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FUTURE OF THE ARTIFICIAL INTELLIGENCE IN DAILY HEALTH APPLICATIONS

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Abstract

This study explores the future possibilities of artificial intelligence (henceforth AI) and related daily health applications. AI mimics human intelligence though approaches of machine learning (ML), natural language processing (NLP), and expert thinking, which enable the use of healthcare data to improve outcomes of care. Leveraging AI in healthcare suggests a better return on investment (ROI) and efficiency than utilizing the skills of clinicians alone. The methodology used was exploratory in nature which hinged on the content analysis and synthesis of a literature review of studies done in this area. The study was driven by two research questions that address the potential benefits of AI and ethical considerations as a significant stumbling block. The results suggest the different types of AI systems are essential in daily healthcare applications which include ML, which requires artificial neural networks, administration, diagnostics, and treatment, and patient engagement and adherence. Focusing on the bigger picture, the application of AI in daily medical procedures will supplement clinicians' understanding of their patients and improve outcomes of care through information processing.

Keywords: AI, healthcare, AI-based systems, clinician, patient

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1. Introduction

The successful application of artificial intelligence (AI) – which is the simulation of human knowledge – involves machine learning (ML), expert reasoning, and natural language processing (NLP) algorithms that enable machines to exhibit rational thinking in problem-solving. Continued innovation in the field of AI has a promising future for daily healthcare applications. The constant improvement is mainly due to the continuous rise of data in healthcare managed through health information systems (Davenport & Kalakota, 2019). Artificial neural networks can mimic the clinician's thinking process by recognizing the interrelationship between data allowing ML systems to approach problems in a fashion similar to that of a clinician (Buch et al., 2018). In essence, an artificial neural network provides a framework for the execution of AI algorithms (Rong et al., 2020). The advantage of an AI system over a clinician lies in its ability to simultaneous processes multiple pieces of evidence with almost limitless inputs. Relatively, if clinics can realize a better ROI with Electronic Health Records (HER) systems in place (Jang et al., 2014), then AI that leverages EHR systems can offer more.

The future of AI in healthcare ranges from simple to complex applications such as a review of medical records, analysis of medical procedures, therapeutic medical practices, and designing of medical tools and equipment. AI has the power to transform healthcare delivery to patients and payers, as well as improve administrative processes by crucial stakeholders like pharmaceutical firms, health insurance companies and the society at large (Horgan et al., 2019).

However, even with a bright future, ethical concerns revolving around patient safety and privacy (Morley et al., 2019) need to be considered. This study takes a close look at the future of AI in daily healthcare applications and related ethical considerations.

2. Purpose of the Study

The aim of this study is to explore the possibilities of AI in augmenting clinicians' role in daily healthcare applications and the possible ethical ramifications in terms of breaches of patient privacy and safety that may compromise the utilization of AI in this domain.

3. Research Question

The following research questions serve to drive the study:

3.1. What is the role of AI in helping clinicians with daily healthcare applications?

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3.2. How can ethical dimensions regarding patient privacy and safety compromise the future of AI in daily healthcare applications?

4. Research Methodology

This study aims to identify and analyze the future of AI and its role in daily healthcare applications. The study utilizes an exploratory approach that involves analyzing and synthesizing information in substantive articles (secondary data sources). This content analysis revolves around the two research questions that drive this study, resulting in an application of a two-pronged analysis to the literature: future possibilities of AI in healthcare and ethical dimensions of using AI in healthcare. While the presence of AI in daily healthcare applications focused on the benefits of the dominant technology in transforming the outcomes of care, the ethical dimensions of AI centered on possible drawbacks that would affect the future success of AI in the healthcare domain. The essence of a qualitative study is that it creates room for in-depth context analysis with emphasis on credibility throughout the process (Bengtsson, 2016). A varied range of relevant secondary sources is easily obtainable from academic research databases such as JSTOR, IEEE Xplore, ScienceDirect, and PubMed. Utilizing browser search engines, keywords and key phrases related to the investigation like AI, healthcare applications, ethical repercussions of AI in healthcare and other related words and phrases were used to delimit and refine the search to the relevant literature needed to answer this study's research questions.

