

# Jenny Melloy, BSN

Jenny has been a NICU nurse for 23 years and is currently the interim assistant nurse manager.



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Kristi is the Clinical Practice Leader in the NICU at the Stead Family Children's Hospital in Iowa City and has been a NICU nurse for 22 years.



# IOWA

# Nursing Care of the Extremely Low Birth Weight Infant

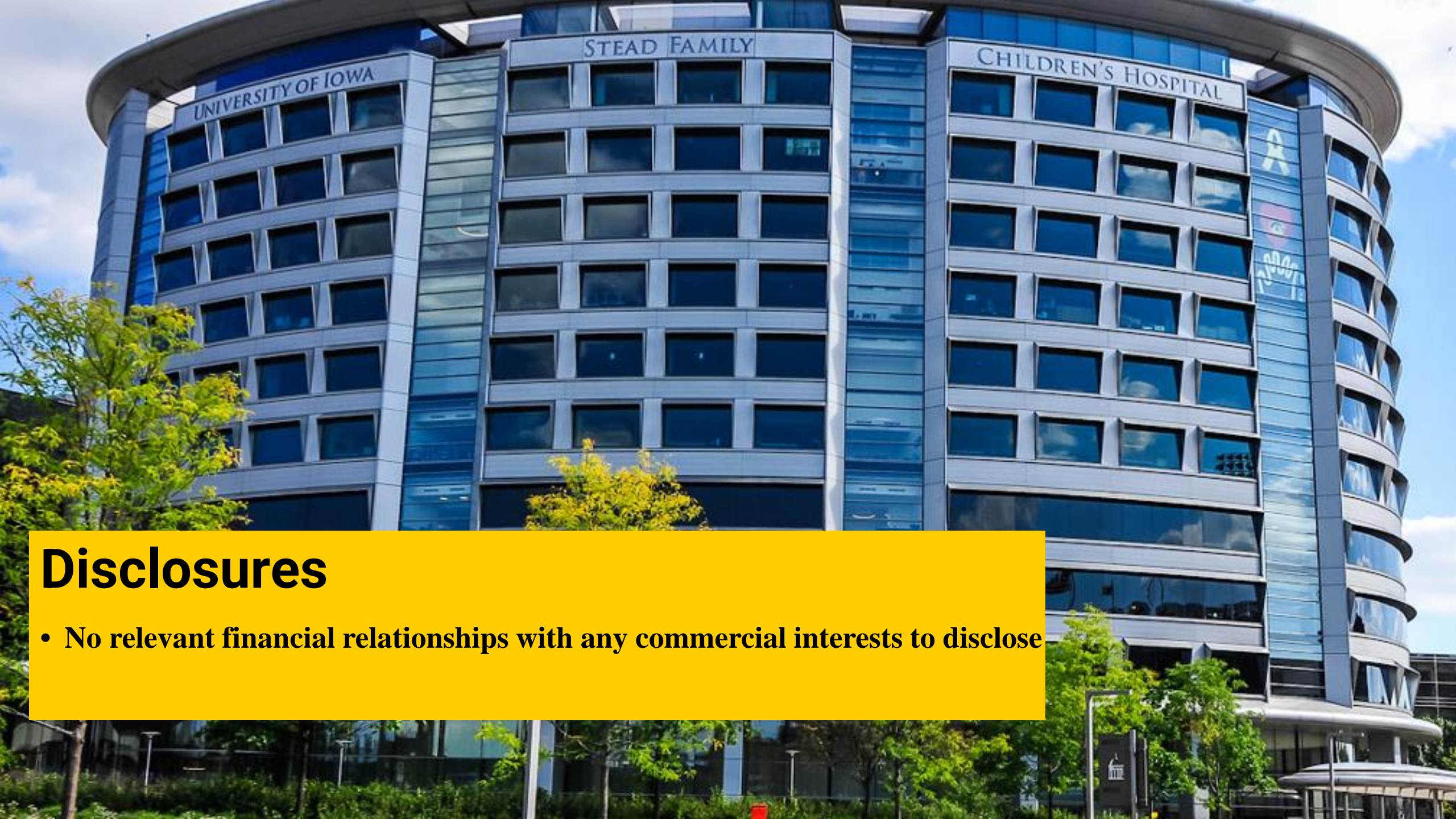
The Iowa Way

April 18, 2024



University of Iowa  
Stead Family  
Children's Hospital





# Disclosures

- No relevant financial relationships with any commercial interests to disclose

# Objectives

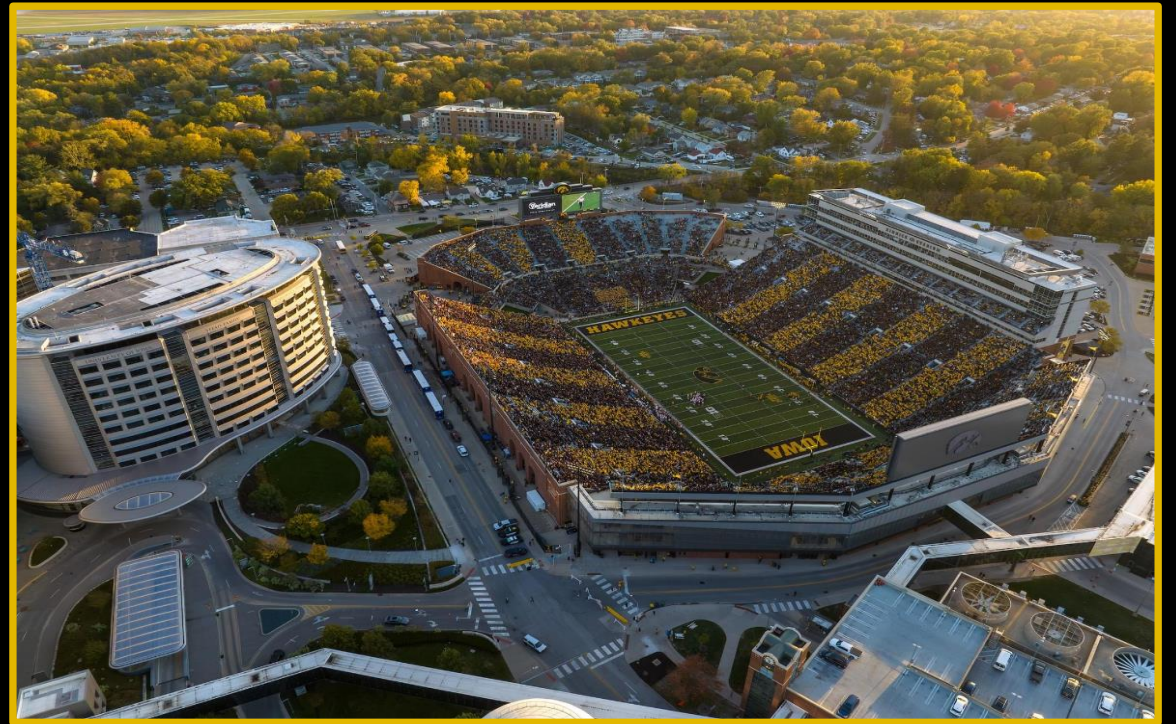
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- Discuss framework of the Small Baby System
- Review delivery room procedures for caring for ELBW infants and discuss Golden Hour goals for admissions of ELBW infants
- Review care bundles, order sets, and preventions
- Discuss skin care and evidence-based practices for ELBW
- Review Neuroprotective interventions

