Computers match doctors in predicting patient discharges

October 14 2015

Credit: Anne Lowe/public domain

A computer can do as good a job of predicting how many patients will be discharged from a hospital unit on a given day as doctors and nurses can, according to new research from the University of Maryland's Robert H. Smith School of Business and Johns Hopkins University. In some cases, the computer does even better.

Accurate estimates of patient discharges are an important component of keeping costs down because they allow hospitals to make the most efficient use of resources—namely, hospital beds. In recent years, the push toward sound management of available beds has led to the introduction of morning "huddles" during which clinicians make their best estimates about which patients will be ready to leave at some point that day. The new study shows that computers can potentially replace, or at least supplement —thereby improving—the morning huddle.

Like doctors, the model used information available at 7 a.m. If the model continues to improve and gets adopted, says Sean Barnes, the study's lead author and an assistant professor of operations management at the Smith School. "Then we can minimize the time the clinicians spend thinking about operations and maximize the time they spend thinking about the treatment of patients."

One notable feature of the model is how few variables it uses: fewer than 30. They include such factors as how long a patient had been in the hospital, whether his or her status was "observational" (as opposed to formally admitted), and the day of the week. Also included were a patient's age, race, and gender and whether he or she displayed certain symptoms (chest pain, abdominal pain) or suffered from certain chronic conditions (congestive heart failure, chronic obstructive pulmonary disease).

Doctors, nurses, and other caregivers, in contrast, had full access to the patients' charts and recent medical orders—and of course could draw on professional lifetimes of medical expertise. "We think it's pretty neat that we can use less information and make predictions on par with what the clinicians are doing," Barnes said.

"This model would be easy to reproduce, because all the information we used is readily available in any hospital information system," Barnes says.

The researchers looked at one general medical unit in a mid-Atlantic hospital, monitoring some 8,000 patient stays over a 34-month period stretching from January 2011 into December 2013. Patients could be discharged at any time during the day; the model generated predictions both for 2 p.m. and the end of the day.

2 p.m. discharges were difficult for both the model (the paper describes two variations) and the clinicians to predict, but the model performed somewhat better. Overall, the model tended to be more aggressive than doctors in predicting whether a given patient would leave. But on what may be the most important measure, number of patients discharged at the end of the day, the model beat the doctors. It was also more accurate in ranking patients by readiness to depart.

To be clear, the model played no role in determining when patients would go; it didn't nudge them out the door: Rather, it predicted the decisions that doctors themselves would make.

At first, the researchers considered including many more variables, including medical orders (as when a patient is restored a standard diet after a restricted one, for example). But those orders didn't add much more predictive power and in some cases took a lot of time to collect and "code," so for this paper the authors omitted them.

The model's simplicity is part of its elegance. Still, Barnes said, it should be considered more of a "proof of concept" than a final, finished product, and the researchers will work on improving its accuracy. Using the model can help to focus attention on a certain kind of patient: Those on the cusp of leaving, or close to that threshold. Moreover, prediction can spur action: Identifying such patients might ensure that they receive the final tests or conversations that they need, before discharge.

While the study examined Medicare status as well as demographic variables including race, and gender, it did not uncover any patterns suggesting that poorer or non-white patients were nudged out of hospitals prematurely. In contrast, a 2012 study by Smith School researchers found that hospitals tended to discharge some surgical patients too quickly when they were crowded. That led to the re-admission of those patients, for expensive further treatment.

More information: "Real-Time Prediction of Inpatient Length of Stay for Discharge Prioritization," by Sean Barnes, Eric Hamrock (Johns Hopkins), Matthew Toerper (Johns Hopkins), Sauleh Siddiqui (Johns Hopkins) and Scott Levin (Johns Hopkins), has been published online in advance of print in the *Journal of the American Medical Informatics Association*.

Provided by University of Maryland