

# Industry Voices—How machine learning and predictive analytics prevented septic shock at Nemours Children's

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When you bring your loved one to the hospital, you expect them to get better, not worse.

But too often, we are failing at this crucial task. Too often, we hear about a patient admitted to the hospital who is seemingly doing fine, and then suddenly goes downhill. The question is “How did they get worse right under our eyes?”

How do we prevent someone from getting much sicker without us even realizing it?

Sepsis kills almost 5,000 children annually in the U.S.—more than cancer—and costs about [\\$7.3 billion for hospitalizations alone](#). This huge and growing burden is now the most expensive cause of hospitalization in the U.S., with a high fatality rate that makes early recognition of patient instability absolutely critical.

Innovation has finally caught up to this age-old issue by harnessing the power of predictive analytics. Three years ago, at Nemours Children's Health System, a multidisciplinary system-wide team built a sepsis response tool that capitalizes on the health system's technological resources.

Proprietary scoring criteria is built into the electronic health records to predict patient downturns before they happen. These stats are monitored by paramedics running the health system's Clinical Logistics Center, a virtual command post that monitors every child seeking inpatient care at our free-standing children's hospitals in Florida and Delaware.

Like air-traffic controllers peering into multiple video monitors, our team of paramedics and emergency nurses closely tracks color-coded vital signs in green, yellow or red to detect subtle changes in biomarkers that predict whether a patient is stable, declining or needs immediate attention. They triage alarms and can instantaneously initiate a rapid response team or even tap into a high-resolution audio/video connection, available in every room, to provide instant virtual care.

Machine learning and sophisticated algorithms that enable us to practice predictive analytics are not just aimed at speeding up our response to alarms. Our Clinical Logistics Center creates a smart support system that eases the alarm fatigue of nursing staff, acts as a fail-safe for patient care and can be a valuable planning tool to anticipate critical staffing needs in advance.

Nowadays, America's hospitals have sicker patients on the general floors, patients who 20 years ago would have been in the ICU. Many of them are existing in what one expert calls “a precarious state of pseudo-stability,” and most hospitals are unprepared when they unexpectedly deteriorate and need instant, life-saving therapies. Without rapid intervention, patients who go into septic shock have an overall mortality rate of more than 50 percent.

Since we set up our response system at Nemours, we have had no unexpected deaths due to sepsis, largely because no alarms go unanswered for more than 90 seconds and no patients can suffer a severe downturn without staff being quickly alerted. Overall, we have reduced medication errors through decision supports, improved patient and nurse satisfaction rates, and, most importantly, we have dramatically lowered the frequency of sepsis from 2 percent to .05 percent.

Recently, we were honored to be the only pediatric health system invited by the Centers for Medicare and Medicaid Services to participate in a national sepsis “listening session” among subject-matter experts and leaders in the fields of innovation, care delivery reform and implementation science. CMS's initiative is a most welcome development in promoting early identification of high-risk sepsis patients, speeding care delivery, and enhancing nutrition, mobility and other measures to improve quality of care.

Stakeholders in the fight against sepsis are encouraged by the emerging possibilities for using “big data” and artificial intelligence. CMS heard pleas for more funding towards awards and prizes that would foster these and other innovations. Participants called for raising community awareness and improving coordination between first responders and emergency departments.

With the backing of federal, state and local health officials, and the willingness to promote coalition-building, we can replicate and expand upon the efforts that we and other healthcare systems have launched. We can create a better system that can be a model for fighting serious diseases and for saving lives.