Another important component of product selection is the vendor’s technical support. Are technicians available 24 hours to help you troubleshoot problems? What kind of educational support and in-services does the vendor offer?

Pharmacy should also consider the size of the pumps’ cassettes and/or syringes before making a purchase. Some pumps are only compatible with long syringes, which may be cumbersome to stock in automated dispensing cabinets. It is important to evaluate the facility’s dispensing systems to avoid potential stocking problems with any given vendor’s cassettes, cartridges, and syringes.

The availability of ready-to-use cassettes is also important to consider when selecting a PCA pump. PCA opioid cassettes compounded in the pharmacy typically have a 30- to 45-day expiration date. Cassettes compounded by a manufacturer have much longer expiration dates, and manufacturers have the

---

**PCA Pump Purchase Considerations**

In selecting a PCA pump for your facility, first carefully consider the pump’s ability to set standard dose concentrations and to place stop limits on doses that are outside of your facility’s recommended ranges. That functionality can decrease programming-related medication errors.

User-friendliness in programming is another very important feature to consider during product selection. Look at the sequence of programming to ensure that it will make sense to your clinicians. For instance, the pump may first prompt the programmer to identify the care setting, such as OBGYN, in which the device will be used, and then will provide a series of dose concentrations for that setting. The pump should then prompt the clinician to select any necessary parameters, such as demand doses, dose intervals, continuous infusion, or lockouts.

Another important component of product selection is the vendor’s technical support. Are technicians available 24 hours to help you troubleshoot problems? What kind of educational support and in-services does the vendor offer?

Pharmacy should also consider the size of the pumps’ cassettes and/or syringes before making a purchase. Some pumps are only compatible with long syringes, which may be cumbersome to stock in automated dispensing cabinets. It is important to evaluate the facility’s dispensing systems to avoid potential stocking problems with any given vendor’s cassettes, cartridges, and syringes.

The availability of ready-to-use cassettes is also important to consider when selecting a PCA pump. PCA opioid cassettes compounded in the pharmacy typically have a 30- to 45-day expiration date. Cassettes compounded by a manufacturer have much longer expiration dates, and manufacturers have the

---

OVER THE PAST 10 TO 15 YEARS, PATIENT CONTROLLED ANALGESIA (PCA) has become a standard modality for acute post-operative pain management. One of the primary benefits is the empowerment of the patient to deliver an analgesic dose, thereby providing increased physical comfort, as well as the improved emotional comfort that comes with knowing there will be no delay in his or her relief. Patients appreciate that control over their doses.

With that in mind, it is important to carefully consider your facility’s PCA medication-use practices, from prescribing to dispensing to administration. It is also vital to select PCA pumps with embedded features that will help ensure the safety and comfort of your patients.

---

Reduce the potential for PCA pump programming errors by narrowing the number of choices your clinicians have when programming the pumps.

---

**PCA Pumps**

Matching the Right Products with Safety Practices

---

Over November 2006, Patient Controlled Analgesia (PCA) has become a standard modality for acute post-operative pain management. One of the primary benefits is the empowerment of the patient to deliver an analgesic dose, thereby providing increased physical comfort, as well as the improved emotional comfort that comes with knowing there will be no delay in his or her relief. Patients appreciate that control over their doses.

With that in mind, it is important to carefully consider your facility’s PCA medication-use practices, from prescribing to dispensing to administration. It is also vital to select PCA pumps with embedded features that will help ensure the safety and comfort of your patients.

---

Reduce the potential for PCA pump programming errors by narrowing the number of choices your clinicians have when programming the pumps.

---

**PCA Pump Purchase Considerations**

In selecting a PCA pump for your facility, first carefully consider the pump’s ability to set standard dose concentrations and to place stop limits on doses that are outside of your facility’s recommended ranges. That functionality can decrease programming-related medication errors.

User-friendliness in programming is another very important feature to consider during product selection. Look at the sequence of programming to ensure that it will make sense to your clinicians. For instance, the pump may first prompt the programmer to identify the care setting, such as OBGYN, in which the device will be used, and then will provide a series of dose concentrations for that setting. The pump should then prompt the clinician to select any necessary parameters, such as demand doses, dose intervals, continuous infusion, or lockouts.

Another important component of product selection is the vendor’s technical support. Are technicians available 24 hours to help you troubleshoot problems? What kind of educational support and in-services does the vendor offer?

Pharmacy should also consider the size of the pumps’ cassettes and/or syringes before making a purchase. Some pumps are only compatible with long syringes, which may be cumbersome to stock in automated dispensing cabinets. It is important to evaluate the facility’s dispensing systems to avoid potential stocking problems with any given vendor’s cassettes, cartridges, and syringes.

