

# Access Data from Anywhere With Handheld Devices

**A**t a recent medical conference, Dr. Peter Kaufman, chief medical officer of DrFirst, a Rockville, Md., company that produces software for electronic prescribing, observed several physicians going to Internet kiosks during breaks, not to surf the Web or even to fire off a quick e-mail or two. They went to the kiosks to process patient requests to refill drug prescriptions—which they did in a matter of seconds.

**Remote access to electronic data from the office via a secure Internet portal “lets you go out of town and not feel like you are neglecting your patients,” says Dr. Peter Kaufman, chief medical officer of DrFirst, a Rockville, Md., company that produces software for electronic prescribing.**

This remote access to electronic data from the office “lets you go out of town and not feel like you are neglecting your patients,” Dr. Kaufman says.

“Remote access is a big crowd pleaser,” says Dr. Paul C. Tang, chief medical information officer (CMIO) for the Palo Alto Medical Foundation, a multi-specialty group in Palo Alto, Calif.

And, says Dr. Jonathan Leviss, medical director for Andover, Mass.-based systems integrator Sentillion, “It makes almost limitless the degree to which a physician can interact with the information systems in a hospital.”

With a well-designed physician portal, a doctor working outside the hospital or clinic can tap into the institution’s databases from any computer in the world that has an Internet connection and a Web browser to view electronic health records (EHRs), test results, medication lists and even X rays. “We make it easier for them to access that data across all those systems,” Dr. Leviss says.

The current situation, though, with perhaps four of every five hospitals in the country lacking EHRs, is that most sites do not

offer their doctors such luxuries.

“I’ll see a patient who was in the emergency room two days ago,” says Dr. Levis, who also practices internal medicine at a community health center in West Warwick, R.I. “The patient is able to give me what they recall about the information. The reality is I need to see the electrocardiogram. I need to see the lab results.”

Because the hospital knows him and the local health center, someone from the ER will call the clinic and arrange to fax the results in such cases. “But that could be three hours. And sometimes that’s insufficient for the patient to be able to remain there,” Dr. Levis says.

**Even if both the ER and the practice have electronic records, it’s unlikely the two systems are compatible. The best the practitioners can do is to rely on state-of-the-art technology, circa 1987. “You call and you ask for information to be faxed,” says Dr. Jonathan Levis, medical director for Andover, Mass.-based systems integrator Sentillion.**

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“That’s essentially the modus operandi at most sites. You call and you ask for information to be faxed,” says Dr. Levis. “It’s

inconvenient; it’s costly in terms of personnel.”

There also may be security and privacy issues, depending on where the receiving fax machine is located and how accurately the sender punches in the digits. “There is always the concern of sending something to the wrong number. You can’t control these things,” says Dr. Levis.

And the information often is incomplete. “When you give someone a set of data, if you fax someone chemistry lab results from the blood test, that’s very different than giving a physician access to a patient’s lab results,” Dr. Levis says.

For example, a physician outside the hospital may get a call from a nurse about a patient who already has been admitted or who is getting emergency treatment. “The nurse or the house-staff physician or another attending physician may tell you that the potassium value was 5.1 or the creatinine kidney test is 1.6. That’s very different from your being able to go in and scroll through two weeks’ worth of blood tests,” Dr. Levis explains.

To Dr. Leviss, anytime-anywhere access to an institution's computer system is more than just a tremendous time saver; it also affords the physician working remotely a complete view of a patient's health status.

"You can't ask someone to scroll through 30 days' worth of blood tests when they are reading you information and when they are faxing you information," he says. "However, when you are looking at a computerized database, when you are looking at a computerized lab system via the Internet, you can graph the results with the click of a mouse and see a 30-day result."

### **Decision Support Tools**

Mark Ecker, director of project management at Skyscape, a Marlborough, Mass.-based developer of healthcare software for handheld and mobile devices as well as for office PCs, says, "With our decision-support tools, the more remote you get, the more help you need at the point of care to make the right decision to practice good medicine."

