ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue XI November 2024

Impact of AI in the Health Sector in the USA - Focus on Leading Industries

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DOI: https://doi.org/10.51244/IJRSI.2024.11110045

Received: 30 October 2024; Accepted: 11 November 2024; Published: 13 December 2024

ABSTRACT

Artificial intelligence (AI) is a disruptive and influential field of computer science that can drastically change the practice of medicine and healthcare provision. The impact of artificial intelligence (AI) has been drastically rising in recent years, mainly in the health sector. Focusing on leading industries such as GE Healthcare, IBM Watson Health, Massachusetts General Hospital (MGH) and Mayo Clinic, this paper aims to spotlight recent breakthroughs in the utilization of AI in the health sector, provide a blueprint for establishing safe, effective and reliable AI systems and discuss the influence of AI on healthcare delivery, operational efficiency and patient outcomes in the top industries within the US healthcare sector. An extensive literature review will spotlight the transformative ability of AI in customized treatments, drug discovery and disease detection while simultaneously discussing challenges such as algorithmic bias and data privacy.

The research approach utilized a secondary data analysis, drawing insights from the available credible sources in Google and other reputable academic databases, including PubMed, JSTOR, Google Scholar and ScienceDirect among others. The expected findings of this research include policy recommendations for addressing challenges to AI adoption and substantial developments in health sector practices. This research will generate insightful knowledge for healthcare stakeholders to reach informed decisions concerning adopting AI into health systems, generally in addition to optimizing patient care and health services in the US.

Key Words: Artificial Intelligence (AI), Healthcare, Health Sector, USA, AI Integration, Patient Care, Technology, Healthcare Systems

INTRODUCTION

Background

Healthcare systems worldwide experience substantial challenges in attaining the healthcare quadruple aim, which includes improving the patient's experience, enhancing the caregiver experience, improving population health and minimizing the increasing cost of healthcare. The worldwide increase in healthcare costs, ageing populations and developing burden of chronic illnesses are ultimately challenging healthcare providers, governments, regulators and payers to change healthcare delivery models innovatively (Rotaru & Amariei, 2023). Furthermore, against a background built by the global pandemic, healthcare systems are getting challenged to deliver high-quality and effective care ("perform") and "transform" healthcare by making use of real-time world data, directly drawing insights into patient care. The pandemic has also exposed the insufficiency of healthcare providers and inequalities in healthcare provision, previously noted by Amisha et al. (2019). Rahman et al. (2024) notes that utilizing technology and AI in the health sector can solve some of these supply-demand challenges. The rising access to multi-modal data (phenotypic, genomics, clinical, economic and demographic) blended with data security, the Internet of Things (IoT) and technological innovations in mobiles point out a moment of convergence between technology and healthcare to substantially change healthcare delivery models using AI-augmented healthcare systems.

Notably, cloud computing is helping shift safe and effective AI systems into healthcare delivery outlets. Cloud computing offers the computing capacity for evaluating vast amounts of data at lower costs and higher speeds, contrary to the traditional on-premises infrastructure of healthcare facilities. Undeniably, bunches of

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technology professionals are increasingly looking to partner with healthcare firms to fuel AI-fuelled medical innovation brought in by cloud computing and technology-linked changes.

Problem Statement

Although there are numerous developments in the health sector, extensive research is necessary to analyse the overall effect of AI on the health sector in the United States. The purpose of this proposal is to discuss the influence of AI on healthcare delivery, operational efficiency, and patient outcomes in the top industries within the healthcare sector. It will also spotlight recent breakthroughs in utilizing AI in the health sector, provide a blueprint for establishing safe, effective and reliable AI systems.

Objectives

This research aims to:

1. To evaluate the influence of AI on the healthcare sector in the United States
2. To analyze the advancements in patient outcomes fuelled by AI integration
3. To evaluate the operational efficiencies attained through AI in top healthcare sector industries
4. To single out the limitations and challenges linked to AI adoption in the health sector.
5. To offer insights into the effectiveness of AI integration in the US health sector, generating useful information for technology developers, policymakers and healthcare providers to reach an informed decision about AI adoption.

