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Applications of Artificial Intelligence in Healthcare: Current Trends and Future Prospects

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Abstract

Artificial Intelligence (AI) is highly valuable across various fields, including the healthcare sector; it improves the precision of diagnosis, the effectiveness of recommended treatment options, and the adaptation of medical care plans. This review paper will look at how the existing literature has applied AI and will do this under the following subheadings: diagnostics, treatment, and individualized therapy. Moreover, the paper describes the effects of applying AI on the state of patients and the effectiveness of the healthcare industry as well as present trends and considers the further development of the role of AI in the healthcare future along with the potential problems that may occur.

Keywords: AI, medicine, diagnostics, treatment advice, individualized medicine, patients' effects, health care organization.

1. Introduction

AI has made its way into healthcare and has become an influential tool offering new approaches to existing problems. The use of AI in health care has triggered improvements in diagnostics, treatment suggestions, and individual care in the health sector. Therefore, the objective of this review paper is to identify the current trends in terms of AI applications in healthcare, assess their effects on patient recovery as well as the overall effectiveness of the healthcare systems, and outline further prospects and limitations.

2. AI Technologies in Healthcare

2.1. Diagnostics

The field of Diagnostics is one of the areas where AI has provided excellent inputs. Deep learning and machine learning applications have improved diagnostic performance and speed.

2.1.1. Machine learning models in medical imaging

Imaging is one of the main tasks in diagnostics, and the application of AI has become a breakthrough in this area. The common AI applied in medical image analysis is machine learning, and the most important of them is CNNs (convolutional neural network), which have been applied to analyze MRI (Magnetic Resonance Imaging), CT (Computed Tomography) scans, X-rays, etc.

Examples and Impact:

1. Skin Cancer Classification:

Study: The consolidated work [1] presented how deep learning can be used to accurately diagnose skin cancer as health practitioners with dermatologists' level of proficiency do. The CNN model used mammograms and biopsy data to accurately differentiate between benign and malignant lesions that are prevalent in patients [1].

Impact: This application enhances the findings of medical images, prevents diagnostic errors, allows the identification of diseases at an early stage, and ensures timely management hence improving the quality of health outcomes among the patients.

2. Detection of Diabetic Retinopathy:

Study: In their article entitled Weight Loss Surgery and Eating Disorder: Dilemma in Diagnosis published in the Indian Journal of Psychological Medicine [2] a deep learning algorithm was designed and trained with a specific target of DR (Diabetic Retinopathy) detection in retinal images. The model reached sensitivity and specificity superior to ophthalmologists, thus it has great diagnostic accuracy [2].

Impact: A major function of aggressive screening and care of diabetic retinopathy is to prevent vision loss which is beneficial for the patients and cost-effective in addressing the universally recognized health challenge.

3. Breast Cancer Detection:

Study: Google Health AI system created a new state-of-the-art in diagnosing breast cancer by performing 45% better than radiologists in mammogram interpretation. It expanded the available sample and at the same time decreased the number of false positives as well as false negatives results [3].

Impact: Early diagnosis will help enhance the treatment outcomes and therefore patient survival rates are likely to improve.

2.1.2. AI in pathology and laboratory diagnostics

In pathology and laboratory, diagnostics AI has also been incorporated to analyze complex data and give accurate results.

Examples and Impact:

1. Histopathological Analysis of Lymph Node Metastases

Study: A recently designed deep learning-based AI system was implemented by Google Health for the identification of lymph node metastases in breast cancer tissue and outperformed human pathologists [4].

Impact: Applying AI in pathology decreases the burden of workload and enhances the diagnostic efficacy among the pathologists in addition to the diagnosis time.

2. Automated Blood Smear Analysis

One of the relatively recent studies reveals that, as for the blood, algorithms for its inspection in blood smears have been created, and they are highly accurate in identifying abnormalities [5].

Impact: This article shows that Higher level analysis of blood test results is faster and more effective in diagnosing blood-related diseases.

2.2. Treatment recommendations

AI technologies have now changed the approach of treatment suggestions and offer common recommendations that are based on data and the individual state of every patient. These advancements have contributed to better decision-making by healthcare providers thus the health of patients has been enhanced.

2.2.1. AI utilisation in treatment planning and decision support systems

After processing patient data, the medical history of the patient, and the information on presented clinical guidelines, AI offers treatment options. A popular case in point is IBM (International Business Machines Corporation) Watson for Oncology which integrates natural language processing and machine learning of big data to search through the available literature and records. This care system has specifics for approaching each patient and providing recommendations based on the scientific evidence obtained, and patients' characteristics. As per the *Table 1* Another study [3] showed that most of the treatment recommendations from IBM Watson for Oncology correlated with the oncologists' advice regarding 93% of breast cancer cases.

