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Use of Artificial Intelligence and Big Data Management in Healthcare Institutions

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Research Article

ABSTRACT

Medical AI is one of the hot topics in the research and applied fields of medicine. Various research mention privacy as a major ethical challenge for medical uses of AI. The good news is most of the AI tools are design to replace physician but to assist them. This reduces ethical challenges, while not eliminating all. Researchers state that although we are far from consensus in ethical uses of medical AI, we have more or less an agreement on key principles. If the medical data to be used to train AI is from a narrow sample of patients, it can err with larger groups. On the other hand, some other problems can be due to users. Thus, development of AI literacy is necessary. In other words, they have to learn which AI tools to use for various purposes. When we consider early versions of medical AI, we realize that they mad sense for explanation and teaching, but fail as an assistant for clinical practice, but this situation has been changing rapidly. Medical students are highly positive of medical AI, and believe that it will not replace but complement human doctors. There is a realistic anxiety that in a group of medical areas, especially radiology, AI will outperform human doctors. AI anxiety can also be due to perceived difficulty to use AI. A solution to ethical problems in medical AI is trustworthy AI model.

Keywords: AI; Medical AI; Medical Uses of AI; Ethical Uses of AI; Ethics Issues in Medical AI

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Introduction

Today what is expected from health institutions is to offer the services to protect individuals from diseases, to ensure the continuation of their health, to increase the health level of individuals, to provide the most rational treatment to patients to ensure their well-being and to help them achieve healthy aging and longevity. Although this aim is the same as yesterday's, the difference from past health service organizational activities is that the healthcare professionals have to struggle with the pressure of the technological destruction and change process because human physical strength, human intelligence and human skills have difficulty adapting to the mind-blowing speed of technological innovations.

Medical AI is one of the hot topics in the research and applied fields of medicine. Shreve et al. (2022) notes that "techniques with emerging clinical utility include whole blood multicancer detection from deep sequencing, virtual biopsies, natural language processing to infer health trajectories from medical notes, and advanced clinical decision support systems that combine genomics and clinomics" (p.842) [1].

Medical AI is especially successful in interpreting medical images [2, 3, 4, 5], which may accelarate the healing processes. This case will be especially influential over radiology departments [6]. Medical AI has social significance, as it promises to democratize medical care [7], whereby the goal of equal access to medical expertise can be attained.

Medical AI brings out its own problems such as disregard of patients' values [8], but this criticism can be technically met. Trust is another issue to consider [9, 10,11,12, 13, 14, 15, 16]. Another key issue is the degree of acceptance of medical AI by medical staff [17]. Before all, we need to think about how to reduce bias in medical AI [18, 19] . On the other hand, a less common topic to discuss is the problem of how to reduce ecological footprint of medical AI [20], considering its enormous footprint. Various research mention privacy as a major ethical challenge for medical uses of AI [21, 22, 23, 24, 25]. The good news is most of the AI tools are designed not to replace physicians but to assist them [26]. This reduces ethical challenges, while not eliminating all.

Theoretical Framework

Feng et al. (2024) state that although we are far from consensus in ethical uses of medical AI, we have more or less an agreement on key principles such as "transparency, justice and fairness, non-maleficence, responsibility and privacy" (p.1) [27]. Möllmann et al. (2021) [28] lists 5 similar ones: "beneficence, non-maleficence, autonomy, justice, and explicability" (p.1). Maccaro et al. (2024)'s list includes [29] "transparency, accountability, confidentiality, autonomy, trust and fairness" (p.1). Bommu (2022) [30] names "data privacy, transparency, accountability, bias, and equity" as ethical issues central for medical AI. Canadian Association of Radiologists (CAR) Artificial Intelligence Working Group (2019) mentions "privacy, confidentiality, ownership, and sharing" (p.107). Another list composed by Masters (2023) features "data gathering, anonymity, privacy, consent, data ownership, security, bias, transparency, responsibility, autonomy, and beneficence" (p.574) [31].

