

AI in Healthcare Services

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Abstract- *In this study, we aim to provide a narrative overview of healthcare services that use artificial intelligence (AI)-based services as part of operations and evaluate the key factors for creating effective AI-based healthcare services. How artificial intelligence improves health care outcomes, helps caregivers at work and reduces health care costs is used to quantify the benefits of artificial intelligence in health care. With a 28% global compound annual growth rate, the AI market in the healthcare sector also has significant market potential. This research will bring together insights from many aspects of the healthcare sector, such as finance, health improvement and care outcomes, as well as provide recommendations and highlight key elements for the effective use of artificial intelligence techniques in the medical field. This study shows how using artificial intelligence in healthcare can reduce costs while improving everyone's health. The method adopted for data collection required for this research is the Survey Method and use of secondary data available. The Survey Method proved to be instrumental in framing the respondent profile and also in realizing their opinions on AI in Healthcare Services.*

Indexed Terms- *Artificial Intelligence, Healthcare Analytics, Machine Vision, Machine Learning, Healthcare Applications, Text Mining, Administrative Applications.*

I. INTRODUCTION

Building intelligent computers that can carry out tasks that traditionally require human intelligence is the goal of the field of artificial intelligence (AI), a subfield of computer science. AI enables machines to simulate and even outperform human mental powers. AI is becoming more and more prevalent in daily life, from the emergence of self-driving cars to the proliferation of smart assistants like Siri and Alexa. As a result, numerous IT firms from a variety of sectors are

making investments in artificial intelligence technologies.

There is a revolution in healthcare driving this shift are rising overall health care costs and a growing shortage of medical professionals. This leads to a situation where the healthcare sector is trying to adopt new procedures and IT-based solutions with cutting-edge technology that could save costs and offer answers to these new problems.

Prior to 2010, health technology companies focused on advances made possible by medical products that offered traditional evidence-based treatments. Since 2010, work has focused on outcomes-based care and real-time medical systems. With an emphasis on collaborative and preventative care, technology is evolving towards medical solutions that provide smart, evidence-based and outcomes-based health solutions from 2020. Robotics, virtual and augmented reality and artificial intelligence can be used to create these intelligent solutions.

According to a recent survey of life sciences executives, 69% of companies in the sector are already testing or using AI in their products, while 22% are considering or want to test AI solutions. By 2026, the adoption of AI in healthcare could save the US economy \$150 billion annually, and this should be one of the drivers for faster adoption of AI in healthcare. Future research will show whether these savings are possible. Healthcare is one of the areas in which services based on artificial intelligence are used.

Surgery, nursing assistance, medical consultation, administration and workflow, treatment planning, cyber security, machine vision, automatic and predictive diagnostics, health monitoring, medication management and clinical trials are some of the areas where AI applications in healthcare fall. Applications that use AI are available in all these areas. We focused on quantitative research, gathering data from reports

from PWC and Accenture, as well as PubMed, Nature Biomedical Engineering, Oxford University Press, the Food and Drug Administration, and some services using AI in the healthcare industry. Based on these documents and reports, we evaluated the effectiveness and results of using AI in non-AI services. Consequently, in this paper, we provide AI-based services for the healthcare sector that have a significant impact on care outcomes, and propose a set of services that can deliver the best results in clinical work and preventive healthcare.

1.2 AI in Healthcare Services

Healthcare is steadily adopting the artificial intelligence (AI) technologies that are pervasive in modern business and daily life. Artificial intelligence in healthcare has the potential to help providers in many areas of patient care and operational procedures, enabling them to build on current solutions and solve problems more quickly. The majority of AI and healthcare technologies are highly relevant to the healthcare industry, yet hospitals and other healthcare organisations may employ very different strategies. And while some articles on artificial intelligence in healthcare suggest that the use of artificial intelligence in healthcare can perform just as well or better than humans at certain procedures, such as diagnosing disease, it will be a significant number of years before AI in healthcare replaces humans for a broad range of medical tasks. But for many, it's still unclear.

Let's take a look at a few of the different types of artificial intelligence and healthcare industry benefits that can be derived from their use.

1. Machine Learning

One of the most prevalent types of artificial intelligence in the medical field is machine learning. There are numerous variations of this broad technique, which is at the foundation of various approaches to AI and healthcare technology.

Precision medicine is the most widely used use of conventional machine learning in the field of artificial intelligence in healthcare. It is a big step forward for many healthcare organisations to be able to forecast which treatment approaches would be most effective with patients based on their characteristics and the treatment framework. Machine learning and precision

medicine applications, which make up the majority of AI in healthcare, require data for training with known outcomes. We call this guided learning.

2. Natural Language Processing

For more than 50 years, healthcare and artificial intelligence have worked to understand human language. The majority of NLP systems combine translation with speech recognition or text analysis. Applications for natural language processing (NLP) that can comprehend and categorise clinical documentation are frequently used in the healthcare industry. Unstructured clinical notes on patients can be analysed by NLP systems, providing amazing insight into how to understand quality, improve procedures, and improve patient outcomes.

3. Rule-based Expert Systems

Expert systems often involve the development of a comprehensive set of rules in a particular knowledge area by engineers and human experts. They are simple to understand and follow, and they work well up to a point. But if the number of rules increases excessively, typically above several thousand, the rules may start to clash and disintegrate. Additionally, altering the rules can be difficult and time-consuming if the knowledge area undergoes a large shift. Machine learning is gradually replacing rule-based systems in the healthcare industry with methods based on data interpretation utilising specialised medical algorithms.

4. Diagnosis and Treatment Applications

The focus of artificial intelligence (AI) in healthcare has been on disease diagnosis and treatment for the past 50 years. Early rule-based systems were capable of diagnosing and treating disease, but clinical practise did not completely adopt them. They didn't significantly outperform humans in diagnosis, and there was poor interoperability with workflows for doctors and medical record systems.

However, whether rules-based or algorithmic, it can frequently be challenging to coordinate the use of artificial intelligence in healthcare for diagnostic and treatment plans with clinical processes and EHR systems. When compared to suggestion accuracy, integration concerns have been a bigger roadblock to the mainstream deployment of AI in healthcare.

