Medical Xpress

Could suicide risk be predicted from a patient's records?

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Suicide is now the second most common cause of death among American youth. Fatal suicides rose 30 percent between 2000 and 2016, and 2016 alone saw 1.3 million nonfatal suicide attempts. Now, a study led by Boston Children's Hospital and Massachusetts General Hospital demonstrates that a predictive computer model can identify patients at risk for attempting suicide from patterns in their electronic health

records—an average of two years ahead of time.

Such models could potentially alert health professionals in advance of a visit, helping patients get appropriate interventions, the researchers say. Findings were published last month in *JAMA Network Open*.

"Computers cannot replace care teams in identifying mental health issues," says Ben Reis, Ph.D., director of the Predictive Medicine Group, part of the Computational Health Informatics Program (CHIP) at Boston Children's Hospital, and co-senior author on the paper. "But we feel that computers, if well designed, could identify high-risk patients who may currently be falling through the cracks, unnoticed by the health system. We envision a system that could tell the doctor, 'of all your patients, these three fall into a high-risk category. Take a few extra minutes to speak with them.'"

The team analyzed electronic health record data from more than 3.7 million patients ages 10 to 90 across five diverse U.S. health care systems: Partners HealthCare System in Boston; Boston Medical Center; Boston Children's Hospital; Wake Forest Medical Center in North Carolina; and University of Texas Health Science Center at Houston. Six to 17 years' worth of data were available from the different centers, including diagnostic codes, laboratory test results, medical procedure codes, and medications.

The records showed a total of 39,162 suicide attempts. The models were able to detect 38 percent of them (this ranged 33 to 39 percent across the five centers) with 90 percent specificity. Cases were picked up a mean of 2.1 years before the actual suicide attempt (range, 1.3 to 3.5 years).

The strongest predictors, not surprisingly, included drug poisonings, drug dependence, acute alcohol intoxication, and several mental health conditions. But other predictors were ones that wouldn't ordinarily come

to mind, like rhabdomyolysis, cellulitis or abscess of the hand, and HIV medications.

"There wasn't one single predictor," says Reis. "It is more of a gestalt or balance of evidence, a general signal that builds up over time."

Designing a suicide risk predictor

The investigators developed the model in two steps, using a machine learning approach. First, they showed half of their patient data to a computer model, directing it to find patterns that were associated with documented suicide attempts. Then, they took lessons learned from that "training" exercise and validated them using the other half of their data—asking the model to predict, based on those patterns alone, which patients would eventually attempt suicide.

On the whole, the model performed similarly at all five medical centers, but retraining the model at individual centers brought better results.

"We could have created one model to fit all medical centers, using the same codes," says Yuval Barak-Corren, MD, of CHIP, first author on the paper. "But we chose an approach that automatically builds a slightly different model, tailored to suit the specifics of each health care site."

The findings confirmed the value of adapting the model to each site, since health care centers may have unique predictive factors, based on different hospital coding practices and local demographics and health patterns.

Under a grant from the National Institute of Mental Health, the team will now seek to enhance their modeling approach, for example incorporating doctor's clinical notes into their data.

More information: Yuval Barak-Corren et al, Validation of an Electronic Health Record–Based Suicide Risk Prediction Modeling Approach Across Multiple Health Care Systems, *JAMA Network Open* (2020). DOI: 10.1001/jamanetworkopen.2020.1262

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