

Smart Pumps

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In 2006, the Institute of Medicine (IOM) reported that “when all types of errors are taken into account, a hospital patient can expect on average to be subjected to more than one medication error each day.” To help counteract patient safety issues, the IOM report suggested that hospitals “make greater use of information technology in prescribing and dispensing medications ... including the adoption of smart infusion pumps.”

Recently, KLAS conducted a study on smart pump usage, with extra attention being given to issues such as the functional strengths of the available pumps, missing functionality, pump tracking and quantifiable benefits reported by providers. KLAS found that while there are difficulties in using, tracking and quantifying benefits for smart pumps, 90% of purchasers would buy their smart pump again. However, there are kinks to be worked out in the areas of functional strengths, missing functionality, pump tracking and benefits.

Functional Strengths

While the majority of study participants (92%) are using smart pumps in all areas, the functional strengths of those smart pumps vary. Collectively, the smart pump vendors KLAS studied scored highest in ease of use of the dose error reduction system (DERS), scored weakest in reporting capability and are most alike in preventing medication errors.

When drilling down into specific vendor scores, KLAS found

that reporting capability is each vendor’s lowest-rated functional capability. In many cases, providers expressed frustration with pulling data from the pumps. A lack of wireless implementation means that each pump must be located, brought to the download station and manually downloaded. Once more hospitals have wireless features implemented, the data pulls will be substantially less difficult.

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But for now, much functionality is simply not accessible. One provider stated, “We are not currently pulling alert data from the system. Not having a way to easily pull the alarm data seems to be the missing link for not being able to do a lot of things, such as monitor which nurses are using the software and which alerts are firing.”

Another common concern is that the generated reports are not user friendly. Providers say they have difficulty understanding portions of the reports or that the data are almost useless because of the way in which they are presented.

However, not everyone is unhappy. Many providers like the

ability to track what caused an alarm to go off. One provider shared, “We like the event history reporting features. We can access the last 1,000 keystrokes when an alarm goes off, print out the data and save the reports for future reference.” Another said, “I like that I can go in and see every button that the nurses push. They will often say it was the pump that was the problem, and oftentimes it was the clinician. This functionality was especially nice in times past when the colleague’s on/off button was next to the start button and people would turn off the pump instead of starting it.”

Missing Functionality

As mentioned above, wireless connectivity and interfaces are considered essential for ease of pulling data. Unfortunately, wireless connectivity (and interfaces to support it) is the functionality most often identified as missing in organizations’ current smart pump arsenal (Figure 1).

Wireless communications needs are varied and range from updating drug libraries, dose guard protection ranges and medication flow rates – which need to be done manually to each machine if not connected – to communicating with the pharmacy. Future anticipated functions involve five rights protection, bar-coding, electronic medication administration record (eMAR) documentation, electronic medical record (EMR) nursing content and other point-of-care functions.

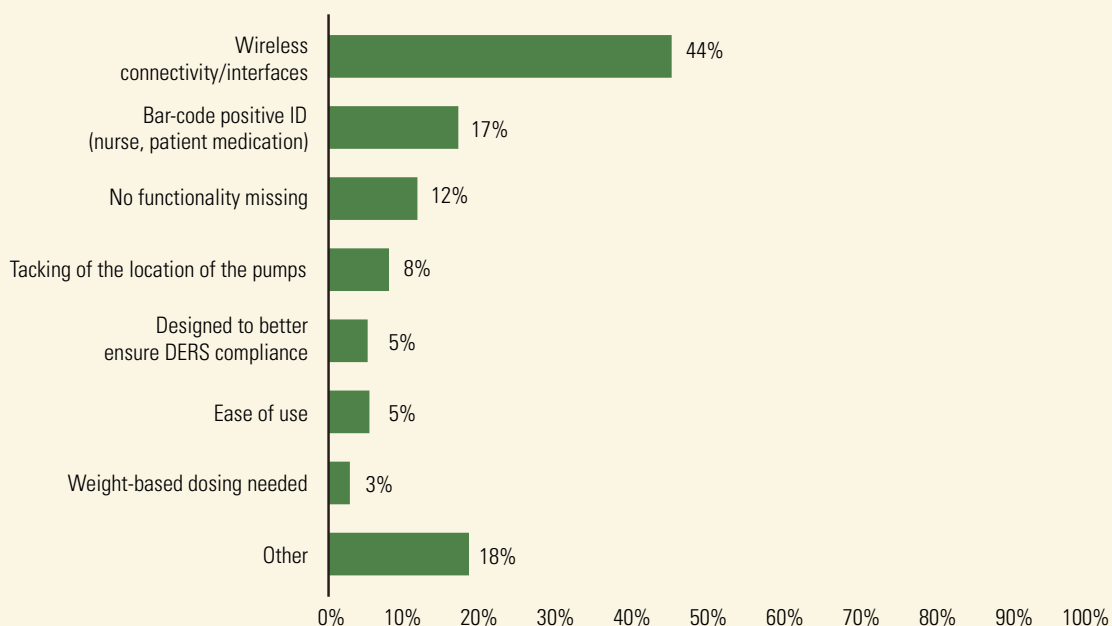
At this point, only 30% of respondents have wireless commu-

