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Expanding Our Grasp: Artificial Intelligence as the Next Leap Forward in Healthcare Quality

Jawahar (Jay) Kalra[1,2] and Patrick Seitzinger[3,4]

[1]Department of Pathology and Laboratory Medicine, College of Medicine, University of Saskatchewan, Saskatoon, Canada
[2]Royal University Hospital, Saskatchewan Health Authority, 103 Hospital Drive, Saskatoon, Saskatchewan, S7N 0W8, Canada
[3]Department of Pediatrics, College of Medicine, University of Saskatchewan, 103 Hospital Drive, Saskatoon, S7N 0W8, Canada
[4]Jim Pattison Children's Hospital, Saskatchewan Health Authority, 103 Hospital Drive, Saskatoon, S7N 0W8, Canada

ABSTRACT

Healthcare quality and improvement rely on recognizing and improving patterns of practice. AI involves self-learning systems using machine learning and pattern recognition to emulate thought processes typically conducted by humans. The purpose of this project was to assess the current state and challenges of healthcare quality and to charter a path forward for innovative applications of Artificial Intelligence technology to strengthen healthcare strategies. Knowledge integration was conducted across medical disciplines to identify key challenges in healthcare delivery and assess how Artificial Intelligence can be leveraged to strengthen healthcare quality. Currently, approximately half of the global population spends less than 5 minutes with their physician during doctor visits. It takes an average of 23.1 seconds for a physician to interrupt patients while they are telling their stories. Most patients around the world will experience one or more diagnostic errors in their lifetime. Systematic reviews and narrative reviews of the available evidence report varying global diagnostic error rates ranging from 5% to 23.5%. Currently, the physician suicide rate is 1.5 to 4.5 times higher than that of the general population. Between 30-50% of medical students and residents experience burnout. Burnout is nearly doubling the rate of medical errors, and physicians involved in major errors are experiencing a threefold increase in suicidal ideation. AI technology has the potential to have transformative effects on increasing diagnostic accuracy, mitigating medical errors, screening and early diagnosis, and determining disease susceptibility and progression. The advantages of AI include efficiency, accuracy, prediction/modelling, standardization, insusceptibility to fatigue, self-correcting abilities, and accuracy. Drawbacks of AI include developmental costs, unclear legislation, integration issues, lack of explainability, insufficient digital literacy, limited data sharing, and fear of the known. Even with unprecedented innovations in healthcare, we must utilize tried and true methods of healthcare assurance and improvement including identifying vulnerabilities, mitigating biases, and ensuring health equity. AI presents a tool to address longstanding issues in healthcare delivery and achieve a calibre of healthcare quality that was previously beyond our grasp.

Keywords: Artificial intelligence, Healthcare quality, Healthcare improvement, Innovation, Optimization

INTRODUCTION

Healthcare delivery is a complex and ever-evolving process. Various factors including advancing technologies, aging populations, time pressure, and diagnostic errors pose challenges to ensuring the best possible care is provided to all patients in all circumstances (Seitzinger et al. 2021). Healthcare systems are tasked with finding innovative ways to address modern healthcare quality challenges while ensuring patient safety in a sustainable and adaptable manner. As the complexity and strain on healthcare systems increases, traditional healthcare quality assurance practices require constant re-evaluation and modernization. Each health encounter, near miss and suboptimal outcome, is an opportunity to recognize deficits and improve practice strategies. Staffing shortages and competing priorities often result in problematic patterns going unrecognized. The amount of healthcare data available is insurmountable given the traditional methods of healthcare quality assurance and improvement. As a result, healthcare systems are left struggling to react to the downstream effects of systemic factors without the time or resources to act proactively to address route causes. AI can be described as the self-learning computer algorithms which carry out processes characteristically performed by humans. The capabilities demonstrated by modern AI systems make it a promising endeavour to alleviate many of the data management and interpretation challenges faced by healthcare systems and to enhance the calibre of patient care around the world.

