# Can vital signs predict cardiac arrest on the wards? Yes, but...

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Researchers at the University of Chicago Medical Center attempting to identify the vital signs that best predict those hospitalized patients at greatest risk for cardiac arrest found that a composite index used in some hospitals to activate a rapid response team and by emergency room physicians to assess the likelihood of a patient dying was a better predictor of cardiac arrest than any single vital sign.

However, because the composite index known as Modified Early Warning Score (MEWS) included vital signs that are poor predictors of cardiac arrest, while excluding others, the researchers called for the development of a tool specifically to predict cardiac arrest risk.

"Rapid response teams have not demonstrated the improvements in patient outcomes that we hoped for, in part because some of the patients who may benefit the most are not identified," said the principal investigator of the study, Matthew Churpek, MD, MPH, a pulmonary and critical care fellow at the University of Chicago. "An objective, evidence-based tool would provide the best way to accurately detect these patients and potentially improve their outcomes."

Dr. Churpek and his colleagues will present the results of their study, "Can Vital Signs Predict Cardiac Arrest on the Wards?" during the ATS 2011 International Conference, in Denver.

The researchers performed a nested case-control study over the course of two years, matching each cardiac arrest patient to four randomly

selected controls who were patients in the same unit at the same time. Among the 83 cardiac patients and 332 matched controls approximately 75 percent were medical admissions, the rest surgical.

Case patients were significantly older (mean age 64 ± 17 vs. 60 ± 16; p= 0.03), hospitalized longer prior to suffering cardiac arrest (median 8 vs. 4 days; p=0.02) and more likely to have had a prior rapid response call (13 percent vs. 1 percent, p

On admission, the case patients and the controls had similar mean vital signs and MEWS, with two significant exceptions: case patients had lower diastolic blood pressure (70 ±19 vs. 75 ± 17) and higher respiratory rates (20 ±3 vs. 19 ±3, p=0.02).

The mean MEWS was significantly higher in patients who would suffer a cardiac arrest within 48 hours than it was for the study's controls, and the difference increased leading up to the event. Although the best predictor in this study, MEWS included variables that were not statistically significant, including temperature, minimum heart rate and systolic blood pressure.

Individual vital signs, including maximum respiratory rate, maximum heart rate, maximum pulse pressure and minimum diastolic blood pressure, were also found to be statistically significant predictors of cardiac arrest. None, though, correlated as highly as MEWS.

The predictive ability of the maximum and minimum vital signs and of MEWS was tested by receiver operating characteristic (ROC) curves, an analysis especially useful in comparing the accuracy of different diagnostic tests.

Although the MEWS performed better than any single vital sign, Dr. Churpek and his colleagues do not believe it is the optimal tool.

"Because current activation systems don't utilize the best vital sign predictors, they often suffer from poor sensitivity and high false-positive rates," explained Dr. Churpek. "This limits the effectiveness of the rapid response team, and the high false-positive rates can lead to 'alarm fatigue' and the wasting of hospital resources."

The creation of an evidence-based cardiac arrest prediction tool, he said, would decrease the false-positive rate and lead to a response system with a better chance of improving patient outcomes. Hospitals would no longer need to choose from the over 50 different published criteria, or make up their own, to determine cardiac arrest risk.

Dr. Churpek and his colleagues believe their study provides important direction to the future creation of an evidence-based system. Several variables, including diastolic blood pressure and pulse pressure, that they investigated are not included in most published rapid response team activation criteria but proved to have predictive ability.

He also noted that the MEWS was similar among patients upon admission but was significantly different 48-hours prior to the event, indicating that there is a window of opportunity for the healthcare team to intervene and improve patient outcomes.

"Rapid response teams are a complex and resource-intensive intervention, so providing evidence-based criteria for their activation is crucial," he concluded "Our patients will do better if we can detect who is at high risk early enough to intervene and prevent a cardiac arrest."

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