The availability of ready-to-use cassettes is also important to consider when selecting a PCA pump. PCA opioid cassettes compounded in the pharmacy typically have a 30- to 45-day expiration date. Cassettes compounded by a manufacturer have much longer expiration dates, and manufacturers have the

---

**PCA Pumps**

Matching the Right Products with Safety Practices

---

Over November 2006, Patient Controlled Analgesia (PCA) has become a standard modality for acute post-operative pain management. One of the primary benefits is the empowerment of the patient to deliver an analgesic dose, thereby providing increased physical comfort, as well as the improved emotional comfort that comes with knowing there will be no delay in his or her relief. Patients appreciate that control over their doses.

With that in mind, it is important to carefully consider your facility’s PCA medication-use practices, from prescribing to dispensing to administration. It is also vital to select PCA pumps with embedded features that will help ensure the safety and comfort of your patients.

---

Reduce the potential for PCA pump programming errors by narrowing the number of choices your clinicians have when programming the pumps.

---

**PCA Pump Purchase Considerations**

In selecting a PCA pump for your facility, first carefully consider the pump’s ability to set standard dose concentrations and to place stop limits on doses that are outside of your facility’s recommended ranges. That functionality can decrease programming-related medication errors.

User-friendliness in programming is another very important feature to consider during product selection. Look at the sequence of programming to ensure that it will make sense to your clinicians. For instance, the pump may first prompt the programmer to identify the care setting, such as OBGYN, in which the device will be used, and then will provide a series of dose concentrations for that setting. The pump should then prompt the clinician to select any necessary parameters, such as demand doses, dose intervals, continuous infusion, or lockouts.

Another important component of product selection is the vendor’s technical support. Are technicians available 24 hours to help you troubleshoot problems? What kind of educational support and in-services does the vendor offer?

Pharmacy should also consider the size of the pumps’ cassettes and/or syringes before making a purchase. Some pumps are only compatible with long syringes, which may be cumbersome to stock in automated dispensing cabinets. It is important to evaluate the facility’s dispensing systems to avoid potential stocking problems with any given vendor’s cassettes, cartridges, and syringes.

The availability of ready-to-use cassettes is also important to consider when selecting a PCA pump. PCA opioid cassettes compounded in the pharmacy typically have a 30- to 45-day expiration date. Cassettes compounded by a manufacturer have much longer expiration dates, and manufacturers have the
sterility and stability data to back up those dates. From both a financial and logistical perspective, those extended expiration dates can make a big difference: In low-volume dispensing areas, you may have increased wastage from expired medications, not to mention the paperwork and documentation associated with opioid waste.

It is also prudent to limit the number of different PCA pump models your facility uses. Ideally, you should use one model facility-wide because of the amount of training and competency testing involved with each device you implement.

**Standard Concentrations**

Your pain committee — comprising nurses, physicians, pharmacists, and quality managers — should bring their different points of view together to design a standard PCA order sheet, as well as a list of standard concentrations for PCA delivery. Reduce the potential for PCA pump programming errors by narrowing the number of choices your clinicians have when programming the pumps. A standard set of a limited amount of concentrations can lead to improved safety overall.

Certain pump manufacturers offer soft-
ware that allows you to set concentrations for and program multiple pumps from one PC. Once your pain committee establishes your facility’s standard concentrations, you can use the software to program all of your pumps, achieving consistency in your programming, as well as workflow efficiency. In addition, certain vendors’ software allows you to program maintenance warnings into your pumps, alerting clinicians when it is time to perform an annual check-up on the device in question.

To further ensure the safety of your patients, it can be helpful to establish dosing limits in your pharmacy information management system. For instance, provide the standard PCA concentrations in a drop down menu, so that data entry errors do not occur, and program your pumps with upper titration limits. These checks within your system can catch wrong-dose errors before they reach the patient.

Selecting Patients for PCA Therapy
In determining if a patient is a good candidate for PCA therapy, you should initially establish if the patient is opiate-naïve, versus opioid-tolerant. Opiate-naïve individuals are at a much higher risk for respiratory depression and other adverse effects of opioids than opioid-tolerant patients.

Sleep apnea history and identification of apnea risk factors (high BMI, history of snoring, large neck circumference) are important initial considerations. If the patient uses a bi-level positive airway pressure (BIPAP) or continuous positive airway pressure (CPAP) machine at home, consider using it before surgery and immediately after extubation to diminish the risk of respiratory depression.

Prescriber Education
It is important to educate prescribers about the different concentrations and opioid equivalencies used in PCA. Traditionally, four opioids are used: morphine, hydromorphone, fentanyl, and meperidine. Because of meperidine’s metabolite toxicity and the related risk of adverse events, meperidine should not be a PCA opioid option, especially in patients with impaired renal function.

Patient Education
It takes about 15 minutes to educate patients on pump use and the dangers associated with PCA by proxy. PCA by proxy is a term that describes the activation of the patient demand dose button by anyone other than the patient. It is crucial to emphasize the following fundamental safeguard of PCA: Excessively sedated patients are usually unable to activate the dose button, thereby preventing the delivery of additional opioid doses and the subsequent clinically significant, opioid-induced respiratory depression. However, family members must be instructed that serious adverse events can result from their unauthorized involvement in administering analgesia for the patient.

