Challenges and Opportunities for Implementing Artificial Intelligence at the Speed of Technology Innovation During the COVID-19 Era

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Abstract
The COVID-19 pandemic has created multiple opportunities to implement Artificial Intelligence (AI) technologies in new ways that address the initial infectious curve (e.g., triaging patients and disseminating information during disease outbreaks), as well as the subsequent curves of pandemic sequelae (managing gaps in care of chronic conditions, addressing new and exacerbated mental health needs, and rectifying worsening health disparities. However, numerous challenges limit scaling development and application of AI technologies in healthcare settings, especially in the context of a rapidly evolving public health emergency. Data representing diverse patient cohorts are necessary both to train and to test systems but often are labor intensive to create and deidentify. The need for new codes and concepts can delay data availability. Biases in data must be identified, evaluated, and managed to mitigate downstream effects. System performance must be continuously monitored and validated as clinical information, such as disease transmission characteristics, become available. This panel will discuss these challenges and propose solutions that include ensuring adequate, equitable, and unbiased data sources are used for AI development, validation of AI in clinical settings, with the context of the rapidly evolving COVID-19 public health crisis as a discussion focus.

General Description

Artificial Intelligence (AI) is defined as the application of computer programs that mimic human intelligence by "learning" from available data inputs using a combination of supervised or unsupervised learning approaches[1]. AI has great potential to revolutionize healthcare particularly during times of greater need for data dissemination and introduction of efficiencies into healthcare processes. The COVID-19 pandemic has presented a global public health crisis with new opportunities and challenges in leveraging AI technologies. These challenges are related to new demands on public health, patients, and providers to manage the infectious disease itself, along with its sequelae, such as delayed care, management of chronic disease, new and exacerbated mental health problems, and worsening disparities in health and healthcare delivery. Each of these challenges represents a unique curve of the pandemic where implementation of AI technologies could help address needs.

The first of these challenges involves ensuring that adequate data representing diverse patient cohorts are available and used for system training and testing and, in turn, to generate clinical evidence for AI. In most health care settings, data are siloed and exist in aggregations that are not readily accessible due to patient privacy and confidentiality regulations, hence data sharing is difficult without significant effort. Limited or delayed access to patient data act as temporal obstacles to innovation. With emergence of a new pathogen, the creation of new data elements and concepts for diagnoses, tests, and treatments may further delay availability of data. Moreover, a second challenge includes addressing biases present in existing data used for training and testing of AI systems especially with regard to health disparities or lack of representation of social determinants of health that must be mitigated in real world application of AI. Another growing challenge is how to manage the care of a rapidly growing elder population that has an existing burden of chronic disease management and which has experienced disproportionate infection rates and complications of COVID-19[2-5].

During the COVID-19 pandemic and with the health system response, early successes will likely be focused in the area of implementing AI systems where the tools, for patient and provider end-users, have the potential to augment human decision making and help manage overwhelming information volume and demand. Furthermore, developed and deployed tools must adapt with the rapid growth of real-world data generation and prospective innovations, along

with a rapidly changing healthcare landscape and policy environment. Requirements for success rely on early and continuous engagement of end users and key downstream stakeholders, considerations for how the tools will be integrated into healthcare workflows, and implementing common frameworks to support real-world application of AI technologies that scale to increasing and ever-changing health system demands.

This panel session will address these challenges, opportunities and potential solutions in the current landscape of AI applications in healthcare, and present practical real-world examples of implementation and innovation using the COVID-19 public health crisis as the discussion focus.

Description of Panelists & Presentations

This panel, comprised of two women and two men from unique racial /ethnic backgrounds and geographic locations, as well as both industry and academic positions, seeks to provide diverse perspectives on addressing important challenges for AI. The moderator will open the panel discussion with a 10 minute presentation on the motivation for convening the panel and the significance of the subject matter. Panelists will then each give a presentation of 10 minutes providing examples and perspectives to the challenges identified above. The final 40 minutes of the panel will be available for questions from the audience and discussion between the panelists and audience.

Brett R. South, MS, PhD is a Biomedical Informatician with IBM Watson Health and the Center for AI, Research, and Evaluation (CARE). He was previously Senior Scientist in the Department of Biomedical Informatics, University of Utah and the Veterans Informatics and Computing Infrastructure (VINCI), Prior to completing his PhD, he worked as a Senior NLP Research Engineer for the Nuance Clinical Language Understanding group where he helped lead a group of 75 clinical language analysts tasked with large-scale semantic annotation of clinical corpora.

Dr. South will serve as the moderator of the panel. He will introduce each panelist with a brief statement about their experience and background, initiate the panel discussion, and facilitate the question and answer segment with the audience.

Wendy W. Chapman, PhD is Associate Dean for Digital Health and Informatics at the University of Melbourne, Australia. She leads the Centre for Digital Transformation of Health. Previous to her current role, she was chair of the Department of Biomedical Informatics at the University of Utah. She is a member of the National Academy of Medicine and was a co-author with Dr. Matheny and others on the recently released report on AI in Healthcare. Her research expertise is natural language processing applied to clinical notes.

Dr. Chapman will speak on the challenge of generating clinical evidence for AI in real-world health settings. She will speak to the gap between innovation and clinical validation and the need for infrastructure to support both innovators and health systems reach digital maturity to implement and validate AI and other digital health interventions. She will use examples related to the COVID-19 pandemic to describe some necessary elements of that infrastructure.

