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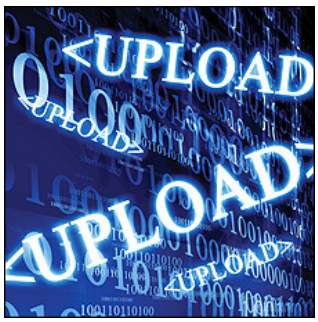
Service Solutions

by Greg Thompson

Easing Infusion Confusion



Dead spots and shielded areas can prevent infusion pumps from receiving updated drug libraries.

When you consider that it can be tough to find matching socks in a simple laundry basket, it should be no surprise that countless items get lost in the Byzantine world of the American hospital. For busy biomeds, the task of finding these pieces of equipment can be frustrating and time consuming.

In the case of high-technology devices such as infusion pumps, wireless interaction with servers transmits crucial information, such as newly updated drug libraries. Within the massive Duke University Health System in Durham, NC, there are more than a few cabinets where equipment can be tucked away. As a result, the wireless signals that update the new formularies may fail to reach the pumps.

In the absence of an electronic tracking system, all items at Duke are supposed to cycle back to a central equipment distribution point when a department is finished with them. To make this a reality, W. Glenn Scales, CBET, patient safety specialist at Duke, works with the nursing staff to discourage hoarding—an all too common practice at many facilities.

Scales acknowledges that getting the message out requires a lot of well-coordinated communication from clinical engineering, nursing, and from those within the centralized distribution system. "Each has a role to play, and each has to understand the strengths and weaknesses of the others to make this work well," Scales says. "Obviously, a lot of finger pointing is indicative of poor planning and dysfunctional communication. I feel that clinical engineering is key to the process, because we understand how everything is supposed to work together, and we can be helpful in educating all the various participants, monitoring progress, and dealing with the stragglers."

Fred Jaramillo, biomed manager, University of Colorado Hospital, Aurora, Colo, decided to get involved with nursing education committees to formally address the hoarding issue. Ultimately, Jaramillo completed a successful "amnesty day," and with the help of the chief nursing officer the biomed department collected equipment and brought it back to the biomedical/clinical engineering department.

In the spirit of amnesty, no one got in trouble for hoarding. "We brought down cartloads of equipment, and the process was not punitive," Jaramillo says. "We just wanted to make sure we had an accounting of all the stuff, and we found a lot of the pumps we needed to update."

The amnesty process also shed light on the mystery of at least two dozen wireless pumps that could not receive a signal. In the radiology areas, pumps shielded by lead-lined walls had no hope of receiving a wireless transmission. "These guys don't like to send the pumps down, but little do they realize the pumps are not getting updated with the new formularies," Jaramillo says. "And no one is going around and letting them know that. Interventional radiology represented the most units that did not get updated. This could also happen in a lot of areas where there might be dead spots and shielding."

In addition to education programs, Scales coordinates with nursing services and clinical engineering staff to

continuously make rounds in all the clinical areas to look for equipment. Multiple outlying areas do not have wireless connectivity, so when it comes time to update drug libraries, each of these areas must have all their equipment swapped out with updated devices.

This year, in addition to annual preventive maintenance (PM), Scales had to locate equipment for a software update that could not be sent over the wireless network. He will also make the equipment available to the manufacturer to perform several recall remediation updates that were announced earlier this year.

Scales reports that clinical engineering has worked with the technology services group on a methodology to help locate devices that are connected to the wireless network. "We have had good success in providing real-time location of the IP phones at one of our facilities," Scales says. "We are trying to adapt the software program and the configuration of our wireless antenna system to help locate the wireless modules. While this might prove helpful, it is not as robust a system as what others may have because, at best, it only locates the PCU or 'brain.' It does not show the location of any module attached to the brain. A tag or transponder-based tracking system gives much more reliable tracking of this kind of mobile equipment."

While a consistent educational effort directed at various hospital departments may sound like a low-tech solution, it can be effective and inexpensive. For those who wish to rely less on the human element, a wireless network card on each pump and an access point at each relevant location can be high-tech heaven.

