# The University of Bedfordshire

**BSS056-6 Theory Into Practice Project**

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A critical analysis of the challenges around the practical implementation of AI-based medical technology in the public healthcare industry in the United Kingdom


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# Executive Summary

The advent of Artificial Intelligence in healthcare has transformed the way the industry currently functions. While some technology experts believe the implementation process has many daunting challenges, others look beyond to its benefits. The topic selected on Artificial Intelligence is both current and relevant in today's world and focuses on a critical analysis of the challenges around the practical implementation of AI-based medical technology, in the public healthcare industry, in the United Kingdom. Applying the principles of a systematic review of the literature, several articles were selected to analyse the challenges around the practical implementation of AI-based technology. The findings revealed a thematic presentation identifying challenges, benefits and influential factors toward AI-based technology. The discussion of the research findings provides an analytical perspective and analyses its alignment with the various influential theories previously identified in the literature review. The research highlights the lack of legislation, governance issues and resistance to change as major global challenges to implementing AI-based technology. These challenges are further linked to issues of trust, poor communication and collaboration, a lack of transparency, poor accountability and the organization's culture. Therefore, a need for ongoing training and education to build knowledge and establish trust, improve stakeholder collaboration and the use of expert knowledge on how to achieve these are required to improve the chances of implementing AI-based medical technology within the UK healthcare industry.

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# List of Abbreviations

Artificial Intelligence (AI)

Chief Information Officer (CIO)

Key Performance Indicators (KPI)

Medicines and Healthcare products Regulatory Agency (MHRA)

National Health Service (NHS)

People, Process and Technology (PPT)

Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)

Stakeholder Theory (ST)

Transformational Leadership (TL)

United Kingdom (UK)

Unified Theory of Use and Acceptance of Technology (UTAUT)

World Health Organization (WHO)

# CHAPTER 1: Introduction

## 1.1 Topic

A critical analysis of the challenges around the practical implementation of AI-based medical technology in the public healthcare industry in the United Kingdom.

## 1.2 Background

Artificial Intelligence (AI) has quickly proven its capabilities to transform and enhance human life within various industries such as entertainment, agriculture, and manufacturing (Espina-Romero et al, 2023; Marr, 2023). The healthcare industry is no different, as AI-based technology can revolutionize population health management in several ways (Bohr and Memarzadeh, 2020). Over the past decades in the United Kingdom, a greater public demand for an efficient and effective healthcare delivery system (Montgomery et al., 2017; Papanicolas et.al., 2019) created greater constraints on the government and the National Health Service (NHS) to provide high quality healthcare. This has been due to issues such as staff shortages (NHS, 2019), an aging population and other human health complexities (Raymond et al., 2021) that requires some type of intervention to improve health outcomes.

To improve how care is delivered, the NHS has evolved to its present-day '*Long Term Plan'* launched in 2019 (NHS, 2019). This is its latest health sector reform strategy with technology as its main driver intended to bring about efficient and effective high quality healthcare (Aldwick and Dixon, 2019). As such, the NHS Digital has already been leading the way by embracing AI-based medical technology, in areas such as radiology analysis for x-ray and mammogram assessments (NHS Transformational Directorate, 2023) that focus on improving efficiency and effectiveness (Tariq et al., 2021). However, while AI-based medical technology is proving to be beneficial in these areas (Chada and Summers, 2022), there are some challenges to its further practical implementation.

## 1.3 Rationale

Globally, the healthcare industry is faced with a greater burden to deliver quality healthcare due to key issues such as staff shortages, an aging population**,** and a growing chronic disease

burden (WHO, 2022). During the past decade, AI-based technological advancement in various industries such as manufacturing, have been improving the efficiency and effectiveness in these industries (Barbosa et al., 2023). Likewise, the healthcare industry has also been able to advance itself by applying AI-based medical technology in some aspects of healthcare. This has brought about efficiency and effectiveness in the delivery of some aspects of care and thus better patient outcomes (Alowais et al., 2023; Chebrolu, 2020).

In the United Kingdom, the NHS has been engaging in the use of AI-based medical technology such as Predictive Care Pathways (Phiri and Delanerolle, 2023) and specialized diagnostic imaging such as mammograms and X-rays enhanced by artificial intelligence. This AI-based medical technology supports the work of healthcare providers by improving diagnostics and early detection toward a more efficient and effective patient outcome (Holdsworth and Zaghloul, 2022).

The United Kingdom is considered one of Europe's leading developers of artificial intelligence (Bughin et al., 2019). As such, using AI-based medical technology to improve the efficiency and effectiveness in the delivery of quality healthcare has already begun. However, there are some concerns such as data security and patient privacy, the absence of legislation for AI adoption and addressing resistance to change (Felzmann et al., 2019) in some instances and are potential reasons why adopting this innovative technology may not have been fully implemented. Therefore, this research topic aims to analyse the challenges surrounding the practical implementation of AI-based medical technology within the NHS in the United Kingdom.

### 1.4 Scope

The methodology of this research topic follows a Systematic Analysis Review of the literature. It was used to critically analyse the challenges around the practical implementation of AI-based medical technology in the United Kingdom's public healthcare industry. The focus surrounded the healthcare industry and AI-based medical technology. Three primary areas around the challenges to implementing AI-based medical technology included (1) A lack of updated legislation and current regulatory frameworks (2) AI Governance and ethical issues such as risk related to data security and patient privacy and (3) organizational issues pertaining to resistance to change. The research material focused on peer-reviewed journal

articles from 2013 to 2023. This helped to identify the challenges surrounding the implementation of AI-based medical technology.

### 1.5 Aim

To analyse the challenges of implementing AI-based medical technology within the public healthcare industry in the United Kingdom.

### 1.6 Objectives

1. To **identify** the challenges affecting the implementation of AI-based technology within the healthcare industry.
2. To **analyse** the effects of those challenges on the healthcare industry.
3. To **assess** the factors that can improve the chances of AI-based medical technology within the healthcare industry.
4. To **recommend** evidence-based strategies for improving the implementation of AI-based medical technology within the UK healthcare industry.

## 1.7 Influential Theories and Models

### 1.7.1 Stakeholder Theory (ST)

Stakeholder Theory (ST) is grounded in the field of business ethics and organizational management (Mahajan et al., 2023) that seek the interest of key players involved including employees, patients, and other individuals in the community, government, regulatory bodies, and public partners (Bhavaraju et al., 2023; Hogg et al., 2023) and who themselves have an interest in the competitive advantage of the organization. Additionally, management decisions are guided by ethical practices through a collaborative process (Harrison et al., 2015) that helps to evaluate how policies and regulation are developed, adapted, or adopted; what are its social and ethical implications; how it guides decision-making and corporate governance and provides feedback through clear communication (Ali and Haapasalo, 2023). As such, Stakeholder theory is the lens through which issues such as corporate governance, leadership and decision-making have been analysed for the implementation of AI-based medical technology.

### 1.7.2 Transformational Leadership theory

Transformational leadership theory was originally developed by Burns (1978) and have since evolved into a modern day approach to management (Bagga et al., 2022). Its role has shifted from traditional and autocratic in nature, to a motivational and inspirational one to bring about change. These leaders use charisma, compassion, and personality to engage people toward a shared vision and goal achievement (Lai et al., 2020). This futuristic approach inspires empathy, motivation, productivity morale, communication and collaboration for an ongoing approach to sustainability (Khan et al., 2020). Therefore, transformational leadership is the most suitable approach since these leaders can lead their organization through the innovative changes needed for Ai implementation to occur.

### 1.7.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

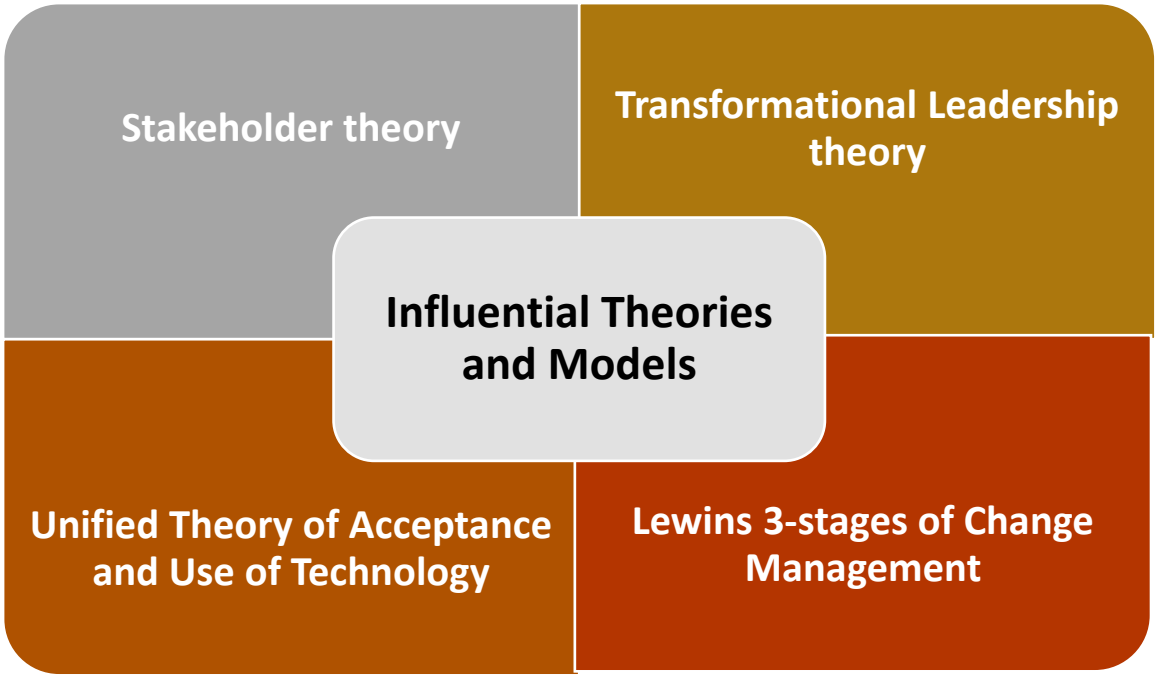
Unified Theory of Acceptance and Use of Technology (UTAUT) is a combined modern version of several technology acceptance models combined by Viswanath Venkatesh and others in 2003. It is used to analyse four factors in technology use, namely (1) performance expectancy, (2) effort expectancy, (3) social influence and (4) facilitating conditions. Additionally, there are four intermediate individual variables, namely (1) age, (2) gender, (3) experience and (4) volunteerism of use (Ayaz and Yanartaş, 2020). Therefore, when there is a concern about the acceptance of technology or a persons' intention to use technology in public institutions such as the NHS hospitals (AlQudah et al., 2021) this becomes a relevant tool.