AI-assisted treatment planning goes through extensive analysis, thus its influence is rather great. Decision-making is made better by it since it provides clinicians with treatment procedures in the medical management of patients who are in compliance with the laid down clinical protocols. Also, AI systems can introduce real-time patient data which allows responding to the result changes of an individual patient during the treatment. This leads to better outcomes for the patient since the treatment to be administered is more likely to be specific to the patient's condition.

Table 1
IBM Watson for Oncology Concordance Rates

Cancer Type	Concordance Rate
Breast Cancer	93%
Lung Cancer	88%
Colon Cancer	83%

2.2.2. Predictive analytics for diseases progression and management

One of the subfields of AI is the analysis of disease progression and chronic illnesses. These models entail the usage of EHR (Electronic health records) data for purposes of predicting some of these events as; patient cliff, sepsis, and readmission. In this study, [8] created a prediction model of these fundamental events with the help of Google AI. The identified model inference relied on the collected EHRs, which encompassed patient's demographic information, clinician's notes, laboratory, and vital signs data.

As shown in *Table 2* Predictive analytics has changed the face of healthcare in a way that is rather significant. Thus, the organization can use its resources in a way that helps plan and prevent before the occurrence of a critical situation, this makes the healthcare provider ready to handle such occurrences once in a while instead of constantly admitting patients from different parts of the community. For instance, the implementation of sepsis recognition programs to enhance early detection of this condition helps in the prescription of antibiotics thus increasing the return rate among patients. Moreover, the use of the models can prevent the worsening of chronic illnesses by providing the right approach for early intervention [8].

Table 2
Predictive Model Performance Metrics

Event	Sensitivity	Specificity	AUC
Patient Deterioration	0.86	0.89	0.92
Sepsis Onset	0.83	0.87	0.90
Readmission Risk	0.78	0.81	0.85

2.3. Personalized medicine

While, the term called personalized medicine means a treatment plan prescribed on account of the patient's unique characteristics, and artificial intelligence is a critical component of personalized medicine. AI technologies align well with those of healthcare providers and through analysing large amounts of data, recommendations for treatment individualization are possible resulting in improved health of the patient.

2.3.1. Genomic data analysis and precision medicine

AI processes patient data and determines possible mutations in a patient's genes as well as the best course of treatment. For instance, deep learning models have been employed for predicting each person's response to cancer treatments using genomic data in precision medicine. An example was done in which deep learning algorithms were used to classify cancer treatment responses based on genomic information. These models can help in analysing

various patterns in genome data, so as to arrive at the identification of probable curative sites and individual treatment plans [9].

As more people become aware of the potential of AI in genomic analysis per the *Table 3*, then the following would be seen to be having more influence; It enhances the outcomes of therapies to be delivered since they would be based on the genetic type of the respective patient who requires the treatment. This approach does two things; it increases the efficiency of treatments while at the same time decreasing the occurrence of negative impacts resulting from the application of incorrect treatment plans. Therefore, the application of smart technologies in personalized medicine improves the efficacy of treatment and patients' quality of life.

Table 3
Accuracy of AI Models in Predicting Treatment Response

Cancer Type	Accuracy
Breast Cancer	85%
Lung Cancer	82%
Colorectal Cancer	88%

2.3.2. AI in drug discovery and development

AI plays a major role in expediting the discovery of drugs through the technique of predicting the efficacy of a drug and the possible drug candidates. An example that can be pointed out is Atomwise's platform which utilizes deep learning in order to predict the binding of small molecules to the target protein to accelerate the process of drug discovery.

AI revolutionizes drug discovery. AI technologies help in cutting down the expense and the time taken to develop drugs bringing a remedy to the market with ease as shown in the *Table 4*. Depending on the accuracy of the Interactions between the Drug and Target AI can often forecast and thereby minimize side effects and possible unsuccessful clinical trials due to them. It is to the advantage of patients because this accelerates drug discovery and brings new treatment options to patients earlier.

Table 4
Time and Cost Savings in AI-Driven Drug Discovery

Process Step	Traditional Method	AI-Driven Method	Time Savings	Cost Savings
Target Identification	2-3 years	6-12 months	50-75%	40-60%
Lead Optimization	1-2 years	3-6 months	50-70%	50-70%
Preclinical Testing	1-2 years	6-12 months	50%	30-50%

3. Contribution of AI to the Effectiveness of Healthcare Services

AI has especially made radical changes in the healthcare systems regarding the patients' conditions and the organization's performance. Thanks to its ability to analyse large volumes of data and find correlations, AI technologies have contributed to the improvement of diagnostics, individual approaches to treatment, and operational activities. This section focused on the RI of AI in multiple aspects of health across different lenses with the aid of illustrative examples and statistics.

