AI in Clinical Medicine: Benefits and Potential Risks of Patient Safety and Ethics

Abstract

Over the last decade, there has been a whirlwind of development of Artificial Intelligence (AI). The main focus of this essay is to review the potential ethical and legal concerns of patients' safety if AI technologies are used in clinical settings. Equity, autonomy, accountability, and explicability are the most common four ethical principles in the context with AI. With increasingly rapid advances in AI, extra care is needed when developing clinical AI applications. Government, insurance sectors, AI developers, and healthcare professionals should work closely to optimise the well-beings of medical professionals and patients.

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Introduction

Over the past decade, artificial intelligence (AI) has become one of the most celebrated topics in all fields including engineering, architecture, art, and even medicine. Ever since the term AI was introduced to the world at the Dartmouth Conference in 1956, numerous research articles and applications have been revolutionising the world[1]. Thanks to the advances in technology, the number of AI and robotics journal articles have been increasing exponentially, reaching approximately 600,000 articles in 2021 only[2]. In current evidence-based medicine, medical professionals must do thorough clinical analyses repeatedly to establish structured diagnoses and standardised treatments. With the help AI, the overall efficiency and lack of work force in hospitals and clinics can be improved[3].

However, the basis of AI heavily relies on an enormous amount of data and complex algorithms, which may raise potential ethical issues such as patient safety and data privacy. In the following sections, major clinical applications of AI will be introduced. The focus will then shift to potential ethical issues of these applications. Finally, recommendations dealing with these issues will conclude this essay.

Clinical Applications of AI

Simply speaking, clinical applications of AI can be categorised as software and hardware. Examples of software include image analysis, electronic health record, and pattern recognition for clinical decisions. Hardware, on the other hand, focuses on AI-aided robotics such as surgical robots, smart protheses, and Internet of things (IoT) for primary care[4]. Image analysis was one of the first clinical examples of AI in medicine. From the early rule-based decision-

making algorithm to the current deep learning or machine learning approaches, medical AI algorithms can now summarise their own structured analysis and suggest the most likely differential diagnosis, which was comparable with human experts[5]. Other types of medical data including medical history, laboratory results, clinical tests like electrocardiogram (ECG)[6], and even latest clinical research journal articles can also be fed into the AI algorithm to generate and summarise differential diagnoses and potential treatments.

Advantages with Clinical Usage of AI

With evolving technologies and increasing numbers of clinical trials and research studies, a few advantages with AI in medicine can already be observed. Firstly, the training time of an expert clinical AI compared to that of an expert physician is significantly less. Traditionally, physicians require years of medical school, residency, and fellowships to become experts or specialists. The learning curve is steep and long but indispensable for physicians to accurately establish diagnoses and treatments for patients. In contrast, the only thing AI needs is the medical database. Within days, AI algorithms can adjust the clinical decision-making structure to provide up-to-date and comprehensive clinical decisions[7].

Another advantage of clinical AI is assistance with healthcare insurance sectors. In Hong Kong, people rely greatly on insurance sectors when it comes to healthcare. However, within the system, there are some fraudulent claims. It was reported that around 20% of bodily injury or personal injury claims were fraudulent in the US[8]. To ease the healthcare economic burdens, preventing these kinds of frauds is crucial. With the help of AI, integration and summary of medical database can help prevent these costs, leaving more resources and budgets which can be allocated to the healthcare sector.

Lastly, AI in medicine can further help the organisation among hospitals, insurance sectors, and government. By sharing and analysing data together, healthcare resources including budgets, professional training, and patient managements can be optimised. Clinical research projects can also be viewed and analysed by AI to plan the most efficient and structured studies[9]. In brief, with the help of AI, labour-intensive works can be reduced with less resource consumption. Those clinical decisions such as patient management plans, healthcare insurance claims, and clinical research planning can be benefitted greatly with clinical usage of AI.

Potential Ethical Issues of Clinical Usage of AI

With all those benefits that comes with AI in medicine, complicated legal and ethical issues came along as well. As mentioned earlier, the basis of AI requires a massive amount of data and training algorithms for better performance. In other words, those clinical data acquired from patients or from clinical studies will encounter unprecedented problems where the usage of data is not clear enough since what the AI algorithms will do often remains unknown. In 2023, World Health Organization (WHO) announced and reiterated the importance of ethics and safety when using AI in medicine[10]. Some core concepts were emphasised, which included protecting autonomy, ensuring transparency and equity, and stating the accountability and responsibility.

As AI continues to develop, experts have been warning the block-box outcome when using it for decision-making. In a recent systematic review of using clinical AI, the explicability of AI was found more commonly discussed than other medical ethics including autonomy and beneficence. Transparency and explainability, core values of explicability, were stated to have more relevance with the use of AI in decision-making. Since the trend now are using machine learning or deep learning algorithms to build an AI, the block-box process during training has

raised many concerns such as how a certain decision was suggested and how the data was used to reach the conclusion[11]. In these situations, whether the informed consent is comprehensive enough and how these AI-assisted clinical decisions could pose potential risks to patients' privacy, safety, and health remain an on-going controversy.

Another ethical and legal concern is the accountability issue. With the emergence of ChatGPT, current AI algorithm can already generate summaries and provide evidence-based information or concepts with online public data. From a different perspective, this behaviour resembles a human being searching online resources to find the information needed. In this case, the time spent is much less when AI is involved in the process. However, to what extent we can trust the outcome that the AI generate is still controversial. Over-trusting the AI may result in unexpected errors, which could be highly dangerous in clinical settings. When errors occur, whether the AI or the person using the AI should be accountable is still under debate, putting patients' physical and legal safety in great danger[12].

Lastly, issues regarding equity could also be present with AI in medicine. Trained by large datasets, clinical AI is inevitably biased by the major trend of disease presentations. That is, people with the so-called "medical minority" or exceptions in clinical medicine will be marginalised and misdiagnosed with large-data-trained clinical AI. Inequalities and lack of diversity can raise another concern in these scenarios[13].

Measures for AI-induced Safety and Ethical concerns

All in all, ethical concerns with clinical AI mainly revolve around equity, autonomy, explicability, and accountability[14]. To avoid related problems, developers of AI should be aware of the black-box issues with learning-and-training-based AI, making sure that the decision

process must be disclosed in detail to prevent any violations of patients' autonomy and informed consent of clinical data usage. Then, governments will have to come up with specific legal criteria to clarify the accountability and responsibility when using AI in clinical decision-making. There should be regulations such as those AI tools can only be used as reference while final decisions should always and only be made by medical professionals. To protect patients' safety and healthcare professionals, the importance of accountability cannot be overemphasised. Finally, the intrinsic disadvantage of using large datasets for designing AI should be taken care of. People with rare medical conditions and clinical presentations must not be marginalised purely due to the current trend of AI development. How to use these data to identify those atypical cases has to work closely with patients' autonomy to ensure data privacy.

Conclusion

To conclude, with the increasingly rapid growth of AI since the development of ChatGPT, clinical usage of AI seems to be around the corner. Despite the countless benefits brought by clinical AI, extra attention is needed to ensure patients' safety and related ethical concerns. Covered by traditional medical ethical principles, autonomy, equity, accountability, and explicability are the most common ethical and safety concerns of AI in medicine. Government, insurance sectors, AI developers, and medical professional should work together to prevent any potential risk to patients' physical and legal well-beings while maintaining the quality of professionalism in clinical setting.

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