

Course Title: Research Methodology in Computer Science

Course Code: AI800

Weighting: 50%

Lecturer: Dr. Mohammed Anbar

Hand-out Date: 14 March 2026

Hand-in Date: 14 April 2026

Hand-in Method: Online Submission via E-Learning.

Student ID: 261002982

Student Name: Alaa Waleed Humaid

Challenges and Reliability of AI in Healthcare Systems

Table of Contents	
Abstract	4
Introduction	5
Background	6
Problem statement	7
Research Objectives	7
Research Scope	8
Literature Review	9
Research Methodology	11
Expected outcomes:	11
Gant chart	12
References	13

Abstract:

Artificial Intelligence (AI) has become very important in hospitals and the healthcare sector. It is used in many areas such as disease diagnoses, drug discovery and patient treatment. Many studies show that AI can reduce errors, cost and time while increasing efficiency and accuracy. However, despite these advantages, AI systems face major challenges when applying them in real-world healthcare environments, such as poor data quality, fragmentation and bias, which will affect the performance and reliability of the AI models. Therefore, this project aims to focus on the current limitations and propose solutions to improve their reliability and practical use in healthcare.

Introduction:

Healthcare systems are facing many challenges due to the rapid growth of medical data, high costs, and the need for fast and accurate decision-making. Healthcare professionals also need more effort to manage all the complex datasets, which can affect the quality of healthcare services. These challenges have created a need for more advanced technologies to improve healthcare systems, leading to the use of AI Artificial Intelligence.

AI systems can analyze large amounts of complex data, support decision-making and identify hidden patterns. As a result, AI is used in diagnosing diseases, medical imaging, and drug discovery. These applications can reduce the workload on healthcare professionals and improve the efficiency of healthcare systems.

However, using AI in real-world healthcare systems is still challenging and has several limitations. These challenges include the lack of integration between systems, data fragmentation and bias, which can affect the performance of AI models. In addition, there are concerns about ethical issues and data privacy.

Therefore, it is very important to examine these challenges and improve the reliability and practical implementation of AI.

Background:

In recent years, AI has become a major technology in healthcare sector due to its ability to process large amounts of complex data. AI systems used advanced techniques like machine learning and deep learning to analyze different types of data, such as medical images and patient records. These techniques help to identify patterns, support clinical decision-making and make predictions.

AI applications are widely used in the healthcare domain. In medical imaging, AI can analyze CT scans, X-rays, and MRI images to detect diseases such as cancer with high accuracy. In addition, AI can support treatment planning by analyzing patients' medical data history and providing personalized solutions.

Furthermore, AI plays a major role in processing large-scale medical data. It can process large amounts of data in a short time, often faster and more efficiently than humans, which help reduce errors. However, the performance of AI systems depends heavily on the quality of the data. Many systems suffer from data fragmentation, where data is stored in different institutions, making it difficult to integrate and use efficiently. This limitation reduces the overall effectiveness of AI systems in healthcare.

In addition, many studies highlight ethical concerns and the lack of transparency in AI systems. Some datasets also contain bias, which can lead to inaccurate results. Therefore, it is Important to address these issues to ensure safe and effective use of AI in real- world healthcare systems.

Problem statement:

AI is widely used in healthcare to improve diagnosis, treatment and decision-making. It enhances accuracy and efficiency while reducing cost and errors.

Despite these advantages, AI systems have limitations, especially when applied to real life. AI systems need high-quality and well-structured data. (Zeb 2024).

Most of the medical data is fragmented, incomplete, and distributed across different systems. (Panch et al., 2019).

Another challenge is the concerns about data privacy, which leads to a lack of trust from users. In addition, data bias will make it inaccurate or unfair because some systems are trained on certain data, which could give inaccurate results sometimes. (Nuffield 2019).

Furthermore, many existing studies focus on theoretical models and experiments that are not applied in real hospitals, which creates a gap between research and real-world implementation.

Even though machine learning has been suggested to enhance AI performance, These solutions still can't provide consistent results in real environment.

There is a clear need to develop AI systems that are more reliable, transparent, and can be effectively applied in real-world healthcare systems.

Research Objectives:

This research aims to enhance the reliability of AI systems in healthcare.

