Let's Get Pumped

… a smart pump overview
Mark J Kliethermes RPh, MBA
September 11, 2014

Conflict of Interest Declaration

I nor my spouse have any actual or potential conflict of interest in relation to this activity.

mark j kliethermes

Learning Objectives

- **Review the key functions and benefits associated with smart pump technology**
- **Explain the steps necessary in setting up smart pumps**
- **Identify the essential resources for implementing and supporting smart pumps**
- **Describe experiences of various institutions with smart pump systems.**

Let's Talk about YOU!

Do you work at an institution that uses smart pumps?

A. Yes

B. No

Let's Talk about YOU!

Have you ever touched a smart pump, programmed one or given a training demonstration?

A. Yes

B. No

Let's Talk about YOU!

Have you ever received a question about how to troubleshoot a smart pump?

A. Yes

B. No

Let's Talk about YOU!

Do drug shortages have an affect on smart pump technology at your institution?

A. Yes
B. No

Since infusion pumps are primarily a nursing function. Pharmacy has minimal impact on smart pump implementation, use and support.

A. True
B. False

A benefit of a smart pump is that the nurse can simply point and click to start an infusion.

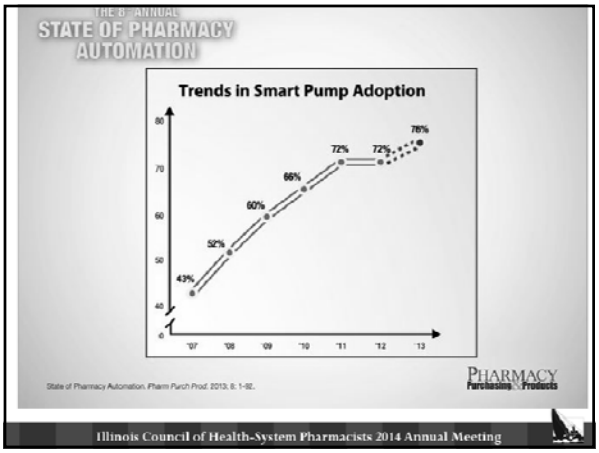
A. True
B. False

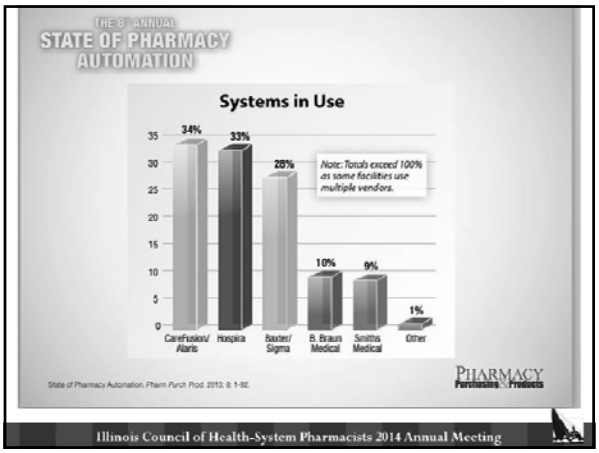
Can you use the term DERS properly in a sentence?

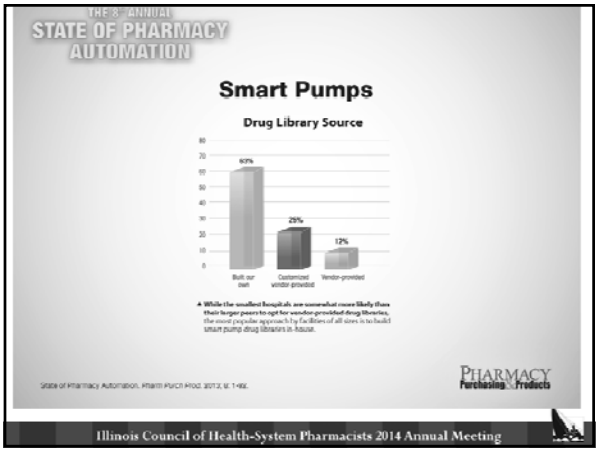
A. Yes
B. No

What percent of US institutions use smart pumps?

