# Rise of the Machine and Medicine: a Qualitative Review of Artificial Intelligence in the Healthcare Industry

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**Abstract**

*Artificial intelligence (AI) is broadly known as the ability of technology to perceive, reason out, learn to solve the problem – qualities associated with matter and human-related issues. AI is transforming the role of doctors and medical practices. This qualitative review in the paper covers the past three years of health research in AI across different medical disciplines and discusses the current scenario's challenges of emerging technology. Medical practitioners, particularly those in leadership roles, should aware of how rapidly AI is growing in health care so that they prepare to face the change for its adoption and adaptation by the health system. 'AI is more effective than humans in the diagnosis of various medical conditions and it is more precise with medical diagnoses based on images.'Especially when it comes to behavioral studies, latest research suggests AI is better than human beings. 'AI's current scenario is in its ability to learn from a large dataset and identification of patterns that can use to diagnose conditions, especially in direct vying with medical disciplines that involve in diagnostic tests which include pattern recognition, such as pathology and radiology.' The current challenges in AI include legal issues and feature of negligence when errors occur, and the ethical issues on patient requirements. 'AI systems can also be developed to learn and to find the existing biases.' The medical practitioners and health leaders should start to prepare for AI and advanced robotics system replacement of their profession.*

**Keywords: Artificial intelligence, machine learning, and algorithms relating to medical diagnosis, planning and treatment.**

## Introduction

The influx of new technologies in the Information Age has affected many industries. Especially automation, machine learning and AI have reshaped the health care industry. The aim of medicine is to heal and promote the health of human being. There are a few stakeholders who are working behind the scene towards, treatment and prevention of disease with medical research in many other aspects of health. Robots have already created a substantial impact on the health care industry. Generally, Robots are employed in healthcare Laboratory but in the recent past they have entered clinical medicine too. This has led to evolution of surgical robotics that adds value to other industries in return.

AI techniques have made big news across healthcare; will AI replace doctors in the Future? We believe that doctors will not be replaced by machines soon, but could it aid them in making better decisions in some healthcare sectors (Example: radiology). There are milestones covered by AI as it is tenderly known, has brought the world at one's feet. It has acted as a catalyst for growth in various industries which has been quickand sometimes, totally unpredictable. AI is a group of multiple technologies that imitate the human's cognitive functions.

Over 1000 North American business executives opined that 20% of the organizations would implement AI enterprises in 2019 in a survey conducted by PwC. A largest European stock broking firm after their trial run of AI program showed that these programs are more efficient than the traditional system of trading. In Insurance a Japanese firm had replaced 34 employees with an AI system and believed that it would increase productivity by 30%, having ROI in less than two years. Today not even the jobs of software developer for AI, are safe. Microsoft and Cambridge developed an AI capable of resolving simple math problem. We as professors are not excused, either with the advent of AI in Teaching and learning pedagogy – Example: online learning portals like Coursera/ MOOCs etc. Which would dispute the teaching fraternity.

In contrast to other industries, the health care industry has been a relatively slow adopter of AI, which has only recently become mainstream. Though the AI is implanted in different sectors its utility remains limited in clinical practice. However, research in this area is growing exponentially.

**Qualitative Review Methodology**

This paper summarizes health research in AI, across different medical disciplines from 2016-2019 and discusses the current scenario, challenges relating to this emerging technology. The authorspecifies thatAI developments in health carehave made vast progress over the past three years because of exponential growth, mainly due to advancements in computer hardware and software technologies. The author has specifically restricted her review to recent research in AIpublished in highly ranked medical journals. This qualitative review is not intended to be a systematic review, and the author has restricted the research to AI research that would affectmedical leaders in the health care industry. The focus of the review is to ensure that medical practitioners, especially those in leadership roles, are made aware of how quickly AI is advancing in health, so that they are ready for its adoption and adaptation by the health system.

**Findings**

**AI in diagnosis**

AI systems help in reducing therapeutic and diagnostic errors that are inevitable in clinical practices committed by man. AI uses sophisticated algorithms to learn attribute from a large source of data to assist clinical practice. It can also be equipped with auto correct abilities after learning from feedback to enhance its accuracy.