- 1- To analyze the role of current AI applications and how to improve them to increase accuracy and efficiency. (Väänänen et al., 2021)
- 2- To evaluate the technique in handling large data and suggest new one to increase scalability and efficiency.(Shaheen, 2021)

- 3- To identify ethical challenges such as bias and privacy concerns and propose solutions to build users' trust. (Nuffield, 2018)
- 4- To study AI methods used in diagnoses and treatment, and improve their ability to adapt to different patient conditions. (Talati, 2023)
- 5- To understand how poor data can affect the systems and develop methods to improve data handling (Zeb et al., 2019)
- 6- To analyze the reasons for AI systems' failure in a real environment and suggest solutions to improve integration and practical use in hospitals. (Panch et al., 2019)

Research Scope:

This research focuses on the limitations of Artificial Intelligence (AI) systems in healthcare, particularly those related to data quality, data bias and data fragmentation. And how these challenges will affect the performance and reliability in real-world healthcare environments.

This research is limited to analyzing and reviewing existing literature without conducting experimental or technical implementations. It also aims to propose practical improvements to enhance implementations of AI systems in healthcare.

Literature Review:

The Nuffield Council on Bioethics (2018) aimed to explore ethical issues related to AI in healthcare. The results showed that AI systems facing challenges such as privacy concerns, data bias and lack of transparency lead to unfair outcomes.

Panch et al. (2019) study that published in *The Lancet Digital Health* aimed to identify the limitations of AI applications in real-world healthcare environments, focusing on data infrastructure. The study found that healthcare data is fragmented across different institutions, making integration difficult. It also showed that many AI systems fail in real clinical settings due to these challenges.

Väänänen et al. (2021) study aimed to review the impact of AI services on healthcare performance. The study used a narrative methodology. The results showed that AI improves efficiency, reduces costs, and enhances patient outcomes. However, successful implementation depends on proper system integration and design

Shaheen (2021) aimed to explore AI applications in healthcare, particularly in patient care and drug discovery. The study used a review methodology and showed that AI supports decision-making and improves data processing. However, limitations were identified, such as high costs and system complexity.

Talati (2023) aimed to examine the role of AI to enhance diagnoses, treatment and patient care. The study used a review perspective methodology. Results showed that AI enhances accuracy and supports decision-making. However, concerns related to data privacy and ethics were highlighted.

Zeb et al.(2024) aimed to analyze the impact of AI in healthcare in diagnosis and treatment. This study used a review methodology. Results showed that AI improve accuracy. However, the study emphasized that that AI performance depends heavily on data quality, and poor data will lead to incorrect results.

Chustecki (2024) aimed to evaluate the benefits and risk of using AI in healthcare systems. The study used a review methodology. The findings showed that AI improves efficiency and accuracy, but also introduces risks such as data bias, lack of transparency, and privacy concerns, which affect trust in AI systems.

Lipkova and Wang (2024) aimed to examine bias and fairness challenges in AI-driven healthcare. The study used a multidisciplinary methodology combining data analysis, case studies, and stakeholder consultation. The findings showed that bias originates from data, algorithms, and societal factors, leading to disparities in healthcare outcomes. The study highlighted the importance of ethical frameworks, data diversity, and fairness-aware AI systems.

Abdelwanis et al. (2025) aimed to identify challenges of AI adoption in healthcare. The study used a systematic literature review and applied the Human-Organization-Technology framework. The findings revealed barriers such as data quality issues, lack of infrastructure, and limited user acceptance, which restrict real-world implementation of AI systems.

Aranam (2025) aimed to investigate the impact of data bias and data quality on AI performance in healthcare. The study used an analytical approach. The findings showed that biased and low-quality data lead to inaccurate predictions and unfair outcomes. The study emphasized the importance of improving data practices to ensure fairness and reliability in AI systems.

Overall, studies show that while AI has significant potential to improve healthcare systems, its effectiveness is limited due to several challenges. Data-related issues such as poor data quality, bias, and fragmentation are major barriers. In addition, ethical concerns, lack of transparency, and limited real-world implementation reduce trust in AI systems. These findings highlight a clear gap between theoretical research and practical application, emphasizing the need for more reliable, fair, and well-integrated AI systems in healthcare.

Research Methodology:

This research adopts a qualitative and analytical approach to examine the limitations of Artificial Intelligence in healthcare. This study is based on a review of selected research papers related to AI applications in healthcare.

A total of ten studies were analyzed to identify the major challenges that affect AI performance. These studies were selected based on their relevance to the topic.

