

## Implementation of Medication Safety Best Practices in a Level III Neonatal Intensive Care Unit (NICU)

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## Disclosures

The program chair and presenters for this continuing pharmacy education activity report no relevant financial relationships.



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## Learning Objectives

- Describe how to design medication safety best practices in the NICU
- Describe how to reduce human error in NICU processes
- Describe how technology plays an important role in safely treating neonates



## Agenda

- Overview of Jordan Valley Medical Center
- History of the NICU at Jordan Valley Medical Center
- NICU Best Practice Design
- NICU Today
- Lessons Learned

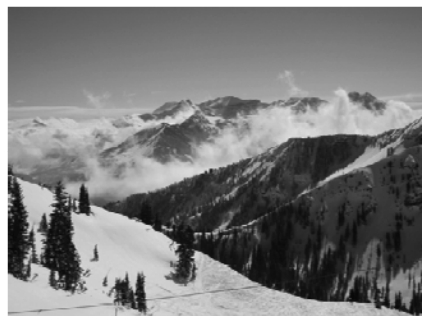


## Jordan Valley Medical Center / Pioneer Valley Hospital

- Located in West Jordan, Utah
- 322 bed community hospital located on two campuses
- Services include
  - Cardiac Care
  - Orthopedic and Rehabilitation Care
  - Stroke Center
  - Women's Services
  - Level III A Neonatal Intensive Care Unit



## Utah – The Skiing Capital of the World



## NICU in Focus

- **Texas Hospital Heparin Error (Part Two)**

Posted by Jane Akre

*Wednesday, July 09, 2008 1:51 PM EST*

An autopsy is planned for a Corpus Christi, Texas infant to determine whether the blood-thinner heparin may have factored into the newborn's death.

The Health System reports the child was already seriously ill and was in the neonatal intensive care unit before he died, Tuesday morning. The child was among 17 premature babies in the unit to receive an overdose



## NICU in Focus

- **California Medical Malpractice: Dennis Quaid's Twins to Receive \$500,000 for Heparin Overdose**

Posted by Howard Law, PC

*June 23, 2009*



## History of the NICU at Jordan Valley Medical Center

- **Women's Services**
  - 250 to 350 deliveries per month
- **Level II NICU**
  - Traditional open floor plan
  - Ampicillin and gentamicin
  - Transfer low weight babies or at risk mothers prior to delivery



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## History of the NICU at Jordan Valley Medical Center

- **Level III NICU**
  - Opened in 2009
  - State of the art design
  - 11 individual rooms
    - Capacity for 31 neonates
    - Sound absorbent ceilings and floor tiles
    - Dimming light systems
  - Family transition room
    - Transition from NICU to home
    - Allows for greater comfort level at discharge



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## NICU Best Practice Design

- **Pharmacy Goals**
- **Identify Tools Available To Help Accomplish Goals**
- **Establish Practices To Meet Goals Using Available Tools**



## NICU Best Practice Design

### Pharmacy's Vision Statement

**Vision:**

To advance the practice of pharmacy, create more positive outcomes for patients and contribute to a healthier world.

**Purpose:**

We combine clinical expertise with operational excellence to increase health-system pharmacy effectiveness and deliver smarter healthcare.



### NICU Best Practice Design

- Pharmacy Goals
  - Provide the safest care possible for our patients
  - Provide the most stress free environment for our pharmacists and technicians
  - Consider workflow changes every step of the way
  - Ensure buy-in by all stakeholders every step of the way



### NICU Best Practice Design – Pharmacy Goals

- Provide The Safest Care Possible For Our Patients
  - Tools
    - IT solutions
    - Standard processes
    - Standard concentrations
    - Standard dosing practices
    - Protocol driven order entry
    - Failure Mode Effects Analysis



### NICU Best Practice Design – Pharmacy Goals

- Provide The Most Stress Free Environment For Our Pharmacists And Technicians
  - Tools
    - Education, education, education
    - Ensure double and triple check methodology
    - Ensure dedicated time for TPN review
    - IT solutions



### NICU Best Practice Design – Pharmacy Goals

- Consider Workflow Changes
  - Tools
    - Changes in duties
    - Redundancy of duties
    - Counting steps
    - Failure Mode Effects Analysis



