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PREDICTIVE HEALTHCARE: USING MACHINE LEARNING TO REVOLUTIONIZE PATIENT CARE AND EARLY DIAGNOSIS

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Abstract

The implication of the machine learning technologies can significantly help the healthcare professionals to easily diagnose the patients in early stages without the occurrence of any human errors. The "aim and objectives" of the research have been identified in the introduction section. Additionally, the literature review section has highlighted the different concepts and variables along with the theoretical underpinning. The research has been conducted with the help of considering the "secondary qualitative data collection method" and thematic analysis method for analysing the "secondary data sets". The conclusion part has summarised the research findings and the acknowledgement part has been conducted to acknowledge the individuals who have contributed their efforts and resources for accomplishing this present research.

Index Terms: Predictive healthcare, Machine Learning, Early Diagnosis, Revolutionised patient care, Diagnosis processes

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I. Introduction

Predictive healthcare is beneficial as it helps in the chronic disease management with the help of predictive analytics as it enhances the ability to detect the healthcare issues in the early stages. In accordance with the reports the adoption of "Artificial Intelligence (AI) and Machine Learning (ML)" in healthcare organizations has increased extensively and the survey revealed that in upper market healthcare organizations the "implementation of AI and ML" reached to 58% mirrored in figure 1 (statista.com, 2023). Apart from this the lower market healthcare organizations implement AI and ML by 40% (statista.com, 2023). Furthermore, based on the aforementioned aspects the adoption of the "advanced technologies" can reflect a positive impact in enhancing the predictive healthcare in order to revolutionise patient care.
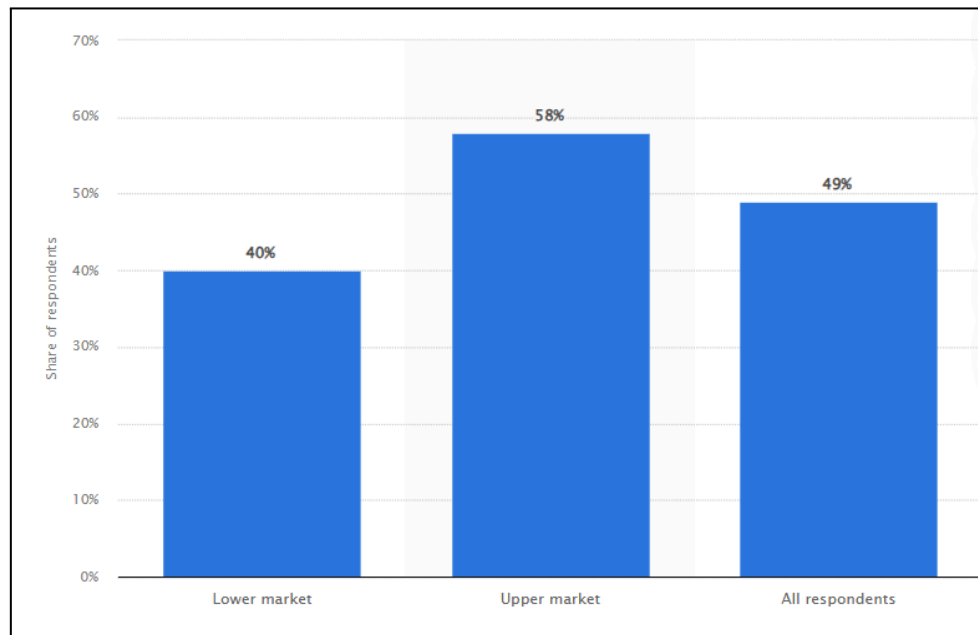

Figure 1: Adaptation of "Artificial Intelligence (AI) and Machine Learning (ML)" in Healthcare Organizations

(Source: statista.com, 2023)

1.1 "Aim and Objectives"

Aim

The aim of research paper is to analyse the usage of machine learning along with its impact to revolutionise patient care as well as enhancing early diagnosis.

Objectives

- To analyse the concept of machine learning in the predictive healthcare
- To identify the challenges in the usage machine learning to revolutionise patient care and early diagnosis
- To evaluate the impact on machine learning in predictive healthcare to revolutionise patient care and early diagnosis
- To access the mitigation strategies to enhance the usage of machine learning and enhancing too early diagnosis and revolutionise patient care

1.2 Research Background and Rationale

The usage of Machine Learning is helpful in the healthcare organisations as it aids in enhancing the diagnosis for the patients as well as providing personalised treatments. The survey conducted in 2020 in the US revealed that young healthcare professionals believe that the focus on digital health records, AI to integrate in diagnosis, and AI to enhance operational efficiency can aid in improvising patient care in the coming five years (statista.com, 2024). Figure 2 of this research paper shows that 25% of young healthcare professionals feel that the integration of the technologies can enhance the digital health records (statista.com, 2024).