CHALLENGES IN MODERN HEALTHCARE DELIVERY

Modern healthcare delivery systems can be characterized by complex challenges with various contributing and interacting factors such as time pressure, burnout, inadequate medical error disclosure and suboptimal patient outcomes (Kalra et al. 2020, Kalra et al. 2019). The average duration of a primary care patient encounter in the United States ranges between 9.2-21.2 minutes and in Canada ranges between 9.0 and 15.5 minutes (Irving et al. 2017). These are likely to be overestimates as evidence has shown that physicians overestimate time spent with patients by 175-200% (Gottschalk and Flocke 2005, Becker et al. 2010). During patient-physician interactions, patients are interrupted while sharing their health concerns within an average of 23.1 seconds (Marvel et al. 1999). The time available for face-to-face interactions with patients and families is dwindling (Seitzinger et al. 2021a). Instead, considerable time, stress and resources are being allocated to tasks such as documentation, synthesizing information, administration and trying to remain up to date on the plethora of new evidence being published on a daily basis. Staffing shortages are becoming an increasing concern in North America and around the world. Among clinicians that stay in practice, 72% report emotional exhaustion, 63.2% report depersonalization and 72% report overall burnout (Rotenstein et al. 2018). Even among medical trainees 30-50% report feeling burnout (Rodrigues et al. 2018). The reconceptualization of healthcare quality and delivery strategies is not only timely but is imminently necessary to ensure a sustainable efficacious path forward for the field of medical care.

A SPRINGBOARD FOR HEALTHCARE IMPROVEMENT

The advantages of AI in healthcare are growing at an exponential rate, with new applications being realized daily. The advantages of AI include efficiency, accuracy, prediction/modelling, and standardization of care (Seitzinger et al. 2021b). These systems are immune to fatigue and have the potential to take over many of the mundane and less desirable aspects of clinicians' daily tasks that contribute to burnout (Kalra et al. 2021). The self-learning nature of these systems allows them to persistently improve accuracy while adapting to new data and applying the newest evidence-based guidelines. Examples of AI systems currently being utilized to improve the efficiency of healthcare tasks include AI transcription technology widely used to increase the efficiency of clinical documentation (Seitzinger and Kalra 2022). AI is being implemented to detect sepsis earlier in the clinical course and alert clinicians to cases that may otherwise be missed (Schinkel et al. 2019). In Laboratory medicine and pathology, AI systems are being used for the histological identification of tumours, with promising precision and efficiency (Chang et al. 2019). Although the introduction of AI systems into healthcare systems is a relatively novel phenomenon, the applications implemented thus far have demonstrated levels of accuracy comparable to that of human clinicians (Seitzinger and Kalra, 2022).

A CAUTIOUS AND CONSCIENTIOUS LEAP FORWARD

As with all leaps forward in healthcare quality and delivery, careful consideration and tactful implementation is required to ensure patients receive the best possible care at all points in time. As healthcare quality strategies utilize new tools to adapt to modern healthcare challenges, there will inevitably be growing pains in domains related to technical challenges, ethical concerns, and legislative clarifications. developmental costs, updating legislation, integration issues, and a need for insufficient digital literacy. Technical aspects of AI will need to be addressed including development costs, transparency, data security, integration and increasing digital literacy.

From an ethical perspective, the implementation of AI in healthcare raises concerns regarding informed consent, accountability, non-maleficence and autonomy (Loder and Nicholas 2018, Parks 2010). Patients should be afforded the opportunity to receive the best calibre of care possible, with the utilization of available tools and resources. They should also have the opportunity to understand the options available to them and how new technologies may contribute to or jeopardize their care (Beil et al. 2019). Laws and regulations may require adaptation and revision to clarify issues around liability around clinicians' decisions to use or disregard interpretations and suggestions provided by new technologies (Wachter et al. 2017, Cath 2018). Navigating these challenges while preventing undue delays in progressing medicine will require a shift in approaches to healthcare delivery and medical education. Clinicians and trainees require ongoing digital literacy training in order to appropriately utilize new technologies to enhance healthcare quality (Weber 2006). Traditional methods of medical education lack the digital literacy training required to practice effectively in the upcoming AI-assisted

medical era (Paranjape et al. 2019). Medical schools, residency programs and continuing medical education will require continuous re-evaluation to ensure clinicians are equipped with adequate digital literacy and understanding to practice effectively and contribute to AI in healthcare quality.

CONCLUSION

Healthcare systems have grown to a level of complexity that requires innovative solutions to ensure quality assurance and improvement. AI technology presents a timely resource to interpret and act on data sets that would otherwise be insurmountable. Using these new technologies to protect patient safety, reduce burnout and address concerning patterns in healthcare delivery is timely and necessary. A framework to prepare healthcare providers to utilize AI technology to enhance the calibre of patient care is not only crucial to advance medicine, but also to alleviate many of the pressing concerns currently faced by healthcare systems. Even with unprecedented innovations in healthcare, we must utilize tried and true methods of healthcare assurance and improvement including identifying vulnerabilities, mitigating biases, and ensuring health equity.

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