### NICU Best Practice Design – Pharmacy Goals

- Ensure Buy-in By All Stakeholders Every Step Of The Way
  - Tools
    - Multidisciplinary Approach
      - Neonatologists
      - Pharmacy
      - Nursing
      - Respiratory
      - Administration
      - Technology vendors



### NICU Best Practice Design – Pharmacy Goals

- Ensure Buy-in By All Stakeholders Every Step Of The Way
  - Tools
    - Administration
      - Educate administration on pharmacy's role
      - Educate administration on pharmacy's time commitments



### NICU Best Practice Design – Pharmacy Goals

- Ensure Buy-in By All Stakeholders Every Step Of The Way
  - Tools
    - Neonatologists
      - Continuity between multiple hospitals
      - Community standards
    - Nursing
      - Trusted partner environment
      - Their workflow



### NICU Best Practice Design – Pharmacy Goals

- Ensure Buy-in By All Stakeholders Every Step Of The Way
  - Tools
    - Technology vendors
      - Smart syringe pumps
      - TPN compounder
      - Pharmacy medication ordering system
      - CPOE



### NICU Best Practice Design – Pharmacy Goals

- Miscellaneous Considerations
  - Costs
  - Take as much decision making out of the equation as possible
  - Minimize the human error component
  - Inventory management



### NICU Best Practice Design

- Pharmacy Goals
- Identify Tools Available To Help Accomplish Goals
- Establish Practices To Meet Goals Using Available Tools



### NICU Best Practice Design – NICU Medication Cabinet

- Concern – How do we ensure that only neonatal appropriate drugs are dispensed from pharmacy
  - Pharmacy goals –
    - Provide the safest care possible for our patients
    - Provide the most stress free environment for our pharmacists and technicians
    - Consider workflow changes every step of the way



### NICU Best Practice Design – NICU Medication Cabinet

- Original Process
  - Shared Pyxis on unit (Obs and NICU)
  - NICU designated area for medications with NICU specific dosages (vitamin K, gentamicin, erythromycin ophth. oint.) in pharmacy
  - Colored bins specific to NICU
  - Pharmacist always checks Pyxis pull prior to delivery



### NICU Best Practice Design – NICU Medication Cabinet

- Considerations
  - Easy to grab wrong drug or dosage from general stock
  - New, unfamiliar medications
  - Medications are occasionally placed in wrong bins (vitamin K 10 mg placed in 1 mg bin, heparin)
  - Increased workflow due to additional Pyxis fill



### NICU Best Practice Design – NICU Medication Cabinet

- Tools
  - Changes in duties
  - Redundancy of duties
  - Counting steps
  - Ensure double and triple check methodology
  - Standard processes
  - Failure Mode Effects Analysis



### NICU Best Practice Design – NICU Medication Cabinet

- Redesigned Process
  - Dedicated NICU medication cabinet in pharmacy
    - All medications used in NICU, regardless of whether they are stocked somewhere else in pharmacy, are stocked in this cabinet
    - Only a pharmacist may stock the cabinet. A tech unloads the order and places the appropriate medications onto a cart. The cart is placed in front of the cabinet. The pharmacist then restocks the cabinet from the cart ensuring correctness of medications. The pharmacist then signs and dates a restocking log



### NICU Best Practice Design – NICU Medication Cabinet

- Redesigned Process
  - Dedicated NICU medication cabinet in pharmacy
    - All medications used to restock the NICU Pyxis or for NICU compounding are pulled from this cabinet



### NICU Best Practice Design – NICU Medication Cabinet

- Tools
  - Changes in duties
    - Pharmacist now restocks the cabinet
  - Redundancy of duties
    - Tech unpack the order and set up NICU drugs for stocking
    - Pharmacists restock NICU cabinet from tech pulled stock
  - Counting steps
    - Addition job for pharmacist



### NICU Best Practice Design – NICU Medication Cabinet

- Tools
  - Ensure double and triple check methodology
    - Restock is checked by tech then pharmacist, meds are checked again at pull and dispense
  - Standard processes
    - Process delineated in written policy and procedure
  - Failure Mode Effects Analysis
    - Validated process
    - Segregated NICU Medication Cabinet



### NICU Best Practice Design – TPN Compounder

- Concern – What is the best way to structure the neonatal TPN process
  - Pharmacy goals –
    - Provide the safest care possible for our patients
    - Provide the most stress free environment for our pharmacists and technicians
    - Consider workflow changes every step of the way