3.1. Increase in the diagnosis efficiency and sensitivity

This results in improved diagnostic precision and identification of diseases in their early stages, thus improving the patient's overall health status. An example of this is the study [2] shown that proposed a deep learning algorithm to predict DR in the actual retina images. The algorithm resulted in a sensitivity of 97 percent. 5% and specificity of 93%. This study obtained a sensitivity of 4%, thus outcompeting that of human ophthalmologists in diagnostics. Arguably, such high accuracy enhances the early detection of many patients correctly, which leads to their early treatment [11].

Diseases such as diabetic retinopathy which, if left undiagnosed, can cause blindness, must be detected early. Early diagnosis means patients get the correct treatment to ensure the disease does not advance further thus maintaining vision and enhancing the patient's quality of life. Its strength is that it would receive experience through a massive amount of retinal image datasets, which enables it to detect patterns that the human eye can hardly detect. In terms of quantitative analysis, the results of the algorithm work may be presented using the ROC (Receiver Operating Characteristic) curve that shows the true positive rate/specificity on the vertical axis and the false positive rate (1-specificity) on the horizontal axis thus portraying the trade-off between the two parameters as per the equation (1).

Equation: ROC Curve

$$\mathrm{ROC}(p)=\{(\mathrm{TPR}(p), \mathrm{FPR}(p)):p \in [0,1]\} \quad (1)$$

Where TPR is the true positive rate and FPR is the false positive rate.

3.2. Improvements in the efficiency of the treatment and individual approaches

Based on the AI obtained from clients, individual treatment suggestions can be offered enhancing the efficacy of deliverance operations. CDSSs (Clinical Decision Support Systems) based on artificial intelligence have played a big role in this regard. For instance, the study [11] presents the efficacy of an AI-based CDSS to enhance healthcare providers' compliance with the recommended protocols for chronic illnesses including hypertension and diabetes. The system incorporated the patient's data such as personal history, laboratory test report, lifestyle, etc to come up with a suitable prescription plan [11].

The effect achieved using individualized treatment programs cannot be overestimated. AI can enhance the effectiveness of therapeutic interactions as well as reduce the number of side effects if it is applied to the specifics of the patient's personality traits. For example, in oncology, the AI algorithms can identify in genetic data, how a patient will be reacting to the various Chemotherapy and hence the oncologist can recommend the right treatment with minimal side effects. This kind of approach also improves the effectiveness of interventions, and the satisfaction and

compliance with therapeutic regimens of patients as per the equation (2).

Equation: Personalized Treatment Optimization

$$\text{Optimal Treatment} = \arg max_{t \in T}\big(\text{Efficacy}(t,p) - \text{Adverse Effects}(t,p)\big) \quad (2)$$

Where *t* is the treatment, *T* is the set of possible treatments, and *p* is the patient profile.

3.3. Health costs and system efficacy

AI in healthcare helps to cut expenses and enhance the processes in the industry. Routine business operations, including appointment setting, billing, and records management, which are important in dealing with patients, have greatly reduced operational costs through AI-generated automation. As established by Davenport and Kalakota (2019), applications of AI in clerical work cut costs by about thirty percent [10].

For instance, making AI chatbots to attend to requests and book appointments from patients has slashed the time that personnel utilize for such basic activities. It minimizes the need for many personnel in the company especially in the area of administration hence saving a lot of money. Besides, the application of artificial intelligence makes it possible to enhance resource utilization to make healthcare organizations` functions effective. For instance, predictive analytics can predict the number of patient admissions possible consequently facilitating good organization of occupancy of the hospital beds as well as employees' working schedules.

Time and money saved through the application of AI can be allocated to patient treatment improving general healthcare. The funds generated from this reinvestment can be used to purchase sophisticated medical equipment, additional education for personnel, and focused services for consumers as per the equation (3).

Equation: Cost Saving from AI Implementation

$$\text{Cost Savings} = \text{Initial Costs} - (\text{AI Implementation Costs} + \text{Operational Costs}) \quad (3)$$

Table 5
Cost Savings from AI Automation in Healthcare

Task	Traditional Method Cost	AI-Driven Method Cost	Cost Savings
Appointment Scheduling	$50,000/year	$20,000/year	$30,000
Billing and Coding	$100,000/year	$60,000/year	$40,000
Patient Record Management	$75,000/year	$40,000/year	$35,000

4. Light of the advanced research current trends in AI development and its applications

4.1. AI with Electronic Health Records (EHR)

Artificial intelligence in synergy with the Electronic Health Record has produced a radical shift in the analysis of patients' data and decision-making in the health sector. EHRs that contain massive information about patients, when augmented by AI algorithms, can greatly improve the possibilities of analysis and clinical decision-making. A good example of such integration is Epic Systems which uses AI algorithms in the system to deliver data analytics and decision support in EHR.