5. Administrative Applications

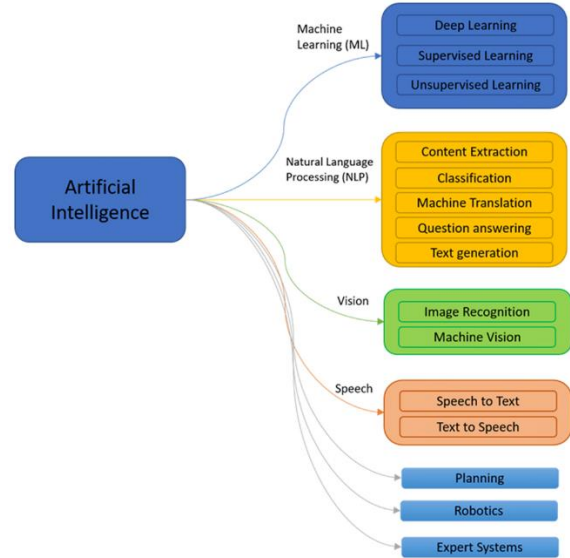
Artificial intelligence has several administrative uses in the healthcare industry. In comparison to patient care, the application of artificial intelligence in hospitals doesn't change the game quite as much. However, using artificial intelligence in hospital administration can result in significant cost savings. Claims processing, clinical documentation, revenue cycle management, and medical records administration are just a few of the applications of AI in healthcare.

Machine learning is another application of artificial intelligence in healthcare that is relevant to the administration of claims and payments. It can be used to match data from several databases. Millions of claims are submitted every day, and insurers and providers must confirm that they are accurate. Time, money, and resources are all saved when code problems and false claims are found and corrected.

6. Text Mining

Massive amounts of textual and numerical data regarding patients, visits, prescriptions, doctor notes, and other topics are gathered by healthcare information systems. The data contained in electronic clinical records may improve the standard of healthcare, encourage clinical and research activities, reduce medical errors, and reduce expenses. However, the complexity, length, and usage of specialised language varies among the documents that make up the health record. This complicates knowledge discovery. Using commercial text mining tools offers a special chance to extract important data from textual data archives.

AI-methods which are commonly utilized in healthcare applications and services. Common applications for AI methods are shown in figure.



Source: <https://f1000research.com/articles/10-6>

1.3 History and Background

Over the past few decades, artificial intelligence (AI) has made major advancements in the healthcare sector. Electronic health records (EHRs), medical imaging, and drug discovery are just a few of the many applications of artificial intelligence (AI) in healthcare that are now under development.

One of the earliest instances of artificial intelligence (AI) in healthcare may be found in the 1970s, when Stanford University Medical Center researchers created an expert system named MYCIN to identify and cure bacterial illnesses. MYCIN was able to analyse patient symptoms and the results of laboratory tests to make therapy suggestions.

In the 1990s, the development of increasingly sophisticated AI systems that could analyse enormous volumes of patient data to find patterns and make predictions was made possible with the introduction of machine learning algorithms and neural networks. Using neural networks to assess mammography images and detect cancers in breast cancer diagnosis is one such example.

The advent of electronic health records (EHRs) in the early 2000s opened up new possibilities for AI in healthcare. Healthcare professionals can choose more effective treatments by using AI algorithms to evaluate

EHR data, find patterns, and forecast patient outcomes.

AI has been applied to medical imaging in recent years to assess images and aid in diagnosis. Virtual assistants and chatbots with AI power have also been created.

In recent years, the adoption of electronic health records (EHRs) has created new opportunities for AI in healthcare. AI algorithms can analyse EHR data to identify patterns and predict patient outcomes, enabling healthcare providers to make more informed treatment decisions. AI is also being used to improve clinical trial design and drug discovery, by identifying potential drug candidates and predicting their efficacy. AI is also being used in drug discovery, clinical trial design, and robot-assisted surgery. Other applications of AI in healthcare include:

- **Medical imaging:** AI algorithms can analyse medical images such as X-rays, CT scans, and MRIs to identify abnormalities and assist with diagnosis.
- **Virtual assistants:** AI-powered chatbots and virtual assistants can provide patients with personalized health advice and guidance.
- **Robot-assisted surgery:** Robots can be programmed to assist with surgical procedures, providing precision and reducing the risk of human error.
- **Despite the many benefits of AI in healthcare,** there are also concerns about privacy, security, and the potential for bias in AI algorithms. As such, ongoing research and development in this field will be essential to ensure that AI can be used safely and effectively in healthcare.

1.4 Objectives of AI in Healthcare

Artificial Intelligence (AI) has the potential to revolutionize healthcare by providing advanced tools and technologies that can improve patient care, diagnosis, treatment, and research. The objectives of AI in healthcare can include:

1. Enhancing Diagnostics:

AI can analyse large amounts of data from various sources such as medical records, imaging studies, and genetic information to aid in early and accurate diagnosis of diseases. This can lead to faster and more

precise diagnoses, reducing errors and improving patient outcomes.

2. Personalizing Treatment Plans:

AI can analyse patient data and provide personalized treatment plans based on individual characteristics such as genetics, medical history, lifestyle, and response to previous treatments. This can optimize treatment options and improve patient outcomes.

3. Improving Patient Monitoring:

AI can enable remote monitoring of patients using wearable devices, smart sensors, and other technologies, allowing continuous monitoring of vital signs and other health parameters. This can help in early detection of deteriorating health conditions and timely intervention.

4. Automating Administrative Tasks:

AI can streamline administrative tasks such as appointment scheduling, billing, and medical coding, reducing administrative burdens on healthcare providers and improving operational efficiency.

5. Enhancing Drug Discovery and Development:

AI can analyse large datasets to identify potential drug candidates, optimize drug design, and predict drug interactions, speeding up the drug discovery and development process and reducing costs.

6. Facilitating Telehealth:

AI can support telehealth initiatives by providing virtual health assessments, triaging patients, and assisting with remote consultations, extending healthcare access to underserved populations and improving healthcare delivery in remote areas.

7. Improving Patient Engagement and Education:

AI can provide personalized health information, education, and recommendations to patients, empowering them to make informed decisions about their health and improve self-care management.

8. Enhancing Surgical Procedures:

AI can assist in surgical procedures by providing real-time feedback, precision guidance, and predictive analytics, improving surgical outcomes and reducing complications.

9. Enhancing Healthcare Research:

AI can analyse vast amounts of healthcare data to identify patterns, trends, and insights that can advance medical research, such as identifying risk factors, predicting disease outbreaks, and conducting large-scale population health studies.

1.5 Applications of AI in Business

a. Recruiting and Hiring

Every day, hundreds of individuals submit applications for one job opportunity in a company due to the severe competition for positions. In order to find the appropriate candidate, it becomes a very time-consuming task for the company's human resources staff to analyse each and every resume.

