Artificial Intelligence in Healthcare: The impact on personalized patient care and clinical decisions

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I. Introduction

As artificial intelligence is ever-changing and evolving, it is becoming more integrated into several sectors of daily life. Specifically, the way artificial intelligence has made its way into healthcare is particularly interesting considering clinical applications. AI has become a part of healthcare operations through Clinical Decision Support Systems (CDSS). CDSS is an application that uses artificial intelligence to help doctors analyze patient data, recommend treatments, make treatment plans, and overall enhance patient care. Furthermore, CDSS can help monitor patients and streamline specific operations. AI can make medicine more personalized and accurate as healthcare systems become more data-driven and complex through the implementation of AI. CDSS uses different algorithms to analyze all possible data, helping doctors detect what a human could normally not. Artificial intelligence in healthcare research is at the forefront of information sciences because since AI is becoming more a part of medicine, the technology will affect each patient going forward. Without proper policies protecting patients and regulation of technology, the impact AI can have on society could be harmful.

I intend to find how we can use AI to aid and enhance medicine as well as weigh these benefits with the potential drawbacks. Drawbacks include the ethical dilemma that AI can worsen existing healthcare disparities specifically among women, elderly, and racial minorities, considering there is limited data that could reinforce historical prejudices. Additionally, human judgment and empathy are important pillars of the medical field where AI falls short. It should also be noted that the more reliance and data are given to AI, the more security is at risk. When encountering untrained situations with no available data, this technology will fail. If there are

misuses or breaches of data, trust in the healthcare system will begin to dissipate. While there is great promise of how AI will advance healthcare, being aware of its limitations is just as critical aiming to balance benefits and risks.

II. Training and Education

As AI is becoming more integrated into healthcare it is crucial that medical professionals understand how it will become their new partner. Although AI in healthcare began in the 1970's, integration is rapidly increasing. To begin, AI has assisted in the improvement of medical education. In the past, training and education have mostly been approached by simply having students study large amounts of information and not adapting to the individual. All around, AI can assist in the learning experience by helping professors and students with tailored learning systems. For example, "AI methods such as Machine Learning/Deep Learning, Robotics Training, and Virtual Reality have been implemented to enhance the learning experience and improve outcomes. In the domain of Behavioral Health, Virtual Reality has been used as a tool to create immersive and interactive environments, allowing students to practice their skills in simulated scenarios that mimic real-world situations" (Nagi et. al, 2023). AI can simulate and create virtual patients while giving real-time feedback to better prepare students. By using augmented reality (AR) and virtual reality (VR), lessons can be more hands-on and practice procedures without the risk of using real patients. In general, the use of AI in training medical professionals can be extremely beneficial in the context of training. Medical students are able to gain hands-on experience through virtual simulations, with no risk of patient harm. Additionally, AI technology can custom-tailor learning modules for practice with specific patients. Getting experience and training with specific AI-simulated patient problems can help train medical students to use their vast and broad knowledge in a targeted, focused area. However, the

limitations of AI in terms of education should be noted. Training in a virtual space is much different than practicing on a real human, and human training is preferred when available. Additionally, students should gain deep knowledge from their studies and be able to rely on just their minds, without the help of AI. In the event of an emergency, one may not have the time to rely on the technology, leaving training and education to react to the medical emergency.

III. Data Assitance

Furthermore, AI systems have been revolutionary in assisting healthcare professionals to do their jobs to the best of their ability along with increasing overall optimization. CDSS assists healthcare professionals through advanced computerized systems and technologies. It helps them "analyze patient data and information to provide robust suggestions for diagnosing, treating, and managing diseases, disorders and health conditions" (Ouanes & Farhah, 2024). A large benefit of CDSS is it assists with daily clinical tasks, ultimately making medical professionals' jobs easier. A physician spends about 50 percent of their time on electronic health records (Fernandes, 2022). With the assistance of AI through reading and understanding these health records, physicians can have more time to pay more attention to the patients and their treatment. Not only does AI allow for more time and attention towards critical aspects of their jobs, but it helps physicians be as accurate as possible and eliminate human error – leading to more precise diagnoses. AI provides accurate and efficient care with the ability to analyze large amounts of complex data by identifying patterns and relationships producing insights that a human would not be able to do alone. Prevention is a large focus in the medical community striving to become more proactive "AI has presented encouraging results in the early detection of diseases such as breast and skin cancer, eye disease, and pneumonia using body imaging modalities" (Kuwaiti, 2023). Patients can be treated earlier through AI detection, leading to a higher likelihood of survival and a less

intense treatment. Furthermore, AI can detect neurological diseases such as Alzheimers and Parkinsons disease. Through this, individuals can take early action through lifestyle changes and preventative methods to combat the development of certain diseases and illnesses. AI positively affects medical professionals, directly correlating to a positive effect on patients.

