Exploring the Ethical Implications and Governance Mechanisms of Artificial Intelligence in Radiology: A Case Study of a Large Medical Centre in the US

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Introduction

An artificial intelligence system (AI system) generally refers to a set of algorithms and computeraided systems that are designed to detect patterns among data sets that have been collected in the past and to interpret those patterns to predict potential outcomes in the future. This type of machine has a distinctive capability to continuously improve decision-making, problem-solving, and reasoning abilities in a manner that approaches human abilities, and is often utilized by organizations to augment and automate tasks (Lebovitz, 2019).

Research has proven that artificial intelligence is useful in the healthcare segment as they promote efficient and trustworthy results. This is so because most of the decisions made by AI applications are void of health practitioners' or patients' influence. For example, it can examine skin cancer, breast cancer, or a person's response to radiation therapy and help the medical industry provide better services to achieve patient satisfaction. AI is capable of adapting to changing conditions and making decisions (Gesk, Wichmann and Leyer, 2021).

The focus of this case study is to investigate the use of AI in three radiology departments- Chest, Breast imaging, and Pediatrics- within a radiology unit at a large medical centre located in the US as part of their diagnostic process (Lebovitz, 2019).

Literature Review

The following literature that seeks to discuss the use, adoption, and ethical issues of AI in the healthcare system was reviewed for this case study.

Rey and Bouaynaya (2022) explored how artificial intelligence (AI) can advance clinical decisionmaking and patient care. They concluded that the development of treatment protocols, personalized medicine, and patient care can all be significantly impacted by AI. Furthermore, they raised ethical concerns about trust, transparency, and emotions as well as the role that emotional and cognitive trust play in fostering AI trust among healthcare professionals. Their review points out that doctors risk betraying patients' trust if they do not base their decisions on solid information but instead depend on their convictions or look for unsuitable superficial data. Overall, the study indicates that AI has the potential to enhance patient care and decision-making in the healthcare segment. This finding is supported by other researchers, for example, Buck, Hennrich, and Kauffmann (2021) who also noted that excessive reliance on AI applications could result in loss of control, job loss, loss of autonomy, unclear duties, trust, and transparency issues. They explained in their study that artificial intelligence (AI) has the potential to enhance medical imaging. According to their study results, medical imaging specialists are taking into consideration the advantages of AI applications, such as better diagnosis, accuracy, quicker processes, and labor simplicity. A useful criticism they made is the possibility of health professionals depending so much on AI applications even when they present inaccurate information. This they claim may hurt patient care.

The COVID-19 epidemic lockdown led to an increase in the demand for telehealth services, which made medical care available to patients whenever and from wherever they were. By enabling patients to obtain care without having to physically visit a doctor or hospital, telehealth assisted in lowering the chances of COVID-19 infection. The reason for increasing facilities to promote telehealth services was to reduce the spread of the COVID-19 virus. According to the authors of this paper, Americans living in rural communities- who may have previously had difficulties receiving healthcare- owing to distance or expense, were to profit the most from this. Instead of embracing the technology, most rural Americans were hesitant to use telehealth services as they argued that they failed to provide them with any government-sponsored digital literacy training. Hence, they could not navigate the application. Others issues they had included the safety of their data and how transparent the whole telehealth technology was, then also they argued their privacy was being invaded. The researchers concluded by saying that despite the goal of increasing access to healthcare for all during the pandemic, the expansion of telehealth services did not benefit rural Americans (Sun and Wang, 2022).

About the concept of telehealth, Lin *et al.* (2021) evaluated the impact of telehealth acceptance on patients' views of service quality, as well as how telehealth adoption might enhance these perceptions. They also looked into the link between doctors' level of telehealth adoption and clients' perceptions of healthcare quality during pandemics, to establish that telehealth may successfully limit viral transmission to medical professionals. Telehealth adoption raises several ethical issues, including access to healthcare, quality of care, patient privacy, inequality, and risks to healthcare workers. Telehealth can provide remote access to healthcare, which is particularly important during a pandemic, but access may be limited for some individuals without reliable internet or computer access or the necessary technology. The use of telehealth may also affect the perceived quality of care, and it may not be appropriate for all patients. The privacy of patient information must be protected when it is transmitted electronically. Inequality in access to telehealth services may lead to disparities in healthcare access and outcomes. Finally, while telehealth can reduce the risk of infection for healthcare workers, it is important to ensure that they have the necessary support and resources to provide these services effectively.

It came to light through research conducted on digital technology that the application of digital technologies in healthcare can prevent the spread of viruses through directed self-regulation. The directed self-regulation notion is a behavioural strategy that encourages good behavioural responses and connects individual self-regulation with the changing epidemiological circumstances of the individual. This can be done by expanding the directed self-regulation program and testing and developing new digital technologies. The paper also emphasizes the potential for stigma or unfavourable outcomes when disclosing information about global exposure to the virus, as well as the necessity to proactively control personal conduct in response to evolving epidemiological scenarios. Individual efforts could be vital in contemporary cultures when strong government action may not be possible to control the growth of a pandemic (Sweeney and Vervest, 2021).