Employers use Artificial Intelligence (AI) and Natural Language Processing (NLP) to analyse resumes and select only those applicants who closely match their requirements. This is done by looking at several characteristics, like location, aptitude, education, etc. If the candidates are qualified, it also implies that they should be given consideration for more positions.

b. Cybersecurity

Storage and administration are now quite practical in any organisation thanks to the internet. Yet, it also increases the chance of data leaks and breaches. Every business needs internet security since all of its critical databases—including their financial information, business strategy, and private information—are kept online. One of the most crucial uses of AI is in Cybersecurity, which is a requirement for all businesses.

c. Market Prediction

Stock markets are among the most popular and unexpected marketplaces due to their dynamic character. Many people invest in the stock market since it has been shown to be quite profitable. Yet, it has also become easier thanks to artificial intelligence. Artificial Neural Networks (ANN) and Support Vector Machines are two machine learning approaches that are used to identify and forecast the patterns (SVM). Technical analysis is essential for predicting the financial markets and achieving successful outcomes.

d. Customer Analysis

Customers are the lifeblood of businesses, and they have the power to build or break any brand. So, it is crucial for businesses to analyse their consumer base and plan for more participation and advancement in any other area. The majority of conversations took place in person in the past, and forecasting remarks manually based on variables like sales or emotions was extremely difficult for organisations to do.

With the ability to conduct surveys, the company can now solicit feedback from clients that goes beyond just analysing past data. It provides accurate information, supports the implementation of programmes for more engagement and sales facilitation by enhancing the client experience.

e. Virtual Assistants and Conversational Interfaces

Every business offers a distinct set of services that need to be publicised in order to draw in more customers and raise sales. The owners are unable to respond to each person's inquiries and issues individually.

Artificial intelligence is being used by businesses to integrate virtual assistants and chatbots into their websites and applications so that they may answer any queries users may have about the company and provide 24/7 customer service. Typically, chatbots adhere to predetermined scripts and pre-programmed response systems while replying to user requests. They are improving steadily thanks to the advent of neural networks and deep learning.

f. Targeted Marketing

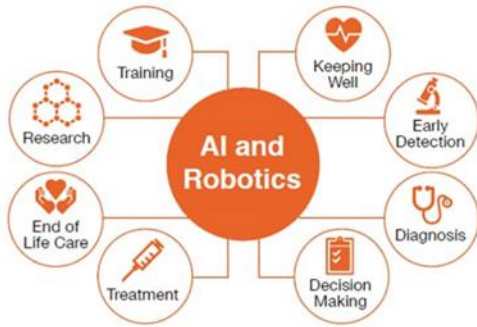
Today, all businesses use the internet to boost their popularity. Targeted marketing or targeted advertising refers to online advertising that employs NLP and AI to display advertisements to just specific audiences. The target market is selected based on their online actions, and if they have recently searched for any relevant goods or services online, they start seeing the advertisements. Because it drastically cuts costs, this type of marketing is very effective and beneficial for the business. This is done by keyword matching.

1.6 Purpose of Study

AI is becoming more proficient at completing human-like tasks more efficiently, and inexpensively. Both

robotics and AI have enormous potential in the field of healthcare. Like in our daily lives, our healthcare ecosystem is becoming more and more reliant on AI and robotics.

Eight examples that show the current state of this shift have been highlighted;



1. Keeping Well

Maintaining people's health so they don't need doctors as regularly, if at all, is one of AI's greatest potential benefits. Artificial intelligence (AI) consumer health applications and the Internet of Medical Things are already helping people (IoMT). Programs and apps for technology help people to adopt healthier behaviours and assist proactive maintenance of a healthy lifestyle. It provides users command over their physical and mental wellness.

2. Prompt Recognition

AI is being used to precisely and early diagnose diseases like cancer. The American Cancer Society claims that a large percentage of mammograms provide misleading results, telling one in two healthy women they have cancer. The application of AI is making it possible to evaluate and translate mammograms 99% accurately and 30 times faster, which eliminates the need for pointless biopsies.

3. Diagnosis

Healthcare businesses are using IBM's Watson for Health to deploy cognitive technology to unlock massive volumes of health data and enable diagnostics. Watson can review and store exponentially more medical data than any human, including every medical publication, symptom, and case study of a treatment's effectiveness worldwide. To address pressing healthcare issues, Google's

DeepMind Health collaborates with doctors, scientists, and patients. The technique combines systems neuroscience and ML to create neural networks that closely resemble the human brain and contain potent general-purpose learning algorithms.

4. Decision Making

Predictive analytics can help prioritise administrative tasks and enhance clinical decision-making and actions. Aligning vast amounts of health data with appropriate and timely decisions is necessary to improve therapy. The application of pattern recognition to identify patients at risk of developing a condition or seeing one worsen due to lifestyle, environmental, genomic, or other factors is another area in which AI is beginning to take hold in healthcare.

5. Treatment

AI can help clinicians manage diseases more comprehensively, better coordinate care plans, and help patients better manage and adhere to their long-term treatment plans. It can also assist healthcare professionals in identifying chronically ill patients who may be at risk of experiencing a negative episode. The usage of medical robots dates back more than 30 years. They range from simple laboratory robots to highly advanced surgical robots that may operate alone or in tandem with a human surgeon.

6. End of Life Care

As we near the end of our lives, diseases like dementia, heart failure, and osteoporosis are causing us to pass away in a different and slower manner than prior generations. Also, it is a stage of life where loneliness is a common problem. Robots have the potential to completely transform end-of-life care by enabling patients to maintain their independence for longer and decreasing the need for inpatient care and nursing facilities. Robots may now interact socially with people to keep human minds young through conversation and other social activities, thanks to AI.

7. Research

It takes a long time and money to get from the research lab to the patient. A medicine must travel from a research lab to a patient for an average of 12 years, of the 5,000 medications that start preclinical testing, only five reach human testing, and only one of these

five is ever authorised for use in humans. Also, the average cost for a business to produce a new drug from the research lab to the patient is \$359 million US.

8. Training

In a way that is not achievable with simple computer-driven algorithms, AI enables students to engage in realistic simulations. In order to continuously adapt the assignments to meet the trainees' learning needs, the training programme might also take into account the trainees' earlier responses. The capability of AI in smartphones also makes it possible to conduct training anywhere, making it easy to do quick catch-up sessions.

1.7 ROLE OF AI IN HEALTHCARE

AI is being used in radiography and incurable diseases like cancer to develop accurate and effective inventions that will assist treat patients who are afflicted by these conditions and, ideally, find a cure. Compared to conventional methods of analytics and clinical decision-making, AI offers a number of benefits. AI algorithms make the systems more precise as they get the opportunity to understand training data, which furthers helps humans get unprecedented insights into treatment variability, care processes, diagnostics, and patient results.

- **Accurate Cancer Diagnosis**

One of the top artificial intelligence and machine learning tools in healthcare, PathAI enables pathologists to make precise diagnosis. PathAI lowers errors in the cancer diagnostic process and provides a variety of fresh methods for customised medical care. Many lives may be saved if cancer patients were diagnosed more accurately so that the majority of them could be treated or cured before it becomes fatal.