Pump Communication

David W. Braeutigam, MBA, CBET, director of biomedical engineering at Baylor Health Care System, Dallas, oversees biomedical equipment technicians who have the luxury of real-time tracking. Based on what access point the device last "talked to," techs can get a good idea of where the missing infusion pump is hiding.

"When we are looking for an IV pump for preventive maintenance, and we can't find it by physically looking for it, we can go into the software application and see where it last communicated with an access point," Braeutigam says. "We had a hospital 30 miles south of Dallas that lost a pump and the biomed could not find it. He got on the application and found it at one of our other hospitals in another county, which we thought was pretty amazing."

Baylor's manager of clinical technology, Richard Swim, MCSE, CLES, is working with Hospira and another vendor on an even more advanced tracking technology—RFID tags. Braeutigam hopes the tags will someday foster an even better way to pinpoint pump location.

According to Swim, the problem with many tracking technologies is that they require their own infrastructure. "For some systems, you may need an infrared detector in every patient room, which does improve accuracy in locating a device," Swim says. "When you have an existing wireless infrastructure in place, which we do, it makes sense to leverage that—even though you might lose a little bit of accuracy. The vendor we are working with right now is AeroScout, and they are partnering with Hospira to integrate location technology into the MedNet applications that manage the IV pumps. The new system uses a triangulation method similar to GPS, which can pinpoint a location to within about 30 feet if the location system is properly calibrated."

Swim acknowledges that the seemingly basic act of finding things has spawned a unique cottage industry that goes well beyond basics. The intricacies of buying and integrating a new system can be tricky. Swim cautions that you must review the proposal and understand if additional infrastructure or hardware might need to be added. You may need to expand your wireless infrastructure, add servers, and put in processes to manage the new system.

Operating under a less computer-dependent system, the folks at Duke University still manage to achieve excellent results. With three large hospitals in the Duke system, equipment must eventually find its way to the biomedical department in conjunction with the university's annual PM inspections. Months in advance of the yearly process, which starts in October and ends December 31, Scales educates department heads with flyers and even posters that publicize software updates and equipment roundups. If all goes well, about 95% of PMs get finished on time.

This year, equipment upgrades include vendor updates for infusion pumps. "It is almost like an operating system for the pump," Scales says, who began his career as a biomed in 1967. "The purpose of the change was to introduce additional features and address some safety issues for which they have provided some software patches. The vendor typically releases software updates to enhance the operating features of the pump."

The blending of the manual and technology-driven tracking systems has worked well so far. Swim says that hospitals must ultimately choose what they can afford in both dollars and time. "There has to be a cost analysis as to what you need and what you want to spend," Swim says. "People often say we need a location system to find our equipment, but if you don't put a process in place on top of that location system, you are not going to get a lot of benefit. Technology will help, but there are still human processes that need to be fine tuned to make sure things work efficiently."

Updating New Libraries

When it comes to smart infusion pumps, pharmacies typically send out new drug libraries every 4 to 6 months, depending on clinical workflow and changes in drugs. Baylor leveraged its existing wireless infrastructure to allow for wireless infusion pumps in 2005. Hospitals without a wireless infrastructure will have to manually update the drug library for each infusion pump. The wireless infrastructure allows for a quicker way to update drug libraries on the infusion pumps. Baylor has also recently converted several of its hospitals' EKG carts to transmit 12-lead EKG

information back to the server via the wireless network.

Biomeds familiar with smart pumps know that when the pump is powered up, it should communicate with the infusion pump management system and tell users if a new drug library is available. It will then ask clinicians if they want to download the new drug library. Much like software applications on computers, users can accept or decline. If nurses need to place a pump on a patient, they are going to make a decision as to whether to install that new library. If a nurse elects to install the new library, the pump will take about 12 minutes to complete the installation process.

Problems could arise when machines are out of range of the wireless network, because they will never see the new library. Braeutigam stresses that all infusion pumps would typically be used in a location that would only be operated in the range of a wireless infrastructure. However, as Jaramillo and Scales report, after use many pumps are stored in areas outside the signal range.

