 2024 and were sourced from PubMed, ResearchGate, and Google Scholar. The primary focus areas of these studies are summarized below.

Applications of AI in Hospitals

Artificial intelligence (AI) is transforming the healthcare industry, particularly in hospitals, by enhancing the quality of care, improving operational efficiency, and reducing costs. Here are some of the key applications of AI in hospitals:

1. **Diagnostic Imaging and Analysis**

- Radiology: AI algorithms analyse medical images such as X-rays, MRIs, and CT scans to detect abnormalities like tumours, fractures, and other conditions with high accuracy. Tools like IBM Watson and Google's DeepMind have shown success in identifying diseases such as cancer and diabetic retinopathy.
- Pathology: AI systems assist pathologists by examining biopsy samples and identifying disease patterns that may be missed by the human eye. These systems improve diagnostic accuracy and speed.

2. **Predictive Analytics**

- Risk Stratification: AI models predict which patients are at higher risk of developing complications, allowing for early interventions. For instance, AI can forecast which patients are likely to experience readmissions, enabling preventive measures.
- Disease Prediction: AI analyses patient data to predict the onset of diseases such as heart attacks, strokes, and chronic conditions, helping in early diagnosis and timely treatment.

3. **Personalized Treatment Plans**

- Precision Medicine: AI helps in tailoring treatments to individual patients based on their genetic information, lifestyle, and other factors. This approach is especially useful in oncology, where AI can suggest personalized cancer treatment protocols.
- Pharmacogenomics: AI analyses how genetic differences affect individual responses to drugs, enabling the prescription of medications that are most effective for each patient.

4. **Robotic Surgery**

- Surgical Assistance: AI-powered robotic systems like the Da Vinci Surgical System assist surgeons in performing complex procedures with greater precision, control, and minimally invasive techniques. These systems reduce recovery times and improve surgical outcomes.

5. **Patient Monitoring and Management**

- Wearable Devices: AI analyses data from wearable health devices to monitor vital signs and detect early signs of health deterioration. This continuous monitoring is crucial for managing chronic diseases and preventing acute episodes.
- ICU Monitoring: AI systems continuously monitor patients in intensive care units, providing real-time alerts to healthcare providers about critical changes in patient conditions.

6. **Natural Language Processing (NLP)**

- Clinical Documentation: NLP tools transcribe and summarize clinical notes, reducing the administrative burden on healthcare professionals and improving the accuracy of medical records.

- Chatbots and Virtual Assistants: AI-powered chatbots assist patients with appointment scheduling, medication reminders, and answering health-related queries, enhancing patient engagement and satisfaction.

7. **Operational Efficiency**

- Resource Allocation: AI optimizes the allocation of hospital resources such as beds, staff, and equipment based on predictive models of patient inflow and demand. This ensures efficient use of resources and reduces wait times.
- Supply Chain Management: AI systems streamline the supply chain by predicting inventory needs and managing procurement processes efficiently, ensuring that hospitals are well-stocked with necessary supplies.

8. **Telemedicine and Remote Care**

- Virtual Consultations: AI enhances telemedicine platforms by providing diagnostic support and monitoring patient data, facilitating remote consultations and follow-ups.
- Remote Monitoring: AI tools enable continuous monitoring of patients with chronic conditions, providing real-time health data to healthcare providers and enabling timely interventions.

9. **Public Health Improvement**

- Epidemiology: AI models predict disease outbreaks, monitor disease spread, and assist in vaccination strategies. These tools analyze large datasets to provide actionable insights for public health interventions.
- Health Data Analysis: AI analyzes population health data to identify trends, predict future healthcare needs, and develop targeted public health policies and programs.

10. **Drug Discovery and Development**

- AI in Pharma: AI accelerates the drug discovery process by analyzing biological data to identify potential drug candidates, predict their efficacy, and optimize clinical trials.
- Clinical Trials: AI improves the design and management of clinical trials by identifying suitable participants, monitoring their health data, and analyzing trial results to speed up the development of new treatments.

By leveraging these AI applications, hospitals can enhance patient care, streamline operations, and improve overall healthcare outcomes, making significant strides towards more efficient and effective healthcare delivery.

Challenges in Implementing AI- based solutions in Hospitals

Despite the potential benefits, several challenges to the implementation of AI in healthcare were identified across the reviewed studies:

1. **Data Security and Privacy**:

   Concerns about data security and patient privacy were prevalent, with studies highlighting the need for robust data protection measures. The sensitive nature of healthcare data necessitates strict compliance with privacy regulations.(8)

2. **Moral and Legal Dilemmas**:

   Ethical issues related to AI decision-making, accountability, and patient consent were frequently discussed. The lack of clear legal frameworks for AI in healthcare poses a significant barrier to its adoption.

3. **Interoperability and Integration**:

   Integrating AI systems with existing healthcare infrastructure and EHR systems remains challenging. Studies noted issues with data standardization and the need for interoperable solutions.

4. **Scalability and Accessibility**:

   The scalability of AI solutions and their accessibility in resource-limited settings were identified as major concerns. For AI technologies to be widely adopted, fair access to them is essential.

5. **Human-AI Interaction**:

   The complexities of human-AI interaction, including the need for user-friendly interfaces and the potential for resistance from healthcare professionals, were highlighted. Training and educating healthcare providers on AI applications are essential for successful implementation.

