

OHTAC Recommendation

Implementation and Use of Smart Medication Delivery Systems

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OHTAC Ontario
Health Technology
Advisory Committee

Background

The Ontario Health Technology Advisory Committee (OHTAC) engaged the University Health Network's (UHN) Healthcare Human Factors Group (HHFG) to collect evidence on the effectiveness, and safety of smart infusion systems. To this end, HHFG conducted both lab and field evaluations. This document presents a summary of recommendations based on results from these evaluations. There is clear evidence to show that the full benefit of this technology can only be realized by a structured approach to implementation, and the purpose of this document is to guide healthcare institutions considering purchasing smart infusion pumps, as well as institutions currently using this technology. While this report presents a summary of the recommendations, a comprehensive report containing lab study results, field study results, and a roadmap to successful migration can be accessed using the following link:

http://www.ehealthinnovation.org/files/SmartMedicationDeliverySystems_FullReport.pdf

It is clear that smart medication delivery systems have the potential to dramatically improve patient medication safety. The purpose of these recommendations is to ensure that this full benefit is achieved.

Preparation Phase

Formation of multi-disciplinary steering committee

The key to a successful implementation of a smart pump system is to view the change as an institutional undertaking as opposed to a departmental undertaking. It is essential to involve a team of physicians, nurses, pharmacists, biomedical engineers and IT system experts. Thus, implementation of smart infusion pump systems requires a formal process that involves many stakeholders, and should not be viewed as a pump replacement initiative but rather as a patient safety initiative.

Key recommendations:

Form a multi-disciplinary steering committee with the following expertise:

- Ordering, preparation, and administration of medications
- Wireless network infrastructure
- Technical requirements

Standardization of drug concentrations and dosing units

Smart IV infusion systems require the use of drug libraries and connections to wireless servers. Therefore, a comprehensive readiness assessment is required for smart pump system implementation. Standardization of drug concentrations and dosing units is critical to ensuring (a) synchronicity of information contained on physician orders and in smart pump drug libraries, and (b) compliance with use of the Dose Error Reduction System (DERS). Thus, standardized drug concentrations and dosing units are a “must have” prerequisite to smart pump implementation.

Key recommendations:

- Establish standardized concentrations and dosing units prior to smart pump implementation to ensure full safety benefits.
- Establish drug libraries that are tailored to specific areas of the hospital, to meet physician prescribing needs.

Drug library development

Optimized smart pump adoption requires the creation, customization and maintenance of drug libraries for different clinical care settings to create library subsets for specific groups of patients.

Key recommendations:

- Establish standardized concentrations and dosing units.
 - Policies and guidelines must be updated according to changes made to standardized list.
- Create Clinical Care Area (CCA) specific drug library subsets.
 - Drug library subsets should be grouped by patient populations that require similar medication concentrations. Neonatal and pediatric patients should be grouped by weight.
- Set dosage limits for different types of infusions, especially for bolus vs. maintenance drug administrations.
 - Both soft and hard limits must be set.
 - Protocols must be established for each dosing guideline.
- Consider the use of clinical advisories to synthesize information and notify clinicians of important issues.
 - Clinical advisories must be highly specific and should be used infrequently to reduce “alert fatigue”.

Planning for integration of key systems

Benefit achieved through smart pump use will depend on the extent to which the smart pump has been integrated with other systems. Many institutions lack a systemic approach to addressing medication safety issues, leading to fragmented solutions that can introduce new, unintended issues. Once the fundamental requirements of a medication drug library containing standardized concentrations and dosing units are met and wireless network-based uploading and downloading of information is prioritized, smart pump implementation can follow an adaptable approach that allows incremental benefits while progressing towards a fully integrated system. Institutions should make a long-term plan that includes the eventual integration of related IT systems and the use of bar coding and radio frequency identification (RFID) tagging for patient and medication identification (Figure 1 provides a description of a potential closed-loop medication administration process).

Key recommendations:

- Assess the extent to which smart pump system can integrate with other safety technology initiatives.
- Use a common database management system or data exchange standards (e.g. HL7 in healthcare) that will allow the sharing of data.
- Establish a formal process to ensure that changes made to information that is shared across multiple stakeholders are reflected throughout the corresponding departments. For example, institutions must ensure synchronicity between standard concentration and dosing units contained in smart pumps and in physician order entry systems (whether computerized or paper-based).

