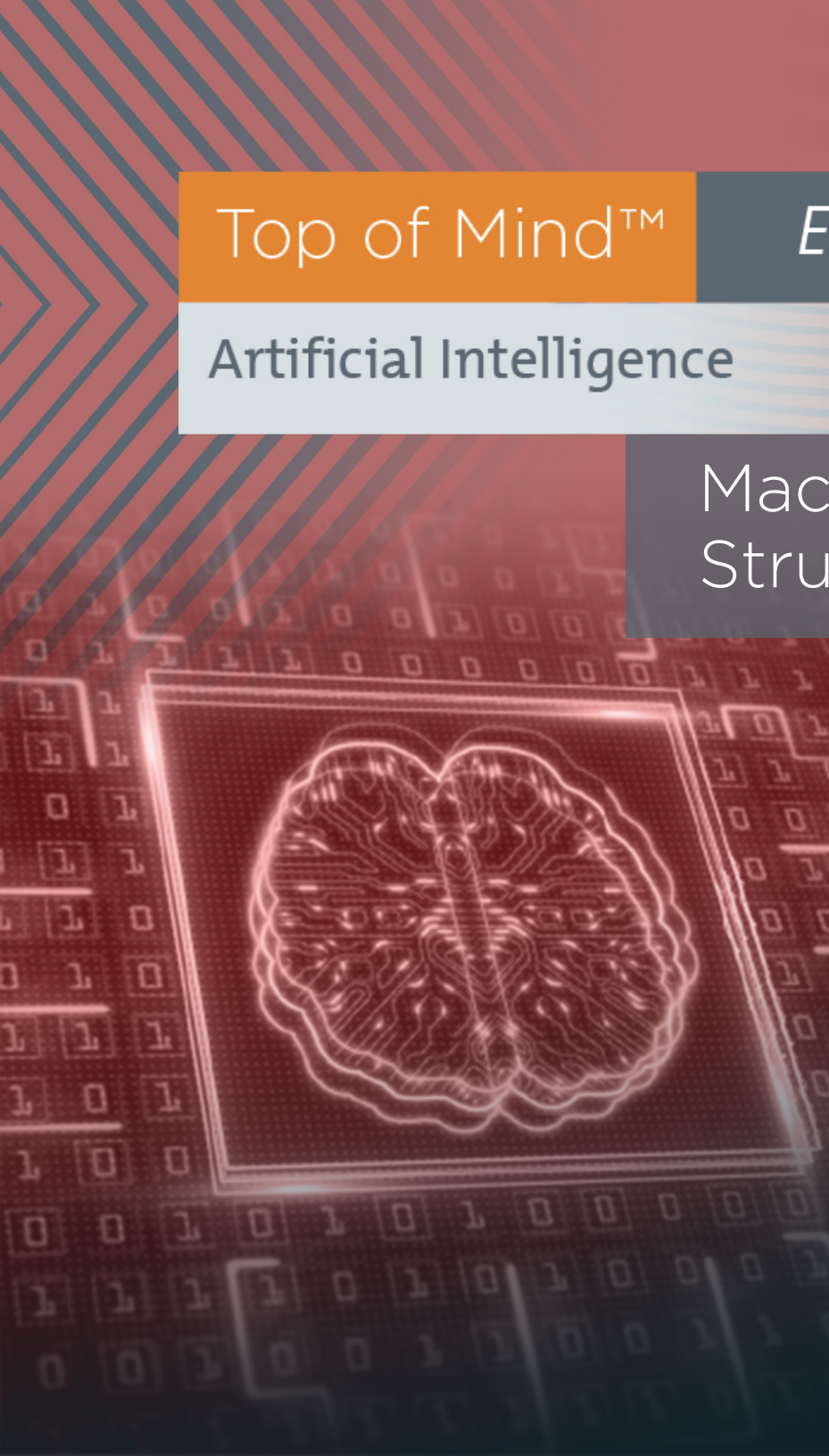
Reports

Top of Mind™ *Exchange*

Artificial Intelligence

Machine Learning and Structural Bias in Health Care

March 2021



Center for **Connected** Medicine

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Forward

The mission of the Center for Connected Medicine (CCM) is to connect and inspire leaders and innovators who want to advance health care and to serve as a resource for information on the future of digital health.

