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AI in Clinical Practice: Current Uses and the Path Forward

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Abstract

Machine learning is developing very quickly in the healthcare field in the field's diagnostics, therapy and caring of patients and new drug development. Machine learning, deep learning, and so on have opened up new areas of diagnosis of diseases, understanding what particular treatment is required for a specific patient, and prognosis of disease. Radiology, Computer Aided Diagnosis and chronic disease applications are the current areas covered by AI to improve the health of patients and to hasten the speed of the health systems. Nevertheless, there are some of the issues that are associated with AI in clinical practice they include; Data privacy and protection, Issue of bias in machine learning algorithms, the black challenge. Some of the professional factors that are important when implementing artificial intelligence are: equity non –discrimination and patient engagement. Nonetheless, policies regarding AI in the healthcare context are still in their development process, and about responsibility or purse or assurance has been put forward, and it involves security. The future of AI in healthcare is consequently expected to continue evolution of precision medicine, enhance the speed of drug development, as well as enhance patient satisfaction through smart health including next generations of virtual assistants and telemedicine. For AI to be used in a way that optimally takes advantage of the potential that exists in significantly improving health care delivery as well as productivity, the technological, ethical, and regulatory factors that characterize the technology's application need to be tamed cohesively to realize safe uses that are patient centered. Heated debates over the life of the next few decades are required to ensure great advancements in the future of AI in healthcare, but these advancements need to be managed carefully to safeguard the best interests of each patient/healthcare consumer and provider.

Keywords

AI & Healthcare, AI & Clinical Decision Support, AI & Precision Medicine, Performance of AI, Forecasting Modelling AI & Health Technology, Data Privacy, AI & Bias, AI Strengths & Weaknesses, AI & Law, AI &Pharma, & AI & Patient care

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Introduction

AI is slowly but surely becoming unavoidable and as a result is steadily revolutionizing the healthcare industry as far as diagnosis is concerned let alone prescriptions and monitoring of patient is concerned. AI in its broadest context refers to the emulation of human cephalization in systems created for the purpose of accurately mimicking mental aptitudes such as decision making, comprehending and learning among others. All health care category is under Artificial intelligence and it entails a process of utilizing artificial intelligence techniques in augmenting the records of the patient and also sophisticated systems in the health systems to improve the wellness of the patient [1]. It appears that the history of AI in healthcare begins from the appearance of the first expert systems and simple quantitative models in mid-twentieth century. AI in medicine in the first few years was centered on employing the rule of thumb in supporting diagnosis just like a good doctor goes through. In more recent years, as the computation capability develops, different new algorithms appear and more sources of medical data appear so applications of AI in health care increases [2].

Current application of AI in health care is mainly used in combination with machine learning technology and the more complex deep learning that means that the computer is able to learn, improve and upgrade results over time. These technologies coupled with possessing the ability to identify aspects and correlations that are difficult for clinicians to identify can help hasten identification of the accurate disease diagnosis and development of individualized care protocols. In particular the subfield of manufacture ring called deep learning has proved to be consistently effective in various fields for instance; in medical imaging the AI models are in a position of interpreting radiographic images, diagnostic slides, and other scans with as much efficiency or even greater efficiency as clinicians [3]. In this paper, we outline the following elements that have led to the adoption of artificial intelligence in the healthcare sector. First, by using EHR and other sorts of data, clinical trials, genome data, and medical articles, it is possible to collect a big data set needed to train an AI model. Second, due to the sustained user growth and appearance of substantive coverage, big amounts of text were written and only recently it was possible to analyze them for volumes' sake using new computational means like cloud computing and GPUs. Third,

with popularization and development of precision treatment and individualized treatment strategy, users need an intelligent AI system which offers solutions depending on patient's genotype, behavior, and surroundings [4].