### 1.7.4 Lewin's Change Model

Lewin's Change Model was developed by Kurt Lewin in 1951 as a 3-step change model to organizational change. These three steps include Unfreezing, Change and Refreezing, taking the organization from a state of known to unknown or a period of instability to stability (Hussain et al., 2018). Each phase is considered timely and requires clear communication to support the change that is required. During each step, those involved in the change process need to first recognize the need for change, then see how it will benefit them and finally, internalize that change to bring about a shift in organizational culture and the stability required by the organization (Deborah, 2018). Therefore, Lewin's

change model is an important tool in implementing AI-based medical technological changes in healthcare, since exploring those steps were necessary for accepting the new technology (Hospodková, 2021) not only at the hospital level where culture is ingrained into practice but also in terms of policy makers being able to make decisions at a more reasonable pace in line with the evolving technology.

**Figure 1.1 Influential Theories and Models**



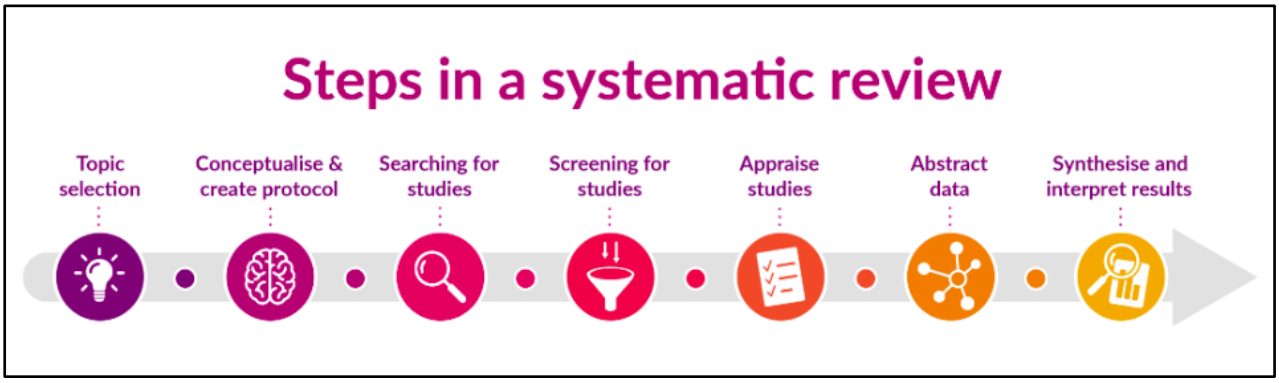

Source: Author generated (2023).

## 1.8 Method of Analysis

A Systematic Analysis is a 7-stage approach illustrated in Figure 1.2, which was used to synthesise the results on the analysis of ten articles as illustrated in Chapter 3 which was related to achieving the aim and objectives (Martinic et al., 2019) for this topic. Therefore, it provided clarity and valuable insight into the research topic founded on the work of other researchers' primary data collection (Phillips and Barker, 2021; Sataloff et al., 2021). The analysis was guided by an inclusion and exclusion criteria using a keyword search approach which helped to zoom into the proposed research topic to be analysed. As a result, this systematic method of analysis was used for the identification and discussion of the findings and helped to identify

any variances in the literature (Gupta et al., 2018). The PRISMA statement guided how to do the systematic literature review and reflected what was included and excluded. This is demonstrated on a flow chart in Chapter 3.

**Figure 1.2 Steps in a Systematic Literature Review**




**Source:** University Library (2023).

### 1.9 Overview of Chapters

This thesis paper consists of four chapters and commences with the introduction as chapter one (1). This chapter gives a general overview of the research paper and why doing this topic is relevant. Then, Chapter two (2) consists of the Literature Review. This chapter reviews the literature and theories relevant to the topic, aim and objectives to develop the context and set the scene for the topic in a comprehensive way while answering some of the objectives set out in this report. In Chapter three (3), the systematic analysis of the available literature describes the method of data collection and are reflected using a PRISMA statement. Chapter four consists of three main sections, namely the discussion, conclusion, and recommendation. The discussion analyses whether the findings from Chapter three are aligned with the influential theories and are analysed based on the themes that emerged from the systematic review of the literature for simplicity. The conclusion discusses whether the aim and objectives were achieved, and the recommendations are based on the conclusion as well as provides an answer for the forth objective. Finally, the paper closes with a reference list following the Harvard UK style in both the in-text citation and reference list reflecting the sources of data used throughout the body of the report.

**Figure 1.3 Overview of Chapters**

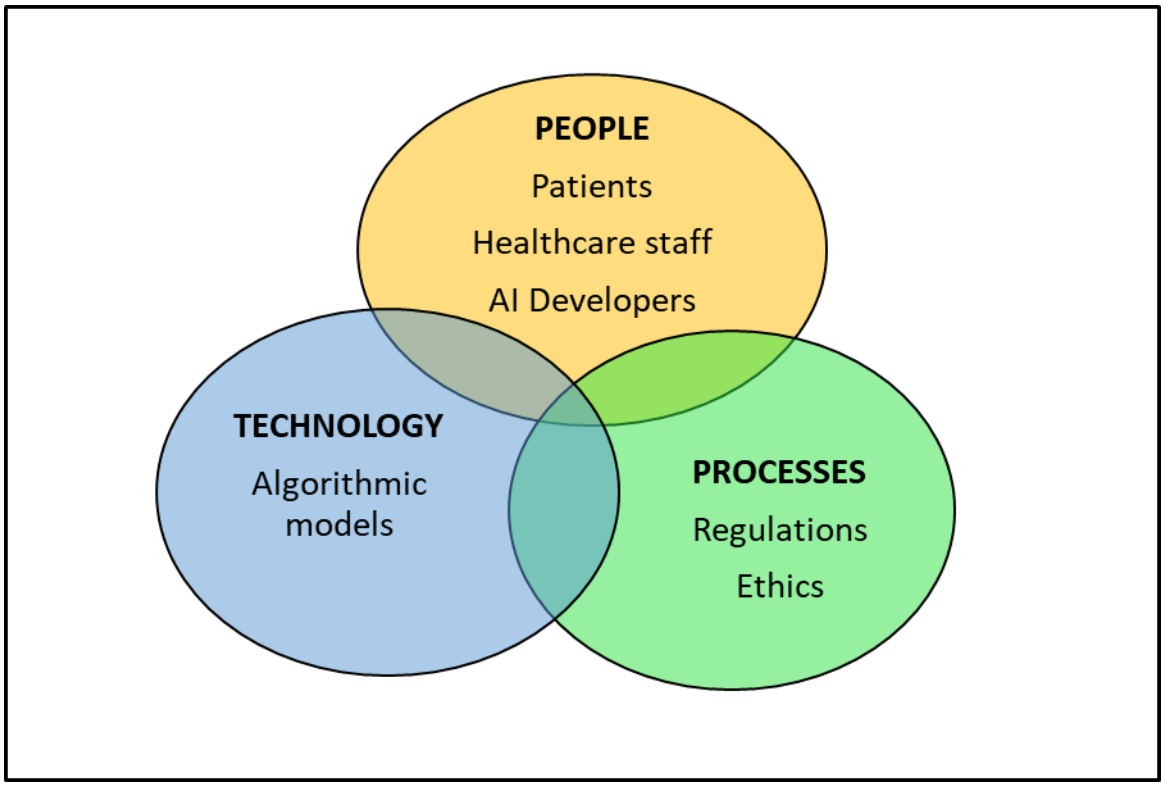

Source: Author generated (2023).

# CHAPTER 2: Literature Review

## 2.1 Introduction

The literature review provides a body of knowledge through the lens of various authors to support and justify this research paper (Leite et al., 2019). An overview of the existing literature provides an insightful view of Artificial Intelligence (AI). This chapter reviews some of the most relevant factors that act either as barriers or facilitators that affects the implementation of AI technology. The following TRIAD approach simplifies the way in which these factors can be identified and analysed. It includes the broad headings of the People, Processes and Technology. Leveraging this framework, as illustrated in Figure 2.1, also helps to assess some of the ways in which an organization can improve its chances of AI-based technology adoption.

**Figure 2.1 The TRIAD Framework: People, Processes and Technology**




Source: Author generated (2023).

## 2.2 Definition of Artificial intelligence

Artificial Intelligence (AI) can be defined as a multipurpose technologically based tool that can be used to support the work of humans through machine learning (ML) and deep learning (DL) (Pattam, 2021). It is powered by algorithms used to develop new content using audio and visual material that make its contents more impactful across various industries. Its capabilities such as automation and analysis can help an organization improve its overall performance and position it at a competitive advantage (Barbosa et al., 2023).

## 2.3 The TRIAD Framework

### 2.3.1 The People's Perspective: Stakeholders and AI

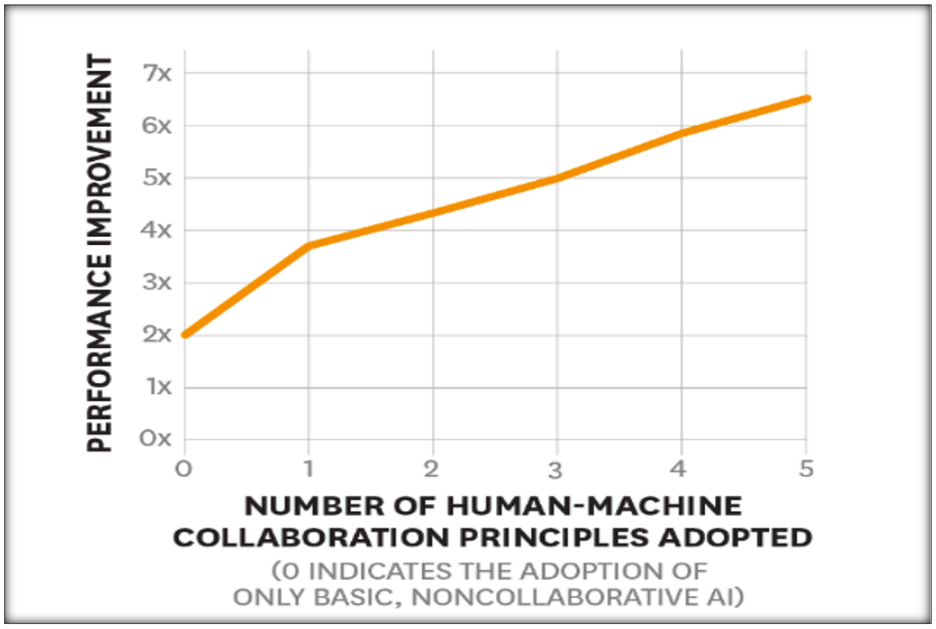
In the business world, AI is considered as a supportive tool for the purposes of automation, analytics, and engagement as seen in the use of chatbots to answer customers' frequently asked questions (Davenport and Ronanki, 2018). However, humans interact in various capacities as stakeholders with AI. These include its individual designers, internal and external organizational users and national and/or international participants that impact on the regulatory and legislative guidelines involved in its implementation and use (Deshpande and Sharpe, 2022). Therefore, each stakeholder group may have differing interests, expectations and varying concerns pertaining to AI.

