**Icy Infants QI Project: Improving Admission Temperature in Very Low Birth Weight Infants**

Authors: Jennifer King MSN RN\(^1\), Susan Jeffrey BSN RN\(^1\), Robyn Daley BSN RN\(^1\), Lyn Kinkle BSN RN\(^1\), Nancy Seraydarian BSN RN\(^1\), Dave Carola, DO\(^{1,2}\), Patoula Panagos, MD\(^{1,2}\).

\(^1\)Thomas Jefferson University Hospital, \(^2\)Nemours Neonatology at TJUH, Philadelphia, PA. USA. (215) 955-8346 Jennifer.King@Jefferson.edu.

**Background:** Hypothermia is associated with respiratory distress, hypoglycemia, sepsis, and intra-ventricular hemorrhage. These can cause morbidity and can lead to mortality in the VLBW infant.

**Aim:** The aim is that very low birth weight (VLBW) infants admitted from the delivery room (DR) have an axillary admission temperature within the range of 36.5 - 37.5 degrees Celsius within one year using The Model for Improvement.

**Setting:** This Intensive Care Nursery (ICN) of a public urban hospital is a 40 bed level three unit with approximately 700 total deliveries and 40 VLBW infant admissions per year. The majority of the deliveries are Cesarean sections.

**Mechanisms:** A chart review of all 2014 VLBW infants revealed potential mechanisms for admission hypothermia. These included the following: subjectively cold c-section room, lack of warming during delayed cord clamping, variable wrapping of infant during resuscitation, and inconsistent warming during transport to ICN. To better understand these mechanisms we created work flow and fishbone diagrams (Figure 1).

**Drivers of Change:** Five primary drivers were identified: 1. Pre-warming the DR and equipment, 2. Warming during delayed cord clamping procedure, 3. Warming during resuscitation, 4. Warming during transport, and 5. Increasing education and awareness in the ICN (Figure 2). Secondary drivers (process changes) include warming the resuscitation room and equipment, placing the baby on warm sterile blankets during delayed cord clamping, maintaining the polyethylene wrap during the resuscitation, standardization of warming during transport to the ICN, pre-delivery huddles, a checklist and in-servicing the staff.

**Methods:** After key drivers were defined, PDSA cycles were performed for each process change (secondary drivers) (Figure 3). Environmental services installed a thermometer in the resuscitation room. The OB staff was educated on pre-warming sterile blankets for delayed cord clamping. All staff was in-serviced on polyethylene wrap and standardized wrapping method and the Biomed department addressed the malfunctioning transport isolette. Due to presence of the balancing measure hyperthermia, a second temperature was checked prior to transport and the chemical mattress was removed if the temperature was greater than 37.5 degrees Celsius. PDSA cycles continue in real time along with data collection and analysis.

**Measures:** The outcome measure is VLBW infant admission temperature. The balancing measure is hyperthermia. The process measure is a checklist. Components of the checklist are also process measures: Pre-delivery huddle, pre-warming the DR, and completion of post stabilization debriefing.

**Data/Results:** Admission temperature is plotted against time on a continuous annotated run chart (Figure 4). We were able to achieve six consecutive data points above the 2014 median (36 degrees Celsius) which shows a meaningful trend.

**Discussion:** Using QI tools and PDSA cycles, admission temperatures for VLBW infants have improved. Families contribute to the improvement process by holding their infants with the bundle wrap after birth. Future direction includes expanding process changes to infants less than 33 weeks gestational age. Improving hypothermia in the VLBW population will lead to better practices and outcomes for VLBW infants.

**Keywords:** Hypothermia, very low birth weight infant (VLBW), delayed cord clamping.

**Team Acknowledgement:** The authors thank our infant patients and their families, Suzanne Lagner MSN RN, Christine Smith MSN RN, Kolawole Solarin MD, Hemant J. Desai, MD, Michelle Epstein CPNP, and the TJUH ICN nurses, RTs, NNPs and fellows for their support in making changes that lead to improvement.
Figure 1. Fishbone Analysis

Environment
- Baby
  - Warmer not warm at delivery
  - Baby blankets cold by delivery time
  - Warmers not available
  - Respiratory equipment and oxygen not warmed
  - Warmer doesn't have scale

Baby
- Management
  - Chemical mattress not prepared
  - Radiant warmer blocked during resuscitation

Process
- Equipment
  - Stethoscope cold
  - Warmer not warm at delivery
  - Warmed hat not available
  - Respiratory equipment and oxygen not warmed

- Process
  - Open neowrap for lead and pulse ox placement
  - No standardized heat saving weight technique
  - Inconsistent bundling technique

- Management
  - Lack of assigned warmth responsibilities
  - Poor placement and maintenance of neowrap
  - No warming during delayed cord clamping

Figure 2. Key Driver Diagram

Aim - Primary Drivers - Secondary Drivers
- Pre-warm room and equipment
- Warming during delayed cord clamping procedure
- VLBW infants will have an admission temperature between 36.5-37.5 °C
- Warming during resuscitation
- Warming during transport
- Education/awareness

- Delivery room/OR temp 77° F
- Warmer set up with warmed equipment
- Warmed sterile blankets on baby
- Keep polyethylene wrap in place
- Place Leads & Pulse Ox
- Standardize weighing in DR/OR
- Avoid blocking warmer lamp
- Pre-warmed isoslette 37° C
- Standardize infant wrap for transport
- In-servicing Staff
- Golden Hour Checklist
- Huddle and Debrief
- Display board in NICU
- Collect data in real time run chart
Figure 3. Plan-Do-Study-Act Cycle

**Act**
- Check infant's temperature in transport isolette prior to move.

**Plan**
- Will decreasing variability in how infants are wrapped help increase admission temperatures?

**Study**
- Vast improvement in hypothermia, but now seeing infants with admission temperatures > 37.5°C.

**Do**
- Implement standardized wrap to include blanket, chemical mattress, blanket, polyethylene wrap, and yellow hat in the delivery room.

Figure 4. Annotated Run Chart

- Admission temp (°C)
- Lower goal limit
- Upper goal limit

Golden Hour Re-education
- Golden Hour Education
- Created DR Checklist

QI bulletin board
- Restructure quality meetings
- Introduced QI methodology
- ICY Infants Bundle

PDSAs cycle:
- Measure second temperature in isolette prior to transport

Isolate issue
- PDSA Cycle

Thermometer issue