- **Early Diagnosis of Fatal Blood Diseases**

Artificial intelligence is a tremendous help in the early detection of potentially fatal blood-related illnesses. Thanks to AI-enhanced microscopes, doctors can now examine blood samples for harmful substances and microorganisms like Staphylococcus, E. coli, etc. much more quickly than they could with manual scanning. Researchers looked at more than 25,000 images of blood samples to train the machines to find the harmful germs. The fatality rate was dramatically reduced because to the robots' ability to recognise

these germs in blood and forecast their presence in fresh samples with 95% accuracy according to artificial intelligence (AI).

- **Customer Service Chatbots**

Through the use of technology like natural language processing (NLP), chatbots enable patients to ask questions about appointments, bill payments, and other topics. In order to lessen the burden on medical staff, chatbots also communicate with patients regarding their sickness and symptoms.

- **Virtual Health Assistants**

Virtual health assistants are in charge of a number of duties, including scheduling medical appointments, notifying patients of follow-up visits and clinical meetings, and taking routine patient calls and emails while safeguarding sensitive information.

- **Treatment of Rare Diseases**

An AI-based clinical-stage biotech platform called BERG seeks to map diseases to hasten the discovery and development of cutting-edge breakthrough drugs and vaccines, revolutionising the way healthcare is provided. Medical practitioners can produce durable products for patients with uncommon diseases thanks to research and development (R&D) and investigative biology.

In addition, BERG has highlighted their Parkinson's disease research advancement. This illness is a neurological ailment that causes stiffness, tremors, and difficulties with basic activities including balance, coordinating, and walking. BERG connects previously unknown connections between human body molecules using artificial intelligence.

- **Management of Medical Records**

Healthcare is among the upcoming Big Data frontiers that must be mastered. A needle in a haystack of important and useful data may get lost in the sea of data being collected, costing the industry billions of dollars per year. In addition, the development of precise diagnoses and novel treatments is slowed down in the absence of the ability to connect essential data points.

A number of healthcare companies have turned to AI as a result of data science in healthcare to stop the data loss. They can now segment and connect the necessary data using AI, which used to take years to handle.

- Reduction of Dosage Errors

Even a single extra dose of a medicine or a drug can have some dire consequences on a patient's body, which is why it is important that the patient takes the right amount of medicine as prescribed. Otherwise, there may be serious repercussions. With the help of Artificial Intelligence, the industry will be able to reduce the margin of probable errors in medication.

- Robot-assisted Surgery

Nowadays, surgery with a robot has become very popular. Robotic technology is being used by several hospitals to help those complete jobs that call for accuracy, control, and flexibility. It is employed for jobs that are beyond the capacity of humans, including as open-heart surgery.

In order to create a new type of surgery, robots outfitted with mechanical arms, cameras, and the necessary surgical equipment enhance the knowledge, abilities, and experience of the surgeons. Robotic surgeries assisted by AI lead to fewer problems, relatively less discomfort for the patients, and quicker recovery times.

- Fraud Detection

While many consumers look for cost-effective medical care, the rate of fraud cases is also rising at an exponential rate. Most medical institutions and patients have sustained significant harm as a result of this. These fraud attempts have significantly decreased thanks to AI-based solutions since they enable complex process navigation and fraud detection.

- Development of New Medicines

The development of drug testing for innovative medications requires considerable time and money. The unique advantage of artificial intelligence technology allows healthcare practitioners to analyse already accessible pharmaceuticals and use them to redesign medications in a way that allows them to combat certain conditions. New drug development is therefore less expensive.

- Improved Healthcare Access
- A variety of interactive and personalised medical applications, such as anytime doctor appointments, have been developed thanks to artificial intelligence. When necessary, the patients have better and improved access to the hospitals, and the AI chatbots further assist them. If the problems are minimal, the patients are immediately advised to take the appropriate prescription, and if a medical visit is required, the same is advised to them.

1.8 The Future of AI in Healthcare

We believe that AI will play a crucial role in the future of healthcare. Machine learning, in particular, is driving advancements in precision medicine, which is widely recognized as a much-needed improvement in healthcare. Although there have been challenges in providing accurate diagnoses and treatment recommendations with AI, we anticipate that these challenges will be overcome in the future. With rapid progress in AI for imaging analysis, it's likely that machines will eventually analyse most radiology and pathology images. Speech and text recognition are already being used for patient communication and capturing clinical notes, and their utilization will continue to increase.

The main challenge for AI in healthcare is not the capability of the technology, but rather ensuring its adoption in everyday clinical practice. To achieve widespread adoption, AI systems must be approved by regulators, integrated with electronic health record (EHR) systems, standardized to ensure consistency, taught to clinicians, funded by public or private payer organizations, and updated regularly. Overcoming these challenges will take time, but we expect to see limited use of AI in clinical practice within the next five years, with more extensive use within the next ten years. The technology will mature faster than the challenges associated with its adoption, and we remain optimistic about the future of AI in healthcare.

It is becoming evident that AI systems will not replace human clinicians on a large scale, but rather complement and enhance their efforts in patient care. As time progresses, human clinicians may transition towards tasks and job roles that require uniquely human skills such as empathy, persuasion, and holistic thinking. It is possible that the only healthcare

providers who may face job loss over time are those who resist working alongside artificial intelligence.

1.9 Key Elements for Successful Implementation of AI-based services in Healthcare

We conducted our research on a subset of global healthcare services and applications. Specifically, we focused on research projects and healthcare services commonly used by healthcare providers, with a particular emphasis on areas related to actual care processes. Through our review, we found numerous research articles in various healthcare areas where AI methods are used to enhance healthcare.

Based on our review and previous studies, we identified several use cases where AI methods can enhance healthcare processes, including saving time in healthcare work, providing accurate diagnoses, analysing medical images and reports, monitoring health conditions and predicting disease occurrence or progression, improving the quality of care, reducing complications in surgical operations, ensuring medical adherence and medication management, and aiding in clinical decision-making.

To successfully implement AI methods in healthcare services, we propose the following factors:

- a. Access to a large, clinically validated dataset to train and validate AI methods.
- b. Scientific Research to validate new or existing AI methods in collaboration with healthcare professionals and AI developers.
- c. Evidence of clinically and scientifically proven enhancements in specific healthcare use cases.
- d. Certification of medical devices for the target market area.
- e. Clear communication to end users that AI does not make clinical decisions on its own, but rather provides recommendations and support for clinical activities and decision-making.

1.10 Key Challenges in adopting AI in Healthcare

Although AI in India is still a relatively new industry, it is expanding quickly. One industry where AI is being widely used to revolutionise quality care is the healthcare sector. However in order to make this efficient, a number of obstacles must be overcome. Here are some of these difficulties discussed:

- Lack of Standardisation

The lack of standardisation is one of the major obstacles to the use of AI in healthcare. There are currently no accepted guidelines for the application of AI in healthcare settings. Both patients and healthcare providers may experience challenges as a result of this lack of standardisation.

