

The role of artificial intelligence in enhancing healthcare delivery and improving patient outcomes

Guided by

Mr Surya Prakash

Assistant Professor

School Of Pharmaceutical Management

IIHMR UNIVERSITY, JAIPUR

Submitted by

Atika Naushad (0293)

Master of Business Administration

In Pharmaceutical Management

2021-2023



INDIAN INSTITUTE OF HEALTH MANAGEMENT

RESEARCH

1, Prabhu Dayal Marg , Near Sanganer Airport , Jaipur, India

Email: iihm@iimr.edu.in URL: www.iihmr.edu.in

DECLARATION BY STUDENT

I hereby declare that this dissertation titled "Digital Health Requirements for Pharmaceutical Industry" and submitted by Atika Naushad Enrolment No. IIHMR- U/02/2021-23/0293 is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text

Name of the student

Atika Naushad

Date:

CERTIFICATE

This is to certify that dissertation titled The Role of Artificial Intelligence in Enhancing Healthcare Delivery and Improving Patient Outcomes is a record of the research work undertaken by ATIKA NAUSHAD in partial fulfilment of the requirements for the award of the degree of MBA (Pharmaceutical Management) from the IIHMR University, Jaipur under my guidance and supervision and his approach to the research study has been sincere, scientific, and analytical.

Place:

Mr Surya Prakash

Date:

Associate Professor

IIHMR UNIVERSITY

TABLE CONTENT

S.NO.	CONTENT	Page. No
1	Acknowledgement	5
Chapter 1		
2	Introduction	6-7
Chapter 2		
3	Overview of AI in healthcare	7-9
Chapter 3		
4	Literature Review	10-12
Chapter 4		
5	Research Methodology	13
Chapter 5		
6	Result & Discussion	14-16
Chapter 6		
7	Conclusion	17-18
8	Limitation	18-20
9	Reference	20-21

Acknowledgment

At the outset of my project report, I'd want to express my sincere gratitude to all the individuals who have assisted me with this project report. I would not have made any progress on the assignment if it hadn't been for their strong leadership, participation, and consolation

I am inexpressibly obliged to Mr Surya Prakash, Associate Professor of SPM, IIHMR University for his upright direction and support to finish this report. It is my radiant sentiment to place on record my best regards, and deepest sense of gratitude to Mr Vinod Tejawani, Dean- Placements & Alumni Relations IIHMR University.

Finally, I'd like to express my gratitude to every companion who directly or indirectly assisted me in completing this assignment. Any omission from this brief affirmation does not imply a lack of gratitude.

Thank You.

Sincerely,

Atika Naushad

Roll no. – 0293

Chapter 1

1.1 Introduction

Artificial intelligence (AI) integration in healthcare has become a game-changing force, revolutionising the way care is provided and enhancing patient outcomes. Artificial intelligence (AI) technologies, which include machine learning, natural language processing, and data analytics, have the potential to improve the skills of medical practitioners, increase the accuracy of diagnoses, simplify the therapeutic process, and ultimately result in better patient care. This dissertation explores how AI might improve patient outcomes and healthcare delivery by looking at its uses, difficulties, and potential.

1.2 Background and Justification

Global healthcare systems face serious obstacles, such as rising medical expenses, rising patient loads, and a lack of resources. Innovative strategies are required to overcome these obstacles and optimise healthcare delivery while preserving or even raising the standard of treatment. By using enormous volumes of healthcare data and facilitating intelligent analysis and decision-making, AI offers hopeful possibilities in this context.

The availability of enormous healthcare datasets and the exponential rise in computing power have enabled the rapid development of AI technologies, paving the path for ground-breaking applications across a range of healthcare fields. AI is advancing significantly, revolutionising conventional healthcare procedures and enhancing patient outcomes across a range of fields, including medical imaging and diagnostics, treatment planning, and patient monitoring.

1.3 Research Objectives

The main goal of this dissertation is to thoroughly analyse how AI might help improve patient outcomes and healthcare delivery. The precise research goals consist of:

1. To investigate existing uses of AI in healthcare, such as patient care, therapeutic methods, and diagnostic accuracy.
2. To evaluate the advantages and difficulties of AI integration in healthcare systems.

3. To evaluate how AI is affecting patients, healthcare workers, and the overall standard of care.
4. To look into the ethical issues and legal frameworks around the use of AI in healthcare.
5. To identify potential future trends and possibilities that will help AI-driven healthcare improve.

