Reports

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Executive Outlook: Artificial Intelligence in Health Care

Experts address how health systems can harness the power of AI and move beyond the hype

Health care leaders across the United States expect artificial intelligence (AI) to have an impact on the industry. But when and how exactly?

There are examples of AI solutions based on natural language processing, machine learning, speech recognition, and other forms of AI benefiting hospital operations and patient outcomes. The Center for Connected Medicine (CCM) has heard this sentiment in surveys asking health system executives about the most promising technology on the horizon. AI has often been at or near the top of the list.

Yet, to some observers, it appears that AI has yet to fulfill its promise of bringing greater value to health care by helping payers and providers improve patient outcomes and increase efficiency.

To better understand the state of AI in health care, the CCM interviewed four leading experts to separate the hype from the reality. The following executives shared their expertise, insights, and opinions:

Erich Huang, MD, PhD
Chief Data Officer for Quality, Duke University School of Medicine, and Director, Duke Forge

Oscar Marroquin, MD
Chief Healthcare Data and Analytics Officer, UPMC

Pamela Peele, PhD
Chief Analytics Officer, UPMC Health Plan and UPMC Enterprises

Gilan El Saadawi, MD, PhD
Chief Medical Officer, Realyze Intelligence

This paper focuses on whether the buzz around AI in health care is warranted by exploring where the technology has helped in response to the COVID-19 pandemic, promising use cases, obstacles, and the role of AI in the future of value-based care.

AI is very exciting and potentially transformational for health care. According to one expert, if it has been overhyped in health care that's because most health systems haven't been ready to take advantage of the technology's potential. Health care needs to be able to harness its data before it can effectively apply AI to it.

"We will get to the point where we've passed that threshold of thinking, 'there's a lot of promise,' and actually arrive at the point where we're able to get value from AI," said Dr. Marroquin, who oversees a team of analysts, statisticians, data scientists, and epidemiologists that are helping UPMC use its data to derive insights to deliver better care.

"As we've seen from other industries that are much more advanced in the use of AI, it's been truly transformational. But it won't be until we learn how to use our data in a meaningful way — the data we're generating every time we care for our patients — and apply these tools to those data, that we'll be able to meet the hype that's been generated," Dr. Marroquin said.

Yet the technology itself is not new. AI has been around for decades, noted Dr. Peele. But, unfortunately, the technology has been "overhyped, oversold, and under delivered" in health care. To successfully deploy AI requires computational power, robust and meaningful datasets, and algorithms, Dr. Peele explained. "We have the storage and computational power. We are getting access to bigger, more robust data sets now, and we have the advanced algorithms," she said.

Using AI in response to COVID-19

There was some early excitement about AI's potential applications for managing the response to COVID-19 and any future public health emergencies. In the CCM's Top of Mind for Top Health Systems survey, conducted in 2020, about half of respondents said their organizations were using AI in some form to respond to the pandemic. One successful application was observed by Dr. Saadawi and her team at Realyze, who were able to effectively harness natural language processing (NLP) to aid in UPMC's response to COVID-19.

Realyze has developed technology that allows health systems to obtain a more complete picture of their patients by using NLP to read and understand patient records, and especially physician notes. This technology was used to quickly identify patients who were most likely to need emergency care due to social determinants of health factors and who would also be at greatest risk of developing severe COVID-19 illness should they become infected with the virus. Armed with this insight, primary care practices proactively contacted those patients to head off visits to the hospital, where they might be more likely to encounter infected patients.

"The practices were saying, 'if I have 10,000 patients, I can't pick up the phone and ask those 10,000 patients how they are doing,'" Dr. Saadawi explained. But with a targeted list, the practices were able to prioritize patients most in need of intervention.

"We picked out the most vulnerable population and targeted them with telehealth intervention. And instead of them ending up in an emergency room, they were treated using telehealth in the home and got the proper treatment without leaving their house," Dr. Saadawi said.

While this use case provides an effective example of the use of NLP in the response to COVID-19, another common AI technology, machine learning, was less useful for large scale modeling.

"In order to make a machine learning algorithm really useful for people, it needs to be able to plug into a source of data that's standardized. It's been difficult for health systems across the country to do that, because once you've seen one health system's electronic health record you've only seen one system's electronic health record," said Dr. Huang, highlighting the problem of non-standardized data across health care.

Making things more difficult was the quickly changing situation. "I haven't found that AI or machine learning has been particularly useful just because the conditions have been so dynamic, the data has not been standardized, and those are poor preconditions for useful application of machine learning," Dr. Huang elaborated.

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Where AI is effective in health care

While it has appeared that AI remains just on the cusp of truly helping health care, there are real-world examples of the technology being effective in improving care.

