

## Remote ICU Monitoring Yields Dramatic Benefits

A system that allows for remote around-the-clock monitoring of ICU patients by intensivists has yielded dramatic clinical and financial benefits at beta site Sentara Healthcare, Norfolk, Va.

The system, by VisICU, Baltimore, Md., combines telemedicine with a system that includes patient monitors, order entry, alerting, on-line reference materials for the intensivist and data mining. Remote monitoring has been accepted by The Leapfrog Group as sufficient to fulfill its ICU patient safety standard.

Six months after going live, Cap Gemini Ernst & Young documented that the hospital had experienced a 17% reduction in both ICU and floor lengths of stay (LOS), a 20% increase in ICU cases due to the increased capacity created by the reduced LOS, and a 25% reduction in hospital mortality of monitored patients. There was no change in severity of illness as measured by the Apache system, developed by Apache Medical and now owned by Cerner Corp. Prior to the study, Sentara had no electronic ICU patient care system.

Gene Burke, MD, the Sentara intensivist in charge, said he is "absolutely certain" that Cap Gemini correctly documented Sentara's clinical benefits.

The technology installed easily, did not appear to be a major drain on IT, and is well-accepted by intensivists, he said. He called the project "the most exciting thing I've been part of" in 20 years as an intensivist. Dr. Burke said he has no financial relationship with VisICU.

For organizations considering similar projects, the obstacles will be mainly political and financial, he said. Sentara is hosting weekly site visits.

He said he was not permitted to disclose the total cost of the project, but it was in the millions. Because the system sets up a scenario of intensivists "looking over the shoulders" of other clinicians, it does open the door for political tensions among physicians, he said.

VisICU declined to say how much the program cost, and Sentara is sworn to secrecy. The Cap Gemini study appears to imply that the project cost about \$3 million. We ran that number by VisICU co-founder Brian Rosenfeld,

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MD, who didn't dispute it. However, he said that as a beta site, Sentara got an extraordinary deal.

Sentara physicians were initially put off by the notion that another physician would be checking their work, Dr. Burke said. What helped: a protocol that said that the patient's personal physician would have final say on patient care decisions. MDs were sold on the concept partly by their personal relationships with the intensivists who supervised the project, he said. Had the intensivists not already been known to Sentara physicians, the project would have been more difficult, he said.

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Cap Gemini found that Sentara reaped \$3 million in annual benefits from the project on two ICUs (a total of 16 beds) after subtracting all program costs. The benefits include both savings and added revenues that resulted from the clinical benefits mentioned above.

The savings include a 26% reduction in hospital costs for ICU patients, or a reduction of \$2,150 per patient, including a 4% decrease in ICU nursing hours per patient day and an 18% decrease in the cost of pharmacy, labs, supplies, therapies and other costs associated with taking care of an ICU patient.

Because of the reduced LOS, Sentara was able to accommodate additional patients, which resulted in a \$1.74 million increase in annual income.

VisICU paid for the study, but all data came from Sentara's electronic systems, not from VisICU, said David Plochers, MD, who managed the financial analysis for Cap Gemini.

Dr. Plochers said that he personally, "criticized, audited and edited" all financial data that went into the study, and has a "high level of confidence" that it correctly states the financial benefits. He noted that it is highly unusual for an organization to realize significant, quantifiable benefits from a new technology without also having to absorb an incremental cost.

Patient rooms are wired with audio and video systems. Data from patient monitors is fed in real time over T-1 lines to a remote monitoring centre. Using eVantage, as the software is called, the MD can:

- Review patient results and place and electronically sign medication orders (the system includes alerts for medication errors and conflicting lab values).
- Review trended results from patient monitor data (trending allows data that may be significant only in the context of a patient's history to be called to the MD's attention).
- Look up evidence-based algorithms for caring for critically ill patients. ICU data is held in a repository which Sentara expects to use to develop best-practice protocols.

Sentara's system currently runs stand-alone with duplicate manual data entry. That's not quite as bad as it sounds, since it is used to care for only 46 patients. Nonetheless, Sentara considers interfacing a priority, Dr. Burke said.


Sentara's project has grown since the initial benefits study. Today, one MD remotely monitors the 46 patients at three hospitals. A new version of the eVantage monitoring system will increase capacity, but Dr. Burke said he doubts that one MD will ever be able to monitor more than 75 patients.

The new version, which was not live at Sentara when Dr. Burke was interviewed, also dramatically improves the patient care software, he said.

Sentara stations its intensivists at a remote location so they will not be tempted to abandon their posts if they see a patient in real trouble, he said.

The MD checks patients one by one, by activating audio and video feeds from a patient room, reviewing patient records and adjusting

orders as needed. Often an ICU nurse works with the intensivist, performing hands-on assessments. The system also scans patient vital signs and sounds an alarm if something goes awry. The system is popular with intensivists in that they avoid being run ragged to respond to ICU emergencies in various parts of the hospital. Sentara Norfolk General, for example, has five ICUs.

The intensivist rings a bell to announce that he is about to activate the camera in a given room. If the camera is already activated when a non-patient walks into the room, the physician speaks. The protocol helps relieve nursing concerns that "Big Brother" was secretly peeping over their shoulders. It also warns visiting family members that they are not "alone" with the patient. 

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