A. 25%
B. 50%
C. 63%
D. 75%







Functions and Benefits

- Standardized Master Drug Library
- Care Area Customization
- Medication Controls
- Library Updates
- BCMA Integration
- EMR Integration
- Continuous Quality Improvement Reports

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Four Issues

1. Pump used in bariatric unit, returned to biomed for servicing then re-issued to pediatric unit.
2. Nurse receives an order to run Heparin at 12 units/kg/hour and makes a mistake in the conversion of pounds to kg.
3. Nurse receives an order for Dobutamine 4.3 mcg/kg/min but programs 43 mcg/kg/min into pump by mistake.
4. Nurse infuses potassium chloride rider but selects meropenem from the smart pump library. 'Because they run at the same rate'.

DERS

DERS is what makes a pump smart

Dose Error Reduction System

DERS Controls and Parameters

Care Area Examples

- critical care
  - emergency department
  - ICU
- medsurg
- neonates / newborns
- oncology
- pediatrics
- telemetry

DERS Controls and Parameters

Care Area Configuration

Patient Weight Limits

- Lower and Upper Hard Limits
- Lower and Upper Soft Limits

Keypad lock

Downstream Occlusion Pressure Settings

DERS Controls and Parameters

Medication and IV Fluid Configuration

- antibiotics
- vasopressors
- insulin
- heparin
- tpn
- specialty medications

DERS Controls and Parameters

Drug Names

- Customization
- Tall Man Lettering

Delivery Bag

- Primary/Secondary/Both
- Call Back Options

DERS Controls and Parameters

Drug Amount
- g/mcg/mg/units/

Diluent Volume (mls)

Concentration

Dose Mode
- mcg/kg/min
- ml/hour
- ml/kg/min

DERS Controls and Parameters

Soft Stops
- Lower Rate
- Upper Rate

Starting Rates

Hard Stops
- Lower Rate
- Upper Rate

Volume to be Infused (VTBI)

DERS Controls and Parameters

Clinical advisories

Bolus controls

Loading dose controls

Variable concentrations

Weight based medications

Multistep option

Smart Pumps Have Limits

Basic (bypass) Mode
- mls/hour

Technical Limitations
- Maximum and minimum rates
  - mls / hour
  - mls / minute

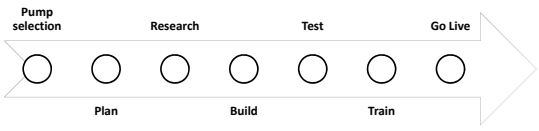
Naming conventions
- Tall Man allowed
- Maximum number of characters

The Human Limits

Video Demonstration

Smart Pump Training Video[2]

Smart Pump Implementation



Smart Pump Implementation Selection

Pump selection

Know your ultimate goals

- BCMA Integration
- EMR Integration
- Wireless considerations

Smart Pump Implementation Plan

Identify facility resources and responsibilities

- **Pharmacy**
  - Build initial Master Drug Library
  - Manage Master Drug Library
- **Nursing**
  - Managers to support training
  - Resource clinicians for the build and testing
  - Educators for training
- **Information technology**
  - Server and wireless support
- **Biomedical Support**

Smart Pump Implementation Research

Pharmacy

- formulary and dilution information
- unique protocols and dosing regimens

Nursing

- care area configuration
- alarm settings
- weight range
- detail current practice

Biomed/Information Technology

- wireless survey

Smart Pump Implementation Build

Compile the information
- Work with your pump format in mind
- Vendor provides starting library

Pharmacy and nursing
- Initial review of compiled data for errors and omissions

Program data into pump Master Drug Library

Upload the data to the pumps

Smart Pump Implementation Test, Train and Go Live

QA entered data
- printed reports

Training
- Train on programmed pumps
- Benefit for MDL validation

Place pumps into production (go live)

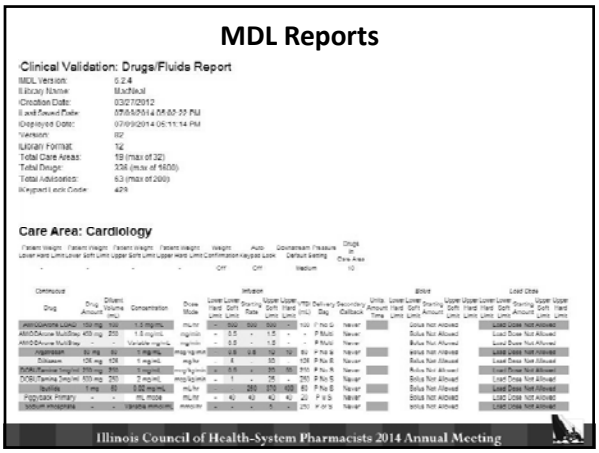
Corrections
- Anticipate corrections for up to two weeks after implementation

Report Options

Master Drug Library Data

Continuous Quality Improvement (CQI)

