The Big Three Medication Safety Challenges:
Physician Order Entry, Smart Pumps, and Bar-Coded Medication Administration

Kelly J. Burch PharmD

“The Big 3!”
Challenges in NICU Medication Safety - CPOE, Smart pumps and BCMA
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Conflict of Interest
- I have no current financial relationship with any of the hardware or software vendors mentioned in this talk.
- Research grant to investigate packed red blood cell transfusion safety using IMED-Gemini (now Alaris/Carefusion) equipment-1989

Case Study: Cefepime
MD: ID suggested cefepime for MDR GNR. But I forgot to tell them 27 weeks GA.
- Dose/interval/monitoring?
- NNP: order entry?
  - Is D5W OK diluent if infant has BG 120?

Pharmacy
- NICU patient needs cefepime:
  - What concentration is safe for a baby, based on IV site?
  - Is the dose measurable with our usual concentration?
  - Is the product stable for our usual dispensing process? What’s the anticipated duration of therapy? Any opportunities for economy?

- Why cefepime for this infant?
  - How fast to give it? Is it in the pump database? Compatibility with TPN? And dopamine? What are the monitoring parameters? If we pull the PICC, can I still give it?

Nurse

Parents
- Why are there so many questions about this antibiotic?

Case Study: Cefepime

AST
- Vigilanz reported use of cefepime in NICU patient; define duration and report outcomes.

Informatics
- Cefepime added to NICU preference list; organized with an NICU specific entry, with dose and interval buttons?
  - Smart pump library

1995
- Bulk containers
- Across patients
- No relationship between dispensed volume and ordered dose
- Unit secretary screened orders, sent to pharmacy if she detected something they should know
- Hand written medication plan/MAR
- Hand written med cards
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Technology Across Mercy Health System

Alaris smart pump implementation
- STLO-2008
- SPRG-2010

Epic EHR implementation
- SPRG-2007
- STLO-2009

Commonalities...screens and clinical decision support shared between all Mercy Ministry locations for both Epic and smart pumps

Timeline of “The Big 3!” at MCH

2003
- BCMA
- Bridge
- Cerner
- PharmNet

2006
- Smart syringe pumps with wires
- MedFusion
- PharmGuard
- Alaris
- GuardRails

2007
- Smart LVF and syringe pumps wireless

2009
- CPOE
- EPIC

Increasing collaboration across Mercy Ministry

How Many Have Introduced BCMA? Have You Addressed the 5 Rights?

Sources of Medication Errors

- Penmanship/decimal point practices/BAs
- Failure to achieve 5 rights (patient, drug, dose, time, route)
- Failure to RL3...read label three times
- Confirmation bias
- Hierarchy problems

How Does BCMA Affect NICU Medication Errors?

It Helps!
- Right patient, right drug, right time (3 of 5)
- Right dose if supported by unit dose drug distribution (+1, now 4 of 5)
- Lasers read BCs in developmentally appropriate lighting.
- Lasers read accurately even if held by chronologically gifted co-workers

BCMA Does Not Help...

- Right route
- Right dose, if not supported by unit dose drug distribution.
- If done after drug administration
- With errors in dosing that start with the wrong order, if they are undetected through the whole medication use system
- Problems from not monitoring for adverse effects
- Problems from not asking enough questions due to hierarchy problems
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BCMA May Cause New Problems...

- Perception that safety precautions delay therapy, then “workarounds” create new opportunities for error
- Label design places emphasis on bar code but displaces ability for human to read letters and numbers

BCMA vs. Letters and Numbers

Using BCMA Software and Processes for Breast Milk

- More important than ever in single family rooms
- Single scanner and established workflow
- Can be adapted; clunky for multiples.
- Voice of experience:
  - Don’t use same printer for medications and milk labels
  - Differing priorities between Rx and NICU
  - Credentialing of milk tech as pharmacy tech
- Words of advice on NICQpedia

Smart Pumps

Smart Pump Profiles Contain “Rules” for Similar Kinds of Patients –Related to Dosing and Container

**Adult and Peds OVER 40 profiles**

- Fixed doses in fixed concentrations
- Less button pushing
- More intermittent drugs given via piggyback

**NICU and Peds 40 & under profiles**

- More weight based dosing
- More low volume syringe pump delivery
- More hard stops, especially for low concentration
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CQI for Smart Pumps

Dataset

Teamwork

Wireless upload

Caregiver Alerts & Alarms

Alert/Alarm Analysis

“Top 25” Drugs Causing Alerts

“Top 25” Drugs Causing Alerts

REPLCMNT Fluid

fentaNYL

LORazepam bolus

.Saline Flush

VANCOmycin

Lipid20% 2 kg & less

fentaNYL bolus

.IV Fluids

dexaMETHasone

ampicillin

caffeine citrate

TOBRAmycin

sodium bicarbonate

hydroCORTisone

midazolam_NICU

DOBUTamine

Lipid20% 3 kg & less

meropenem

.NS or LR Bolus

milrinone

amphotericin B

NICU TPN under 1 kg

Blood Products

indomethacin

CLINDAmycin

Cumulative Frequency of Alerts

Number of Alerts

Drug

”Top 25” Drugs Causing Alerts

Can you describe the process and people involved in smart pump analytics in your organization?