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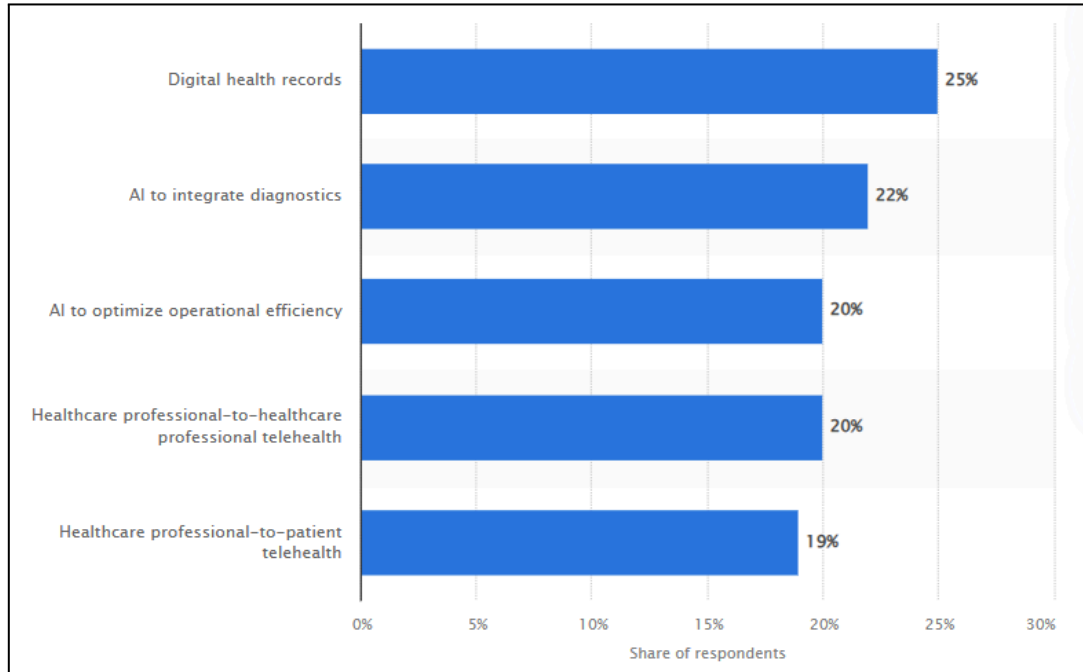
Figure 2: "Healthcare Professionals Believe Following Digital Health Technologies" to Provide "Improving Patient Care in Coming Five Years"

(Source: statista.com, 2024)

The focus on the digital health records is beneficial for providing early diagnosis of the issues. Apart from this one of the major issues that are prevailing in healthcare organizations is lack of knowledge in the usage of the technologies. The reports reveal that in 2021 the "AI and machine learning" "medical device market was valued at $3.1 billion" globally reflected in figure 3 (statista.com, 2024). This reflects that the adaptation of machine learning in the present situation is low due to lack of knowledge in the usage of the technologies and to enhance the predictive results. The reports alps mirrors that the usage of the machine learning medical device market value across the globe is expected to be increased by $35.46 billion in future that an aid in providing better medical sauces to the patients.