### NICU Best Practice Design – TPN Compounder

- Original Process - None
- Considerations
  - Order could be misinterpreted by the pharmacist
  - Delays in preparation
  - Standardized way of ordering
  - Human errors are possible during compounding
    - Wrong salt
    - Wrong amount
    - Wrong drug



### NICU Best Practice Design – TPN Compounder

- Tools
  - Changes in duties
  - Redundancy of duties
  - Counting steps
  - Ensure double and triple check methodology
  - Standard processes
  - Failure Mode Effects Analysis



### NICU Best Practice Design – TPN Compounder

- Tools
  - Ensure dedicated time for TPN review
  - IT solutions
  - Standard concentrations
  - Standard dosing practices
  - Ensure buy-in - neonatologists



### NICU Best Practice Design – TPN Compounder

- Redesigned Process
  - TPN compounder with network access to CPOE in the NICU – closed loop system
    - Neonatologists enter TPN orders directly into compounder program on the unit
    - Pharmacist validation of orders
    - Order feeds directly to compounder and prepares TPN solution
    - Compounder uses barcode technology to ensure correct product selection



### NICU Best Practice Design – TPN Compounder

- Redesigned Process
  - Only one pharmacist enters and checks TPN
  - Pharmacist given dedicated time to validate TPNs orders
  - Tech sets up compounder, pharmacist validates



### NICU Best Practice Design – TPN Compounder

- Tools
  - Changes in duties
  - Redundancy of duties
    - Neonatologists enter order directly into CPOE TPN program
    - Pharmacy validates TPN orders in program
  - Counting steps
    - Compounder increases time but improves safety



### NICU Best Practice Design – TPN Compounder

- Tools
  - Ensure double and triple check methodology
    - CPOE system
    - Tech sets compounder up and pharmacist validates
  - Standard processes



### NICU Best Practice Design – TPN Compounder

- Tools
  - Failure Mode Effects Analysis
    - Validation of new processes
  - Ensure dedicated time for TPN review
  - IT solutions
    - TPN compounder



### NICU Best Practice Design – TPN Compounder

- Tools
  - Standard concentrations
    - Reduces human error
  - Standard dosing practices
    - Reduces human error
  - Ensure buy-in – neonatologists
    - Their buy-in helped push validity of extra costs



### NICU Today

- Dedicated NICU Drug Storage Cabinet
- Closed Loop TPN Process
- Standard Solutions
  - Manufacturer premixed solutions are used as often as possible (ex: dopamine, dobutamine, gentamicin)
  - Standard solutions match community standard



### NICU Today

- Smart Syringe Pumps with Standardized Colored Rate and Syringe Size Charts
  - Medication library matches second practice site of neonatologists
- NICU Daily Work Sheet
- Patient Specific Emergency Dose Sheets



## NICU Today

- Weekly Rounding
- Excellent Relationship with Both the Neonatologists and the Nurses
- No CPOE for Non-TPN Orders
- Protocol Specific Order Entry with Pharmacy System



## Lessons Learned

- Stakeholder Buy-in is the Key
  - Multidisciplinary approach
- FMEA
  - Points out everything that can go wrong
- Technology
  - Sometimes less is better



## NICU Best Practice Design

JORDAN VALLEY MEDICAL CENTER  
NICU PEDI Standard Continuous Infusion

16 mcg/ml (0.16 mcg/ml)  
Becton-Dickinson (BD) norepinephrine Syringe Size 16 mcg/ml

Order by mcg/kg/min (rate in units)

