



# Mobile Yet Connected: The Essence of 21st-Century Healthcare Delivery

## WHITE PAPER

Sponsored by: Cisco

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### HEALTH INDUSTRY INSIGHTS OPINION

Globally, healthcare service delivery faces many challenges that transcend regional and national boundaries. Population growth, increased life expectancy, increasingly stringent regulatory and compliance requirements, and demand for more and better access to quality care are driving up healthcare costs and creating a chronic shortage of skilled professionals. Continuing to deliver healthcare services using 20th-century technology is unsustainable in the 21st century. IT-enabled process improvement is essential to meet the challenges facing the industry. Based on our research and interviews with leading hospitals around the world, Health Industry Insights believes:

- Despite the worldwide economic downturn, recent IT spending increases by healthcare providers will continue to rank healthcare among the fastest-growing verticals in both the United States and the rest of the world.
- Clinical leadership's involvement in, and commitment to, process redesign is critical to the successful use of technology.
- Integrated data and voice technologies that provide reliable "anytime, anywhere" information access to highly mobile healthcare workers are fundamental components of the process improvements needed to meet industry challenges.
- Deriving maximum benefit requires executive commitment at the highest levels of the organization, a solid plan, sustained investment, strong leadership, effective project governance, knowledgeable technology partners, and effective project management.
- While some of the enabling technologies described in this document are prerequisites for others, a hospital need not implement all technologies to begin to derive benefits; early adopters demonstrate a diversity of approaches and priorities.

## IN THIS WHITE PAPER

This White Paper is presented by Health Industry Insights, an IDC company, and sponsored by Cisco. The objectives of this research were to gain insights into:

- The drivers and decision-making process for investment in mobility solutions, mobile clinical devices (MCDs), and location-based service (RFID) technologies by hospitals
- Barriers and challenges to the implementation and utilization of mobility solutions
- Benefits derived from the adoption of mobility solutions

To meet these objectives, Health Industry Insights conducted in-depth interviews with early adopters of mobility solutions at four healthcare organizations:

- **Children's Hospital at Westmead (CHW), Sydney, Australia.** At CHW, a comprehensive network infrastructure provided the foundation for the deployment of a diversity of wireless voice and data communications devices that facilitated staff communications and mobile access to clinical applications, including an electronic medical record (EMR). The resulting efficiencies facilitated an acceleration of EMR adoption, improved staff communications, and resulted in documented productivity gains and improved patient care and staff satisfaction.
- **Health Service of Castilla-La Mancha (SESCAM), Spain.** At SESCAM, mobility solutions included handheld WiFi and cellular devices, a wireless network, and laptops to provide access to the EMR system at the point of care and location-based services (RFID) to keep track of staff and patients. These innovations resulted in improved efficiency, improved ability to locate staff when emergency situations arise, and enhancements to the quality of care and the patient hospital experience.
- **Health First, Brevard County, Florida, United States.** At Health First, improvements included wireless coverage that support the deployment of voice and data applications and a pilot implementation of RFID-based asset tracking. These efforts increased communication and teamwork among staff, resulting in perceived improvements to the quality and coordination of care.
- **St. Olav's Hospital, Trondheim, Norway.** At St. Olav's, Norway's largest hospital, the construction of a new campus that incorporates the medical university and hospital into a single, integrated facility provided the opportunity to reimagine healthcare delivery for the 21st century. The goal of the plan was to provide a layout and infrastructure designed to maximize staff productivity, and improve workflow, care quality, patient safety, and overall patient

experience. A comprehensive, integrated technology infrastructure was an essential element in the design. St. Olav's single, integrated IP network provided the basis for deployment of a variety of wired and wireless communications systems encompassing data, voice, text, and video applications. Today, St. Olav's is considered one of the most IT-sophisticated hospital facilities in the world.

## **SITUATION OVERVIEW**

Historically, hospitals, physician practices, and other healthcare provider organizations invested sparingly in IT compared with other industries. But competitive pressures, rising costs, revenue constraints resulting from the ongoing U.S. and global recession, and increasingly stringent regulatory requirements have combined to drive increased IT investment by healthcare provider organizations of all types and sizes. Many provider organizations now recognize IT as a critical component of strategic initiatives to improve service quality, process efficiency, and staff productivity and to reduce operating costs. The adoption of IT has accelerated accordingly.

Although the total healthcare industry IT spend in the United States remains well below that of other industries in which IT use is far more mature, IDC estimates that the current 5.7% compound annual growth rate (CAGR) for overall IT spending by U.S. healthcare providers ranks healthcare as one of the fastest-growing vertical markets in the United States, despite the current national economic climate. And this is not merely a U.S.-centric phenomenon. Outside the United States, the CAGR in overall IT spending by healthcare providers also exceeds that of many other industries. IDC's current estimates for healthcare IT spending growth exceed 5% in EMEA and 7% in Asia/Pacific. In other, less mature markets, growth rates are expected to be even higher, although total current market size is considerably smaller.

