Infusion Management
One Journey in Clinical Innovation

Kristen O’Shea

In October 2009, WellSpan Health, an integrated healthcare system in south-central Pennsylvania, was asked by its electronic health record (EHR) vendor to participate as an alpha partner in developing and testing an application known as Infusion Management. The purpose of Infusion Management was to enable clinicians to more effectively manage complex patients with multiple infusions. It was to be accomplished by the creation of bidirectional interfaces between the EHR and the infusion pump that allow for complete closed-loop administration of intravenous infusions and medications, and auto-programming of the IV pump, as well as graphically depicting and documenting data from the pump in a series of useful gadgets.

WellSpan Health’s leadership was interested in partnering on a project that would demonstrate the true power of the EHR. Infusion Management was the perfect project. Not only would it be a test for the power of automation and using data in the record, it was consistent with the WellSpan vision for device connectivity. WellSpan had already connected cardiac monitors and ventilators in their intensive care units (ICUs), post-anesthesia care units (PACUs) and emergency departments, and anesthesia machines in the operating rooms. The WellSpan vision for an automated workflow is based on the premise that a device, once thought to be stand-alone, now should be viewed as an integrated piece of the clinical workflow in the context of a computerized environment. The value of the device increases when it is connected to the electronic record.

At WellSpan, the benefits and drivers for continued device connectivity have been reduction of caregiver time to manually enter high volumes of discreet data in high-acuity care units, improvement in safety by assuring correct data is entered into the EHR, and rapid access to all data elements in EHR for clinician viewing across the system in real-time. In addition, WellSpan believes that nurse and patient satisfaction is improved as the result of nurses spending more time with patients in meaningful ways rather than entering data into an electronic record.

Alpha Partnership
It was determined that an ideal pilot unit would be an ICU that had a variety of complex patients who had large numbers of infusions and titratable medications. A 10-bed medical ICU at York Hospital, known as Med Surg ICU, was chosen as the pilot unit. The unit already had connected ventilators and cardiac monitors.

Everyone knew that being an alpha partner would involve a lot of testing and that there would be trials and tribulations; however, no one foresaw that the project would impact nearly every aspect of each supporting organization. In order to achieve the goals of Infusion

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Management, layers of infrastructure needed to be added and technology needed to be implemented in a phased approach. Over the course of several months, smart infusion pumps were deployed, bar codes were added to intravenous infusions and pumps, and new hardware, including new computers with 27-inch monitors in each room and more servers, were installed. Servers were needed not only to support device connectivity, but also to support the wireless infusion pumps as they were now sending information more frequently. Computer codes were modified to meet clinical needs and to fix glitches. New software packages were installed frequently.

The WellSpan team consisted of a project manager, nursing informaticians, pharmacists, clinical and technical application specialists, nurses, and network and biomedical specialists. Teams from the EHR and infusion pump vendor companies included engineers, computer technicians and software developers, data and performance specialists of all types as well as clinicians.

Communicating with weekly, sometimes daily calls, the teams worked together to design and implement this complex project. There were many times when conference lines were open all day as teams worked in three different locations to bring this project together. As an alpha partner, WellSpan would receive and test code, develop workflows, and put into place the necessary pieces for implementation. There were occasional challenging times when the existing software did not match clinical needs. As an alpha partner, the WellSpan team felt that it needed to push for that functionality to be developed. The team encouraged clinicians to remember that “it wasn’t like other traditional implementations when the software comes tied up in a big red bow.” They were helping to create the package for others who would implement Infusion Management around the world in the future.

Finally in July 2010, Infusion Management and the gadgets were ready for implementation. All of the teams—comprised of members from WellSpan, the EHR, and infusion pump companies—were together in one room. The go-live went well. There were issues and needed tweaks, but for the most part, it was successful. The nursing staff described the day as a little bit like Christmas morning. Despite a highly complex technological infrastructure, the nurses performed the very simple “scan, scan, scan” of the patient, medication and the infusion pump, heard the “beep, beep, beep” that indicated success, and saw documentation elements populating their dashboards.

Infusion Management worked well for a period of about four weeks. But at the end of one long work week, new problems surfaced that compromised the reliability of the system. The pumps were not sending data in a consistent fashion. While there was no direct harm to patients, the nurses needed to shift back and forth between the automated process and manual documentation and processes. It was too difficult to manage the unpredictable performance in a high acuity environment such as an ICU, and so the system was temporarily turned off.

During the next 96 hours, engineers and technical experts peeled away layers to determine why things weren’t working as designed. Ironically, most of the important lessons that were learned as a result of this project occurred in the time period following the temporary interruption in use of Infusion Management. Prior to the incident, the WellSpan team had worked closely with the teams consisting of associates of the EHR and the infusion pump vendor companies. Following the incident, it was clear that new levels of teamwork were needed. Over the next week, the project team unpeeled the layers of a complex system and found what was causing the issue—a problem with a specific server’s version of operating system software. The primary lesson learned that week and over the following months was not just about that server and its operating system. It was about how to work as a team. Not only did the WellSpan team need to work more closely and transparently with its vendor partners, but it needed to work more closely across departments and internal “silos.”