5. Findings and Discussion

5.1. Future possibilities of AI in Healthcare

This section focuses on the response to the first research question which is to identify the possibilities AI that can help improve daily healthcare applications. Acknowledging the current trends of AI should help set a precedence for future possibilities of AI in healthcare. AI leverages various healthcare data – structured and unstructured – through ML techniques and NLP: ML techniques are applicable in artificial neural networks (which involve structured data), while NLP focuses on unstructured data (Jiang et al., 2017). AI tools are currently applied in prognosis and the diagnosis of cancer and cardiology (Jiang et al., 2017). Specifically, clinicians can utilize healthcare data in the prediction and evaluation of prevalent health complications. According to Rigby (2019) "its potential contributions to biomedical research, medical education, and delivery of health care seem limitless. With its robust ability to integrate and learn from large sets of clinical data, AI can serve roles in diagnosis, clinical decision making, and personalized medicine." (para. 2) Indeed, it has been established that a

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computer can diagnose skin cancer with greater precision than a dermatologist while radiologists are now relying on AI based diagnostic algorithms applied to mammograms as a "second opinion" as part of their investigative procedures. Apart from assisting with physical health issues, AI in the form of "advanced virtual human avatars are capable of engaging in meaningful conversations has implications for the diagnosis and treatment of psychiatric disease" (Rigby, 2019, para. 2)

With such possibilities abounding, it is inevitable that AI systems can operate efficiently only with 'training' before deployment through healthcare data generated from medical procedures and clinical diagnosis, among other health applications. Since the data influence the scope of the system application and degree of success (Floridi, 2020), the future possibilities of such intelligent systems depend on the 'training' approaches and the availability of data (Calegari et al., 2020). Altogether, properties of data like its availability, reusability, and ease of transportation and processing not only define but also guarantee the future efficacy of AI.

AI-based systems can help clinicians understand their patients better, save time, and improve the outcomes of care. The nature of the interaction between clinicians and their patients is a core determinant of healthcare outcomes. There is a possibility of developing future ML algorithms that can study the medical history of a patient and enable the clinician to understand their client at a personal level (Ahuja, 2019). In this way, AI systems will help augment the efforts of human clinicians rather than replace them due to the unique social skills like persuasion and empathy that only humans can deploy and which machines may fail to mimic (Davenport & Kalakota, 2019; Jiang et al., 2017).

Arguably, one of the major mistakes made by clinicians is assuming that every patient responds the same to specific medical procedures instead of trying to familiarize themselves with the patient at a personal level in order to provide patient-specific care. In some instances, patients and clinicians lack a shared understanding of what constitutes illness and treatment expectations (Harris et al., 2020). Understanding the patient through medical informatics may expose the clinician to the personal beliefs of their clients regarding treatment which would help solve any conflict between clinicians and patients (Snyder et al., 2011). For instance, a Muslim patient may disregard prescribed medicines because of their religious belief that Allah (God) is the giver and taker of life (Ahaddour et al., 2018). Such scenarios may require an AI system to generate and analyze the medical history of the patient involved or related cases and the clinician to apply persuasive skills after understanding the patient. This and other such

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examples highlight the fact that the application of AI in daily medical procedures will act to supplement the clinicians' understanding of their patients through informed judgment.

The healthcare industry will definitely benefit from the capability of AI-based predictive and prescriptive analytics. The prevalence of chronic diseases like diabetes and cancer can be attributed to inadequate healthcare delivery systems. Additionally, chronic diseases are also expensive to treat when discovered at advanced stages. However, this is where the future is bright for AI systems in the healthcare industry. AI will utilize reactive programming to offer real and actionable insights in real-time by integrating big data with healthcare data such as Electronic Medical Records (EMRs) or Personal Health Records (PHR) (Dash et al., 2019; Kaur & Mann, 2017). Also, the AI-based methods will be able to predict the possibility of an individual suffering from a chronic illness and provide prescriptions or necessary precautions before it is too late (Kaur & Mann, 2017). Buch et al. (2018) highlight the significance of AI in preventive medicine because AI can intelligently analyze and summarize close to unlimited medical data and provide consultation based on the risks involved. Also, increased data volume will enable doctors to personalize diagnosis and predict responses to treatment (McCue & McCoy, 2017), hence improving the accuracy and efficiency of treatment. Unfortunately, compliance and concordance factors also heavily influence the effectiveness of healthcare delivery (Rafii et al., 2014). While AI-based systems can promise to control chronic diseases through predictive and prescriptive analytics, some patients never comply with prescriptions from their clinicians (Jimmy & Jose, 2011; Rafii et al., 2014). The issue of non-compliance to clinicians' prescriptions and advice is, therefore, a social complication that poses a significant challenge for the efficacy of AI-based systems.