The adoption of AI by some stakeholders in the workplace have been low (Dai et al, 2022). This has been attributed to high levels of distrust about AI's ability to make decisions and the fear of job loss (Ganapathi Muppidath, 2020; Sanan, 2017; Zirar et al., 2023). At the individual and organizational levels, lack of understanding due to poor communication and transparency (Borges de Nascimento et al., 2023) about how AI can transform decision making has affected human perception about the capabilities of AI and is therefore perceived as a job threat (Booyse and Scheepers, 2023).

According to the tenets of Stakeholder theory (Harrison et al. 2015), open communication within and among the various stakeholder levels such as Leaders, Managers, and lower level employees, help to minimize distrust by creating a culture of inclusivity in the decision-making process. This will help them understand how AI will affect their organizational role and function and reduce the perception of job loss. Also, this may facilitate the process of generating a third culture between AI technology and humans that can improve the efficiency

and effectiveness of the organization (Kolbjornsrud et al., 2017). For example, as illustrated in Figure 2.2, Wilson, and Daugherty (2018, para. 3) reflected how technology supplemented and amplified organizational performance levels when there is '*Human-Machine collaboration'* and therefore, creates the synergy required for the development of a third culture.

**Figure 2.2 Performance improvement with Human-Machine Collaboration**




Source: Wilson and Daugherty (2018).

Additionally, this paradigm shift can set the foundation for organizational sustainability through an AI and human partnership which will seek to create value through a multi-stakeholder collaborative, decision-making process. However, for this partnership to prosper, the organization must have a Leader who is open to change and is able to make change happen.

Various leadership styles exist but few can help organizations affect change management when technology is involved. Therefore, a strong leadership is critical that not only focus on the people and the processes but also on the technological aspect (Bennett, 2023) to bring about innovative change in an organization. As such, Transformational leadership (TL) has been widely discussed as an effective leadership style that displays charisma, provides inspiration, is visionary and can transform an entire organization when change related to innovation is required.

Among an organization's tools for a competitive advantage, is its knowledge base embedded in its people or human resources. From a resource-based view perspective, for an organization to be sustainable, its people resources must have the necessary tools, knowledge and skillset required for growth and innovative development in today's world (The World Bank, 2023). Therefore, through the transformational leadership's leader-follower or role model approach, it is ideal for developing the human resource aspect of any organization (Caputo et al., 2023). That is, because of the motivation and intellectual inspiration these leaders provide toward future workforce planning, it stimulates employees at all levels to recognize the need for change, as seen in Lewin's unfreezing stage through knowledge acquisition and upskilling in AI as it continues to evolve (Indeed Editorial Team, 2023). This is important since leaders can help employees adapt to the vision and mission of the organization by providing the training required for leveraging AI. Therefore, the learning process for employees according to Koziol-Nadolna (2020), is organized around the organization's need to create value through its employees or human resource assets to maintain a competitive advantage and sustainability using an innovative approach.

This charismatic approach can further facilitate knowledge creation by developing the personal interaction and varying levels of professional relationships and trust building (Ghasabeh, 2020; Lis et al., 2015) that will help to mitigate resistance to change. This is facilitated through clear and constant communication to all stakeholders that create an environment for a more effective technology adoption rate (Dennison, 2023). Therefore, employees begin to see the possibilities toward improving the efficiency and effectiveness of their human tasks and are less reluctant to changes in the organization's culture (Wilson and Daugherty, 2018).

In a business sense, AI can make a valuable contribution to the efficiency and effectiveness of a company's operations as seen in Davenport and Ronanki' s (2018) adaptation of a Deloitte 2017 Executive's poll, illustrated in Figure 2.3. Company leaders expressed their views on the benefits of AI to improve the operations of their organization. As such, since transformational leaders help to reshape their organization's business model through effective motivation, knowledge sharing and talent development, their leader-follower role can also potentially influence their employees in knowledge acquisition and leveraging AI adoption.

**Figure 2.3 Benefits of AI**


Source: Davenport and Ronanki (2018).

Employees are supported by their leaders through training and development and become familiar with latest changes over time (Sreekumar, 2023). This marks the entry of the transitioning stage where employees see AI as a beneficial support tool in their functioning and where the organization exploits its operational management processes and overall competitive advantage opportunities (Townson, 2021). Therefore, both the employer and the employee benefit as humans become more skilled and the organization becomes efficient and effective in its processes.

Organizational leaders provide one of its main stakeholders – its employees, with continuous support, on-demand training, open communication for transparency, and an opportunity for feedback to maintain a trusting and empathetic relationship. This drives the change process to its refreezing stage where acceptance occurs. At this stage, transformational leaders use the new organizational culture to solidify the desired change toward AI adoption (Raza, 2019). This behaviour change is reinforced with a reward mechanism that some organization provide to early adopters of change (Addon Skills, 2023).

Through the lens of a transformational leader, the insightful view of the people's perspective as stakeholders, and as a valuable human resource asset, can be skilfully utilized as a catalyst

for AI implementation despite its challenges such as resistance to change at the organizational level. However, while leaders maneuver the internal change process, issues such as regulatory and legislative frameworks must also be explored as part of the processes that guide the implementation of AI-based technology.

### 2.3.2 The Processes: Toward AI Governance

As part of the three elements comprising the People, Process and Technology (PPT) framework, the process defines 'how' the efficiency and effectiveness within the PPT framework can be achieved. Additionally, it reviews how to use the people and technology to leverage coordination of support to the needs of customers. Regarding AI implementation, the regulatory, legislative and governance agendas that guide the development and implementation of AI must be considered as part of that coordination process. That is, particularly in healthcare, there are major concerns for AI governance such as ethics in patient privacy, confidentiality, and risk management (Pusca, 2018) as it relates to AI's use of real health data. This is the data used to develop and train AI algorithmic models for accuracy. However, AI has also provided much beneficial support for improved population health management through better patient outcomes, reducing healthcare cost, improving diagnostic and treatment interventions (Kwint, 2023).

The World Health Organization (2021) indicated that all stakeholders in both the public and private sector must be responsible for the ethical impact of AI on all levels of society to ensure there is benefit in healthcare. In October 2023, the WHO further recognized the contribution of AI to improved health outcomes and have outlined six areas for AI regulations in healthcare. Since we seek to discuss the *'how'* aspect representing the processes involved in implementing AI, it is important to review how these regulatory frameworks guide ethical conduct.

Globally, there is no implemented legislation on AI. However, there have been recent legislative developments transitioning toward implementing AI (Whyman, 2023). Several countries including the United States, European Union countries and the United Kingdom have active regulatory frameworks that guide data privacy and patient confidentiality. However, this has been a grey area for AI creators in healthcare as these stakeholders (Lebcir et al., 2021) require access to real-time, patient data for developing algorithms and models to train AI. Creators and users of AI in healthcare are also held accountable for the use of AI tools as this has implications (Habli et al., 2020), including breaches in confidentiality, potential injury to

patients, and litigation for workers. This is due to poorly established ethical standards and regulatory frameworks that are either absent or minimal (Ananny and Crawford, 2018). Therefore, AI risk related to its reliance on real-time data can pose many challenges for the healthcare industry without the right governance features.

While AI risk can be characterized in several ways including being high or low (Bollan and Howie, 2023), it requires a mitigation strategy that prevents or minimizes harm such as breaches in human rights and confidentiality at every level of society (NIST, 2023). Hence the reason many countries including the United Kingdom have taken on a macro level, Control Objectives for Information and Related Technologies (COBIT) approach toward AI management (IT Management, 2023). That is, COBIT 19, the latest version, will help to create better strategies for IT Governance (White, 2023) and holistically work toward strengthening stakeholder relations which would include AI creators, patients, medical staff, government, and national regulatory bodies such as the Medicines and Healthcare products Regulatory Agency (MHRA) and NHS England. This partnership will develop trust and promote open communication (Mohammed et al., 2023) creating stakeholder values and community dynamism for continuous feedback and adaptation that will help to mitigate AI risk as part of IT governance principles. However, for some stakeholders, the risk appetite may not be as significant as others and hence the reason regulatory and legal compliance is as important as advocacy for new laws and guidelines that can sustain AI-based medical technology in the healthcare industry (ITA, 2023).

Nuthi (2023) provides a different view for various regulatory partners and stakeholders in the UK. Presently, there is a plethora of cross over regulations and statutory acts that already exists across various UK industries. Consequently, the UK government's approach to AI implementation will focus on establishing partnerships between regulators and AI creators. This way, there is transparency on how regulations affect AI technology development. To this end, statutory action will only be considered as a necessity for creating guidelines to empower regulators unlike other nations (Connell and Lim, 2023) where legislative action such as where the EU's European AI Act is being proposed. This way, in the UK, the process becomes flexible, and AI can continue to evolve and become more sophisticated. Therefore, the UK, recognized as a world leader in AI technology, can leverage AI to optimize healthcare outcomes, improve decision-making, reduce cost (McKendrick, 2023), ensure sustainability, and maintain competitive advantage in the AI world.

The process plays an equally significant role in the TRIAD as it brings together the 'how' toward achieving AI implementation. The importance of legislation, regulations and IT Governance including risk management, improved decision-making, transparency, accountability and a feedback mechanism, can create a smoother transition toward AI implementation in the UK healthcare industry. Therefore, operational efficiency and effectiveness at the industry and governmental levels can achieved for all stakeholders.

