**A SPECIAL TWO-PART REPORT ON IT & HEALTH CARE**
**PART 1: MOBILE MEDICINE**

# Wireless: Just What the Doctor Ordered

As medical records go electronic, hospital CIOs are finding that wireless networks can get the records to where the doctors and nurses want to use them. CIOs in other industries would do well to watch and learn.
**BY GALEN GRUMAN**

**Executive Summary:** Wireless systems, especially those based on the 802.11b standard (also known as Wi-Fi), are becoming more widely deployed in hospitals today—where patients and medical staff are constantly moving and it's difficult for staff members to take a break to enter patient data and test results or to order tests and medications. This new conduit lets staff access and update records and make orders at the point of care. That reduces transcription-related errors and delays, and fits into doctors' and nurses' workflow. The systems have proven relatively inexpensive to deploy, costing a few percent of the overall outlay for a facilitywide electronic medical records system. Several early adopter hospitals share lessons learned in securing the sensitive patient data, dealing with network performance problems such as delays between access points and dropped connections, and supporting multiple types of wireless access devices.

**ELECTRONIC MEDICAL RECORDS** systems top hospital CIOs' agendas because they can prevent errors, enforce standards, make staff more efficient, simplify record keeping and improve patient care.

But the systems deliver only when doctors, nurses and other medical staff actually use them.

In hospitals, where patients and medical staff are constantly moving, it's difficult for staff members to take a break to enter patient data, or to order tests and medications. So, even though many hospitals began installing data-access terminals a decade ago at nurses' stations and near hospital wards, staff members still tend to scribble notes a few hours before they enter data and place orders. That can lead to transcription errors, delays in test results and incomplete records when other staff look up a patient's status.

Health-care information has to be available anytime, anywhere. "We didn't see any other way to do it other than wireless," says Tim Stettheimer, vice president and CIO of St. Vincent's Hospital in Birmingham, Ala.

"If you're not entering data as you go, a lot of efficiency is lost. With paper, it sits in a pocket for an hour, then sits in a bin," says Dr. Andrew Thomas, assistant dean and internal medicine professor at Ohio State University (OSU) Medical Center, a teaching hospital in Columbus, Ohio.

That's why wireless systems, especially those based on the 802.11b standard (also known as Wi-Fi), are more widely deployed. This new conduit lets staff access and update records and make orders at the point of care. That reduces errors and delays, and fits into the doctors' and nurses' workflow. And they're inexpensive to deploy, costing a few percent of the total budget of an electronic medical records (EMR) system. Plus, they can be a springboard to services such as communications badges and mobile sensors. (See "Where Health Care Leads the Way," right.)

## More Patient Face Time

R. Bruce Brown, a physician at St. Vincent's, says he believes using mobile technology to access and update medical records will help him spend more time with patients.

Before Brown began using a wireless wearable computer from Xybernaut, complete with an LCD screen mounted on his glasses, he commuted between his patients and hills of paper. "I used to work on a stack of papers, then see the patient, then go back to the patient's stack of papers," he says. "I spent only 20 percent of my time on a patient in front of me." With wireless systems, where he can access records and order needed tests while still with the patient, "I expect that to increase to 50 to 60 percent." Brown has also seen the cycle time per patient—from diagnosis to test result and later to delivery of treatment to the patient—shrink from 24 hours using the old-fashioned paper methods to four or five hours with the combination of EMR and wireless systems.



"If you're not entering data as you go, a lot of efficiency is lost," says OSU Medical Center's Dr. Andrew Thomas.

Wireless makes productivity sense whenever workers are mobile and work with time-critical data, says Chris Kozup, a Meta Group analyst. And, notes Kathryn Korostoff, president of consultancy Sage Research, the use of wireless can also relieve staff constraints. "Hospitals are always understaffed," she says. "In the face of economic hardship, wireless has a payback scenario. It's not a huge amount of capital investment. They're clearly saving time for doctors and nurses, which is their greatest asset." For the users, "it really becomes a part of their job satisfaction—it relieves stress. It has a major effect on how people are satisfied with their job," she adds.

