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Digital imaging may not quite be mainstream, but more and more hospitals and imaging centers are choosing to implement digital radiology systems. Digital imaging for general radiography typically includes a combination of digital radiography (DR), picture archiving and communications system (PACS) and computed radiography (CR). In addition to actual equipment, many institutions utilize an array of professional consulting and support services to make their digital transition far smoother. They find partnering with a vendor that provides network services, project management, integration and education services, helps facilitate the transition to digital.

No matter what the final digital configuration looks like, the initial objectives for going digital tend to be similar in many facilities. Most healthcare providers moving to digital strive to improve patient care and decrease report turn-around time. Image quality is also an important consideration. And many digital facilities aim to be wholly filmless. Despite similar objectives, there is no common blueprint for digital implementation. The process varies from institution to institution. Some facilities bite off the entire project in one fell swoop, while others take a gradual step-wise approach. The upshot, says Paul Sylvester, radiology administrator for **Alpena General Hospital** (Alpena, Mich.), is that every facility is unique when it comes to implementing digital technology. This has significant ramifications for selecting a vendor. Sylvester explains, "Vendors don't know what your needs are until they take the time to learn about your situation and draw the project out with you."

Not all vendors are willing to invest the time in understanding individual facilities. Some may employ a one-size-fits-all

approach that does not take into account the unique needs of each customer. When Sylvester solicited proposals for Alpena's PACS project, nine vendors responded, but he found that only two vendors really understood the hospital's needs. One of those companies was **Eastman Kodak Company** (Rochester, N.Y.). Like many other facilities making the shift to digital radiography, Alpena General Hospital decided that Kodak would best meet its digital needs.

The Digital Rationale

Digital imaging is a monumental undertaking. In some facilities, the implementation process can span nearly a decade. It entails a hefty financial outlay and also has significant impact on human resources as radiologists, technologists and referring physicians must be sold on the new technology and retrained on a new paradigm. Despite the tremendous commitment, many facilities realize that taking their radiography digital is a wise investment; it increases productivity and efficiency, enhances patient care and saves money.

Consider **XRC Medical Imaging** in South Bend, Ind. This privately owned out-

patient center opened as an all-digital site in 2002. Gary Jensen, director of clinical operations for XRC, confirms, "I would never consider building a state-of-the-art imaging center using film-screen technology. Digital is a superior way of imaging patients for a number of reasons. First of all, it allows you to operate in a PACS environment. It also produces a higher-quality image and reduces patient radiation exposure because there are fewer retakes. And finally it gives you the ability to post-process images."

Other outpatient imaging centers share Jensen's enthusiasm for a digital department. Within the next year, two more outpatient digital imaging centers will open in the South Bend area. But digital imaging isn't only geared to brand new state-of-the-art outpatient centers. It also works well for rural hospitals.

Alpena General Hospital is the only hospital serving a six-county area in northern Michigan. Faced with the all-too-common issue of a lack of space for film storage, the hospital set out on its digital journey with the ultimate goal of going filmless, which necessitated a secondary objective of



Virginia Mason Technologist Luis Ortiz positions a patient for a chest x-ray on the Kodak DR 5100 system.

connecting to physicians in offices at the hospital's four remote clinics.

While Alpena operates in a rural environment, it shares some characteristics with urban sites. The motivation behind transitioning to digital at the northern Michigan facility is identical to that at

Virginia Mason Hospital (Seattle, Wash.). The radiology department and the hospital's six satellite clinics plan to go filmless. John Eusek, administrative director of radiology at Virginia Mason, identifies the motivation behind the transition to digital and filmless. "It's all about connectivity. We want to supply diagnostic information quicker. Getting a system-wide digital network is important for faster access to images."

Like Alpena and Virginia Mason, many sites shoot for a full digital and filmless environment. **High Point Medical Center** (High Point, N.C.) is there. The hospital is fully digital and filmless. Radiology Administrator Diane O'Connell says the hospital decided to implement digital in an effort to reduce inefficiencies and operating costs while providing physicians with timely access to images.

