Artificial Intelligence in Health Care: Insights From an Educational Forum

Andrew B Barbour¹, Jennifer M Frush¹, Luke A Gatta¹, William C McManigle¹, Niobra M Keah², Lorena Bejarano-Pineda¹ and Evan M Guerrero¹

¹School of Medicine, Duke University, Durham, NC, USA. ²Wake Forest School of Medicine, Wake Forest University, Winston-Salem, NC, USA.

ABSTRACT: Discussions surrounding the future of artificial intelligence (AI) in healthcare often cause consternation among healthcare professionals. These feelings may stem from a lack of formal education on AI and how to be a leader of AI implementation in medical systems. To address this, our academic medical center hosted an educational summit exploring how to become a leader of AI in healthcare. This article presents three lessons learned from hosting this summit, thus providing guidance for developing medical curriculum on the topic of AI in healthcare.

KEYWORD: artificial intelligence, augmented intelligence, AI, leadership

The incorporation of artificial intelligence (AI) capabilities into the practice of medicine is controversial and is often met with trepidation by medical professionals. Artificial intelligence has already fundamentally changed other industries¹ and is beginning to alter interactions between health care providers and patients.² In fact, the global AI market in health care is projected to grow at a compound annual growth rate of 43.5% from 2018, reaching a valuation of US$27.6 billion by 2025.³ To elucidate this transformative topic, we organized a half-day educational summit at the Duke University Medical Center (DUMC) on March 28, 2019. The purpose was threefold: (1) defining AI, (2) highlighting examples of AI in health care, and (3) exploring strategies to develop leadership in AI. We addressed these topics through formal lectures and open-table discussions led by clinicians, data scientists, and administrators from the DUMC, highlighted by a keynote lecture on AI strategy by a 4-star general. The summit’s audience included a mixed population of medical trainees (ie, medical and nursing students, residents, and fellows), health care providers, researchers, and health care administrators from DUMC and surrounding medical centers. Here, we present lessons learned during the development and implementation of this educational program.

Lesson 1: Definition
Artificial intelligence is subject to preconceived notions based on popular fiction and misleading media portrayals. Broadly, AI can be defined as computer systems that perform tasks normally requiring human intelligence. We reframed AI as “augmented intelligence,” defined as intelligent computer algorithms designed to enhance the capabilities of highly trained professionals. While AI often evokes the concept of machines replacing human work, augmented intelligence frames a discussion of what can be achieved when humans are assisted by intelligent machines.⁴ Augmented intelligence algorithms can be created via processes such as supervised machine learning, in which systems improve their performance for a certain task by optimizing the relationship between inputs and outputs. Typically, an algorithm is created via an adaptive process and is subsequently validated against a novel data set. Algorithms can then be “locked,” meaning they generate a reproducible output given the same data, or remain “adaptive,” § they automatically update their behavior based on new data. Implementing the resulting algorithm as a locked system helps to avoid unexpected behaviors during real-world application. As regulatory frameworks are formalized in the United States, it is likely that only the “locked” version of an algorithm will be granted Food and Drug Administration (FDA) approval as a medical device, with subsequent updates requiring additional review prior to deployment.⁵

Lesson 2: Implementation
Artificial intelligence is a developing technology that will affect health care professionals through its clinical potential.² In contrast to traditional, standardized medical training pathways, a health care provider’s path to becoming a leader of AI development and implementation is largely uncharted. We identified 2 themes that may help guide clinicians interested in employing AI solutions. First, it must be understood

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FUNDING: The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Funding was provided by the Feagin Leadership Program and Duke AHEAD. A.B.B. was supported by the Stead Scholarship Program of the Duke University Department of Medicine.

RECEIVED: October 19, 2019. ACCEPTED: October 21, 2019.

