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### Early Warning for Sepsis

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#### Sepsis Care Faster, Reduced Mortality Suggested

Harnessing vital signs information in the electronic health record (EHR) to develop an automated early warning and response system for sepsis led to a marked increase in sepsis identification and care, transfer to the ICU, and an indication of fewer deaths due to sepsis. A study assessing the tool, developed by Penn Medicine experts, is available online in the *Journal of Hospital Medicine*. It is believed to be the first published study implemented in a multi-hospital system.

The prediction tool uses laboratory and vital sign data in the EHR of hospital inpatients to identify patients at risk for sepsis. When certain data thresholds are detected, the system automatically sends an electronic communication to physicians, nurses and other members of a rapid response team (RRT), who perform a bedside evaluation and take further action if warranted.

The study developed the prediction tool using 4,575 patients admitted to the University of Pennsylvania Health System (UPHS) in October 2011. The tool was validated in a preimplementation period from June to September 2012, when data on admitted patients was evaluated and alerts triggered in a database, but no notifications were sent to providers on the ground. Outcomes in that control period were then compared to a post-implementation period from June to September 2013. The total number of patients included in the pre- and post- periods was 31,093.

In both the pre- and post-implementation periods, four percent of patient visits triggered the alert. Analysis revealed 90 percent of those patients received bedside evaluations by the care team within 30 minutes of the alert being issued. In addition, the researchers found that the tool resulted in:

- A two to three-fold increase in orders for tests that could help identify the presence of sepsis;
- A 1.5 to two-fold increase in the administration of antibiotics and intravenous fluids;
- An increase of more than 50 percent in the proportion of patients quickly transferred to the ICU;
- A 50 percent increase in documentation of sepsis in the patients' electronic health record.

The study found a lower death rate from sepsis and an increase in the number of patients successfully discharged home, although these findings did not reach statistical significance.

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*ICU Management* spoke to lead author, Craig A. Umscheid, MD, MSCE, director of Penn's Center for Evidence-based Practice MD, to find out more.

## **You suggest that the EWRS could help triage patients for appropriateness of ICU transfer. Could you expand on that?**

The mortality of those patients flagged and transferred to the ICU was much higher than those that were not. This suggests that this tool could have a purpose beyond what was originally planned. ICU beds are always at a premium, and as the literature demonstrates, the longer the delay in transfers to the ICU for patients who need it, the higher the risk of mortality. The potential purpose for this tool is there, but we haven't used it in that capacity yet.

## **Will EWRS improve detection of sepsis or are other tools/ processes as important?**

Our project was very much focused on detecting sepsis as early as possible. After the warning is triggered that a patient may have sepsis, there is a process in place that the "covering providers" (a nurse, an intern and the rapid response coordinator) go to the bedside and write a note after that encounter. It could be argued that an EWRS improves documentation and coding of sepsis, as well facilitating detection and care of patients with sepsis. In fact, the number of patients coded with sepsis increased during the intervention period.

## **Do most commercial EHR systems have this automated alert system available? How widely are they used?**

Most large EHR systems have institutional users that have created these kinds of alert tools and shared them. There are a number of systems out there. However, most systems are only examining the test characteristics of the system and are not implementing them in practice.

## **Is the EWRS best used with a rapid response team or coordinator, or could it be used with existing staffing practices?**

It can be used with existing staff, with an attending physician and a nurse. However, the benefit of a rapid response team (RRT) is the experience they build up. There are fewer than 200 triggers a month, so most attending physicians and nurses would not get more than 1-2 a year for each hospital. However, the RRT is present for each of these alerts, and therefore they build up experience and practice.

## **How can hospitals avoid alarm fatigue?**

We need a balanced view. Having alerts is not positive if they become "guard rails". This is probably not so much of an issue when it comes to identifying sepsis early.

## **What further research is planned?**

Now we are spending time on improving the prediction rules that drive this system. We are working on harnessing big data and using machine learning approaches to make predictions.

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