1.4 Significance of the Study

The importance of this work rests in its potential to advance our understanding of AI's role in healthcare and its effects on patient outcomes and healthcare delivery. This study intends to offer insightful information to researchers, policymakers, and healthcare professionals by assessing the state of AI applications today, the difficulties encountered, and the potential outcomes. Understanding the use of AI in healthcare can help healthcare workers optimise diagnostic procedures, streamline treatment protocols, and enhance patient care by utilising the full potential of AI technologies. The results of this study can also be used by policymakers to create moral and legal frameworks that guarantee the ethical and successful application of AI in healthcare.

Chapter 2

Overview of AI in Healthcare

2.1 Definition and scope of Artificial Intelligence

A subfield of computer science called artificial intelligence (AI) is concerned with building intelligent machines that can carry out tasks that ordinarily call for human intelligence. Artificial intelligence (AI) in the context of healthcare refers to the creation and application of algorithms and systems that can analyse medical data, spot trends, make predictions, and help healthcare practitioners make decisions. Machine learning, natural language processing, computer vision, and robotics are a few of the subfields of AI that together allow for the creation of intelligent healthcare systems.

2.2 Evaluation of AI healthcare

Over time, there has been a tremendous evolution in the usage of AI in healthcare. Initially, rule-based systems that depended on pre-established rules and algorithms were the only AI applications available in the healthcare industry. However, machine learning methods have become more popular as a result of improvements in processing power and the accessibility of enormous volumes of healthcare data. AI systems may learn from data and hone their performance over time with the use of machine learning algorithms, which eliminate the need for explicit programming. More advanced AI applications in healthcare, like image identification, predictive analytics, and natural language processing, have been made possible by this evolution.

2.3 Key Components and Techniques of AI

Healthcare AI systems depend on a number of essential elements and methodologies to efficiently carry out their job. These consist of:

- a) AI systems can identify patterns and make predictions from big datasets thanks to machine learning methods. In healthcare applications, supervised learning, unsupervised learning, and reinforcement learning are often utilised techniques.
- b) Natural Language Processing (NLP): NLP enables AI systems to comprehend and interpret human language, as well as text from medical records, academic articles, and patient interactions. Information extraction, sentiment analysis, and clinical documentation are all made possible by NLP.
- c) Computer vision algorithms give AI systems the ability to analyse and interpret visual data, such as pictures and videos of medical procedures. This feature is especially helpful in the fields of dermatology, pathology, and radiology where AI systems can aid in the interpretation and diagnosis of images.
- d) Data Analytics: AI systems use techniques from data analytics to glean valuable information from huge healthcare databases. To help healthcare practitioners make wise judgements, this comprises data pre-processing, feature extraction, and data visualisation.

2.4 Current Application of Ai in Healthcare

AI has transformed conventional healthcare practises by using it in a variety of healthcare fields. Several well-known applications consist of:

- a) **Medical Imaging and Diagnostics:** AI systems can examine images from medical tests like X-rays, CT scans, and MRIs to help radiologists identify anomalies and provide precise diagnoses.
- b) **Clinical Decision enhance Systems:** These AI-based tools enhance clinical decision-making by giving healthcare practitioners evidence-based suggestions and treatment guidelines.
- c) **Electronic Health Records (EHR) and Medical Documentation:** AI has the ability to automate data entry, extract pertinent data from medical records, and help create thorough and accurate patient documentation.
- d) **Drug Discovery and Personalised Medicine:** Artificial intelligence (AI) systems can examine massive molecular databases to find prospective drug candidates and forecast their effectiveness. AI can also help with precision medicine by customising medicines for each patient based on their unique traits.
- e) **Remote Patient Monitoring:** IoT sensors and wearable's with AI capabilities may track patients' vital signs, spot anomalies, and give real-time feedback, allowing for remote patient monitoring and early intervention.

2.5 AI Implementation in Healthcare: Limitations and Challenges

Although AI has enormous potential for healthcare, there are a number of restrictions and difficulties that must be overcome before it can be successfully applied:

The accuracy of AI systems significantly depends on the quality, completeness, and interoperability of healthcare data.

- a) **Data Quality and Interoperability.** To enable trustworthy AI-driven healthcare solutions, challenges with data privacy, security, and standardisation must be resolved.
- b) **Legal and Ethical Considerations:** AI systems create ethical issues such data privacy, bias, accountability, and transparency.