Irene Dankwa-Mullan, MD is Deputy Chief Health Officer and Chief Health Equity Officer at IBM Watson Health. She is nationally known for her contributions to population health and health disparities science, community-based participatory research, implementation and translation science. In her role, she assists with the global efforts of the Center for AI, Research and Evaluation to promote scientific evidence for Watson's technology. She also leads efforts to increase awareness, and transparency around the importance of diversity of identity, inclusion and thought in the industry to better represent the populations being served with cutting-edge technologies.

Dr. Dankwa-Mullan will discuss the ethical and social implications of rapid development of AI applications in healthcare settings, particularly in the arenas of clinical decision support, care management planning, risk stratification and prediction, and precision medicine. The COVID pandemic presents a number of important ethical and social issues that need to be addressed including resource allocation and priority-setting, public health surveillance and contact tracing, patient privacy and frontline or healthcare worker rights. In addition, there is the obligation from industry and researchers to ensure optimal clinical trials and vaccine development are being conducted in rapid time and ethically acceptable. She will describe the value issues and propositions reflected in various AI systems and the need to identify drivers of unwarranted outcomes, medical explainability and risk mitigation. She will summarize the various Ethical, Legal and Social Implications (ELSI) statements, established by governmental, global organizations and various industry stakeholders, and provide a framework for harmonizing rapidly changing technology innovation and with need for ethical and socially accountable AI.

Michael E. Matheny, MD, MS, MPH is the Co-Director of the Center for Improving the Public's Health Using Informatics, an Associate Professor of Biomedical Informatics, Biostatistics, and Medicine at Vanderbilt University Medical Center, and Associate Director of VINCI, HS&RD, at the Tennessee Valley Healthcare System VA. His area

of expertise is in the development and evaluation of machine learning risk prediction models in inpatient settings for a variety of clinical use cases as well as natural language processing.

Dr. Matheny will discuss the overall framework for the lifecycle of AI development that the National Academy of Medicine has proposed, including needs assessment, workflow mapping, target state definition, model development, implementation, surveillance, and de-implementation in healthcare applications (Chapter 6 of the publication), with examples of successes, failures, and challenges from his work and others that relate to elements of that framework[9]. He will also highlight some of the challenges faced due to tremendous data shifts that have occurred during the COVID pandemic and initial small volumes of training data.

Yuri Quintana, Ph.D. is Chief of the Division of Clinical Informatics, Beth Israel Deaconess Medical Center, and Assistant Professor of Medicine at the Harvard Medical School. His research is focused on developing innovative technologies and systems that empower collaborative care between healthcare professionals, patients, and families. Quintana and colleagues have created InfoSAGE Health for caring for frail older adults at home, the European Union's UNICOM Consortium for standardization of data collected via mobile apps, and Alicanto™, a global online collaboration platform for health professionals that supports virtual tumor boards, standardization of care treatment guidelines, and collaborations for international bioinformatics studies.

Dr. Quintana will speak on approaches to collecting patient-reported data to support big-data analytics for improving symptom management. Early data shows significant differences in COVID-19 cases and mortality based on race and ethnicity, but it is unclear to what extent this is related to genetics, clinical history, social determinants of health, or other factors. To understand this problem and perform data analytics at a global scale requires the standardization of symptom representation, social determinants of health, and ways to cross-link international databases for drug identifiers that vary by country.

Participation Statement:

All proposed panelists have agreed to participate in the panel.

Discussion Questions

1. What are the various ethical and social implications of rapid development and implementation of AI in healthcare particularly in the context of COVID-19?

2. What opportunities for innovation can be leveraged to ensure scalable, equitable, adequate and reproducible application of AI in the healthcare domains? How will these innovations affect the pandemic response in terms of information dissemination and information volume?

3. What community activities can be used as a model for development and implementation of AI in healthcare?

4. Are there community accepted recommendations or guidelines for evaluation of AI systems and what types of best practices ensure transparent and reproducible reporting of system performance?

5. What types of collaborations between industry/academia could be pursued to address the challenges in AI development and implementation addressed by this panel?

References

1. Benjamins JW et al. A primer in artificial intelligence in cardiovascular medicine. Neth Heart J. 2019; 27(9): 392-402.
2. Quintana Y, Fahy D, Crotty B, Jain R, Kaldany E, Gorenberg M, Lipsitz L, Engorn D, Rodriguez J, Orfanos A, Bajracharya A, Henao J, Adra M, Skerry D, Slack WV, Safran C. InfoSAGE: Supporting Elders and Families through Online Family Networks. AMIA Annu Symp Proc. 2018 Dec 5; 2018: 932-941.
3. Suzman R, Beard J. Global health and aging. National Institute on Aging. Published October 2011. Available from: https://www.nia.nih.gov/sites/default/files/2017-06/global_health_aging.pdf.
4. Agency for Healthcare Research and Quality. Multiple Chronic Conditions [Internet]. Rockville, MD: AHRQ. 2014 May [last reviewed 2017 December; cited 2020 March 10]. Available from: https://www.ahrq.gov/patient-safety/settings/long-term-care/resource/multichronic/mcc.html.
5. Matheny M, Israni ST, Ahmed M, Whicher D, editors. Artificial Intelligence in Healthcare: The Hope, The Hype, The Promise, The Peril. NAM Special Publication. Washington, DC: 2019, National Academy of Medicine.