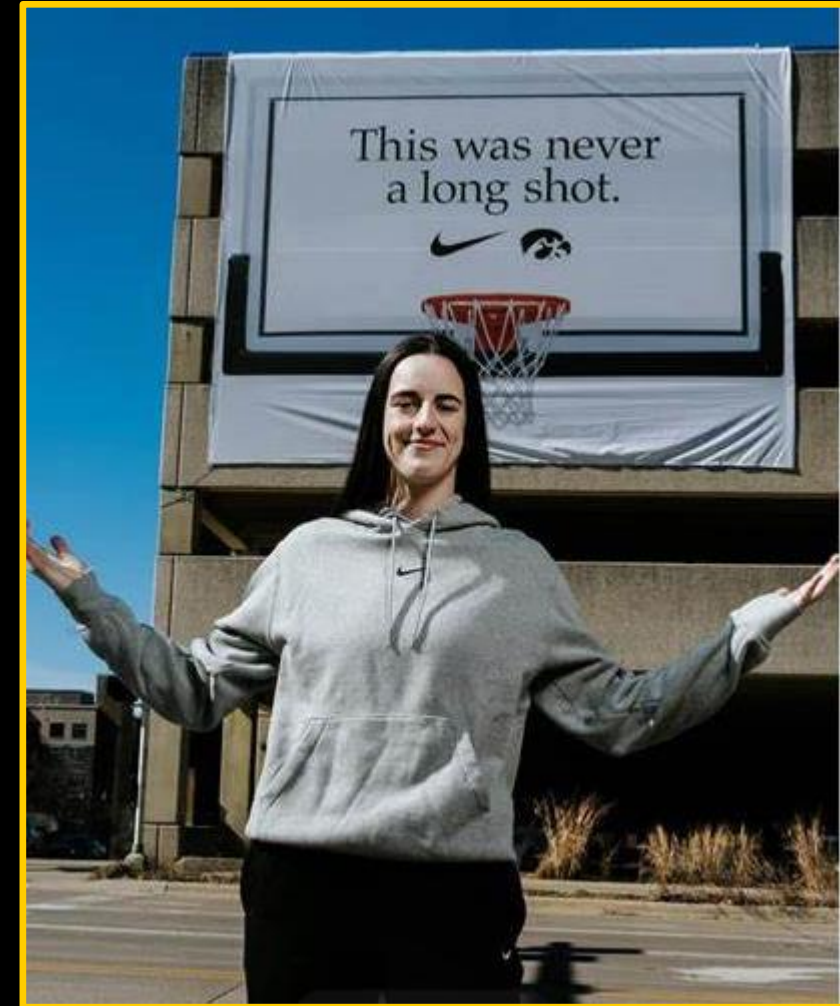
# Wave



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# Caitlin Clark

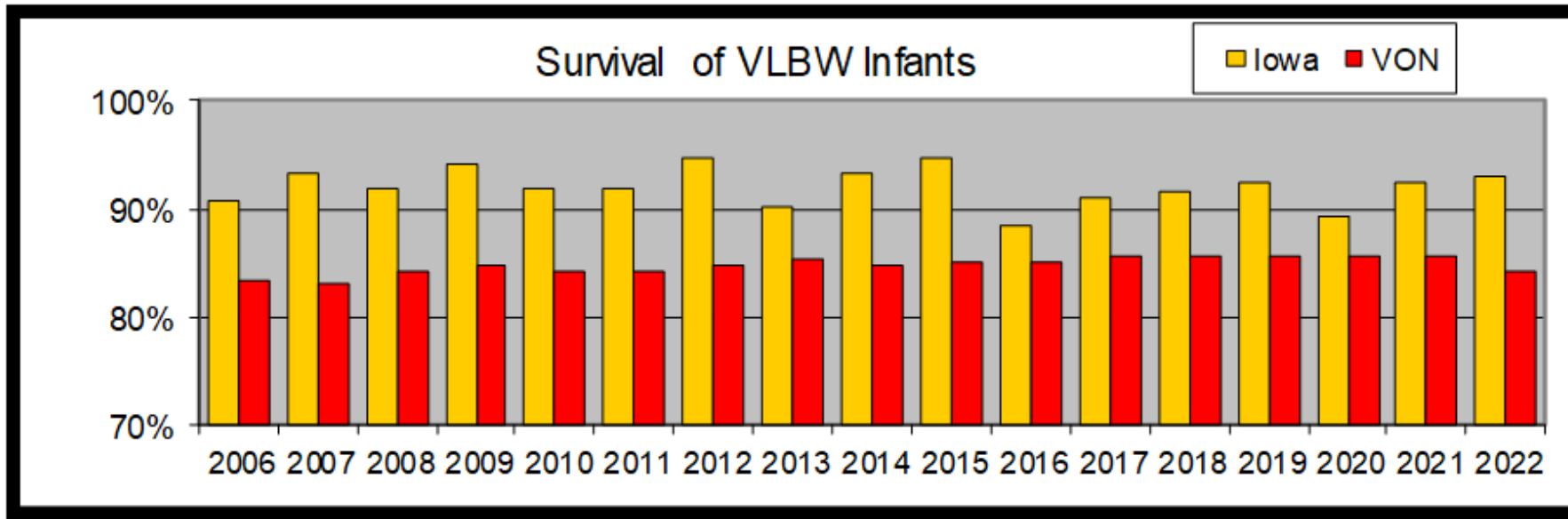


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**Of all the places to  
come talk about  
ELBW care, why  
Iowa?**