In November 2020, the CCM convened a group of experts in health care data science, artificial intelligence (AI), and machine learning (ML) for a virtual roundtable. The invitation-only *Top of Mind Exchange: Artificial Intelligence* virtual roundtable was moderated by Robert M. Califf, MD, Head of Clinical Policy and Strategy for Verily and Google Health, and included experts from academia, government, health systems, and industry. This report captures high-level summaries of the discussion that took place during the roundtable.

These leaders came together for a candid discussion on the important and timely topic of structural bias in health care and the role AI/ML can play in improving disparities. The goal of the roundtable was to share progress, raise needs, and discuss what's "top of mind" in AI/ML for the year to come.

The roundtable was part of the CCM's fourth annual *Top of Mind* program, which included a research report, webinar, virtual summit, and the Exchange roundtable series. The program, held in the fall of 2020, focused on the impact of the COVID-19 pandemic on health system innovation priorities and three essential technologies: telehealth, AI, and revenue cycle management. Learn more at **connectedmed.com/digital-health**.

The CCM extends sincere appreciation to the participants in *Top of Mind Exchange: Artificial Intelligence* for their time and expertise, and to the *Top of Mind Advisory Committee* for its guidance and support.

TOP OF MIND ADVISORY COMMITTEE

A Data Diversity Problem Plagues Health Care AI

There is significant excitement about the potential for AI/ML to benefit health care. Advances in the technology in recent years have suggested algorithms may be able to more quickly and accurately diagnose cancers from medical imaging and suggest the best care pathways. Health system leaders are bullish on the technology. Health system leaders identified AI as the most exciting emerging technology in health care, according to the CCM's Top of Mind for Top Health Systems report published in October 2020. Investment abounds, with AI startups in health care receiving $4 billion in financing in 2019.[1]

But while scientists and researchers see great promise in AI's potential role in advancing diagnostics, treatment pathways, and clinical workflows, recent studies and reports also have highlighted challenges related to bias. While many recognize the need to train algorithms with diverse data sets, the authors of a review study published in the Journal of the American Medical Association (JAMA) found that clinical AI systems are relying on narrow sets of data.[2] While unintentional, this data problem can have serious consequences for the practice of medicine. An algorithm trained with historical health care data that was used to predict which patients needed extra medical care privileged white patients over black patients, according to a study published in Science.[3]

These issues have not escaped the attention of regulators. An advisory committee for the Food and Drug Administration's Center for Devices and Radiological Health has called on the agency to take a strong role in addressing algorithmic bias in artificial intelligence and machine learning.[4]

Against the backdrop of social justice issues receiving significant attention during 2020, the roundtable discussion summarized on the following pages of this report took on even greater significance. As roundtable participants pointed out, not only are there issues with bias in algorithms but there are also serious problems with disparities in health and outcomes across the medical industry. A pivotal question for leaders and innovators to consider is, will advanced technology be a force for correcting or perpetuating long-standing inequities in society generally and medicine specifically?

[1] Fierce Healthcare, **Investors poured $4B into healthcare AI startups in 2019**, January 2020

[2] Scientific American, **Health Care AI Systems Are Biased**, November 2020

[3] MIT Technology Review, **A biased medical algorithm favored white people for health-care programs**, October 2019

[4] Healthcare IT News, **FDA highlights the need to address bias in AI**, October 2020

Roundtable Participants

The following executives participated in *Top of Mind Exchange: Artificial Intelligence*. The CCM extends its thanks to these leaders for sharing their expertise, perspectives, and experience.

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Opening Remarks: Will We Build AI to Correct or Exacerbate Disparities in Health Care?

AI already is at work in many parts of our daily lives and is likely to be operating in the background across much of health care in the future, Dr. Califf said during his opening remarks during the *Top of Mind Exchange: Artificial Intelligence* virtual roundtable.