### 2.3.3 Technology: the tools that support human functioning.

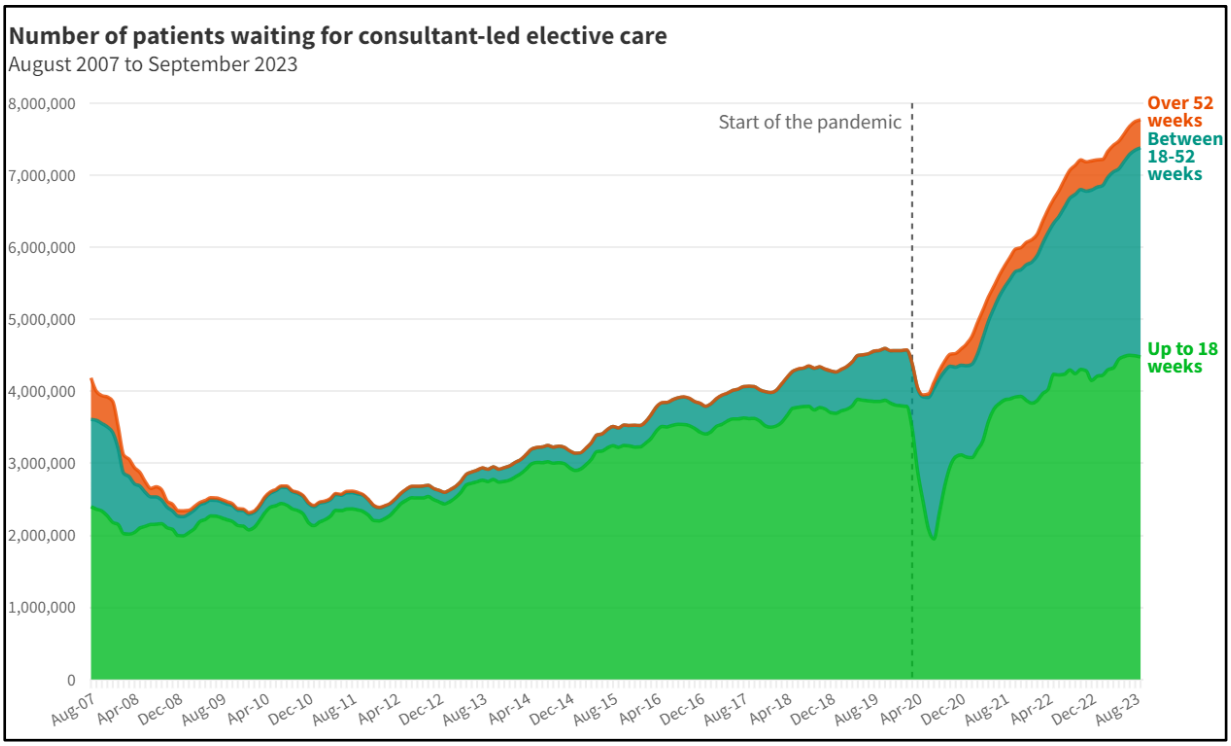
The technology aspect of the TRIAD addresses the tools that are required by the people and is supported by the processes involved to create efficiency and effectiveness in an organization. It must be well aligned with the business model and overall goals of the organizations to be properly utilized for creating a strategic advantage (Scherr, 2023). However, the organization must ensure that they understand the problem they are attempting to resolve which for example, in the UK healthcare industry, is to improve how care is delivered. The UTAUT Model which incorporates individual benefits determined by core determinants and moderators help to diffuse the technology acceptance rate through a different lens and provides some clarity in understanding how AI tools can be leveraged to bring about efficiency and effectiveness in healthcare. Several authors across various disciplines agree that the UTAUT model has its usefulness in implementing technology including AI (Andrews et al., 2021; Jain et al., 2022; Raffaghelli et al., 2022) which can potentially be utilized in the healthcare industry.

In the healthcare industry, the design thinking strategy is shifting into the 4.0 industry, defined as the latest healthcare technology which includes new digital tools such as AI and automation that can make the healthcare industry efficient and effective and promote better decision-making in the process (Huda, 2023). Hence, new digital business models are leveraging AI as an evolving tool to support the work of humans (Han, 2022). For example, AI has already begun to transform healthcare through faster diagnostic and treatment capabilities, thus reducing the amount of time clinicians spend trying to diagnose and find the appropriate treatment options for patients (Alkhaldi, 2023). Therefore, AI is primed to take healthcare stakeholders including patients, their families, healthcare providers, organizational leaders and Managers, and their hospitals to a whole new level of care (Council Post, 2023). Additionally, the application of AI technology in healthcare will also redefine communication, collaboration, and the team approach which will help to define the performance expectation for the employee

(Seeber et al., 2020). That is, users of AI will be able to have access to a more efficient and effective healthcare system that help them improve how care is delivered.

Digital transformation using AI, is considered a disruptive communication pathway, and is ushering in a reduction in time and cost (Maruping and Magni, 2015) for the people who use it (Verhoef et al., 2021). This includes both the employees as internal customers and citizens as external customers. Hence, effort expectancy is improved and requires less time from the employee to perform a task such as interpreting a radiography scan, thereby freeing the clinical staff to perform other human-centric tasks. This is vitally important since many public healthcare organizations experience a bottleneck in the time spent waiting for delivery of care. This includes the NHS in the UK as seen in Figure 2.4 where waiting time is a key factor to the delivery of care. However, with the support of AI tools, waiting time backlog can potentially be reduced. Therefore, user behaviour in the application of AI technology rationalization and acceptance remains an equally important part of the triad for firm performance (Chakravarty et al., 2013). Additionally, patient feedback is used to measure how well care is being delivered against the organization's preset objectives also known as Key Performance Indicators (KPIs) (Maxwell and Lamont, 2020). However, patient feedback may not only be influenced by their experience but also by social influence that plays a significant role in technology adoption (Jacob et al., 2022).

**Figure 2.4 Number of patients waiting for consultant-led elective care in the NHS.**




Source: BMA (2023).

As AI continues to influence a change in thinking at the societal, organizational, national, and international levels, each influential stakeholder plays a fundamental role on the use and impact of AI-based technology (Kelly et al., 2023). When these stakeholders such as employees recognize how beneficial technology has been to others, this influences the adoption rate and helps to mitigate the resistance to change (Scholkmann, 2020). However, some authors argue that employees may not be as easily convinced, and this may require organizations to find other facilitating conditions such as incentives, communication, training, and input in the decision-making process (Richter and Sinha, 2020; Damawan and Azizah, 2020; Sharp, 2023) to influence behaviour change. While this may provide some influence over the technology adoption among employees, the UTAUT model identified moderators that also support the adoption process and are linked to each of the core determinants. These include age, gender, experience, and voluntariness of use (Marikyan and Papagiannidis, 2023). While these determinants may have been applied to employees, some authors argue that these mediators also apply to citizens as they also play a significant role in technology adoption and use (Guo, 2015; Natarajan et al., 2017; Tsourela and Roumeliotis, 2015). Therefore, their relevance must not be overlooked as they too can be considered the end-users of the technology and affect adoption rates.

## 2.4 Conclusion

Investment in the right technology, which provides the right tools to the people, also help to define the right processes that support those tools grounded in AI technology. Throughout this people, process, and technology framework, is the integration and alignment of various theories and models including Stakeholder and Transformational Leadership theories, Resource-Based View, Lewin's Change Management, IT Governance and COBIT 2019 and the UTAUT model that sets the foundation for operational efficiency and effectiveness to the implementation of AI-based technology.

Various barriers, and facilitators to implementing AI-based technology were identified, and mitigating factors explored through the lens of various authors in this literature review utilizing the perspective of the People, Process and Technology triad. However, while the application of this triad framework has been useful in analysing the existing literature on AI and its implementation challenges, there is still a need for further research on the topic. That is, although the literature explains what challenges currently exists, our understanding is still limited since AI represents a new and constantly evolving form of medical technology for the healthcare industry. Therefore, further research is required to analyse the challenges of implementing AI-based medical technology within the public healthcare industry in the United Kingdom.

# Chapter 3: Systematic Analysis of Literature

## 3.1 Introduction

The aim of this chapter is to develop a detailed learning on the challenges of implementing AI-based medical technology within the healthcare industry. To accomplish this, a systematic analysis method was chosen as it offers a comprehensive scope of literature that captures the relevant information required for a holistic view (Chigbu, Atiku and Du Plessis, 2023) of the challenges to implementing AI in the healthcare industry. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework was used to capture the relevant information for this research topic as its methodology follows a rigorous strategy for data extraction that minimizes bias in data collection from its pre-set inclusion and exclusion criteria and maximizes its objectivity (Sinha, Menon and Denny, 2022) as illustrated in Tables 3.1 and 3.2 respectively. Thus, reliability and validity of the research are preserved. Through this robust, structured approach, various themes emerged as seen in Figure 3.2, that helped to identify the various challenges, benefits, and influential factors to AI implementation in the healthcare industry. Additionally, this method was chosen for its reproducibility and transparency (Shokraneh, 2019) that can easily allow other researchers to reproduce the research thereby making it credible and a significant contributor to a wider body of knowledge on the challenges to implementing AI-based medical technology.

## 3.2 Scope of the Study

### 3.2.1 Keyword and Search Terms

The keywords and Boolean operators utilized in this research paper were determined based on the aim and objectives of the topic. The key words selected included the following: artificial intelligence, healthcare industry, medical technology, implementation challenges, improving implementation, AI-based medical technology, UK healthcare industry and NHS healthcare system. The Boolean operators used were “AND” and “OR” which were utilized to broaden the search as seen in Table 3.3. Three online databases were used, and the same key words were used across each one to maintain a search standard. The search engines included were Scopus, PubMed and ResearchGate.

### 3.2.2 Inclusion Criteria

Table 3.1

| No | Inclusion Criteria | Reason for Inclusion |
|---|---|---|
| **1** | Peer-reviewed journal articles | Highest source of academic research evidence |
| **2** | Publication written from 2013 | Defines the specific timeframe for most recent evidence available |
| **3** | Publication only written in English | To prevent misinterpretation of information |
| **4** | Both quantitative and qualitative empirical studies | To acquire all practical evidence available |
| **5** | Publications that address the research topic, aim and objectives | It is relevant to the topic |

Source: Author generated (2023).

### 3.2.3 Exclusion Criteria

Table 3.2

| No | Exclusion Criteria | Reason for Exclusion |
|---|---|---|
| 1 | Abstract only papers, unavailable full texts, conference papers | Will not be able to capture the relevance of the study |
| 2 | Publications more than 10 years old | Timeframe will be too wide |
| 3 | Publications not written in English | To avoid translation bias |
| 4 | Publication that does not address research aim and objectives | It is irrelevant to the topic and will introduce bias |
| 5 | No systematic reviews, scoping reviews | It is based on secondary data |

Source: Author generated (2023).