Other advantage of utilizing artificial intelligence in the health care sector is that it shall assist in diagnosing without much mistakes. AI seems to be more relevant in diagnosis of ailment like cancers, heart ailments, skin ailments, and ailments of the eye and mouth among others; this is because the diseases are diagnosed at infant stage with the use of AI technology. In addition, it can help clinicians to process the great amount of information coming from different sources in order to make more effective decisions in the sphere of treatment planning, disease prevention [5]. Nevertheless there are some challenges that are attached to the use of AI in clinical practice, these various challenges range from data security and privacy to the best way to regulate AI. It is evident that real time AI tools are safe, ethical and fully functional provided they are placed under observation and validation. However, such challenges should be born collectively by the healthcare systems data scientists and government in order to guarantee that such potential benefits will be realized and received by both individuals and the total healthcare systems. Practice has shown that the robust opportunity of AI in healthcare contains specific threats; that is the prospect of enhancing practicing accuracy, effectiveness, and availableness of the medical aid. AI will only continue to be more prevalent as technology drives change as well as the incorporation of its technologies to be a power to reckon as healthcare advances into the future years [6].

The things that AI is used for in Clinical today

However, in the clinical practice, AI also known as artificial intelligence has greatly evolved and is now providing solutions in clinical practice in different fields of practice. In diagnostics, treatment, and patient care, AI's strengths in data gathering, pattern recognition, and data modeling for prediction have made strong impressions. Below are some of the key areas where AI is currently being utilized in clinical practice:

AI in Diagnostics: There is a vast area of artificial intelligence usage has been clearly mentioned, and one of the exemplary is the use of artificial intelligence identifying various ailments

particularly through the imaging and pathological methods [7]. Applications of the algorithms for both ML and DL can be used in medical imaging studies of X-ray, CT, MRI and histo pathological slides. For instance in radiology, such uses of AI are now being discovered to diagnose tumors as well as bone fractures and early signs of pneumonia or cancer and at times even more effectively than human radiologists. In dermatology, utilizing the constructed AI model Skin injuries can be first scrutinized by the AI model to assess whether they represent melanoma of first stage. It also reduces diagnostic errors and increases the level of early diagnosis in patients with the applications benefiting from them [8].