Over the course of his career as a clinician and clinical investigator, Dr. Califf has interacted closely with tech experts. And now, as a leader of Alphabet's health care efforts, he has a front row seat for the expansion of AI into more and more of daily life through the use of apps and smartphones that guide us.

While much of this technological advancement has been slow to penetrate health care, the industry is rapidly moving into an era where algorithms and machine learning will be humming in the background. If health care leaders accept that this is the future, then it is essential to ask if AI will lead to better health for everyone. Or will AI further segment populations and exacerbate disparities?

Monitoring needed

Dr. Califf recommends closely monitoring AI and machine learning algorithms as they are deployed in health care to watch for drift in performance over time and how biases that may be built into them may impact care.

"We need a systematic approach to monitor what algorithms are doing as they guide us in our work," he said.

Most importantly for the U.S. health care system, it is essential that leaders recognize its structure has created disparities between groups. The disparities go beyond health care, but there are differences in outcomes and life expectancy for people based on race, ethnicity, education level, wealth, and other criteria.

"We need a systematic approach to monitor what algorithms are doing as they guide us in our work," he said.

"We're starting with an uneven playing field in the U.S. that greatly advantages people who have money and education and preferentially advantages white people and in which rural people are at a tremendous disadvantage," Dr. Califf said. "So, the question for us is, are we going to build algorithms that correct this or are we going to further segment the population?"

DISCUSSION TOPIC: Structural Bias in Health Care

Overview

The first of three roundtable discussion topics focused on laying out a framework for the world in which AI is operating. It is a world in which implicit and explicit individual biases, as well as structural bias, can affect the care patients receive and the health and outcomes of populations.

It is well known that race and ethnicity influence health and outcomes in ways that are not fully understood. It is essential that these factors are measured in a standardized way so they can be understood over time. Socio-economic status also has an impact, but this is not frequently measured by researchers in a health care setting.

On top of these issues are discrimination and racism, which can take the form of implicit bias or even overt discrimination. These biases tend to present as a preference for younger over older, men over women, whites over non-whites, and wealthy over poor, to name several of the most common, participants said. When it comes to implicit bias, it is important that providers and others in health care acknowledge that everyone carries unconscious preferences.

“Just acknowledging that these exist is a major step in the right direction,” one roundtable participant said.

Structural bias observed in many areas

In addition to individual biases there is structural racism and discrimination built into society. There is a long history of unequal treatment, laws, and segregation based on race and ethnicity that did not disappear with the passage of the 1965 Civil Rights Act. This structural bias can be observed in differences in housing values between white and non-white neighborhoods, family wealth, infant mortality rates, uninsured rates and elsewhere.

There are many possible interventions to reduce the impact of structural bias across society and in health care. For example, it is known that African American and Latino physicians are more likely to treat minority patients, yet only 12% of medical school graduates are from these groups even though they make up about 40% of the overall population in the U.S. Further, health care researchers should ensure that there are standards for collecting data around the Social Determinants of Health so that we may better understand health disparities and create strategies for addressing it.

Data ingrained with biases

With this background in mind, the roundtable participants turned to the implications of bias on the design and implementation of AI/ML. One of the first implications of this bias is to know that all health care data already has ingrained health inequities and disparities. Those building algorithms for health care must be aware that these biases affect the ability of AI/ML to predict outcomes. While health practitioners may want to believe that all patients receive identical treatments for identical diseases or other health problems, we know that isn't the case.

Complicating the issue is the difficulty in quantifying where structural bias is present and the unintended consequences that can come from trying to control for it. For example, including pictures of doctors in their online profiles may make it easier for patients to find providers who are the same race or ethnicity as themselves – which can lead to an experience that patients find more satisfying. But at the same time, those photos could also cause other people to avoid even the most well qualified physician because they are a different race.

DISCUSSION TOPIC: AI, ML, and Health Disparities

Overview

The roundtable moved to its second discussion topic by examining the role of AI/ML in addressing health disparities and other inequities.