The focus of these IT investments not only has increased but also has shifted. Until recently, the majority of IT investments by healthcare providers had been devoted to core financial and administrative transaction systems, but over the past five years, investments have shifted from these traditional "back-office" applications to applications designed to support patient care delivery processes.

More established ancillary department clinical applications, such as clinical laboratory information systems and radiology reporting systems, are being complemented by newer applications, such as clinical order entry systems, digital medical imaging storage and management systems, pharmacy order management systems, clinical documentation systems, and others that are being brought together to create comprehensive EMRs. Since healthcare workers are highly mobile, this increased emphasis on IT-enabled information collection, dissemination, and access is driving provider organizations to invest in technologies that provide pervasive and ubiquitous wireless access to

patient EMR data throughout their facilities, particularly at the point of care. To improve the experience for patients' families and visitors as well, more and more healthcare organizations are offering wireless guest access services so they can remain apprised of their patients' conditions from wherever they are in the hospital. This, in turn, is driving investments in wireless networks, wireless digital communications, real-time location-based services (RTLS) — most notably radio frequency identification (RFID) — and wireless MCDs that facilitate communication and access to this data. These technologies are the focus of the case studies discussed in this white paper.

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### **What Are Mobile Clinical Devices?**

Mobile clinical devices, or MCDs, are vital technology for those healthcare organizations migrating the capture and display of their patient clinical data from tethered desktops at nursing stations to patient rooms, exam rooms, and other point-of-care locations. The ability to obtain and deliver patient data at the point of care has been proven in numerous studies to improve care quality and reduce costs by improving workflow, increasing clinician productivity, and enabling the use of clinical decision support tools, which, in turn, have led to reductions in medical and medication administration errors. MCDs in common use today include personal digital assistants (PDAs), smartphones, digital communicators, and laptop and tablet personal computers (PCs) that can be carried or deployed on mobile carts as "computers on wheels" (COWs) that can be wheeled to the bedside and communicate with clinical applications via wireless network connections. In addition, several other, specialized MCD form factors are in use that are employed for specific tasks, such as closed loop medication administration and blood transfusion, processes that are the focus of many of the industry's current IT-enabled patient safety initiatives. Additionally, these processes may also utilize other WiFi devices or active tags in conjunction with MCDs.

Examples of MCDs, wireless communication devices, and wireless network access points used in the hospitals that were interviewed included:

- Cisco Aironet® wireless network access points that allow MCDs to connect to the hospital's network infrastructure
- Cisco unified wireless IP phones and Vocera® hands-free communication badges that provide voice-activated, hands-free communication over an IP network
- Cisco desktop IP phones that allow telephone calls to be made over the hospital's IP network
- Wireless notebook computers attached to mobile carts (COWs)
- Handheld tablet PCs that allow clinicians wireless access from the patient bedside to EMR applications and other services

## **Current Trends in Mobile Clinical Devices**

Advances in technology, along with political pressure to improve healthcare quality while reducing costs, and cultural shifts are propelling providers to embrace wireless health information technology as a way of maximizing the benefits of EMR adoption. These changes, in turn, are driving a dramatic increase in the adoption of EMR systems to enhance the productivity and efficiency of clinicians by enabling order entry, eprescribing, results reporting, and a multiplicity of clinical documentation and related applications at the bedside.

Specific factors contributing to growth in the usage of MCDs and related devices in healthcare organizations include:

- Enhancements to existing CIS/EMR implementations, including the expansion of these systems into a greater diversity of patient care locations
- Rising rates of adoption of CIS and EMR products among physicians for both computerized physician order entry (CPOE), especially in the area of eprescribing and medication administration, and the retrieval of medical images and other clinical data
- The introduction of mobile access into applications that support remote clinical functions, such as ambulance services, as well as nonclinical areas such as materials management, patient transportation, and environmental services
- Design improvements that are making MCDs smaller, lighter, faster, cheaper, more legible, durable, and energy-efficient are also making them more accessible, more affordable, and more acceptable to caregivers
- The advent of RFID-based technologies that add location-aware capabilities to monitor resources in the clinical environment and applications that utilize location-based information to communicate status and event updates to mobile caregivers via text messages
- Enhancements to wireless coverage and telephony options that increasingly provide continuous, uninterrupted access to clinical applications throughout the hospital campus and community
- The need to replace aging, expensive, and inefficient telephony and nurse call systems
- The proliferation of customized, packaged solutions targeted at specific clinical disciplines and designed to integrate with other CIS vendors' products

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## **The True Value of IT Investment Is Realized Through the Synergies Created by Multiple Technologies**

While the implementation of the advanced clinical applications that make up an EMR is an important foundational step in the evolution of the digital hospital of tomorrow, it is only one early step in the creation of a comprehensive, IT-enabled healthcare environment designed to facilitate workflows and improve overall process efficiency. These efficiencies come through the synergies created by the integration of digital data, voice, text, and video technologies that work in concert.