# Survival of **All** Inborn and Outborn: Very Low Birth Weight Infants $\leq$ 1500 grams (3 lbs, 5 oz) vs VON NICU Type C (median values)

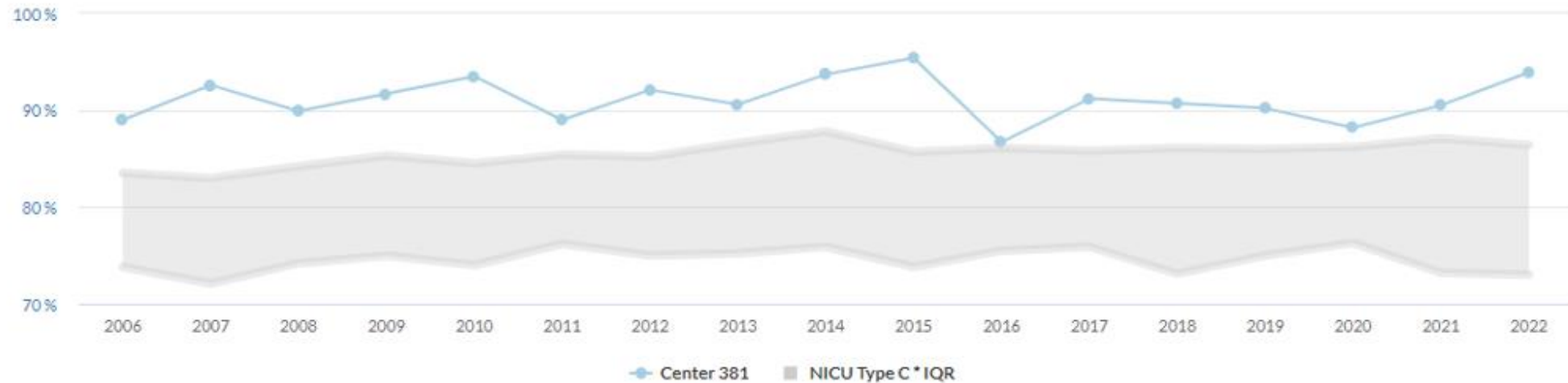


Comparison group: VON NICU Type C Median data



# Survival Trends of Inborn Infants 22 - 29 weeks EGA 2006-2022 Compared to Median (IQR) VON Type C NICU

Center 381  
Survival  
GA 22 To 29 Weeks, Inborn  
Annually By Birth Year 2006-2022  
Compared with NICU Type C \* 2006-2022



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**The Secret to our  
success??**

CONSISTENCY  
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&



**TEAMWORK**

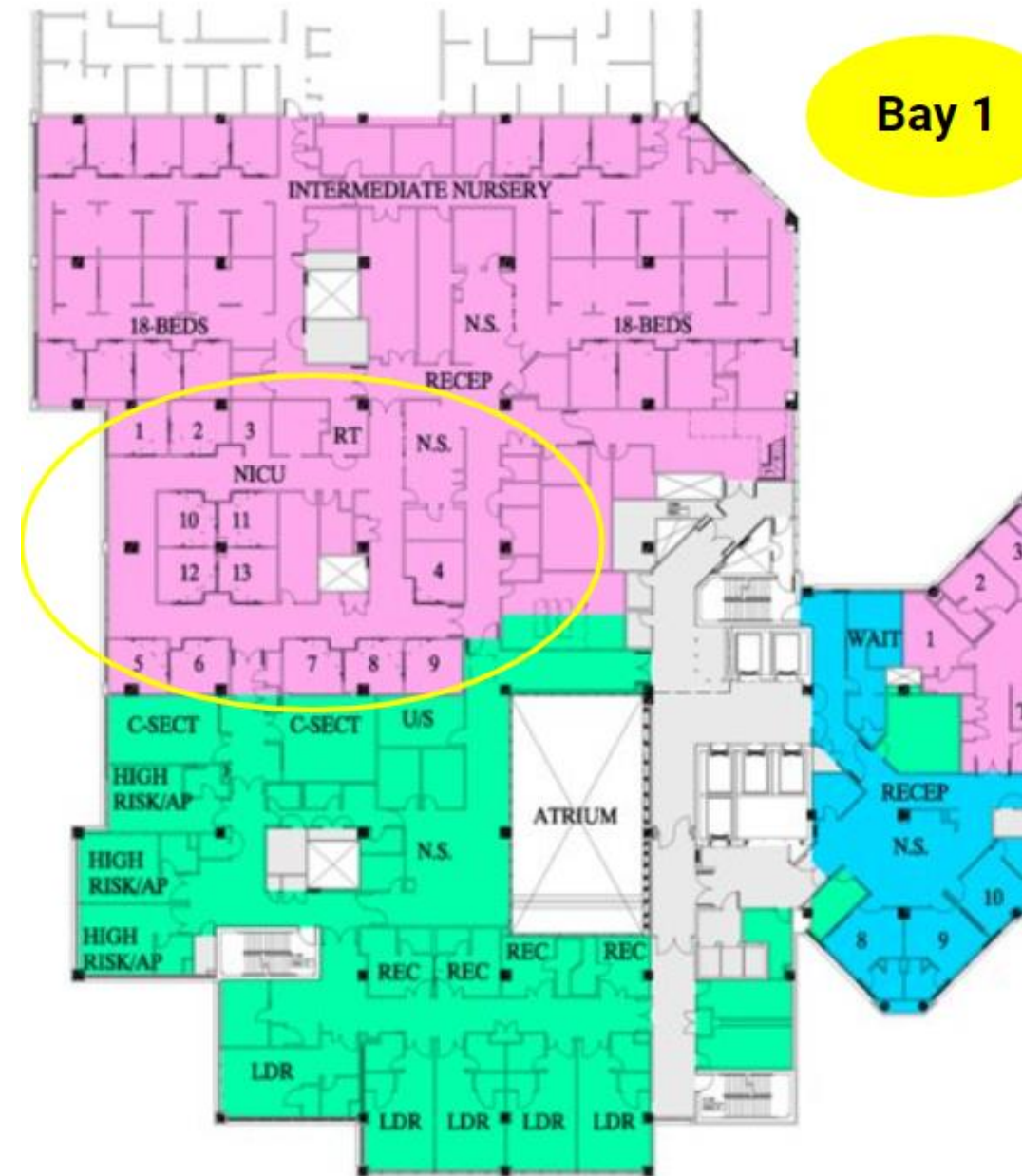
# It Takes An Army.....