Epic Systems' AI solution for EHRs uses machine learning algorithms to understand patient's information and provide suggestions. For example, the various aspects include patient deterioration, readmissions, and probable diseases forecasted by learning from past and present data. Another study [13] investigated the impact of AI integration and noted that Epic significantly enhanced the ability to make accurate predictions and thus, enhanced clinical decision-making.

However, the use of advanced EHR systems aided by AI has a positive effect in the following ways. First of all, they enhance the availability of data as these systems are designed to provide more comprehensible and easily navigable patient data. For clinicians, they can easily obtain the necessary information, as well as the patient background, laboratory analysis, and proposed treatment options using mobile devices. Second, based on numerous simple operations, AI algorithms reduce the workload, for instance, ordering prescriptions, entering data, and scheduling appointments to contribute to providing more time for doctors to care for their patients. Third, AI and EHRs also have prediction capability which helps in preparing and managing the healthcare of the patients in advance to reduce the possibilities or risks to the minimum [12].

Example: AI Integration with EHR In this concept; a useful case of application of the various AI models with EHR is the ability to accurately predict clinical deterioration. The AI algorithms consider the data acquired from sources such as vital signs, laboratory work, and notes from the clinicians to detect deteriorating patterns of a patient. It generates predictive data that can help the clinician act earlier before the deterioration of the patient's state. One study claimed that in Epic EHR by applying the explored predictive models, the rates of unplanned readmissions were reduced by 20% and the rates of overall positive patients' outcomes were improved by 15% as per the *Table 6* [13].

Table 6
Impact of AI-Enhanced EHR Systems

Metric	Before AI Integration	After AI Integration
Unplanned Readmissions	25%	20%
Patient Outcome Improvement	10%	15%
Data Retrieval Time (minutes)	10	5
Clinician Time Spent on Data Entry	40%	25%

The use of AI in EHR system represents today's strategies of incorporating sophisticated technologies in healthcare industry. As these systems would remain to be developed in the future then it is expected that the systems would incorporate better AI models to enhance the probability assessment part and widen the abilities of the

system. This trend shows how AI-based solutions should be implemented in healthcare in order to reduce the negative impacts and enhance the positive ones on clinicians, patients, and the existing systems.

4.2. AI in telemedicine and remote patient monitoring

Telemedicine and remote patient monitoring are among the domains that integrate AI as a primary element to enhance the availability and the management of the patients' conditions. Telemedicine is the use of technology for the remote delivery of medical care and Artificial intelligence improves the services by improving on diagnosis, continual and unique patient care.

Many well-known applications of AI that exists in telemedicine today are the use of chatbots and virtual health assistants. These tools offer video and audio calls, prescription of medicines, and the assessment of health parameters of patients. For instance, one study [14] documented on how conversational AI can be used to assign patients into the right categories and provide them with first contact diagnosis and appointment for various healthcare providers. These virtual assistants are able to engage the patients and process their symptoms and give the correct health advice [14].

Telemedicine driven by Artificial Intelligence is valuable and has multiple outcomes. First of all, it helps to cut down the actual visits that are often crucial in rural or any areas with restricted healthcare access. Clients can get quick intervention and ongoing treatment without using their valuable time going from one hospital to the other. Second, the use of AI in telemedicine means that services are available to patients 24/7. They can be accessed anytime based on the patient's needs and this will enhance the engagement and satisfaction of the consumers as per the details on *Table 7*. Third, by remotely monitoring chronic conditions with the help of AI, its continuous assessment of client's state is possible, which can help in the identification of problematic moments that may require intervention.

Table 7
Impact of AI in Telemedicine and Remote Monitoring

Metric	Before AI Implementation	After AI Implementation
Hospital Readmissions (CHF)	30%	21%
Patient Satisfaction Score	75%	88%
Average Consultation Time	20 minutes	10 minutes

4.3 Emerging AI technologies and future directions

Federated learning and explainable AI are the two growing trends in AI that outline the future of healthcare by improving the security and privacy of AI applications. Federated learning is an innovative technique that allows model training across numerous institutions or organizations with the help of data other than patients' data. This technique maintains the patients' confidentiality since only summary statistics are disclosed to the organizations while the latter gets to gain access to a wider and more diverse data set. One application of federated learning is in medical imaging, described in a study [16] where hospitals cooperated to enhance the diagnostic models without sharing patients' data. This approach helps to protect the data and has non-negotiable high privacy standards; therefore, the proposed solution holds promise for future AI applications in healthcare.

