It’s getting hot in here 🔥🔥🔥

Reducing Rates of Newborn Hypothermia by Maintaining Operating Room Temperatures: A Quality Improvement Initiative

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LINC Scholars Distinction Track
Mentor: James deVente, MD, PhD
Define: Hypothermia of the newborn

Hypothermia in newborns: Defined as a core temperature ≤ 36 to 36.5 °C

- The newborn regulates body temperature much less efficiently and loses heat more easily
- The smaller and more premature the baby, the greater the risk
- After birth, the wet newborn immediately starts to lose heat
  - Larger surface area per unit body weight
  - Decreased thermal insulation due to lack of subcutaneous fat in low birth weight infants
  - Reduced amount of brown fat in low birth weight infants
- Contributes to complications such as respiratory distress, bradycardia, hypotension, and intraventricular hemorrhage

Minutes matter! If not protected from heat loss, the infant’s body temperature may drop as quickly as 0.1-2 °C per minute!¹
Neonatal Mortality Rates: North Carolina and Pitt County

According to the National Center for Health Statistics, North Carolina’s neonatal mortality rate is one of the highest in the country. Eastern North Carolina’s mortality rate is one of the worst in the state.

<table>
<thead>
<tr>
<th>State</th>
<th>Neonatal Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tennessee</td>
<td>6.9</td>
</tr>
<tr>
<td>Kentucky</td>
<td>6.9</td>
</tr>
<tr>
<td>Ohio</td>
<td>7.0</td>
</tr>
<tr>
<td>West Virginia</td>
<td>7.1</td>
</tr>
<tr>
<td>Indiana</td>
<td>7.2</td>
</tr>
<tr>
<td>North Carolina</td>
<td>7.2</td>
</tr>
<tr>
<td>Arkansas</td>
<td>7.5</td>
</tr>
<tr>
<td>Georgia</td>
<td>7.6</td>
</tr>
<tr>
<td>Louisiana</td>
<td>7.6</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>7.7</td>
</tr>
<tr>
<td>Delaware</td>
<td>7.9</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>7.9</td>
</tr>
<tr>
<td>Alabama</td>
<td>8.5</td>
</tr>
<tr>
<td>Mississippi</td>
<td>8.8</td>
</tr>
</tbody>
</table>

Source: North Carolina State Center for Health Statistics

Infant mortality rate in the United States as of 2017, by state (deaths per 1,000 live births)
Source: National Center for Health Statistics, CDC
# Neonatal and Infant Mortality: Leading Causes of Infant Death in North Carolina

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>NUMBER OF DEATHS</th>
<th>PERCENTAGE OF DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prematurity/low birth weight</td>
<td>189</td>
<td>22.0%</td>
</tr>
<tr>
<td>Birth defects</td>
<td>125</td>
<td>14.5%</td>
</tr>
<tr>
<td>Maternal complications of pregnancy, labor and delivery</td>
<td>125</td>
<td>14.5%</td>
</tr>
<tr>
<td>Other unknown causes</td>
<td>105</td>
<td>12.2%</td>
</tr>
<tr>
<td>Other perinatal conditions</td>
<td>101</td>
<td>11.7%</td>
</tr>
<tr>
<td>Respiratory distress</td>
<td>44</td>
<td>5.1%</td>
</tr>
<tr>
<td>Infections</td>
<td>39</td>
<td>4.5%</td>
</tr>
<tr>
<td>Circulatory diseases</td>
<td>28</td>
<td>3.3%</td>
</tr>
<tr>
<td>SIDS</td>
<td>28</td>
<td>3.3%</td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>17</td>
<td>2.0%</td>
</tr>
<tr>
<td>Other accidental injuries</td>
<td>14</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

Source: State Center for Health Statistics, 2014 mortality data
Among the leading causes of North Carolina’s infant mortality rate are prematurity and low birth weight, maternal complications of pregnancy and labor and delivery, and other perinatal conditions – which includes development of hypothermia in the newborn.

INFANT DEATHS BY AGE AT DEATH IN NORTH CAROLINA, 2014

- Neonatal (<28 days) infant deaths per 1,000 live births
- Postneonatal (≥28 days) infant deaths per 1,000 live births minus neonatal deaths.