In a previous job as CMIO for an integrated delivery system and an attending hospitalist physician at a teaching hospital, Dr. Leviss could log onto the facility's information system at any time. "I now had the list of patients that my team had admitted because they were assigned to me," he recalls.

"I had radiology results. I had laboratory results. I had medication orders. It allowed me to review this information so that when I then spoke to the resident who was running the service an hour later when they were on call, I already had a whole view of the patient that the resident didn't need to present to me. Now the resident and I could focus on management discussions," Dr. Leviss says.

"Before we did it this way, I would call, and the first thing the resident would do was present information to me. If we had four minutes on each patient, they had to give me what they thought was important, whereas, by my having access to everything, I got to see essentially everything they were seeing. It gives you more of a global view."

This sort of access can help hospitals and doctors alike better manage call schedules because physicians are able to check on hospitalized patients from any computer anywhere. "You will be

able to handle your patients more efficiently than your partner,” Dr. Tang says.

And the technology is significantly better than it was just a few years ago. Dr. Leviss recalls how around 2000 and 2001, vendors were demonstrating how they could send lab results and other bits of clinical information to pagers and other mobile devices such as cell phones. “The reality is, it was of limited value because, again, it would send one or two values when you had ordered 30 tests on a patient,” he says.

These days, the onus is on the remote physician to connect to a practice or hospital computer, but the payoff for taking this small step is much greater.

### **Virtual Private Networks**

Sometimes the doctor goes through a Web portal to view information specially formatted for that type of application, but many institutions are turning to the virtual private network, or VPN, which is a secure means of tapping into an organization’s computing system and databases from outside the physical boundaries of the network.

“A portal presents what’s just in the portal, whereas a VPN can emulate what the hospital can offer if you were standing in front of a computer in the hospital,” Dr. Leviss says.

The VPN is helping to quash a frequent refrain among naysayers that the Internet is not secure enough for transmitting sensitive healthcare information.

“[Security] is less of a concern for people now,” says Stephen Hau, vice president for marketing and business development and a co-founder of PatientKeeper, Boston, a developer of healthcare software for handheld computers. He cites VPNs, as well as the emergence of Internet standards such as 128-bit encryption over the last several years. The latter is the same technology that safeguards on-line banking and e-commerce sites on the Web.

“Remote access is a great tool to have,” says Jeffery Daigrepont, a health IT implementation expert for the Coker Group, a consulting firm based in Alpharetta, Ga. He advises that a VPN is the only way to protect medical data.

What’s more, a VPN can keep up as a hospital or practice adds more sophisticated technologies.

“As we are implementing more and more advanced clinical technologies, things like computerized physician order entry (CPOE), so much of what a physician does is really around orders,” Dr. Leviss says. “When you implement CPOE, you make it possible for the physician to have all those interactions with the nursing staff, respiratory therapy, with all the different providers in the hospital, from outside the hospital if they can access the system.”

This is important, he says, because he believes that communication with nurses is all about orders. “There’s lots of concern about verbal orders, for all the obvious reasons. People make mistakes when they hear each other talk and they write things down,” says Dr. Leviss.

“While there will always be verbal orders that will be needed,” he continues, “lots of verbal orders are because the physician is outside the hospital. They’ve just gotten a call from a lab and they’ve gotten a result from a culture and now they want to start antibiotics.

“That takes the doctor’s time to call, the nurses’ time or the clerk’s time to write the order down,” Dr. Leviss says, adding that the whole process depends on the person on the receiving end of the call to transcribe information accurately. This invites error and safety lapses.

Also, the physician could be calling in from a cell phone while navigating heavy traffic or otherwise preoccupied, and thus not completely focused on the patient’s condition.

“By automating these processes, by implementing tools like CPOE, and then providing the physician access to a hospital’s information system when they are outside the hospital, you can change all these practices,” Dr. Leviss explains.