"There's a good body of work already around things such as predicting readmissions and understanding the multitude of factors that are important to identifying an avoidable readmission," Dr. Peele said.

Another example, UPMC is using natural language processing to develop insights from unstructured text in electronic medical records to better understand the trajectory of developing chronic kidney disease. Dr. Marroquin's team is using AI to try to predict which patients with chronic kidney disease are most likely to progress to dialysis in a 12- to 24-month timeframe so that physicians can intervene.

"We built a model that actually predicts who are the patients who are the highest risk of progressing to dialysis in the near future. We can then use those insights to enable our clinicians to have more targeted outreach and start to pay more attention to those patients," Dr. Marroquin said.

There are similar applications for diabetes, one of the more prevalent and costly chronic diseases. "We want to better deploy our diabetes educators to identity and work with the patients who are most likely to have difficultly controlling their diabetes and wrap around more resources that would result in better outcomes," Dr. Marroquin said. "So that's where a lot of our team's efforts have been focused, in what I like to call applied machine learning. We build the models, we train them, we test them, and then we do prospective validation internally. Then we work with our clinicians to make sure that those models are built to address their needs."

NLP is used in health care in several limited ways, including in revenue cycle for computer-assisted coding and clinical documentation improvement, said Dr. Saadawi. Voice recognition, a conversational AI-leveraging NLP, is moving from solely being a dictation tool to becoming a virtual assistant listening to the patient and provider to understand what's being said, Dr. Saadawi explained.

The next step, and where AI would be most beneficial in health care, would be to have solutions that help clinicians predict the problems patients will experience and allow doctors to intervene earlier. "I'm not saying it's easy. I'm not saying that it can be done quickly. We need to reach a level of accuracy that's accepted by clinicians and that's why it is progressing slowly," she said.

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Biggest obstacles to implementing AI in health care

A major challenge for health systems to overcome if they want to adopt AI is gaining access to enough data to develop accurate and robust algorithms. But even large health systems, which have many hospitals and doctors and treat thousands — or even hundreds of thousands — of patients, don't necessarily have the infrastructure in place to standardize and analyze their data, Dr. Marroquin said.

"One has to have the right data and analytics infrastructure in place to be able to make that data available so that they can be utilized for the whole continuum of analytics — from basic descriptive statistics all the way to doing more complex AI, such as machine learning algorithms," he said.

There are many steps needed to build that infrastructure, from data harmonization tools to having the teams in place to handle data curation and maintenance of models. For UPMC, it has been a 10-year process to build the foundation of its analytics program, according to Dr. Marroquin. And in the past five years, UPMC has dedicated greater resources to stand up Dr. Marroquin's team to perform system-wide analytics.

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Oscar Marroquin, MD
Chief Healthcare Data and Analytics Officer, UPMC

"Now we are at a point where we have many solutions in production that have relied on machine learning methods and AI to derive the insights that are enhancing our service lines and enabling our clinicians to provide better patient care," he said, adding that it's a complex endeavor to stand up a clinical AI program. "To think that these are out of the box solutions that are just plug and play would be naïve, in my opinion. It requires real commitment and significant resources."

Another major hurdle is the potential for data scientists to create AI technology that doesn't solve a problem identified by clinicians. AI

needs to address clinical needs, explained Dr. Peele. "When scientists are driving the models, they might not be serving the clinical business needs. This is one of the biggest potential obstacles — we need to service the clinical delivery needs, not the methods and the math of AI," she said. How do health leaders overcome this potential hazard? It is essential for data scientists to work closely with clinicians.

Dr. Marroquin and Dr. Huang echoed this point.

Dr. Marroquin has structured UPMC's analytics team to be embedded within clinical operations. "As a matter of fact, it's the only way that it works. The clinicians and the data scientists are working hand-in-hand from the beginning," he said.

> **"There's one very large obstacle, and to overcome it requires a partnership between clinicians and data scientists. They need to be able to communicate to solve problems clinicians are looking to solve."**

Pamela Peele, PhD
Chief Analytics Officer, UPMC Health Plan and UPMC Enterprises

Dr. Huang agreed that health care's high expectations for AI won't be met when those developing machine learning methodologies are connected to the realities of clinical practice. "What we need are better working relationships between the methodologies and the people who have real health care problems that they need to solve," he said.

So-called "messy data" is the biggest problem in AI, according to Dr. Saadawi. "The technology is only as good as the data that you feed it. If you feed it biased data, the results will be biased," she said.

This problem with the data can also influence another obstacle, which is a lack of trust in AI. Several experts pointed to this challenge, with varying degrees of concern for its long-term impact on AI in health care.