- Parents/Family
- Doctors/Nurse Practitioner/Residents
- Nurses
- Respiratory Therapy
- Pharmacy
- Dieticians
- Social Work
- Phlebotomy
- Physical/Occupational Therapist
- Child Life Specialists
- Nursing Assistants
- Developmental Care Volunteers
- And more.....



# Layout of NICU

- 88 total beds
- Unit is divided into 4 Bays or areas
  - Bay 1 most acute/small baby unit
  - Bays 2-3 less acute admissions > 28 weeks
  - Bay 4 & Level 6 feeders and growers
- Located adjacent to Labor and Delivery unit
- NICU Critical Care Lab staffed w/ phlebotomy 24/7



# Small Baby System

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## Integrated Structure and Culture for Extremely Premature Infants

- 1. Separate Dedicated Unit of 14 Beds – Bay 1**
  - Infants < 30 weeks are admitted here as well as the most critically ill term infants
- 2. Dedicated nursing staff “Core Bay 1” trained**
- 3. Dedicated Medical Team for Bay 1 patients**
  - Separate Attending Neonatologist, Neonatal Fellow, Neonatal Nurse Practitioner, Pharmacist, Respiratory Therapist, & Dietician



# Nurse Training

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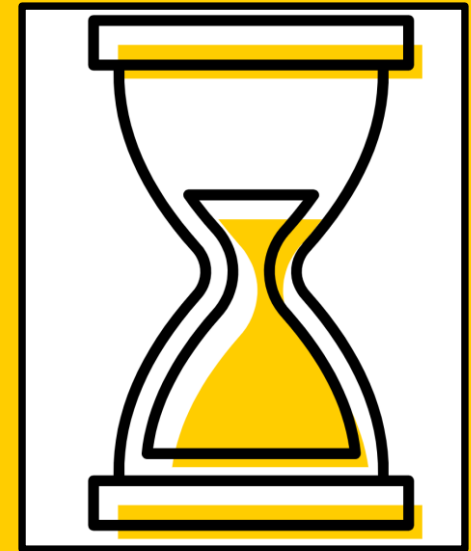
- Standard training for nurses in the NICU is 280-360 clinical hours
- Core Bay 1 training is an additional 144-180 hours (~50 of total 280 NICU nurses are Core Bay 1 trained)
  - Delivery room attendance
  - Admission and care of high acuity patients such as ECMO, CRRT, bedside surgery, admissions <30 weeks gestation, requiring vasoactive drips



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# Delivery Room and the Golden Hour



# Golden Hour Goals

1. Admission temperature > 36.0° C
2. Surfactant (Curosurf for ELBW) given
3. IV dextrose initiated
4. Antibiotics
5. Communication with family

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## Congratulations!

Welcome to the NICU Baby \_\_\_\_\_ and family

Your baby is being taken care of in NICU Bay \_\_\_\_\_, Room \_\_\_\_\_

Weight \_\_\_\_\_ Length \_\_\_\_\_

Your baby is receiving the following care: \_\_\_\_\_

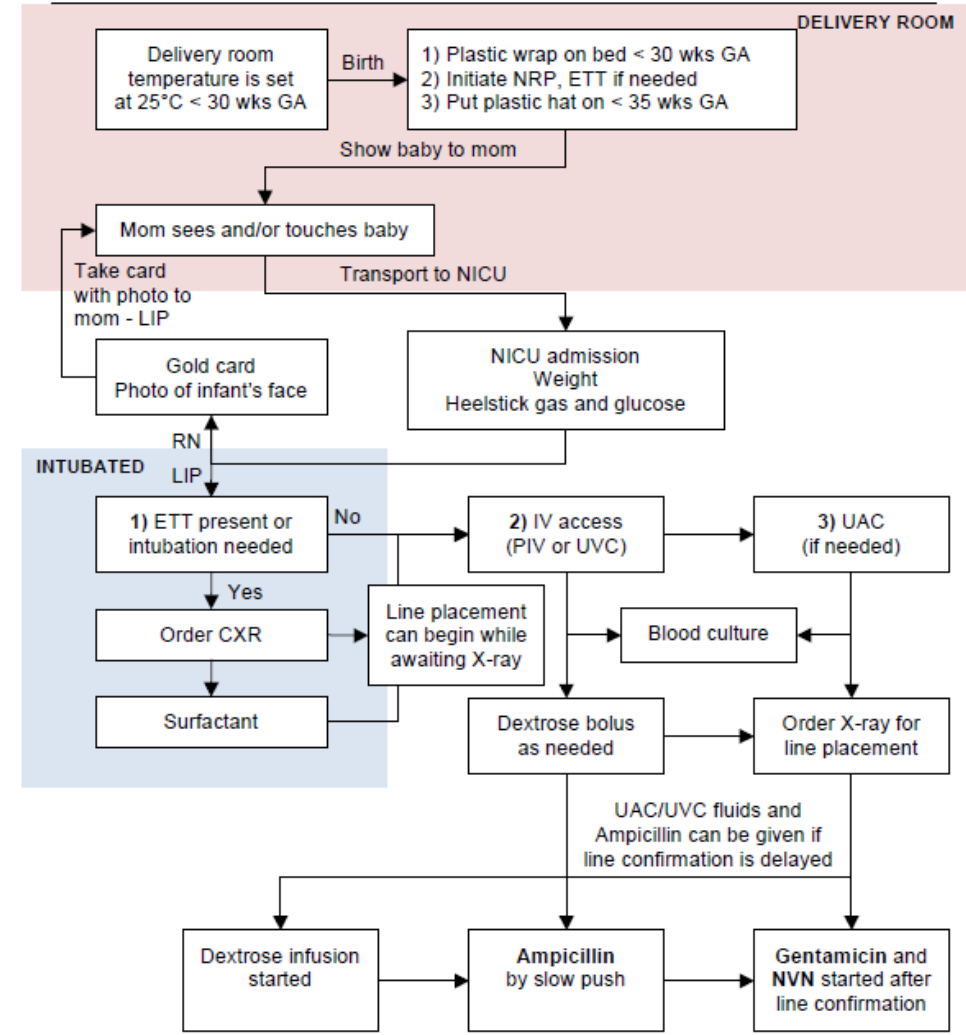
Your baby's medical provider is: \_\_\_\_\_