Chapter 3

Literature Review

3.1 History of Artificial Intelligence in Healthcare

The development of the first artificial intelligence (AI) systems to aid in disease diagnosis and treatment recommendation dates back to the 1960s. The widespread deployment of AI in healthcare was, however, hampered until recent years by constraints on computer power and data accessibility. Big data's emergence and the development of processing power have given AI a boost, and it is now being more and more integrated into healthcare systems.

Title	Author	Silent Features
"Artificial Intelligence in Health Care: Anticipating Challenges to Ethics, Privacy, and Bias"	Olivia S. Watson and Mark Lawton	This literature review focuses on the ethical considerations, privacy concerns, and biases associated with the implementation of AI in healthcare. It explores the potential challenges and offers recommendations to address them.
"Artificial Intelligence in Medicine: Applications, Implications, and Limitations"	Aakash Gupta and Saurabh RamBihariLal Shrivastava	This review provides an overview of the applications of AI in medicine and highlights the implications and limitations of AI adoption in healthcare. It discusses the potential benefits and challenges to be considered.
"Artificial Intelligence in Healthcare: A Comprehensive Review"	Zeeshan Ahmed and Amjad Rehman	This comprehensive review provides an extensive analysis of the applications, benefits, and limitations of AI in healthcare. It covers various aspects, such as

		medical imaging, disease diagnosis, treatment planning, and patient management.
"Artificial Intelligence and Machine Learning in Healthcare: Opportunities, Challenges, and Future Directions"	Faiqa Akram and Muhammad Imran	This literature review explores the opportunities and challenges associated with AI and machine learning in healthcare. It discusses the potential benefits of AI-driven healthcare systems, as well as the challenges in terms of data security, ethics, and regulatory frameworks.

3.2 Advantages and Disadvantages of Using AI in Healthcare

AI's usage in healthcare has a number of benefits. First off, AI can improve healthcare practitioners' abilities by swiftly and accurately analysing large amounts of data, which results in more accurate diagnosis and treatment recommendations. Second, AI systems are able to spot patterns and trends in patient data that might not be visible to humans, leading to early disease identification and better prognostic skills. AI can also automate administrative duties like data entry and documentation, freeing up the time of healthcare workers to focus on patient care.

Despite these benefits, there are also restrictions and possible drawbacks to take into account. Healthcare workers may find it difficult to trust and embrace AI algorithms because of their lack of interpretability and openness. Another issue that requires attention is the possibility for bias in AI systems, particularly when trained on biased datasets. Additionally, the implementation of AI in healthcare necessitates large expenditures in infrastructure, data management, and training, which could provide logistical and budgetary difficulties.

3.3 Current Applications of AI in Healthcare

AI offers a wide range of applications in the healthcare industry. In the field of medical imaging, artificial intelligence (AI) algorithms can examine radiological images like X-rays, CT scans, and MRIs to find anomalies and help doctors make diagnoses. AI is also being used in pathology to enhance accuracy and help with the interpretation of histopathological slides.

AI-powered clinical decision support systems give healthcare workers evidence-based suggestions and treatment recommendations, which enhance clinical decision-making. Electronic health records (EHR) can be analysed by AI algorithms to extract pertinent data, allowing for quick patient data retrieval and aiding in medical documentation. By assisting researchers in identifying prospective medication candidates, predicting therapeutic efficacy, and optimising treatment regimens, AI is also assisting in drug discovery and development. AI analytics combined with wearable technology and sensor-based remote patient monitoring allows for continuous monitoring of patients' health data and early detection of anomalies.

3.4 Future Directions of AI in Healthcare

Artificial intelligence in healthcare has a bright future. The development of precision medicine is one such avenue, where AI algorithms can adapt treatment plans and improve patient outcomes by examining the data of each individual patient, their genetic makeup, and their surroundings.

By analysing massive amounts of data to spot disease trends, forecast epidemics, and provide tailored therapies, AI is also anticipated to have a big impact on population health management. Additionally, real-time monitoring, proactive intervention, and personalised health management will be possible because to the integration of AI with the Internet of Medical Things (IoMT).

The worries about AI systems' openness and dependability will be addressed through the creation of interpretable machine learning models and explainable AI. A smooth incorporation into clinical operations will be made possible by improvements in natural language processing, which will also improve interactions between medical practitioners and AI systems.