### 3.3 Result Based on Keywords Search

Table 3.3

| Online databases & Search dates | Search Terms | Number of articles retrieved | Articles retrieved post-screening |
|---|---|---|---|
| ResearchGate **7/12/23** | "Challenges AND implementing AI OR artificial intelligence AND healthcare" | 2026 | Articles downloaded:16<br>Articles selected: 3<br>Articles excluded:2023 |
| Scopus **1/12/23** | "Effects of challenges AND Healthcare industry AND Artificial Intelligence" | 122 | Articles downloaded:26<br>Articles selected:0<br>Articles excluded:122 |
| PubMed **5/12/23** | "Improving implementation chances" OR "facilitators of AI" AND "Artificial Intelligence" AND healthcare industry" "Recommendations to improve" AND "AI implementation" AND United Kingdom" OR NHS" AND "healthcare industry" | 1605 | Articles downloaded:24<br>Articles selected:6<br>Articles excluded:1599 |

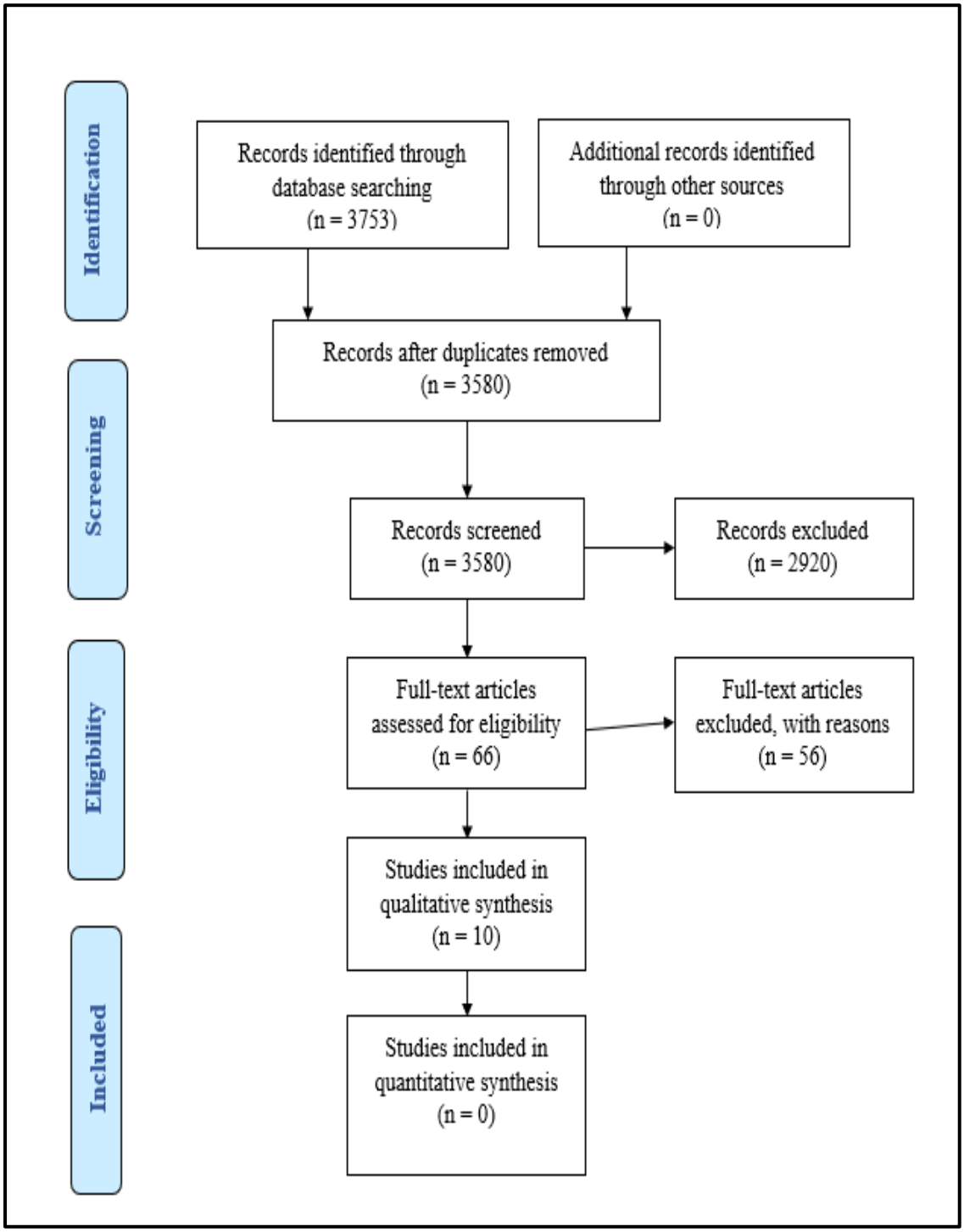
Source: Author generated (2023).

### 3.4 Search Result Strategy

As reflected in the PRISMA Statement below, 3,753 articles were identified from the data bases identified in Table 3.3 and none from other sources. There were 3,580 articles after duplicates were removed. However, 2,920 articles were further excluded based on the criteria identified in Table 3.2. However, from this figure, sixty-six articles were further selected based on the availability of full text articles and research methodology. The final ten (10) articles were selected based on a more in-depth reading and further exclusion based on issues such as non-availability of information to complete the descriptive summary of the journal articles. For example, no participant numbers or the article was not related to healthcare. Overall, most articles were excluded due to them being systematic reviews.

### 3.5 PRISMA Statement

**Figure 3.1** PRISMA 2009 Flow chart




Source: Adapted from Moher et al. (2009).

### 3.6 Descriptive Summary of Journal Articles

The following tables reflect a synopsis of each full-text article selected for this systematic review as highlighted in the PRISMA Statement. It provides an insightful view on AI as it relates to the healthcare industry. Each article provides a unique perspective on the implementation of AI in the healthcare industry as it relates to challenges, benefits and influential factors which is later reflected in Figure 3.2 as a thematic analysis uncovered in the selected articles.

**Table 3.4.1**

| **Journal Article # 1** | |
|---|---|
| Author(s) and year of publication | Petersson et al., 2022 |
| Journal | BMC Health Services Research |
| Article Title | Challenges to implementing artificial intelligence in healthcare: a qualitative interview study with healthcare leaders in Sweden |
| Sample Size & Participants | 26<br>Healthcare leaders |
| Country of research | Sweden |
| Research Purpose: | To explore the challenges perceived by leaders in regional Swedish healthcare setting in relation to the implementation of AI |
| Research Method | Semi-structured interviews using phone or video communication |
| Key Findings | The authors identified four main challenges to implementing AI which included (1) conditions external to the healthcare system such as laws and policies (2) internal capacity for strategic change management such as culture and performance (3) transformation of healthcare professions through leadership and (4) healthcare practices that could potentially reduce barriers such as communication and a collaborative approach. |
| Theoretical Perspective | Diffusion of Innovation Theory<br>Theory of Organizational readiness for change<br>Stakeholder Theory<br>Transformational leadership |

Source: Author generated (2023).

**Table 3.4.2**

| **Journal Article # 2** | |
|---|---|
| Author(s) and year publication | Sun, 2021 |
| Journal | International Journal of Environmental Research and Public Health |
| Article Title | Adopting Artificial Intelligence in Public Healthcare: The Effect of Social Power and Learning Algorithms |
| Sample Size & Participants | 24<br>Healthcare providers and patients in three (3) hospitals |
| Country of research | China |
| Research Purpose | To determine how social power among various stakeholders affect IT adoption in healthcare |
| Research Method | Semi-structured interviews and participative observation |
| Key Findings | The research was conducted in three Chinese hospitals all of whom used AI systems provided by the same supplier. The research highlighted the applicability of social power in relation to resistance to change and adoption of AI into healthcare. Influence from various stakeholders on adoption rate was referred to as either being high or low based on the influencers' knowledge and skills. Low level learning was found among medical staff users and patient users who were influenced by other users while high level were medical staff influenced by reward and legitimate power systems |
| Theoretical Perspective | Stakeholder theory<br>Social power theory |

Source: Author generated (2023).

**Table 3.4.3**

| **Journal Article # 3** | |
|---|---|
| Author(s) and year of publication | Cornelissen et al., 2022 |
| Journal | JMIR Formative Research |
| Article Title | The Drivers for Acceptance of Artificial Intelligence-Powered Care Pathways Among Medical Professionals: Web-Based Survey Study |
| Sample Size & Participants | 67<br>Medical professionals or other hospital staff employed at a Dutch hospital and worked on improvement of quality healthcare projects |
| Country of research | Netherlands |
| Research Purpose | To identify the factors that influence the acceptability of AI-based technology among medical professionals in the Netherlands |
| Research Method | Web-based survey |
| Key Findings | The researcher utilized the UTAUT theory as the lens through which to examine technology adoption in medical professionals using patient care pathways. This pathway is considered a useful technology tool in creating efficiency in the healthcare given the existence of an aging population and increasing life expectancy in the Netherlands. The findings concluded that predictor variable such as medical performance expectancy, nonmedical performance expectancy, performance expectancy, facilitating conditions, perceived trust, and professional identity to technology adoption were much better when it comes to behaviour changes to adoption. |
| Theoretical Perspective | UTAUT Model<br>Stakeholder theory |

Source: Author generated (2023).

**Table 3.4.4**

| **Journal Article # 4** | |
|---|---|
| Author(s) and year of publication | Fritsch et al., 2022 |
| Journal | Digital Health |
| Article Title | Attitudes and perceptions of artificial intelligence in healthcare: A cross-sectional survey among patients |
| Sample Size & Participants | 452<br><br>Patients and their companions at a German tertiary level hospital |
| Country of research | Germany |
| Research Purpose | To evaluate where patients in general locate themselves on the spectrum of using AI in healthcare |
| Research Method | Cross-sectional study using a paper-based questionnaire |
| Key Findings | The researchers examined the view of patients and their partners' perception of AI in healthcare. The majority respondents indicated they recognized there is benefit in AI use in terms of diagnosis and therapy. However, they also indicated a preference for a final decision to come from a physician. Significant to the research, there was more scepticism among elderly females, less educated persons, and those with a low use of technology. |
| Theoretical Perspective | Stakeholder theory |

Source: Author generated (2023).

**Table 3.4.5**

| **Journal Article # 5** | |
|---|---|
| Author(s) and year of publication | Yu and Li, 2022 |
| Journal | Behavioural Sciences |
| Article Title | Artificial Intelligence Decision-making Transparency and Employees' Trust: The Parallel Multiple Mediating Effects of Effectiveness and Discomfort |
| Sample Size & Participants | 235<br><br>Both male and female persons with previous work experience |
| Country of research | China |
| Research Purpose | The research focused on the human and AI collaboration where AI was the primary decision-maker and how transparency in AI decision-making affects employees' trust in AI |
| Research Method | Experimental vignette methodology with online recruiting |
| Key Findings | This research suggests that more transparency in the AI decision-making process increases the trust of employees in AI decision-making and perceived effectiveness. The authors explored the topic from two perspectives, the cognitive and emotional aspects which contributes to the trust employees develop in AI decision-making. |
| Theoretical Perspective | Social Identity Theory; Stimulus Organism Response (SOR) theory; Algorithmic reductionism |

Source: Author generated (2023).