Another promising technology that tries to shed the light on "black box" of prevailing AI is Explainable AI, or XAI for short. XAI improves the interpretability of the decision-making process which the AI model is going through thus increasing the trust in the healthcare solutions that are automated. Especially important in clinical domains, where it is critical to identify the reasoning behind AI's suggestions for both the clinicians and the patients. Methods like SHAP (Shapley Additive Explanations) values and LIME (Local Interpretable Model-agnostic Explanations) offer visualizations on top of which it is easier to understand what the AI model predicts.

The effects of these new technologies are quite profound. Another proven advantage of federated learning is that it increases the protection of AI use cases because individual data are not sent to a central server. The integration of explainable AI allows for the increased utilization of AI in healthcare delivery since its results are easily explicable owing to medical practitioners' nature of work.

Example: As shown in *Table 8*, Applications of Federated learning in Medical Imaging In a study done by Rieke [16], federated learning was applied in creating an AI model that would help in identification of brain tumour in MRI scans. The cooperation was conducted with 10 hospitals and the result showed that the federated approach provided a comparable accuracy of the model to a centralized one while preserving data security as per the equation (4).

Equation: Federated Learning Model Update

$$w_{t+1} = w_t + \eta \sum_{i=1}^{N} \frac{n_i}{n} \nabla L_i(w_t) \quad (4)$$

Where w_t are the model weights at iteration t, η is the learning rate, n_i is the number of samples at site i, and ∇L_i is the gradient of the loss function at site i.

Table 8
Comparison of Federated and Centralized Learning

Model Type	Accuracy	Data Privacy
Centralized Learning	92%	Low
Federated Learning	91%	High

These emerging AI technologies paint the picture of the future of the development of healthcare AI, which seeks to offer optimal data security, privacy, and potentially, patients' enhanced specialized solutions.

5. Future Prospects and Challenges

5.1. Ethical and regulatory consideration

While the usage of AI in healthcare is still in its infancy it has the potential to improve efficiencies, however, implementing AI raises several legal and ethical issues that must not be overlooked even in the slightest. Such difficulties are related to eliminating bias within the AI algorithms, preserving the patient's rights to privacy, and following the established principals that are currently in force.

The AI algorithms that are trained from historical data can in fact institutionalize or even magnify bias if the data used for training is non-diverse or biased. For instance, an AI developed with most of the data from one ethnic group will not provide the best results for the other ethnicity, which in this case creates diverse healthcare inequalities. To address this problem,[17] noted with concern the importance to warrant that the AI devices are built and checked with thorough datasets and diverse population settings to prevent bias. Bias auditing and fairness-aware machine learning are some of the techniques applied in removing bias in AI algorithms.

Example: Mitigating Controlled Bias and Data Privacy Some of these facets include the following: When using an example of applying an AI-based diagnostic tool. The tool must be validated through different population groups to ascertain the correctness and equity of the tool. Also, the data used in the training of this tool must be concealed with the patients' details being encrypted to enhance the patients' privacy. Thus, it is possible to develop AI systems that will have both high efficiency and people's trust by following these guidelines.

Impact: As shown in *Table 9*, Governing and Regulating AI Regarding ethical and regulatory concerns, there is a need to address these to receive the public's trust for the use of AI in healthcare. Thus, fair and impartial AI can help to generate better results for patients and increase the effectiveness of care in general. Additionally, healthcare practitioners will be in a position to decrease the probability of legal and ethical difficulties hence ensuring that health care organizations deliver healthy and reliable care.

Table 9
Ethical and Regulatory Considerations for AI in Healthcare

Consideration	Challenge	Mitigation Strategy
Algorithm Bias	Ensuring algorithms perform well across diverse groups	Use diverse datasets, bias auditing, fairness-aware ML
Patient Confidentiality	Protecting sensitive health information	Encryption, access controls, compliance with HIPAA/GDPR
Regulatory Compliance	Adhering to standards for safety and efficacy	Develop clear guidelines, ensure algorithm transparency

Equation: Fairness Metric (Disparate Impact Ratio)

$$\text{Disparate Impact Ratio} = \frac{\text{P}(Y-1\,|A-0)}{\text{P}(Y-1|A-1)} \quad (5)$$

Where Y is the outcome, and A is a protected attribute (e.g. race, gender). A value close to 1 indicates fairness.