When the biomed department has a pump in the shop, the biomed technicians will routinely verify the library version and install the latest version of the library. "The current technology is that the pump will communicate when it is plugged in and charging or it is powered up and in use," Braeutigam says. "We are working with the vendor to install a second beaconing technology that will rely on a separate battery that should last 5 years. So when your infusion pump is unplugged, you can still use this secondary beaconing technology and find a pump that has been sitting in a cabinet for 8 months. This will only help with location of the infusion pump, and is not designed to update the drug library. By having the additional tag on the infusion pump, you are still going to use the same network infrastructure, and it will only communicate with the network once every so often to tell you where it is located."

Over at Duke University, Scales uses an Alaris wireless network in which the server is constantly looking at all the connected pumps. The technology keeps track of whether the crucial information is successfully being transferred to the pumps. "The server keeps track of who has been updated and where it is in the updating process," Scales says. "When an update is in progress, we monitor this in clinical engineering using a software program that summarizes this data uploading, minute by minute."

For the process to cover every pump, each unit must be plugged in and turned on until the data upload is complete. Because the server can update only six "brains" at a time, and the upload takes 4 to 5 minutes, Scales and his staff can do just over 70 per hour.

"If they are all on and within range of a wireless access point, then you can theoretically update about 1,700 per 24 hours," Scales says. "Here at Duke, we have about 1,400 brains, and the last time we did an update we were at 88% complete at the end of 24 hours. It also took us almost 2 months to get to nearly 100%—and we still aren't there after 6 months, although we are close. Unfortunately, without some kind of device tracking we will only find the few remaining pumps that need updating by pure luck."

According to Braeutigam, one helpful method for finding the pumps is to inform the nursing staff that a new drug library will be released. He adds that you cannot force someone to download the software update, but you can teach him or her why it is important to do so: patient safety.

"We have run into similar situations where staff did not want to wait for the download/update to occur—the screen said it would take 1 hour, but it was actually closer to 20 minutes," Braeutigam says. "One way we have tried to handle this is to have our staff turn on the IV pumps when they see one in the hallway or come in for repair. By turning it on they can tell it to force a download, especially if we knew a new drug library was just recently updated. Another method is we asked the vendor to update the screen to give a more realistic time for the download."

Braeutigam also suggests having a central place for IV pumps where a process can be put in place for that department to ensure the pump is updated before it leaves the department.

"The bottom line is we are a team that needs to decide the best way to do this with all parties in the same room," Braeutigam says. "You probably won't be able to create a rock solid method to ensure all pumps are updated, but you can find a few ways to ensure more pumps are updated if people are aware."

From the biomed perspective, wireless technology is a huge convenience. While it is an undeniable timesaver for many biomeds, additional complexities (in addition to the problem of wireless range) tack on additional challenges. "In the old days, infusion pumps were reasonably cost efficient to repair," Braeutigam says. "Now you have additional infrastructure, software, firmware, and server costs. The costs to support these systems have dramatically increased because of this."

Ultimately, benefits to the patient outweigh the problems. "You can now collect data on what selections were made by the clinician, where the pump was last located, and how many infusion pump channels are in use," Braeutigam says. "And that is a good thing, because you want to capture those numbers and be able to make better decisions."

Supporting the security aspects of any type of wireless equipment that can be spread across multiple hospitals is perhaps the final ingredient in the high-tech recipe. Basic Web-based encryption data could be cracked by savvy computer users who could theoretically figure out the security key, jump on the network, and pull sensitive information.

"I am working with our office of information security team to decide the best level of encryption, and that must be a consideration when any system is deployed," Swim says. "Assign a person with IT experience to communicate

effectively with the IT security team and your vendor so you can ensure effective security measures."

For infusion pumps, security adds yet another level of complexity. Swim says most of the burden should fall on the vendor. "As we continue to get more connected health devices, the vendors are going to have to recognize that they are working on an enterprise network," he says. "They will have to comply with the hospital's information security requirements."

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