5.2. Ethical Dimensions of Using AI in Healthcare

This section discusses the response to the second research question which focuses on how the ethical dimensions regarding patient privacy and safety can compromise the future of AI in daily healthcare applications. As much as the application of AI in healthcare seems to have limitless possibilities for good, Rigby (2019) rightly warns that "this powerful technology creates a novel set of ethical challenges that must be identified and mitigated since AI technology has tremendous capability to threaten patient preference, safety, and privacy" (para. 3). Additionally, as with all technology, the developments in AI are taking place at a much faster pace than the policies and regulations in place to control its use in the healthcare domain (Rigby, 2019; Forcier et al., 2019). Also, since AI-based medical platforms heavily rely on the availability of big data to make decisions, it is essential to apply privacy protection measures, especially since not everyone is willing to share their information (Ellahham et al.,

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2019; Rigby, 2019). According to Joerin et al. (2020), transparency and accountability are the guiding principles for ensuring the privacy and control of data and the users involved. Primarily, the safety and privacy of AI systems are linked to human bias (security) and data breach or theft (privacy).

Humans are susceptible to bias which is equivalent to mistakes made by clinicians while executing medical procedures; this forms the basis of ethical considerations regarding the security of AI-based systems in healthcare. AI-based systems will reciprocate based on the training offered by humans who are susceptible to bias, mistakes or errors (van den Bosch & Bronkhorst, 2018). AI systems can incorporate and transfer flaws from training data sets to operational data sets (Ellahham et al., 2019). Further, Caliskan et al. (2017) affirm recorded instances of human-like bias in automated systems, which is likely to compromise the safety of future AI systems. Such erroneous decisions may apply during predictive and prescriptive analytics or interpretation of radiological imaging. Privacy, on the other hand, has a lot to do with the system's regulatory compliance. Since 1996, the Health Insurance Portability and Accountability Act (HIPAA) has been responsible for the standardization of the collection and application of Protected Health Information (PHI) (Lenert & McSwain, 2020). However, HIPAA's scope of use is restricted to data owned by 'covered entities' and 'business associates'; this implies that data miners, which include technology giants like Facebook and Google are exempted from the policy regulations involved (Forcier et al., 2019; Price & Cohen, 2019). Therefore, rules and policies open to misinterpretation as well as the possibility of bias in data use may compromise the application of AI-based systems in healthcare on ethical grounds. A frightening example of this is when Facebook created a "suicide detection algorithm" ostensibly "to promote suicide awareness and prevention" (Kulkarni, 2019, para. 8). In this case, AI was employed to gather data from users' posts "to predict their mental state and propensity to commit suicide". What is important to note here is that this data collection and manipulation is beyond the jurisdiction of HIPAA. While some may say that this is a "service" being provided by Facebook to help detect and prevent suicides, it also happens to be unethical as the data was collected and manipulated without users' permission. Another scenario that should give pause to the unfettered use of AI in healthcare is the case where predictive genetic data of individuals is abused by insurance companies (again outside the jurisdiction of HIPAA) to "biased selection processes" in order to charge higher premiums to certain groups of people based on "higher statistical prevalence of certain diseases among certain demographics" Kulkarni, 2019, para. 27). According to Kulkarni (2019), one way to overcome the inherent weakness of the HIPAA in data protection is to take a leaf from the "European Union's General Data Protection Regulation (GDPR) which harmonizes data

privacy laws across Europe, protects EU citizens and reshapes the way organizations in the region approach data privacy. Under the law, all organizations must obtain informed, explicit consent to collect user data. This comprehensive policy approach both creates effective consumer protections and enforces them with heavy fines and penalties" (para. 33). It would be worth the while of all concerned stakeholders advocating the implementation of AI in the healthcare domain to study this legislation with a view to adopting it in the rest of the world.