Formula(s) for Success

There is no surefire formula that guarantees a successful digital imaging implementation. Moreover, Eusek notes, "There are a zillion things that can go wrong along the way." Without a common blueprint and

Digital Imaging

The Case for Digital Imaging

with the potential for never-ending snags and missteps, it becomes even more critical to select a vendor that not only markets a wide array of high-quality digital solutions but also makes an extra effort to support its products by proactively identifying and meeting the unique needs of the individual sites that purchase its products. Sylvester notes, "This isn't like buying a CT scanner or other equipment. It can take two years just to get the project off the ground. Going digital isn't a decision you can make in one year; you are stuck with your choice for life and it affects everyone."

XRC Medical Imaging literally jumped into the digital world with both feet. The facility opened with two Kodak DirectView CR 800 systems, Kodak PACS and a Kodak DryView 8700 laser imaging system. It also utilized Kodak's Professional Services team.

At XRC, the Professional Services component largely consisted of Network Services. Kodak's team helped design an adequate network for the new facility. Jensen says, "I'm not an IT person. Having a known company undertake the network design allowed me to sleep at night. This is a big enough and expensive enough proposition that it must be right. I recommend using Kodak for the network design."

While Kodak's Professional Services can play a key role in digital imaging implementation, Jensen found that the entire Kodak team is equally helpful. He says, "I'm very pleased with the whole spectrum of services from negotiations at the time of purchase to installation to service thereafter from Kodak." In fact, Jensen says he often is on the receiving end of a 'check-in' phone call from his Kodak service manager or sales representative. This type of proactive support, coupled with a very responsive service team, helps XRC stay on top of the game and iron out any minor glitches before they grow into crises.

Many Kodak customers reap the benefits of the company's commitment to service and support. Sylvester of Alpena General Hospital admits, "We've asked for a lot above and beyond run-of-the-mill service and support, and Kodak has done a lot for us."

Kodak's broad range of service offerings became apparent early in the digital process at Alpena. The hospital hoped to start its

digital conversion with the purchase of a Kodak PACS and Kodak DirectView DR 9000 system. Before the hospital invested in the products, however, Kodak assessed their current network infrastructure and found that the network required modifications prior to the PACS and DR installation.



Technologist Luis Ortiz reviews an image at the Kodak DR system operator console before sending it to Virginia Mason's PACS.

As a result of Kodak's findings, the hospital backpedaled and turned to Kodak's Professional Services team for the first phase in a four-phase transition to digital. During phase one, Kodak's Network Services set out to improve the hospital network, so that it could handle digital image transfer. The Kodak team partnered with Alpena's IT staff and analyzed the existing network and completed necessary upgrades. The consultancy approach panned out very well at Alpena. For example, the project required pulling together all imaging modalities (and vendors) and making changes necessary for DICOM-compliance. Sylvester says, "Kodak was very good in this aspect. They even helped solve problems with others vendors and offered them their expertise in bringing their systems up to date."

With the bulk of the network groundwork and design out of the way, the hospital has embarked on phases two and three of its pro-

ject. This includes the PACS installation, Kodak CR and DR installations, and the addition of a Kodak DryView laser imager and some non-DICOM modalities. These steps are not without challenges; the hospital needs to find room for the equipment and determine where to locate workstations for maximum accessibility. Sylvester notes that these challenges are mere minor details and Kodak is helping the hospital work out its ideal configuration.

One of the larger challenges facing Sylvester and his colleagues is phase four of the project, which entails equipping the offsite satellite clinics for electronic image transfer and adding a physician portal. Unfortunately, rural Michigan does not possess high-speed telecommunications capability, which poses a huge dilemma. How can the hospital get images to radiologists and physicians when the only infrastructure may be a mere telephone line? The hospital's IT department isn't quite sure how it will overcome this hurdle, but Kodak has taken the matter into its hands and is researching different ways to manage and compress images to speed transmission. And if there is a way around the constraints posed by rural telecommunications, Kodak will find it. Sylvester confirms, "I am confident in Kodak's ability to identify solutions."