PCA by proxy errors are highly preventable and can be minimized with the adequate and appropriate education and training of staff and family members. Following are a few strategies for preventing PCA by proxy errors.

Proper patient selection: Some patients may not be appropriate candidates to receive PCA (e.g., cognitive level, confusion, psychological stability).

Careful monitoring: Respiration, sedation level, and capnography monitoring may be appropriate in some cases.

Education: Teach patients and family members about PCA, and consider
It is important to evaluate the facility’s dispensing systems to avoid potential stocking problems with any given vendor’s cassettes, cartridges, and syringes.

posting signs above the bed and on the pumps themselves. (See Figure 1 below.)

Figure 1. For an added level of safety, pumps can be labeled to prevent PCA by proxy.

Nurse Education
Staff nurse education should include PCA opioid assessment and monitoring. Each hospital will have its own policy regarding the assessment, but generally, the nurse should assess the patients’ respiration rate and level of sedation, along with asking the patient to rate the level pain. The Presbyterian Hospital of Dallas is currently conducting a study to identify the value of additional monitoring on the general care nursing unit for patients identified as having a higher risk of adverse events while administering PCA. Additional monitoring includes the patient’s oxygen saturation, end tidal CO₂ expiration, and continuous respiratory rate. However, this investigational monitoring is not standard in every hospital at this time.

Nursing education should also include the dangers of PCA by proxy, and the risks associated with look-alike drugs such as hydromorphone and morphine. Hydromorphone is approximately five times as potent as morphine, and in order to prevent confusion between the drugs and subsequent wrong-drug errors, pharmacists and drug manufacturers should consider using tall-man lettering on hydromorphone and morphine packaging.

In addition, nurses should be aware of the potential for PCA pump programming errors. Recently, an error occurred from “double-key bounce” with one manufacturer’s pumps. Double-key bounce occurs when the pump is incorrectly programmed with a number value that has been accidentally entered twice. For instance, a nurse may enter a rate of 50 mLs per hour, however, double-key bounce causes the pump to register that rate as 550 mLs per hour. Programming errors have been reduced by performing independent double checks. In other words, one nurse should program the pump and then another nurse should independently confirm the accuracy of the programming, versus the two nurses checking side-by-side. You are more likely to catch errors with that kind of independent check.

Pharmacy Training and Education
Pharmacy training and education is a little different from nursing training and education. If pharmacists are programming your facility’s PCA pumps, they should be able to demonstrate competency in programming different concentrations and delivery situations.

Dispensing PCA
Before dispensing PCA opioids, physicians, pharmacists, and nurses should consider the appropriate selection of an opioid based on the patient history, including whether or not the patient is opiate-naïve, previous allergies (and the patient’s response), and

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Reader Service Number</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Braun Medical Inc.</td>
<td>112</td>
<td><a href="http://www.bbraunusa.com">www.bbraunusa.com</a></td>
</tr>
<tr>
<td>Baxter Healthcare</td>
<td>109</td>
<td><a href="http://www.baxter.com">www.baxter.com</a></td>
</tr>
<tr>
<td>Hospira, Inc.</td>
<td>108</td>
<td><a href="http://www.hospira.com">www.hospira.com</a></td>
</tr>
<tr>
<td>Smiths Medical</td>
<td>113</td>
<td><a href="http://www.smiths-medical.com">www.smiths-medical.com</a></td>
</tr>
<tr>
<td>Sorenson Medical</td>
<td>111</td>
<td><a href="http://www.sorensonmedical.com">www.sorensonmedical.com</a></td>
</tr>
</tbody>
</table>

WHERE TO FIND PCA Pumps:
other concomitant medications.

Storage of opioids in automated dispensing cabinets on the nursing unit may help to eliminate errors related to selection of the wrong opioid. If possible, store each opioid type (morphine, hydromorphone, or fentanyl) in separate drawers.

Storage of opioids in automated dispensing cabinets on the nursing unit may help to eliminate errors related to selection of the wrong opioid.

**Conclusion**

The benefits of PCA in terms of patients’ satisfaction and pain relief have made this modality a standard approach for acute postoperative procedures. However, these benefits will be maximized, and the associated risks minimized, if the right products are matched with safety practices and processes. Implementing comprehensive safety practices and processes for clinical staff, patients, and family members will improve pain management outcomes.

Rob Hutchison, PharmD, is an assistant professor at Texas Tech University Health Sciences Center School of Pharmacy and the clinical specialist in pain management and palliative care for the Presbyterian Hospital of Dallas since 2000. He received a BS in pharmacy from the University of Texas and a PharmD from the University of Arkansas.