Errors happen often in the writing and dispensing of prescriptions. Even though electronic prescribing might eliminate the possibility of a pharmacist’s not being able to read a physi-

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cian's handwriting, a system that lacks full automation remains quite fallible.

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**E-prescribing** still has some drawbacks because many scripts still get sent by fax to the pharmacy, even if the fax is computer-generated. No matter how legible and accurate the electronic script may be, someone at the pharmacy still must enter the data into the pharmacy's computer system, presenting another opportunity for errors.

into the pharmacy's computer system. The extra data entry presents another opportunity for errors, according to Dr. Eric Liederman, director of medical informatics for Kaiser Permanente HealthConnect, an initiative to integrate EHRs with scheduling, registration and billing services for the Oakland, Calif.-based healthcare plan.

"You've got to get over the efficiency hump," Dr. Liederman

says. This means direct electronic connectivity to the pharmacy of the patient's choice. It means that the physician would know before writing a prescription if the drug is on the patient's insurance formulary and could tell patients exactly what their out-of-pocket cost will be.

Two services, RxHub and SureScripts, are working to make vision a reality. RxHub, a company founded by the nation's three largest pharmacy benefit managers, provides real-time formulary reference services, specific to patients' health plans. SureScripts, a project of the National Association of Chain Drug Stores and the National Community Pharmacists Association, works with hospitals, medical practices, pharmacies large and small and e-prescribing technology vendors to create the type of two-way data exchange that will truly automate the prescribing process.

To date, SureScripts claims more than 100,000 physician-users, though the patient's pharmacy and health plan also must be on the system for there to be full electronic connectivity.

When the prescribing process is completely automated, the pharmacist does not have to call the doctor's office to ask the physician to reconsider a medication that might cause an aller-

gic reaction or a harmful interaction with another drug the patient takes. But Dr. Liederman cautions that drug-allergy interaction checking is “not so simple.”

“Interaction checking is only a benefit if alerts are specific and accurate,” Dr. Liederman says. He has seen instances of physicians’ overriding 80 percent to 90 percent of electronic warnings, mostly because of false positives. Too many alerts might cause a doctor to bypass the computer and go back to the old prescription pad.

## Electronic References

This is why doctors still rely on old standbys like the Physicians’ Desk Reference and the Merck Manual of Diagnosis and Therapy. But an increasing number of physicians are not riffling through thick, printed volumes anymore. They are getting the same information in electronic form, often on handheld computers called personal digital assistants (PDAs) or even cell phones—mobile devices that fit in a pocket, purse or lab coat.

PDA-based reference materials have been popular since at least 1998. Back then, applications were designed to be used offline. Today it is a much different picture.

“It’s not just a PDF of that book on a handheld. It’s a very sophisticated, repurposed version,” says Mr. Ecker. The data are the same, but the text links to other reference products.

“It’s not just a static, longstanding textbook, but it’s peer-reviewed, it’s the latest and greatest information and very much independent,” Mr. Ecker says. This system is updated at least quarterly. Skyscape provides access to electronic versions of nearly 300 professional and consumer health reference sources.

When connected by wireless network or the Internet to a hospital or practice system, the physician can verify drug formulary information that is specific to each patient, cutting down on the number of phone calls from health plans and pharmacies. “It saves the physician two or three phone calls back to get the script correct and saves the patient frustration, so it really just makes everything much, much better,” Mr. Ecker says.

Like many vendors of mobile applications, Skyscape has a partnership with an EHR producer, in this case, eClinicalWorks. The eClinicalWorks system has programmed into it a number of

hot links to Skyscape reference tools. If the physician is looking at the record but not completely comfortable with his or her particular knowledge of a condition, one click can bring up interactive reference material to help the doctor.

“If you are looking for aplastic anemia, you can just bounce very, very quickly among the products,” Mr. Ecker explains. This sort of dynamic electronic information can move a practice into evidence-based medicine, he says.