Virginia Mason Hospital got its first taste of digital imaging in 1994 with a Kodak CR 400 system and has been in a near constant process of upgrading since then. Eusek says the hospital opted for a phased approach to digital imaging because of the expense of implementing digital. Few hospitals, he says, can afford to make the change in one fell swoop.

Since 1994, the hospital has installed a Kodak DirectView DR 5100 system, Kodak DirectView CR 800 system, Kodak PACS workstations and Kodak archive, and several Kodak laser imagers. Eusek notes, "We're really up and running at this point. We're filmless in MRI, CT, ER, inpatient radiology, mobile radiography and ultrasound, and two of our satellite clinics could go filmless tomorrow."

Although the implementation has been a resounding success, it was not without challenges. Prioritizing purchases is a fact of life for

any institution on a budget. Eusek says the hospital prioritized its purchases by considering two questions. Which equipment will help patient care the fastest? Where can we get the biggest bang for the buck? The formula worked like charm. Eusek concludes, "Productivity, cost-savings and patient care is better than ever before everywhere in the hospital."

Professional Services Facilitates Success

A digital imaging implementation is a massive undertaking. It can go smoother by partnering with a vendor that has made a significant commitment to digital technology and service. High quality technology and a commitment to service are certainly essential for a successful implementation. There are other, less obvious factors that can pave the way for a smooth ride into the digital world.

What happens before and during the implementation can have a tremendous impact on the ultimate outcome of the project. For example, digital requires a certain amount of IT time and experience. This may be available in-house, but the IT department may be overburdened with other projects. The digital implementation may be low on the priority list. In other cases, the IT staff may not offer expertise necessary to pull off the project. In either scenario, the final results could be disastrous. Perhaps, the network is insufficient for digital. Or maybe some equipment is not DICOM-compliant.

These scenarios, while possible, are certainly not the norm and can easily be avoided by selecting a vendor with a robust Professional Services team. **Eastman Kodak Co.** (Rochester, N.Y.) offers an array of Professional Services to facilitate their customers' transition to digital. These include Network Services, Project Management, Integration Services and Education Services.

Kodak's Professional Services can be customized to meet each facility's needs. Customers can pick and choose services that complement their internal expertise. For many hospitals of the missing link is IT or Network Services.

XRC Medical Imaging (South Bend, Ind.), used Kodak's Professional Services during its implementation. For XRC, the Professional Services component largely consisted of Network Services. Kodak's team helped design an adequate network for the new facility. Jensen says, "I'm not an IT person. Having a known company undertake the network design allowed me to sleep at night. This is a big enough and

Budgets are internal challenges. Unfortunately, during the midst of the Virginia Mason project, HIPAA reared its head and presented an external challenge. The law triggered both technical and regulatory issues. For example, two of the satellite clinics are fully equipped to go filmless; however, the hospital must delay the shift until it can set up a virtual

expensive enough proposition that it must be right. I recommend using Kodak for the network design."

Alpena General Hospital (Alpena, Mich.) found itself in a similar situation when it learned that its network could not handle PACS and DR. The hospital turned to Kodak's Professional Services team for the first phase in a four-phase transition to digital. During phase one, Kodak's Network Services set out to improve the hospital network, so that it could handle digital image transfer. The Kodak team partnered with Alpena's IT staff and analyzed the existing network and completed necessary upgrades. The consultancy approach panned out very well at Alpena. For example, the project required pulling together all imaging modalities [and vendors] and making changes necessary for DICOM-compliance. Radiology Administrator Paul Sylvester says, "Kodak was very good in this aspect. They even helped solve problems with others vendors and offered them their expertise in bringing their systems up to date."