Your baby's nurse is: \_\_\_\_\_

Please feel free to call and receive an update on your baby at any time. NICU Bay 1, 3-1671 NICU Bay 2/3, 6-3333

Changing Medicine. Changing Kids' Lives.®

## Golden Hour Guide - NICU



- Golden Hour Goals:
- 1) Admission temperature  $\geq 36.0$
  - 2) Surfactant given, if ordered
  - 3) Dextrose infusion started
  - 4) Antibiotics started
  - 5) Communication post-delivery with mom - Gold card given





**Delivery Room Attendance**

- Neonatal Fellow and/or staff physician
- Resident and/or Neonatal NP
- 2 Core Bay 1 NICU Nurses

**GOAL:**  
Initiate NRP, intubate patient, stabilize, thermoregulation, take infant to see mom, and get to NICU ASAP!

THE  
**A-TEAM**

# Preemie Pack for attending ELBW deliveries



- #2.0 & #2.5 endotracheal tube w/ stylet
- CO2 detector



- #00 and #0 intubation blade and handles
- video laryngoscope with #000 size blades also available



- Plastic Wrap
- Polyethylene lined hat



- Velcro oximeter - used for all patients < 26 weeks
- Micro preemie EKG leads

# Standardization of Care in the Delivery Room

Minimize hyperoxia and hypoxia during resuscitation

- Delivery room protocol
- Initiate resuscitation with oxygen not RA. **Start with 50% oxygen and then titrate**



## NICU Delivery Room NRP Oximeter Protocol

Time after Birth	Preductal Target Saturation
1 minute	60 - 65%
2 minutes	65 - 70%
3 minutes	70 - 75%
4 minutes	75 - 80%
5 minutes	80 - 85%
10 minutes	85 - 95%

2010 AHA

JM Klein 1/1/12

# Thermoregulation in the Delivery Room

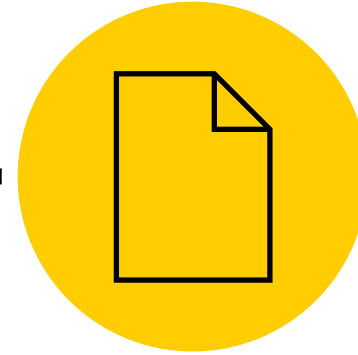
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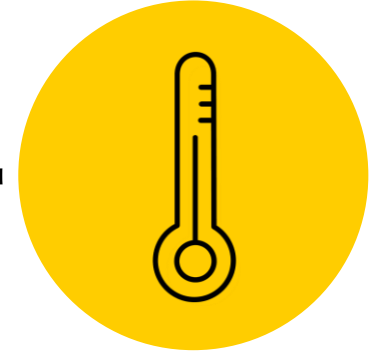
**Transwarmer  
mattress**



**Polyethylene  
lined hat**



**Neo Wrap**



**Delivery Room  
Temperature**

# Thermoregulation post delivery

- We are a non humidity center
- Patients are managed on radiant warmers or isolates under skin temp control
- Transwarmer removed immediately on transfer to bed
- Hat and neowrap removed when temperature is at 36.5 for at least 1 hour



# Immediate Post Admission Interventions

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- Weight obtained
- Warmer bed placed in skin temp control, hat and neowrap remain on patient during line insertion/admission
- Infant positioned for umbilical line placement
  - Infants <28 weeks will have double lumen UVC (3.5 Fr or 5 Fr) and Umbilical Arterial Catheter (2.8 Fr or 3.5 Fr) placed on admission
  - UVC placed first, depending on time and if line draws well will send VBG, glucose from line. Allows for immediate management of glucose
  - UAC placed and remaining labs drawn (CBC, Type and Screen, blood culture, hgb)
- Line verification by x-ray or by Point of Care Ultrasound if hemodynamics fellow/staff is available
- Surfactant not given in delivery room, only after tube placement is confirmed by x-ray

# Standardized Admission Order Sets

One stop shop for all NICU admission that can be customized for gestational age and acuity

- lab schedule
- admission fluids/medications
- respiratory orders
- includes standard activities of daily living
- surfactant
- x-ray