Healthcare workers, particularly those skilled professionals who work in hospitals, are both highly mobile and highly dependent on effective, timely communication. Whether the mode of communication is telephone, paper, or even the transmittal of information electronically, ensuring that the communication is effective and timely can literally be a matter of life and death, and yet the mobility of hospital workers presents inherent challenges.

Today, these communication processes are both highly inefficient and highly ineffective. For example, according to a study published by Kaiser-Permanente ("A 36-Hospital Time and Motion Study: How Do Medical-Surgical Nurses Spend Their Time?" *The Permanente Journal*, Summer 2008), almost 21% of nursing time was spent in the communications necessary for care coordination. Surprisingly, this was slightly more than the 19% devoted to direct patient care. Much of this communication is via telephone, yet those initiating the calls are frequently unable to reach the party they are trying to contact on the first attempt.

In today's hospital environments, an integrated, technology-enabled approach can ensure the timeliness and certainty of that communication, regardless of the location of the individual or the mode of delivery. More important, if the designated individual is not available to respond, today's unified communications technology is capable of ensuring that an appropriate alternative can be readily identified and contacted, reducing the risks associated with delayed communications.

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## **The Implementation Process for Mobile Clinical Devices**

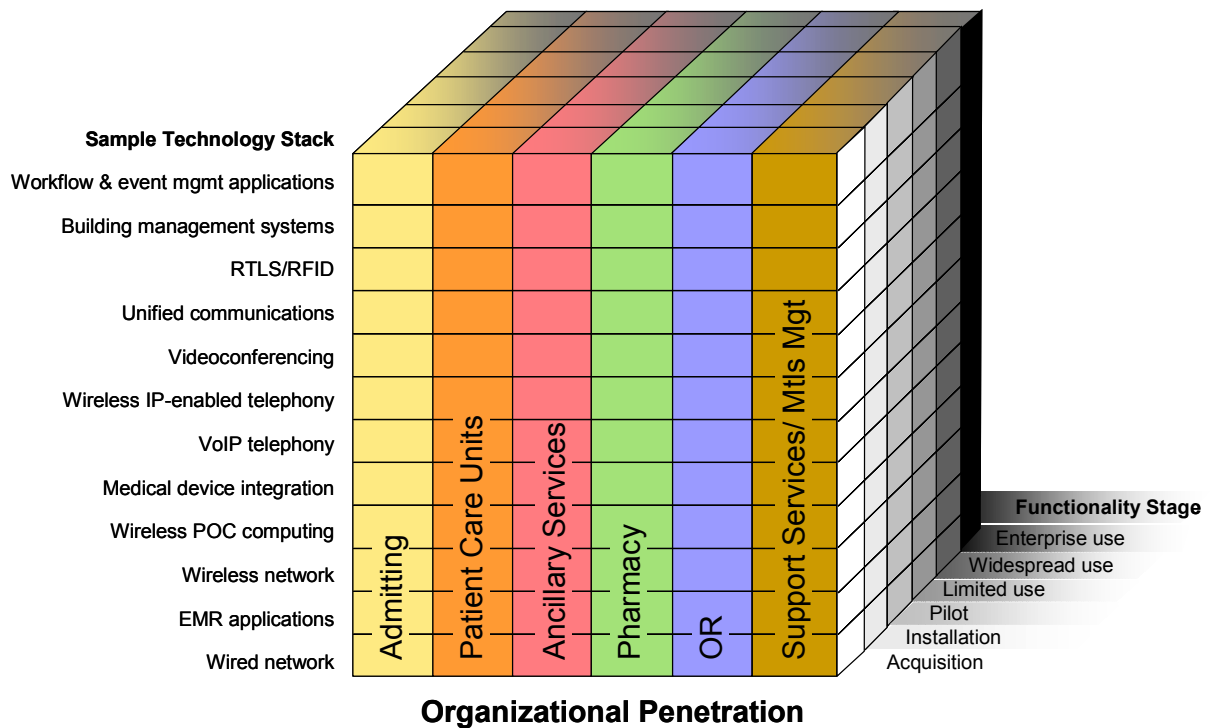
Implementation of a fully functional EMR is a complex, often multiyear commitment that involves far more than just the implementation of the EMR software itself. To realize the full potential of this technology, the creation of a robust EMR requires the organization to commit to the implementation of supporting applications, infrastructure, technologies, and, most important, care

process redesign and workflow improvements. These changes, in conjunction with the EMR software, lead to measurable quality and productivity gains.

To achieve this digitally enabled environment, prerequisite foundational elements need to be in place first, such as pervasive wired and wireless network access. Once that foundation has been laid, many sequences can be followed in deploying the remaining technologies, implementing applications based on these technologies and propagating them across the enterprise. What we found in our research is that there is no standard "blueprint"; the best course for one organization may not be the best course for another based upon differences in their budgets, facilities, operations, priorities, and cultures. The bottom line is that with the incremental implementation of each technology, further synergies are created from the interplay between them. These technologies, and the applications that exploit their capabilities, can be applied, to a large degree, independently (that is, serially or in parallel) across one, a related group, or a wide range of departments, much the same way the individual elements of the Rubik's Cube can be brought together into a coherent whole (see Figure 1).