Equation: Privacy Preservation (Differential Privacy)

$$\epsilon - \text{Differential Privacy: } P(f(D)-y) \leq e^{\epsilon}.P(f(D')-y) \quad (6)$$

where D and D' are datasets differing by one element, f is the algorithm, and ϵ measures privacy loss. Lower ϵ values indicate better privacy.

Privacy complications in healthcare AI system are a big problem that have been brought out by some major events. One recent illustration is UChicago Medicine which became party to a class-action lawsuit when it emerged that it had relayed patients' records in 2017 to Google without eradicating identifiers from the data. The notes contained annotations and timestamps that viewed alongside geographical data could be used to Monitor the patients [20]. In the same year, the case of data sharing in healthcare AI partnership between Royal Free NHS Foundation Trust and DeepMind Health was revealed to be illusory. While the implementation of artificial intelligence in the healthcare sector may prove to bear immense benefits a report from the UK's Information Commissioner's Office demonstrated that the trust involved was found to have breached the data protection act various principles while sharing 1.6 million patient records or records as they are referred to in the report [21]. Another huge instance is the partnership between Ascension Health and Google where the latter's "Project Nightingale" aggregate all patient records in 2019, negation consent and information to the patients [22]. These examples prove that patient's privacy must be protected when designing and implementing new AI technologies in healthcare. The leakage of personal data of participants in the Massachusetts General Hospital in Boston in 2019, which contained research data from about 10,000 people, when accessing a database with an incorrect setting, also proves the weakness of healthcare data within data systems [23]. To overcome these concerns organizations have started practicing improved privacy measures like federated learning, which enable aggregated training of artificial intelligence models on distributed datasets without compromising patient information. For example, Stanford University's use of federated learning in medical imaging analysis, showed the way educational institutions could work together to develop AI while still preserving data sovereignty [16]. All these cases therefore raise the issues of the need to establish sound privacy protection mechanism that will ensure both innovation in the use of AI in delivering health care as well as protection of the patients' rights to privacy.

5.2. Data privacy and security concerns

Security of patients' records from risks such as hacks and privacy, therefore, becomes paramount in the application of AI in this sector. Since AI systems frequently rely on big

data analysis and may involve patients' data, safeguarding the systems against malicious attacks and ensuring compliance with data privacy legislation are crucial to avoiding patients' data leaks.

A standout case on legal frameworks in the domain of AI healthcare apps is the GDPR (general data protection regulation) that operates in the Europe region. GDPR has stringent measures regarding the protection and processing of personal data that organizations are required to enforce proper measures. As the authors Shabani and Marelli pointed out in their work of 2019, it does not only avoid the violation of GDPR and, thus, the exposure of patient data but also strengthens the trust in AI in healthcare and thus its legitimation.

Sometimes, enhancing cybersecurity entails the following strategies. Firstly, data encryption makes sure that patient information is safe during transferring or even storing. Techniques known as encryption also serve to prevent other people from accessing the document: Advanced Encryption Standard (AES), for example. Another is the restriction of access, meaning data can only be accessed by personnel with multiple forms of identification, and data access is restricted according to organizational stature. This minimizes internal threats electronic data has the advantage of minimizing threats from within the organization since it is encrypted. Thirdly, security audit and vulnerability assessment processes are performed equally to establish possible security threats [18].

The consequences of the security and privacy of data with reference to AI healthcare applications are immense. By ensuring the privacy of patient information, healthcare organizations foster trust from the patients because the patients' data to be used by AI will be provided freely if patients are assured of their privacy. Further, it's in accord with legal standards for instance GDPR thus enabling organizations to shun legal consequences and loss of reputation in cases of data compromises. Finally, emphasis on data privacy and protection helps govern the utilization of AI in the health sector through ethical means, which in return helps harness the advantages of AI in health practices without infringing on the clients' rights.

Example: Measures of cybersecurity and GDPR Violation Telemedicine platforms with the help of AI can be an example of the use of strict measures of cybersecurity and GDPR compliance. Such platforms require patients' data such as health histories, and real-time monitoring information to be processed and or stored. Through end-to-end encryption, proper access restriction to the patient's data, and the periodic update of policies, these platforms can offer the privacy of the patients/clients and compliance with GDPR. Besides safeguarding patients' information from an unauthorized person, the above approach also increases the patient's confidence in engaging in a telemedicine program.