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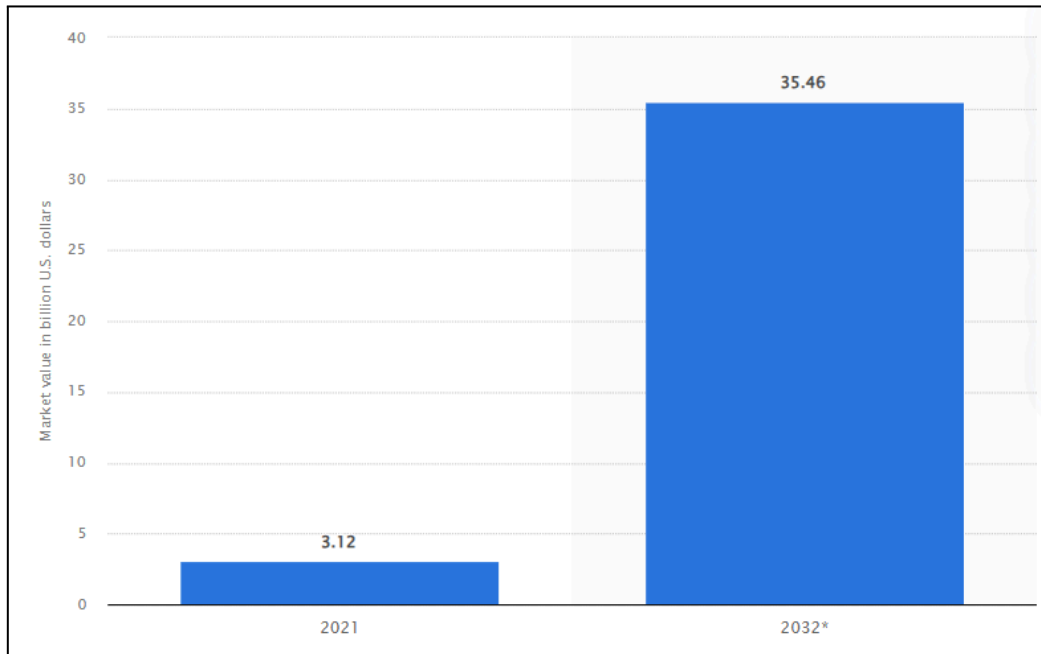
Figure 3: Machine Learning Medical Device Market Value Across the Globe

(Source: statista.com, 2024)

II. Literature Review

2.1 Importance of machine learning in the predictive healthcare

The use of machine learning is significant in the different healthcare organizations as it helps in enhancing the medical tests and "accessing the medical" issues of the patients effectively. In accordance with the viewpoint of Dixon et al. (2024), has mentioned that predictive analytics is helpful in the identification of optimal treatment plans as well as medication regimens that sheds a positive impact in enhancing the patient outcomes. Based on the aforementioned perspective, it can be stated that the usage of "advanced technologies such as machine learning" can be helpful in predictive healthcare as it helps in the early detection of healthcare issues in order to provide early diagnosis. The perspectives by Bica et al. (2021), has mentioned that machine learning can be helpful in evaluating information along with data of patient's that can enhance the treatment for the patients. This reflects that the usage of machine learning is important in the multiple healthcare organizations as it reflects a positive impact in providing better treatment to the patients by early detection of diseases.

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2.2 Issues in the usage of machine learning along with measures to enhance providing better healthcare to the patients

The adaptation of machine learning in healthcare can reflect positively in improving the predictive analytics that assists in providing early diagnosis of the healthcare issues faced by the patients. Mansour and Nogues (2022) stated that one of the noteworthy issues revealing in the healthcare organizations is inappropriate of knowledge among the healthcare professional along with the medical staffs for the usage of the technologies. Relied in the above factor, it can be stated that providing better training facilities to the medical staff along with the healthcare professionals can reflect a positive impact in the better usage of the technologies. On the contrary to this, Glette et al. (2023) stated that lack of budget in the healthcare organisations can reflect a negative impact in the adaptation of the "advanced technologies" that can create issues in providing better healthcare facilities. In this context, avoiding miscellaneous costs can aid healthcare organisations in order to increase funds for the adaptations of technologies such as machine learning in order to enhance the early diagnosis factor. However, Khodadad-Saryazdi (2021), has mentioned that issues in resistance to change in the different healthcare organisations can create issues in the adaptation of the technologies. Considering this attribute it can be reflected that the adaptation of the change management strategy in the healthcare organisations can reflect a positive impact in dealing with the issue of resistance to change as well as revolutionise patient care.