Weight (kg)	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0
1.0	0.0016	0.0032	0.0048	0.0064	0.0080	0.0096	0.0112	0.0128	0.0144	0.0160	0.0176	0.0192	0.0208	0.0224	0.0240	0.0256	0.0272	0.0288	0.0304	0.0320
1.5	0.0024	0.0048	0.0072	0.0096	0.0120	0.0144	0.0168	0.0192	0.0216	0.0240	0.0264	0.0288	0.0312	0.0336	0.0360	0.0384	0.0408	0.0432	0.0456	0.0480
2.0	0.0032	0.0064	0.0096	0.0128	0.0160	0.0192	0.0224	0.0256	0.0288	0.0320	0.0352	0.0384	0.0416	0.0448	0.0480	0.0512	0.0544	0.0576	0.0608	0.0640
2.5	0.0040	0.0080	0.0120	0.0160	0.0200	0.0240	0.0280	0.0320	0.0360	0.0400	0.0440	0.0480	0.0520	0.0560	0.0600	0.0640	0.0680	0.0720	0.0760	0.0800
3.0	0.0048	0.0096	0.0144	0.0192	0.0240	0.0288	0.0336	0.0384	0.0432	0.0480	0.0528	0.0576	0.0624	0.0672	0.0720	0.0768	0.0816	0.0864	0.0912	0.0960
3.5	0.0056	0.0112	0.0168	0.0224	0.0280	0.0336	0.0392	0.0448	0.0504	0.0560	0.0616	0.0672	0.0728	0.0784	0.0840	0.0896	0.0952	0.1008	0.1064	0.1120
4.0	0.0064	0.0128	0.0192	0.0256	0.0320	0.0384	0.0448	0.0512	0.0576	0.0640	0.0704	0.0768	0.0832	0.0896	0.0960	0.1024	0.1088	0.1152	0.1216	0.1280
4.5	0.0072	0.0144	0.0216	0.0288	0.0360	0.0432	0.0504	0.0576	0.0648	0.0720	0.0792	0.0864	0.0936	0.1008	0.1080	0.1152	0.1224	0.1296	0.1368	0.1440
5.0	0.0080	0.0160	0.0240	0.0320	0.0400	0.0480	0.0560	0.0640	0.0720	0.0800	0.0880	0.0960	0.1040	0.1120	0.1200	0.1280	0.1360	0.1440	0.1520	0.1600
5.5	0.0088	0.0176	0.0264	0.0352	0.0440	0.0528	0.0616	0.0704	0.0792	0.0880	0.0968	0.1056	0.1144	0.1232	0.1320	0.1408	0.1496	0.1584	0.1672	0.1760
6.0	0.0096	0.0192	0.0288	0.0384	0.0480	0.0576	0.0672	0.0768	0.0864	0.0960	0.1056	0.1152	0.1248	0.1344	0.1440	0.1536	0.1632	0.1728	0.1824	0.1920
6.5	0.0104	0.0208	0.0312	0.0416	0.0520	0.0624	0.0728	0.0832	0.0936	0.1040	0.1144	0.1248	0.1352	0.1456	0.1560	0.1664	0.1768	0.1872	0.1976	0.2080
7.0	0.0112	0.0224	0.0336	0.0448	0.0560	0.0672	0.0784	0.0896	0.1008	0.1120	0.1232	0.1344	0.1456	0.1568	0.1680	0.1792	0.1904	0.2016	0.2128	0.2240
7.5	0.0120	0.0240	0.0360	0.0480	0.0600	0.0720	0.0840	0.0960	0.1080	0.1200	0.1320	0.1440	0.1560	0.1680	0.1800	0.1920	0.2040	0.2160	0.2280	0.2400
8.0	0.0128	0.0256	0.0384	0.0512	0.0640	0.0768	0.0896	0.1024	0.1152	0.1280	0.1408	0.1536	0.1664	0.1792	0.1920	0.2048	0.2176	0.2304	0.2432	0.2560
8.5	0.0136	0.0272	0.0408	0.0544	0.0680	0.0816	0.0952	0.1088	0.1224	0.1360	0.1496	0.1632	0.1768	0.1904	0.2040	0.2176	0.2312	0.2448	0.2584	0.2720
9.0	0.0144	0.0288	0.0432	0.0576	0.0720	0.0864	0.1008	0.1152	0.1296	0.1440	0.1584	0.1728	0.1872	0.2016	0.2160	0.2304	0.2448	0.2592	0.2736	0.2880
9.5	0.0152	0.0304	0.0456	0.0608	0.0760	0.0912	0.1064	0.1216	0.1368	0.1520	0.1672	0.1824	0.1976	0.2128	0.2280	0.2432	0.2584	0.2736	0.2888	0.3040
10.0	0.0160	0.0320	0.0480	0.0640	0.0800	0.0960	0.1120	0.1280	0.1440	0.1600	0.1760	0.1920	0.2080	0.2240	0.2400	0.2560	0.2720	0.2880	0.3040	0.3200



## NICU Best Practice Design

Name: \_\_\_\_\_

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Weight (kg)	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0
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