Impact: As shown in *Table 10*, Trust and Adoption of AI Technologies Protecting consumers' data is an essential factor in the creation of trust in AI applications. When patients can be assured that their data is being protected, they are likely to embrace more deep-learning healthcare services. It is this trust that is necessary for the extensive implementation of AI technologies that can greatly enhance the process of diagnosing disease and providing therapy, as well as improving the organizational and administrative aspects of present-day medicine.

Table 10
Key Cybersecurity Measures for AI in Healthcare

Cybersecurity Measure	Description	Benefit
Data Encryption	Encrypting data during transmission and storage	Protects data from unauthorized access
Access Controls	Implementing multi-factor authentication and role-based access	Limits data access to authorized personnel
Security Audits	Regularly assessing system vulnerabilities	Identifies and mitigates security risks

Equation: Data Encryption (AES Algorithm)

$$C = E_k(P) \quad (7)$$

Where C is the ciphertext, E is the encryption function, k is the key and P is the plaintext.

5.3. AI as a solution to redress health inequalities across the world

AI still has the capability to show green pastures concerning health equity and global health in the future, especially in LMICs. With the help of AI technologies applied in healthcare, the previously lacking opportunities in healthcare can be covered, and high-quality care can be provided to individuals who were deprived of such access earlier. This section is focused on the possibilities of AI's application in decreasing existing gaps in patients' care and making medical treatment more equal.

A clear demonstration of the opportunities AI in resource-scarce environments is the creation of diagnostic tools and mobile health applications. Study showed that it is possible to implement AI diagnostics through the use of mobile devices particularly to support the health workers in remote regions. These AI applications include the ability to inspect medical images which may encompass skin lesions, chest X-rays, and many more, in order to arrive at well-timed and accurate results. It is especially useful in areas where there is a scarcity of highly trained medical personnel to attend to such cases [17].

Artificial intelligence-based diagnostics have the potential to enhance the availability of healthcare. The health workforce in most of these regions is scarce, which means that diagnostic services are also scarce. The absence of readily available diagnostic functionality can be supplemented with the assistance of AI-driven tools. For instance, an AI-designed mobile application for the diagnosis of skin cancer can help health personnel in the screening of the patients, and timely recommendation for biopsy of questionable skin lesions. They also observed that the early detection and referral system would also help in improving the health of the people since diseases are detected at an early stage which is always easier to treat.

Example: Mobile Diagnostics in AI in another research, Study [19] proposed an AI system that is used in the

diagnosis of skin cancer through use of image captured through smart phones. The system proved to have a level of accuracy similar to dermatologists, through this, it can be useful in areas that lack dermatologists or where specialists are scarce. Due to the immediate output, the need for diagnostic proficiency is not a limitation for local healthcare workers while patients in dire need of attention are promptly identified and attended to.

Impact: As shown in *Table 11*, Health care accessibility and Equity through the use of Artificial Intelligence This paper elucidates the efficient ways of using Artificial Intelligence to address the question of global health disparities. AI technologies can popularize healthcare delivery because several diagnostic and treatment methods can be offered in regions where they are inapplicable. This in turn can help narrow the gap between health inequalities and indeed the general health status of the population. Moreover, AI solutions create opportunities for increasing the effectiveness of healthcare delivery and optimizing the distribution of resources for the benefit of patients [19].

Table 11
Impact of AI in Low-Resource Settings

Metric	Before AI Implementation	After AI Implementation
Diagnostic Accuracy	70%	90%
Patient Referral Rate	15%	30%
Healthcare Worker Efficiency	Low	High

Equation: Diagnostic Accuracy Improvement

$$\text{Accuracy} = \frac{\text{True Positives} + \text{True Negatives}}{\text{Total Cases}} \quad (8)$$

Therefore, this paper concludes that AI has the potential in the explained ways to potentially have a positive impact on global health inequality by improving diagnostics as well as the accessibility of care. AI solutions for instance in diagnosis, and in mobile health presentation can help in reducing health disparities and help in providing quality healthcare to populations in need. Through the incorporation of these technologies, the goal of offering adequate care to all people irrespective of their position and location can be met [19].

Several years of implementation of AI in the healthcare systems have showed efficiency in practical application. Integration in Mayo Clinic is a good example, Mayo Clinic managed to optimize implementation of AI that reduced the radiologist workload by 30% and reduced task time for report generation by half [24]. Cleveland Clinic confirms the value of the infrastructure – whereas, AI enterprise investment decreased the IT maintenance costs by 40% and increased the data processing speed by 60% [25]. The three-month training program carried out in Massachusetts General Hospital led to wide participation by the staff, 85% of the staff actually followed the training while revealing a 50 percent improvement in the efficiency with a definite decrease in errors initiated by users [26]. A study on Healthcare from Stanford by cost-benefit analysis reported nearly 25% cut down in the operational cost and enhancement of about 35% in the use of resources [27]. Implementation of the 18-month system also brought about a 40% enhanced diagnostic accuracy and a 30% minimization of the time patients needed to wait at Johns Hopkins [28].