For example, the quick-reference Griffith’s 5-Minute Clinical Consult may help the physician develop a differential diagnosis. “Once you have decide what the disease state is, you can then pop open A to Z Drug Facts and, in context, if you are looking at aplastic anemia, it will open A to Z Drugs right to the point where here’s the particular pharmaceutical product to treat aplastic anemia,” he says.

“What we’re doing is saving the physician from going to five or six different reference books on his shelf or doing some research that would take half an hour to an hour to something that he can get to within one to two minutes in his hand, right there in front of the patient.”

“Physicians really have embraced mobile technology,” says Mr. Hau. “I don’t think that’s a surprise in some ways. If you think about it, in some ways, they are mobile professionals.” It is not unusual for a doctor making rounds in a hospital to walk three, four, even five miles a day.

“You can start with some users, unlike other projects, which require the entire institution to change their processes. With mobile technology, you can start with a group of physicians and roll out to more and more over time,” says Mr. Hau.

The Ohio State University College of Medicine and Public Health has taken that approach over the past five years, issuing PDAs to third- and fourth-year medical students and residents, adding one class each year until all house staff had the devices. Faculty were not required to carry PDAs, but school officials report that many attending physicians bought their own handhelds after they saw how useful the compact, mobile computers can be.

Literally hundreds of thousands of physicians already use ePocrates on handheld, portable and standard office computers for basic medication interaction and formulary information. A

free version currently indexes more than 3,300 brand-name and generic drugs and provides medical calculation tools and periodic news alerts. The price of free software is the occasional pharmaceutical advertisement. Subscription packages come with clinical guidelines, monographs for “alternative” medications and several other features. They also come without the ads.

Dr. Liederman says that ePocrates and UpToDate, an electronic collection of evidence-based clinical information for adult and pediatric primary care, infectious diseases and nearly a dozen specialties, are popular because they replace the thick compendia that doctors traditionally carried around with them, particularly when loaded onto PDAs.

Once informally known as Palm Pilots, from the name of an early model of PDA, the handheld computers have come down in price and grown in functionality over the years.

The Palm name endures as one of two popular PDA platforms, the other being Pocket PC. Palm devices run on an operating system called Palm OS, while Pocket PCs are powered by Microsoft’s Windows Mobile, formerly known as Windows CE.

The popular line of BlackBerry mobile e-mail appliances operate on a distinct platform from Research In Motion, the Canadian firm that created the devices, but BlackBerrys are communication tools first and PDAs second.

Palm used to command more than 80 percent of the physician PDA market. Today it’s about evenly split between Palm and Pocket PC, according to Mr. Hau. Palm offers simplicity of use, while the Windows-based Pocket PC tends to be more powerful, Mr. Hau says, though those distinctions are eroding as both technologies advance.

Increasingly, a Palm-based line of devices named Treo and Windows-powered “Smartphones” are combining features of a cell phone, PDA and mobile e-mail appliance into a single unit. Newer BlackBerry models also include phone and PDA functions.

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Mr. Hau says that a “growing minority” of customers are opting for all-in-one units. “It looks like Smartphones are very, very popular, and that certainly allows the physician to connect to information when they are outside the confines of the four walls of the hospital.”

Thanks to a recent partnership with GE Healthcare, some 13,000 physicians now access patient lists, scheduling and charge-capture functions of GE’s Centricity Physician Office practice management software on handheld computers and Smartphones, Mr. Hau says.

“Nowadays, as physicians are looking at what mobile technology can do for them, it’s very much about integrating to existing information systems,” he says. “As you support more and more of the work day, the PDA becomes more and more indispensable.”

### **PDA Limitations**

However, Mr. Hau and others do not consider the PDA to be a replacement for a full-featured computer yet, nor may they ever.