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Order Sets

- ▶ OXYGEN - NICU [Click for more](#)
- ▶ FREE STANDING NPCPAP [Click for more](#)
- ▼ WEANING TRIAL
  - WEANING TRIAL
- ▶ INFANT STAR [Click for more](#)
- ▶ SERVO U Ventilator [Click for more](#)
- ▶ BUNNELL JET [Click for more](#)
- ▼ DRAGER VN 500
  - VENTILATOR PC-HFO
  - VENTILATOR PC-HFO + SIGH
  - VENTILATOR PC-HFO VG
  - VENTILATOR PC-HFO VG + SIGH
- ▶ SENSORMEDICS 3100A [Click for more](#)
- ▶ REGIONAL SATURATION [Click for more](#)
- ▶ TRANSCUTANEOUS MONITOR [Click for more](#)
- ▶ SPECIALTY GAS [Click for more](#)
- ▼ Inpatient Medications
  - ▼ Medication - UAC Fluids
    - NICU UAC continuous infusion - sodium acetate and sodium chloride only
    - NICU UAC continuous infusion - sodium acetate only
    - NICU UAC continuous infusion - sodium chloride only
  - ▼ Medication - UVC Fluids
    - Standard UVC infusion - D2.5 + Heparin (< 24 weeks gestation)  
Intravenous, Continuous
    - Standard UVC infusion - D5 + Heparin (24 weeks to < 27 weeks gestation)  
Intravenous, Continuous
    - Standard UVC infusion - D10 + Heparin (27 weeks to < 30 weeks gestation)  
Intravenous, Continuous
    - Standard UVC infusion - D10 1/4NS + Heparin (> or = 30 weeks gestation)
    - D10W infusion  
Intravenous, Continuous
    - D5W continuous infusion  
Intravenous, Continuous
    - NICU dextrose/saline custom continuous infusion  
For 23 week gestational age
    - NVN starter fluid - in less than 30 wk EGA
  - ▶ Medication - PIV Fluids [Click for more](#)
  - ▼ Medication - General
    - sodium chloride 0.2 % flush - Infants < 26 weeks  
2.5 mL, Intravenous, As Needed, < 26 weeks gestation
    - Vitamin K (phytonadione) - Infants < 1500g

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**It's all about the  
small details.....**





# Strict Management of Ventilation

- Prophylactic Surfactant Administration
  - after tube placement is verified on x-ray
- Standardized initial vent settings
- Target pCO<sub>2</sub> ranges
  - 45-55 first 3 days
  - 45-60 next 4 days
- Target Oxygen Saturations
- Frequent blood gas ensures proper response to changes
  - Q 2-3 hours or more as needed
  - Repeat BG 20 minutes after changes



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### NICU Preterm Oximeter Protocol

Post Menstrual Age	Alarm Limits	Target Saturation
≤ 26 weeks	80 - 93%	84 - 93%
27 - 31 weeks	80 - 95%	86 - 94%
≥ 32 weeks	85 - 98%	90 - 95%
≥ 32 wks on RA or on nasal cannula ≤ 1 LPM	90%	> 94%

Adjust O<sub>2</sub> by 5% increments. If the patient requires > 70% O<sub>2</sub> on Nasal CPAP or while intubated, please notify medical team. If high alarming on 21% O<sub>2</sub>, may change upper alarm limit with order. 4/06, 11/08, 5/13.

# High Frequency Jet Ventilation

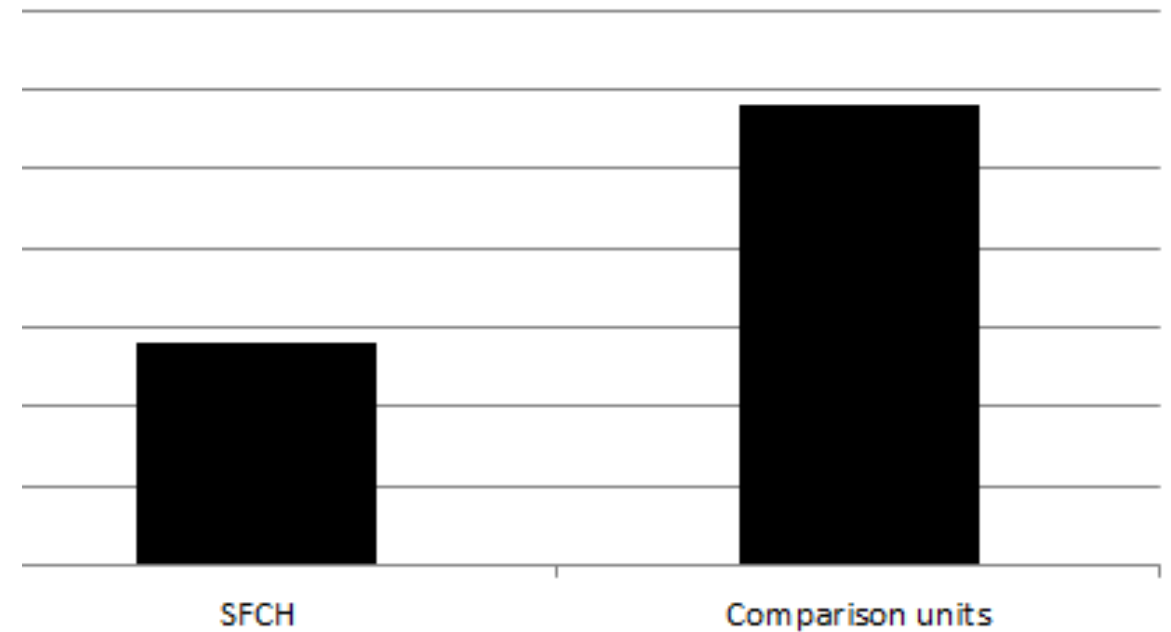
- Bunnell Jet Ventilator is the standard for infants < 29 weeks that need to be intubated
- Advantages of HFJV over conventional
  - Using smaller tidal volumes
  - Can independently manage ventilation and oxygenation
  - Can safely use higher level of mean airway pressure



# IVH Bundle/Prevention

- Two person cares is optimal (part of developmental and neuroprotective care bundle as well)
- Flat/midline for first 2 weeks of life
- Avoid excessive turning of head
- Close monitoring of ABGs and CO2 to avoid fluctuations in cerebral blood flow
- Flush and draw off lines SLOWLY.... At a rate of no faster than 1mL/30 seconds
- Cluster cares, hands on every 4-6 hours depending on patient acuity
- No trial of exutbation in first 2 weeks
- Transfuse for Hgb <11.5

**Percent of VLBW infants - any IVH**



# NICU CLABSI Maintenance Bundle Elements

## Line Discussion/ Infection Prevention

- Minimize access
- Minimize dwell time
- Evaluate need for line daily
- All unused ports secured with Curoc cap and lines off the floor
- Lines not in direct contact with any dirty suction/ventilator equipment and off the floor

