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Chapter 12

The future of artificial Intelligence in healthcare IT: Trends, opportunities, and predictions

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Abstract:

The future of AI in healthcare IT is poised for significant growth, with trends like personalized medicine, predictive analytics, and AI-powered diagnostics leading the way. Opportunities for improving patient care, reducing costs, and enhancing operational efficiency are abundant, alongside emerging challenges in ethics, regulation, and integration.

Keywords

AI, Healthcare IT, Medicine, Predictive Analytics, Regulations, Trends

12.1. Introduction

AI in healthcare IT is gaining penetration and increasing significance. Especially in the background of the pandemic and its radical impact on healthcare, AI is expected to revolutionize healthcare in the near future. The healthcare sector is lagging behind when it comes to adapting to technological advancements in the IT sector, but at the same time, technological developments are anticipated to shape the healthcare sector, especially with the increasing knowledge-sharing activities. IT in healthcare has transcended its basic role of paperless documentation and computerization of operations to move on to more advanced roles like data analytics, decision-making, and capability building. The future of healthcare IT involves the increased penetration of AI and ML to assist decision-making through advanced algorithms. Healthcare IT is a significant subject area that warrants intense investigations as it is one of the areas where IT is lagging behind (Danda, 2022).

Healthcare IT is influenced by trends such as telehealth, data security, research culture, big data analytics, and AI, which have diverse influences in the healthcare sector. AI in healthcare IT is a subject area for investigation due to its criticality, transformative potential, and the increasing attention it demands. The paper first provides an insight into the current scenario of AI integration in healthcare IT and then goes on to make predictions about the integration. The paper provides a narrative after a thorough review and exhaustive discussion with multiple stakeholders. This paper will provide insights into AI applications in healthcare.

12.1.1. Background and Significance

Artificial intelligence approaches are becoming an integral part of a healthcare IT ecosystem. The processes of market analysis and forecasting, examination, the role of cognitive AI with the implementation of machine learning, cognitive computing, chatbots, robotics, and other AI modalities may have substantial potential in healthcare. The movement from strictly structured to unstructured data analytics, which is an unpredictable, unstructured, and valuable source, allows for smarter and more personalized care than has been available before. This is also a trend that may change the face of medicine while enhancing a healthcare entity's financial performance. Aging and the growing number of people experiencing chronic diseases are significant trends of AI and cognitive innovation in healthcare. The millennial generation's preferences are also representative of a change in behavior. Millennials have grown up working with tech-savvy tools and are considerably more comfortable adopting new technology. Their preferences may have a really positive influence on personal assistance robots and promote the expansion of chatbot and cognitive digital health products.

AI in healthcare is anticipated to deliver twice as much potential to aid healthcare providers in enhancing outcomes and operational productivity. Healthcare organizations plan to save upwards of $150 billion every year by 2025 through AI-dependent applications, including care logistics, dosage error reductions, fraud, cybersecurity, counterfeit drug error reduction, and administrative assistance. New opportunities continue to arise in research and drug production in order to offer personalized medication treatments and implants. Cognitive computing is predicted to grow to a market size of over $12.5 billion. The manuscript reports the latest healthcare and cognitive AI technology trends, explains the process of handling data generated from population health to the patient level and their integration into clinical decision support and cognitive AI platforms, and evaluates the likely future effect on a company's finances.

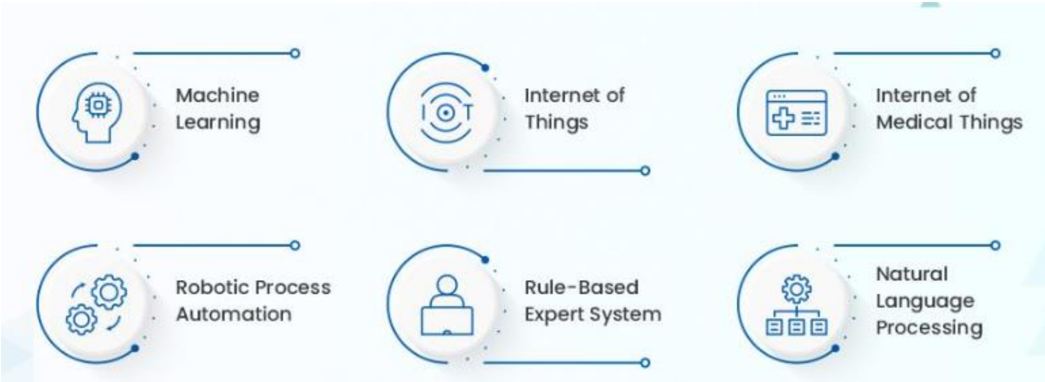

Fig 12 . 1 : The Future of AI in Healthcare.

12.1.2. Purpose of the Paper

The main purpose of the research presented in this paper is to identify and critically analyze core trends and developments in artificial intelligence (AI) pertinent to healthcare IT, especially as they might apply to and benefit healthcare information and communications (ICT) systems (Syed, 2022). The specific aim is to contribute to the current landscape of AI and healthcare IT through: providing clarity on healthcare AI applications today; foreseeing potential future developments in the field; distinguishing important emerging opportunities and challenges; and identifying and offering an outlook on emerging technologies and their implications over the near- and mid-term horizons. With the ongoing and unprecedented evolution of AI research and development, the paper addresses both the technical audience involved in developing and deploying healthcare IT/ICT technologies and solutions, as well as policy-makers and practitioners in healthcare involved in the practice of care delivery, administration, and management. While there is a wealth of available products and services facilitated by AI in the healthcare sector today, there is little documented or synthesized evidence proposing to integrate this learning into healthcare systems. This paper seeks to not only inform healthcare systems of potential future progressions in AI, but also to inform research and development in the AI-oriented technologies that are beginning to emerge. It is hoped that the paper, and the literature review in particular, will catalyze further research and interest from the scientific community. In the subject area of ICT in healthcare, AI introduction is often addressed through the lens of ethics, as well as through computer science, for example in clinical decision support systems.