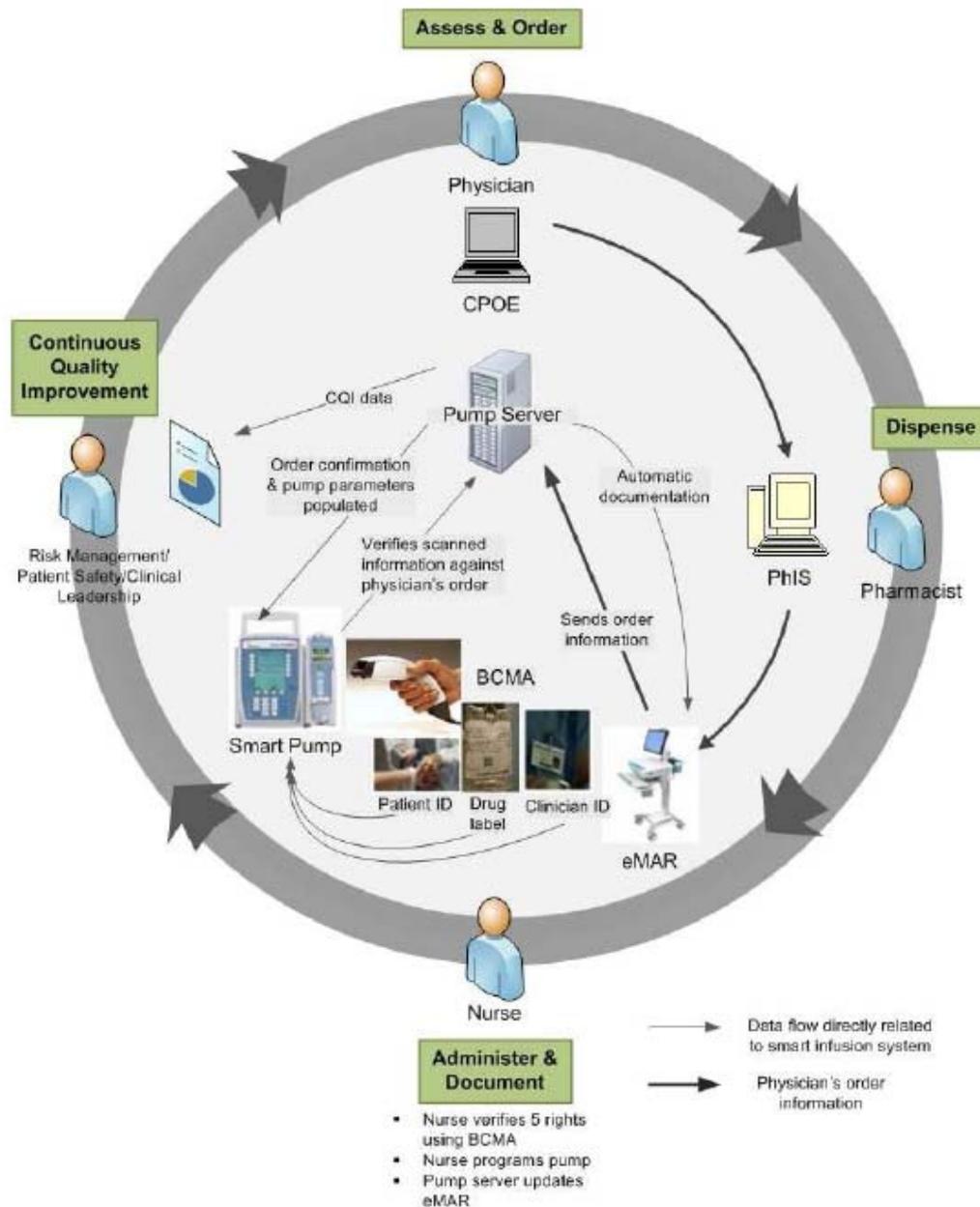


Figure 1: Example of a potential closed-loop medication administration process

Description of a closed-loop medication administration process:

First, physician's orders can be transmitted to a smart pump server after being approved by pharmacy. The nurse at the bedside uses a scanner on the smart pump (or a third party scanner) to scan the patient's armband, the medication label, and his/her nursing badge (in the case where a third party scanner is used, the nurse would also scan the smart pump). This information is sent wirelessly from the smart pump to the pump server. The pump server, which is electronically linked to the Computerized Physician Order Entry (CPOE), the Pharmacy Information System (PhIS), the Positive Patient Identification system (PPID), and/or the electronic Medication Administration Record (eMAR), tethers the administration to the medication order. If the scanned information matches the physician order, the pump server populates the smart pump's parameters according to the stored doctor's orders. The nurse reviews the entries and starts the infusion. The automated system transmits the infusion with the associated clinician and patient ID to the eMAR.

Identification and preparation for cultural shift and process changes resulting from smart pump implementation

Prior to implementing smart pumps, institutions must prepare for the cultural shift and process changes that result from smart pump implementation. The migration from traditional IV infusion pumps to smart infusion systems brings about changes to practice in nursing and in pharmacy. For example, given that smart infusion systems require the standard concentration platform, there may be changes in who mixes the drugs (e.g., shift from nursing to pharmacy). Furthermore, the steps involved in programming a smart pump differ from those involved in programming a traditional pump, and this may include a shift from flow rate to dose rate.

Key recommendations:

- Identify process changes resulting from smart pump system implementation and educate all stakeholders to ensure that they understand and are prepared for the cultural shift.

Implementation of wireless infrastructure

A wireless-ready pump and wireless network environment is necessary for frequent drug library updates and for continuous quality improvement. Many institutions do not ensure wireless connectivity prior to implementing smart pumps. Consequently, these institutions cannot reap the benefits that smart pumps can offer (e.g., ability to rapidly update drug libraries and download use data to assess compliance with drug templates during programming).

Key recommendations:

- Implement wireless network infrastructure, and integrate with smart infusion pump system. If this is not possible at start up, it should be done as soon as possible afterwards.
 - Wireless infrastructure is necessary for regular Continuous Quality Improvement (CQI) downloads, drug library uploads, and pump tracking. Drug libraries must be updated on a regular basis to ensure compliance.
 - Regardless of an institution's wireless network readiness, a connectivity strategy for information upload and download to smart pumps must be defined.

Implementation Phase

Smart pump system evaluation and acquisition

There are many variations in the functionality and ease of use of both pumps and their associated software across suppliers. When evaluating the shortlisted products, the steering committee must assess all components of smart infusion systems (e.g., drug library software, continuous quality improvement software) rather than focusing solely on the pumps themselves.

Key recommendations:

- Evaluate all components of smart pump system (including drug library and continuous quality improvement software). Vendors' CQI data analysis software is still immature and difficult to use and should therefore be assessed carefully when selecting the smart pump manufacturer.
- Conduct a Human Factors evaluation.

Training/ policy development

In planning training, institutions must consider the technical skills and process changes required for adopting the new smart pump system.

Key recommendations:

- Address technical and behavioural factors associated with the effective use of technology and user acceptance, and conduct hands-on training for each user.
- Establish a process to coordinate training and troubleshooting before, during and after implementation.
- Establish ongoing communication and education about new processes and policies regarding smart pump system use.

Ongoing Optimization Phase

Compliance with use of Dose Error Reduction System (DERS)

User entry into the Dose Error Reduction System (DERS) is critical to achieving safety benefits of the smart pump. Bypassing the DERS by programming in the generic mode leads to a negative return on investment and an absence of safety benefits.

Key recommendations:

- Select pump design that encourages entry into DERS.
- Mandate use of DERS.
- Conduct post go-live follow-ups to assess compliance.
- Regularly update drug libraries based on pump system user reports.
- Promote a culture of safety urging nurses to evaluate alerts, and limit overrides to circumstances that are clearly defined.

Maintenance/monitoring

Compliance with the complete system should be assessed and barriers to successful adoption should be identified and removed.

Key recommendations:

- Assign the task of analyzing CQI data to specific individuals and provide them with necessary training.
- Plan for the allocation of significant time and resources into CQI data analysis to produce quality reports.
- Evaluate CQI data to (a) assess drug library compliance, and (b) identify and remove barriers to adoption.