6. Conclusion

The literature review clearly establishes that the current benefits of AI are overwhelmingly in favour of the integration of such AI-based systems in daily healthcare applications. However, a note of caution needs to sounded as despite the extensive current and possible uses of AI in the healthcare domain. In response to the horrific ways that AI can be abused by unscrupulous individuals and organizations, there is a dire need to strike a balance between the benefits and risks of its application in the healthcare domain. This is especially so as patients' private details related to physical and mental wellbeing are being stored, retrieved, and manipulated not only by numerous healthcare professionals from clerks to clinicians which may lead to serious security breaches but also by other individuals and organizations for private renumeration and profits.

Indubitably, constant technological innovations in the field of AI has a bright future in healthcare by facilitating clinicians' decisions on patient care, thus enhancing and hastening patient recovery. However, as with all technological applications, ethical implications are invariably part of the parcel. Hence, to fully appreciate the good that AI can bestow to healthcare applications, it is imperative that stakeholders do the necessary to ensure that all ethical challenges are studied and resolved for the long term efficacy of this useful technology.

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References

Ahaddour, C., Van den Branden, S., & Broeckaert, B. (2018). "God is the giver and taker of life": Muslim beliefs and attitudes regarding assisted suicide and euthanasia. *AJOB empirical bioethics, 9*(1), 1-11. https://doi.org/10.1080/23294515.2017.1420708

Ahuja, A. S. (2019). The impact of artificial intelligence in medicine on the future role of the physician. *PeerJ, 7*, e7702. https://doi.org/10.7717/peerj.7702

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, *2*, 8-14. https://doi.org/10.1016/j.npls.2016.01.001

Buch, V. H., Ahmed, I., & Maruthappu, M. (2018). Artificial intelligence in medicine: current trends and future possibilities. *Br J Gen Pract*, *68*(668), 143-144. https://doi.org/10.3399/bjgp18X695213

Calegari, R., Ciatto, G., Denti, E., & Omicini, A. (2020). Logic-Based Technologies for Intelligent Systems: State of the Art and Perspectives. *Information, 11*(3), 167. https://doi.org/10.3390/info11030167

Caliskan, A., Bryson, J. J., & Narayanan, A. (2017). Semantics derived automatically from language corpora contain human-like biases, *Science, 356*(6334), 183-186. https://doi.org/10.1126/science.aal4230

Dash, S., Shakyawar, S. K., Sharma, M., & Kaushik, S. (2019). Big data in healthcare: management, analysis and future prospects. *Journal of Big Data, 6*(1), 54. https://doi.org/10.1186/s40537-019-0217-0

Davenport, T., & Kalakota, R. (2019). The potential for artificial intelligence in healthcare. *Future Healthcare Journal, 6*(2), 94-98. https://doi.org/10.7861/futurehosp.6-2-94

Ellahham, S., Ellahham, N., & Simsekler, M. C. E. (2019). Application of artificial intelligence in the health care safety context: opportunities and challenges. *American Journal of Medical Quality, 35*(4), 341-348. https://doi.org/10.1177/1062860619878515

Floridi, L. (2020). What the near future of artificial intelligence could be. In *The 2019 Yearbook of the Digital Ethics Lab* (pp. 127-142). Springer, Cham. https://doi.org/10.1007/978-3-030-29145-7_9

Forcier, M. B., Gallois, H., Mullan, S., & Joly, Y. (2019). Integrating artificial intelligence into health care through data access: can the GDPR act as a beacon for policymakers? *Journal of Law and the Biosciences, 6*(1), 317. https://doi.org/10.1093/jlb/lsz013

Harris, S. M., Binder, P. E., & Sandal, G. M. (2020). General Practitioners' Experiences of Clinical Consultations with Refugees Suffering from Mental Health Problems. *Frontiers in Psychology,* 11, 412. https://doi.org/10.3389/fpsyg.2020.00412