As stated earlier, because AI can help physicians with unimaginable amounts of data, physicians can share more statistics and meaningful data related to their patient's health, leading to patients themselves being more educated and informed. AI has risen above expectations when it comes to preventative medicine. By analyzing Electronic Health Records (EHR) AI can predict diseases and disorders, therefore providing a personalized treatment plan. Attempting to address a problem preemptively and enacting preventative solutions saves medical expenses and lives. This could cause individuals to be more proactive in their health and care as well as eliminate the need for multiple opinions. If patients have access to more data needed for care, decisions do not need to be delayed by searching for multiple approaches and diagnoses from different medical professionals. As AI makes the patient more involved, patients and physicians have the ability to access resources from anywhere.

IV. Virtual Care

The COVID-19 pandemic changed the field of healthcare forever. Once the worldwide pandemic hit, there was an immediate push toward virtual care. Remote healthcare services became essential for patients quarantining. The rapid increase of virtual care was out of necessity and often there were no other options during the pandemic. Today, virtual care allows consistent communication and easily accessible medical care, especially for patients in rural areas. Virtual care solves a distance barrier that may have taken longer if not for the pandemic. Patients can be monitored through AI algorithms and tools and receive consultations remotely. For example "In

cardiovascular patients remote monitoring is cost-effective and safe, and it decreases the staff workload and improves the prognosis of heart failure patients" (Fernandes, 2022). Furthermore, Augmented Reality (AR) could be used for patients to interact with their physicians in real time using audio chats and live video tapes. Using AR and VR allows motions and emotions to be taken into account even in emergency situations so health professionals can provide faster on-the-spot solutions. Essentially, the goal of medicine is to lower costs while increasing the quality of care which can be achieved with the support of AI tools and systems.

V. Privacy

The medical field is implementing AI into practice because of its current benefits and the potential for how it could transform care in unimaginable ways. While this is true, there has also been substantial research done on the negative implications that need to be understood. The ethical and privacy concerns of AI becoming integrated into healthcare are at the forefront of concerns. Privacy has become a large part of the conversation as technology continues to develop. When there is a lack of privacy an individual's data can be used to manipulate them without even knowing which has already been seen in some cases. Arguably, health data is the most private details of an individual. Unfortunately "In healthcare, the mean time to identify a data breach was 236 days and 93 days to contain" (Hlávka, 2020). Most of the time companies are not motivated to protect data privacy considering they can financially benefit from the breach of data. Most companies wildly abuse private patient health information. In the United States, there are not strong enough regulations or legal penalties to prevent this behavior (Murdoch, 2021). This leads to the public not having trust and essentially disapproving of further implementation of AI. This general public mistrust is because of the type of data that AI needs to run efficiently. AI analyzes medical history, medical imaging, lifestyle, and genetic

information. That being said, it is crucial to take steps to protect patient data such as encryption, anonymization, and eliminating unauthorized access and misuse of data to ensure confidentiality. Although the usage of AI in healthcare can be extremely beneficial, personal data protection is a large concern of patients.

VI. Algorithmic Bias

With all the data AI applications have and the algorithms that are used, AI can lead to discrimination toward minority patients. "Applied AI systems could improperly restrict opportunities and provide substandard care for minority groups by propagating historical patterns of prejudice encoded within limited training datasets" (Iloanusi & Chun, 2024). An unchecked AI system could create a further divide for marginalized groups by receiving lower-quality patient care. Medical data can reinforce discrimination because there is an underrepresentation of minorities. Said AI systems use historical data where there are biases towards certain ethnic groups. If the AI is not trained on diverse data it could cause inaccurate or lack of diagnoses for those minority groups (Iloanusi & Chun, 2024). Challenges arise if patients are diagnosed based on race and are either underdiagnosed or overdiagnosed for a certain disease because there are certain predispositions among the medical community towards that racial group. If certain groups of people are affected and realize they are not getting proper treatment they may lose faith in the system and not seek the care they need. Furthermore, individuals in lower income groups have a tendency to seek medical help less, so the algorithm has less data on them. Every group of people presents differently and if that is not accounted for it can become dangerous if unchecked. There is limited accountability if AI is used for decision making and there is a large reliance on automation.