However, wireless and mobile technologies have supported mission-critical needs only in the past few years, and hospitals deploying the new systems continue to wrestle with the best ways to deploy them and integrate them into their overall IT structure. While wireless network security has become a straightforward issue for CIOs to address,

several other technology hurdles continue to require experimentation and greater heterogeneity than many IT departments would prefer to support.

Hospitals are early wireless adopters, and the issues they face and the benefits they achieve apply to any industry—professional services, retail, inventory warehouses—that has mobile workers within a building, Korostoff says.

## At the Core: Laptops on Carts

Hospitals' wireless deployments typically involve setting up 802.11b access points in patient wards, treatment facilities and in corridors in which patients travel. Wirelessly enabled laptops affixed to carts are rolled from bed to bed and ward to ward as needed so that doctors and nurses can access medical records and order tests and medications wherever they are.

Usually, these shared laptops complement existing wired desktops installed at nurses' stations and other locations during earlier-generation attempts to digitize medical records. Wireless tablets and sometimes PDAs often supplement these laptops, either to provide staff with a dedicated device or for use in other medical activities.

Some hospitals keep the mix of devices limited, while others let doctors choose almost anything to encourage usage. "We have not found there is one perfect answer to how people access information: wired PCs, laptops on carts, tablets, PDAs," says St. Vincent's CIO Stettheimer.

OSU Medical Center's Dr. Andrew Thomas is getting efficiency through Enterprise Systems Director Phil Skinner's (above) wireless systems.

Consider four hospital deployments:

■**OSU Medical Center** has more than 1,100 medical staffers who care for 33,000 inpatients and 625,000 outpatients every year. It has set up 220 access points and 180 notebooks on carts. Although OSU hasn't tracked its wireless costs separately, Enterprise Systems Director Phil Skinner figures it costs $600 per device—whether it's a PDA, access point or wireless card—including setup, software and hardware.

■**St. Vincent**'s has a similar setup of 168 access points and 18 notebooks for its 600 medical staff members (on average, 40 people per day access the wireless network). The hospital cares for 19,000 inpatients and sees 140,000 outpatients every year. St. Vincent's has three tablets dedicated to registration at patient beds, so patients don't

have to wait in a lobby, as well as 12 wireless notebooks used by technical and administrative staff.

This fall, St. Vincent's will install an electronic order-entry system for physicians, which will be available over 100 wireless PDAs and 60 tablets, as well as more than 200 existing wired bedside computers. Stettheimer figures the wireless infrastructure cost about $1 million, out of the hospital's $45 million investment in IT.

■**Memorial Medical Center** in Springfield, Ill., a teaching hospital affiliated with Southern Illinois University, also took this route for its wireless deployment. The hospital, whose 550 physicians care for 22,000 inpatients and 450,000 outpatients, has about 150 access points for an initial six notebooks. CIO O.J. Wolanyk expects the number to grow dramatically after the first users talk about their experiences and as the hospital runs out of room for stationary terminals. The wireless system cost $900,000 out of the three-year, $30 million EMR effort.

■**St. John's Hospital**, a block away from Memorial, is focused on using wireless handheld scanners to record medication delivery; patients' wristbands, drug labels and nurses' badges are all bar-coded. A nurse scans all three so that the system can immediately track which nurse gave which patient which medication at what time, says IS Director Gordon Lashmett. St. John's is implementing a wireless system like Memorial's while it also completes its EMR rollout.

The common theme: inexpensive records access. "The investment is not atrocious," says St. Vincent's Stettheimer. "We take the Wal-Mart approach: It must be affordable and present benefits up front, so it also usually has to be modular, since health budgets are very tight."

Despite these fiscal requirements, St. Vincent's has extended the wireless network to cover the entire hospital, including the wing housing doctors' offices (already wired for Ethernet connections). Memorial originally planned on having 802.11b wireless access in just a few locations that were difficult to wire or where staff was very mobile, such as in patient wards, but Wolanyk argued that it made more sense to make the entire hospital wireless—including the parking structures and cafeterias—so that doctors and nurses can access information anywhere.