**AI in information systems**

Training must be provided to AI system users on the data which is generated from clinical activities like Screening, diagnosis, treatments, review checkups, etc.As it could be associated with similar subject features and outcomes of interest.

The other two major data sources are Physical examination notes and clinical laboratory results. Which are differentiatedby image, genetic and electrophysiological (EP) data as they contain large volume of unstructured lengthy texts, example: clinical notes, which are not so easily understood. Hence, the first focus of AI applications is on converting the unstructured text to machine-understandable language - electronic medical record(EMR).

## AI in clinical results

AI devices are mainly categorized into two. The first one is Machine learning (ML) technique –structured data like imaging, genetics and EP. At medical application ML procedures, attempts to classify the patients' attributes. The second form is known as natural language processing (NLP) – information is extracted from unstructured data such as medical journals/clinical notes which supplement the structured medical data by enriching them.

## AI in treatment of diseases

Even though there are many rich AI literature in health care, the research mainly focuses around a few disease types: cancer, nervous system disease and cardiovascular disease. The focus around these three diseases is expected as early diagnoses are required to prevent the deterioration of patients' health status.This can be achieved in AI system through proper analysis of procedures on imaging, genetic, EP or EMR

Robotic surgical devices require human intervention. The AI System performs autonomous surgery with human aid.  In 2017, a robotic surgery breakthrough, a robot dentist in China was able to carry out the world's first successful autonomous implant surgery by fitting two new teeth into a woman's mouth without any human intervention.

## AI's current scenario

So, based on the available sources, what is AI good at today? The AI's present context is in its ability to learn from a large dataset and identify patterns that can be used to diagnose critical conditions. The AI has a direct competition with medical specialties that are involved in diagnostic tests for pattern identification, and the required tests are pathology and radiology.

It is evident that, radiologists are utilizing ML applications for image analysis in their discipline, but the AI System will provide ample opportunities for radiologists improve the quality of the patient's health with their diagnostic and predictive capabilities in radiology.  The diagnostic and predictive capabilities in radiology will continue to improve on AI System.

The diagnostic and predictive capabilities in radiology continue to improve in AI systems.  The United States Food and Drugs Administration has approved an AI application in deep learning platform in a clinical setting which helps doctors to diagnose heart problems.

## Could AI take over the role of a doctor totally?

AI may be as safe as, or even better than, humans when it adds up to formulating diagnoses based on identifying patterns on images, but is AI ready to acquire over the complete role of a fully trained medical practitioner?Thus far, the result seems to be—not even. In the first direct comparison of diagnostic accuracy, physicians were found to vastly outperform computer algorithms in diagnostic accuracy (84.3% vs 51.2% correct diagnosis in the top three listed bearing in mind that this study compared doctors with relatively simple symptom checker applications.

It is paradoxical that AI systems seem more in force than human doctors diagnosing or in starting up with management plans, if they are provided with sufficiently large amounts of data that are beyond what humans can manually stop down.Medical practitioner as a leader is more proficient in logical reasoning, problem solving and analytical skills.

## Challenges of AI in health industry

It is understood from the qualitative review that AI in health, has progressed significantly, within the span of three years.It is probable that a lot of this recent advance is due to the increasing presence of large training data sets and advances in computer hardware, in the flesh of computer storage and

computational capability. Nevertheless, on that point are some challenges that necessitate to be considered as AI usage increases in health maintenance.Firstly, the primary fear is that of legal liability. If an error occurs medically, who is to be held liable? A robot surgeon is not a legal entity, so who should the patient sue, is it the owner, the programmer, the manufacturer or someone else? Could it ever be subject to criminal liability? All these AI dilemmas are not unique to the health care industry.

Secondly the subject is the reliability of doctors on the recommendations of AI by reducing the number of medical errors and misdiagnoses which fosters reduction in medicolegal claims.In fact, there may come a day that it would be considered negligent for a physician not to rely on the recommendation of a health AI system if it becomes the standard of upkeep.