Knowing which AI applications are efficient and which are not might be difficult for healthcare providers. This may result in a waste of time and money on AI applications that don't work out in the end. Lack of standardisation might leave people perplexed and unclear about the level of treatment they will get.

- Limited Data

Healthcare organisations have increasingly incorporated artificial intelligence to enhance patient treatment and results. Yet, a significant barrier to this process, especially in India, is a lack of data. Health data is often divided and hard to obtain, making it tough to train AI models.

However, a lot of healthcare facilities lack the resources and infrastructure necessary to fully deploy and employ AI technology. As a result, despite the potential advantages, AI adoption in healthcare is still sluggish.

- Integration with Legacy Systems

Integrating AI with legacy systems is one of the hurdles of its adoption in healthcare. Typically, legacy systems are built on outdated technologies that cannot be used with more modern ones. As a result, data sharing between the two systems, which is essential for AI applications, may be challenging. Also, it's common for legacy systems to lack the processing power or storage space required to run AI algorithms. As a result, organisations might need to spend money modernising their old systems before implementing AI.

- Fear of change and lack of trust in AI

The fact that many individuals are wary of change and have little faith in AI is one of the obstacles to the adoption of AI in healthcare. This is especially true when it comes to selecting our course of treatment. Even when something has the potential to make our

lives better, we are frequently hesitant to give it a try. We may even be more resistant to change when it comes to something as private as our health. Making sure there is open and honest communication about how AI is being utilised in healthcare and the advantages it can provide is one method to address this difficulty.

- High Costs

Another issue with implementing AI in healthcare is its high cost across the board. Although AI has many potential uses in the healthcare industry, the high costs associated with its deployment and development continue to be a major obstacle to its mainstream adoption. Because of this, the high expenses of adopting AI may prevent it from being widely used in healthcare.

- Lack of Qualified Personnel

The shortage of skilled workers in the field of artificial intelligence is one of the most troublesome issues in healthcare. Even though AI has enormous potential to revolutionise healthcare, few people are qualified to create and use AI-based technology. The use of AI in healthcare is significantly hampered by the lack of skilled workers. The potential advantages of AI will not be realised if there are not enough skilled professionals to create and execute AI solutions.

The development of AI is being hampered by these difficulties. But happily, veterans and other professionals are figuring out a way around it and addressing issues to catalyse the development of the technology and support healthcare in more effectively calming and healing people.

1.11 Innovativeness of the Study

Artificial intelligence (AI) has numerous applications in the healthcare industry, and as technology advancements continue to grow, there are challenges that need to be addressed for successful integration of AI into current healthcare systems. In this research, we propose ways to overcome these challenges.

1. Invest in Privacy-Enhancing Technologies

Privacy is a significant concern in the healthcare industry, as patient data contains sensitive personally identifiable information (PII) such as medical histories, identity information, and payment information. The large data requirements of most AI

models and concerns over data breaches reduce the adoption of healthcare AI technologies. Healthcare institutions can use privacy-enhancing technologies (PET) to take advantage of AI while lowering the risk of data breaches. Traditional methods such as data masking involve replacing sensitive information with false but realistic data, and there are emerging PETs that can help ensure the security of sensitive data without reducing its utility.

2. Test AI more to Prevent Diagnostic Errors

Diagnostic errors account for a significant portion of all medical errors and result in an estimated 40,000 to 80,000 deaths each year. Although AI can offer more accurate diagnostics, there is still a chance of mistakes, which causes hesitation in adopting AI for diagnosis. One frequent issue is that low-quality data that does not precisely depict the workings of real-world mechanisms is frequently used to train AI technologies. Healthcare organizations must test and verify that the training data is representative and that the model generalizes well without underfitting or overfitting against the training data.

3. Provide Training and Increase Engagement among Healthcare Workers

One of the top concerns about the advent of AI among healthcare providers is its potential impact on employment. While AI may replace repetitive and routine jobs, it is still far from replacing most jobs that require human expertise. This slows down the adoption of AI among healthcare organizations. To overcome this challenge, healthcare organizations should provide training to upskill their workers in AI and machine learning technologies and their applications. This will help create a confident workforce that can effectively use emerging technologies and support employees in their long-term careers.

4. Educate to Reduce Patient Reluctance

People are often resistant to change and more accepting of familiar things, especially in healthcare. Introducing new and unknown technology to patients can create hesitations. A significant obstacle to integrating AI in healthcare is patient resistance. For example, at the beginning of the Covid-19 pandemic, patients were not comfortable with online check-ups. However, now many people prefer them. According to

a recent American study, about 50% of patients prefer healthcare facilities to offer online or web-based check-ups. Initially, patients might find it intimidating to be operated on by a robot. While hesitations may diminish as people comprehend and understand well about advantages, such as less post-procedure discomfort and problems.

1.12 About the DaVinci Surgical System

Robotic-assisted surgery utilizing the DaVinci Surgical System provides surgeons with the ability to perform complex minimally invasive procedures with a high degree of precision and accuracy. This advanced robotic platform enhances the capabilities of surgeons and provides an alternative to traditional open surgery. The da Vinci System has been utilized successfully in numerous procedures, with its safety and efficacy well-documented in clinical publications and extensive literature supporting its utilization.



The da Vinci Surgical System provides the surgeon with:

1. Precision, dexterity and control during surgery
2. The ability to execute 1-2 cm incisions versus longer incisions

The da Vinci Surgical System consists of:

1. An ergonomically designed surgeon's console
2. A patient cart with four interactive robotic arms
3. A high-performance vision system and patented

DaVinci Surgical System Fast Facts

- In 2000, the da Vinci Surgical System became the first robotic surgical platform commercially available in the United States to be cleared by the FDA for use in general laparoscopic surgery.
- There are more than 1,700 da Vinci Systems installed in hospitals worldwide.
- More than 775,000 patients worldwide have had a da Vinci procedure.
- Da Vinci procedures are performed for a wide range of conditions in specialties including cardiac, urologic, gynaecologic, paediatric and general surgery.
- Roughly three out of four prostate cancer surgeries in the U.S. today are performed using da Vinci Surgery.
- Improved Technology for Physicians, Better Outcomes for Patients

The da Vinci System represents a significant advancement over traditional laparoscopy, where the surgeon operates while standing and uses rigid, long-shafted instruments that lack flexibility and rotation. In conventional laparoscopy, the surgeon must divert attention from the instruments to a 2D video monitor to view the target anatomy. Additionally, the surgeon relies on an assistant to position the camera correctly. In contrast, the da Vinci System's ergonomic design enables the surgeon to operate comfortably from a seated position at the console, with hands and eyes aligned with the instruments. The surgeon can easily manipulate the instruments and adjust the camera position using hand movements. With superior vision, enhanced dexterity, improved precision, and ergonomic comfort, the da Vinci Surgical System expands the capabilities of more surgeons to perform complex and delicate minimally invasive procedures involving dissection or reconstruction.

