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Artificial Intelligence in Healthcare: Replacement or Reinforcement for Clinical Practice

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Since the dawn of the modern age, individuals have created several machines to assist humankind in various tasks. One of the most prominent discoveries in recent ages has been Artificial Intelligence. John McCarthy devised and constructed the term Artificial intelligence in 1956.[1] He fabricated an idea that machines, like humans, could be programmed to think and make decisions independently. Herbert Simon and Allen Newell formulated the , the first AI system, to prove 38 theorems in Russell's *Principia Mathematica*.[2] This field has recently undergone numerous implementations in various sectors worldwide. Today, this technology has evolved from a single program to multiple layers of complex neural networks that can accomplish complex tasks within seconds and produce human-like cognitive ability, which is proven by several pieces of research carried out worldwide.[3] AI models have been used to perform many tasks such as problem-solving, data collection, storage and analysis, automated administrative tasks, risk and fraud detection, and much more. AI has entered almost every global sector nonetheless efforts have been made to incorporate this technology into healthcare as well.

In the 1970's the AI model CASNET (computer-assisted decision-making based on a causal-associational network) was developed for consultation, identification, and prognosis for glaucoma patients.[4] In later years AI experienced breakthroughs in all fields of medicine such as drug discovery and delivery[5], aiding in the diagnosis of multiple sclerosis by helping radiologists analyze large sets of Magnetic Resonance Images (MRI),[6] advent of robotic surgeries with AI modeling,[7] and much more. The incorporation of AI methods started later in dentistry as compared to medicine. AI systems are being used for the diagnosis and assessment of caries, periodontal diseases, orthodontic patients, and treatment planning of implants.[8]

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Structurally speaking, an artificial intelligence model is categorized into three basic layers; input, intermediate, and output layers. For the model to perform the required task independently, the model must undergo the training phase. This phase of AI is still not independent of the clinician because to be trained and validated the system has to be fed with a data set that has to be annotated by an experienced individual regarding the correct diagnosis and identification of given data. Afterward, new raw data is added to the system to perform the validation phase, in which the accuracy of the machine is checked to correspond to the gold standard dictated by the clinician. After initial programming, the machine is then ready to be tested. Data is entered through the input layer and analyzed in the intermediate layer. Finally, the machine independently generates the results in the output layer.[9]

In the age of modern technology clinicians and patients are leaning more towards solutions that are faster and more efficient, selecting a faster treatment option rather than the conventional one, which requires multiple visits, long patient interviews, and clinical examinations. One question that often troubles many clinicians is as the use of AI is increasing rapidly, will it ultimately replace them in the treatment process? There are two ways of looking at this; a study published by Christopher *et al.* recently stated that among nurses, sleep deprivation and fatigue are some of the most common factors leading to medication errors by registered nurses.[10] This is because the burden on healthcare services is more than the number of healthcare professionals available, which leads to overworking of clinicians and healthcare staff. This issue could be easily sorted out by having AI-assisted medical services, however as desirable as this sounds, there are multiple challenges associated with the use of AI. First and foremost, AI systems in their developmental phase are still dependent on the input data. This input data can have biases, have limited generalizability, and be difficult to collect. An AI model trained on a small dataset is bound to make errors. Even if we have adequate input, this input is still preprocessed by humans and thus can be prone to errors. Any error or biases in the development of the model cannot be assessed when the model is in use due to the black box effect.[11] As clinicians deal with conditions that can affect an individual quality of life, complete dependence on any technology without proper protocol breaks the ethics code of non-maleficence.[12] If any clinician

commits medical malpractice, the individual is accountable in court and can ultimately lose their license. There is no such system in place to check that if an AI model makes a misdiagnosis who is accountable? The creator, the doctor, or the institute. Furthermore, machines could be hacked and personal data can be misused. Even the machines could be used for negative purposes.

All of the above-mentioned concerns lead to the conclusion that no doubt Artificial intelligence is a prodigious development, still complete reliance on it on matters that are related to an individual's well-being and quality of life is detrimental. These machines could be used to assist clinicians and reduce their workload, in data storage and processing administrative tasks, however, treatment should always be performed by the clinicians. They could also be used for diagnosis; however, this should also be verified by a clinician. Further studies should be directed towards the role of Artificial Intelligence in assisting clinicians rather than creating machines for their replacement.

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Farzeen Tanwir: Supervised and review of the manuscript
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