**FIGURE 1**

The Evolution of the Digital Hospital



Source: Health Industry Insights, 2009

While the goal for all of the end-user organizations we spoke with was to have an end-to-end environment using MCDs in conjunction with a comprehensive clinical software portfolio, a unified communications infrastructure, and a sensor-based network, we did not see a complete end-to-end implementation at any of the sites we interviewed. This indicates just how early in the adoption cycle many of the requisite technologies are, as well as the complexity of the healthcare organizations involved and the level of effort, readiness, and investment required to complete their transition to a fully mobile, digital environment. These organizations were generally in the initial stages of implementing and using their mobility solutions; some were in the pilot stage, and others were slightly further along. Many had live components of their planned MCD infrastructure in place either in limited areas of the organization or at some subset of the facilities in their organizations.

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### **The Benefits of MCD Adoption**

Use of MCDs offers a number of critical benefits, including:

- **Improved workflows and enhanced productivity.** By providing data entry at the point of care, improved access to data/results, and accessibility of medications and vitals, MCDs can greatly improve clinician productivity and minimize errors. However, before deploying MCDs, healthcare organizations should analyze, redesign, and optimize workflows and processes.
- **Improved care team communication and collaboration.** MCDs allow unprecedented levels of communication between clinical staff and help to provide an enhanced patient care experience.
- **Cost savings as a result of reductions in lost charges and improved data accuracy.** Hospitals face the problem of both entering clinical data and concurrently capturing all billable charges. Charge capture at the point of care is especially important when the service performed includes modifiers or add-on procedures or incorporates billable supplies, aspects that may be forgotten if the clinician enters the charges after the fact. Some sources estimate that unbilled hospital charges can represent 5–10% of a typical patient admission, an important justification for MCD implementation. In addition, because many MCDs utilize barcode scanning, many hospitals have experienced improvements in the billing of pharmaceutical items and floor stock supplies. Even in those countries with state-funded healthcare systems, where hospitals do not bill patients as they do in the United States, there is still a need to accurately track resource consumption for costing and management purposes.

- **Intangible benefits.** MCDs also help to address some of the challenges of the healthcare industry (such as nursing and staff shortages) by improving job satisfaction and employee morale, which can lead to reductions in staff turnover and thus lower recruiting costs. Job enrichment can also serve as a recruiting mechanism.

## **EXPERIENCES OF LEADING-EDGE ADOPTERS**

The following case studies highlight the experiences of leading-edge healthcare adopters of these technologies.

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### **Children's Hospital at Westmead, Sydney, Australia**

Children's Hospital at Westmead (CHW) is a pediatric specialty hospital located in Westmead, Queensland, about 20 miles west of downtown Sydney. CHW is not representative of the typical Australian hospital, in terms of either its size or the sophistication of its IT environment. With 339 beds, CHW is one of the largest healthcare facilities in Australia, where only 11% of hospitals have more than 200 beds. CHW also enjoys one of the most mature and complete CIS implementations in Australia and one of the most comprehensive and sophisticated clinical IT environments in the entire Asia/Pacific region. The CHW applications portfolio includes an EMR; a document imaging system; an electronic admission and scheduling system; one of the first RIS/PACS systems installed in Australia; and applications supporting the surgical suite, emergency department (ED), clinical laboratories, pharmacy, and intensive care units. This technological sophistication is what led to the selection of CHW for the MCD pilot project.

In 2006, CHW launched an ambitious program to pilot a wireless network including bedside access to Cerner Corporation's Millennium EMR suite (and other non-Cerner clinical systems); wireless phones; and a Vocera VoIP communications system in its ED, operating room (OR), and one surgical unit. About 80 registrars, physicians, and nurses were involved in the initial pilot study. In a study published in 2007 by the NTF Group ([www.ntf.com.au](http://www.ntf.com.au)), commissioned by Cisco and technology partners including Cerner, Dell, IBM, Intel, Power Clinical, and Vocera, measurable improvements in staff productivity, savings to operating costs, and improvements to the quality of patient care were reported. According to Dr. Ralph Hanson, CHW's CIO, the economic benefits realized exceeded the estimates cited in the NTF study (see below).

CHW utilizes Dell wireless laptops on carts (COWs) and Power Clinical wireless PDAs as its bedside clinical data entry/display devices; Vocera voice-activated, hands-free IP phones for staff communications; and Cisco wireless networking technology to enable these technologies to work in concert. Software included an in-house-developed patient management system and the Cerner PowerChart EMR application. Installation, design, and integration services were provided by IBM, and other technology was provided by Intel.