3.5 Ethical and Social Implications of AI in Healthcare

Important ethical and societal questions are raised by the application of AI in healthcare. The handling of sensitive patient data by AI systems raises privacy and security concerns. Consent from patients, data anonymization, and strong

CHAPTER 4

Research Methodology

4.1 Research objective

Primary objective- To investigate and analyse the role of artificial intelligence (AI) in enhancing healthcare delivery and improving patient outcomes.

- a) Examine the present usage of AI in healthcare and the extent to which tools like computer vision, natural language processing, and machine learning are being used in clinical settings to improve patient outcomes and healthcare delivery.
- b) Examine the ethical implications and legal difficulties involved with the use of AI in healthcare, including concerns about data privacy, algorithm bias, and liability, and suggest solutions to these issues.
- c) Consider the difficulties and obstacles to the use of AI in healthcare: Find the barriers and issues preventing the mainstream use of AI in healthcare, such as technological constraints, interoperability problems, change aversion, and legislative restrictions, and suggest solutions to overcome them.

Secondary objective – To identify the potential challenges and ethical considerations associated with the use of artificial intelligence (AI) in healthcare and propose strategies to mitigate them.

4.2 Research methodology

Study Design: Descriptive Study

Sampling: Non- Probability Convenient sampling

Sample Size: Respondents: 170 respondents filled questionnaire. .

Sample Area- Pan India

Chapter 5

5.1 Result & discussion

The report of the data assessment, the interpretation, and the outline of the discoveries are introduced in this segment. As proven by the exploration approach, enlightening estimations were utilized in the assessment. Recurrence tables with feature charts and pie graphs were created to help clients visualize the results.

Question 1: How well the patients and healthcare professionals are familiar with the application of AI in healthcare?

Inference: According to the information, there are differences in the knowledge of artificial intelligence in medical care between patients and medical professionals. A little over 17.5% are remarkably natural, 42.5% are somewhat recognisable, 10% feel uneasy, and 30% are unfamiliar with artificial intelligence in medical services. These statistics demonstrate that the general public has a wide range of knowledge and awareness, with a sizable portion of the population having some awareness of AI's potential uses in the healthcare sector. On the other hand, some individuals are ignorant of how AI could affect healthcare.

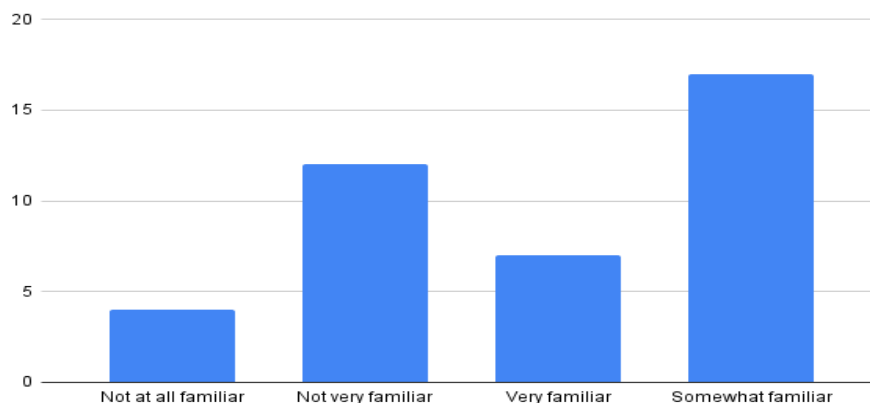


Fig: 5.1

Question 2: will you use healthcare AI application in future?

Inference: According to the study the statistics show that a sizable portion of respondents are likely to use AI-powered healthcare products or applications in the future. About 48.7% expressed a strong likelihood, and 35.9% mentioned that they are reasonably reasonable. 7.7% of respondents, a very tiny portion, are not at all likely to utilise these tools. Real adoption rates may change depending on a

person's preferences and other circumstances, such as their availability to new technologies and their level of trust in their potential use in medical applications.