6. Discussion and Conclusion

6.1. Discussion

While the use of AI in healthcare is rife with either prospects or issues. On the one hand, AI has a huge capacity to transform such key areas as diagnostics, treatment, and numerous organizational processes in the sphere of healthcare. Thus, it is one thing to benefit from AI to improve efficiency, but quite another thing if it turned out that this can be done only at the cost of violating ethical and regulatory standards.

Ethical and Regulatory Concerns Discussions on the use of AI in the delivery of health care have ethical consequences. Thus, the absence of bias in the adopted AI algorithms, and the confidentiality of patient information are of significant importance. Contradicting these ethical concerns is crucial for building public trust that defines the correct use of AI in the healthcare sector. The GDPR as well as the HIPAA contain the guidelines on the protection of patients' information as well as the safe implementation of AI technologies. Future regulation of AI has to consider the protection of the patient as well as his or her personal information and, at the same time, encourage technological advancement.

Security: Patients' data are vulnerable to breaches and privacy is one of the major challenges in AI development. According to the discussion, it is essential to ensure high levels of cybersecurity and strictly follow the rules of protecting patients' data to avoid leakage and loss, which decreases patients' confidence in physicians. AI developers, along with healthcare providers, also shall use higher encryptions and access control measures and strict security scans on the data collected from patients. AI integration in the health sector is contingent on meeting the security needs of the patient data while allowing for the timely processing of information in treatment.

Global Health The use of Artificial intelligence in the healthcare sector can be used to reduce health inequalities and advance the health of people in the global world. The result shows that in the environments particularly in the developing countries, AI as diagnostic and in mobile health will give the needed quality patient outcome., By applying AI, proper diagnosis can be made even in remote areas of the world, hence the importance of AI in increasing access to healthcare facilities. However, the application of AI in these contexts should come hand in hand with measures put in place to enhance local capacity as well as increase healthcare workers' competencies to incorporate the applications so developed in their practice.

Therefore, AI has shown the possibility of changing healthcare for the better by increasing diagnostic precision,

the possibility of customization the treatment process, and the reduction of the rate of inequality in access to satisfactory healthcare services across the world. Despite the current issues that face the intended industry there is the expectation of further capital investments in A. I. and the functions that exists within its framework that must shape the future of the healthcare providers. Maintaining the ethical usage of AI will go hand-in-hand with getting the best out of the technology for the individual's and patients' benefit.

6.2. Conclusion

Health is one of the industries AI has revolutionized with new opportunities in diagnosis and treatment, individualized medicine, and managing healthcare facilities. Thus, in this review paper have attempted to look at the current use of AI in health fields to see how it serves the patients and the systems. Also looked at the developments of AI in research and in the market and the prospects and future problems, including the ethical issues and regulations, data protection and Volume, and AI solutions for health inequalities [19].

AI technology's performances have noted an encouraging positive impression in enhancing the diagnostic precision and early diagnosis of diseases and afflictions. Another study has revealed that first-tier algorithms in the diagnostic system often outperform anatomic pathologists or radiologists. It makes the detection of the diseases take place at an early stage but precise which in the long run enhances the patients' experience through early interferences.

With regards to intervention advice, using artificial intelligence and clinical decision support systems has demonstrated that through using patient-specific data to design treatment regimes, the efficiency of the implemented measures as well as patients' satisfaction is higher. Predictive analytics is intended to also enhance the timely management of diseases; hence lowering the rates of patients who are being discharged and later readmitted to hospitals, and management of chronic diseases.

The incorporation of Artificial Intelligence with Electronic Health Record systems has brought about drastic changes in data processing and clinical decisions. The incorporation of Artificial Intelligence in telemedicine and remote patient monitoring has increased the reach of healthcare services mainly to people in rural and remote areas and has also increased patient involvement and satisfaction.

Modern AI technologies like federated learning and explainable AI are already setting the tone for tomorrow's healthcare market by increasing the security and privacy of data as well as explainability of the results. Such innovations ensure their effectiveness and trustworthiness, which provides solutions for some essential ethical and legal issues.

One is that artificial intelligence has the ability to effectively solve the problems of global health inequality. Applying AI in low-resource environments can fill gaps in healthcare systems by offering diagnosing help and mobile healthcare services, to increase the citizens' accessibility and equality in the health care sector.

Conflicts of Interest

There are no conflicts to declare.

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