Thirdly, it's the subject of morality and ethics with AI.An AI in healthcare can provide guidance as to the moral wishes of the patient—for example, does the patient want to maximize the quality of life?

Another issue with AI—inherent bias. AI systems can be incorrectly programmed to be biased in accordance with the preconceptions of the programmers or, with the development of self-learning algorithms, determine to be biased based on the data robot is learning from. In addition, AI systems find it tougher to generalize findings from a minimaldata set. Schemes to reduce such biases must be solved with an increase in the adoption of AI by healthcare.

The last issue that needs to be considered relates to how the AI uses data. The character of the information extracted is still dependent on the accuracy of the data being entered, as patient-reported outcome measures may still be treacherous.The advanced AI systems can link disparate health data from separate databases together to forge associations that may otherwise be lost.

Nevertheless, the publication of information ownership and privacy needs to be studied. A related case study is the recent finding by the UK's Information Commissioner that a National Health Service trust breached privacy laws by sharing patient data with Google for Google's DeepMind Streams app. Although this app did not directly use AI, the alleged data breach demonstrates that the demand for the maturation of a data governance framework that brings into account data ownership, privacy rules, patient consent and data security. Privacy laws may need to be reviewed to ensure they are relevant even as it is exhibited in the public domain.

## Future of AI

Today AI has become an integral part of our life due to the advancements of smart phones and other industries. For example, Alexa is a virtual assistant developed by Amazon, It is capable of voice interaction, music playback, making to-do lists, setting alerts, streaming podcasts, playing Audiobooks, and providing weather, traffic, sports, and other real-time information, such as news. Alexa can also hold in several smart devices using it as a home automation system

AI can currently analyze large amounts of data much faster than humans can use today's hardware. AI researchers are already developing AI algorithms that can discover, grow and mature like human being's act, through self-expression.

With drastic improvements in computer software and hardware, with gain in large datasets that are being joined together, Ray Kurzweil, a Google AI expert, believes that AI will override the human brainpower by 2023 and touch what he terms 'singularity' in 2045, which is when the AI will excel the brainpower equivalent to that of all human beings combined.

## Implications on Medical Leaders

Medical leaders need to be aware of the potential impacts that new health technologies will have on the current and future health system.

They demand to ensure that strong governance structures with appropriate review of new technologies must be planned prior to their implementation, in terms of safety and cost-effectiveness. An appropriate training regime should also be carried out to ensure that staff is prepared and cognizant of their ethical and legal responsibilities.A strong framework needs to be devised towards data management with relevant laws and rules.

They willhave to constantly expose themselves to future innovations in AI by preparing forupcoming threats and opportunities, well in advance. AI and robotization will have an impingement of the health workforce, which is of outstanding worry.

They must be aware that AI systems are not precisely relevant to clinical attention, they too can be practiced supporting, and relatively replace, the role of managers, in health, financial management, priority setting, resource allocation and workforce management.

Lastly, medical leadership will possess to be catalytic in AI transformation for the healthcare industry in the years to come. They will have to ensure that the patient experience and needs are always the top most priority; ultimately, medical leaders are still doctors, whose duty is to care for patients as imports.

**Conclusion**

It is clear from this qualitative review of recent evidences that AI research in the health care industry is progressive in nature, by being effective in major aspects of medicine like diagnosis, preparation and even treatment.The medical leaders need to hold a mature deliberation about the legal, ethical and moral challenges of AI in health, and alleviate any prospective bias that such systems may accept from their manufacturers.

Regardless of whether the AI singularity comes to take place or not, AI in health will continue to speed up.However, challenges are realized in the adoption of AI in health care services, foundations, organizations and governments. As doctors and health leaders, they need to forester in preparing the professionals to be supported, in the future, potentially, betaken over by, AI and advanced robotics systems. This review depicts vast Opportunity to shape the development of humanity's future autonomous health providers, and they should be leaders in their domain rather than passive professionals.

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