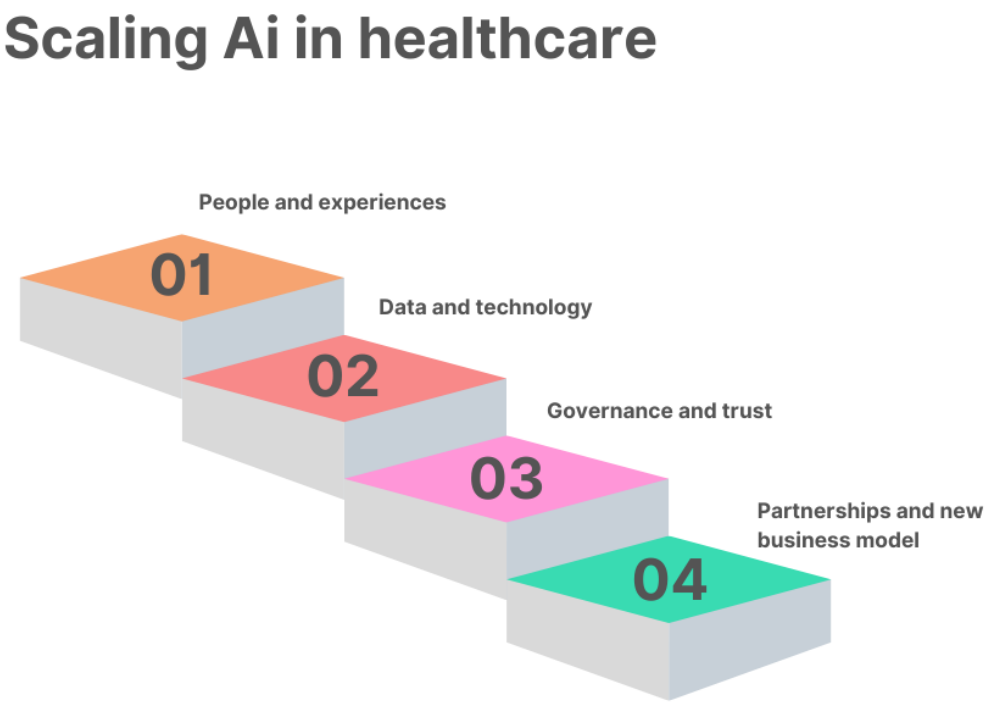


Figure: 1 showing scaling of AI in healthcare

AI in Personalized Treatment: It is also used in treatment planning most especially during the formulation of the patients' treatment plan. Since the AI models embrace the patient's genetic predisposition and medical history coupled with the patient's lifestyle, a doctor can recommend suitable treatment plans. For example in cancer a AI is used in deciding right chemical or immune-

therapy for a patient depending on the genes of the tumor. In that way, it minimizes the time the patient spends in treatment that does not suit them until the doctors identify one that suits them [9].

Role of AI Cardiac Monitoring: But considering its relevance for Android for the sphere of cardiac healthcare and its closeness to AI integration, it is conceivable to come to the conclusion that among such methods, the methods of continuous control and prediction seem to be most promising. Unlike some of the previous approaches, it has become possible to feed AI-based systems that are related to the health of the heart using real-time information that a patient is wearing some device, and give updates of a patient's condition [10]. It is useful after cardiac surgery as it tell you that there is something like Blood lactate that can trigger complication and also enhance the wound healing process if implemented with AI technologies those systems allow the right decisions concerning the treatments and detection of traces of relapses. Overall, the integration of AI in a number of cardiologic interactions is altering the approach taken to patient management, in directions of greater sophistication, target-oriented and timeliness [11].

AI in Clinical Decision Support: Clinicians employ what is called the Clinical Decision Support Systems (CDSS) that encompasses patient information intended to provide instant feedback regarding the further examination and/or treatment. These systems enable clinical practitioners make informed decisions most especially when the problem presented does not operate in isolation but may be a product of other. With the help of AI, the potential development of the disease can be predicted, the possibilities of prevention measures can be suggested, possible outcomes or side effects will be better to show in clinics [12].

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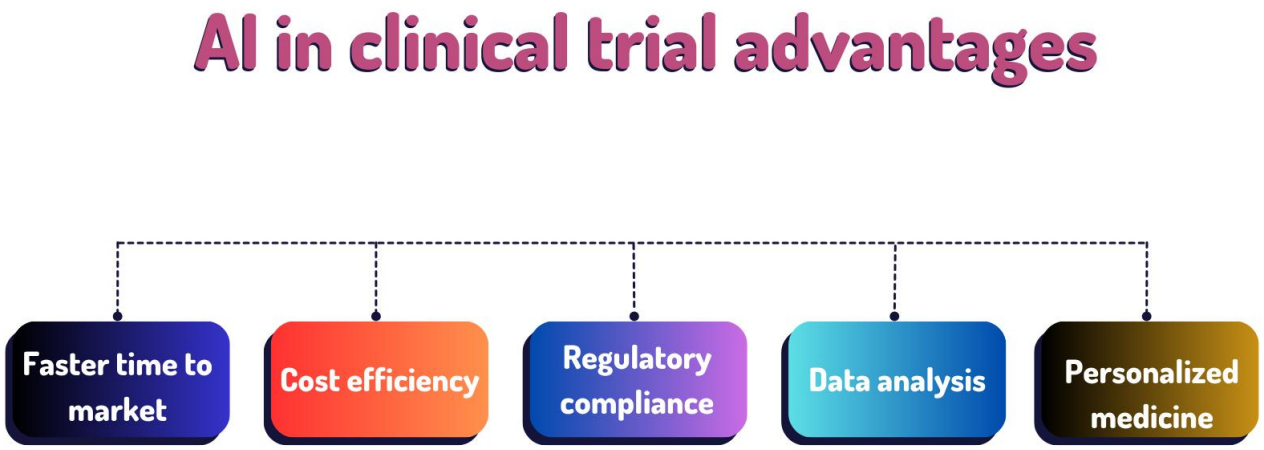


Figure: 2 showing AI in clinical trial advantages

AI in Patient Monitoring: AI is also revolutionizing the tools that patients applying for handling of Chronic and critical illnesses. AutoNER Learns with information such as heart rate, glucose levels, wearable devices, smart watch etc., to constantly check for clinical deterioration of the patients. They also allow the patient to be monitored outside the hospital setting and any time the patient is found to exhibit some irregularity it can be appropriately handled as in case of diabetes, hypertension and heart diseases [13].