**Table 3.4.6**

| **Journal Article # 6** | |
|---|---|
| Author(s) and year of publication | Petersson et al., 2023 |
| Journal | Digital Health |
| Article Title | Ethical considerations in implementing AI for mortality prediction in the emergency department: Linking theory and practice |
| Sample Size & Participants | 18<br><br>Healthcare managers and healthcare professionals connected to emergency room settings in southern Sweden |
| Country of research | Sweden |
| Research Purpose | To use the implementation of AI to predict patient outcomes at the Accident and Emergency department and to develop a model to guide ethical considerations |
| Research Method | Semi-structured interviews using phone and video calls |
| Key Findings | The research determined that while ethics plays a crucial role in patient care and decision-making, an additional principle is required. Professional governance was proposed as such and is expected to address the ethical conflict that can potentially occur between human healthcare providers' expert knowledge and the information that AI applications provide as a decision about a patients' survival rate and/or plan of care. They also found that AI can assist in preventing and managing challenges such as lack of communication, collaboration across departments and legal regulations that could affect how decision-making occurs. |
| Theoretical Perspective | Ethical theory |

Source: Author generated (2023).

**Table 3.4.7**

| **Journal Article # 7** | |
|---|---|
| Author(s) and year of publication | Rainey et al., 2021 |
| Journal | Frontiers in Digital Health |
| Article Title | Beauty is in the AI of the Beholder; Are we ready for the clinical integration of Artificial Intelligence in radiography? An Exploratory Analysis of Perceived AI Knowledge, Skills, Confidence, and Education Perspectives of UK Radiographers |
| Sample Size & Participants | 411<br>All UK based Radiographers, including students and retirees |
| Country of research | United Kingdom |
| Research Purpose | To determine the perceived knowledge, skills, and confidence in AI amongst UK Radiographers and highlight priorities for educational provisions to support a digital healthcare ecosystem |
| Research Method | A Survey using a snowball sampling |
| Key Findings | The research was centred around Radiology and Radiography staff and their perception on using AI in clinical practice. Threat to job security and advanced role development were the two major perceptions on AI adoption. However, both were open to training and education on AI use and felt it should be done at the undergraduate, pre-registration period. The research also found a relationship between males having a higher confidence in AI use as opposed to females. Age also was significant where younger persons and those with fewer years' experience felt less confident in AI use. Overall, both groups verbalized that there is a need for training and education to increase confidence and use and they want to be included in the designing, developing and decision-making process of AI in their field. |
| Theoretical Perspective | UTAUT theory, stakeholder theory |

Source: Author generated (2023).

**Table 3.4.8**

| **Journal Article # 8** | |
|---|---|
| Author(s) and year of publication | Rivera et al., 2021 |
| Journal | Therapeutic Innovation and Regulatory Science |
| Article Title | Advancing UK Regulatory Science Strategy in the Context of Global Regulation: A Stakeholder Survey |
| Sample Size & Participants | 145<br>Persons with expertise in regulatory science and in developing or applying regulations in healthcare and included UK healthcare professionals, academics, patients, health technology assessment agencies, ethicists, trade enterprises. It also included international regulators, pharmaceutical companies and small or medium enterprises with regulatory expertise. |
| Country of research | United Kingdom |
| Research Purpose | To identify the most accurate definition of regulatory science as it relates to AI and innovation that will allow for the exploration of training and infrastructure needs to advance the UK in regulatory science. |
| Research Method | Survey |
| Key Findings | The researchers found that regulatory science must be clearly defined to create a framework that is most applicable for the UK to maintain competitive advantage in innovation. They identified several areas including: 1. the need for flexibility within the framework to be able to adapt to novel innovative product. 2. Collaboration across sectors including patients in developing an appropriate framework and the required training needed to do so. 3. The framework must be able to weigh the risks and benefits of innovative products and data sharing. When this is achieved, patients would be able to benefit from timely access to innovative products and healthcare providers would have the necessary information to make informed decisions on care. |
| Theoretical Perspective | Stakeholder Theory |

Source: Author generated (2023).

**Table 3.4.9**

| **Journal Article # 9** | |
|---|---|
| Author(s) and year of publication | Kulkov et al., 2023 |
| Journal | International Journal of Entrepreneurial Behaviour and Research |
| Article Title | Stand-alone or run together: artificial intelligence as an enabler for other technologies |
| Sample Size & Participants | 22<br>Persons who had the experience of integrating or applying a solution based on innovative technology such as blockchain, virtual reality or Internet of Medical Things (IoMT), with AI in the healthcare industry |
| Country of research | USA, EU, Asia, and South America |
| Research Purpose | To examine the role of artificial in transforming the healthcare sector |
| Research Method | Exploratory qualitative methodology using a specialized podcast platform |
| Key Findings | The researchers identified that AI coupled with evolving technologies such as blockchain, created value for the organization by enhancing data security and patient privacy. AI powered devices created better risk reduction strategies for organizations and optimized patient outcomes. However, creating an organizational culture receptive to this evolving technology required leadership that encourages stakeholder engagement, communication, collaboration and training that would build trust and mitigate the implementation challenges for AI and other technology integration in healthcare. |
| Theoretical Perspective | Influence model in Change management<br>Resource Based View (RBV) Theory<br>Service-Dominant logic |

Source: Author generated (2023).

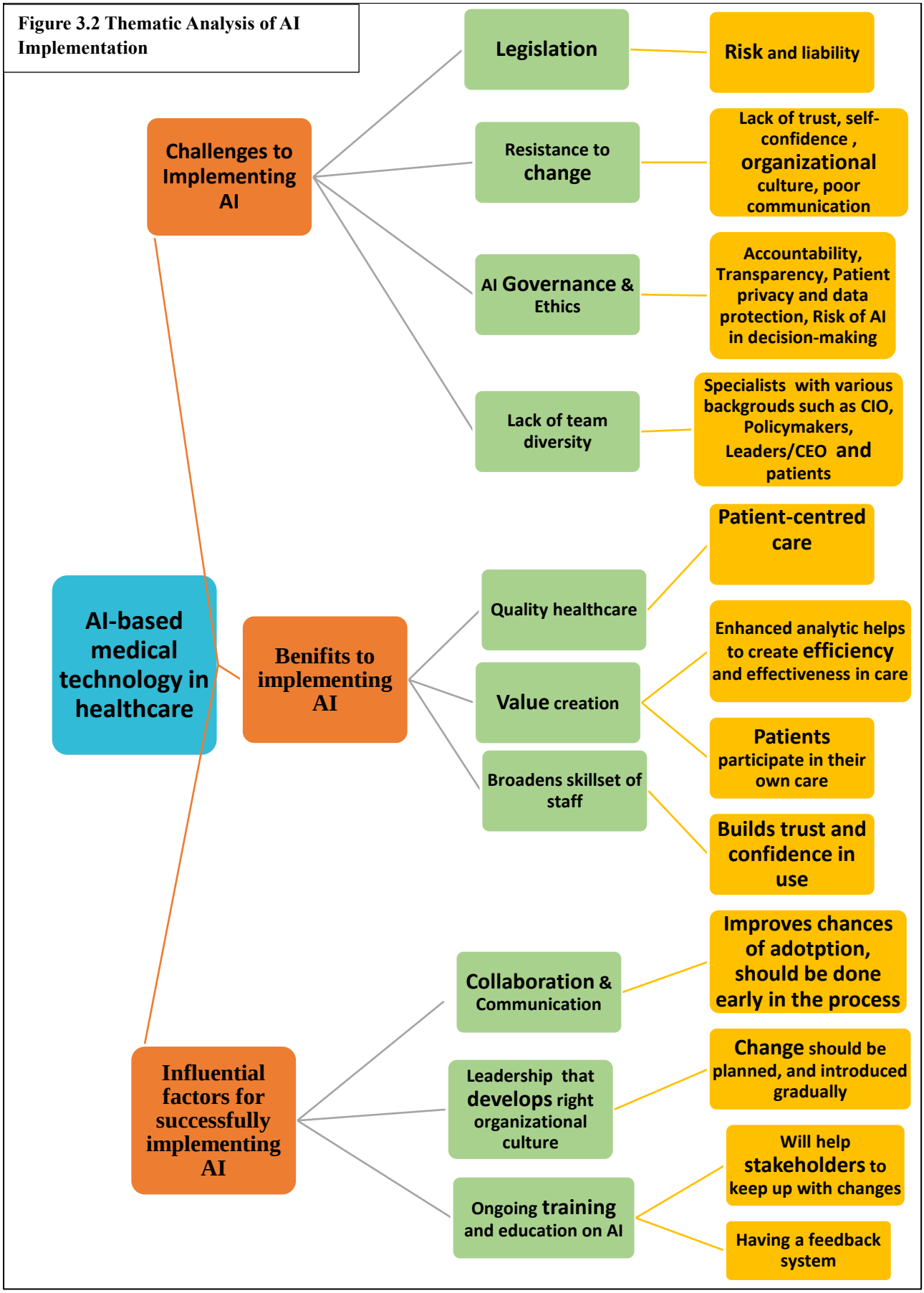
**Table 3.4.10**

| **Journal Article # 10** | |
|---|---|
| Author(s) and year of publication | Litchfield et al., 2023 |
| Journal | Health and Social Care in the Community |
| Article Title | "Trying to find people to fit tech…": A Qualitative Exploration of the lessons Learnt Introducing Artificial Intelligence-Based Technology into English Social Care |
| Sample Size | 18<br>Operational leads, decision makers and care staff were identified as key stakeholders who used sensor-based technology (SAT) powered by AI to collect patient data in their home |
| Country of research | United Kingdom |
| Research Purpose | The research focused on the potential benefit of new and emerging AI technology that can collect and provide home-based evidence to support the potential needs of patients at home over time. |
| Research Method | Interviews |
| Key Findings | The use of technology in healthcare can help to improve the lives of patients and create value for an organization by saving time and reducing cost. However, challenges such as a lack of expert knowledge, an inconsistent evidence base for best-practice standards and the rapid emergence of innovative technology contribute to a slow uptake by healthcare organization and resistance in the workforce. The public must also feel there is privacy, and their data is secure with minimal risk.<br>The researchers found that a shift in organizational culture, more collaboration and communication among healthcare partners, training and upgraded infrastructure regarding legislation and policies, and early workforce engagement may reduce the perceived risk in AI implementation in healthcare |
| Theoretical Perspective | Stakeholder theory |

Source: Author generated (2023).

## 3.7 Thematic Analysis of Findings

**Figure 3.2 Thematic Analysis of AI Implementation**




Source: Author generated (2023).