LITERATURE REVIEW

Role of Artificial Intelligence in Healthcare

Disease Detection and Diagnosis and Medical Imaging

The utilization of artificial intelligence within diagnostic procedures to help medical professionals has been valuable for the healthcare field and patients' overall well-being (Rahman et al., 2024). The primary goal of the disease diagnosis is to determine if a patient is affected by an illness or not. According to Rahman et al., (2024), the initial step in the diagnosis procedure incorporates getting an entire medical history and carrying out a physical examination on the patient. For example, an approach can apply sound analysis to recognize COVID-19 from several respiratory sounds such as voice, cough and breathing. In addition, Poalelungi et al. (2023) notes that AI algorithms can be utilized for a precise diagnosis to evaluate pathology images and medical scans. Imaging applications include quantifying and detecting breast densities using mammography, the volumetric quantification and detection of lung nodules using radiographs and the identification of ejection fraction from echocardiograms. AI-driven tools are improving the efficiency and accuracy of medical imaging. Varnosfaderani & Forouzanfar (2024) Showed that AI systems can surpass or match radiologists in sensing diseases such as breast cancer using mammograms. Firms such as GE Healthcare and IBM Watson Health are at the forefront of building AI-fuelled imaging technologies. Simultaneously, top facilities such as Massachusetts General Hospital (MGH) utilizes artificial intelligence for diagnostic image analysis to detect abnormalities in MRIs and X-rays. By utilizing this tool, MGH enjoys more accurate and faster diagnoses, resulting to informed and better treatment decisions.

AI in Personalized Medicine

AI streamlines personalized medicine by analysing lifestyle, genetic and environmental data to design treatments for individual patients. Bajwa et al. (2021) revealed that AI could predict an individual's reaction to specific treatments, hence enhancing outcomes. Artificial intelligence tools have the capability to evaluate huge amounts of data and sense sequences (Cortecci & Bonetti, 2024). Hence, AI has the ability to generate predictions for personalized and efficient treatment approaches. Personalized medicine, a branch of medical sciences, utilizes medical and practice decisions to provide tailored healthcare services to patients. For

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instance, CURATE.AI, an AI platform, maps the connection between a phenotypic result (output) and an intervention intensity (input-drug) for a patient, exclusively depending on their data, building a profile that operates as a map to forecast the results for a particular input and to suggest the intervention severity that will offer the most desirable results.

Most top healthcare facilities in the country are using this tool to improve personalized healthcare. For instance, Mayo Clinic utilizes artificial intelligence tools for predictive analytics to prevent emergencies and monitor patients. By evaluating patient data, this facility can single out key indicators and proactively intervene (Eghrari, 2024). According to Cortecci & Bonetti (2024) this has enhanced patient experience and minimized emergency cases. Simultaneously, Cleveland Clinic has joined with Microsoft for predictive analytics. This enables them to evaluate patient data to foresee health risks and better care delivery; enhancing not only patient safety but also resource allocation (Rao et al., 2024). Still on the same, Johns Hopkins Hospital partners with GE Healthcare for predictive analytics, which allows them to utilize AI to monitor patients and prevent severe events. This has not only enhanced patient outcomes but also minimized hospital stays.

AI in Pharmaceuticals

The application of AI has been drastically rising in the pharmaceutical industry, leading to a minimized human workload and the achievement of goals over a short period. According to Timthomas (2022) AI has helped in recognizing hit and lead compounds and providing quicker validation of the drug target and optimization of structure designs of drugs. AI is revolutionizing drug discovery and development by optimizing clinical trials and predicting drug efficacy. A study by Cortecci & Bonetti (2024) spotlights ways in which AI algorithms can evaluate vast datasets to determine possible drug candidates, minimizing the cost and time linked to traditional methods of drug tests.

Global Data predicts that the market for artificial intelligence platforms for the whole healthcare field will be at 4.3 billion dollars by 2024, raising from 1.5 billion dollars in 2019 (The Economic Times, 2023). According to Jiang et al. (2017) this will be facilitated by pharmaceutical firms using AI tools, side by side with healthcare professionals and payers, with the prediction to hit 2.9 dollars in 2024 (The Economic Times, 2023). These predictions are dependent on the fact that topmost pharmaceutical industries are heavily investing resources, time and money in advancing their AI solutions to smoothen their R&D process. For instance, according to GlobalData’s Drug Development Thematic Scoreboard Novartis is one of the firms best known to benefit from AI. The firm empowers its scientists using AI solutions that dig through laboratory experiment findings of decades ago. These AI tools recommend molecules tested for particular medical tasks, fastening the drug discovery process. Additionally, Pfizer blends AI with ML (machine learning) for its clinical trials. For instance, according to Peckham (2022) during the PAXLOVID clinical tests, AI tools assisted the firm to perform quality checks and review patient data fifty percent faster that their usual speed.