AI in Drug Discovery and Development: AI is typically used in drug discovery since the former help the latter to select the right drug molecules from a pool of chemicals and biological information. AI models can predict how certain compounds might interact with disease targets, thereby skipping several stages in the drug development process and time it takes to bring new medication to the people. This is especially so, in the area of rare diseases or during emergencies which include the present COVID 19 situation where there is demand for rapid development of drugs [14]. AI is already revolutionizing clinical practice through enhancing diagnostic precision, delivering individualized therapeutic approaches, supporting clinical decisions, offering continuous patient monitoring, and facilitating drug development. Since the use of these technologies is still perpetually evolving, it is expected that the continued adoption of these

technologies in Clinical Practice settings will also enhance subsequent progress of the health care industry [15].

AI is best for Large Scale Clinical Decision Making

The use of AI is moving to its core role in advancing clinical decision support by supplying dependable instruments to clinicians. This paper has outlined many positives of putting an AI mechanism in medical decision making, including increased likelihood of diagnoses, the ability to predict how an ailment will progress as well as an opportunity to offer unique treatment plans. Below are some of the key benefits of AI in clinical decision-making:

Enhanced Diagnostic Accuracy: Few of the AI models are the ML and the DL models which can easily handle a huge amount of clinical data such as images, result of lab tests or records of the patients with very high accuracy. In certain circumstances such as identifying tumors, fractures, or the onset of a disease – whether cancer related or not, AI is as good, if not better than people in areas such as radiology or pathology. This would reduce the rate of wrong diagnosis, also enhance early diagnosis of some ailments and is very useful to the many times complex or rare situations with the patient [16].

Predictive Analytics for Disease Progression: AI can also assist clinicians concerning asking what kind of future the patient is likely to have. Based on EHRs data and other sources the AI can predict the emergence of chronic diseases including diabetics, cardio logical diseases, and cancer. This predictive potential means that the clinical professional has to ensure that the patient modifies some of the prescribed medication or adopt healthy lifestyles and change the disease progress rate to a generic level. It may also help the clinicians for risk factor appraisal, pattern analysis from the collected data and the potential results of the clientele hence admitting or attending to those patients who need their attention [17].

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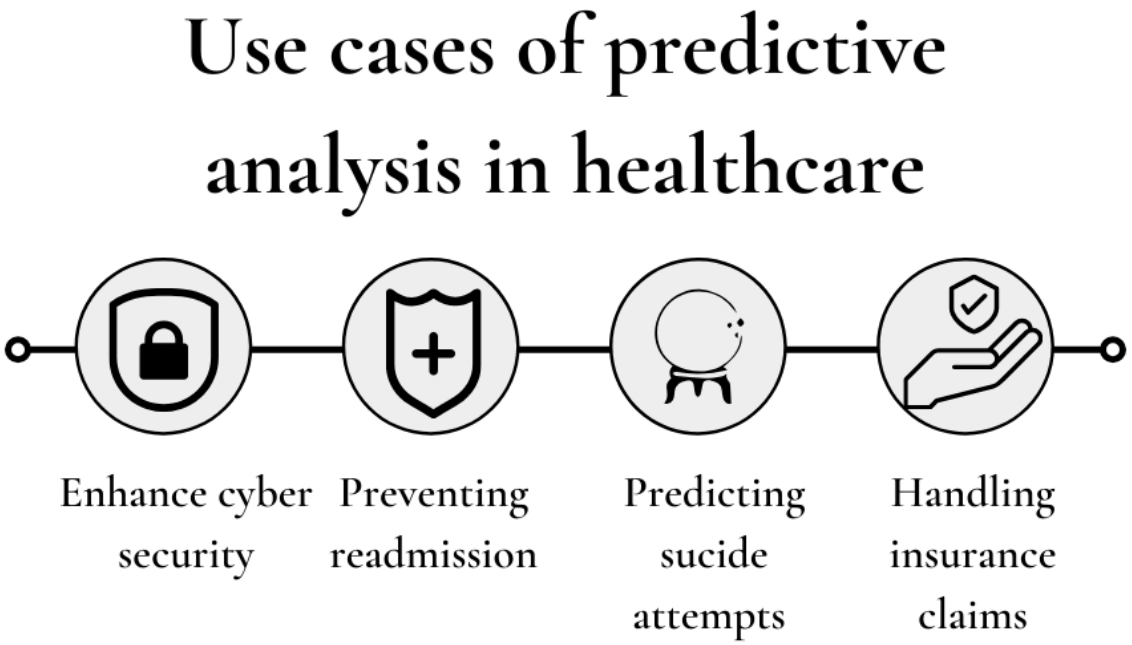