### 3.8 Data Extraction and Thematic Presentation

**Table 3.5 Theme 1**

| Themes | Details of Themes | Data Sources by Author(s) and year |
|---|---|---|
| **Theme 1: Challenges of implementing AI** | Legislation that currently exists requires updating and are too strict for AI adoption to occur | Fritsch et al. (2022)<br>Petersson et al. (2022)<br>Petersson et al. (2023) |
| | Lack of flexibility in the existing legislation and lack of further development in the existing regulatory framework increases the risk involved in maintaining patient privacy | Rainey et al. (2021)<br>Rivera et al. (2021) |
| | Staff resistance to change related to trust | Fritsch et al. (2022)<br>Kulkov et al. (2023)<br>Litchfield et al. (2023)<br>Petersson et al. (2023)<br>Sun (2021)<br>Yu and Li, (2022) |
| | Poor self confidence in technology use | Rainey et al. (2021) |
| | AI Governance and ethical issues related to lack of transparency, confidentiality, collaboration, communication and accountability | Cornelissen et al. (2022)<br>Petersson et al. (2022)<br>Petersson et al. (2023)<br>Rivera et al. (2021)<br>Yu and Li, (2022) |
| | Lack of team diversity | Petersson et al. (2022).<br>Petersson et al. (2023) |
| | Risk related to AI decision-making, data protection and patient confidentiality issues | Cornelissen et al. (2022).<br>Litchfield et al. (2023) |

Source: Author generated (2023).

**Table 3.6 Theme 2**

| Themes | Details of Themes | Data Sources by Author(s) and year |
|---|---|---|
| **Theme 2:**<br>**Benefits of AI implementation** | Value creation for the organization occurs when new job positions are created | Litchfield et al. (2023)<br>Petersson et al. (2022) |
| | Value is created through enhanced data collection, security and integration of other innovation for better planning of patient outcomes. It improves efficiency and effectiveness of the organization. | Cornelissen et al. (2022)<br>Kulkov et al. (2023)<br>Litchfield et al. (2023)<br>Yu and Li, (2022) |
| | Allows patients to participate in their own care | Petersson et al. (2022) |
| | Opportunities for quality healthcare that is patient cantered is created | Cornelissen et al. (2022)<br>Petersson et al. (2022).<br>Petersson et al. (2023) |
| | Reduced clinical workload with AI analytics that guides clinical pathways and decision-making | Rainey et al. (2021)<br>Sun (2021) |
| | Allows clinicians more time to expand clinical knowledge and expertise | Sun (2021) |
| | Broaden the skillset of staff and builds trust and confidence in use | Petersson et al. (2022) |

Source: Author generated (2023).

**Table 3.7 Theme 3**

| Themes | Details of Themes | Data Sources by Author(s) and year |
|---|---|---|
| **Theme 3:**<br>**Influential factors that improve AI implementation** | A collaborative approach to healthcare that involves all stakeholders | Kulkov et al. (2023)<br>Litchfield et al. (2023)<br>Rivera et al. (2021)<br>Sun (2021) |
| | Early communication with all stakeholders is required | Petersson et al. (2022)<br>Sun (2021) |
| | Creating a feedback system | Petersson et al. (2022) |
| | Leadership must drive the development of an appropriate organizational culture that is receptive to change and AI adoption | Kulkov et al. (2023)<br>Litchfield et al. (2023)<br>Petersson et al. (2022) |
| | Involve staff and patients in the decision-making process on AI tools and begin staff engagement earlier to get buy-in for AI adoption | Rainey et al. (2021) |
| | Social influence also plays a role in AI-based technology adoption rates | Sun (2021) |
| | Educate both staff and patients on AI use to promote trust, transparency and familiarity | Kulkov et al. (2023)<br>Petersson et al. (2022). |
| | | Rainey et al. (2021)<br>Sun (2021) |

Source: Author generated (2023).

### 3.9 Analysis of Findings

#### 3.9.1 Theme 1: Challenges to implementing AI

Analysis of the eligible articles in this systematic review found that there were five (5) main categories identified in the literature as challenges to implementing AI. Multiple authors have identified legislation that requires updating as the main challenge and one that can lead to liability (Fritsch et al., 2022; Petersson et al., 2022; Petersson et al., 2023; Rainey et al., 2021; Rivera 2021 et al., 2021; Sun 2021). Staff resistance to change was identified in the analysis by several authors (Fritsch et al., 2022; Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022; Sun, 2021) who have also linked this to sub-categories such as lack of trust and self-confidence, strong organizational culture, poor communication, and late staff engagement in the change process (Fritsch et al., 2022; Kulkov et al., 2023; Petersson et al., 2023; Rainey et al., 2021; Yu and Li, 2022). AI governance and ethics in healthcare were other areas identified in the literature in terms of accountability, transparency, patient privacy, data protection and risk in AI decision-making that challenges the sustainability of an organization pertaining to AI implementation (Cornelissen et al., 2022; Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022; Petersson et al., 2023; Yu and Li, 2022). Additionally, a lack of team diversity emerged as a challenge since new skills and knowledge about AI technology were required that clinicians did not possess (Petersson et al., 2022; Petersson et al., 2023).

#### 3.9.2 Theme 2: Benefit to AI implementation

On identifying the benefits of implementing AI, several categories and sub-categories emerged. However, these benefits also illuminate how to improve the chances of AI implementation. The main categories emerging from the literature include quality healthcare for patients where clinicians could focus on patient-centred care with more time to be spent with the patient. This is done through the capabilities of AI analytics that help reduce the clinicians' workload by developing algorithms that create applications such as a care pathway that guides clinician decision-making or aids in reading imaging results (Cornelissen et al., 2022; Petersson et al., 2022; Petersson et al., 2023; Rainey et al., 2021; Sun, 2021). Value creation for the organization occurs. This is through enhanced AI data collection, security, and integration of other innovation for better planning of patient care that improves patient outcome and allows them to participate in their own care (Cornelissen et al., 2022; Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022; Yu and Li, 2022). Also, the

requirement of new knowledge, broadens the job descriptions and skillset and therefore new jobs are created due to the role diversity created by AI tools (Litchfield et al. 2023; Petersson et al., 2022).

### 3.9.3 Theme 3: Influential factors that improve AI implementation

This theme emerged as several factors were identified within the systematic review that supports a smoother AI implementation strategy in the healthcare industry. A collaborative approach and open communication among all stakeholders including patients, clinicians, designers of AI technology, policy makers, and hospital leaders that come together to make decisions on how AI should be developed and deployed as part of the patient care decision-making process (Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022; Rainey et al., 2021; Rivera et al., 2021; Sun, 2021). Having a leadership that can develop the right organizational culture was also determined by the literature as a key aspect to facilitate technology adoption within an organization (Kulkov et al., 2023; Litchfield et al., 2023; Rivera et al., 2021). However, this change should be planned and introduced early to the workforce as a strategy for buy-in and implemented on a gradual basis so that learning can take place (Kulkov et al., 2023; Rainey et al., 2021; Rivera et al., 2021). Additionally, since AI technology is a rapidly growing, yet newly developed field, ongoing education and training was identified as an important aspect to implementation since it would allow for trust development and transparency that would help to improve adoption of AI-based medical technology (Kulkov et al., 2023; Petersson et al., 2022; Rainey et al., 2021; Rivera et al., 2021; Yu and Li, 2021).

# CHAPTER 4:
# Discussion, Conclusion & Recommendation

## 4.1 Introduction

This chapter consists of three main sections consisting of the discussion, conclusion and recommendations. The discussion section focuses on the findings of chapter three and defines whether it aligns with the theories or literature from chapter two. The conclusion section outlines whether the pre-set aim and objectives were met, unmet or partially met based on the findings of chapter three. The recommendations are based on the conclusion section as it relates to the findings of chapter three and contributes to answering objective four as stated in in chapter one.

## 4.2 Discussion

### 4.2.1 Theme 1: Challenges to implementing AI

Legislation, governance issues and resistance to change, were the main categories emerging from the research findings in the preceding chapter. Risk related to AI decision-making, data protection and patient confidentiality issues (Cornelissen et al., 2022; Litchfield et al., 2023) amidst the rapid emergence of AI, along with regulations being too strict for AI adoption to occur (Fritsch et al., 2023; Petersson et al., 2022; Petersson et al., 2023) were among the major concerns surrounding regulations and lack of legislative structures to guide the AI implementation process. The findings from the systematic review suggests that a lack of flexibility in the existing legislative framework and further development in the existing regulatory framework (Rainey et al., 2021; Rivera et al., 2021) increases the risk involved in maintaining patient privacy. Therefore, the findings suggest there is need for improvement in AI standardization and accountability that can help to improve AI-based technology implementation in the UK.

Additionally, healthcare leaders are required to drive the implementation process through a transformational leadership approach and are expected to motivate employees toward developing an appropriate organizational culture (Kulkov et al., 2023). The systematic review also identified a lack of collaboration (Petersson et al., 2022; Petersson et al., 2023; Rivera et al., 2021) and poor communication with other stakeholders including patients (Rivera et al.,

2021) as barriers to having timely access to innovative AI-based medical technology. This finding was also supported in the literature review (chapter 2) and described as a third culture between AI and humans (Kolbjornsrud et al., 2017). Therefore, through a transformational leadership approach, AI-based technology can be influenced by these leaders who have the capabilities to motivate their staff and foster a collaborative environment with better communication. This finding is also supported theoretically in the literature review by Khan et al. (2020) in the literature review.

Resistance to change due to a lack of trust, self-confidence in technology use, and poor communication (Fritsch et al., 2022; Petersson et al., 2023; Rainey et al., 2021; Sun, 2021; Yu and Li, 2022) were some of the challenges identified in the systematic review. That is, staff concerns such as too much confidence being placed in AI decision-making and how to go about sharing AI decisions with patients (Petersson et al., 2023), a lack of transparency (Yu and Li, 2022) and poor communication (Kulkov et al., 2023; Sun, 2021) contributed to poor AI adoption rates among staff.

Additionally, poor knowledge and self-confidence in AI use contributed toward the fear of job loss (Rainey et al., 2021) and added to an employee's distrust in AI. Furthermore, the findings from chapter three concluded that the four intermediate variables of age, gender, experience and volunteerism utilized in the UTAUT theory (Ayaz and Yanartaş, 2020) as identified in chapter two, does have some level of influence over an employee's acceptance and use of AI technology. Similarly, patients who have distrust in AI decision-making as seen in the German study (Table 3.4.4), also displayed features of the UTAUT theory's intermediate variables, namely age and gender (Fritsch et al., 2023). Therefore, the studies in both the systematic review by Rainey et al. (2021) and those found in the literature review (Andrew et al., 2021; Jain et al., 2022; Raffaghelli et al., 2022) conclude that intermediate variables such as age, gender, experience and volunteerism as seen in the UTAUT theory (Ayaz and Yanartaş, 2020) does have a significant impact on the adoption rate of technology.