nication with their pharmacy, and most also do not have wireless access to pump data. For those who do have wireless capabilities, the story is positive. One such provider stated, “The reporting capabilities are great for those who have the server. Without the server, it takes a bit of effort to get the data. I love it with wireless. I can log onto the server in the morning and discover that there has been a reprogramming event, or three or four reprogramming events, during the night on a certain patient, and I can find the patient and see if the changes were appropriate. I can also see if there has been an override on a guardrail that worries me.”

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In addition to wireless issues, 17% of providers mentioned bar-coding functionality as a missing element in their smart pumps. Most agree that being able to tie data to a specific patient through bar-coding is a desired functionality. One respondent explained, “I can take a look at how many times a user has overridden a particular alert in the guardrails. I can’t tie

Figure 1. Functionality most often identified by organizations as missing



DERS = dose error reduction system; ID = identification.

this data to a particular patient or nurse, but I can see general trends around when the alerts are happening, for which drugs and what the corrective actions are. In order to tie this to a particular patient, I would need bar-code scanning technology. This would allow me to scan the patient’s wrist and tie the pump to that patient.”

However, currently only 6% of respondents indicate that patient medication orders are entered using bar codes. This finding is consistent with other bar-code and nurse findings in KLAS surveys, namely computerized physician order entry (CPOE), where the use of bar-code scanning at the patient bedside for positive patient and medication identification (closed-loop medication administration) was still in its infancy, with 84% of respondents showing none to very low adoption (0–15%).

Pump Tracking

Pump tracking also appears to be its infancy. Users of Hospira pumps were the most successful at tracking the physical location of pumps via radio frequency identification (RFID) or other technology with 53% reporting in the affirmative. This is compared with 19% reported by users of Cardinal Health pumps and 0% reported by users of B. Braun and Baxter pumps. As to the technology used to track the pumps, approximately one-third of study participants reported using RFID, while others reported tracking by noting which wireless hub a group of pumps is transmitting to, and determining general location in this manner.

For those who do not have RFID or other tracking methods (which is the vast majority of users), various manual tracking methods are employed. One provider explained, “Nobody really understands how the pumps move throughout the hospital.

For a time, we tried a serial number check-in/checkout process for the pumps, but that failed. Nurses wouldn’t trust the fact that they would get clean pumps back if they would just turn in those they were using. Even if the pumps needed repairs, they were hesitant to turn them in. Now, until we get RFID or something like it, we just do the best we can at trying to keep tabs on all the pumps.”

Another provider stated, “Right now, we have a system where each pump has a bar code on it, and every day a central service-person goes around the hospital and scans each device to make sure they are all accounted for. The scanner then talks to our ADT [admissions, discharge and transfer] system and makes sure it is on the right patient. Some pumps are kept on standby in departments, but most are assigned to a particular patient. When the patient is discharged, the pump is returned to central services for cleaning.”