MDL Reports



MDL Reports

Clinical Validation: Drugs/Fluids Report

MDL Version:	6.2.4
Library Name:	
Creation Date:	03/27/2012
Last Saved Date:	07/09/2014 05:02:22 PM
Deployed Date:	07/09/2014 05:11:14 PM
Version:	82
Library Format:	12
Total Care Areas:	19 (max of 32)
Total Drugs:	336 (max of 1600)
Total Admixtures:	63 (max of 200)
Keypad Lock Code:	429

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MDL Reports

Care Area: Cardiology

Drug	Drug Amount	Diluent Volume (mL)	Concentration	Dose Mode	Lower Hard Limit	Lower Soft Limit	Starting Rate	Upper Soft Limit	Upper Hard Limit
AMIODArone LOAD	150 mg	100	1.5 mg/mL	mL/hr	-	600	600	600	-
AMIODArone MultiBag	400 mg	220	1.8 mg/mL	mg/min	-	0.0	-	1.0	-
AMIODArone MultiBag			Variable mg/mL	mg/min		0.0		1.0	
Argatroban	50 mg	50	1 mg/ml	mcg/kg/min		0.5	0.5	10	15
Diltiazem	125 mg	125	1 mg/ml	mg/hr	-	5	-	30	-
DOBUTamine 1mg/ml	250 mg	250	1 mg/mL	mcg/kg/min	-	0.5	-	20	50
DOBUTamine 2mg/ml	500 mg	250	2 mg/mL	mcg/kg/min		1		35	
Ibutilide	1 mg	50	0.02 mg/ml	ml/hr	-	-	250	370	400
Piggyback Primary	-	-	ml mode	ml/hr	-	40	40	40	40
Sodium Phosphate	-	-	Variable mmol/ml	mmol/hr	-	-	-	5	-

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MDL Reports

				Bolus						Load Dose				
VTBI (mL)	Delivery Bag	Secondary Callback	Units: Amount Time	Lower Hard Limit	Lower Soft Limit	Starting Amount	Upper Soft Limit	Upper Hard Limit	Lower Hard Limit	Lower Soft Limit	Starting Amount	Upper Soft Limit	Upper Hard Limit
100	P No S	Never			Bolus Not Allowed				Load Dose Not Allowed				
-	P Multi	Never			Bolus Not Allowed				Load Dose Not Allowed				
-	P Multi	Never			Bolus Not Allowed				Load Dose Not Allowed				
50	P No S	Never			Bolus Not Allowed				Load Dose Not Allowed				
125	P No S	Never			Bolus Not Allowed				Load Dose Not Allowed				
200	P No S	Never			Bolus Not Allowed				Load Dose Not Allowed				
250	P No S	Never			Bolus Not Allowed				Load Dose Not Allowed				
50	P No S	Never			Bolus Not Allowed				Load Dose Not Allowed				
20	P w S	Never			Bolus Not Allowed				Load Dose Not Allowed				
250	P or S	Never			Bolus Not Allowed				Load Dose Not Allowed				

Continuous Quality Improvement Reports

Sample Reports

- DERS compliance
- Soft Limit Exceeded
- Device or MDL Hard Limit Attempted
- Pump Utilization

DERS Summary

Mode	Date Range	Care Area	# of Infusion starts	Total # of Infusion per Care Area	% of Total Infusion Starts per Care Area
Basic Mode	07/01/2014 -07/31/2014	A	0	7	0.00%
DERS Mode	07/01/2014 07/31/2014	A	7	7	100.00%
Basic Mode	07/01/2014 -07/31/2014	B	1	31	3.20%
DERS Mode	07/01/2014 07/31/2014	B	30	31	96.80%
Basic Mode	07/01/2014 -07/31/2014	C	3	364	0.80%
DERS Mode	07/01/2014 -07/31/2014	C	361	364	99.20%