Müller et al. (2021) lists the following for '10 Commandments of Ethical Medical AI':

"1. It must be recognizable that and which part of a decision or action is taken and carried out by AI.

2. It must be recognizable which part of the communication is performed by an AI agent.

3. The responsibility for an AI decision, action, or communicative process must be taken by

a competent physical or legal person.

4. AI decisions, actions, and communicative processes must be transparent and explainable.

5. An AI decision must be comprehensible and repeatable.

6. An explanation of an AI decision must be based on state-of-the-art (scientific) theories.

7. An AI decision, action, or communication must not be manipulative by pretending

accuracy.

8. An AI decision, action, or communication must not violate any applicable law and must not

lead to human harm.

9. An AI decision, action, or communication shall not be discriminatory. This applies in particular to the training of algorithms.

10. The target setting, control, and monitoring of AI decisions, actions, and communications shall not be performed by algorithms." [32].

D'Souza et al. (2024) "presents twelve essential tips for addressing the major ethical concerns in the use of AI in medical education. These include emphasizing transparency, addressing bias, validating content, prioritizing data protection, obtaining informed consent, fostering collaboration, training educators, empowering students, regularly monitoring, establishing accountability, adhering to standard guidelines, and forming an ethics committee to address the issues that arise in the implementation of AI" (p.1) [33].

If the medical data to be used to train AI is from a narrow sample of patients, it can err with larger groups [34]. On the other hand, some other problems can be due to users. Thus, the development of AI literacy is necessary[34]. In other words, they have to learn which AI tools to use for various purposes [35].

When we consider early versions of medical AI, we realize that they made sense for explanation and teaching, but failed as an assistant for clinical practice [36]. However, this situation has been changing rapidly. According to Bélisle-Pipon et al. (2021), medical AI increases efficiency by "automatizing routine tasks and decreasing health-related costs, broadening access to healthcare delivery, targeting more precisely patient needs, and assisting clinicians in their decision-making" (p.1) [37].

Rosemann & Zhang (2022) lists various challenges involving medical AI such as "concerns regarding (i) the control, reliability, and trustworthiness of AI systems, (ii) privacy and surveillance, (iii) the impact of AI and automation on healthcare staff employment and the nature of clinical work, (iv) the effects of AI on health inequalities, justice, and access to medical care, and (v) challenges related to regulation and governance" (p.103) [38].

Alolabi, & Aarthy (2021) investigates ethical issues arising from medical uses of AI under six headings[39]:

- Accuracy, Reliability, and Continuous Updates
- Data Concerns: Bias, Privacy, and Security
- Transparency, Explainability, and Trust
- Liability, Oversight, and Consent
- Human Aspects: Depersonalization, Over-reliance, and Economic Impacts
- Accessibility, Equity, and Global Reach (p.30-44).

One reason people are not willing to use medical AI is the fact that they lack knowledge of algorithmic processes, which leads to a 'black box' feeling. However, Cadario (2021) [40] reports a successful intervention program that matches this lack of knowledge and accordingly improves willingness to use medical AI.

A solution to ethical problems in medical AI is the creation of a trustworthy AI model. According to Zhang & Zhang (2023) [41], five factors influence this model: "data quality, algorithmic bias, opacity, safety and security, and responsibility attribution" (p.1).

Conclusion

There are many ethical challenges in terms of AI and using big data. One key element is data privacy, which involves protecting patient data. Another challenge is AI systems may reinforce inequalities in the data they are trained on. The other key element is transparency of how AI systems make decisions. When we succeed in improving AI-powered healthcare applications in the field of diagnostic support, clinical decision-making, and patient data management with ethical standards such as transparency, data confidentiality, accountability, and fairness this will persuade healthcare professionals to focus on AI literacy and embrace the challenges, paving the way to reliable AI models for a sustainable human-AI collaboration for positively evolving future healthcare facilities.

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