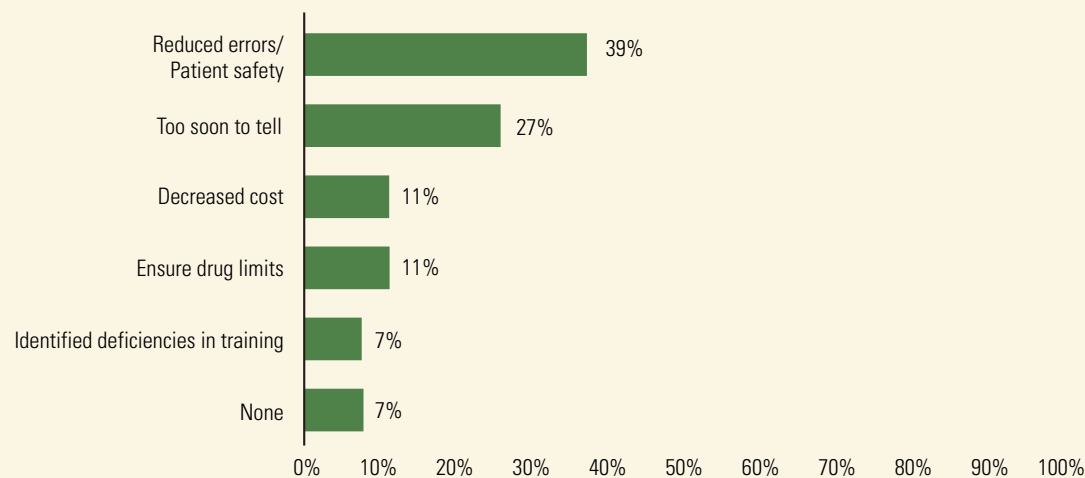
Nurses are reported to guard their pumps carefully – too carefully in some cases. For instance, one organization reported, “Tracking the pumps is a major issue. We can locate about 95% of the pumps, but there is always a group of them that we just cannot find. We aren’t able to really make timely delivery of the pumps, so nursing does hoard them in dropped ceilings or anywhere else they can find.”

Quantifiable Benefits

Nurses aren’t the only ones who value their smart pumps. Study respondents were asked if they had achieved any quantifiable benefits from their smart pumps purchase, and many answered in the affirmative. Their responses are grouped by category in Figure 2.

As one would expect, reducing errors/patient safety is the top benefit reported, though it is surprising that *more* respond-

Figure 2. Provider-reported quantifiable benefits of smart pumps



ents did not respond in a like manner. Also surprising is that the number two benefit reported was “too soon to tell.” This response suggests that there is more than meets the eye regarding successful implementation and usage of smart pumps. Interestingly, the majority of study participants were seasoned smart pump users who reported that they have used their solutions for more than one year. One would expect that, with such use, the benefits would be realized by now – unless implementation and usage are more difficult than previously suspected.

Another possible explanation is that return on investment (ROI) and other analyses have simply not been conducted yet. As one provider stated, “The data we get from the pumps are only gathered when there is a problem, so it has pieces of data here and there but nothing consistent. It is way too early for us to even try to determine an ROI. I know that we are reporting more errors than before, so that is a good thing. However, for us to get a consistent stream of data from the pumps, either we need them to have a wireless interface to the pharmacy or we need a lot of people to go out and pull the data out of them. We just do not have the personnel to do this.”

However, some organizations have done quantifying based upon the cost of an adverse drug event. One provider stated, “We have had a lot of what we call ‘great catches,’ where a programming error was stopped by a hard limit. We have calculated the average cost of an adverse drug event at \$4,500. We had 11 of those last month from the patient-controlled analgesia units alone.”

Again, not all organizations have conducted studies to see the rate at which errors have been reduced, and there *are* difficulties with such an effort (e.g., it is hard to find an accurate baseline since errors often went unreported previous to smart pump implementation); however, those who have conducted basic research generally estimate they are experiencing fewer errors.

One such provider reported, “We have had some good cost avoidance through medication error prevention. We see about four or five medication error preventions every month.” Another stated, “I know that in the last year, we have gotten between 30 and 50 calls from nurses who got warnings from the pumps, which prevented medication errors. I do not know the value of these saves.”

Complicating matters is the fact that a drug error can be defined in different ways. Should one count a “safe error” as an error? One provider explained this difficulty: “We are constantly looking at drug errors, and I would like to say we are preventing them with the pumps, but I do not know. It is hard to say if going slightly outside the limit would have any kind of effect on the patient, so I do not know what to count as a prevented medicine error.”

However, 90% of those who have purchased smart pumps say they would buy them again. Clearly, while each organization’s pump data are not all in (or downloaded!), smart pump purchasers are finding enough benefits to warrant continued use and purchase.

For further information on the smart pump study or other KLAS findings, go to www.healthcomputing.com. Providers receive free access to KLAS Online, where one can access ratings on hundreds of medical equipment and HIT vendors and products.

References

The Institute of Medicine. July 20, 2006. *Preventing Medication Errors*. Washington, DC. Author. < <http://www.iom.edu/Object.File/Master/35/943/medication%20errors%20new.pdf>>.

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