Source: State Center for Health Statistics

Thus, almost 70% of the state’s neonatal mortality is caused by obstetrical issues. Therefore, as OB/GYNs, we have to reduce our neonatal mortality rate.
Our rates of severe intraventricular hemorrhage are not where we want them to be – why?
Hypothermia in newborns contributes to complications such as respiratory distress, bradycardia, hypotension, and **intraventricular hemorrhage**.

Source: Vermont Oxford Network
The Warm Chain: Thermal Protection of the Newborn

The World Health Organization (WHO) developed the “warm chain” which is a set of ten interlinked procedures carried out at birth and during the following hours and days which will minimize the likelihood of hypothermia in all newborns.

1. Warm delivery room
2. Warm resuscitation
3. Immediate drying
4. Skin-to-skin contact
5. Breastfeeding
6. Bathing postponed
7. Appropriate clothing
8. Mother and baby together
9. Professional alert
10. Warm transportation

Preparation of the place of delivery and of the supplies that will be needed is the first step of the warm chain. The room should be clean, warm, at least 77 °F (25 °C), and free from drafts from open doors or from fans.
Project Overview: Our AIM, the Team, Measurements, Fishbone Diagram

Global Aim
To reduce the incidence of newborn hypothermia at Vidant Medical Center

Specific Aim
To increase the number of labor and delivery operating rooms that maintain a temperature of 77 °F (25 °C) during cesarean sections by 50% by December 2018

The Team
- Pooja Sarin, MS4
- James deVente, MD, PhD
- Angela Still, RN
- Kristen Hardison, BSN, RNC-OB
- Junette Harper, RNC
- Elaine Henry, BSN, RNC-NIC

Performance and Outcome Measures
- Operating room temperatures set at or above 77 °F (25 °C)
- Compliance with temperature documentation
- First neonatal axillary temperature
- Rate of hypothermic newborns

Identifying root causes
- No thermometers that clearly display the OR’s temperature
- No specific role that is designated to control the OR temperature
- Adjusting the thermostat is not part of the routine preparation of L&D ORs
- Provider and staff discomfort with hot operating rooms
- Bystander effect – OB/GYNs know that the NICU is also responsible for preventing hypothermia
One of the barriers to maintaining the recommended temperature of labor and delivery operating rooms during scheduled cesarean sections was lack of education that the WHO’s recommendation applies to all deliveries, regardless of gestational age.

- Goal was to educate all providers about the WHO’s recommendation to maintain the optimal delivery temperature
- Developed presentation for all OB/GYNs to inform about commitment to ensuring the first step of the warm chain is implemented during every cesarean section
- Continued education on WHO’s practical guide on thermal protection of the newborn
- Continued reinforcement on importance of maintaining the optimal OR temperature
- L&D Medical Director presented the WHO’s practical guide for thermal protection of the newborn in August 2017
- Addressed concerns about provider discomfort and lack of buy-in with maintaining the recommended OR temperature at time of delivery
- Baseline temperature collection could not be performed retroactively
Another barrier to maintaining the recommended temperature of labor and delivery operating rooms during scheduled cesarean sections was there was no visible thermometer that displayed the room’s temperature and the thermostats’ limits were inadequate.

**PDSA #2: Thermometers and thermostats**

- **Plan**
  - Goal was to visually display temperature in OR and to allow staff to adjust temperature to cooler temperatures after delivery and prevent OR from reaching above 77 °F (25 °C)
  - Purchased thermometers to place in each L&D OR to display the environmental temperature

- **Do**
  - Placed thermometers in each L&D OR next to the thermostat in an easily visible location
  - Removed governor from thermostat that was previously set at 70 °F to 68 °F
  - Placed an upper limit temperature governor at 77 °F
  - Collaborated with MS3s on the OB/GYN clerkship to record temperatures at the time of delivery for all scheduled cesarean sections
  - Provided freezer vests to improve staff comfort

- **Act**
  - Developed improved data collection system
  - Continued reinforcement on importance of maintaining optimal OR temperature

- **Study**
  - Provided freezer vests for delivery room staff
A key barrier to maintaining the recommended temperature of labor and delivery operating rooms during scheduled cesarean sections was that adjusting the thermostat was not part of the routine preparation of L&D ORs.