## Dressing Assessment and change

- Ensure dressing is clean, dry and intact
- Standard process for dressing change
- Core group of nurses for dressing changes
- Addition of Tissue Adhesive to insertion site on insertion and with every PRN dressing change

## Standard Access

- Decrease overall line entries
- Ensure each entry is clean reducing change of introduction of bacteria into central line

## Tubing change

- Standardize tubing change to modified sterile procedure
- Standard tubing change days to ensure Q 96-hour tubing changes completed

## Daily CHG bathing

- CHG to lines and wires for patients less than 48 weeks adjusted
- Decrease bioburden in environment by changing linens daily
- Currently looking at implementation of bath wipes



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# **Nutrition for ELBW Infants**

## Breast Milk or Donor Milk



- Breastmilk or Donor Milk is preferred enteral nutrition
- Donor “agreement” obtained if Mother does not intend to pump or if demand outweighs current supply

## Neonatal Venous Nutrition (NVN) & Lipids



- NVN is started on DOL 0
- Lipids started on DOL 1 or at least after 12 hours of life

# Initiation of Enteral Feeds

- Trophic feeds started 24-36 hours after delivery @ 10mL/kg/day
- BID Glycerin suppository by DOL 2 if no stool
- Advance SLOWLY 10-12 mL/kg/day if tolerating
- Strict residual management
- No fortification until after 5 days of life and  $\geq$  5mL



# Standardized Feeding Administration

- Nurse driven
- Infants < 1500 grams
- > 5mL
- Infant can be transitioned to bolus feedings after > one month of age and weight is > 1800 grams at the nurses' discretion





# Oral Immune Therapy (aka Oral Cares with Breast milk)

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- Initiated as soon as fresh mother's milk is available
  - NPO- Every 6 hours
  - Once enteral feedings are initiated Q 4hours with cares
- 0.5mL-1mL on a green oral swab
- Decreased incidence of NEC, Bacteremia, Length of stay, and Ventilator Associated Pneumonia



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# Skin Care

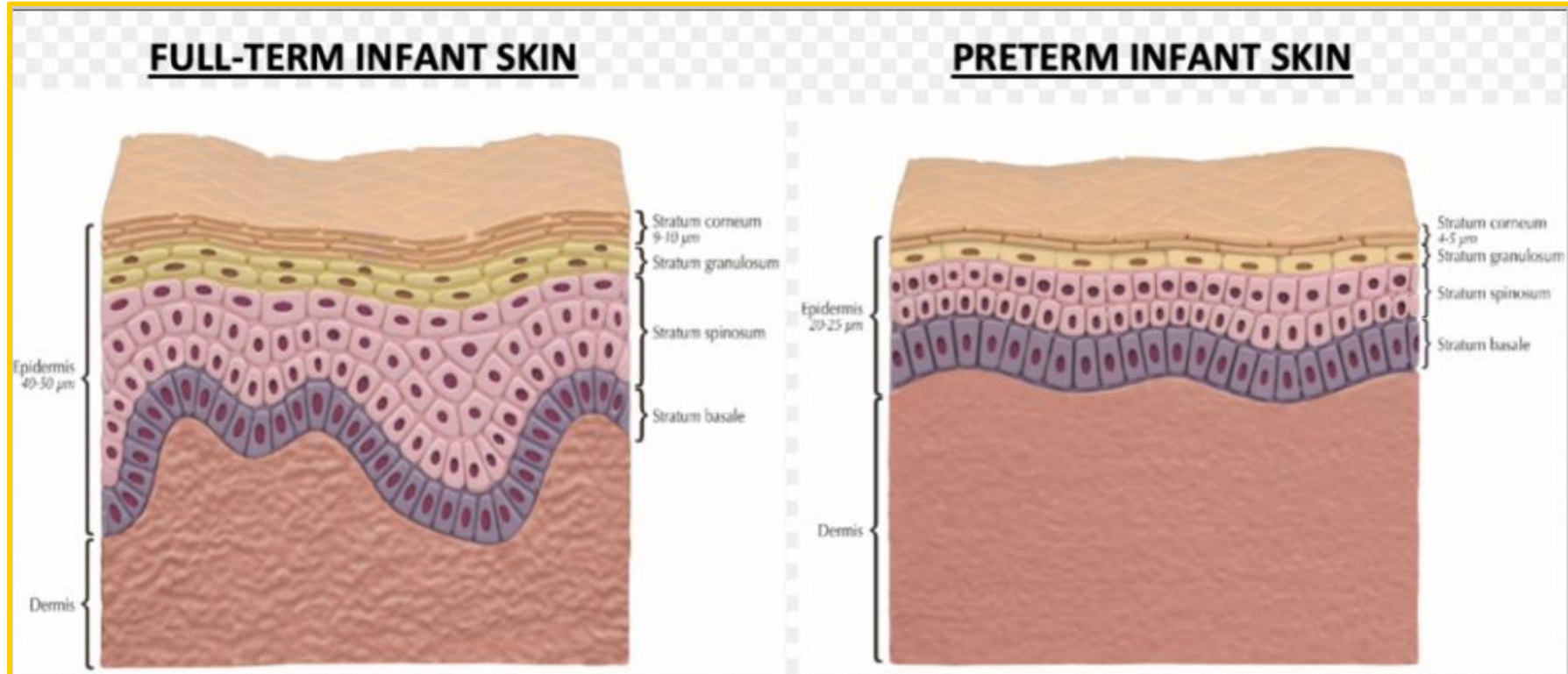
Disclaimer \*\*Limited published evidence about skin care in 22-24 week infants\*\*

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**Disclosure..... We  
don't use humidified  
incubators**

# ELBW Skin



Term infant has ~ 15 layers of Stratum Corneum, 28-week infant has ~2-3 layers, and 22–23-week infant may be entirely deficient of Stratum Corneum

# Challenges of Skin Care in ELBW

- Increased incidence of needing lifesaving and life-sustaining measures such as ETT and central lines.
  - ❖ According to AWHONN the removal of even ONE adhesive can result in damage to the skin barrier function and increase irritation leading to skin stripping and tearing.
- Epidermal stripping can occur from adhesives, rubbing, friction, and removal of leads
- 80% infants < 24 weeks have skin injuries during their stay
- High trans epidermal water loss (TEWL)