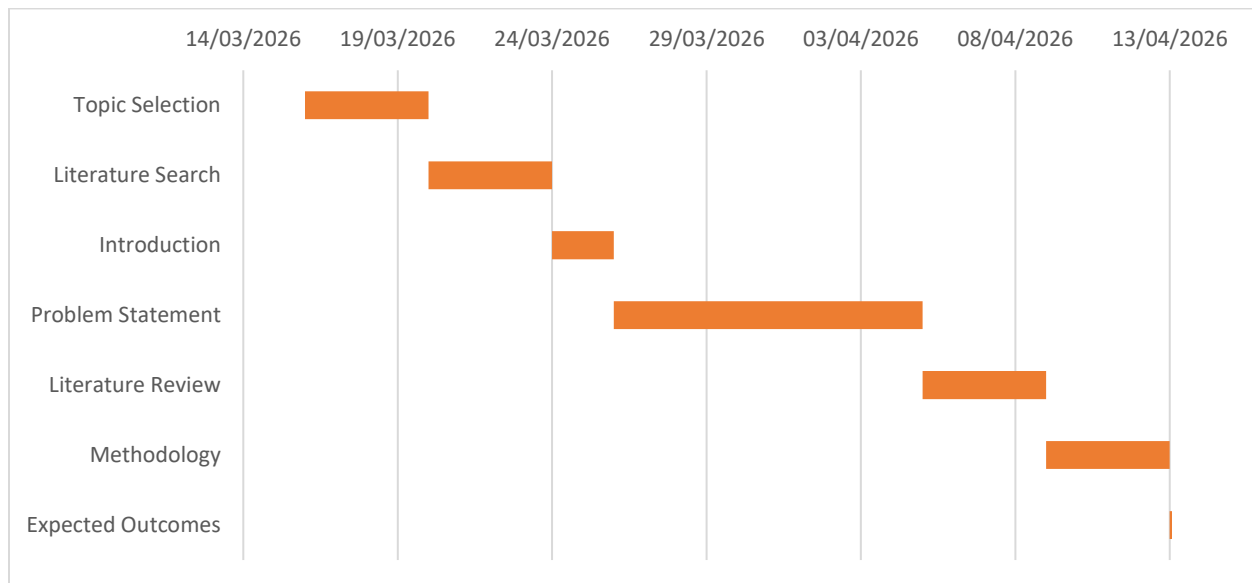
The analysis focuses on comparing the objectives, methodology and results of each study. Based on this analysis, the research aims to provide insights and suggest practical improvements to enhance the implementation of AI in the healthcare system.

Expected outcomes:

The research is expected to provide a clear understanding of the limitations of AI systems in healthcare. Also, expected to highlight the gap between theoretical research and real-world implementation of AI systems.

The results of this study may help healthcare organizations to understand the challenges of AI adoption and support the development of more reliable and effective AI systems in real-world healthcare environments.

Gant Chart:



References:

Panch, T., Mattie, H., & Celi, L. A. (2019). The “inconvenient truth” about AI in healthcare. *The Lancet Digital Health*, 1(1), e11–e12.

Väänänen, K., et al. (2021). Artificial intelligence-based services in healthcare: A systematic review. *Journal of Medical Systems*, 45(7), 1–15.

Shaheen, M. Y. (2021). Applications of artificial intelligence (AI) in healthcare: A review. *ScienceOpen Preprints*.

Talati, Z. (2023). Artificial intelligence in healthcare: Applications and challenges. *Healthcare Technology Letters*.

Nuffield Council on Bioethics. (2018). Artificial intelligence (AI) in healthcare and research. London, UK.

Zeb, A., et al. (2024). Artificial intelligence in healthcare: Opportunities and challenges. *International Journal of Advanced Computer Science and Applications*.

Chustecki, M. (2024). Benefits and risks of artificial intelligence in healthcare: A narrative review. *Journal of Medical Internet Research*, 26, e53616.

Abdelwanis, A., et al. (2025). Artificial intelligence adoption challenges in healthcare: A systematic review. *Information Processing & Management*, 62(1).

Karanam, S. (2025). Data bias and data quality in AI healthcare systems (Master’s thesis). Iowa State University.

Lipkova, J., & Wang, F. (2024). Bias and fairness in AI-driven healthcare systems. *Journal of Biomedical Informatics*.