

Advanced ICU Offers a Virtual Eye on Patients

MetaVision Helps Hospital Keep a Constant Vigil on Patients

As director of critical care services at Lehigh Valley Hospital in Allentown, Pa., Dr. Steve Matchett knows that he faces a chronic manpower shortage and must marshal his resources wisely to maintain quality health care. He just marshals them virtually.

Since 2004, Lehigh has operated the Advanced ICU. Patients are monitored by machine, with software that weaves medical data into one comprehensive record, and data is transmitted to doctors at a control room several miles away. The doctors then send instructions back to nurses and other staff on-site, or even talk with family members who are present in the patient's room.

Telemedicine itself, of course, is not a new concept; doctors have zipped digitized medical images across data lines for years. But Lehigh's ICU goes beyond that, networking various medical devices and databases into one detailed history of a patient. Doctors at the far end of the data line can explore that history as they see fit and complement that picture with fresh information from two-way cameras and microphones focused on individual beds.

"We've built our system on the medical record ... and then layered the telemedicine piece on top of it, rather than just putting the telemedicine in the ICU and letting the ICU function with whatever workflow system they had," Matchett said. "For us, this was a much more sweeping change in the way we deliver services."

The hardware for the system was straightforward, Matchett said. Lehigh purchased audiovisual equipment (including high-resolution cameras that can even depict dilation of a patient's pupils) from Vistacom Information Systems, in Exton, Pa. Medical devices—from heart monitors to urinalysis machines to thermometers—came from a variety of manufacturers.

Instead, Matchett said, the principal challenge was to find the right underlying software to interface with all those medical devices and systems and to create the virtual patient record.

A priority was to integrate that software with Lehigh's existing physician-order-entry application, LastWord, from IDX Systems, to avoid the cost of purchasing another new system.

That quickly narrowed the field to a few medical-software vendors, and Lehigh ultimately approached IMDsoft, in Needham, Mass. IMDsoft's MetaVision ICU product works by supplying device drivers for medical equipment and mapping data points against a library of events that Lehigh wants to monitor—say, tracking both blood pressure and temperature and alerting doctors when both fluctuate at once (indicating more serious trouble than if either vital sign fluctuated alone).

MetaVision's flexibility allows hospitals to integrate more pieces of equipment into the system simply by building the right data driver. Lehigh, for example, integrated its medical lab so that doctors can see the results of blood work in a patient record within 90 seconds of lab technicians finishing the job. Doctors can also create "algorithms" for each patient, stringing together scenarios that merit various levels of attention from nurses or doctors.

Software aside, the most impressive part of Lehigh's ICU is the control room: eight high-resolution monitors in a two-person workstation manned 24 hours a day by a critical-care doctor and an ICU nurse using another IMDsoft application called MVcentral.

How does it all work? Nurses and staff physicians routinely stroll the floors of Lehigh's ICU wards (the hospital has since expanded its Advanced ICU to 72 beds in three separate buildings) to monitor patients in their rooms. A PC sits at each bed, where medical staff can enter their observations. That information, along with data from a patient's medical devices, is fed into a server that compiles the virtual record for that patient.

Assuming the patient is doing well, that virtual record zips off to the ICU control room and waits for review by the critical-care technician. When the technician

pulls up the record on one of the monitors, cameras automatically queue up a real-time image of the patient that the doctor can study while reviewing the person's health. The doctor can then send further instructions to the ICU nursing station or to the PC at each Advanced ICU patient's bedside, all electronically.

More important is how MetaVision works when a patient's recovery goes wrong. When a troubling event happens, MetaVision alerts doctors in the control room to examine the patient's file immediately. Those doctors can tap into a trove of historical information all tied in to MetaVision: medication records, X-ray images as far back as 1994, notes from previous admissions and more. If necessary, they can talk with nurses in the room via a two-way microphone.

The Advanced ICU is not cheap: Capital costs were \$1.9 million, and operating costs run approximately \$1.5 million annually, Matchett said. He also said he is confident that higher patient throughput still translates into cost savings for the hospital, although an exact number hasn't yet been tallied.

More important are the improved patient outcomes. Overall patient mortality fell from 16 percent in the third quarter of 2004 to 10 percent by the first quarter of 2005, Matchett said. And because nurses now have fewer paperwork chores, they have approximately 75 minutes more free time per 12-hour shift to devote to patient care. (Lehigh deliberately decided not to cut staff once its nurses had more free time, so as not to have a negative impact on patient care.)

And what about the added layer of distance between patient and doctor? Matchett insists that hospital visitors don't consider the technology a step toward more impersonal care. Rather, he said, both patients and families appreciate the system because they can always reach a doctor even in late hours, rather than wait (possibly for hours) for an attending physician to come by to follow up and answer questions. ■