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>
> -ST. VINCENT'S CIO TIM STETTHEIMER

## Deployment Hurdles
Deploying wireless laptops has its challenges. Here's a rundown:

**1. Battery life.** Surprisingly, security and network management don't top the list. Battery life does, whether that means a laptop, a PDA or tablet computer. "It's hard to replace batteries a lot—charge, drain, recharge," notes OSU's Thomas. Worse, staff members tend not to notify IT if a laptop battery is drained or if the computer is not working, since

the laptops are shared with 40 other users and thus no one's direct responsibility. To encourage staff members to plug notebooks into outlets to be recharged, OSU will raise the outlets' height as it remodels units, he says.

Battery life is also an issue for PDAs, which usually can't be plugged in to recharge. Still, says St. Vincent's Stettheimer, some physicians take them and live with the four-hour battery times.

**2. Security and network management.** The typical IT concerns of security and network management are largely handled by the current generation of wireless routers and gateways. "Wide area wireless doesn't require that much expertise. The device is doing the network implementation," notes Mark Lowenstein, head of consultancy Mobile Ecosystem.

That doesn't mean hospitals simply plug in access points. Instead, they connect access points via wireless routers such as those from Bluesocket, Cisco Systems, ReefEdge and Vernier Networks, as well as use management software such as those from Wavelink and XcelleNet. And they implement a host of access controls: virtual LANs, policies for user IDs and passwords, authentication tools such as MAC addresses (the unique media access control ID for each device on a network), the 802.1x wireless authentication standard, and basic key-oriented encryption such as the wired equivalency protocol (WEP). Some hospital network managers also use intrusion detection software and hardware.

**3. Network performance.** Even with security vigilance, traditional network implementation issues remain. For example, the use of routers and virtual LANs can introduce some delays as users roam among access points, notes Stettheimer: Smaller devices such as PDAs that have less powerful radios to save on battery life are more likely to drop connections as a user roams, he says, while some access points don't reliably forward user log-in information to the next access point as the person roams.

Reconfiguring access points' radio power levels solved the first issue, while upgrading access point firmware addressed the other. Stettheimer's staff also had to adjust LAN settings to optimize traffic between the wireless and wired segments to prevent signal gaps that caused firewalls to reject some roaming users.

Ironically, it's the use of standard network security tools that can create hand-off issues among wireless access points, says Meta Group's Kozup. The 802.11b standard allows for and enforces efficient roaming, he says, but the use of security mechanisms separates the unified 802.11 networks into segments. The need to reauthenticate users when they pass from one network segment into another can lead to service disruptions. Some of this may get simpler as wireless standards are updated, Kozup says.

**4. Access-point placement.** This is not so much a hurdle as an important consideration. Wolanyk of Memorial Medical says he originally thought he would need 300 access points to provide wireless network coverage. A radio-placement consultant helped him cut that in half, and in the process paid for its fee, he adds.

## Not Ready For Prime Time

Tablet PCs and slate computers are all on hospitals' radars because they are most akin to familiar notepads, but none are yet appropriate for deployment.

"We looked at Fujitsu and ViewSonic slates, but the battery is gone in two hours," recalls OSU's Thomas. "When the battery died, you had to reload the drivers for the device because everything is in memory."

St. Vincent's is testing 20 tablets from different manufacturers. Whatever tablets Stettheimer selects, he will not store data on them, even if he takes advantage of their processing power to offload work from the servers. That's already the policy for PDAs: no data stored on the devices. Instead, he uses XML on the handhelds to query the EMR system for information that is read-only on the device screen.

**Handhelds Across the Ward**

A hospital installs docking stations so medical students can update data on their PDAs

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## Ongoing Experimentation

Wireless technology is still new and evolving, so hospital wireless systems—just like their EMR systems—will evolve for years, and hospitals will choose different paths for their deployments.

"We're right there on the edge. We can see it, but it's not quite there," says Stettheimer about personal hospital information technology.

Meanwhile, doctors are used to changing their diagnostic technology annually, St. Vincent's Brown says. At the same time, a more technically savvy crop of doctors is entering the field, adds Brown, who prides himself on finding technology for doctors faster than his IT department. (OSU, for example, will give entering medical students the new Palm Tungstens this year, mostly to try out the new audio capability for dictation.)

It will take an openness to experimentation by both users and IT managers to ensure that wireless and mobile technologies deliver on their promise in today's increasingly IT-based medical practice. **CIO**

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