Figure: 3 showing use cases of predictive analysis in healthcare

Personalization of Treatment Plans: Of all the application of AI, probably the most radical is genetic and molecular diagnostics and treatments in health care. Doctors may even be able to use AI techniques on the gene of the patient and other factors such as previous medical records, the lifestyle of the patient and much more to be in a position to know what treatments are suited for this patient [18]. For instance in oncology, AI uses its capability and ability to match a cancer patient to the right chemotherapy or immunotherapy depending on the genes of the tumor in a specific patient. Because enjoyed from a person-centered approach, the techniques used in AI reduces the trial and error methods thus leading to better treatments with minimal side effects [19].

Reducing Cognitive Load on Healthcare Providers: High cognitive load is felt by healthcare providers because clients bring enormous amounts of information within one day. AI can help by first soft sorting and analyzing the data at hand and then make available for use useful data for clinical decisions by the health care professionals in time [20]. CDSS can help physicians by giving information of various kinds of risks such as drug interaction, allergy or departure from a normal

clinical path. AI also reduces time that could otherwise be consumed on tasks like, data review, analysis, or other sundry tasks that would help clinicians attend patients [21].

Improved Efficiency and Cost-Effectiveness: Extremely learning from AI highly improved the efficiency of the operation by minimizing the clinical elements and assets management. For instance, AI possibility in teach the patients that are likely to develop complications means that, resource distribution among the patients would be more effective done through these factors. This shall lead to reduced hospitalization, shorter hospitalization period and therefore low prices in the health sector. It also suggests the temporal gains on the side of the healthcare care providers because even for simple mathematical computations or diagnostic image interpretations, there is the AI [22]. The employing of AI in clinical decisions introduces important positive changes concerning diagnostic accuracy, forecasting abilities, special treatments, and efficiency. Since the use of the AI tools in the patient approach and the healthcare systems have become somewhat inevitable, the dignity of the tools as well as the integration of the tools into the care setting will ensure better patient status, better results and cost effective care delivery in the future [23].

Considerations that are peculiar to Integration of AI and Ethical Issues

The use of AI has a higher possibility in clinical practice but there strong advantages and disadvantages in applying AI as well as strong ethical concerns that have to be addressed for optimal and reasonable deployment of AI. They are Technological issues, Regulatory issues, Ethical issues, societal issues, all which must be addressed in order to optimize the use of AI in healthcare [24].

Data Privacy and Security: This issue remains one of the main challenges the field of medicine is to overcome when integrating AI into clinical practice: maintaining the patient's privacy. AI algorithms customarily entailed analyzing a vast quantity of records data of patients' personal health information to create models and sometimes prediction. This gives rise to some query such as; data leaks, data intrusions and patent data abuse [25]. Since patients' data is often targeted in cyber-attacks targeting healthcare organizations, patient data protection is necessary to maintain

patients' confidence as well as to fulfill the Security and Data Privacy regulations and laws such as HIPAA in USA and GDPR in EU [26].