Benefits experienced included:

- **Significant time savings.** The NTF Group study found savings of 20 hours of staff time per day, equating to almost 7,500 hours per year for the ED alone. The computers at the point of care reduced walking back and forth from rooms to nursing stations, saving time and improving the timeliness and accuracy of clinical documentation.
- **Enhancements to patient care and safety.** The software and wireless network gave providers real-time access to patient information at the point of care, enabling them to make better-informed, more timely decisions and to document clinical examinations immediately, thus improving access, accuracy, and efficiency.
- **Shorter wait times in the ED.** According to the results of the NTF Group study, the probability of a fast triage response increased from 38% to 46%, while the probability of a slow triage response decreased from 42% to 34%.
- **Increased hospital capacity.** Throughput in the ED increased dramatically as a result of reductions in triage times, overall patient waiting times, and treatment times, leading to increased capacity without requiring additional space, facilities, or staff.
- **Improved communications.** The Vocera badges, with their integrated, voice-activated, VoIP communications capabilities, provided staff with a communication option that eliminated time-consuming contact efforts such as paging and allowed for faster responses to emergencies.
- **Improved staff job satisfaction and productivity.** Staff of all types reported high levels of job satisfaction, as the new technology was able to support the delivery of care with the high degree of reliability, usability, and performance required in a demanding emergency care environment.

The benefits initially realized by CHW were limited by the lack of a pervasive, ubiquitous, wireless infrastructure. An institutionwide expansion of the wireless infrastructure at CHW is under way and is

essential if it is to expand bedside access to clinical data and implement its plans for closed loop medication administration throughout the hospital. CHW's future road map allows for expansion of the use of the technology in multiple hospital departments to facilitate the hospital's mission.

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### **Health Service of Castilla-La Mancha (SESCAM), Spain**

In 2002, a reorganization of the Spanish public health system resulted in a move from central management by Spain's Ministry of Health to the introduction of a regional health system. The SESCAM regional health system includes 18 hospitals; 200 health centers; and 1,100 local clinics, with a total budget of €2.5 billion and an annual IT budget of €15 million. Because the regional government places a high priority on healthcare IT, the IT function has enjoyed a 35% growth rate in its annual budget and currently employs a staff of 220 individuals.

SESCAM's key facilities include:

- Hospital General de Ciudad Real (Ciudad Real General Hospital), a 540-bed new-build facility serving the capital of the province of Ciudad Real, with a population of more than 69,000. This hospital was in Phase I of its initial implementation with a Cisco Unified Wireless Network with Cisco Aironet® 1131 and 1232 Series wireless access points distributed across the hospital's six floors, supporting Cisco Unified wireless IP phones and desktop IP phones connected to the Cisco IP infrastructure.
- The Almansa and Villarrobledo hospitals in Albacete province and Tomelloso in Ciudad Real province were further along in Phase II of their implementation. These hospitals implemented wireless access points and IP phones and are now adding location-based services using RFID to their environment. When fully implemented, the RFID technology will be used to track patients, staff, and equipment.

The overall driver for the purchase of MCDs at SESCAM was the demand for mobility. Mobility was seen as a key aspect of the hospital's operational excellence strategy and was a consideration in its construction planning. At the new hospital in Ciudad Real, SESCAM has implemented mobile handsets in dual mode (WiFi and cellular) for use on the campus WLAN and as GSM phones off campus. Mobility and wireless solutions are being implemented in four hospitals, and two more will quickly follow. The plan will eventually extend to the remaining 12 SESCAM hospitals. Solutions include tablet PCs with access to medical histories in use at clinics and hospitals, mobility solutions that help locate clinicians in the ED, voice and data communications with ambulance crews, and a software solution for

location-based services. The wireless communications devices are replacing pagers currently used in the inpatient setting.

Collaboration was also a key driver for implementation at SESCAM. In the past, it was common to find islands of knowledge that did not benefit the community. As such, a high value is placed on the technologies' ability to foster collaborative work. The SESCAM officials interviewed also highlighted the value of the connectivity that has been enabled between hospitals. Now multiple hospitals not only have the same technology but also have the ability to share information for medical second opinions and better administrative decision making.

At the point of care, nurses use tablet PCs and specialized software to record vital signs and facilitate medication administration. Software uses clinical alerts to guide decision making in other areas of patient care as well. Patients wear bracelets embedded with RFID chips to allow staff to locate them anywhere in the facility.

While a formal economic analysis of the technologies' costs versus benefits was not conducted, SESCAM officials believe that significant cost savings have resulted from the implementation. The pressure to implement the mobility solutions came not from economic need but from the need to increase capacity of health personnel and make the most of their time, a goal they believe they have achieved. They believe that the ED has benefited the most from the wireless solutions, as location-based services alleviate many of the difficulties related to locating clinicians and staff quickly in emergencies.

SESCAM officials also believe they have experienced fewer "adverse patient events" and an improvement in patient safety and quality of life and care as a result of the new technology. With medical history information on hand when the nurse and doctor are visiting the patient, they have been able to decrease prescribing errors. Automation of medication administration has resulted in an estimated decrease of 20% in the volume of medication administration errors. In the catering department, automated systems allow patients to request their own meals while food allergies are checked automatically, reducing mistakes and improving the quality of care.