The three major categories of healthcare errors have been recognized as imaging, laboratory, and pharmaceutical errors (the most common). Prescription and diagnostic mistakes, both of which are

frequently referenced in malpractice claims, have been documented to have a particularly negative impact on patients. According to previous research, implementing patient portals may minimize mistakes in electronic medical records and improve patient safety. This initiative attempts to incorporate patients in decreasing errors and out-of-date information in their electronic medical records, with an emphasis on non-diagnostic information such as demographics, family history, allergies, and medication lists. The research also considers moral problems such as patient data security and how long information is stored in the system before being deleted (Rahimi, Ayabakan, and Mahoney, 2021)

Yan and Xu (2021) explained the concept of privacy in simple terms as the level of self-control people have over their data. According to them, privacy-related issues are best comprehended using the Information Boundary Theory (IBT) in information systems. To safeguard their private data, people are advised to set up informational boundaries, which may be physical or virtual, depending on the person's surrounding conditions. They noted that, based on each individual's assessment of trust and expected benefits, these boundaries may be opened or closed. They argued further that, people are more likely to disclose the information if they trust you, and knowledgebased trust, built on concepts like explainability can encourage them to do so. The ethical issue considered is a trust which relates to how secure the private information that is collected is (Yan and Xu, 2021).

Another area in that AI can be helpful in the field of clinical pathways, in particular virtual coaches (VCs), is to aid in home rehabilitation. VCs are interactive virtual people who converse with patients, offer advice and support for physical activity, and keep an eye on vital signs. VCs could not be able to adjust to the patient's behaviour without these technologies, and doctors would not be able to efficiently monitor their patients. The possibility of discrimination against people who do not have access to these devices and the restrictions of machine learning elements in VCs are just two of the ethical concerns addressed in the research. The authors' overall argument is that not everyone may benefit from the VC strategy (Gand et al., 2021).

Case Description

The advancement of artificial intelligence (AI) has the potential to transform the healthcare industry by increasing the efficiency of decision-making tasks in a variety of fields, including radiology. To reduce radiologists' workload, improve the accuracy and efficiency of medical diagnoses and treatments, and ultimately improve patient outcomes, Urbanside Hospital, a medical centre in the United States, implemented artificial intelligence in three of its radiology departments - chest radiology, breast imaging, and paediatric radiology.

There was a widespread expectation among radiologists at Urbanside that AI tools could enhance their daily work, so they were interested in implementing AI in their departments as a means of improving, for example, the speed at which they can perform time-consuming routine tasks.

In addition, they established formal and informal procedures for notifying the responsible radiologists in case of errors were detected. This practice caused them to continue to deliberate and second-guess the decisions they had made earlier in the day. Urbanside's radiologists also adopted

a practice called “doubt practices”. This technique was used to cope with the subjectivity and complexity associated with diagnostic decision-making. To exercise doubt, radiologists had to seek out evidence that would contradict or support diagnosis theories. They also had to ask themselves questions, consult colleagues, and obtain additional imaging or patient information. Radiologists used these practices to prevent premature conclusions, and weigh conflicting information thoughtfully, so every aspect of a case is thoroughly considered.

Urban side radiologists in the Breast and Chest sections used artificial intelligence tools during cancer screening tasks and "bone age assessments" as they were of high expectations of it.

To conclude, radiologists at Urbanside used AI because they argued it has the potential to improve the accuracy and efficiency of medical diagnoses and treatments which will lead to consistency in their line of work.

Analysis and Discussion

Ethical perspectives:

a) The ethical viewpoints at Urbanside include the potential for diagnostic errors by radiologists due to the subjectivity of their assessment of medical outcomes. Furthermore, they were under a lot of pressure to meet deadlines as the volume of cases they were investigating daily increased. The radiologists' own professional judgement and subjectivity consistently surpassed the AI assessment, resulting in biased and erroneous diagnoses which are potentially harmful to patients health. The radiologists also expressed worries about the AI tool's transparency, including how it was trained and what data was used. They asserted doubt about the tool. There was also the problem of privacy of patient data collection and use, as the radiologists employed "doubt practises" that may have resulted in the leaking of confidential patient information (CS5705 week 03 Teaching Material, 2022).

b) One ethical consideration is the potential for AI to make biased or unfair decisions. This can occur if the data used to train the AI system is biased, leading the AI to replicate and reinforce those biases in its decision-making processes. It is important for those developing and implementing AI systems to ensure that the data used to train the AI is diverse and representative, and to regularly evaluate the AI's performance to ensure that it is not making biased decisions(CS5705 week 03 Teaching Material, 2022).

   Another ethical consideration is the potential for AI to replace human jobs, including those of radiologists. While the use of AI can potentially improve the efficiency and accuracy of certain tasks, it is important to consider the impact on the employment and livelihood of those whose jobs may be automated. It may be necessary to implement measures to ensure that the transition to AI is done in a responsible and fair manner, such as providing training and support for those affected by job automation.