II. LITERATURE REVIEW

As suggested by Zupic and Čater (2017) [2], the research stream can be evaluated using bibliometric methods that can introduce objectivity and mitigate researcher bias. For this reason, bibliometric methods are attracting increasing interest among researchers as a reliable and impersonal research analytical approach (2019, 2020) [3, 4]. Recently, bibliometrics is a basic

method for analyzing and predicting research trends (2020) [5].

The cited scientific articles show substantial differences in keywords and research topics that have been previously studied. Bibliometric analysis of Huang et al. [6] describes rehabilitation medicine using virtual reality technology. According to the authors, the primary goal of rehabilitation is to increase and restore functional capacity and quality of life in patients with physical disabilities or impairments. In recent years, many healthcare disciplines have privileged access to various technologies that provide tools for both research and clinical intervention.

Hao et al. (2018) [7] focus on text mining in medical research. As stated, text mining uncovers new, previously unknown information by using a computer to automatically extract information from a variety of textual sources. Text mining methods can be considered as an extension of data mining to text data. Text mining is playing an increasingly important role in medical information processing. Similarly, a study by dos Santos et al. (2019) [8] focus on the application of data mining and machine learning (ML) techniques to public health problems. As stated in this research, public health can be defined as the art and science of disease prevention, health promotion and life extension. Using data mining and ML techniques, it is possible to discover new information that would otherwise be hidden. These two studies are related to another topic: medical big data. According to Liao et al. (2018) [9], big data is a typical “buzzword” in the business and research community that refers to large amounts of digital data collected from various sources. In the medical field, we can get a huge amount of data (i.e. medical big data). Data mining and ML techniques can help deal with this information and provide useful information to doctors and patients. Recently, Choudhury et al. [10] provide a systematic review on the use of ML to improve the care of elderly patients and demonstrate appropriate studies mainly in psychological disorders and eye diseases.

Tran et al. (2019) [14] focus on the global development of artificial intelligence research in medicine. Their bibliometric analysis highlights trends and topics related to artificial intelligence applications

and techniques. As reported by the study of Connelly et al. (2020) [11], the number of robot-assisted surgeries has increased rapidly in recent years. Their bibliometric analysis shows how robot-assisted surgery has gained ground in various medical fields such as urology, colorectal, cardiothoracic, orthopedic, maxillofacial, and neurosurgery. Moreover, the bibliometric analysis of Guo et al. (2020) [12] provides an in-depth study of AI publications up to December 2019. The article focuses on specific healthcare applications of AI and gives researchers an idea of how algorithms can help doctors and nurses. A new stream of AI-related research is also emerging. In this sense, a scientific contribution by Choudhury and Asan (2020) [13] provides a systematic review of AI literature to identify health risks for patients. They report on 53 studies involving technology for clinical alerts, clinical reports and drug safety. Given the considerable interest in this research stream, this analysis differs from the current literature for several reasons. Its aim is to provide an in-depth discussion that is mainly related to the field of business, management and accounting and is not only concerned with medical and health publications.

In addition, our analysis aims to provide a bibliometric analysis of variables such as authors, countries, citations and keywords to guide future research perspectives for researchers and practitioners, as has been the case for several publications in other research streams (2015, 2020,2021) [2,3]. . For this we use another database, Scopus, which is commonly accepted in social science fields. Finally, our analysis will propose and discuss a dominant framework of variables in the field, and our analysis will not be limited to descriptions of AI applications.

III. RESEARCH METHODOLOGY

Methodology

Qualitative versus Quantitative techniques

In order to satisfy the objectives of the project, quantitative research was held.

The aim is to classify features, count them, and construct statistical models in an attempt to explain what is observed.

Data collection method and tools

The method adopted for data collection required for this research is the Survey Method and use of secondary data available. Thus, a questionnaire was prepared consisting of simple questions and was distributed among 100 respondents. The Survey Method proved to be instrumental in framing the respondent profile and also in realizing their opinions on AI in Healthcare Services

Research Technique: Descriptive Research

Method Adopted for Data Collection: Survey Method

Sample Unit: 100 respondents

Sample Selection

There are several different sampling techniques available, and they can be subdivided into two groups: probability sampling and non-probability sampling. In probability (random) sampling, you start with a complete sampling frame of all eligible individuals from which you select your sample. In this way, all eligible individuals have a chance of being chosen for the sample, and you will be more able to generalize the results from your study. Probability sampling methods tend to be more time-consuming and expensive than non-probability sampling. In non-probability (non-random) sampling, you do not start with a complete sampling frame, so some individuals have no chance of being selected. Consequently, you cannot estimate the effect of sampling error and there is a significant risk of ending up with a non-representative sample which produces non-generalizable results. However, non-probability sampling methods tend to be cheaper and more convenient, and they are useful for exploratory research and hypothesis generation.

Tools of data collection

The main tool used for collecting the data for this research is the Questionnaire. The questions in the questionnaire were arranged in a logical order with personal information in the beginning followed by questions related to AI in Healthcare Services. Likert scale was used mainly while preparing the questionnaire. The questionnaires were to be filled by 100 respondents. This was done by personally asking the doctors or medical students to fill the questionnaire or was filled by interviewing customers and some of them also chose to reply to questionnaires, which were sent to them through E-mails.

Primary Sources of Data

- Direct access to respondent (Students)
- Google form

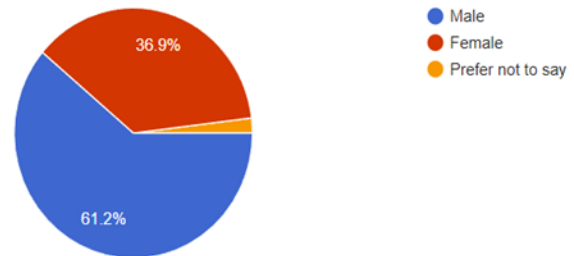
Secondary Sources of Data

- Internet websites
- Newspapers and magazine articles
- Social site
- Research journal

IV. DATA ANALYSIS

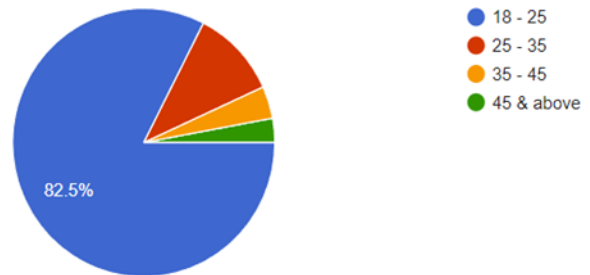
We had conducted a survey among 100 people, where 63 of the respondents were male and 37 of the respondents were female. This survey was conducted to collect information about their understanding of AI in Healthcare Services, and we have the following findings—

Chart 4.1: Chart showing the respondent’s gender.