In the beginning, there were some doubts as to whether clinical staff would accept the technology, but these doubts have proven to be unfounded. SESCAM officials believe adoption barriers were eased by selecting a reliable, transnational company such as Cisco, and the clinical staff's experience to date has transformed staff members from reticent to enthusiastic about the technology. Patients are also grateful; SESCAM officials believe that patients feel safer when they see that their doctors are equipped with modern technology. Doctors are able to show information to patients on the tablet PCs, allowing patients to experience the technology as well.

SESCAM's highest priorities were to improve patient safety and the quality of care and facilitate collaboration — goals it believes it is in the process of attaining. It has also achieved important secondary goals such as improving staff efficiency and physician satisfaction. While cost savings were not an a priori requirement of Spanish healthcare system officials, the technology does allow them to make more effective use of public funds.

In the future, SESCAM expects to add access to care plans and clinical pathways as well as medical reference databases to the EMR and extend the use of the technology to additional hospitals in its network, all while implementing additional functionality. It also hopes the industry will respond to innovators like itself by developing better healthcare-specific hardware, as it finds the current tablet PCs too heavy and impractical for doctors and nurses to routinely carry.

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**Health First, Brevard County, Florida,  
United States**

At Health First in Brevard County, Florida, Senior VP/CIO Rich Rogers has expanded mobility technologies as part of both the expansion of capacity at three existing hospitals, comprising a total of 800 beds, and the outfitting of a new facility that is expected to come on line in 2011. As the primary healthcare provider for Florida's "Space Coast," Health First is an integrated delivery system that operates a number of facilities, including the Cape Canaveral Hospital; Holmes Regional Medical Center, which includes a level II trauma center and a heart center; and Palm Bay. Health First also has a health plan offering with 63,000 covered lives. Health First employs a total of 6,000+ people at 50–60 locations throughout the county, including ambulatory surgical facilities, clinics, physician practices, and health clubs.

Health First provides centralized IT support for its three locations. Its clinical application portfolio consists primarily of products from Eclipsys Corp. Health First's IT group committed to wireless and unified communications several years ago when it began an effort to provide 100% wireless coverage throughout its hospitals and selected Cisco as the vendor of choice. Health First has upgraded its wireless infrastructure over time and now uses lightweight access point protocol (LWAPP) and centralized intelligence with access points controlled by the centralized system. Its aim is to reach 100% coverage for all of its voice and data applications, but it has been constrained by coverage and infrastructure issues that it is currently addressing. Originally, the technology was deployed only in the emergency department on hardware that included laptops and COWs, but over time, Health First has implemented VoIP wireless using Vocera badges and Cisco 7920 and 7921 wireless IP phones. With both the Vocera badges and Cisco wireless phones, Health First has found that

the enhanced architecture and expanded coverage, as well as the strong usability and features of the phones, have made a significant difference.

Maintaining badges and replacing damaged badges were among the challenges Health First encountered. These issues were addressed by Vocera's "Evergreen Maintenance Program," which provides monitoring of performance, reporting on problem badges, and replacement of damaged ones at no additional cost. This generated additional uptime and created a turning point in adoption. Health First has also upgraded its Vocera system to benefit from enhanced voice recognition capabilities. According to Vice President of Information Technology, Christi Rushnell, "We have 500–550 badges and complete an average of 90,000 calls per month predominantly with nursing and OR staff. It is music to our ears to hear that people are successfully connecting with that kind of traffic .... This was communication [between clinical staff] that would have been more difficult without these tools."

Although her organization has not yet conducted a detailed economic analysis, Rushnell believes that Health First has realized significant ROI from the system, stating that "it is hard to put a price tag on the 90,000 completed calls a month. The open communication really addresses the need of the clinicians to communicate and provide an enhanced patient care experience."

Health First is also working to expand device infrastructure and MCD usage. It is challenged by the human factors associated with switching technologies among its older clinician population but has made significant progress in reducing the number of pagers in use. Implementing integrated nurse call and clinical information system alerts on the wireless phones is the next step. Health First wants to be able to send alert information to the mobile device of the provider's choice. Pilots are in the planning stage, and the organization's belief in the potential for the technology is strong.

In 2007, Health First set its sights on an RFID asset tracking system. Its strategy was to leverage the wireless infrastructure to deliver these capabilities. While the system is still in an experimental stage, there are 800 RFID tags in use with the clinical engineering team, tracking IV pumps. Health First also deployed 200 temperature tags in medication refrigerators at one hospital to monitor temperature levels and trigger automated alerts to maintenance personnel if normal operating ranges are exceeded. The RFID implementation has been complicated and has had mixed results, but Health First continues to explore the potential for these tools. It's not clear whether there is an ROI to be seen from using RFID on IV pumps, as preimplementation pump utilization data was limited. Health First expects to be able to demonstrate ROI when RFID-based tracking is expanded to additional device types.