Bias and Fairness in AI Models: In other words, it is postulated that AI models are as good as the datasets inform of their training, therefore if the datasets on which these models are trained are biased, the tools that arise from the AI models will also be biased. In one case, lack of information is likely to trigger a minority status within the health care service, meaning that individuals are discriminated regarding treatment recommendations or even the precise nature of their illnesses-a vice that is most likely to affect, the blacks as well as those who cannot access health care [27]. For instance, if an AI model is being created based on data that majority is relevant to a given group, then it will be likely to provide want in other groups hence limited fairness in treatment. Bias removal from AI solutions requires the integration of variety spanning samples and the consistent evaluate of AI algorithms for bias free and fair outcomes [28].

Lack of Transparency and Explain ability: The key problem is that most of the AI models – and particularly the deep learning models – are uninterpretable, which makes the mechanism boring to the users. It may thus therefore be this very opacity that would therefore bar them from being embraced for use in clinical practice since their users – both the practitioners and the patients – may not be ready to rely on a system that they cannot explain how it came to the conclusion made [29]. For clinicians relying on AI for clinical decision making then they need to fully understand how the AI arrives at the suggested course of action. There is therefore the issue of the dark morass of unavailable cross over –communication between health care providers and the users thus erasing the practice of the tenet of patient's right to self–autonomy and informed consent [30].

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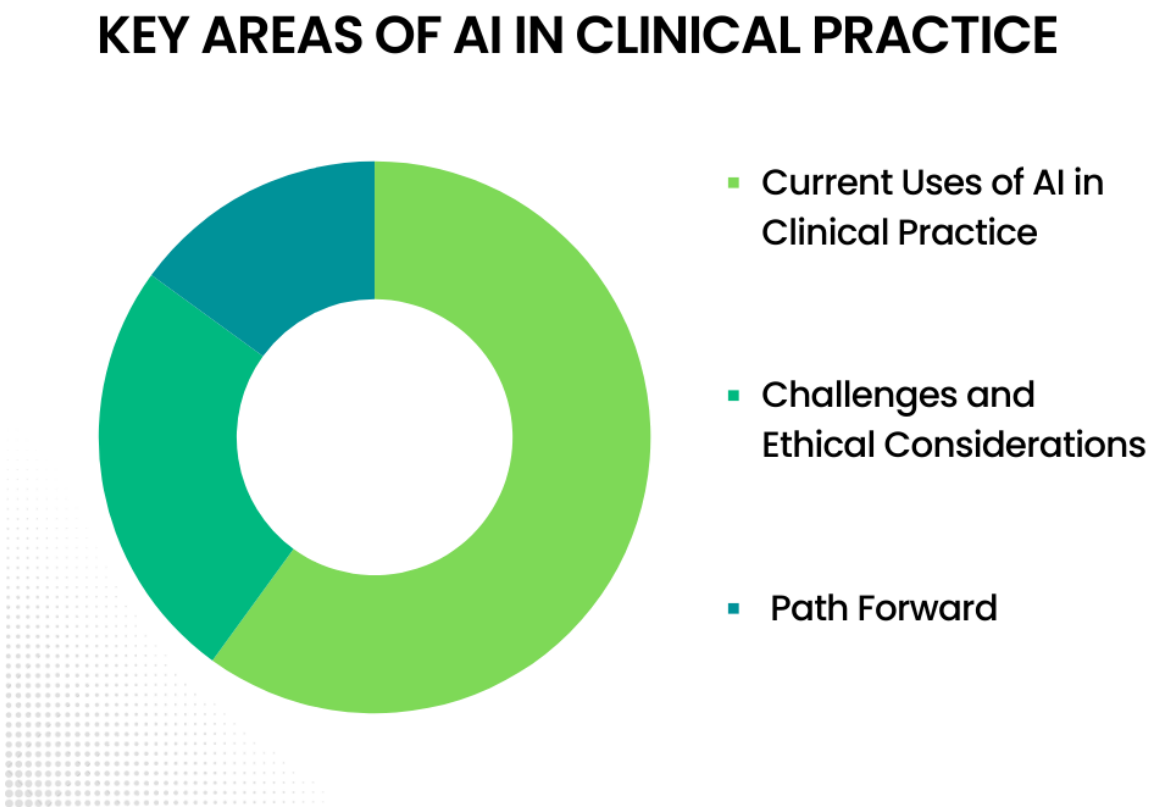