“The applications are not necessarily there,” says Mr. Ecker. While it is possible to run a full EHR on a handheld, the small size of the screen makes viewing a complete record a chore. PDA software companies instead are focusing their programming efforts on various EHR and workflow-management components and applications.

“While it is true that probably the majority are not using handhelds as a primary tool right now for electronic medical records and those types of things, it is beginning,” Mr. Ecker says.

“The PDA is very useful for a lot of things,” says Dr. Liederman. “You can look up and read monographs on a PDA.” They also are great for simple, low-volume test results, he says. “So it’s probably okay for a doctor’s office.”

In July 2005, Manhattan Research reported that the rate of physician e-prescribing on PDAs had quadrupled in just a year, probably because the handheld is much more efficient than a full-size computer for this particular task. “Physicians using the handheld platform write an average of 42 more prescriptions per week than physicians using e-Rx through the desktop or another platform,” states the Manhattan Research study.

Processing speed, memory and battery life have improved

since vendors started turning out PDA software for healthcare before the turn of the century, but the size of the screen remains a limiting factor. "The transaction capabilities are just too painful," Dr. Liederman says.

Another problem, according to Dr. Tang, is that PDAs and other handheld computers do not offer good access to the Internet, because of the tiny display and slow connection speeds. But the latter problem is rapidly disappearing.

Mr. Ecker, a microbiologist by training, talks about his background on the lab and diagnostic sides of medicine, and about moving into the technology business in the early 1990s to work on the development of laboratory information systems. "I very quickly realized that the information coming off the instrument

### **Report Challenges Hospital Cell Phone Bans**

One barrier to increased use of mobile technology is a common hospital policy that bars or restricts the use of cellular technology on the premises, ostensibly because the low-powered radio transmitters inside cell phones can interfere with sensitive medical equipment.

That argument may be close to drawing its last breath. A 2004 report on electromagnetic compatibility (EMC) and electromagnetic interference (EMI) in healthcare facilities challenged the wisdom of prohibitions on mobile phones and other wireless devices in hospitals.

According to a white paper issued by the Mobile Healthcare Alliance (MoHCA), a Washington-based group of mobile-technology advocates, a properly designed policy on wireless technology can help healthcare facilities prevent medical errors, save money and improve patient and clinician satisfaction. "With simple procedures, effective management and clear communications, a healthcare institution's well-coordinated EMC program can help to improve cost-effectiveness and provide patients with state-of-the-art healthcare that includes the safe co-existence of medical devices with wireless mobile technology."

MoHCA recommended against general bans on cell phones and wireless networks and suggested that hospitals consider controlling radio signals only in critical areas such as emergency departments and intensive care units. The group instead urged healthcare providers to develop sensible policies on wireless technology. "The key is to optimize EMC by minimizing emissions while maximizing the immunity to EMI," the report said.

didn't do any good sitting in the laboratory. It had to get to the physician," he recalls.

"How do I get this information off of the instruments, into the hospital system so that the physicians can get printouts of the full patient record?" was a popular question a dozen or so years ago, Mr. Ecker says. "There was even talk at that time of can I use my PDA wirelessly to get information directly from the lab off of that instrument?"

The wireless Internet "hot spots" showing up in coffee shops, offices, hotels, libraries and other public places follow the 802.11 standards. Just pop a wireless card into a laptop computer, tablet or PDA and away you go. As long as the signal is strong and steady, a Wi-Fi-enabled computer is just as functional as a desktop PC plugged into a high-speed network.

Says Mr. Ecker, "All of the things were really kind of possible at that point in time, but it was just so painstakingly slow. For 15 years, I've been trying to use a cell phone on Verizon, connected by cable or Bluetooth to my PDA and trying to surf the Web. It was just so painfully slow. You could do it but you would give up."

Bluetooth is a wireless technology to transfer information over very short distances, usually no more than 30 feet. Wireless headsets for cell phones use Bluetooth, as do some digital cameras to send images to nearby printers.