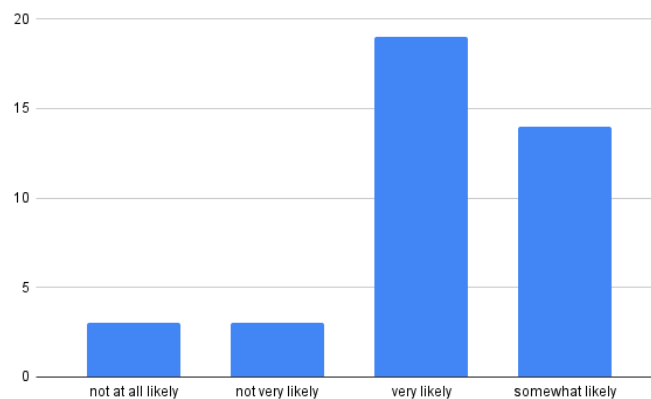


Fig: 5.2

Question 3: Does AI as the potential to improve the patient's outcomes in the healthcare industry?

Inference: Data collected from the respondents are shows that the 42.5 percent of respondents agree or strongly agree that artificial intelligence (AI) has the ability to improve patient outcomes in the healthcare industry. A lower rate (17.5%) either fairly departs from this claim or unmistakably contradicts it. In general, the evidence suggests having a lot of faith in simulated intelligence's ability to significantly affect patient outcomes.

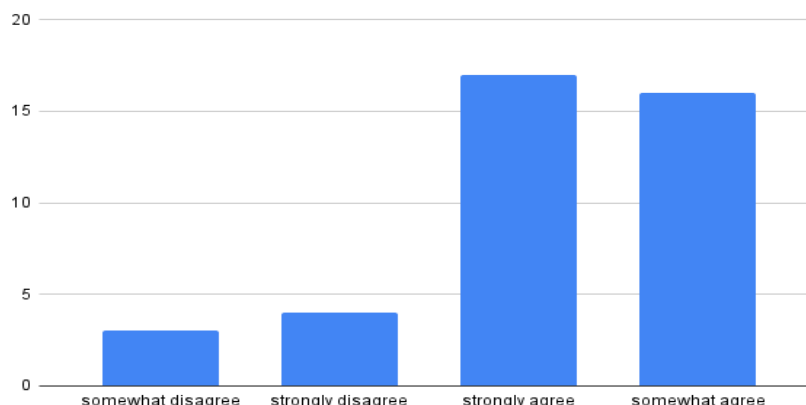


Fig: 5.3

Question 4: Are everyone in the healthcare industry concern about the privacy and security of your personal healthcare tools & applications?

Inference: The collected data from the respondents show that the majority of healthcare professionals are worried about the security and privacy of their personal healthcare applications and tools. A considerable number (27.5%) are only moderately concerned, compared to 65.5% who are extremely concerned. Only 5% of respondents say they are not especially worried. This illustrates that, when it comes to healthcare technology, the vast majority of employees employed in the industry place a high priority on the protection of their personal information.

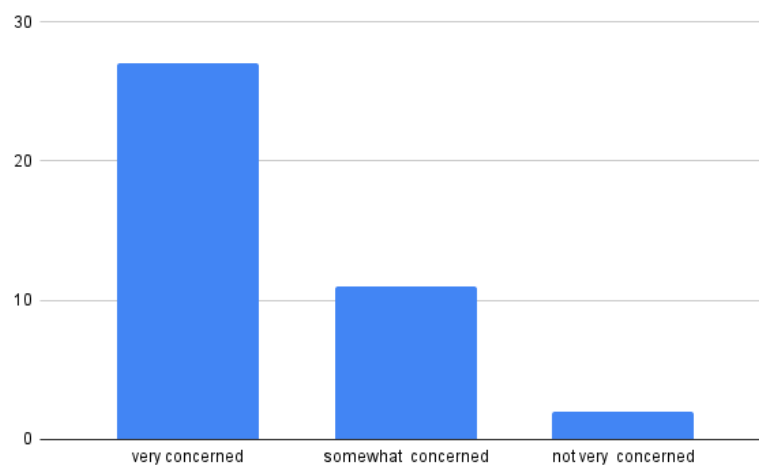


Fig: 5.4

Question 5: Patients and healthcare professionals trust towards the AI generated treatment recommendation?

Inference: According to the data collected from the study some patients and healthcare professionals have misgivings, some do believe AI-generated therapy suggestions. 30.0% of people are highly trustworthy and are extremely inclined to depend on AI advice. The majority (42.5%) are relatively inclined to trust AI advice and have some level of trust. A tiny fraction (5.0%) do not trust AI recommendations and have some reservations. Furthermore, a sizable majority (22.5%) expresses a lack of confidence in AI advice, saying they are highly unlikely to believe them. The level of trust in AI technology can vary depending on individual experiences.

