

Researchers develop new tool to predict early ICU readmission for surgical patients

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Health care providers can identify which patients are likely to be readmitted to the surgical intensive care unit (SICU) within several days of leaving it by using just seven common variables that almost all critical care patients have measured, according to study results presented at the 2016 Clinical Congress of the American College of Surgeons.

Researchers from the University of Utah School of Medicine, Salt Lake City, developed a [risk](#) prediction tool, called a *nomogram*, that uses a scoring system to determine a patient's risk level for returning to the SICU within 72 hours after discharge from the unit.

"A [nomogram](#) simplifies the process of calculating risk and could easily be used by a clinician in the SICU without the need for a complex equation," said the study's presenting author, Luke A. Martin, MD, a general surgery research resident. There are several benefits to evaluating the possibility of early unplanned readmission to the SICU, which Dr. Martin called an established measure of postoperative care quality.

"If we can recognize that a patient's condition is at risk of deteriorating before it happens, we may be able to prevent it," he said. "And preventing ICU readmission avoids transitions to and from the SICU and the general inpatient ward. Transitions of care are episodes when errors and adverse events often can occur."

Additionally, ICU readmissions are costly for both patients and

hospitals. The Centers for Medicare and Medicaid Services reduces reimbursements to hospitals that have excess 30-day readmission rates, including ICU readmissions.

For the study, Dr. Martin and his colleagues evaluated the medical records for all SICU admissions at the University of Utah Hospital between April 2010 and July 2015. From among 3,109 SICU admissions, the investigators found that 141 patients were readmitted to the SICU within 72 hours of discharge.

Patients had undergone the following types of operations: trauma (43 percent of patients), general surgical (34 percent), vascular (14 percent), and transplant (9 percent). Most cardiac surgical procedures were not included in this group because the hospital has a separate cardiac ICU, Dr. Martin noted.

The researchers studied 179 possible risk factors—patient demographic factors and clinical and laboratory data collected in the SICU (the most recent measurement before the initial SICU discharge)—that might contribute to SICU readmission. Using statistical methods, the investigators reduced that number to the following seven risk factors:

- patient age
- respiratory rate (breaths per minute)
- history of atrial fibrillation (a blood rhythm abnormality)
- history of renal insufficiency (poor kidney function)
- level in the blood of urea nitrogen (a measure of kidney function)
- blood glucose (blood sugar) level
- level of serum chloride (a blood electrolyte that helps maintain the proper acid-base balance in the body, needed for many aspects of health)

The research team assigned points to each risk predictor based on how

much each contributed to risk. Larger values (higher respiratory rate, higher blood glucose level, and so on) indicated a greater risk for readmission. For instance, up to 30 years of age was assigned 0 to 8 points; 31 to 60 years was 9 to 15 points; and 61 to 100 years was 16 to 27 points. Points for each predictor were summed and displayed graphically on a nomogram.

A total of 40 points (the minimum that an ill SICU patient would likely have, Dr. Martin explained) to 79 points represented a 1 to 5 percent chance, or low risk, for SICU readmission, according to the study abstract. A 6 to 20 percent chance—medium risk—of readmission was 80 to 114 points, and a 21 to 50 percent chance—or high risk—was 115 to 150 points total.

To validate the accuracy of their predictive nomogram, the researchers tested it using data from 577 additional SICU patients, who were not among the admissions data used to develop the model.

"The risk prediction model has a moderately good ability to predict readmission to the surgical ICU and takes only about a minute to calculate for each patient," Dr. Martin said. "This nomogram allows for a quick and easy assessment of the surgical ICU patient's readiness to leave the SICU."

A surgeon or other health care provider in the SICU might use the nomogram results to try to reduce a patient's readmission risk, according to Dr. Martin. For example, providers might extend a high-risk patient's SICU stay, send the patient first to a stepdown unit for intermediate care, or prescribe close monitoring of the patient after discharge to a general inpatient floor, he said.

Because the study patients were "a fairly diverse spectrum of surgical patients" who went to the SICU postoperatively, Dr. Martin said he

believes their study results are generalizable to other hospitals' SICUs.

He said the researchers currently are studying the accuracy of the nomogram by specific category of surgical procedure, starting with vascular surgical procedures.

Provided by American College of Surgeons

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