Equation 1 : Predictive Analytics for Patient Outcomes

$$P_{\text{outcome}} = \frac{1}{N}\sum_{i=1}^{N} P_{\text{AI}}(Y_i|X_i, H_i)$$

P_{outcome}: Average predicted probability of patient outcomes.

$P_{\text{AI}}(Y_i|X_i, H_i)$: AI-predicted probability of outcome Y_i for patient i, based on features X_i and historical data H_i.

N: Total number of patients analyzed.

12.2. Current Applications of AI in Healthcare IT

AI technologies are already providing value to healthcare IT in a variety of ways. Here, we will provide an overview of some of the most impactful uses of these technologies and how they are being employed. We identify and discuss a range of use cases from three areas: 1) Diagnostic imaging, which is one of the most successful applications of AI in healthcare IT, 2) Drug discovery and development, which can benefit from AI and real-world evidence technologies to accelerate approval and modernize drug development, and 3) Personalized medicine, which can leverage AI to apply a data-driven strategy in identifying subpopulations of patients to determine which treatment strategy is most successful.

AI in Diagnostic Imaging

In diagnostic imaging, AI has shown success in detecting, diagnosing, and predicting a wide array of conditions and diseases, such as diabetic retinopathy, cancer, radiotherapy outcomes, and fractures.

AI in Drug Discovery and Development

While the outputs of AI have not been directly integrated into clinical practice, the trends outlined suggest that the potential opportunities for these applications will be large and may add value at the intersection between market and patient areas of interest.

AI for Personalized Medicine

AI technologies have demonstrated success in addressing real-world challenges, including lack of standardization in the pathway and a current focus on pre-symptomatic or early-stage disease detection. • There is a significant need in the area of personalized medicine to reduce the number of patients appropriate for treatment based on clinical trial participation. There is potential for these applications to significantly impact patient treatment once they reach the market (Nampalli, 2022).

12.2.1. Diagnostic Imaging

AI Applications in Diagnostic Imaging

AI algorithms are currently employed to review complex medical images in real time. Machine and deep learning models can effectively go through enormous amounts of medical imaging to detect anomalies or other deviations. The application field, modalities, and results of AI use in medical imaging are very diverse. The radiological field was a pioneer in innovative technological equipment such as computed tomography, magnetic resonance, angiography, or more recent 3D ultrasound scans, which permit increasingly detailed imaging and dimensional quality. Diagnostic radiology has a direct benefit of prognostic nature in the majority of cases. AI can be used for automated image interpretation in almost all of the radiological fields. The pathology field benefits from the application of digital imaging, since biopsy results can be provided in less than 48 hours for a patient with cancer.

Technology Based on AI in Diagnostic Imaging

The technology is now based on algorithms using deep learning, which is a more sophisticated category of AI based on the different layers of artificial neural networks. Examples of utilization are found both in radiology and pathology. First, we mention the already famous usage of AI in radiology: from early evidence to deep learning. For some years, there has been a growing interest, namely an increase in attention to the subject of AI and its application in diagnostic imaging. This has long been a subject of research; however, only recently have they managed to obtain impressive results in image classification, so AI can have a high application potential for various complex data analyses, including medical imaging. A subfield of AI that involves the development of algorithms capable of performing tasks that normally require human intelligence is machine learning. It provides an example of the application of predictive diagnosis on MRI. Among the most evident results at the moment is the image classification of possible cases of CRC from existing endoscopy investigations. The method of abbreviated colonoscopy by ML has significantly increased not only the accuracy of the patients with normal colonoscopy but also those with significant lesions. This technique managed to predict polyps and scar tissue. In addition, a recent study independently validated the diagnosis model using endoscopic still images. Other studies have shown that DL is more useful in the presence of heterogeneous data. It is concluded that AI is fundamentally different in addressing tasks by clinicians in general. It does not show a very beneficial model for the detection of neoplasia only, but also has information on the degree of malignancy. Many research studies on AI in recent years have shown great success in using data and these innovations to increase their sensitivity and specificity compared to manual diagnosis. A transition to the use of AI in radiology is foreseen, and it will benefit both the doctor and the patient in increased accuracy, speed, and decreased human error. AI benefits both economically and in terms of time for the patient.

12.2.2. Drug Discovery and Development

Drugs can take as much as a decade and more than $2.6 billion to bring to market, with nearly 90% of potential candidates failing within the first three phases of the drug development process. Therefore, businesses need technologies that can predictively model drug interactions and effectively gauge safety and efficacy as soon as possible. To help with this, AI has shown promise at all stages of drug discovery and development. By screening vast datasets filled with medical and biological information, existing drug candidates can identify potential new uses and uncover entirely new possibilities fairly quickly. In a machine learning setting, this task is typically framed as a binary or multi-class classification problem: given approved, novel, and invalid drug-protein interaction data, train a classifier to forecast and prioritize high-confidence future drug-protein interactions for experimental validation. Owing to the special attention endorsed by the research community, and to the substantial interest of th

is research topic from industry, independent academic groups, non-profit organizations, and several pharmaceutical companies have engaged in drug-protein interaction prediction projects.