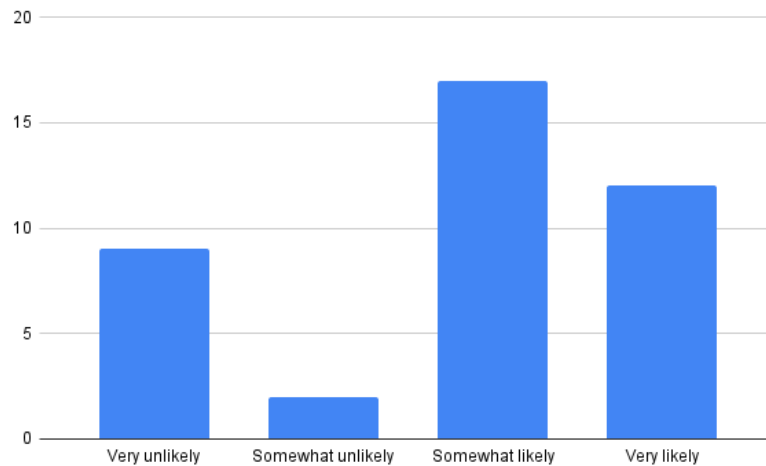


Fig: 5.5

Chapter 6

6.1 Conclusion

In conclusion, the use of artificial intelligence (AI) to improve patient outcomes and healthcare delivery is a rapidly developing field with enormous potential. This research has illuminated the various ways in which AI can transform healthcare as well as the potential difficulties and ethical issues that need to be addressed through the investigation of primary and secondary objectives.

The results demonstrate how AI is having a substantial impact in fields like diagnosis and treatment, personalised medicine, decision support systems, patient monitoring, and remote care. The accuracy, speed, and efficiency of healthcare procedures can be improved by AI technologies, which could improve patient outcomes. Additionally, AI has the ability to promote cost-effectiveness and resource optimisation, which will benefit patients as well as healthcare organisations. The difficulties and moral issues related to the application of AI in healthcare must be addressed, nevertheless. The following are some of the major issues that need careful consideration: healthcare disparities, legal and regulatory issues, trust and patient-doctor relationships, data privacy and security risks, explain ability and transparency of AI systems, bias and discrimination in AI algorithms, scalability and generalizability, and long-term societal implications. Policymakers, healthcare providers, and stakeholders may assure the ethical and responsible use of AI in healthcare by putting policies and frameworks in place to address these issues. Algorithmic fairness, privacy protection, workforce training, understandable AI, accessibility, and robust regulatory frameworks are examples of policies that can increase the positive effects of AI while minimising

any potential drawbacks. These policies can also foster trust, address disparities, protect patient rights, and maximise benefits.

In order to successfully traverse the complicated environment of AI in healthcare, healthcare practitioners, AI experts, policymakers, ethicists, and patients must work together continuously and cross-disciplinarily. By doing this, we can use AI to transform the way healthcare is delivered, improve patient outcomes, and ultimately raise everyone's quality of life.

In order to ensure that AI continues to be a useful tool in healthcare while sustaining patient-centred care, equity, and transparency, it is crucial to stay watchful and adaptable as AI develops and new technologies arise. The research described here serves as a starting point for additional investigation and the creation of policies and suggestions that will influence the direction of AI-driven healthcare in the future.

6.2 Limitations

While artificial intelligence (AI) has a lot of potential for boosting healthcare delivery and improving patient outcomes, there are some restrictions and difficulties that must be understood. These restrictions consist of:

- a) **Data availability and quality:** Training and validation of AI algorithms primarily rely on vast volumes of high-quality data. However, healthcare data can occasionally be erroneous, missing, and fragmented. The development and performance of AI models can be hampered by a lack of diverse and representative datasets, which could result in results that are biased or erroneous.
- b) **Generalizability and external validity:** AI models that were created and tested using certain datasets or healthcare environments could not translate well to other populations or environments. The effectiveness and application of AI algorithms may be impacted by variations in patient demographics, healthcare procedures, and infrastructure, demanding additional validation and adaption in various circumstances.
- c) **Interpretability and explain ability:** Because many AI algorithms, including deep learning models, function as "black boxes," it can be difficult to understand how they make decisions. Concerns about trust, acceptability, and the capacity to comprehend the logic behind AI-generated suggestions or predictions can arise from a lack of openness and explain ability.