To achieve greater range, there is Wi-Fi, a trademarked name for a wireless local area network (WLAN) following standards known as 802.11(b), 802.11(g) and 802.11(n). The letters signify maximum data transmission speed. The Wireless B, Wireless G and Wireless N protocols, as they sometimes are called, run at 11 megabits per second (Mbps/s), 54 Mbps/s and 100 Mbps/s, respectively.

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For this reason, Mr. Hau says, “We’re certainly seeing a lot more use of wireless out there in the field.” But is it safe enough for the kinds of medical and financial information that physicians, practices and other healthcare organizations handle?

As long as network administrators and users take the proper precautions, the airwaves are quite secure for medical data, says Mr. Daigrepont.

It has been possible for years to connect a cell phone to a computer modem and get dial-up Internet access from just about anywhere, but dial-up connections can be frustratingly slow. Now, with high-speed network following a technical data-transmission protocol known as Evolution Data Optimized (EVDO), true wireless broadband is possible.

Technical issues for CIOs and practice executives to consider with wireless technology include the level of security and whether switches that determine the closest and strongest access points for any given user are managed or unmanaged. Wireless encryption protocol (WEP) is as distinct as—and more secure than—wireless access protocol (WAP), Mr. Daigrepont says.

If there is any question about an individual’s trustworthiness, you can pull that person’s password. “You always reserve the right to grant permission or revoke permission to use the wireless network,” says Mr. Daigrepont. The same goes for users wanting to tap into IT systems via the Web or a VPN.

Users should be careful about using public wireless hot spots for accessing healthcare systems, as some hackers have the means to keep a log of another user’s keystrokes—a great way to steal someone’s password, account number or identity. When in doubt, disconnect.

Since not everybody can be on-line all the time, especially with PDAs, Mr. Hau says that his company, PatientKeeper, supports what he calls the “casually connected” physician. If wireless is available, the user can take advantage of the live link. If not, the doctor can work off-line for a period of time, then synch with the information system by docking the PDA to a cradle connected to a PC or swap data by infrared beam.

This very big “if” highlights the limitations of Wi-Fi technology. “Clearly, there’s a lot of 802.11 use out there,” Mr. Hau says, but often the wireless signal does not reach every part of an office,

building or hospital campus.

“Now you’ve got the tablet, which is powerful and pretty much does everything that the desktop or laptop can do,” Mr. Ecker says. “It usually has built-in Wi-Fi, but what happens when you walk outside the building? All the access you had to information is now dead,” Mr. Ecker says.

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Now, with high-speed network following a technical data-transmission protocol known as Evolution Data Optimized (EVDO), true wireless broadband is possible.

“Right now, everything with the handheld is pretty much based on the model that you synchronize the handheld with a desktop or a laptop,” Mr. Ecker says. The new types of networks might change that, though.

Before, cellular networks simply couldn’t handle large amounts of information. “Nobody’s going to sit and wait 25 minutes to get a megabyte of data. But now you can do that in a couple of minutes,” he says.

“Now there really will be instantaneous, over-the-air access and updates,” Mr. Ecker suggests. “Whether you are internal to the building or external to the building, where we are going with this is that you can always have the latest and greatest information anytime you want it.”

The publisher can update the core reference book, but also offer subscriptions to provide alerts with new medical news, such as a drug recall by the Food and Drug Administration. Those alerts usually show up when the user synched the PDA with a computer, but with live connections, they are available instantly.

“I don’t think the medical community really has a great appreciation for the network that is developing around them,” Mr. Ecker says.