There are several very successful initiatives that apply AI to drug-protein interaction prediction. As another example, a London-based drug development company was able to create entirely new compounds for treatment alongside synthesizing kidney disease treatments by identifying unanticipated immunosuppressant properties (Danda, 2022). An Alzheimer's project announced last year that, thanks to the AI cooperative, it discovered six drug targets instead of the five it was expecting. They then used the program to identify new compounds that interact with these protein assets and put them into their existing infrastructure for validating drugs. Therefore, AI is being utilized in the early drug discovery process for its potential to rapidly and accurately predict the new use of a deep portfolio of chemical probes and signal the most effective of these for clinical translation to human trials. Consequently, AI reduces the time and costs associated with the traditional drug development process. When successful, the rapidity and efficiency of these disease-in-a-dish models is demonstrated by accelerating a candidate therapy to human clinical trials. Having identified a compound that is genetically matched to those patients whose disease is most similar to human Alstom syndrome, it could be developed uniquely for this targeted population. In general, the likely widespread application of personalized medicine may present numerous issues that lower the visibility of patients, such as smaller studies and the lateness of regulatory approval of targeted therapies, leading to the need for affordable and efficient ways to precisely match a patient to the right therapy. Moreover, expertly identifying subtypes and maintaining good downstream translation are likely the key, although limited, applications. Developing a range of efficacy and systemic outcomes remains a very challenging area of epidemiological research. Exactly because the single-gene disorders can be attributed to a single suspect and multiple gene/biochemical disruptions further complicate identification of drug targets. It is unclear which trigger will address the potential risks and barriers of this. Opportunities should be well justified, administratively feasible, and attractive to regulatory agencies, the pharmaceutical industry, and the investment community. At the same time, ethical and public health considerations for implementation at the population level should be taken into consideration.

12.2.3. Personalized Medicine

Personalized medicine, using AI, is designed to tailor healthcare, its practices, sorts, and decisions because it is all determined by the individual patient. In other words, there isn't always a drug or remedy that works the same way on each affected person, now that we are capable of diagnostic analysis along with AI medical imaging computers. By analyzing a patient's unique genetic makeup and evaluating all of the scientific and phenotyping categories of his condition, AI has the capability to uncover the precise outcomes or best-fit medicinal effects. For example, delivering a dose of treatment that works for a patient's unique genetic makeup is a way of tailoring it to his unique characteristics—a step that creates a personal cure (Syed, 2022). The AI climate field has unlocked a number of new, exciting possibilities like drug breakthroughs and research therapy planning. A majority of healthcare executives agree that they will enter a new wave of research and treatment due to AI. This will include selecting the right medicine, focusing on identifying unknown drug responses, which can help to minimize destructive side effects. AI has already shown that non-modified leukemia stem cells will continue to multiply in a clinical trial of persons who did not respond to initial therapy. In the same week, HPV survivors who took AI twice daily for 2 weeks underwent the early stoppage of medication in the history of the study, which infused their own killer T cells in target cancerous tumors. Clinical trial findings showed that AI-infused cells shrank tumors in many patients to miss tumor-free state evaluations. But clinicians are unable to monitor the direct attention effects after the trials were completed. AI modeling was used to examine patient data with the influence of AI CAR T after 6 months of treatment and determine its response.

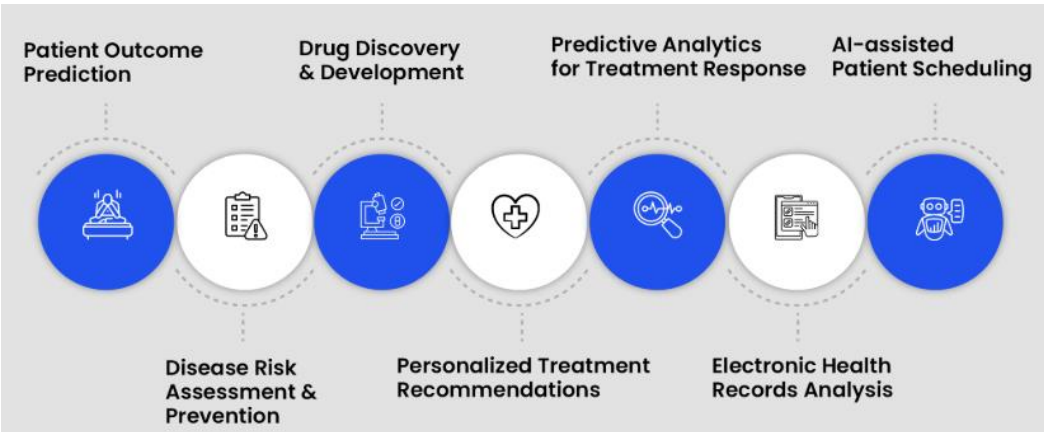

Fig 1 .2: The Future of AI in Healthcare and Personalized Medicine.

12.3. Trends in AI Technologies for Healthcare IT

As always, artificial intelligence (AI) capabilities are only as good as the data they are trained on, not to mention patiently validated by physicians. What is different now? The biggest trend in IT right now is changing software to use more machine learning and deep learning patterns. In medicine, and more broadly for healthcare data, the information is often reported in a natural language format or is otherwise quite unstructured. Natural language processing (NLP) has been a useful tool in AI for decades. The advent of large models and data sets is transforming both robotics and business process automation today. Automation, in particular, has several likely benefits: it could be cheaper; it won't get sick; it will do whatever it is programmed to do. The old debate was all about the robots taking over – that is not at issue here; RPA isn't intelligent in that sense, but it has optimized both labor and costs in other segments. As such, we need to pay attention to the market trends manifest in funding and start-up accelerators. It's worth noting that we are seeing nearly all major commercial cloud companies position the AI technology in use as part of an expanding set of Software-as-a-Service (SaaS) offerings. The dynamics of AI as a Service have an impact beyond software development, and I will describe a few below. Given the rapid pace of technological innovation and the maturing of core capabilities, it is incumbent on stakeholder leaders in the healthcare industry to explore the capabilities and opportunities of AI in healthcare. There are a great number of working groups within healthcare attempting to catalog these applications to form a Digital Health Lexicon (Danda, 2020).