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Do Caregivers Use GuardRails?

Comparison % GR Compliance / NICU Profile Goal = 93%
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Reading rule reports for intermittent medications

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Therapy</th>
<th>Intermittent Drugs - NICU</th>
<th>Intermittent Drugs - NICU</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Available As Total Dose Limits</td>
<td>Module Duration Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Concentration</td>
<td>Clinical Ads. Name</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Min Max</td>
<td>Min Max</td>
</tr>
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<td></td>
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<td>Min Max</td>
</tr>
</tbody>
</table>

Intermittent drugs: primary or secondary, dose limits, pump or syringe, infusion time limits; concentration limits

Ask yourself, what is the usual concentration of acetaminophen? What is the usual dose of acyclovir? How quickly is acyclovir usually given?
The intermittent medication rules were built to accommodate the "usual".

HARD Stops on LOW Concentration

- Entering too LOW a concentration implies that the product is
  - Dilute
  - Not very potent
- Rate calculations will try to give the desired dose, using a not-very-potent product, so the dose volume calculated will be TOO LARGE resulting in
  - OVER DOSE!!!
- Rapid rate...if a unit dose has been dispensed, the patient will be protected from over dose, but will receive the desired dose too quickly
- Hard stops on LOW concentration help protect patients from over dose

Can you describe the process and people involved in smart pump data set management in your organization?

CPOE and NICU Medication Safety + List

- Penmanship problems/good decimal point practices/BAs
- Decision support
  - Drug dosing
  - PN solution design
- Decision perpetuation
  - Concentration
  - Diluent
  - Expiration date/hang time

CPOE and NICU Medication Safety

- Yes, it's a cow.... a C.O.W.!
- Some people call a C.O.W. a W.O.W.

CPOE and NICU Medication Safety New Sources of Problems

- SALALAD
  "sound alike, look alike, list alike drugs"
  Alpha lists/drop down lists may encourage choice of the wrong agent
- Flexibility for unusual circumstances may be lost.
- Many choices for communication
- Workarounds if the screens don’t match desired practice.
- Formerly useful double checks are no longer robust (or worthwhile).
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Drug searches and alpha lists

Searching for ampicillin using a larger database...

Beyond “The Big 3!”
Medication Safety and Technology Goals for 2014

- Bolus from infusion for pain meds
- Improved order entry dosing communication
- Mature in use of drug information sources
- EPIC/smart pump connectivity (2015+)
- Abandon outdated med safety strategies
  - spreadsheet for potent infusions
  - Improve TPN check
- Maintain useful med safety strategies
  - Drug calculation cards/sheets
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History and Culture Related to Safety

Beyond “The Big 3”…
Tools for Clinical Decision Support
- EPIC
  - TPN solution design for prescribers
- Abacus
  - TPN solution design for pharmacists
- Vigilanz
  - Rules based drug use algorithms
  - Adversity detection
- Evidence based medicine databases
  - UpToDate
- Drug information sources
  - Micromedex and subindexes

Beyond the Big 3
Tools for Drug Distribution and Compounding
- ADCs-Pyxis/Omicell
  - Routine review of products and override lists
- Automated PN compounder
  - “BCMA” and QA for PN compounding
- DoseEdge
  - “BCMA” for sterile product compounding
  - Digital photo record of product and components

Beyond the Big 3
More Tools for Drug Distribution and Compounding
- Simplifi <797>
  - Documents compliance w/ sterile product compounding requirements.
  - Organizes records related to oral liquid compounding
  - Medex
    - Time points and personnel in drug distribution
    - Carousel based medication storage
      - OLD: put things that get mixed up on separate shelves
      - NEW: carousel serves and highlights your choice… but you made your choice from an alpha picklist on a screen

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How will we know if BCMA, or smart pumps, or EHR/CPOE causes problems or solves problems?
- Literature
  - Study
    - Rates of events
    - Frequency of alerts/alarms
    - Metrics for alert/backup “value”
    - Cases and anecdotes
- Event reporting
  - An “event”: any time something doesn’t go just right.
    - Near misses
    - 1 wrong of 5 rights
    - System problems…waits, can’t finds.
- Internal data analysis of real life use

Selected References