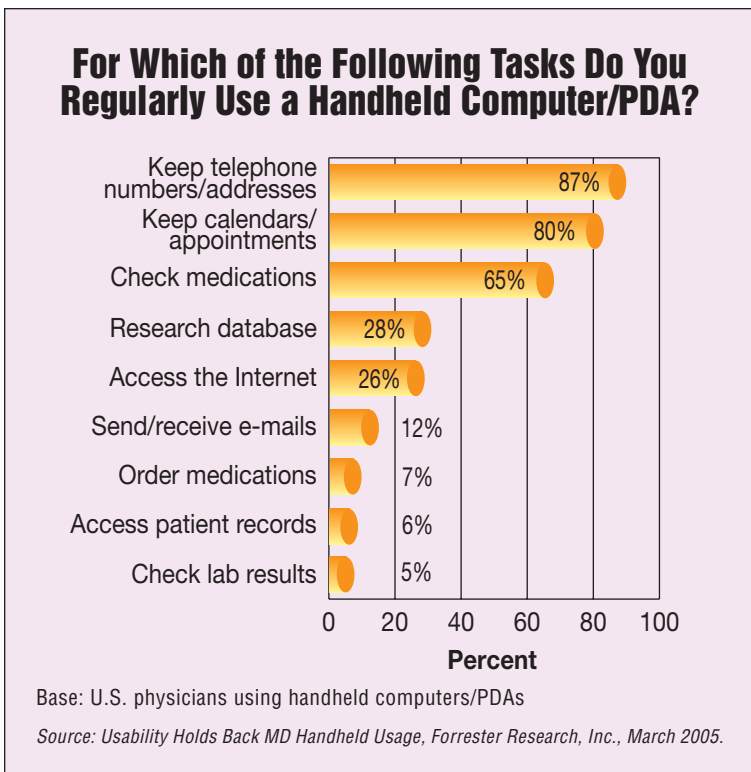
“You really can have a workflow solution on a handheld,” whether it is a Smartphone or a PDA,” Mr. Ecker says. With Wi-Fi and advanced cellular networks, access is fast enough to handle the volume of data that goes into practicing medicine.

“If you are sitting in a stadium on Sunday afternoon watching a football game and you get a call and you have an emergency

with a patient, you're not going to be sitting there with your desktop or your tablet. It used to be a cell phone and you had to talk about everything. Now, it could be a cellular-enabled Smartphone that gives you electronic medical records, any charge-capture information that you need, and underneath it all are tools to make those decisions wherever you might be," Mr. Ecker says.

"We call types of things like electronic medical records, charge capture, practice management 'workflow solution tools,'" he explains. Skyscape focuses more on decision support, such as reference materials, though Mr. Ecker says that these two areas are merging.

"We're really at a point, just in the last year or so, that all of this stuff is becoming possible," Mr. Ecker says. "What has held us back before is the handhelds had good power, but they didn't



have that much power.”

But he says two developments may change that. External memory cards allow you to store up to 2 gigabytes of information on some handhelds today. “That used to be the problem with handhelds—you couldn’t store enough information on there.”

And processor speeds were slow. “Now what’s happening, with the high-speed networks and handhelds with built-in cellular and built-in Wi-Fi, you don’t need to store that much stuff on there anymore because you can quickly gain access off the Internet or some main system and pull it down when you need it,” Mr. Ecker notes.

Still, Mr. Ecker does not believe that this evolution in handheld technology will cause seismic shifts in the way doctors practice medicine anytime soon because IT people in large healthcare enterprises are focused more on building the underlying infrastructure for clinical information technology than on mobile devices other than wireless PCs. Instead, the greatest concentration of investment seems to be on EHRs, charge capture and practice and hospital management systems within institutions, not on the outside.

If chief information officers are making any change in hardware preferences, it is to help users migrate from desktop computers to laptops and now toward tablets, as well to expand existing networks to support VPNs. “Handhelds are something they are aware of, but it’s not their primary focus right now,” Mr. Ecker says.

“In some cases, handhelds are the bane of medical IT people,” he adds. Physicians come to them with questions about the appliances. “It’s not something that IT people like to work with,” Mr. Ecker says. “but I think it will really probably be driven from physicians.”