**PDSA #3: Incorporating delivery temperature into electronic medical record**

- **Goal was to incorporate the temperature at the time of delivery into the electronic medical record**
- **Work with IT to include delivery temperature in the delivery summary for every c-section**
- **Standardize data collection, data analysis, and reporting process**
- **Continued reinforcement on importance of maintaining optimal OR temperature**
- **IT updated the EMR to include the delivery temperature in the delivery summary by February 2018**
  - Assigned L&D RN to be responsible for documenting the delivery temperature in the delivery summary in the EMR
- **Data was automatically pulled into reporting spreadsheet by April 2018**
  - Quality specialist began to analyze and report delivery temperatures monthly by June 2018

**PLAN**

**DO**

**ACT**

**STUDY**
The final phase of the project is to ensure the project’s long-term success by including the delivery temperature on the department’s quality improvement (QI) scorecard.

- Include “optimal delivery room temperature” in departmental quality improvement scorecard
- Department leadership is updated regularly on performance metrics
- Continue to report documentation and compliance to maintain project’s success
- Continued reinforcement on importance of maintaining optimal OR temperature
- Updated QI scorecard to include metric, “optimal delivery room temperature,” or the percentage of rooms at or above 77 °F, in October 2018
- Quality specialists determine the colors for each metric on the scorecard
- The metric is currently **yellow**
- The cutoff for green is >90%
Results: Delivery room temperatures, documentation compliance, and hypothermic babies

- Documentation compliance percentage
- Room temp > 77 degrees
- Hypothermic babies < 36.5
- Hypothermic babies < 36

<table>
<thead>
<tr>
<th>Month</th>
<th>Documentation Compliance</th>
<th>Room Temp &gt; 77</th>
<th>Hypothermic &lt; 36.5</th>
<th>Hypothermic &lt; 36</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>45.1%</td>
<td>24.5%</td>
<td>4.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>May</td>
<td>68.1%</td>
<td>14.3%</td>
<td>0.0%</td>
<td>22.4%</td>
</tr>
<tr>
<td>June</td>
<td>74.8%</td>
<td>22.4%</td>
<td>11.0%</td>
<td>5.6%</td>
</tr>
<tr>
<td>July</td>
<td>75.2%</td>
<td>28.0%</td>
<td>4.0%</td>
<td>5.6%</td>
</tr>
<tr>
<td>August</td>
<td>67.0%</td>
<td>19.0%</td>
<td>1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>September</td>
<td>71.9%</td>
<td>13.5%</td>
<td>4.3%</td>
<td>2.8%</td>
</tr>
<tr>
<td>October</td>
<td>75.2%</td>
<td>24.8%</td>
<td>5.7%</td>
<td>2.8%</td>
</tr>
<tr>
<td>November</td>
<td>77.1%</td>
<td>22.9%</td>
<td>5.5%</td>
<td>5.5%</td>
</tr>
<tr>
<td>December</td>
<td>79.1%</td>
<td>21.8%</td>
<td>5.5%</td>
<td>5.5%</td>
</tr>
<tr>
<td>January</td>
<td>75.0%</td>
<td>26.0%</td>
<td>4.2%</td>
<td>4.2%</td>
</tr>
<tr>
<td>February</td>
<td>74.8%</td>
<td>89.3%</td>
<td>11.7%</td>
<td>11.7%</td>
</tr>
</tbody>
</table>
### Conclusions: Challenges and Outcomes

<table>
<thead>
<tr>
<th>Lessons Learned</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The temperature in the OR is just one part of a chain of steps to protect newborns from hypothermia</td>
<td>Standardized process to ensure that L&amp;D ORs are maintained at the optimal delivery temperature</td>
</tr>
<tr>
<td>Use clean freezer vests</td>
<td>Temperature is now a component of the official documentation within the electronic medical record</td>
</tr>
<tr>
<td>Nurse managers provided additional coaching to nurses who inconsistently recorded temperatures</td>
<td>Improved documentation and adherence to maintaining recommended temperatures</td>
</tr>
<tr>
<td>Ensure compliance with surgical temperature regulations</td>
<td>VMC has seen a decline in rate of hypothermic newborns</td>
</tr>
<tr>
<td>Engage stakeholders early and often!</td>
<td></td>
</tr>
</tbody>
</table>

![Image of a woman in various stages of pregnancy](image)
References


Questions?

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