12.3.1. Machine Learning and Deep Learning

Machine learning methods refer to applications that aim to develop algorithms that can learn from data, identify hidden patterns, and solve problems more accurately with increasing experience. This makes machine learning systems very effective in identifying patterns at an impossible scale and making predictions based on data trends. These predictions allow healthcare professionals to direct their attention and resources more specifically and create actionable insights for providers that are critical to preventing illness from becoming dangerous to treat patients. Specifically, machine learning is being used in predictive analytics, patient monitoring, and decision support systems such as relevant treatment protocol suggestions and diagnosis.

Deep learning is a development in machine learning techniques that uses algorithms to model and abstract data in the form of complex structures composed of multiple processing layers with corresponding levels of abstraction pictorially in a manner similar to the human brain. This deep architecture allows the model to learn representations that are composed of hierarchical features directly from the data, without the feature extraction processes used in traditional machine learning. The sophistication of deep learning applications in medicine is linked to the scale of the data, computation, and clinical problems compared to classical machine learning approaches. Consequently, deep learning techniques have been found to confer a larger degree of accuracy and efficiency in assessing images in radiology and digital pathology and non-imaging clinical data, interpreting medical measurements from multiple, discrete, and time series from electronic health records, as well as natural language processing in text data. Further research in deep learning has aimed to not only use multiple data types to make diagnoses but also predict patients' true clinical outcomes and inform the most efficacious care pathway on an individual scale. These technologies hold the potential to help identify diseases missed by experts and improve diagnostics, treatments, and drug development. Despite its promise, the application of deep learning models at clinics is still in its infancy due to high levels of noise in medical data, which can lead to misleading results without proper data curation. Additionally, deep learning models require a large number of labeled data instances to work, which can be difficult to obtain in healthcare. Moreover, the integration of big data as well as large-scale deep learning technology into clinical practice will require considerable changes to traditional clinical care as well as policy and regulatory frameworks. Issues relating to privacy and ethics still need to be resolved before using these data to drive clinical practice.

12.3.2. Natural Language Processing

Natural Language Processing (NLP) works with technologies and methods for converting unstructured text into structured data that can be treated by computer programs. As with the applications mentioned, some examples of implementation are patient clinical notes held in Electronic Health Records, various forms of media, and dialogues. Many possibilities are contained in medical records. Sources can be derived from clinical notes, patient records, medical images, and many others. NLP benefits mainly by converting textual data into structured data, and combining the data with other information such as lab results and vital signs provides a more holistic view of the patient. Aside from that, healthcare users who do not have clinical backgrounds may lack the knowledge to understand clinical documentation, so NLP can be used to improve clinical documentation and offer the most relevant facts upfront, thereby enhancing patient-provider communication and having significant impacts on the quality of patient care.

NLP is also making headway in routine administrative tasks to control messages, book appointments, and provide basic information to patients. If that comprises even a portion of the workload on a regular basis, it allows back-office or clerical staff to work on higher-value projects. Therefore, technology that decreases administrative labor, either by eradicating or automating manual tasks, is generally recognized and developed. Furthermore, with a significant portion of clinical documentation converted exclusively from FA to NLP, the impact of NLP extends beyond risk reduction and organizational attributes. Few professionals still engage in manual correction as part of their workflow, and although reducing manual transcription significantly changes FA's effect and its continued relevance, if you incorporate the techniques that models use to recapture training data and their underlying capabilities, it can be beneficial. While producing fake and altered datasets seems a better approach, those attributes have not recently been evaluated. Although NLP might seem costly and does not have the full attributes of standard techniques, it also provides structured data to diminish costs and is designed specifically to meet human comprehension protocols, as well as functioning appropriately to prevent patients from being harmed (Subhash et al., 2022).

12.3.3. Robotics and Automation

The growing trend for automating businesses' repetitive processes has also extended to the healthcare industry. The main goals of implementing robotics and automation in healthcare IT are boosting operational efficiency and improving patient care delivery. While robotics might come to someone's mind as a technology mainly useful in surgery, robotics are also used for a number of other healthcare-related actions. Surgical robots are used in minimally invasive procedures and allow the surgeon to control machine arms to operate on the patient. These robots are also used in remote tele-surgery with machines conducting the operation on a patient in a different hospital location than the surgeon. Patient monitoring robots, on the other hand, help hospital workers monitor patients, even in the intensive care unit, remotely and in real-time. Disinfectant robots that use high-intensity ultraviolet light disinfect patient rooms, reducing surface contamination that can cause infections.

Automation is first and foremost about eliminating human operator error and maintaining consistent, efficient workflows. In a medical environment, where errors can be costly in terms of both financial costs for treating ill effects of errors and lives due to patient harm, having machines perform tasks could be seen as a positive thing. Notably, one of the hospital CIOs said that they were already seeing the impacts of this transformation with longer life expectancies and higher care quality. The IoT robotics initiatives represented 10% of overall resources. The Vice President of Integrated Technology Services and Security, who led these initiatives, said that he also saw value in data acquisition and partnering with vendors, as he had access early on to technological advances. This is a principal reason why hospitals are enthusiastic about integrating robotics technology into their organizations. The trend towards automation in health IT is expected to keep growing in the United States and in other advanced economies.

Equation 2 : Workflow Automation Efficiency

$$E_{\text{workflow}} = \frac{T_{\text{manual}} - T_{\text{AI}}}{T_{\text{manual}}}$$

E_{workflow}: Workflow efficiency improvement percentage.

T_{manual}: Time required for a task using manual processes.

T_{AI}: Time required for the same task using AI-based systems.

