Nudges combined with machine learning triples advanced care conversations among patients with cancer

October 16 2020

Credit: Unsplash/CC0 Public Domain

An electronic nudge to clinicians—triggered by an algorithm that used machine learning methods to flag patients with cancer who would most

benefit from a conversation around end-of-life goals—tripled the rate of those discussions, according to a new prospective, randomized study of nearly 15,000 patients from Penn Medicine and published today in *JAMA Oncology*.

Early and frequent conversations with patients suffering from serious illness, particularly cancer, have been shown to increase satisfaction, quality of life, and care that's consistent with their values and goals. However, today many do not get the opportunity to have those discussions with a physician or loved ones because their disease has progressed too far and they're too ill.

"Within and outside of cancer, this is one of the first real-time applications of a machine learning algorithm paired with a prompt to actually help influence clinicians to initiate these discussions in a timely manner, before something unfortunate may happen," said co-lead author Ravi B. Parikh, MD, an assistant professor of Medical Ethics and Health Policy and Medicine in the Perelman School of Medicine at the University of Pennsylvania and a staff physician at the Corporal Michael J. Crescenz VA Medical Center. "And it's not just high-risk patients. It nearly doubled the number of conversations for patients who weren't flagged—which tells us it's eliciting a positive cultural change across the clinics to have more of these talks."

Christopher Manz, MD, of the Dana Farber Cancer Institute, who was a fellow in the Penn Center for Cancer Care Innovation at the time of the study, serves as co-lead author.

In a separate issue of *JAMA Oncology* published in September, the research team validated the Penn Medicine-developed machine learning tool's effectiveness at predicting short-term mortality in patients in real-time using clinical data from the electronic health record (EHR). The algorithm considers more than 500 variables—age, hospitalizations, and

co-morbidities, for example—from patient records, all the way up until their appointment. That's one of the advantages of using the EHR to identify patients who may benefit from a timely [conversation](#). It's in real time, as opposed to using claims or other types of historical data to make predictions.

This latest trial combined that algorithm with a behavioral nudge, including texts, emails, or notifications to the clinical team, to determine its ability to both identify patients and prompt conversations around end-of-life planning. The study—which included 14,607 patients and 78 physicians across nine oncology clinics in the University of Pennsylvania Health System—was conducted between June 2019 and November 2019.

Among patients with a high-predicted mortality risk, conversations in the intervention group occurred in 304 out of 1,999 patient encounters (15.2 percent) compared to 77 out of 2,125 in the control group (3.6 percent). Even when patients were not flagged as high-risk, clinicians in the trial engaged more in these conversations. Among all patient encounters, serious illness conversations occurred in 155 out of 12,170 encounters (1.3 percent) in the control group, while conversations in the intervention group occurred in 632 out of 13,889 encounters (4.6 percent).

"We've taken an algorithm from retrospective validation to [real-time](#) validation to actually testing it in the clinic to see if it can shape [patient care](#)," said Parik, who is also part of the Penn Center for Cancer Care Innovation. "Because of its success, I think we've provided of a road map for other institutions that may be thinking of using analytics to drive important behaviors."

The machine learning tool continues to be utilized in Penn Medicine oncology clinics, and further proved its value during the COVID-19 pandemic. The rates of serious illness conversations continued to remain high after the trial ended, despite many of those conversations taking

place online through much of 2020, when many clinical visits had to occur through telemedicine to ensure patient safety.

"This is one of the first applications of combing behavioral nudges with machine learning methods in clinical care," said senior author Mitesh S. Patel, MD, director of the Penn Medicine Nudge Unit and an associate professor of Medicine in the Perelman School of Medicine at the University of Pennsylvania and a staff physician at the Corporal Michael J. Crescenz VA Medical Center. "There are many opportunities build upon this work and apply it to other aspects of cancer care and to other areas of medicine."

More information: Christopher R. Manz et al. Effect of Integrating Machine Learning Mortality Estimates With Behavioral Nudges to Clinicians on Serious Illness Conversations Among Patients With Cancer, *JAMA Oncology* (2020). DOI: 10.1001/jamaoncol.2020.4759

Provided by Perelman School of Medicine at the University of Pennsylvania