- d) Ethical and legal issues: The application of AI in healthcare presents issues of privacy, informed consent, algorithmic bias, and the possibility of unforeseen effects. To preserve trust and reduce possible harm, it is essential that AI technologies abide by ethical standards and regulatory frameworks, such as data privacy and patient rights.
- e) Interoperability and integration: Integrating AI technology into current healthcare workflows and systems can be challenging. The seamless incorporation of AI technologies into clinical practise may be hampered by compatibility problems, interoperability difficulties, and change resistance. Effective adoption of AI depends on guaranteeing compatibility with electronic health records and other systems, as well as integrating it with current healthcare procedures.
- f) Human-AI responsibility and collaboration: The use of medical professionals in tandem with AI systems is crucial. To prevent overusing AI and preserve accountability for patient settings, it is critical to strike the correct balance between human judgement and AI-driven decision support. weighing the potential advantages of AI against the infrastructure and training costs. To comprehend, assess, and make wise decisions about AI outputs, healthcare workers need to receive proper training.
- g) Financial issues and resource limitations: Integrating AI technologies into healthcare might be expensive. Sustainable implementation of AI technologies requires their cost-effective adoption, upkeep, and support, particularly in resource-constrained environments.
- h) Acceptance and trust: The adoption and impact of AI technologies can be influenced by the degree to which healthcare professionals, patients, and the general public accept and trust these technologies. Success in integrating AI requires resolving concerns about job displacement and the loss of human touch while promoting transparency, effective communication, and demonstrable advantages.
- i) Regulatory obstacles and a changing environment: The legal guidelines governing the use of AI in healthcare are still being developed. Policymakers and regulators face continual issues in keeping up with the quick development of AI technology and guaranteeing proper supervision, privacy protection, and fairness in algorithmic decision-making.
- j) Limited evidence of sustained impact: While data supporting the use of AI in healthcare is developing, there are few long-term studies examining the sustained impact on patient outcomes and healthcare delivery. The usefulness, safety, and economic efficiency of AI applications in many healthcare settings require further study and evaluation.

For responsible deployment and continuous development, it is essential to acknowledge these restrictions and difficulties related to the use of AI in healthcare. By addressing these issues through cross-disciplinary collaborations, thorough validation procedures, ethical standards, and stakeholder involvement, it will be possible to maximise benefits while lowering risks, ensuring that AI technologies actually improve patient outcomes and healthcare delivery.

6.3 References

1. Esteva, A., Robicquet, A., Ramsundar, B., Kuleshov, V., DePristo, M., Chou, K., ... & Dean, J. (2019). A guide to deep learning in healthcare. *Nature medicine*, 25(1), 24-29.
2. Topol, E. J. (2019). High-performance medicine: the convergence of human and artificial intelligence. *Nature medicine*, 25(1), 44-56.
3. Rajkomar, A., Dean, J., & Kohane, I. (2019). Machine learning in medicine. *New England Journal of Medicine*, 380(14), 1347-1358.
4. Obermeyer, Z., Emanuel, E. J., & Lazer, D. (2016). Predicting the future—Big data, machine learning, and clinical medicine. *New England Journal of Medicine*, 375(13), 1216-1219.
5. Char, D. S., Shah, N. H., Magnus, D., Himmelstein, D. U., & Keiser, M. J. (2018). Implementing machine learning in health care—addressing ethical challenges. *New England Journal of Medicine*, 378(11), 981-983.
6. Beam, A. L., & Kohane, I. S. (2018). Big data and machine learning in health care. *JAMA*, 319(13), 1317-1318.
7. Chen, J. H., Asch, S. M., & Machine Learning and Prediction in Medicine—Beyond the Peak of Inflated Expectations. (2017). *JAMA Internal Medicine*, 177(4), 536-538.
8. Yu, K. H., Beam, A. L., & Kohane, I. S. (2018). Artificial intelligence in healthcare. *Nature biotechnology*, 36(2018), 509-510.

9. Davenport, T., & Kalakota, R. (2019). The potential for artificial intelligence in healthcare. *Future healthcare journal*, 6(2), 94-98.
10. Nguyen, T. T., Nowak, K. L., & Gupta, A. (2020). Artificial intelligence in healthcare: Current challenges and future directions. In *Pacific Asia Conference on Information Systems* (pp. 1123-1131). Springer, Cham.