12.4. Opportunities and Challenges in Implementing AI in Healthcare IT

There are a number of prime opportunities that implementing AI in healthcare IT would present. The most apparent advantage is enhancing diagnostics. By supplying AI systems with vast amounts of healthcare data, healthcare providers could make use of the information for more accurate diagnoses and, consequently, better treatment planning. This could ultimately lead to better outcomes for patients. AI could also streamline the diagnostics process even further by assisting in the prioritization of cases that need urgent attention. A number of AI systems also exist at the production phase that are capable of predicting health events before they happen.

Implementing AI also holds a number of opportunities where the improvement of operational efficiency is concerned. One of the most common examples of how this technology could be used is automating unnecessary manual processes such as managing appointment systems, handling bills and claims, and more. By identifying patterns in operational data, it is also possible for AI systems to customize processes to reduce costs. While it is clear that a growing number of opportunities are becoming available through AI, there are also a number of significant issues that should be addressed. The most pervasive of these issues is handling and maintaining data. For example, data privacy is a core concern because health institutions use patient data to train AI models. Not only do these models store patient data, but they also draw from external sources to better train algorithms. The quality and completeness of information also create big issues, with many health databases not advertising key cultural or demographic markers that impact diagnostics (Danda, 2021). This creates a heavy overrepresentation of Caucasian experiences. Rather than embracing this lack, many providers have elected to create synthetic data to fill the gaps - that is, generate AI-generated data to test systems - as a way of creating a more accurate model. However, in some cases, this creates issues of algorithmic bias. For example, a lack of data in healthcare IT means AI may be slightly less effective for pensioners as medications may not have been as heavily tested or designed for them.

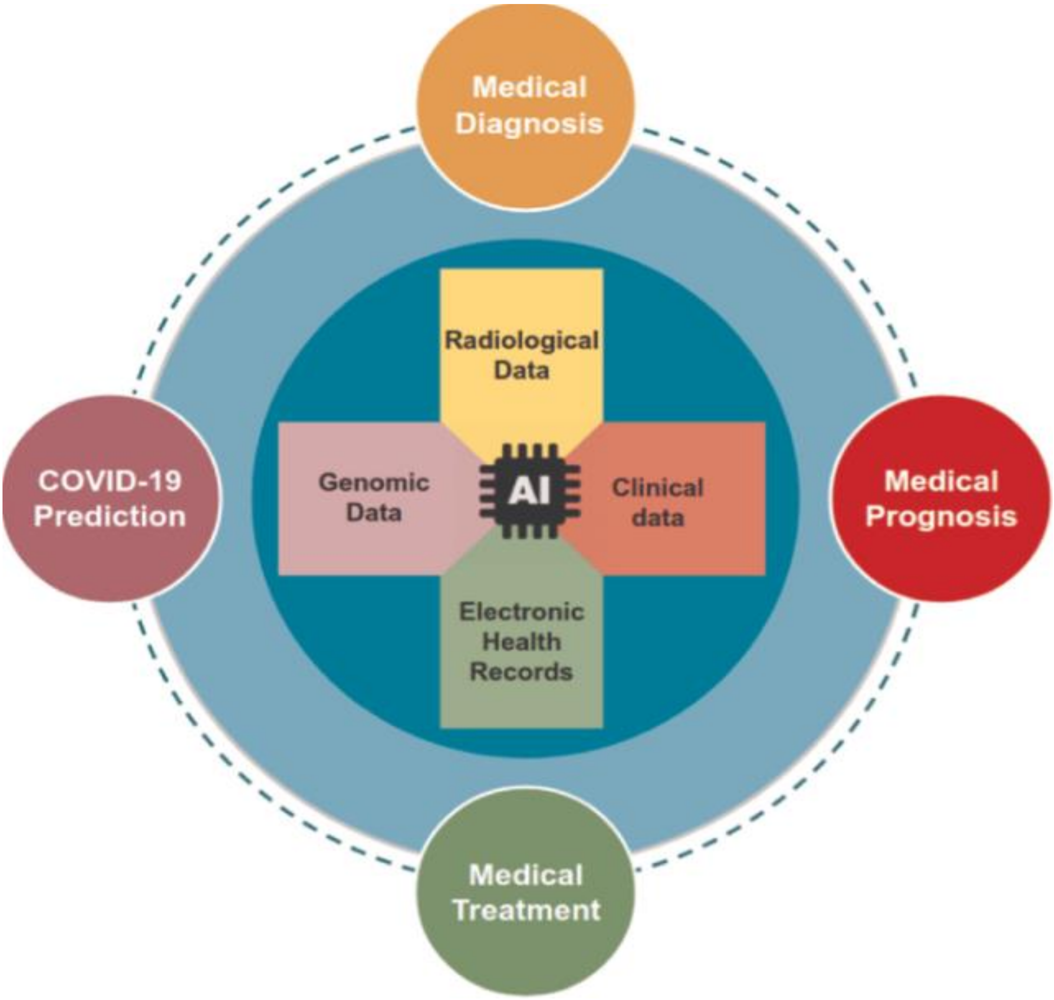

Fig 12 . 3 : Opportunities and Challenges in Implementing AI in Healthcare IT.

Healthcare AI also interfaces with many legal considerations. Examples include differing regulations concerning the usage of algorithms for clinical use, lack of guidelines for technology, asymmetric global AI regulation, and a general lack of evidence that can be used to motivate AI for clinical use. The majority of countries have little or no guidelines for the usage of AI in healthcare in clinical use. While there is some lawful protection, it is limited to mostly the broadest tech application and, to a large extent, pertinent AI legislation is scarce. In the nations where there is an increase in healthcare AI interest, regulation is generally asymmetric - that is, nations have varied offerings, such as not enforcing guidelines when dealing with trials or implementing rest conditions. In Asia, this is broadly the case - while Japan has been rolling out AI healthcare products for some years, China has only very recently removed protection for AI usage in healthcare. In Europe, regulation is mostly broken along the lines of whether the application is included in the EU Medical Devices Regulation.