TYPE: Commentary

Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (http://creativecommons.org/licenses/by-nc/4.0/) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (https://us.sagepub.com/en-us/nam/open-access-at-sage).
that AI is not a panacea. Proper application of AI requires a careful understanding of the start-to-finish process that an AI application is being designed to improve. For example, if designing an AI application to improve Emergency Department triage, the investigator must carefully consider all steps from how patients reach the hospital, to the logistics of bed allocation, diagnostic tests, and provider workflow. This thought process is necessary regardless of AI application (eg, sepsis-risk prediction, antibiotic selection, or automation of administrative tasks) as it allows the investigator to target critical areas for improvement that have sufficient data for training an AI algorithm. Furthermore, this assists identification of vulnerabilities that may be exploited by bad actors, such as adversarial attacks in medical billing.6 Second, health care professionals do not need to become expert programmers. Instead, a baseline understanding of the capabilities and limitations of AI algorithms is sufficient to allow health care professionals to effectively partner with programming experts. This partnership is best accomplished when health care professionals have completed the first step of critically reviewing the system in question and can identify and effectively communicate their needs with those trained in programming AI.

Lesson 3: Education

We conducted a 5-question before-and-after poll of those attending our educational summit. Attendees arrived believing they had a poor baseline understanding of AI’s role in health care, and left the summit with an enhanced understanding of the topic (Figure 1A). Baseline beliefs about how AI will affect the future of health care careers and patient care were similarly positive before and after the event (Figure 1B and C), but there was a general belief that AI would make health care less humanistic (Figure 1D). Overall, we interpret these results as showing the importance of educational programs designed to advance the understanding of AI systems, and the necessity of ensuring AI deployment does not harm the humanism enshrined in medicine’s Hippocratic oath. Following the event, we did not observe a meaningful shift in attitudes regarding the desire to take a leadership role in developing or implementing AI, likely due to the high baseline interest in leadership roles expressed by the summit’s audience (Figure 1E).

Conclusion

By reframing AI as augmented intelligence, those within and outside of health care may better understand the role of AI in enhancing, rather than replacing, various aspects of the patient-physician relationship. Advancing holistic, patient-centered care should be a central goal of AI integration with health care systems. To accomplish this, medical practitioners should serve as leaders of integrating AI with clinical practice, and can do so without becoming expert programmers.

Acknowledgements

We are indebted to Duke University Medical Center’s Feagin Leadership Program, who sponsored this educational summit, as well as the mentorship and guidance of Joe Doty, PhD; Dean Taylor, MD; and David Bond.
Author Contributions
All authors contributed to the design of this project, analysis of results, writing, and final approval of this manuscript.

Ethical Approval
The study received an exemption from the Duke University Health System Institutional Review Board (Pro00102280).

ORCID iDs
Andrew B Barbour https://orcid.org/0000-0003-1405-4897
William C McManigle https://orcid.org/0000-0003-2435-2118

REFERENCES
1. Autor DH. Why are there still so many jobs? the history and future of workplace automation. *J Economic Perspectives*. 2015;29:3-30.
2. Rajkomar A, Dean J, Kohane I. Machine learning in medicine. *New Eng J Med*. 2019;380:1347-1358.
3. Research and Markets. *Artificial Intelligence in Healthcare Market by Product (Hardware, Software, Services), Technology (Machine Learning, Context-Aware Computing, NLP), Application (Drug Discovery, Precision Medicine), End User, and Geography—Global Forecast to 2025*. Dublin: Research and Markets; 2019:1-178.
4. Davenport TH, Kirby J. Beyond automation. *Harvard Business Review*. 2015;58-65.
5. United States Food Drug Administration. *Proposed Regulatory Framework for Modifications to Artificial Intelligence/Machine Learning (AI/ML)-Based Software as a Medical Device SaMD* (discussion paper request for feedback). https://www.fda.gov/media/122535/download. Updated 2019.
6. Finlayson SG, Bowers JD, Ito J, Zittrain JL, Beam AL, Kohane IS. Adversarial attacks on medical machine learning. *Science*. 2019;363:1287-1289.