Smart Pumps: Achieving 100% Drug Library Compliance & Averting Medication Errors

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INTRODUCTION

Goals of the Project
- Uphold the health system culture of patient safety by improving medication administration processes and monitoring
- Standardization of practices, supplies, and implementation of new technology to decrease potential for pump related errors and associated patient harm

Problems Identified
- Old Technology with limited safeguards
- Clinician manual programming for IV drip infusions
- Customized medication concentrations and infusions leading to large variability
- Multiple types and models of IV pumps and accessories throughout the organization
- Reporting of medication errors relied solely on direct observation and self reporting

IMPLEMENTATION

PHASE I
- Development of the multidisciplinary team with members from Pharmacy, Nursing, Education, Biomed, Materials Management, and Management
- Research and investigation regarding different vendors and technology available including site visits and testing of IV pumps in-house with our wireless system.

PHASE II

Drug Library Development
- Pharmacy applied best practices and evidenced based guidelines for medication infusions to recommend standards for IV drip concentrations and infusions
Examples:
- Fentanyl in both 10 mg/250ml and 20mg/250ml-standardized to 20mg/250ml
- Norepinephrine prescribed both mcg/kg/min and mcg/min dosage-standardized to mcg/min
- Epinephrine and phenylephrine dosed both mcg/min and mcg/kg/min-standardized to mcg/kg/min
- Collaboration between Pharmacy, Physicians and Nurse Clinicians to evaluate practices and preferences
- Safety “double-checks” including clinician advisories on high risk medications Heparin and Insulin
- Soft minimum and soft maximum dosing limits set for all drugs to alert clinicians of programming that is above or below the customized limits set
- Soft limits designed to warn but not restrict
- Hard maximum limits set for high alert drugs preventing clinicians exceeding specified dosing limit

PHASE III

Drug Library Validation Workshop
- Multidisciplinary review of the drug library by all areas
- Nurses, physicians, and pharmacists included
- Training Workshops
  - Clinical Mentors (Resource staff for each area)
  - All nurses received hands on training immediately before pump implementation
- Patient ID scanning procedure with handheld and built in pump scanners for patient specific real time monitoring

INNOVATION

DoseTrac® Real Time Data
- Monitoring by clinicians and pharmacy to view pump settings, alerts and active alarms
- Pharmacists use real time monitoring to improve workflow and decrease turnaround times

DoseTrac Reports
- Retrospective reports of pump infusions and alerts to understand trends, identify education opportunities and drug library improvements

Technology Integration
- Smart pump IV solution is embedded with BMV process
- Smart pumps are integrated with nurse call and portable phone technology
- Alarms from IV pumps are directed through nurse call system directly to the phone of the primary caregiver

Over 400 Outlook® ES IV pumps were installed throughout the health system, almost a full year from the start of the project!
**DATA ANALYSIS RESULTS**

- Initial data analysis was completed 6 weeks post implementation
  - Total of 11,784 infusions – 35.34% used drug library

**Post Implementation:**
Total 400 Alerts in 11,784 Infusions

- Dose Alerts (260) 65%
- Rate Alerts (140) 35%

**OUTCOMES**

**Compliance Rates**

<table>
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<th>Target</th>
<th>12/2011</th>
<th>07/2012</th>
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<tbody>
<tr>
<td>Dose Delivered</td>
<td>95%</td>
<td>93%</td>
<td>100%</td>
</tr>
<tr>
<td>Rate Delivered</td>
<td>95%</td>
<td>49%</td>
<td>100%</td>
</tr>
<tr>
<td>Correct Location</td>
<td>95%</td>
<td>92%</td>
<td>100%</td>
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<tr>
<td>Correct Care Area</td>
<td>95%</td>
<td>62%</td>
<td>100%</td>
</tr>
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- Compliance increased to 100% through awareness, education, and process improvements
- Within the first three months of implementation, seven (7) adverse drug events were averted

**LESSONS LEARNED**

- Alert fatigue from soft maximum limits set too low vs. actual infusion practices was a concern
  - Limits adjusted to prevent potential alert fatigue and maintain safe dosing
- Ongoing education: Bolusing, oncology drug infusions
- Communication with staff
  - Outcomes, good “catches” and averted errors
- Custom concentrations could possibly increase errors:
  - Propofol entered as 10mg/100ml instead of 1000mg/ml could result in 100 times higher rate
  - Norepinephrine 8mg/250ml programmed as 4mg/250ml could result in an infusion rate double the intended rate
  - These examples demonstrate opportunities for error when custom concentrations are enabled
  - Supported decision to limit entering custom concentrations on as many drugs as possible
- Smart pump technology resulted in improving medication safety, preventing patient harm, faster recognition and response to alarming pumps, and further promoting a culture of safety!

**INTERVENTION**

- Weekly unit-based audits to assess and document drug library utilization and compliance due to
  - Overall low drug library utilization (35%)
  - High number of aborts
  - Wrong care area/location selections
- Targets of 95% established across key infusion pump metrics:
  - Dose delivered infusions, rate delivered infusions, correct location, and correct care area

Compliments of:

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