12.4.1. Enhanced Diagnostics and Treatment Planning

Computational technologies are revolutionizing diagnostics by combining volumes of patient data to present medical professionals with a goldmine of insight. With technology like artificial intelligence, medical content searching is moving beyond keyword matching to understanding context, improving pattern recognition, and machine learning. In the process, the margin for diagnostic errors narrows considerably. Sophisticated diagnostic platforms can analyze medical images and speed up the identification process. But perhaps even more exciting, AI’s approach will go even further in the diagnostic process and, based on the patient data provided, guide clinicians in developing and personalizing treatment plans for patients.

AI-based diagnostics, especially in radiology and pathology, allow for observations at a complex biological level and are efficient in automatically detecting the factors that may cause diseases to spread at a microorganism level. Early diagnoses allow for more efficient interventions and create higher chances of success. Although the use of AI diagnostics offers promise in increasing early diagnosis and better patient outcomes, stakeholders will need to validate its findings to ensure both accuracy and reproducibility. It would be dangerous, for example, to commence a serious treatment plan based entirely on deep learning software. Stakeholders could solve for this by integrating AI’s conclusions with existing diagnostic paradigms. Furthermore, though AI shows promise in diagnostics, this health application will also exhibit ethical, regulatory, and operational obstacles. Leaders managing AI in healthcare delivery will want to continue this discussion.

12.4.2. Efficiency and Cost Reduction

Efficiency and Cost Reduction: Reducing physical and cognitive workload represents a chance for better allocation of healthcare professionals to other tasks. AI can broaden these possibilities towards the automation of most health-related corporate business, clinical, and administrative processes among caregivers and care receivers. On the administration side, AI can be implemented to personalize workflows involving financial aspects, resource transaction management, patient care strategy, disease management tasks, and many others. Overall, workflow integration can lead to the standardization and orchestration of all involved agents, including the patient. Such promising applications are expected to reduce costs, speed, and improve the quality of overall patient services. From a technology effort point of view, the benefits are immediately quantifiable for all the time spent reducing mechanized processing phases of an enterprise workflow.

Several examples of the application of AI tools integration to enterprise-wide healthcare data have demonstrated improvement in efficiency. One healthcare service showed yearly cost reductions while maintaining and enhancing selected care for their elderly population. Another system has promised and demonstrated cost reductions with a functioning tele-radiology system that uses AI tools for automatic coordination between facilities, expert radiologists, equipment, and patient cognitive and planning coordination at the enterprise level to manage resource allocation. A comprehensive suite of wide-area telemedicine services has been in operation for over a decade. During the last five years or so, cases per day at an average cost per case have directly used AI tools for image processing and transfer over WAN bandwidth to support teleradiology. Larger applications exist in community hospitals, but private funding parties have contracts that do not allow the lapse of case availability information. Large scale efforts are being considered. For example, managed care agents will use an AI-mediated dashboard to ensure that the patient benefits, medically speaking, from sliding-scale drug dosages, including the minimum possible, and should allow prescription integration with investigational drug study electronic protocol compliance (Vankayalapati et al., 2023).

12.4.3. Ethical and Legal Considerations

Despite all the enthusiasm surrounding AI, there are a number of ethical and legal issues that AI-powered health studies will need to address. One of the key concerns in healthcare, especially as it pertains to life and death issues, is the potential for algorithmic bias. If not properly managed, this presents a serious risk to patient safety. The use of AI with the potential to affect patient care requires a great deal of transparency and may necessitate changes to the current regulatory environment. The other often reported problem, regardless of the subject or the field, is related to data privacy. To train AI, a large amount of data is required, which often contains sensitive information. In healthcare, data about a patient’s personal health information might be contained within their electronic health records. If this data is shared or used improperly, it could have serious legal and ethical ramifications. As regulators arm themselves with the tools to govern AI, healthcare providers will need to be aware of and stay ahead of legal changes and developments as they arise. This ethico-legal framework around AI is necessary if AI is to become an integrated and impactful part of the healthcare industry. Many countries are still struggling to establish the scope of AI use in clinical settings and the extent to which it should alter the legal standards. Research and investment in AI are on the rise at a national, as well as global level. At the core of the AI-centric future of healthcare is a need for efforts to balance innovative developments with ethical responsibilities. There are still many questions surrounding AI use in healthcare; however, academics and industry experts largely agree that ethical and regulatory considerations cannot be taken lightly. With regulatory considerations in mind, another big question is whether an AI consideration should be held to the same legal standard as its human counterparts. Healthcare professionals are legally responsible and can be held liable for their mistakes, so the same would have to be true for a healthcare AI tool, but creating these laws and regulations is not without its own ethical considerations. There are discussions of what the legal standards, and hence, the AI responsibilities, unequivocally are, and AI ethical considerations pertain to bias, transparency, or a lack thereof, privacy risks in data-sharing for AI training, consent, accuracy, accountability, explainability, and AI decision automation. The most forthright alignment between the responsibilities of healthcare professionals and how they should manage and handle AI is that ultimately they should be striving to, and we should be seeking to regulate them to, 'do no harm'.

12.5. Predictions for the Future of AI in Healthcare IT

According to a survey of healthcare providers, industry executives feel roughly 15% of clinical workflow has been automated via AI over recent years. Over the next few years, respondents in the survey predict an additional 10% of clinical workflow will be automated by AI. With this stated, there are many predictions when it comes to the future of AI in healthcare IT. We can expect an explosion of healthcare-specific AI models trained on a range of proprietary and open-source datasets. These models will be increasingly integrated into the EHR interface, enabling a range of use cases spanning clinical decision support, operational management, and genomics. Similarly, it is predicted that external AI tools will be used in concert with a range of healthcare and clinical technology applications for telemedicine, patient engagement applications, and population health management.