Prospects and Future Directions of AI in Hospitals

The future of AI in healthcare appears promising, with several prospects identified in the reviewed studies:

1. **Regulation and Standardization**:

   The development of regulatory frameworks and standards for AI in healthcare is imperative. These should address ethical considerations, data security, and quality assurance.

2. **Advancements in AI Technology**:

Continued advancements in AI algorithms, particularly in deep learning and NLP, are expected to enhance the capabilities of AI in healthcare. Research into explainable AI (XAI) could improve the transparency and trustworthiness of AI systems.

3. **Collaboration and Multidisciplinary Approaches**:

   Collaboration between AI researchers, healthcare professionals, and policymakers is essential to address the challenges and harness the full potential of AI. Multidisciplinary approaches can lead to innovative solutions and more effective implementation.

4. **Focus on Real-World Applications**:

   Emphasizing real-world applications and conducting large-scale clinical trials to validate AI technologies will be crucial for their acceptance and integration into routine healthcare practice.

5. **Investment in AI Education and Training**:

   Investing in education and training programs for healthcare providers on AI technologies will facilitate their adoption. Building AI literacy among healthcare professionals can help overcome resistance and promote a culture of innovation.

DISCUSSION

The findings of this literature review highlight the transformative potential of AI in the hospital sector in India. AI applications have demonstrated significant benefits in various areas, including diagnosis and treatment support, patient monitoring, hospital operations, and public health improvement. AI technologies such as machine learning, deep learning, and natural language processing have shown promising results in enhancing diagnostic accuracy, personalizing treatment plans, and optimizing resource management. These advancements can significantly improve the quality of care, increase accessibility, and reduce healthcare costs, thereby addressing some of the critical challenges faced by the Indian healthcare system.

There are two possible benefits of AI in healthcare above human performance. Firstly, AI is more efficient than humans in learning from huge data, including isolated layers of unstructured information kept in an electronic health record. An effective AI system may quickly and effectively collect pertinent data from offline or real-time sources to support better organizational performance and real-time decision-making by physicians. Second, AI systems are more accurate at completing tasks that have been predetermined. Artificial intelligence is capable of operating continuously without experiencing performance degradation, unlike humans who experience burnout(3).

However, the implementation of AI in hospitals is fraught with challenges. Data security and privacy concerns are paramount, as the use of AI involves handling vast amounts of sensitive patient information. The lack of clear regulatory frameworks further complicates the

situation, raising legal and ethical issues that need to be addressed to ensure safe and effective AI deployment. Interoperability and integration issues also pose significant barriers, as AI systems must seamlessly integrate with existing hospital information systems to be effective. Additionally, the scalability and accessibility of AI solutions remain limited, particularly in rural areas with inadequate infrastructure and financial constraints.

Human-AI interaction is another critical challenge, as healthcare professionals may resist adopting AI technologies due to a lack of trust or understanding. Training and education programs are essential to build trust and ensure that medical staff are equipped to work effectively with AI tools. Addressing these challenges requires a multifaceted approach involving regulatory reform, infrastructure investment, collaborative research, pilot programs, and public engagement.

CONCLUSION

In conclusion, artificial intelligence (AI) in hospitals in India has advanced significantly across a range of applications, including electronic health records, medication development, diagnostics, and predictive analytics. Nevertheless, issues with data privacy, ethics, regulation, and system integration stand in the way of its broad implementation.

In terms of the future, artificial intelligence in healthcare has bright possibilities. Explainable AI (XAI) can increase trust, AI-driven telemedicine can improve access to care, and AI in public health can help with early illness identification and prevention. AI-enhanced medical education can also result in the production of medical practitioners with greater skill.

To fully utilize AI's potential and meet its obstacles, healthcare practitioners, researchers, and policymakers must continue their collaborative efforts. Artificial intelligence (AI) has the power to completely transform healthcare, enhancing both patient outcomes and overall care quality.
In summary, AI in healthcare has the potential to completely change the sector in ways that were previously unimaginable.

AI applications provide significant advantages, including better patient outcomes, lower costs, and increased accessibility to healthcare, ranging from diagnosis and treatment to administrative duties. But issues like data privacy, moral dilemmas, complicated regulations, and the requirement for worker upskilling need to be handled methodically.

There is no doubt that AI in healthcare especially in hospital sector has a bright future. AI will probably become a vital tool for healthcare practitioners as technology develops and stakeholders work together to address the issues head-on. AI has the power to transform healthcare and rethink how we approach people's and communities' well-being, ultimately resulting in a better and more connected world, if innovation and accountability are balanced.

LIMITATIONS

There are various limitations on this review:

1. Availability of Healthcare Data online.
2. We limited the inclusion to peer-reviewed journal publications written in English. It's possible that some pertinent papers were authored in different languages and published in news articles, conferences, or workshops.
3. Furthermore, based on our search results, which show that AI has just recently begun to gain popularity in the clinical area, we excluded studies published prior to 2014.
4. An additional apprehension is that certain AI applications might have been employed in actual healthcare settings without any publicly available literature.
5. In the future, clinical practitioners need to be more proactive in disclosing AI evaluations and incorporating the findings into their routine work.

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