DERS Detail

Event Name	Date	Time	Device Serial #	Device ID	Care Area	Drug(Modifier) + Concentration	Dose Programmed	Description	Location
Basic Mode	7/1/2014	16:59	931698	15199	X	BASIC 0.0 ml/ml	10.0 mL/hr	Pump RUN	AP: 00-24-97-89-04-b8
Basic Mode	7/1/2014	17:00	935751	15131	X	BASIC 0.0 ml/ml	75.0 mL/hr	Pump RUN	AP: 00-24-97-89-04-b8
Basic Mode	7/1/2014	18:51	931782	14892	X	BASIC 0.0 ml/ml	150.0 mL/hr	Pump RUN	AP: 00-24-97-89-0b-58
Basic Mode	7/3/2014	0:09	938538	15160	X	BASIC 0.0 ml/ml	150.0 mL/hr	Pump RUN	AP: 00-24-97-89-04-b8
Basic Mode	7/3/2014	1:05	934510	15001	X	BASIC 0.0 ml/ml	125.0 mL/hr	Pump RUN	AP: 00-24-97-89-0b-58
Basic Mode	7/3/2014	7:56	734914	14862R	X	BASIC 0.0 ml/ml	75.0 mL/hr	Pump RUN	AP: 00-24-97-89-04-b8

Soft Limit Exceeded Summary

Event Name	Date Range	Care Area	# of Soft Limits Exceeded	Total # of SoftLimit Exceeded	% of Total Softlimit Exceeded per Care Area
Double Confirmation	07/01 -07/31	A	3	3	100.00%
PullBack	07/01 -07/31	A	0	3	0.00%
Double Confirmation	07/01 -07/31	B	2	2	100.00%
PullBack	07/01 -07/31	B	0	2	0.00%
Double Confirmation	07/01 -07/31	C	28	29	96.60%
PullBack	07/01 07/31	C	1	29	3.40%

Soft Limit Exceeded Details

Event Name	Date	Time	Serial #	Device ID	Care Area	Medication	Dose Programmed	Description	Location
Double Confirmation	7/1	20:22	926442	14966	A	IV MAINTenance 0.0 ml/ml	999.0 mL/hr	Value accepted; (10 - 250) ml/hr; Rate - 999 mL/hr	AP: 58 bf ea 60-68-98
Double Confirmation	7/3	3:25	929165	15059	A	Ketamine 10 mg/mL	50.0 mL/hr	Value accepted; (limits out of range) ml/hr; Rate - 50 mL/hr	AP: 58-30-97-89-0b-68
Double Confirmation	7/5	1:11	929914	15074	A	Propofol 10.0 mg/mL	2.0 mcg/kg/min	Value accepted; (5 - 30) mcg/kg/min; Dose - 2 mcg/kg/min	AP: 00-24-97-89-0a-68

Event Name	Date	Time	Serial #	Device ID	Care Area	Medication	Dose Programmed	Description	Location
Pull Back	6/4/2014	23:26	937310	15218	A	IV MAINTenance 0.0 ml/ml	990.0 mL/hr	(10 - 250) ml /hr; Rate - 990 mL/hr	AP: 00-24-97-89-0b-58

Hard Limit Attempts Summary

Event Name	Date Range	Care Area	# of this event	Total Events	% of Total Events
Hard Limit Attempted	7/1 to 7/31	A	1	149	0.70%
Hard Limit Attempted	7/1 to 7/31	B	1	149	0.70%
Hard Limit Attempted	7/1 to 7/31	C	11	149	7.40%
Hard Limit Attempted	7/1 to 7/31	D	43	149	28.90%
Hard Limit Attempted	7/1 to 7/31	E	10	149	6.70%
Hard Limit Attempted	7/1 to 7/31	F	41	149	27.50%
Hard Limit Attempted	7/1 to 7/31	G	3	149	2.00%
Hard Limit Attempted	7/1 to 7/31	H	9	149	6.00%
Hard Limit Attempted	7/1 to 7/31	I	4	149	2.70%
Hard Limit Attempted	7/1 to 7/31	J	26	149	17.40%
Total			149	149	100.00%

Hard Limit Attempts Detail

Date	Time	Serial #	Device ID	Care Area	Medication	Dose Programmed	Description	Location
7/5	1:11	929934	15074	X	Propofol 10.0 mg/mL	1.0 mcg/kg/min	Hard limit exceeded -; (1.39 - 50) mcg/kg/min; Dose - 1 mcg/kg/min	AP: 00-36-97-89-0a-68
7/6	7:59	937283	15139	X	Heparin Rate Based 100.0 Units/mL	12.0 Units/hr	Hard limit exceeded - ; (30 - 4000) Units/hr; Dose - 12 Units/hr	AP: 58-bf-ea-61-2c-48
7/7	15:04	936823	15014	X	IV Fluid BOLUS 0.0 ml/ml	1000.0 mL/hr	Hard limit exceeded -; (0.5 - 999) mL/hr; Rate - 1000 mL/hr	AP: 58-bf-ea-60-68-98
7/7	20:56	767674	150818	X	NORepinephrine 8mg 0.032 mg/mL	10.0 mcg/kg/min	Hard limit exceeded -; (0.01 - 1) mcg/kg/min; Dose - 10 mcg/kg/min	AP: 58-bf-ea-60-68-98
7/9	21:00	928212	15180	X	Magnesium Sulf Rider 0.01 g/mL	250.0 mL/hr	Hard limit exceeded -; (0.5 - 200) mL/hr; Rate - 250 mL/hr	AP: 58-bf-ea-60-68-98
7/9	21:01	928212	15180	X	Magnesium Sulf Rider 0.04 g/mL	250.0 mL/hr	Hard limit exceeded -; (0.5 - 200) mL/hr; Rate - 250 mL/hr	AP: 58-bf-ea-60-68-98