The president and co-founder of an AI engine development company predicts the mainstreaming of the first, if relatively simplistic, application of personalized medicine: n-of-1 treatment pathways. Over the next few years, rapid advancements in large-scale computing power and additional data inputs will allow these n-of-1 treatment pathways to become more refined and/or economical to deliver. The CEO of an AI-powered healthcare technology company believes that more healthcare organizations will offer telemedicine. In fact, as a result of the pandemic, it was found that 97% of organizations increased or planned to increase their remote patient monitoring efforts, not including patients who are self-service reporting health information at home. The organization plans to expand to the entire patient care journey using machine learning. An economist with a focus on AI and healthcare predicts that the volume and scale of AI-driven drug discovery will accelerate and will soon lead to AI-powered drug delivery chips that can be swapped in and out of the body. As a result, the role of pharmacy will change.

The manager of a university healthcare AI division predicts there will be no widespread change in healthcare AI for the next three years. However, he thinks the next three to five years look more interesting, with AI likely supplementing human clinical providers by placing more risk and liability on technology companies and will require a collaborative approach to development, and will be driven by technology companies and risk-taking primary and secondary care providers who are willing to bet their company on something different. The other CEO of an AI-powered healthcare technology company predicts that the next five-plus years will lead to different trends led by tech companies jumping into population health and patients realizing the value of their individual health data and leveraging it. It is stated that the healthcare companies that will have made the largest strides during this time are those who partner and work with tech companies to make customized health management available and accessible while also working with providers to develop a conducive revenue model and outcome-focused service level agreements. In general, as every technology requires learning, adaptation, and discovery, more scientific research is needed to understand the safety issues around AI and how to balance the potential benefits and technological risks. It is also necessary to update AI risk assessments on the subject and to develop adaptive AI regulation strategies (Ramanakar, 2022).

Equation 3 : Personalized Care Optimization

$$Q_{\text{personal}} = \sum_{j=1}^{m} w_j \cdot U_j(C_j)$$

Q_{personal}: Quality score for personalized care.

$U_j(C_j)$: Utility of intervention C_j for condition j.

w_j: Weight representing the importance of condition j.

m: Number of health conditions addressed.

12.5.1. Integration with Electronic Health Records

As the accessibility of standalone AI tools and platforms is reduced and as more EHR vendors partner with AI companies, hospitals and healthcare systems are beginning to integrate AI directly with their EHR systems. By eliminating the need for a human intermediary to input the data into a separate system, AI can ingest, analyze, and report on data efficiently and in real time. The end goal in the evolution of an AI-integrated EHR system is to provide the most pertinent, real-time data in the most digestible way to the clinician, while applying predictive analytics to the historical data to aid the decision support process. Early evidence has shown that AI-instilled EHRs reduce the time a clinician needs to spend inputting data, aid in the care team's analytic ability, and provide higher levels of overall patient safety.

When a patient presents to the hospital with an ailment, it could be that particular patient’s unique condition or it could be a specific disease state that is more prevalent in the patient’s demographic and location. An AI-integrated EHR will look across patient databases and go back and forth from multiple fields to deliver the most likely outcome that is particular to that hospital and patient. By using a combination of patient history and risk factors, online knowledge, and the possibility of factors not yet captured in the EHR but still applicable, the system can return greater insights. An AI-integrated EHR will standardize workflow and improve simplification, reduce human error in inputting data, improve system interoperability working between departments, and will improve data integrity and flow reliability within the data system.

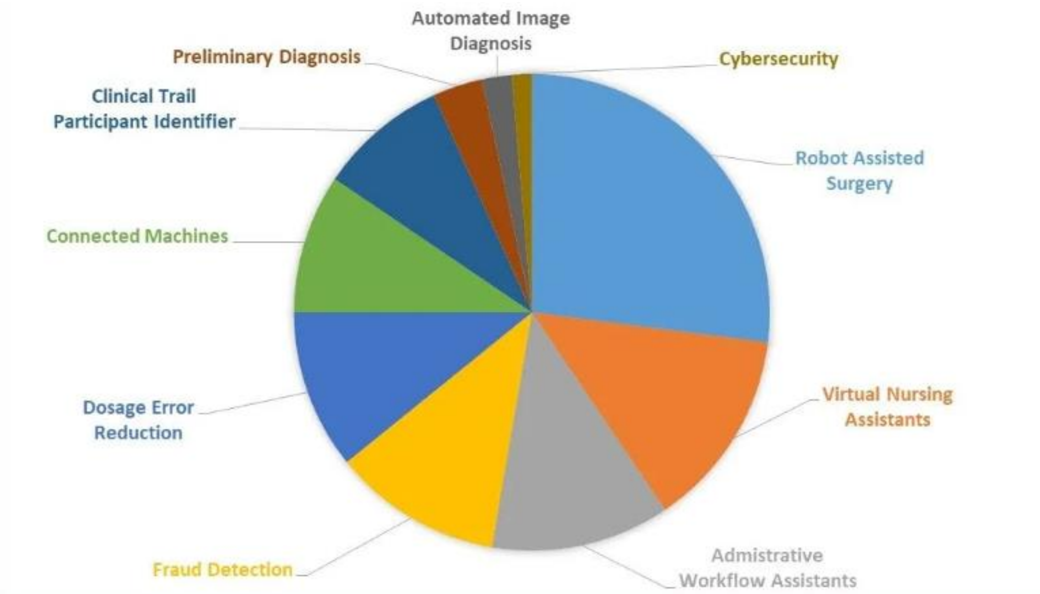

Fig 12 . 4 : The Future of AI in Healthcare.