Horgan, D., Romao, M., Morré, S. A., & Kalra, D. (2019). Artificial Intelligence: Power for Civilisation–and for Better Healthcare. *Public Health Genomics, 22*(5-6), 145-161. https://doi.org/10.1159/000504785

Jang, Y., Lortie, M. A., & Sanche, S. (2014). Return on investment in electronic health records in primary care practices: a mixed-methods study. *JMIR medical informatics*, *2*(2), e25. https://doi.org/10.2196/medinform.3631

Jiang, F., Jiang, Y., Zhi, H., Dong, Y., Li, H., Ma, S., Wang, Y., Dong, Q., Shen, H., & Wang, Y. (2017). Artificial intelligence in healthcare: past, present, and future. *Stroke and vascular neurology, 2*(4), 230-243. https://doi.org/10.1136/svn-2017-000101

Jimmy, B., & Jose, J. (2011). Patient medication adherence: measures in daily practice. *Oman medical journal, 26*(3), 155. https://doi.org/10.5001/omj.2011.38

Joerin, A., Rauws, M., Fulmer, R., & Black, V. (2020) Ethical Artificial Intelligence for Digital Health Organizations. *Cureus, 12*(3), e7202. https://doi.org/10.7759/cureus.7202

Kaur, J., & Mann, K. S. (2017). AI based healthcare platform for real time, predictive and prescriptive analytics using reactive programming. *Journal of Physics: Conference Series 1*(933), 012010. IOP Publishing. https://doi.org/10.1088/1742-6596/933/1/012010

Kulkarni, A. (2019, November 12). AI in Healthcare: Data Privacy and Ethics Concerns. https://www.lexalytics.com/lexablog/ai-healthcare-data-privacy-ethics-issues

Lenert, L., & McSwain, B. Y. (2020). Balancing health privacy, health information exchange, and research in the context of the COVID-19 pandemic. *Journal of the American Medical Informatics Association, 27*(6), 963-966. https://doi.org/10.1093/jamia/ocaa039

McCue, M. E., & McCoy, A. M. (2017). The scope of big data in one medicine: unprecedented opportunities and challenges. *Frontiers in veterinary science, 4*, 194. https://doi.org/10.3389/fvets.2017.00194

Morley, J., Machado, C., Burr, C., Cowls, J., Taddeo, M., & Floridi, L. (2019). The Debate on the Ethics of AI in Health Care: A Reconstruction and Critical Review. https://doi.org/10.2139/ssrn.3486518

Price, W. N., & Cohen, I. G. (2019). Privacy in the age of medical big data. *Nature Medicine, 25*(1), 37-43. https://doi.org/10.1038/s41591-018-0272-7

Rafii, F., Fatemi, N. S., Danielson, E., Johansson, C. M., & Modanloo, M. (2014). Compliance to treatment in patients with chronic illness: A concept exploration. *Iranian Journal of Nursing and Midwifery Research, 19*(2), 159-167.

Rigby, M. J. (2019). Ethical dimensions of using artificial intelligence in health care. *AMA Journal of Ethics, 21*(2), 121-124. https://doi.org/10.1001/amajethics.2019.121

Rong, G., Mendez, A., Assi, E. B., Zhao, B., & Sawan, M. (2020). Artificial Intelligence in Healthcare: Review and Prediction Case Studies. *Engineering, 6*(3), 291-301. https://doi.org/10.1016/j.eng.2019.08.015

Snyder, C. F., Wu, A. W., Miller, R. S., Jensen, R. E., Bantug, E. T., & Wolff, A. C. (2011). The role of informatics in promoting patient-centered care. *Cancer Journal (Sudbury, Mass.), 17*(4), 211-218. https://doi.org/10.1097/PPO.0b013e318225ff89

van den Bosch, K., & Bronkhorst, A. (2018). Human-AI cooperation to benefit military decision making. *Proceedings of the NATO IST-160 Specialist' meeting on Big Data and Artificial Intelligence for Military Decision Making*, May 30th - June 1st, Bordeaux, France. https://repository.tudelft.nl/view/tno/uuid:49e7b3ec-602f-4edd-a748-cf88a317e49d