It is a challenge because typically these algorithms and systems are designed to optimize for one thing, such as accuracy. But given the complexity of the health care system and bias, health care leaders need to rethink how they approach the problem. A starting point suggested by several participants is to first transform the quality of data. Most health systems are using the data that's easiest to get, which tends to be the structured data contained in their electronic health care record systems intended first and foremost to guide medical billing. But to get to a place where health care has the data it needs to create AI/ML that can improve the situation might require mandates from the government around data standardization and collection.

Addressing underlying disparities first?

Another participant suggested that correcting for health disparities with algorithms may not be enough without first addressing the pre-existing biases in society that lead to low quality data. But absent that, health care needs to be relentless about examining its AI/ML models for bias and finding ways to correct them.

It's becoming easier to identify bias in the data thanks to greater availability of data. "We've gone from implicit bias to explicit understanding of where the bias is. And that should be celebrated," one participant said. This means it is possible that well-designed systems powered by advanced algorithms could help reduce bias and disparities. Such a system might be able to identify opportunities in real-time for physicians and other care providers to rethink their practices and become more equitable. This is possible if health care leaders are explicit about their goals and what they want to achieve.

Overview

The third and final area of discussion for the roundtable participants focused on how health care leaders can make health care equity a priority. The discussion first touched on the challenge of aligning incentives within health systems, where leaders are primarily concerned with reducing cost and maximizing revenue. In this framework, addressing disparities is not likely to be a priority.

Health systems that do want to prioritize the use of AI/ML to deal with biases and make improvements in care need to set aside significant budget for information technology infrastructure and for implementation.

Training of physicians in understanding biases is very important and has proven successful already. It becomes more difficult with established providers because of the natural instinct to become defensive if it is suggested they harbor biases. One panelist suggested the need for "brave spaces" where people can discuss these issues.

Data standards needed

Leaders in government should step up around the issue of creating standards for data collection around the Social Determinants of Health so that researchers may better examine health disparities.

Related to the issue of incentives that drive health systems to maximize revenue, which can leave little room for implementing technology to reduce disparities, it was suggested that greater equity and lower cost can go hand-in-hand. The U.S. health care system is the most expensive in the world, yet it gets mediocre results compared to other rich, industrialized nations. "How is it that engineering and technology have made everything else in society less expensive except in health care?" a participant asked. "It's not contradictory to think about equity and cost. We need to do both to make progress."

"How is it that engineering and technology have made everything else in society less expensive except in health care?" a participant asked.

Next Steps and Points of Importance

- **Think about "values" based medicine, not just value-based medicine.** It's a way of addressing structural issues that ultimately will provide better guidance for health systems tackling disparities.
- **We need to create a new vision for health care systems** — perhaps through government mandate or by following a role model health system that demonstrates a way to maximize margin through equitable community-based health.
- **Incentives matter.** Health systems respond most effectively and more timely to financial carrots and sticks. To drive more equitable health care, participants said the government needs to lead.
- **We must decide if the issue is eliminating bias or adjusting to bias.** We have been adjusting to the bias that exists in health care delivery. But can we go after the underlying structural bias in our services?
- **We must support and highlight the concrete examples of well-designed systems that can reduce bias,** which we will be seeing in the next five to 10 years.
- **There is a dilemma where people are uncomfortable measuring certain things because of unintended negative consequences** — but if we don't measure then we can't know if we're making progress or if bias is creeping in.
- **Similar to the stress tests the government mandates the financial system undergo,** there should be an AI/ML driven stress test for health systems to ensure resilience.
- **Leaders must recognize the importance of the moral determinants of health.** To address the social determinants of health requires an embrace of a moral obligation to create the circumstances for a healthy life for all people.

Contributors

Overview

Thank you for reading this summary of *Top of Mind Exchange: Artificial Intelligence* virtual roundtable from the Center for Connected Medicine. For more digital health resources and to get involved with the CCM, please visit connectedmed.com

Roundtable participants

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Center for **Connected** Medicine

The Center for Connected Medicine (CCM) connects and inspires leaders and innovators who want to advance health care. Collaborating with a network of experts, we serve as a resource for information and events focused on the future of digital health. Established in 2009, the Pittsburgh-based CCM is supported by UPMC and Nokia. Join us at **connectedmed.com**.

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