Inference: Here 63 respondents were male, and 38 respondents were female.

Chart 4.2: Chart showing the respondent’s occupation.



Inference: Highest number of respondents belonged to the age group of 18 to 25 and least respondents were for the age group of 45 & above.

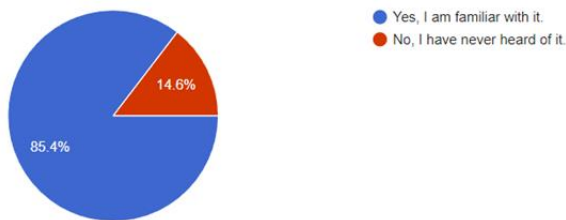
Chart 4.3: Chart showing the occupation of the respondents.



Inference:

Most of the respondent were students but we managed to get responses from different fields such as software engineers, businessmen, freelancers, housewife etc.

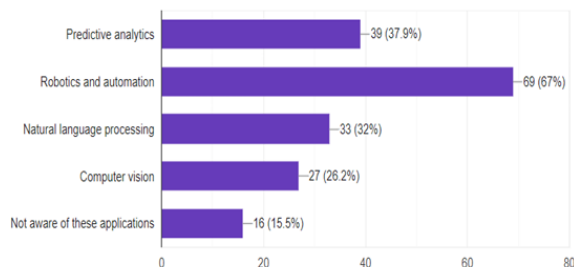
Chart 4.4: Chart showing the respondent's familiarity of AI in healthcare services.



Inference:

Over 85% of the respondent knew what AI is and its contributions in the healthcare sector and around 15% of the respondents were not so sure about it. This shows a lack of awareness about the use of AI.

Chart 4.5: Chart showing the Applications of AI.

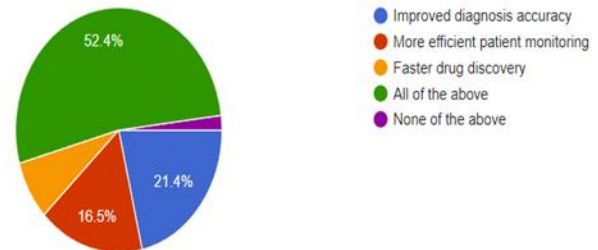


Inference:

When the respondents were given a set of AI applications that are being used in the healthcare sector, close to 70 of the respondents stated that

Robotics and automation has greatest potential in the sector and the next application which was voted the most was Predictive analytics while there were around 16 respondents who were unaware of these applications.

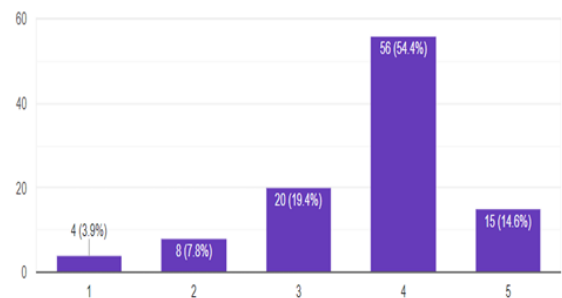
Chart 4.6: Chart showing the benefits of AI in healthcare services.



Inference:

When asked about what benefit the use of AI in healthcare services can give, most respondent (52.4%) said all the above options which included improved diagnosis, more efficient patient monitoring, faster drug discovery and the next majority (21%) of respondents said that AI will help to improve diagnosis accuracy.

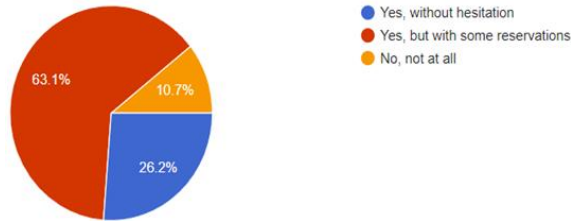
Chart 4.7: Chart showing how like the respondents would use an AI powered healthcare service.



Inference:

When asked how likely were the respondents to use an AI-powered healthcare service if it is recommended by your healthcare provider? Over 50% of the respondents said most likely but they were 4 respondents who said that they wouldn't use them. There were 5 respondent who said that they are very likely to use it.

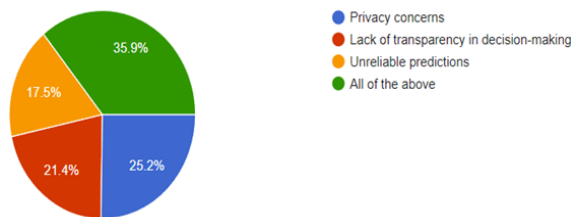
Chart 4.8: Chart showing the willingness of the respondents to share their personal health data to an AI.



Inference:

Over 60% of the respondents were willing to share their personal health data with an AI with some reservations but the rest would not do it. Over 10% of the respondent were hesitant to provide personal health related data to the AI due to security and privacy concerns.

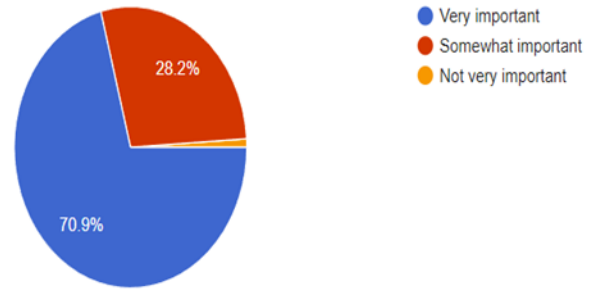
Chart 4.9: Chart indicates the risk associated with use of AI in healthcare services.



Inference:

Close to 36% of the respondent felt that they might face privacy issues, lack of transparency and might receive unreliable prediction or analysis for the AI. They felt this as a threat as it was concerned to their health. Over 60% of the respondents had privacy concerns.

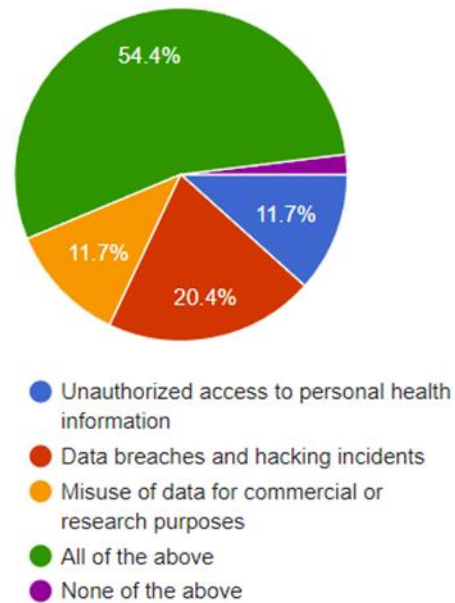
Chart 4.10: Chart showing the importance of transparency in decision making process.