### New Ways to View Partnerships

This project showed new ways to partner with vendors. It also introduced new internal partnerships at WellSpan Health. Historically,
the WellSpan-vendor relationship was formal. In working closely as an alpha partner with two vendors, a new way of thinking emerged—not seeing vendors in the traditional sales, almost “adversarial” way, but as partners in problem solving. This change seems to bring innovation and opportunity to all partners. For WellSpan, it has brought resources for problem solving; partners in a project are willing to bring support to the table. For example, WellSpan recently encountered unexpected problems with the flow of infusion devices, and the vendor partner was quick to offer resources to assist with the issue.

Vendor partners have benefited from relationships with WellSpan’s leadership team and subject matter experts as well. WellSpan clinical and IT leaders have been able to provide important insight to both vendor organizations. Infusion Management brings new issues to infusion pump companies. Engineers from both companies were able to experience first-hand what the clinical ramifications of their work was in a clinical setting. 24/7 technical support has a whole new meaning with the connected infusion pump. In working with WellSpan, the company was able to rethink how this would work. In addition, WellSpan is able to be a reference site for others who wish to learn more about Infusion Management.

Internal partnerships look different too. In the past, clinicians, informatics and clinical applications specialists may not have fully appreciated the important part that the technical applications, biomedical, desktop, materials or server teams play in keeping our system going. Similarly, the technical teams may not have fully appreciated the role that the clinical and informatics teams play. Following the Infusion Management project, there is greater appreciation and understanding for the many roles that combine to make a complex project work. Meetings no longer are held in silos and include a vast array of members so that each is able to contribute to the support and functionality of complex projects such as this one.

New ways of partnering internally and externally affect the processes for device selection and procurement. Device decisions must include an analysis of the ease of connectivity and the willingness of the device company to work in concert with your system’s vision for connectivity. All devices companies will likely say you will be able to connect their device; however, specific assessment of the ability to get the data needed is important. It may be possible to get some, but not all of the data. It may be possible to get it, but through additional gateways, which may affect the user experience. It is imperative that a technical and clinical informatics review of devices takes place to assure that devices will provide the desired output. EHR and middleware partners can help with this selection variable as well.

While there are many drivers for device standardization within an organization, device connectivity projects, such as Infusion Management, quickly demonstrate the need for such standardization. There is no question that a variety of devices makes this work even more complex than it already is. WellSpan had already begun the work of standardizing across the organization...
and has added device connectivity as an important driver of this strategy.

**New Structures and Roles**
Support of a complex system is, well, complex. Many organizations are challenged with how their general information technology (IT) help desk supports an EHR. One area that required much thought was how the help desk would support clinician calls. On one hand, it is not possible for clinicians, let alone those who work in an ICU setting, to spend much time on the phone with the help desk. On the other hand, there are many systems and technologies at play in Infusion Management. Is it the pump or its safety software? Is it the wireless? Is it the EHR? Is it the middleware? Is it one of the servers that supports one of those systems? Is it a user knowledge error? Is it a bar-code scanning error?

After many months, WellSpan has turned the troubleshooting assistance over to the help desk from the implementation team. Clear and precise algorithms have been developed to assist the help desk personnel to quickly triage issues to the correct support service. There's a new area for the help desk: biomedical devices. In the past, a clinician would call directly to the biomedical engineering department. Now if the device is connected, a clinician only needs to call the help desk to get the help that is needed. It is critical when implementing such a system to give careful thought to the support that will be necessary.

As a result of thinking about devices in new ways, it became clear that the Biomedical Engineering Department needed to be more closely aligned with the IT Department. As a result of thinking about devices in new ways, it was clear there were new areas that required expertise and attention. There was a need for someone who understood the device and the output, as well as the middleware and how it connected the device and the EHR system. A new position, medical equipment information system specialist or MEISS, was developed to specifically work on connectivity as it related to the medical devices. Cisco Certified Entry Networking Technician (CCENT) certification is required. Two individuals serve in this new role at WellSpan. The MEISS is involved in all projects that are related to connectivity, working to ensure that all aspects of the device preparation support connectivity, including bar-code scanning.

**The Result**
There is no question that there is a new way to manage infusions in the Med-Surg ICU, resulting in safer and more efficient care. Medication errors have been reduced and nurses are able to spend more time caring for patients. Computer clicks have decreased from as many as 42 to as few as six, and time needed for documentation has dropped 57%. Computer code enhancements have been completed and expansion is scheduled. The work wasn’t easy. However, it appears that the lessons learned were invaluable. The lessons helped to prepare WellSpan for “what could be possible” when vendor partnerships are formed, departmental silos give way to robust, multitalented teams, and structures are aligned in new ways to support complex processes.
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