A lack of team diversity was identified in the systematic review (Petersson et al., 2022; Petersson et al., 2023) as having an impact on AI implementation. That is, given that AI-based medical technology has been rapidly expanding, new skillsets and knowledge are required that go beyond the scope of clinicians (Sun, 2021). Therefore, a skill gap is created that can further exacerbates the staff shortages if new AI specialist roles are not created (Rainey et al., 2021). This finding on lack of team diversity was not identified in the literature review and therefore

represents new evidence about the challenges to AI implementation. Therefore, this unique finding from the systematic review can help healthcare organizations to minimize some of the challenges faced when implementing AI-based technology in healthcare.

### 4.2.2 Theme 2: Benefit to AI implementation

The findings from the systematic review indicated that value is created for the organization when new job positions (Litchfield et al., 2023) are created. That is, clinically unrelated skillsets through knowledge acquisition from training (Kulkov et al., 2023) can broaden the human resource value of the organization (Yu and Li, 2022) and its sustainability (Litchfield et al., 2023) which aligns with Lewin's unfreezing stage in the literature review where knowledge acquisition takes place in the change management process (Koziol-Nadolna, 2020).

Additionally, AI's analytical role is two-fold and perceived as beneficial for both patients and staff. Patients can participate in their own care through digital literacy (Petersson et al., 2022) and AI tools that guide their home-based, tailored care plan which only prompts them, when necessary, to seek hospital treatment. This analytical feature reduces hospital bottlenecks and waiting time while improving efficiency and effectiveness. Staff performance optimization is also improved as quality time is spent directly with patients (Kulkov et al., 2023) while AI analytics help to optimize diagnostic and patient care pathways. Thus, allowing healthcare providers time to further expand their clinical knowledge and expertise toward improving patient outcomes (Sun, 2021).

### 4.2.3 Theme 3: Influential factors that improve AI implementation

Several authors from the systematic review identified early communication, collaboration, a planned, gradual introduction to AI use over time, coupled with ongoing training and education and a robust feedback system as important leadership strategies (Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022) that influence the AI adoption rate. These strategies not only utilize the tenets of Lewin's change management strategy of unfreezing, transitioning and refreezing, but introduces opportunities for building trust, transparency that helps to maintain that broader collaboration open communication. Likewise, Sun, (2021) argues that social influence also improves the adoption rate of AI among clinicians and patients, although propelled by different tactics such as other users and a reward system. Moreover, while several influential theories were previously identified, Kulkov et al. (2023),

utilized the resource-based view to discuss the role of the people as it pertained to creating value for the organization. They found that while human resource is vital, it is equally important that AI coupled with evolving technology such as blockchain, will also optimizing the patient's outcome and should be incorporated into the ongoing training of staff for a more receptive implementation of AI into the organizational culture. The evidence presented by Kulkov et al. (2023), where innovative technology such as blockchain is incorporated into the ongoing training and development of staff represents new information that can influence the AI implementation process. This type of visionary training which incorporates the latest technology, can transform an entire organization's culture. Therefore, transformational leadership as identified in the literature review by Bennett (2023), also aligns with the findings of the systematic review since innovative change and visionary characteristics define this type of leadership.

A critical analysis of the findings revealed that there are several influential factors to mitigating the challenges of implementing AI-based medical technology. These include a transformational leader who has vision and understands the operational environment and can deploy a well-executed strategy grounded in theory. Therefore, Stakeholder, Transformational leadership and Unified Theory of Accept and Use of Technology theories along with Lewin's change management have proven its usefulness in innovation and its tenets are aligned to some of the findings in the systematic review. These findings from the systematic review are illustrated in Figure 3.2. and in the literature review and illustrated in Figure 1.1 for clarity.

### 4.3 Limitations

The articles reviewed for this research paper were among hundreds of studies examining AI implementation and its challenges. However, many of those papers were completed using a systematic review as its methodology and could not be utilized for this study. Therefore, this proved to be a limitation for this research since studies using systematic reviews were excluded from the search criteria. There were even fewer articles available from the literature search when this exclusion criteria were applied. This limitation further provides an opportunity for other researcher to conduct primary research in the field of AI implementation as few studies collected primary data to analyse the challenges of implementing AI.

### 4.4 Conclusion

This systematic review, with an aim of analysing the challenges of implementing AI-based medical technology within the public healthcare industry in the United Kingdom, concluded that the aim and objectives of this paper were fully met.

**Objective 1: To identify the challenges affecting the implementation of AI-based technology within the healthcare industry.**

The challenges that affect the implementation of AI-based technology within the healthcare industry were identified. One such challenge was legislation that requires updating. This was identified in the systematic review findings as the main challenge (Fritsch et al., 2022; Petersson et al., 2022; Petersson et al., 2023; Rainey et al., 2021; Rivera 2021 et al., 2021; Sun 2021). Another major challenge was staff resistance to change (Fritsch et al., 2022; Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022; Sun, 2021). Staff resistance to change was linked to a lack of trust and self-confidence, strong organizational culture, poor communication, and late staff engagement in the change management process (Fritsch et al., 2022; Kulkov et al., 2023; Petersson et al., 2023; Rainey et al., 2021; Yu and Li, 2022).

**Objective 2: To analyse the effects of those challenges on the healthcare industry.**

The effects of those challenges affecting the implementation of AI-based technology within the healthcare industry were analysed. The effects of those challenges were poor AI governance and inappropriate ethical behaviour in healthcare. These were linked to the poor practice of accountability, transparency, patient privacy, data protection and increased risk in AI decision-making. These were also further linked to the sustainability of the organization in which care is being transmitted (Cornelissen et al., 2022; Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022; Petersson et al., 2023; Yu and Li, 2022). Additionally, a lack of team diversity (Petersson et al., 2022; Petersson et al., 2023) also influenced the challenges to AI-based technology implementation. That is, since clinicians would require non-clinical specialized training beyond their scope, an AI-based skill gap is created that requires an AI specialist role to be created (Rainey et al., 2021).

**Objective 3: To assess the factors that can improve the chances of AI-based medical technology within the healthcare industry.**

The factors that can improve the chances of AI-based technology within the healthcare industry were assessed. Collaboration, and open communication among all stakeholders including patients, clinicians, designers of AI technology, policy makers, and hospital leaders in the decision-making process (Kulkov et al., 2023; Litchfield et al., 2023; Petersson et al., 2022; Rainey et al., 2021; Rivera et al., 2021; Sun, 2021) were found to be influential implementation factors. Also, a leader that can develop the right organizational culture (Kulkov et al., 2023; Litchfield et al., 2023; Rivera et al., 2021) using a planned, gradual approach (Kulkov et al., 2023; Rainey et al., 2021; Rivera et al., 2021) were found to be useful factors to AI-based implementation.

Additionally, ongoing education and training was identified as another important aspect to AI-based implementation since it would allow employees to develop trust and create better transparency that would improve the chances of AI-based medical technology (Kulkov et al., 2023; Petersson et al., 2022; Rainey et al., 2021; Rivera et al., 2021; Yu and Li, 2021).

In conclusion, the aim of this research paper was achieved. It was established from the systematic literature review that issues surrounding legislation and staff resistance to change were the major challenges experienced in several countries including Sweden, China, Germany, the USA and even in the UK. However, this research has also provided an opportunity to contribute to the existing body of knowledge on the challenges to the practical implementation of AI-based medical technology. A lack of team diversity was identified as a unique finding in this research paper and calls for future studies to verify this finding.

**Objective 4: To recommend evidence-based strategies for improving the implementation of AI-based medical technology within the UK healthcare industry.**

### 4.5 Recommendation

The following recommendations are based on the aim of this paper and on answering objective four which is stated above. The related findings highlighted in chapter 3 and related conclusion section above, are used below to provide strategies that can improve the chances of AI-based medical technology implementation in the UK's NHS system.

### 4.5.1 Training and Education:

Since the NHS is state-funded, the British government should provide ongoing training and education for clinical and non-clinical staff on using AI-based medical tools that already exist to boost user confidence. Also, gradually providing them with latest information on the latest technology would introduce new ideas and concepts on how these AI-based tools can benefit them and expand their knowledge base. Training and education should also commence as early as the curriculum level in medical-related training institutes, which can provide the familiarity and grounding required for entering the world of work with AI-based medical technology.

### 4.5.2 Stakeholder Collaboration:

Collaboration among various AI users including clinicians, and non-clinical staff and patients should be encouraged since this will boost confidence and encourage use. It will also encourage more excellent dialogue among various stakeholders including AI developers, policymakers, users and hospital leaders who provide varying views on how implementation should occur and how it will affect them. This way, AI-based medical technology can be standardized across all NHS institutions for ease of use.

### 4.5.3 Use of expert knowledge:

Since resistance to change can be challenging to manage without the right expertise, a Change Management expert should be utilized for at least a year. This way, the change process can be expertly and collaboratively planned and executed on a staggered basis so that employees are not overwhelmed but rather eased into accepting and using AI-based medical technology.

### 4.5.4 Creation of new organizational positions:

Due to the fast-paced development of AI-based medical technology, it is essential to have expert guidance on how, what and when AI-based medical technology should be integrated into the healthcare system. Therefore, new positions should be created, such as AI Implementation Managers who support the Chief Information Officer's (CIO) role. This new position can manage the AI integration process and other unforeseen infrastructural challenges that may arise while allowing the CIO to continue focusing on other pertinent technology matters.

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# Appendix I

University of Bedfordshire
Business School

**Business School Research Ethics Committee**

**No Specific Ethics Risk Declaration**

| | |
|---|---|
| Student Name/SID | Gail Narinesingh, 2018091 |
| Course | MBA in Hospital and Health Services Management |
| Unit | BSS056-6 Theory into Practice Project |
| Research Project Title | A critical analysis of the challenges around the practical implementation of AI-based medical technology in the public healthcare industry in the United Kingdom. |

In signing this declaration I am confirming that my proposed project does not involve:

- Primary research
- Access to identifiable personal data for living individuals not already in the public domain
- Ownership of the original data not acknowledged
- Research into potentially sensitive areas (e.g., sexual activity, substance abuse)

My proposed project does not therefore require an ethics review and I have not submitted a Research Ethics Application Form.

If any changes to the project involve any of the criteria above, I undertake to resubmit the project for approval.

Signature of Student:  Date: 25/10/2023

In signing this Declaration I confirm that I have reviewed the proposed project and am satisfied that that it does not involve any specific ethics risk as defined by the University of Bedfordshire (https://www.beds.ac.uk/research-ref/rgs/support).

Signature of Unit coordinator/Supervisor:  : 02.11.23