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2.3 Conceptual Framework
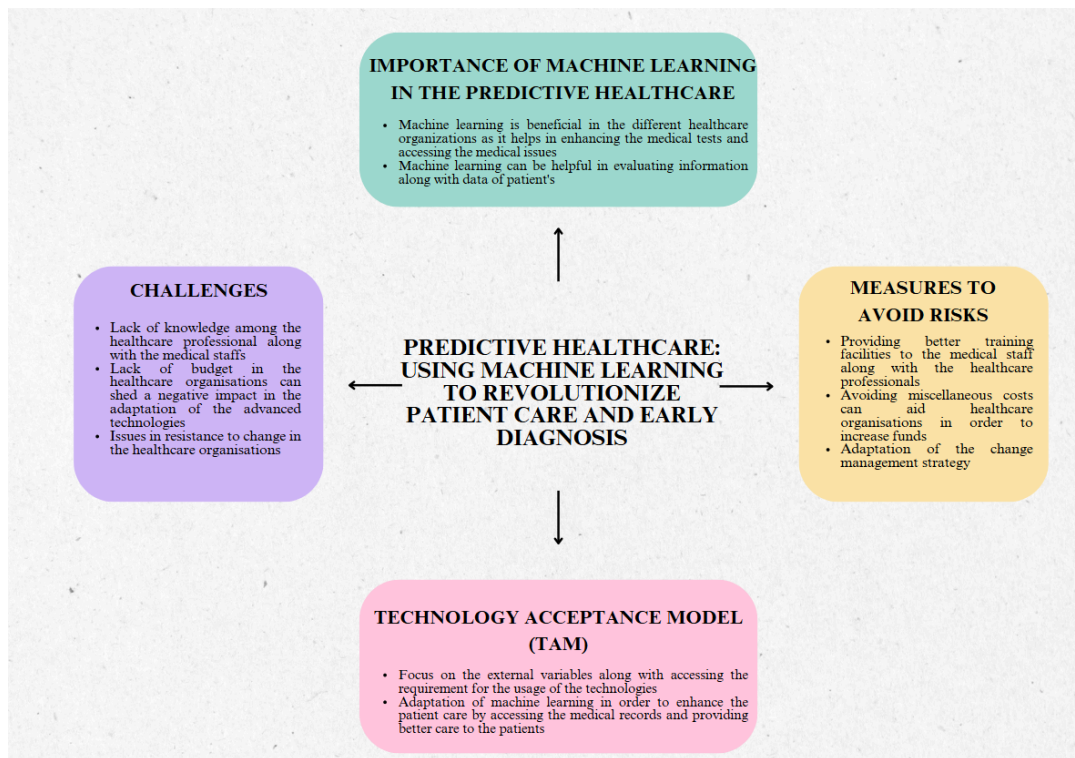
Figure 4: "Conceptual Framework"

(Source: Self-Created)

2.4 Technology Acceptance Model (TAM)

The implication of the "Technology Acceptance Model (TAM)" in the different healthcare organizations can be held in the adoration of the advanced technologies that can assist in enhancing the patient care attributes. Alsyouf et al. (2023) stated that the usage of the "Technology Acceptance Model (TAM)" assists to focus on the external variables along with accessing the requirement for the usage of the technologies. The integration of the "Technology Acceptance Model (TAM)" can shed a positive impact in the healthcare organisations as it helps in the adaptation of machine learning in order to enhance the patient care by accessing the medical records and providing better care to the patients. Thus, the use of the "Technology Acceptance Model (TAM)" can aid in enhancing predictive healthcare and revolutionised patient care along with early diagnosis.

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2.5 Literature Gap

One of the noteworthy gaps in the literature is in "some of the articles" there is "lack of information" regarding predictive healthcare along with the role of machine learning in enhancing patient care. Besides this the other lacking aspect is that time constraints can reflect a drastic impact in analysing the information regarding the research variables effectively.

III. Methodology

3.1 Research Approach and Research Design

The utilisation of the different methods in the research is beneficial as it assists in enhancing the gathering of the knowledge to enhance the readability as well as validity of the research. In the respective research, "Deductive research approach" was used that mirrors a positive impact in accessing variables and concepts such as predictive healthcare, machine learning and others effectively. Hall et al. (2023) mentioned that the utilisation of the "Deductive research approach" aids in providing an "abundance of sources" that enhances in accessing knowledge. In this research, "Interpretivism philosophy" along with "descriptive research design" was used that helps to focus on the information and enhances comprehensive understanding regarding the adaptation of machine learning in providing early diagnosis.

3.2 Data Collection Methods

In the concerned research "Secondary data collection method" was used as it "helped in the gathering information" from previously published journal articles and it is less time consuming compared to other methods. Taherdoost (2021) stated that "Secondary data collection method" assists in gathering knowledge from journal articles, "authentic online websites" along with books. The source from which information is collected regarding predictive healthcare includes "Google Scholar and authentic online websites".