Inference:

Over 70% of the respondents said that AI in Healthcare Services should be transparent and explainable in its decision-making process but the rest 30% responded that it is somewhat or not very important.

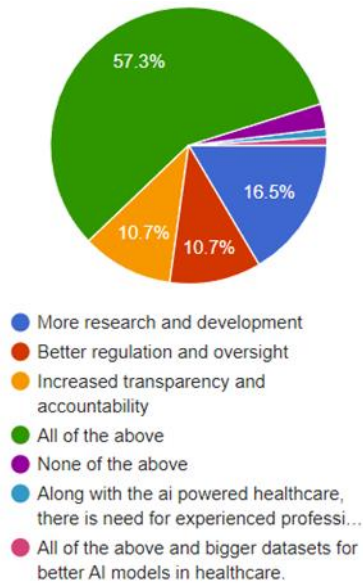
Chart 4.11: Chart showing the kinds of data privacy and security concerns of respondents over the use of AI.



Inference:

Respondents had high data privacy and security concerns and felt that they might face unauthorized access to personal health information, Data breaches and hacking incidents, Misuse of data for commercial or research purposes as over 54% of the respondent chose all of the above option. Most of the respondents were concerned about data breaches and hacking incidents.

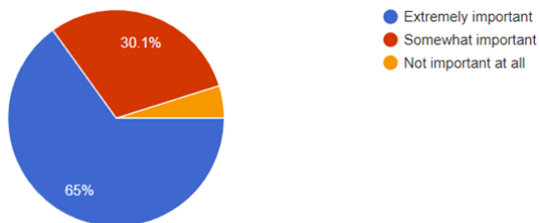
Chart 4.12: Chart showing the opinions of the respondents over the improvements in the use of AI in healthcare.



Inference:

Over 50% of the respondents responded that more research and development should be done, better regulation and oversight is needed and increased transparency and accountability. And also, a respondent suggested that we need a professional with the AI to make better decision and to verify the analysis of the AI. Another respondent suggested that we need a bigger database for making better models of AI for the use in healthcare industry.

Chart 4.13: Chart showing how important the respondent feel about integrating AI in healthcare industry.

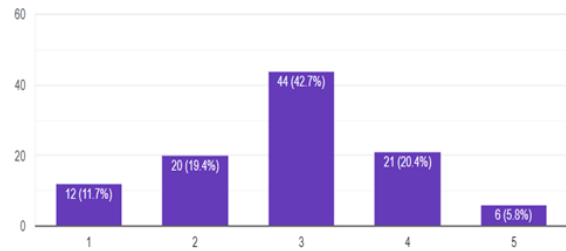


Inference:

65% of the respondents suggested that it is extremely important for us to integrate AI with healthcare

services. Whereas 30% of respondents suggested that it is somewhat important and the last 5% of the respondent suggested that it is not important at all.

Chart 4.14: Chart showing how knowledgeable do respondents feel about the use of AI in healthcare services.



Inference:

When the respondents were asked to rate themselves out of 5 on how knowledgeable they felt they were after the survey, 43% of the respondent rated themselves 3, 20% of the respondent rated themselves as 4 and only 6% of them rated themselves 5 out of 5. This shows a lack of awareness about the use of AI in healthcare services.

V. FINDINGS AND ANALYSIS

1. The participants' knowledge of AI technology varies, according to their answers to the survey about its use in healthcare services.
2. Highest number of respondents belonged to age group 18-25 and least were of age group 45 & above.
3. Over 60% of respondents stated that more research and development should be done, better regulation and oversight is needed and increased transparency and accountability.
4. The majority of participants agree that employing AI in healthcare services may have advantages such as better diagnosis accuracy, faster and more effective therapy, and individualised treatment plans.
5. Issues with data security and privacy, possible biases or errors in AI decision-making, and decreased human interaction and care were also brought up.

6. The participants also acknowledged that sectors like diagnostics and imaging, drug discovery and development, and patient monitoring and management may benefit most from AI.
7. The majority of participants also agreed that it is crucial for AI decision-making in healthcare services to be transparent and understandable.
8. Many respondents were willing to share their personal health information with AI-powered healthcare services, and transparency and explainability in AI decision-making were viewed as being of utmost importance by respondents.
9. One other thing which we can notice that people are not truly aware of the use of AI in healthcare or they are not been given the right knowledge about the use of AI.
10. There is a lack of trust and a lack of knowledge in the participants and they were hesitant to provide their personal information to AI. Participants were not aware of all applications where AI were being used in the sector but knew that use of AI will help them with some risk associated with it.
11. When the respondents were asked to rate themselves on how much they know about AI in healthcare services they rated themselves 3 out of 5 this suggest that there is a lack of knowledge among people.
12. Overall, the results indicate that while there is optimism about the potential advantages of AI in healthcare services, there is also a need to address worries about data privacy and security, decision-making biases, and transparency in AI algorithms.
13. The results of this survey can be used to guide the creation and application of AI-powered healthcare services that put patient safety and privacy first while maximising the technology's potential advantages.

CONCLUSION

As a conclusion of our systematic review we found out that AI can have remarkable possibilities in reducing healthcare costs, providing preventive healthcare, ease the work burden of healthcare professionals, and providing more accurate diagnosis faster and easier. The need for AI services arises in the facts that healthcare costs are continuously increasing. Additionally, age structure of population is changing, especially in developed countries, Causing that there

will be more chronic diseases within aged population needing expensive care. There will be also shortness of trained nurses and healthcare professionals. Moreover, access to modern and effective healthcare services are not available especially to poor and elderly people and for most of the population living in developing countries. When AI methods are used in healthcare research and IT processes in full scale, we can achieve remarkable savings in overall healthcare costs and same time improve health outcome and quality of life.

The need for enhancement provided by AI methods can be seen in every studied healthcare service areas. Moreover as conclusion we have identified and proven that there is very high potential for the state-of-the-art AI solutions in almost every healthcare sector to reduce costs, ease healthcare professional's workload, improve quality of life for patients, provide preventive health and improve overall health outcome. There are also AI based solutions which can be utilized for population in developing countries. These services include preliminary diagnosis, preventive health services, patient health monitoring services and virtual nurse assistants. In addition, it must also be emphasized that artificial intelligence solutions can produce \$150 billion savings in global healthcare industry by 2026. Based on these findings we can express that investing to AI in healthcare will pay for itself. We recommend all healthcare IT service development companies and research organizations to fully adopt scientifically validated AI methods in their research and development projects.

When developing and implementing new applications and services for industrial purposes and especially for healthcare industry safety and quality of service are also key elements for successful new service implementation. To maintain and enhance quality AI method developers need to fulfil standards, regulations and solve possible emerging legal constraints.

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