Figure: 4 showing key areas of AI in clinical practice

Regulatory and Legal Challenges: There is no regulation of AI in healthcare to this date and the regulation of this technology is still very much in its infancy. Today there are no best practices in the regulation of the AI in practice and it means that such systems can be developed, validated and used ineffectively. The governmental regulatory organizations like FDA in the US and EMA in Europe have already been working to create the codes of practice, laws and regulation for the Article 56 AI-based medical device and software, but these rules still are in their infancy [31]. It becomes cardinal to ensure the safety of the tools in the AI system; the effectiveness of the tools; and the compatibility of the tools with the current demand of the prevailing health care system standard. In addition, questions related to precaution and legal responsibility in case of an error or patient harm involving the use of AI are still unanswered leaving concerns such as who is legally responsible; the developers,: either, the healthcare providers or the AI systems [32].

Ethical Implications of AI in Healthcare: There are numerous ethical considerations pointed by AI in the health sector, and the basic of all is the involvement of a machine in decision-making process. This is because the integration of AI brings about the possibility that due to reliance of patient on AI, patient's care is entirely relieved by clinical human beings [33]. Second, an AI willingness to take over some of the health care jobs poses other questions about social implications, like displacing employees and subsequent repositioning. However, it is a great importance to comprehend that AI must follow ethical standards as the patient's rights, seeking benefits, and being justice to respect patients and not to spoil them or decrease the quality of service additionally [34]. While in practice seems to advance the healthcare sector, its developers, and health managers require understanding of the risk, disadvantage, and impact on professionalism. The main issues affecting the implementation of AI are Patient data privacy, minimizing bias, and proper disclosure, and establishing of correct legal frameworks that will promote the right use of AI in delivering of health care to all patient efficiently and effectively. Although the he adoption of AI is expected to increase in the future, issues about its effects on ethics and society will continue to define the best use of the technology in the health care system [35].

The Future of AI in Healthcare: Opportunities and Innovations

The proposed application of artificial intelligence in the healthcare field will create even broader new perspectives for making patients have more choices in receiving treatment and decreasing expenses as well as increasing the efficiency of the disease diagnosis and treatment processes. As AI technologies are integrated into use and become more sophisticated, healthcare is practically sitting at the doorstep of capability augmentation and invention that may revolutionize clinical and patient services [36].

AI in Precision Medicine and Genomics: I also firmly believed that AI could have a lot to offer in precision medicine which is one of the most promising fields. Pursuant to this, growing genetic, clinic and environment data could be mined to provide patients with better treatments. On the other hand, as the cost of genomic data is continuously decreasing and is continuously becoming more accessible, the AI systems are going to be more and more capable of identifying various diseases by their genetic markers, and, using this information, prescribing how certain patients are going to

respond to particular treatments. This may mean precision quality treatment as in the case of cancer where the treatment given depends with the DNA of the cancer cells [37].

AI in Drug Discovery and Development: AI is a prevalent research evidence in the drug discovery process and is expected to be even more Ten major applications of artificial intelligence in drug discovery include: The process is slow and expensive in legacy pharmaceutical manufacture, but if AI is applied, it is much easier to obtain a list of compounds that might be effective, to evaluate how likely the biomolecules would interact with the target compounds, and how the groups of compounds would behave in a human body [38]. Also, AI models can help to identify whom to approach for reallocating an existing drug to another disease. In the future, through the adoption of AI platform one is also able to bring down the cost of developing drugs and hence in the design of new drugs, not only are they termed to meet various needs, but also meet needs for conditions that are rare or often neglected [39].

