Study suggests new computer analytics may solve the hospital readmission puzzle

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A University of Maryland School of Medicine study suggests that a novel machine learning model developed at the University of Maryland Medical System (UMMS), called the Baltimore score (B score), may help hospitals better predict which discharged patients are likely to be readmitted.

The research was led by Daniel Morgan, MD, MS, Associate Professor of Epidemiology and Public Health at the University of Maryland School of Medicine (UMSOM). Dr. Morgan analyzed data on more than 14,000 patients from three UMMS hospitals using this special predictive score to determine the likelihood these patients would be readmitted.

The research, published in the journal *JAMA Network Open*, could help set the stage toward improving patient care and avoiding returns to the hospital.

"A significant proportion of readmissions may be preventable with better planning and follow-up for how the patient would transition back into the community," said Dr. Morgan.

Readmissions occur for almost 20 percent of patients hospitalized in the United States and are associated with patient harm and expenses. Furthermore, rates of unplanned readmission within 30 days after discharge are used to benchmark a hospital's performance and quality of patient care. Nevertheless, studies have shown that clinicians are poorly equipped to identify patients who will be readmitted, and many readmissions are thought to be preventable.

"If hospitals can better target time and money in planning for discharge to home, then patients may not have to come back to the hospital, with the harm sometimes associated with hospitals, including risks for infection, falls, delirium and other adverse events," said Dr. Morgan.

Using Health Data and An Algorithm

Machine learning is widely used to make predictions about the future, based on a set of computer algorithms that analyze massive amounts of data. The algorithms form what is known as a neural network, modeled loosely after the human brain, to recognize and learn from patterns. In

the realm of hospital patient care, the increased adoption of electronic health records makes it possible to apply machine learning techniques to health care data.

Existing readmission risk-assessment tools, including the LACE index, the HOSPITAL score and the Maxim/RightCare score, look at a limited set of variables for each patient, such as length of stay in a hospital, type and severity of admission, types and amounts of medications, other chronic conditions a patient may have, and previous hospital admissions.

One of the study's co-authors, William Bame, a Senior Data Scientist at UMMS, designed a neural network to mine thousands of health data variables in real time. The system then calculated a score to predict a patient's chance of returning after hospital discharge.

This experimental B score algorithm was individualized for each of three University of Maryland Medical System hospitals in different settings, after initially evaluating more than 8,000 possible data variables from September 1, 2014 through August 31, 2016. The final machine learning model drew from 382 variables, including demographics; lab test results; whether the patient required breathing assistance; body mass index; affiliation with a specific church; marital status; employment; medication usage and substance abuse.

Morgan and colleagues compared the B score readmission risk ranking to actual readmissions at the three hospitals, and to the predictions scored by the other programs. Across the three hospitals, despite the different settings, the B score overall was better able to identify patients at risk of readmission than other scores. It was most accurate among patients at highest risk. Patients scoring in the top 10 percent of B score risk at discharge had a 37.5 percent chance of 30-day unplanned readmission. Likewise, a patient in the top five percent B score at discharge had a 43.1 percent change of readmission.

"The widespread use of electronic health records has enhanced information flow from all clinicians involved in a patient's treatment," said UMSOM Dean E. Albert Reece, MD, Ph.D., MBA, University Executive Vice President for Medical Affairs and the John Z. and Akiko K. Bowers Distinguished Professor. "This study underscores how patient data may also help solve the readmission puzzle and, ultimately, improve the quality of patient care."

More information: Daniel J. Morgan et al, Assessment of Machine Learning vs Standard Prediction Rules for Predicting Hospital Readmissions, *JAMA Network Open* (2019). DOI: 10.1001/jamanetworkopen.2019.0348

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