Predictive Analytics and Risk Assessment

Simultaneously, AI is substantially changing the health sector through its risk assessment and predictive analytics abilities. Cortecci & Bonetti (2024) pens that disease risk assessment refers to the process of analysing an individual's possibility of developing a particular illness, depending on risk factors such as lifestyle choices, genetic predispositions and environmental exposures. AI tactics have been implemented to handle the several steps followed in clinical genomic analysis: variant classification, phenotype-to-genotype correspondence, variant calling and genome annotation, and they can eventually be used in genotype-to-phenotype predictions. According to Bajwa et al. (2021), predictive analytics utilizes statistical approaches, historical data and machine learning algorithms to predict future results, helping healthcare professionals to anticipate patients' conditions, determine risk factors and prevent adverse incidences.

AI applications in this field include early diagnosis and disease prediction, where AI systems evaluate big datasets from EHRs (electronic health records) to sense sequences and predict the outcomes of cases such as cancer, diabetes and cardiovascular. A study conducted by Jiang et al. (2017) Google Health's AI system has revealed high accuracy in foreseeing lung cancer from CT scans, mostly determining malignancies earlier than

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radiologists. These developments promise to improve healthcare provision, enhance patient outcomes, and smoothen operational efficiencies by enabling personalized and proactive care. Furthermore, Gourmet et al. (2024) performed a successful prognosis prediction for 27 out of 32 cancers using AI to evaluate different kinds of genetic data, including omics data of copy number variation, point mutations, RNA expression and DNA methylation, utilizing data fetched from the Cancer Genome Atlas (TCGA).

Challenges and Ethical Considerations

As previously suggested, from utilizing health applications to weigh a patient's symptoms to clinical applications in fields such as diagnostics and imaging to workflow optimization in healthcare facilities, many researchers hold that AI will transform the health field (Rotaru & Amariei, 2023). Despite this transformation for the better, AI also brings out ethical challenges, including informed consent to use, safety and transparency, algorithmic fairness and biases and data privacy.

To begin with, although health intelligence applications, including surgery, imaging and diagnostics, will change the clinician-patient relations for the better, how will the utilization of artificial intelligence to help in healthcare provision comply with the principles of informed consent? According to Mennella et al. (2024), this is a strong question that has not gained sufficient attention in the ethical debate, although informed consent is the most immediate challenge in adopting AI into clinical practice. AI chatbots and health apps are being utilized, from health assessments to diet guidance, to help enhance medication adherence and evaluation of data gathered by wearable sensors (Gerke et al., 2020). This kind of AI tool raises concerns for bioethicists about user agreements and their correlation to informed consent. Contrary to the traditional informed consent procedure, a user agreement is a contract in which a person agrees with zero physical dialog. Kaplan & Ranchordás (2019) mentions that many individuals do not take time to comprehend user agreements, and they end up ignoring them routinely. Furthermore, regular updates of the software make it more challenging for users to follow the terms they agreed to. What information should be provided to persons using these apps and chatbots? What could an ethically responsible user agreement look like?

Additionally, safety is another core challenge for artificial intelligence in the health sector. For instance, IBM Watson for Oncology utilizes AI algorithms to evaluate information from patient's medical history and assist physicians in evaluating cancer treatment options for their patients (Strickland, 2019). Despite that, it has currently undergone criticism for reportedly generating "incorrect and unsafe" suggestions for cancer treatments. Seemingly, the problem surrounds the training of Watson for Oncology; rather than utilizing real patient data, the tool was only designed with a few synthetic cancer incidences. This real-time instance has exposed the field in a negative light. However, it also indicates that AI is effective and safe. This can be done by ensuring that datasets should be valid and reliable. According to Rotaru & Amariei (2023) like in the real world, the slogan: garbage in, garbage in" applies in AI, too. The more promising the training data, the better the artificial intelligence will perform. Rawat et al. (2022) Holds that the algorithms should be further refined to produce accurate outcomes.