Overall, the ethical use of AI in radiology work involves ensuring that the AI is transparent and accountable in its decision-making processes, and that it is used to complement and enhance human work rather than replace it. It is also important to consider the potential impacts on patients and to prioritize their well-being (CS5705 week04 Teaching Material, 2022).

Governance Mechanisms:

c) Some governance mechanisms radiologists at Urbanside put in place to address the ethical issues are: To cope with the complexity and subjectivity of diagnostic decision-making, radiologists employed doubt management techniques, such as seeking additional evidence to confirm or refute tentative diagnoses (termed "doubt practice"). They also consulted with colleagues, gathered additional imaging or patient data, and engage in doublereading, where two radiologists independently reviewed a case and combine their evaluations into a single report. These practices helped the radiologists avoid hasty judgments, carefully considering all the available information, to ensure the accuracy and consistency of their work (CS5705 Week 5 Teaching Material, 2022).

d) The effectiveness of the governance mechanisms in ensuring reliable diagnoses in Urbanside include the fact that radiologists' propensity to provide limited or incorrect interpretations could lead to diagnostic mistakes and this was made worse by the fact that they were constrained by time. Also, the hospital on the whole lacked the resources required to carry out “double-reading” in all departments. They struggled to keep up with the daily influx of cases, which made it even more difficult and for them to conduct thorough evaluations and inn effect make accurate diagnostic: At the close of the day, there was a rush to try to finish all the cases (CS5705 Week 5 Seminar Material, 2022).

Regulatory Stance:

e) When it comes to regulating the use of artificial intelligence (AI) in radiology, there are several aspects to consider. Some argue that regulation is required to ensure ethical and responsible AI use, while others argue that excessive regulation will stifle innovation and stymie the development and deployment of AI technologies. One argument in favor of regulation is that it can guarantee AI is utilized ethically and responsibly, especially in industries like healthcare where the potential repercussions of biased or unjust choices might be considerable. In addition to ensuring that patients' rights and wellbeing are respected, regulation can offer a framework for addressing potential challenges such job automation and its potential influence on employment. On the other hand, an overburden of regulation can stifle innovation and the advancement of AI. As the technologies and their applications are continually changing, it may also be challenging to adequately control a rapidly expanding industry like AI. In general, it's crucial to strike a balance between the requirement for regulation to ensure the ethical and responsible use of AI and the requirement to permit innovation and the growth of these technologies. To guarantee

that AI systems are utilized ethically and responsibly, this may unique integrated standards and best practices for their use in radiology, as well as supplying resources and support to people who are designing and putting AI systems into use (CS5705 Week06 Seminar, 2022).

Reflections:

f) Artificial intelligence (AI) systems have the ability to boost productivity and speed, culminating in more effective and timely decision-making by digesting vast amounts of data and producing suggestions faster than people. By analysing data more accurately and consistently than people, they might also be able to improve accuracy. If designed and trained properly, they might also be able to reduce or completely eradicate unconscious bias in decision-making. Notwithstanding, there may be limitations to using AI for highly skilled decision-making tasks, such as opacity and lack of transparency, which may prevent users from understanding and evaluating the assumptions underlying the technology and result in a lack of trust and acceptance; responsibility and accountability, as the use of AI tools may shift decision-making responsibility away from professionals; and, finally, the potential for bias and error in the data collected by the AI tools. In terms of bias and fairness, if the AI tool is skewed or unfavourable, it may continue or amplify pre-existing preconceptions and result in unfair or prejudiced decision-making.

g) As a future research considering the exist of ambiguity concern in AI systems in healthcare can be a research on developing new AI algorithms specifically designed to reduce ambiguity in healthcare settings.
one way to progress the research on developing new AI algorithms specifically designed to reduce ambiguity in healthcare settings would be to focus on a specific problem or challenge related to ambiguity in healthcare that needs to be addressed. For example, the problem could be that current AI algorithms used in healthcare are not accurate enough, leading to some incorrect diagnoses or treatment recommendations.
To address this problem, a research can be conducted to identifying the top machine learning techniques for reducing ambiguity in healthcare data. This could involve a literature review to identify the most promising techniques, as well as empirical research to compare the performance of different techniques on a healthcare dataset.
prototypes of new AI algorithms that incorporate these machine learning techniques could be developed and test, and their performance in terms of their ability to reduce ambiguity can be evaluated. This could involve conducting experiments to compare the performance of the new algorithms with existing algorithms, and gathering feedback from healthcare professionals and patients to assess the usefulness and usability of the new algorithms.

In terms of methods, a variety of techniques, including machine learning (e.g. clustering, classification, etc.), natural language processing, and user-centered design can be considered. The research could aim to contribute to the development of more effective AI

algorithms for use in healthcare, with the goal of improving patient outcomes and reducing the risk of errors or misunderstandings.

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