3.3 Sampling Technique

"Convenience sampling strategy" has been applied in this research paper as it is more flexible for the "collection of the journals and articles" regarding predictive healthcare. Golzar et al. (2022) stated that the usage of the "Convenience sampling strategy" is beneficial in the

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research as it assists in eliminating biases in the research. Apart from this the sampling of the journals and articles are based on the "inclusion and exclusion criteria" mentioned below.

3.4 Inclusion and Exclusion Criteria

"Inclusion Criteria"	"Exclusion Criteria"
• The peer reviewed journals that are "written and published after the year 2021" are being accepted by the researcher for the secondary data collection purpose in this present research • The research articles that are written and published as well as completely available in standard English language have only "been accepted by the researcher" for data collection purpose • The "peer reviewed journals and authentic websites" that are "completely available" in reliable sites and databases in Google Scholar have only been selected by the researcher for collecting secondary data for this present research context	• The research articles, peer reviewed journals and websites that are not available in "standard English language" are "not been accepted by the researcher" in this present research context for enhancing the acceptability and comprehending of the research outcomes • The inauthentic contents such as blog posts and doctoral dissertations have completely been "rejected by the researcher" for collecting data in this present research due to the "probability of reliability issues" • The peer reviewed journals and websites that are "written and published before" the "year 2021 have strictly been avoided" by the researcher for reducing the issues regarding validity on research outcomes

Table 1: "Inclusion and Exclusion Criteria" for the Data collection in the Present Research

(Source: Self-Created)

3.5 Data Analysis Technique

The researcher has strictly followed the "thematic analysis" tabular format for analysing the "secondary data sets" and to provide an "in-depth understanding" of the concepts. As per the

view of Braun and Clarke, (2023) it has been highlighted that the major six stages of "thematic analysis" need to be taken into consideration by the researchers and research practitioners while conducting a "thematic analysis" in research practices. In the present study, the researcher has constructed a total of 4 themes based on the 4 research objectives and supported them with 8 secondary sources and justified the statements in the description and discussion sections accordingly. However, the consideration of "thematic analysis" has highly facilitated the researcher to provide a detailed understanding of the actual effects and importance of machine learning technologies in the better patient care and diagnosis purposes.

3.6 Ethical Considerations

The researcher has "acknowledged the authors of peer reviewed journals" and websites by creating an organised reference list at the end of the research paper. The adaptation of the *"General Data Protection Regulation Act 2010"* can aid in facilitating for the researchers in order to maintain the "privacy and confidentiality" of the collected data sets which can increase the loyalty of the samples and the readers as well (gov.uk, 2024). Additionally, the consideration of the *"Copyright Act 1956"* can also make the researchers aware of the piracy and plagiarism related activities which can help to create distinctive and different research results than other studies (legislation.gov.uk, 2024). Moreover, the researcher has adequately followed the complete "inclusion and exclusion criteria" for the data collection processes and data analysis process as well.

3.7 Research Timeline

Tasks	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
Initiating the Research												
Preperation of Aims and Objectives												
Selection of Articles for Literature Review												
Constructing Literature Review												
Selection and Finalisation of Methods and Application of Methodologies												
Identifying Relevant Secondary Sources												
Conducting Thematic Analysis												
Conducting Discussion and Findings												
Summing up the Research												
Final Submission												

Figure 5: Estimated Research Time Table

(Source: Self-Created)

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IV. Results and Discussion

4.1 Results

Authors	Themes	Descriptions
Iftikhar et al. (2024) Chen et al. (2021)	*"Robotic surgery tools and predictive analytics are some major machine learning technologies that are being used in healthcare industries for better patient care"*	The modern decade and the advanced healthcare facilities have introduced different kinds of advanced digital technologies that have been accepted and been used consistently by the healthcare professionals in this present decade. As per the study by Iftikhar et al. (2024) it has been mirrored that the robotic surgery tool is one of the majorly used by the private as well as the developed governmental healthcare sectors for reducing the human errors while surgery cases in operation theatres. The study has also elaborated that the robotic surgery tools powered by machine learning technologies are supremely able to analyse the situations and make error free surgeries effortlessly. On the contrary to this, the study by Chen et al. (2021) has demonstrated that predictive analytics is also a significant example of advanced technologies that are operated by machine learning models. The predictive analytics and the robotic surgery tools are some of the major examples of advanced technologies in the healthcare industries that are operated by machine learning models for giving better patient care.
Banapuram et al.	*"Prediction of diseases in*	The machine learning technologies have highly