# Humidity Free Zone



- Use warmer beds with saran wrap instead of incubators with humidity
- Relative humidity under saran is 50% and favors skin maturation
- Initial IV fluids are ordered at 200 mL/kg/day to help compensate for fluid loss
  - Nutrition is not restricted in the first days/weeks but is maximized





# NICU Skin Care

- Extreme caution with adhesives and monitoring devices
- Wipe of alcohol, betadine, adhesive tape remover with water or sterile saline wipes
- Trial and error of products that worked best for this patient population
- All products approved by pharmacist prior to use to determine risk for absorption
- Department Expert Skin, Wound Ostomy Nurse leads our skin care
- Nursing Skin Stars

# Skin Friendly Preemie Products



## Once a day Dimethicone Lotion

- Daily application
- Safe for use in all gestational ages



## Silicone Tape

- Ability to remove without causing skin tears or friction
- Use on non-life sustaining devices



## Velcro Oximeter

- Not adhesive to the skin but instead velcros to itself



## Silicone Contact layer

- Provides barrier for high friction areas
- Place under leads and oximeter
- Able to apply lotion on top of dressing



## Micro preemie Leads

- Stick well and have good conduction without covering a large surface area
- Easy to place and remove



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# **Developmentally Supportive Care**

# Four Pillars of Neuroprotective Care



## Healing Environment

- Protect sleep
- Daily skin to skin (per protocol after 2 weeks)
- Appropriate sound & lighting levels
- Good positioning



## Individualized care

- Handling based on infant cues
- Minimizing stress & pain
- Protecting skin
- Optimizing nutrition



## Supporting Families

- Education
- Helping families read infant cues
- Daily skin to skin
- Participation in cares & Family-centered rounds

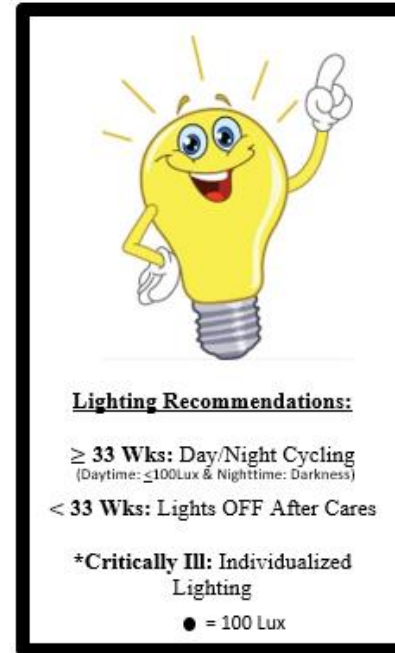


## Working Collaboratively

- 2-person supported care
- Good communication
- Clustering of cares/assessments
  - Nursing
  - Medical
  - Ancillary services

# The Intensive Care Environment

- Negative stimuli of the NICU environment contribute to negative outcomes
  - Bright lights
  - Noise
  - Frequent handling
  - Procedures



**A person's a person,  
no matter how small.**

-Dr. Seuss



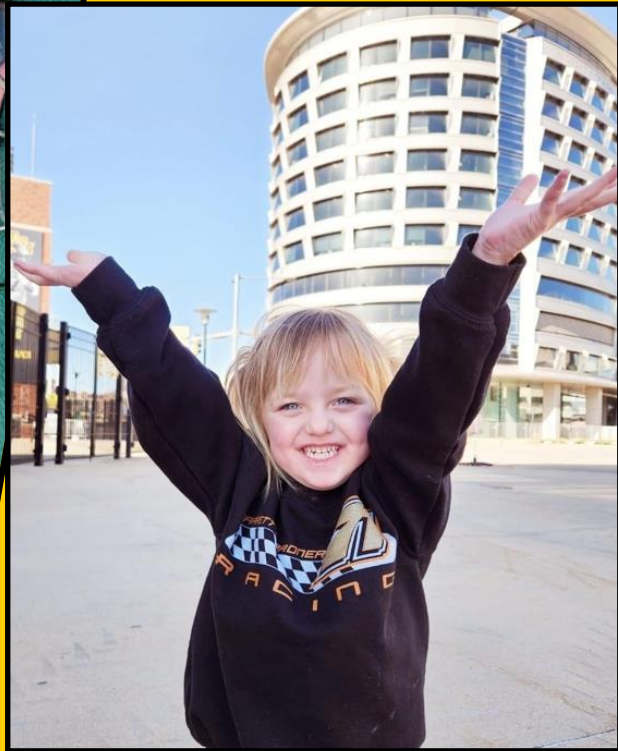
23 6/7 weeks



5 years old



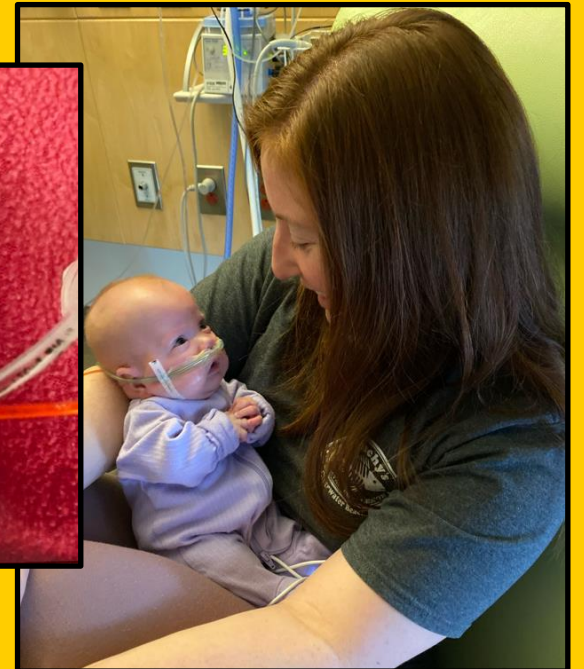
23 0/7 weeks



5 years old



23 3/7 322 grams



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**Questions?**

**→ [uiowa.edu](https://uiowa.edu)**

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