High Point Medical Center (High Point, N.C.) opted for Project Management Services for everything from workstation placement to delivery schedules to PACS storage space. The project manager also worked hand in hand with the hospital architects to put the DR room together. Finally, the manager arranged a cost-benefit analysis from a third party consultant, which the radiology department used to present the project to the hospital board. PACS Administrator Shaun Hill concludes, "We're very pleased with Kodak's Professional Services. The Kodak project manager was crucial to the success of our implementation."

The combination of a broad array of high-quality digital products, a true commitment to service and an extensive Professional Services team allows Kodak's customers to reap the full benefits of digital radiology. The end results are not only enhanced productivity and optimal image quality but also better patient care.

private network (VPN) for the offices.

Other issues relate to the integration of technologies from multiple vendors. Consider a hypothetical, but all too familiar, situation. The RIS company offers an upgrade, but the imaging company isn't quite up to speed or on the same page. In these types of situations, the companies need to coordinate their efforts. This, of course, requires communication, not finger-pointing. Hospitals can facilitate the process by initiating a conference call or meeting with the relevant vendors. Virginia Mason Hospital selected Kodak because the company offers a great digital imaging portfolio, and it found that the company's service efforts have been equally impressive. Eusek notes, "They worked very hard on this project. They jumped in and solved all of the little problems right away."

Like Virginia Mason, High Point Medical Center took the slow and steady route to filmless. In 1997, the hospital started the transition with a PACS project at its outpatient imaging center. Over the next three years, the hospital added several Kodak DirectView CR 800 and 900 systems and Kodak DirectView remote operations panels. It also upgraded image acquisition systems for fluoroscopy, CT, MRI and vascular ultrasound. In 2000, the hospital upgraded its network and began laying the groundwork for full-blown PACS. The following year it started CR-PACS at the outpatient center. The hospital's radiology staff rotates through the center, so this step allowed staff to get a feel for PACS prior to the full implementation.

The phased approach and outpatient PACS project was especially helpful for staff training. Todd Misenheimer, quality assessment coordinator for High Point Medical Center, explains, "We evaluated several vendors. Kodak's systems are definitely the most streamlined and easiest to operate. Still the biggest hurdle in shifting to digital imaging is acclimating staff to the technology."

The hospital continued to prep its physicians when it added an archive and workstations for online viewing. This step cleared the way for phase two of the project—full PACS and full digital. The hospital also purchased a Kodak DirectView DR 9000 system and addi-

tional CR systems during this phase. Many radiologists immediately picked up on image viewing on the workstations, but the hospital still encountered hit and miss resistance to the new system. PACS Administrator Shaun Hill notes, "It became clear that physicians were accepting this when an occasional short period of downtime became inconvenient to them." In fact, the hospital went from three workstations in phase one to 15 in phase two. Kodak helped the hospital determine optimal placement for the workstations, which has been one factor in continued physician acceptance and increased productivity.

Kodak's Professional Services assisted High Point in other ways as well. Hill says, "We're very pleased with Kodak's Professional Services. The Kodak project manager was crucial to the success of our implementation." The project manager handled everything from delivery schedules to PACS storage space. He also worked hand in hand with the hospital architects to put the DR room together. Finally, the project manager arranged a cost-benefit analysis from a third party consultant, which the radiology department used to present the project to the hospital board.

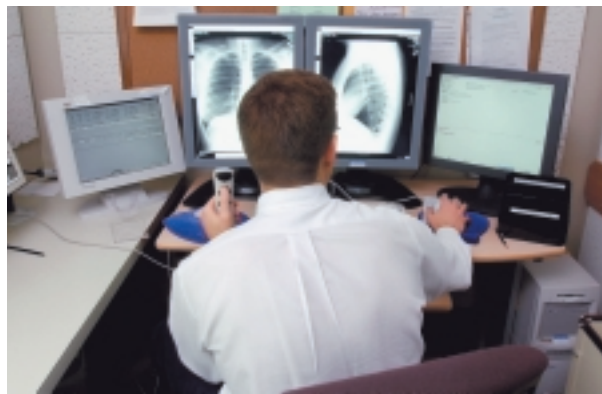
Digital Radiology = Results

The transition to digital can be slow and expensive. It also requires a substantial commitment of time and effort on the part of radiology staff and administrators. Are the final results worth the price? Absolutely, say the facilities that have partnered with Kodak for their digital implementation. Digital imaging brings significant benefits in nearly all areas of radiology from image quality to cost-savings to productivity.