The Basic mode is the easiest and safest mode to use in a smart pump.

A. True

B. False

Which of the following is NOT a DERS (Dose Error Reduction System) parameter?

A. Soft stops
B. Hard stops
C. Infusion mode
D. Document patient fluid intake

Smart pumps document the diluent (Saline/D5W etc.) used for antibiotic entries.

A. True
B. False

Which of the following is NOT an integral resource for implementation of a smart pump program?

A. Nurse clinician
B. Nurse manager
C. Nurse educator
D. Medical staff/physician
E. Pharmacist

Panel Discussion Recap

- challenges to wireless
- other challenges on site or with pump
- support and implementation team
- team members who played bigger role than initially anticipated
- team roles after go-live
- other system requirements

References

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2. Sigma Spectrum Infusion Pump Tutorial. Available at: https://www.youtube.com/watch?v=Jt2E4UAZGjE. Accessed August 2014.

3. Proceedings from the ISMP Summit on the use of Smart Infusion Pumps: Guidelines for safe implementation and use. Available at: http://www.ismp.org/tools/guidelines/smartpumps/printerversion.pdf. Accessed August 2014.

"Let's Get Pumped"

CareFusion Alaris

Michelle Geurink, RPh
OSF Healthcare System

No conflicts of interest to disclose

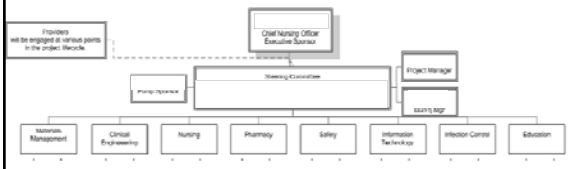
Components of the Pump

- PC ("brain")
- Modules
  - Pump*
  - PCA*
  - Syringe*
  - Auto-ID
  - EtCO2
- Anesthesia Mode
- Therapies

Challenges

- Wireless
  - Review of wireless at all facilities
  - IP addresses ongoing
- Home Care
  - Library and Training of patient/caregiver
- Library Capacity (upgrade added space--syringes)
  - Limit Redundancy
  - Profiles (5)
    - Components
      - Drug and Fluid Libraries
      - Therapies
      - Clinical Advisories
      - Instrument Configuration Settings
      - Channel Label Library

Implementation



Guiding Principles

- Standardization of pump processes
- Standardization to obtain efficiency and safety
- Different drugs can vary in programming (critical care vs. general, central vs. peripheral)
- Support medication administration (alert fatigue, reasonable limits)
- Not to enforce prescribing practices
- Bolus doses programmed from infusion bag
- Use of pump labels (e.g. investigational)

Library Build Process

- Sample Library (OSF-atized—standard concentrations, formulary medications, units from EMR ordering)
- Profile SME Review/Validation Groups
  - Homework
  - Line by line review
  - Anesthesia
- Hands on Session
- Pump Settings

Parallel Activities

- Education Development
- Wireless Network Assessment
- Clinical Engineering—pump usage, etc.
- Policy/Procedure Development
- Disposables (crosswalk)
- Logistics planning (pump conversion and disposables)
- Software/Hardware/CQI Planning

After Go Live

- CQI
  - Rounds
  - Standardized reports
- Library Updates
  - Monthly
  - SBAR requests to change
    - Through standard governance channels/advisory councils

Questions?

- michelle.l.geurink@osfhealthcare.org

Lets Get Pumped!