12.5.2. Expansion of Telemedicine Services

Expansion of Telemedicine Services Enabled by AI

By 2020, the telemedicine market was worth over $40 billion and is expected to surpass $130 billion by 2025. The ability of AI to enhance telemedicine services will be another important factor in this growing market space. AI can power remote patient monitoring services, tracking and aggregating patient-generated health data to enable timely interventions. AI-driven chatbots and virtual assistants will play a critical role in driving patient engagement by conversing with the patient to document their symptoms and generate a comprehensive health report that will be valuable to the medical practitioner during virtual consultations. More sophisticated chatbots can monitor patient conversations to detect life-changing events and trigger an appropriate response. They can prompt them with lifestyle guidance and check in proactively to ensure compliance with their treatment plans all through an automated chatbot. The machine can 'learn' through the interaction and adapt its conversational style to suit the patient's facial expressions and dialogue pattern.

Ultimately, making healthcare more affordable and accessible simultaneously will lead to earlier interventions that help prevent patients from worsening and reduce admissions to hospitals. The use of remote monitoring will be particularly valuable for chronic disease management, given that in the U.S., 7 in 10 adults have at least one chronic condition and the out-of-pocket costs can consume up to 50% of the disposable income for someone with a truly debilitating disease. Many insurance companies and medical regulatory bodies already have telemedicine as a covered service. In terms of technology adoption, the telehealth industry has moved forward 10 years within three months, accelerated by a worldwide pandemic. The use of telemedicine has increased by more than 30% across all age demographics.

12.5.3. AI-Powered Drug Delivery Systems

The precision of drug administration is nowadays getting more and more consideration due to the high prevalence of non-adherence to therapeutic guidelines. Specifically, AI-based drug delivery systems can deliver treatments at an optimized time, matching the patient's needs and relevant preferences. The synergy between patient relevance and individual medication schedules could signify a move from standard one-size-fits-all models and shift towards the realization of tailored personalized medication. Here, we provide a selection of successful studies in AI-powered drug delivery systems, which developed attractor models to consider, in the data-driven machine learning loop, both the intrinsic noise due to realistic suites of patients and unexpected external disturbances and modulations.

One of the first AI-powered drug delivery systems that inspired the idea behind the attractors was the AI-powered oncology team prescription approach. This is an instructive application because, similar to the attractor discussed here, it can incorporate a number of other external determinants, including hospital capacity and individual patient preferences. Up to 295 kinds of hospitals and up to 215 kinds of training scenarios have been explored. Afterwards, a potential treatment is still considered as an open-access possibility, even if analyzing it together with the marginal benefit for a population results in a recommendation gain of approximately 33%. A full implementation of the attractors will primarily require coping with critical logistical and regulatory questions that will probably last for years before approval. We point out, however, that employing a scatter of clinical data, drug delivery could be shifted in animal testing; if validated, animal models could be used for different treatments in human clinical trials with pre-existing pharmaceuticals.

References

Danda, R. R. (2020). Predictive Modeling with AI and ML for Small Business Health Plans: Improving Employee Health Outcomes and Reducing Costs. In International Journal of Engineering and Computer Science (Vol. 9, Issue 12, pp. 25275–25288). Valley International. https://doi.org/10.18535/ijecs/v9i12.4572

Danda, R. R. (2021). Sustainability in Construction: Exploring the Development of Eco-Friendly Equipment. In Journal of Artificial Intelligence and Big Data (Vol. 1, Issue 1, pp. 100–110). Science Publications (SCIPUB). https://doi.org/10.31586/jaibd.2021.1153

Danda, R. R. (2022). Application of Neural Networks in Optimizing Health Outcomes in Medicare Advantage and Supplement Plans. Journal of Artificial Intelligence and Big Data, 2(1), 97–111. Retrieved from https://www.scipublications.com/journal/index.php/jaibd/article/view/1178

Danda, R. R. (2022). Deep Learning Approaches For Cost-Benefit Analysis Of Vision And Dental Coverage In Comprehensive Health Plans. Migration Letters, 19(6), 1103-1118.

Nampalli, R. C. R. (2022). Machine Learning Applications in Fleet Electrification: Optimizing Vehicle Maintenance and Energy Consumption. In Educational Administration: Theory and Practice. Green Publication. https://doi.org/10.53555/kuey.v28i4.8258

Ramanakar Reddy Danda. (2022). Telehealth In Medicare Plans: Leveraging AI For Improved Accessibility And Senior Care Quality. Migration Letters, 19(6), 1133–1143. Retrieved from https://migrationletters.com/index.php/ml/article/view/11446

Subhash Polineni, T. N., Pandugula, C., & Azith Teja Ganti, V. K. (2022). AI-Driven Automation in Monitoring Post-Operative Complications Across Health Systems. Global Journal of Medical Case Reports, 2(1), 1225. Retrieved from https://www.scipublications.com/journal/index.php/gjmcr/article/view/1225

Syed, S. (2022). Integrating Predictive Analytics Into Manufacturing Finance: A Case Study On Cost Control And Zero-Carbon Goals In Automotive Production. Migration Letters, 19(6), 1078-1090.

Syed, S. (2022). Towards Autonomous Analytics: The Evolution of Self-Service BI Platforms with Machine Learning Integration. In Journal of Artificial Intelligence and Big Data (Vol. 2, Issue 1, pp. 84–96). Science Publications (SCIPUB).https://doi.org/10.31586/jaibd.2022.1157

Vankayalapati, R. K., Sondinti, L. R., Kalisetty, S., & Valiki, S. (2023). Unifying Edge and Cloud Computing: A Framework for Distributed AI and Real-Time Processing. In Journal for

ReAttach Therapy and Developmental Diversities. Green Publication. https://doi.org/10.53555/jrtdd.v6i9s(2).3348