Future plans at Health First include improved management capability for the devices; adding integrated CIS, eMAR, and next-generation pharmacy systems to its application portfolio; and communicating information from these systems to enhance its unified communication tools. From a governance perspective, clinical leaders are involved in testing and prototyping new applications of these technologies, and IT is working with a group of clinical leaders for feedback and leadership on new clinical projects. Lessons learned include cautions about the complexity of the vision when compared with the reality of what can be achieved and how long it will take. Managing realistic expectations is important when implementing a project of this scale and complexity.

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### **St. Olav's Hospital, Trondheim, Norway**

In 1991, the Norwegian government initiated plans to build a new campus to replace both the hospital and medical school facilities of St. Olav's, the major teaching hospital serving the city of Trondheim and the surrounding communities. The initial phase of this massive €1.5 billion project was completed in 2006 and has been profiled in an IDC case study (*The Hospital of the Future: IP Overall; All Over IP – St. Olav's Hospital, a Study in the Healthcare Industry*, IDC #AU201209N, September 2006). Since that time, subsequent phases of the project have been completed. By 2014, when the project is expected to be fully completed, the new campus will consist of 11 interconnected buildings totaling more than 2 million square feet.

The overarching planning and design philosophy at St. Olav's was to create an environment that was, at its core, patient centered. The workflow was employed by the staff in the patient care process itself. The demand for information this workflow generated became the design requirement for the information and communications technology required.

These requirements, coupled with the guiding principle of "IP overall; all over IP," led to the integration of multiple communications networks into a single environment. These networks included data from building automation, building safety and security, and information systems; data from patient monitors and other medical devices; paging, television, telephony, video, and wireless mobility data; and nurse call systems.

Alongside each patient bed is a multifunction terminal that provides services such as television, video, Internet/email, music, radio, videogames, telephony, lighting, bed shading and air conditioning controls, nurse call, and food service ordering. Physicians and nurses can also access the patient's EMR from this terminal, including both data and images, and share this information with the patient and visiting family members.

Employee access to network resources, such as a patient's EMR, and to physical facilities is controlled by a multifunction smart card. Smart card readers are fitted into desktop PCs, wireless laptops and tablets used at the point of care, fixed bedside terminals, and doors and other facility access points.

At St. Olav's, the wireless data network not only supports wireless point-of-care MCDs and wireless IP telephones but also serves as the central nervous system of a fleet of WLAN-based automated guided vehicles (AGVs) that deliver supplies, food, linens, mail, medications, and more.

"Today, wireless IP phones comprise 55% of all phones in the hospital and are used by all levels of the organization. Conventional wisdom has been that hospitals are slow to accept new ICT technology — I believe the reverse is true. Doctors and nurses embrace mobile technology when the mobile technology becomes sufficiently mobile to support their work processes," says Public Relations Manager Arve-Olav Solumsmo from the hospital building project.

The architects and hospital leadership worked throughout the planning and design process with the consortium of vendors providing the various components of the technology infrastructure to ensure not only that the technology was properly designed, sized, and installed but also that the design maximized the workflow, quality, cost, and customer service improvements that were central to the design philosophy. The consortium, led by Telenor, included Cisco, HP, and Cardiac AS. Today, St. Olav's is considered one of the most technologically advanced hospitals in the world.

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### **Common Traits Among End Users Interviewed**

The end-user organizations we spoke with were similar in their willingness to embrace new technology and serve as early adopters. They were bound together by two qualities: their long-term strategic vision of how the various components of a mobility solution could be brought together to create a more efficient and more effective care environment and the organizational commitment to utilize technology as a catalyst for that change.

But perhaps the most notable "commonality" among these organizations was the diversity of paths they followed with respect to the technologies they selected and their approaches to implementation. This diversity was a product of their business priorities, budgets, and existing technical environments.

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## **Next Steps for Early Adopters**

All of the end users we spoke with recognized that their organizations were willing to take risks to achieve new levels of productivity, efficiency, and quality. However, most of them were in the initial stages of implementation and use; some were in the pilot stage, and others were slightly further along, with live components of their planned MCD infrastructure in place in limited areas of the organization. While they all have work to do, we expect these determined leaders to expand pilot programs across additional departments, implement broader portfolios of technology, and add functionality to their implementations to achieve the goal of an end-to-end unified communications environment.

## **FUTURE OUTLOOK**

Over the past decade, digital technologies of many kinds have transformed the practice of medicine, but until recently, this investment had been largely limited to automating isolated islands of clinical practice — converting medical diagnostic imaging from film-based to digital media; monitoring the vital signs of critically ill patients; analyzing laboratory specimens; and distributing results electronically, to name just a few. But the past is merely prologue. The future of healthcare will be increasingly digital.