Sometimes referred to as the "black box" problem in AI, the contention is that physicians won't accept predictions from a machine learning algorithm unless they understand how the model arrived at its prediction. But the complexity of AI can make it very difficult to shine a light inside the black box and illuminate an algorithm's inner workings.

Dr. Saadawi said Realyze's technology will provide evidence along with the "answers" to build trust with clinicians. "I will not give you the answer with a black box. I will give you evidence why I chose that answer. That's what the technology needs to change to," she said.

The role of AI in value-based care

AI can help health systems achieve greater value for patients by optimizing for better clinical outcomes. But health systems need to be willing to take on risk and embrace value-based payments.

AI can be deployed to better judge the types of care and services that have more value. "Care is not consistent or uniform from one patient to another. Using AI, we would be able to do a better job of understanding the difference between low-value care and high-value care," Dr. Peele said. "It is a perfect problem for AI, in my opinion. And if we could do that, that would be the foundation for standing up value-based care and in particular value-based payments."

Dr. Huang led a project using machine learning for a Medicare Shared Savings Program at Duke Health. In order to deliver high-touch case management services to the patients who would benefit most from meeting with social workers, working with pharmacy technicians, receiving transportation services, and other additional services, Duke needed to stratify risk among the population in the program. "We did not have sufficient capacity to provide it for everyone so we had to try to pick and choose who are the people who would most benefit from those high touch services. That's a good place to think about using an algorithm to help you stratify your patients so then you can more efficiently utilize a scarce resource," Dr. Huang said.

> **"AI is actually quite good at finding needles in haystacks. I think there's a lot of promise in this particular area of health care going forward for AI to be applied to relatively rare diseases, which are more like needles in haystacks. There are many ways to use AI — it is my opinion that AI needs to be clinically driven, not clinical care being driven by AI."**

Pamela Peele, PhD
Chief Analytics Officer, UPMC Health Plan and UPMC Enterprises

Combining Medicare claims data with electronic health record data, Dr. Huang and his team can predict unplanned hospital admissions over a six-month period — which allows Duke to better align its case management resources to the patients who need it the most. The team also updates the model each month using fresh claims data from Medicare, allowing insight into patients who are moving up the risk continuum.

"That's helpful as well because now our complex case management service has this concept of a rising-risk patient. If a patient

looks like they're rising into a treacherous trajectory for their chronic diseases, we now can allocate case management services to those people to try to forestall a future event," Dr. Huang said.

While the use case among Medicare patients at Duke has been successful, Dr. Huang also believes there's great potential for AI and machine learning to also wring cost out of the system by optimizing operations. "We are a very inefficient industry. There are opportunities for increasing that efficiency that don't have anything to do with clinical decision support or population health. I think there is a ton of opportunity with optimizing ordering our supplies, for example," he said.

Another key piece of the puzzle to bringing AI into the clinical setting is for health systems to have more emphasis on value-based models, Dr. Huang suggested. The data that machine learning can most easily utilize tends to be from the electronic medical record, which is essentially billing information. And currently, most health systems are optimized to boost revenue and increase profitability, he said.

"You choose an objective function for the machine learning model to optimize a solution, and in many cases right now in health care, the objective function of being profitable and the objective function of taking better care of our patients are not always in the same place," Dr. Huang said. "You can't just think of machine learning as a pure technical exercise. If your motivations are structurally problematic, well, your result is going to be structurally problematic."

Conclusion

Several points were commonly heard in the interviews and serve as key takeaways for health care leaders who may be considering the technology but are concerned about the hype. The consensus from the four experts consulted for this paper is there are valid use cases for AI in health care, but real impact requires a substantial commitment from health systems in time and resources.

"If we think of AI as just a siloed sort of entity or magic wand that is going to solve our problems, we're never going to get to the point where we realize the potential that it has. AI is not going to replace doctors. It should be viewed as an enabler. It's one more tool that we have to do our work better."

Oscar Marroquin, MD
Chief Healthcare Data and Analytics Officer, UPMC

Health systems are swimming in data thanks to the digitization efforts of the past decade. But a lack of standards, prevalence of data silos, and the use of unstructured notes is a serious challenge for AI.

AI solutions should be driven by clinical need. This can be accomplished by embedding data scientists within clinical teams. Ensuring clinicians have a voice can also build trust in AI. The "black box" problem of AI is a frequently cited obstacle to greater deployment of the technology.

AI is not a magic wand for health care's challenges, but it does offer possibilities for significant improvement over time for those willing to put in the hard work of getting their data in shape, building a team of experts, and adopting a value-based approach.

About the CCM

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.

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