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(2024) Zhang et al. (2023)	*early stages, improved clinical research, diagnostic accuracy and improved radiotherapy are some advantages of machine learning in healthcare industries"*	impacted the patient care and diagnosis processes in the modern healthcare sectors that have actually revolutionized the medical field. In the study by Banapuram et al. (2024) it has been stated that the machine learning technologies have helped the healthcare professionals to predict and address the diseases with early diagnosis processes. On the other side, the study by Zhang et al. (2023) has demonstrated that the improved radiotherapy and accurate clinical research are some of the major advantages that have been gained and also improved the healthcare supremacy across the globe in this recent decade. The advanced clinical research and efficient diagnosis and treatment processes through machine learning technologies can immensely speedup the growth of the medical system and healthcare facilities in the upcoming years.
Chikhaoui et al. (2022) Pang et al. (2023)	*"Lack of expertise to utilise the technologies and data security concerns are the major issues faced by the healthcare sectors for implicating ML technologies"*	The inclusion of the advanced machine learning technologies in the healthcare sectors can be also challenging due to some specific reasons. As per the view of Chikhaoui et al. (2022) it has been stated that the lack of expertise in the employees to utilise the advanced technologies can be a major reason behind lack of employee motivation in work due to digitalisation. The lack of expertise in the employee base for utilising the technologies can disrupt the healthcare organisations to provide modern healthcare facilities to the patients as well. On the

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		other hand, the study by Pang et al. (2023) has highlighted that the increased data breaches and lack of proper cybersecurity standards in the organisations can reduce the patient loyalty as well as employee satisfaction. In this regard it can be determined that the lack of cybersecurity standards and the poor employee efficiency to utilise the advanced technologies are the major factors that can be challenging for the healthcare sectors to adapt to digitalisation.
Popov et al. (2022) Irwandy et al. (2024)	*"Providing training programs to the employees and installing strong cyber walls can address the challenges of adapting digitalisation in healthcare sectors"*	Based on the identified issues in the healthcare sectors for adapting the machine learning technologies, it can be stated that the improved efficiency of the employees and improved cybersecurity standards are the major recommendations. According to the study by Popov et al. (2022) it has been seen that the strategy to give frequent technical training programs to the employees based on their job requirements can improve their "job efficiency and technical skills" as well. On the other hand, the study by Irwandy et al. (2024) has stated that the implication of advanced IT infrastructure and strong cybersecurity walls in the organizations can reduce the rate of cybercrime cases and data breaches in businesses. However, based on the comparison and evaluation of findings, it can be estimated that the personalised "training and development programs" and the installation of

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		the advanced IT infrastructure and strong cybersecurity walls are helpful to mitigate the digitalisation related issues in healthcare sectors.

Table 2: Thematic Analysis Table

(Source: Self-Created)

4.2 Discussion

The predictive analytics and the robotic surgery tools are some of the major examples of advanced technologies in the healthcare industries that are operated by machine learning models for giving better patient care (Chen et al., 2021). The advanced clinical research and efficient diagnosis and treatment processes through machine learning technologies can immensely speedup the growth of the medical system and healthcare facilities in the upcoming years (Banapuram et al., 2024). On the other hand, it can be mirrored that the "lack of cybersecurity standards" and the "poor employee efficiency" to utilize the advanced technologies are the major factors that can be challenging for the healthcare sectors to adapt to digitalisation (Chikhaoui et al., 2022). Therefore the strategies like giving personalised technical training programs to the employees based on their job requirements and installing advanced IT infrastructure and strong cybersecurity walls can address the identified issues effectively.

V. Conclusion

The research has summarised that the "implication of the advanced tools" and digital devices powered by the ML technologies can highly facilitate the healthcare professionals in this recent decade to provide better patient care and diagnosis in this recent decade. On the other hand, the research findings have also included that there are some common issues that can restrict the healthcare sectors to implicate ML technologies in their organizations to follow the traditional healthcare processes such as the lack of employee expertise and the poor data security standards. In this regard, the strategies like providing customized training and development programs to the employees based on their requirements and job needs as well as installing strong cybersecurity walls can immensely address and mitigate the identified

healthcare digitalisation issues. Therefore, based on the findings and literature, it can be summarised that the implication of the ML technologies can facilitate the healthcare sectors to grow further in the upcoming years.

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VI. Acknowledgement

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