AI-Driven Virtual Health Assistants and Telemedicine: This is quickly set to transform the way patients are managed by future improvement of virtual health assistants employing use of artificial intelligence. Finding being capable of making real health advice, monitoring signs and symptoms, and administering medicine reminding, these AI systems hold an endless discussion with people with their mobile phones or another connecting techno instruments [40]. Even more closely tied to telemedicine services, AI could contribute to increasing the number of patients coming closer to primary care, considering that many of them have limited access to medical services in the regions. Virtual consultations could also be employed by AI to mean an avenue through which patient are diagnosed and treated at a higher rate to help ease stressed health systems and increase access to care [41].

AI in Surgery and Robotics: With reference to the surgical field of specialization, the use of AI is anticipated to advance as can be seen from the robotic assisted surgical systems. Such systems using the algorithm of the Artificial Intelligence can assist surgeons in performing complex minimal invasive operations with shorter healing time and quality outcomes [42]. The robotic surgery with AI is currently in practice also on some specialties including the urological and orthopedics while the advancement of in the technology is rapid. Future advancement are likely to

be adopted such that complicated operations can be conducted by enhanced robots with little or no involvement of surgeons hence increased precision [43].

Ethical AI and Patient-Centric Healthcare: As the years go by based on the advancement being seen in the application of the AI technologies, it will be more challenging to mitigate on the development and implementation related to AI technologies that feed fake data. AI solutions oriented on the patient will also mimic or adhere to the principals of justice by stressing justice of delivering the AI for all the patient groups and for all regions of the society regardless the reimbursement one could have or location he/she lives in. The nature of the question will always remain how do best get on with the technology and this in my view can only be done by continuous collaborative effort by the technologists, clinicians, ethicists as well as the policymakers on the right frameworks of how such an AI system should function, so as to support the discretion of the health care system [44]. Very closely related to this, healthcare is among the most promising and potentially rich areas that has virtually no limit to the development of AI. In the future AI will continue the change healthcare from adopting in the realm of drug discovery and development to achieving precision medicine, complex surgery, and remote care through telemedicine. Nevertheless, it will be crucial to discuss the issue based on the developmental aspect of these technologies in the future and answer the ethical question of responsibility in healthcare technology for the improved presentation of the best reforms to satisfy each patient.

Conclusion

AI is a new vision for each aspect of the healthcare system in terms of diagnosis, therapy, treatment, patient, and drug discovery. These current forms of AI use in clinical practice are marked by medical imaging, personalized medicine, decision support systems, chronic illness, where such AI application is worth a worthwhile increase in health effectiveness and precision. According to a number of publications, AI-tools can be applied not only as a means of refining diagnosis made by physicians, but also for the prognosis of the further development of the pathology, which in turn helps clinicians to make more informed decisions – both of these are necessary for the maximization of individual outcome and, therefore, satisfaction of the patient . But the implementation of AI has some problems and questions regarding it as it is being introduced

globally. Four issues Creases are data protection, bias in AI, the black box nature of the AI decision-making system, and legalities remain as challenges in integrating AI to healthcare securely and efficiently. These concerns provide the justification for continual oversight, returning to the problem of choosing inclusive datasets, and to monitor and adjust AI's performance for optimum beneficial, fair, and trustworthy interactions across the healthcare sector.

Further progression of AI in health care looks far more progressive. The potential for ai to transform medical care remains immense; discoveries in precision medicine for which A I could deliver treatment depending on the genetic information a patient possesses; increased tempo for identification and development of drugs. Similarly, virtual health assistants driven by artificial intelligence, and Robotic surgery also hold potential to provide more outreach to patients and procedures. But there the increasing sophisticated of these systems there needs to be right use to prevent the things that bring on the replacement of human control and end up with patient preference oriented care. AI has the potential to improve the quality, accuracy, and effectiveness of healthcare services when offered, but using AI must be done properly, with consideration to ethical legal and or sociological consequences. In answering these questions, AI can help place the right change in the practice of healthcare to be easier on clinicians and the patients.

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