Still the same, AI has the ability to enhance the health sector in high-income settings, democratize expertise, bring healthcare to remote areas and globalize healthcare. Nevertheless, any human-trained or machine-learning algorithm will only be as fair, trustworthy and effective as the data that it was trained with. AI also has risks for biases, hence discrimination. Therefore, it is crucial that artificial intelligence makers know the danger and reduce possible bases at every stage in the product development process ("Ethics and governance of artificial intelligence for health," 2021). Remarkably, they need to consider the risk of biases when selecting ML procedures and technologies they would utilize while training the algorithms, as well as what data sets (remembering diversity and quality) they would utilize for the programming.

RESEARCH METHODOLOGY

Research Design

This research will use a secondary data analysis methodology, greatly depending on the available credible sources in Google and other reputable academic databases, including PubMed. The research purpose is to

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systematically analyze and synthesize data from authoritative publications, peer-reviewed journals, and industry reports to analyze the influence of artificial intelligence in the health sector of the United States. Utilizing secondary sources will guarantee an efficient and extensive analysis without the call for primary data collection methodologies such as surveys and interviews.

Data Collection

The data for this study will be gathered from multiple vital sources. Peer-reviewed journals will offer validated and rigorous studies on the adoption of AI in the health sector, guaranteeing that the information is scientifically credible. Also, industry reports from top consulting organizations, including Accenture and McKinsey, as well as reports from healthcare firms and AI technology firms, will generate insights into existing trends, practical implementations, and technological developments of AI in the health sector. In addition, institutional and government publications of organizations such as the Centres for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA) and the National Institutes of Health (NIH) will provide regulatory views and reliable statistics. Lastly, the research will also rely on reliable news outlets to collect updated information on recent impacts and advancements of artificial intelligence in healthcare.

Data Analysis

The gathered data will be evaluated through a systematic review process. The literature review of this study will include an extensive synthesis of existing research to determine the state of artificial intelligence in the health sector and its impacts and applications. Additionally, the thematic analysis will be done to single out and examine key trends and themes correlated to artificial intelligence integration in fields such as operational efficiencies, medical imaging, personalized medicine and pharmaceuticals. This will classify the data into relevant themes and evaluate differences and commonalities. Moreover, comparative analysis will be applied to compare findings from various sources, validate the effect of artificial intelligence and identify common challenges and benefits. This multi-faceted strategy guarantees a nuanced and robust comprehension of the role of artificial intelligence in the health sector.

Expected Outcomes

This research anticipates garnering multiple substantial findings. To begin with, it will offer a comprehensive comprehension of the influence and role of artificial intelligence in the health sector in the US, spotlighting ways in which AI improves healthcare provision and enhances patient outcomes and experiences. Also, the research will generate evidence of operational efficiencies attained through artificial intelligence applications, including improved resource management and healthcare cost reduction. The research will additionally single out core limitations and challenges related to the implementation of artificial intelligence in healthcare, not forgetting issues associated with the necessity of big datasets, data privacy, and algorithmic bias. Lastly, the research will provide stakeholders with recommendations on efficiently implementing AI into health sector practices while dealing with these possible challenges. This approach guarantees an extensive and rigorous examination of the existing secondary data, resulting in informed conclusions about the influence of artificial intelligence on US healthcare.

Implications and Contribution to Knowledge

The outcomes of this study have substantial implications for several stakeholders in the US health sector, including technology developers, policymakers and healthcare professionals. To begin with, the research will equip policymakers with a comprehension of the influence AI has on patient outcomes and healthcare provision. This knowledge will offer a map for formulating policies and regulations that promote the effective and ethical application of AI tools. For healthcare professionals, the study will spotlight the practical challenges and benefits of utilizing AI in clinical facilities. This knowledge of how AI can improve personalized treatment plans, resource management and diagnostic accuracy will assist healthcare facilities in making insightful decisions about implementing and adopting AI solutions. AI companies and technology developers may use the knowledge gained from this research to fuel the advancement of more user-friendly and targeted AI tools that address real-world healthcare challenges.

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Simultaneously, the research adds on to the current body of knowledge by generating extensive evaluation of AI's influence on the health sector of the US. By reviewing data from a broad spectrum of reliable sources, the research will provide a holistic perspective of ways to change healthcare delivery, operational efficiencies, and patient outcomes. The research also bridges a gap in the literature by putting efforts mainly on top companies within the healthcare field, such as personalized medicine, pharmaceuticals and medical imaging.

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