The past five years and, in our view, the next five years will be characterized by a concerted, coordinated effort by healthcare organizations worldwide to link these islands of automation into a coherent, integrated, patient-centered digital record that provides caregivers instantaneous access not just to data related to the patient's current encounter but also to the patient's medical history from past encounters. The use of digital patient information in the delivery of care will become as ubiquitous as paper is today. But this is only half the story we see unfolding.

Healthcare service delivery, particularly in hospital settings, is highly time-sensitive, and clinical personnel are highly mobile. Leveraging the value of this transition from paper to electronic recordkeeping will require that healthcare organizations invest in the technologies that can deliver information in a timely manner to those who must act on it — anytime, anywhere. The convergence of data-, voice-, and text-based communications technologies and platforms is the mortar that will bind digital patient information, and mobility solutions will be the catalyst that holds the key to maximizing the value achieved.

## ESSENTIAL GUIDANCE

Today's technology offerings present an enticing, but almost daunting, array of choices. Healthcare provider organizations considering an investment in mobility solutions face a high level of complexity in their selection decisions. Purchasers need to consider numerous factors in determining not simply what is possible but also what choices are right for their particular circumstances.

The experiences of the organizations we spoke with regarding their selection, acquisition, implementation, and use of mobility solutions provided valuable guidance for others contemplating the acquisition of mobility solutions. Some specific considerations included:

- **Plan big; start small.** While the planning, configuring, and sizing of the mobility infrastructure should be based on a well-defined, multiyear vision that considers all of the applications, devices, and associated workloads that will be implemented during the planning horizon, implementation should be more measured. Hospital leadership should sequence those applications in small, manageable steps that consider both priority and precedence. Wherever feasible, pilot deployments should be considered to ensure that the impact of unexpected challenges is contained.
- **Develop an integration strategy.** Integration into the clinical workflow is critical for the success of MCDs, yet hospitals often defer the development of a comprehensive integration strategy until after the implementation of their clinical systems is completed. If the integration of MCDs is not incorporated into the clinical workflow from the outset, clinicians are often forced to perform duplicative work, manually recording orders, vital signs, notes, and other medical record documentation at the bedside, only to later record it again in electronic form at fixed computers at the nursing station. Numerous studies have shown that such inefficiencies contribute to lost productivity, unbilled charges, inaccurate chart transcriptions, and delays and errors in information capture. This can compromise the integrity of patient care and undermine user acceptance of clinical systems.
- **Select appropriate form factors.** End-user devices come in many form factors, each suited to particular task requirements. These form factors range from small handheld devices to desktop PCs and laptops equipped with wireless network cards affixed to rolling carts. Organizations must carefully consider their workflows, processes, and task requirements when selecting task-appropriate form factors. Workflow and process reengineering must be an integral part of the clinical system implementation process.

- **Ready the organization for implementation.** The success of an MCD implementation, and the level of eventual success in facilitating communications and creating more efficient practices, is tied to the readiness of the organization and its approach to implementation. MCDs commonly replace manual documentation processes or older communications devices such as pagers, and while these solutions are generally recognized as deficient, staff may be resistant to learning to use new devices and processes when new and emerging technologies are implemented.
- **Gain clinical staff buy-in.** Physician and nurse buy-in, participation in system selection and implementation, and configuration options can be make-or-break functionality for MCD implementations. A multidisciplinary team should be used to review vendor products, evaluate options, and design and test new technologies and processes to ensure that all impacted areas and staff groups are on board and their needs considered before a system is selected.
- **Focus on process improvement and clinical transformation.** The ability of an organization to meet the expectations of clinical system implementations is closely tied to the facility's underlying ability and readiness to transform its administrative and clinical workflows and processes. MCDs should be considered an integral part of those transformation strategies. Appropriate change management processes, including strong leadership and team-based approaches, must be in place to assist in this process. Outside change management services may be required, and expert advice on best practices and the experiences of early adopters is key to making changes happen successfully.
- **Budget accordingly.** The cost of acquiring, implementing, and maintaining MCDs and the related infrastructure remains a high hurdle for many provider organizations. Organizations should also consider the total cost of ownership, including the level of maintenance and support required, and budget accordingly. Organizations should consider prepaid maintenance programs to control replacement costs for lost or damaged devices. It is important for provider organizations to select the devices and infrastructure that meet their needs without adding unnecessary complexity or demanding maintenance and support that a vendor is not capable of providing.
- **Consider success factors.** MCDs are creating a new standard for collaboration among healthcare providers. While there are some areas of benefit from MCDs that could be clearly tied to ROI, there are even more areas where less quantifiable benefits associated with increased communication and improvements to the quality of care have resulted. Provider organizations should consider the full benefit of MCDs and not just specific operating cost savings when making purchase decisions.

With numerous MCD options and multiple approaches to creating wireless and wired infrastructure to support them, provider organizations need to consider requirements carefully and choose the functional areas that make the best candidates for initial efforts. Enabling MCDs across an entire hospital is a massive and costly undertaking, and organizations are better served by starting with pilot areas that have the biggest operational and economic impact.

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