VII. Conclusion

Artificial Intelligence has done amazing things for the medical community and there is potential for it to become even greater. There are promising developments and new discoveries every single day. There are so many possibilities for AI in the future and what can be done. For example, AI is making huge strides in drug discovery. Unfortunately, drug discovery is a long process that requires a large amount of energy, time, and money. It is an inefficient process that usually takes 10-15 years to get a new drug out on the market. With the use of AI, the entire process is sped up and becomes more efficient. This process is helped through AI being able to sift through vast amounts of data to make drug candidates that are customized for certain properties. It increases the success rate as well as making drugs safer and more successful by becoming more personalized towards patients' needs. Furthermore, it can focus more on rare diseases and certain conditions that are commonly overlooked (Gupta, 2024). AI also has great potential to do amazing things for the future of cancer detection. Almost every individual knows someone who has been affected by cancer and one of the largest issues is detecting cancer when it is too late where it could have been preventable. Thankfully, the development of AI is helping with early detection and diagnostics. For example “Sybile, an AI model developed at the Massachusetts Institute of Technology, can detect signs such as abnormal growth in the lungs, showing doctors where the cancer is likely to appear, and where they should monitor routinely” (“How is Artificial Intelligence”, 2024).

The healthcare field is incredibly complex and multifaceted, even more so when it comes to AI. On one hand, AI can aid medical professionals in fantastic ways revolutionizing patient care. AI has achieved what was not thought possible for many years to come. On the other hand, there are serious harms through the usage of AI in healthcare that must be considered. To approach AI integration in the best way possible it needs to be done in ways that maximize the

benefits and minimize the risks. In order to do so it is important to understand how to mitigate those risks. In an ever-transforming world, the future of AI in healthcare is promising.

References

Al Kuwaiti, A., Nazer, K., Al-Reedy, A., Al-Shehri, S., Al-Muhanna, A., Subbarayalu, A. V., Al Muhanna, D., & Al-Muhanna, F. A. (2023). A review of the role of Artificial Intelligence in Healthcare. *Journal of Personalized Medicine*, *13*(6), 951. https://doi.org/10.3390/jpm13060951

Fernandes, J. G. (2022). Artificial Intelligence in Telemedicine. *Artificial Intelligence in Medicine*, 1219–1227. https://doi.org/10.1007/978-3-030-64573-1_93

Gupta, U., Pranav, A., Kohli, A., Ghosh, S., & Singh, D. (2024). The contribution of artificial intelligence to drug discovery: Current progress and prospects for the future. *Microorganisms for Sustainability*, 1–23. https://doi.org/10.1007/978-981-99-9621-6_1

Hlávka, J. P. (2020). Security, privacy, and information-sharing aspects of Healthcare Artificial Intelligence. *Artificial Intelligence in Healthcare*, 235–270. https://doi.org/10.1016/b978-0-12-818438-7.00010-1

How is Artificial Intelligence (AI) shaping the future of cancer control?. UICC. (n.d.). https://www.uicc.org/news-and-updates/news/how-artificial-intelligence-ai-shaping-future-cancer-control#:~:text=Earlier%20detection%2C%20better%20treatment&text=Treatment%20of%20cancers%20is%20also,help%20speed%20up%20the%20process.

Iloanusi, N.-J., & Chun, S. A. (2024). AI impact on health equity for marginalized, racial, and ethnic minorities. *Proceedings of the 25th Annual International Conference on Digital Government Research*, 841–848. https://doi.org/10.1145/3657054.3657152

Murdoch, B. (2021). Privacy and artificial intelligence: Challenges for protecting health information in a new era. *BMC Medical Ethics*, *22*(1). https://doi.org/10.1186/s12910-021-00687-3

Nagi, F., Salih, R., Alzubaidi, M., Shah, H., Alam, T., Shah, Z., & Househ, M. (2023). Applications of artificial intelligence (AI) in Medical Education: A scoping review. *Studies in Health Technology and Informatics*. https://doi.org/10.3233/shti230581

Ouanes, K., & Farhah, N. (2024). Effectiveness of artificial intelligence (AI) in Clinical Decision Support Systems and care delivery. *Journal of Medical Systems*, *48*(1). https://doi.org/10.1007/s10916-024-02098-4