Experiences of Kish Health System with Hospira pump

Kristi Stice, PharmD BCPS

Conflict of Interest

- I have no conflict of interest to disclose

Plum A+ and Lifecare PCA

Hospira Smart Pump Specs

Plum A+

- Up to 18 care areas
- Up to 150 meds/area
- Loading doses
- Multistep delivery
- Closed system for hazardous medications
- Special infusion cartridge

Lifecare PCA

- Up to 18 care areas
  - Standard dose
  - High dose
  - Hospice dose
- Up to 25 meds/area
- Utilizes PCA syringe vials
- Recognizes drug bar code

Implementation Resources

- Team members
  - Pharmacist: populated libraries and limits
  - Nursing clinical leads: Reviewed limits and library organization
  - Biomed/Manufacturer: pump setup & initial library push
  - IT
- Who played a bigger role than initially anticipated
  - PHARMACY!

Action Steps

Step	Nursing	Pharmacy	IT	BioMed
Identify Nursing Super Users	X			
Identify/Confirm Dates for Core Group Review and Nursing Review	X	X		
Define Clinical Care Areas	X	X		
Define CCA and Master Infuser Setting Preferences	X	X		
Identify Medication Formulations to be Included in each CCA	X	X		
Begin planning for periodic library updates	X	X	X	X
Begin planning for infuser data uploads	X	X	X	X
Identify Team Members to Lead Data Evaluation Activities	X	X	X	

Support Resources

- Pharmacy
  - Drug library edits
  - Drug library pushes
- Clinical Leads
  - Solicit library changes
  - Help locate pumps/communicate changes to staff
- Medication Safety Team – approves changes
- Biomed – push library when pumps serviced

Tips & Tricks

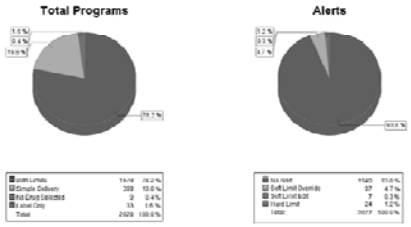
- Get wireless connections mapped
  - Easier location of pumps
- Make loading doses and infusions separate entries
- Require use for ALL infusions, not just high risk
- Have list library contents available
  - Pump view
  - Alphabetical view
- Share references guardrails are based on

Tips & Tricks

- Teach nursing which serial number is important
  - Safety reporting
- Have a method in place to request library changes
  - Med safety team reviews changes
- Coordinate library updates with Biomed's schedule
  - Yearly preventative maintenance
- Audit, audit, audit

Infusion Summary Report

- Library Utilization & Response to Alerts – high level
  - Med Safety Committee Review- overall and by care area



Edit & Override Variance Detail

- Edit - Potential ADE's avoided

Medication/Concentration	Alert Date/Time	Limit	Limit Violated	Initial Dose	Final Dose	Variance
Depacon 1000 mg/50 mL	07/30/2014 17:07:10	20 mg/min	↑ UPPER HARD	26.7	20	33.50%
Depacon 1000 mg/50 mL	08/01/2014 04:01:17	20 mg/min	↑ UPPER HARD	50	20	150.00%
Insulin (regular) 1 units/1 mL	08/01/2014 17:28:12	45 units/hr	↑ UPPER HARD	2002	2.9	4,526.67%
Levaquin 750mg/750 mg/150 mL	08/01/2014 10:37:28	100 mL/hr	↑ UPPER HARD	150	100	50.00%

- Override – Potential white noise

Medication/Concentration	Alert Date/Time	Limit	Limit Violated	Initial Dose	Final Dose	Variance
Ampicillin 1 g/ 1 grams/50 mL	07/30/2014 05:45:19	100 mL/hr	↑ UPPER SOFT	200	200	100.00%
Ampicillin 1 g/ 1 grams/50 mL	07/30/2014 06:18:43	100 mL/hr	↑ UPPER SOFT	200	200	100.00%
Ativan 50 mg/50 mL	07/31/2014 09:00:36	0.5 mg/hr	↓ lower soft	0.25	0.25	-50.00%
DOPamine 400 mg/250 mL	07/30/2014 19:45:08	2.5 mcg/kg/min	↓ lower soft	2	2	-20.00%
Levaquin 250mg/250 mg/50 mL	07/29/2014 11:30:47	50 mL/hr	↑ UPPER SOFT	100	100	100.00%

Other Reports

- Infusion status – real-time monitor of library use
- Event/Alarm Log – audit for safety events
- PCA History – usage data for individual pumps
- Asset Tracker/Utilization - Biomed

Biomed's Perspective

- Stable hardware package
- Rated as good to very good due to stability
- Heavy, can be noisy at high rates
- Seems to alarm a lot for air in line
- Cost of specialized infusion cartridge
- Several battery errors, even if plugged in
- Hospira is currently revising it's pump offerings

Questions