Radiologists at **City Hospital Darmstadt** (Darmstadt, Germany) have noticed a significant improvement in image quality since installing a Kodak DR 5100 system. Peter Huppert, M.D., chief radiologist, opines, "The quality of chest x-rays with the new Kodak system is excellent without exception, and the large skeletal images are also much better than with our conventional system." The gains don't end with image quality. Huppert adds, "The users are very

happy because they can look at images at their own offices via the network."

Radiologists could discuss qualitative advantages of digital until they are blue in the face, but the truth is, money talks. And implementing a digital radiology department can yield significant cost savings. Diane O'Connell, radiology administrator for High Point Medical Center, explains, "We're seeing cost-savings in film, chemistry and office supplies. We're operating under a reduced budget and are not only meeting that but also exceeding it." O'Connell projects a 12 month cost-



Radiologist Mark LaCrampe reads DR chest images on a Kodak DX workstation (two center screens) at Virginia Mason Hospital, Seattle. The screen on the right is the IDX Rad Imaging Suite, which is integrated with the Kodak workstation. The screen on the left is for the Dictaphone Power Scribe voice recognition system.

savings in the \$375,000 range. Not bad for an institution completing 100,000 procedures annually. And that figure does not take cost-avoidance into account. The hospital recently purchased two multi-detector CT scanners, which could have yielded 800 to 1,000 print images per scan. O'Connell says, "That's a huge cost-avoidance." The department forecast that its film budget would have had to double or triple before phase two if it had continued to print film images.

High Point has realized other benefits as well. As technologists spend less time handling films and taking care of paperwork, they can spend more time with patients. And the repeat ratio has fallen dramatically; it sits at a mere two to two and one-half percent for the department. Patient throughput is also increased, and turnaround time to the emergency department has dropped. Overall, the turnaround time for preliminary reports to the emergency department fell 46 percent between 2001 and 2003 at High Point Medical Center. Finally, the hospital has

avoided the plague of lost images and studies. The upshot of all of the benefits is increased productivity for radiologists.

Virginia Mason Hospital has also seen significant gains. For example, report time to the emergency room fell from 4 hours to 15 to 20 minutes. Eusek credits this boost to the combination of Kodak digital radiography systems and a Powerscribe voice recognition system. And because radiologists can read any type of study at any one of the hospital's 12 workstations, they remain busy and productive throughout the day. Productivity doesn't end with radiologists either. Technologists are much more productive with a digital system because they aren't waiting for film processing or handling jackets. Eusek admits, "Radiologists were initially worried about the quality of digital chest films." Kodak's DirectView DR 5100 system, however, has put those fears to rest. He continues, "Image quality is exceptional and the Kodak DR chest unit is phenomenal."

XRC Medical Imaging opened fully digital, so it is impossible to compare digital and analog. Nevertheless, Jensen believes the decision to go digital played a key role in the center's success. Patient satisfaction is excellent at 98 percent. XRC has not yet quantitatively analyzed referring physician satisfaction, but Jensen reports, "They are absolutely thrilled that they can receive images in a variety of ways—on the webserver, CD-ROM and on film with the caveat that they store the film." Report turnaround time is a respectable less than 24 hours, with urgent studies reported within an hour.

For many facilities, digital imaging represents a new way of doing business. While new isn't always better, in this case it is. Digital facilities reap tremendous benefits on a number of fronts—cost-savings, productivity and efficiency and patient care. The challenge is selecting a vendor that will take the time to understand the unique needs of each site and guide the hospital to the right solution. Kodak's digital customers agree that the company has demonstrated its commitment to the field of digital imaging via a full range of high quality digital products and an outstanding service team.