

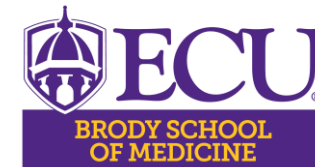
It's getting hot in here 🔥🔥🔥

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

Pooja Sarin

LINC Scholars Distinction Track

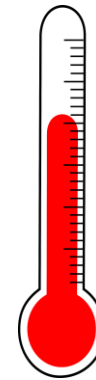
Mentor: James deVente, MD, PhD



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**

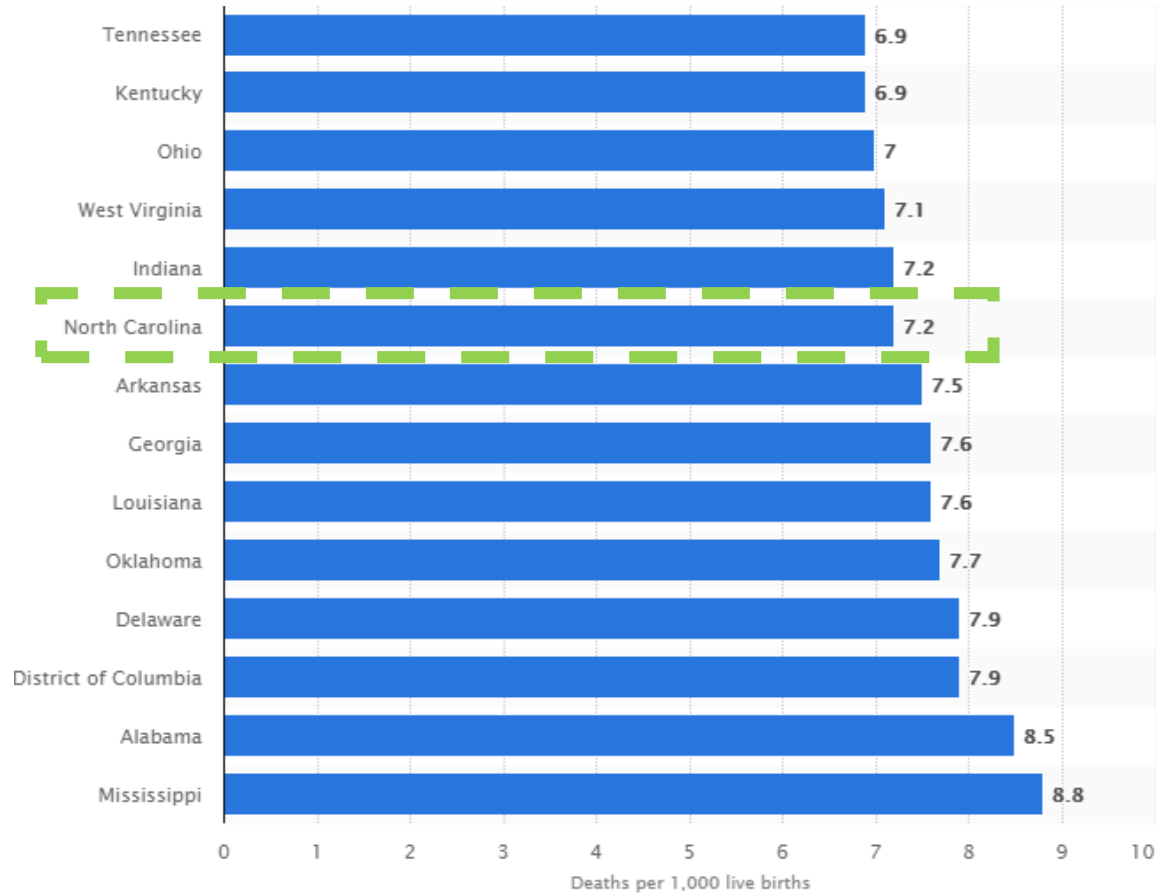


- 37.5 °C, Normal range → **Neutral thermal environment**
- 36.5 °C, Cold stress → **Cause for concern**
- 36.0 °C, Moderate hypothermia → **Danger!**
- 32.0 °C, Severe hypothermia → **Outlook grave, skilled care urgently needed!**

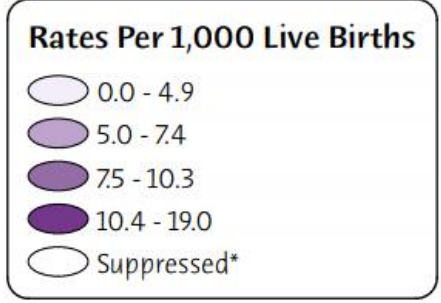
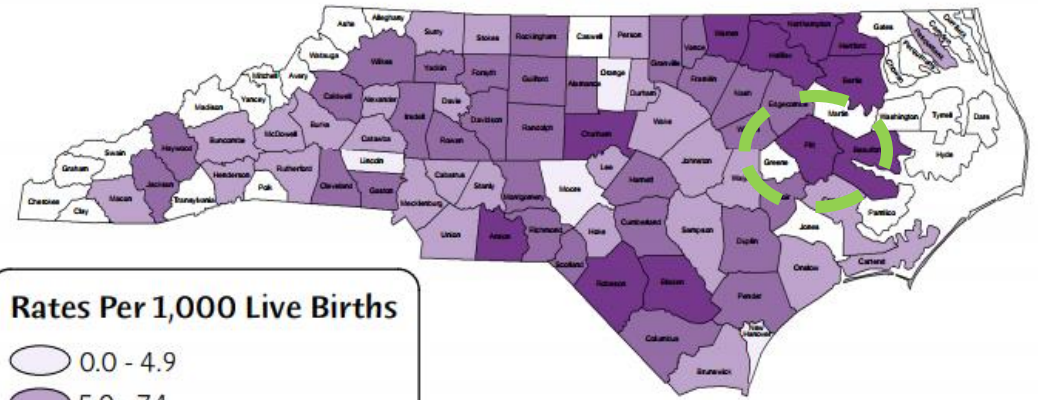
Minutes matter! If not protected from heat loss, the infant's body temperature may drop as quickly as 0.1-2 °C per minute!¹

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.



North Carolina Infant Mortality Rates by County 2012 - 2016



* Rates based on less than 10 deaths are unreliable and have been suppressed.

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

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

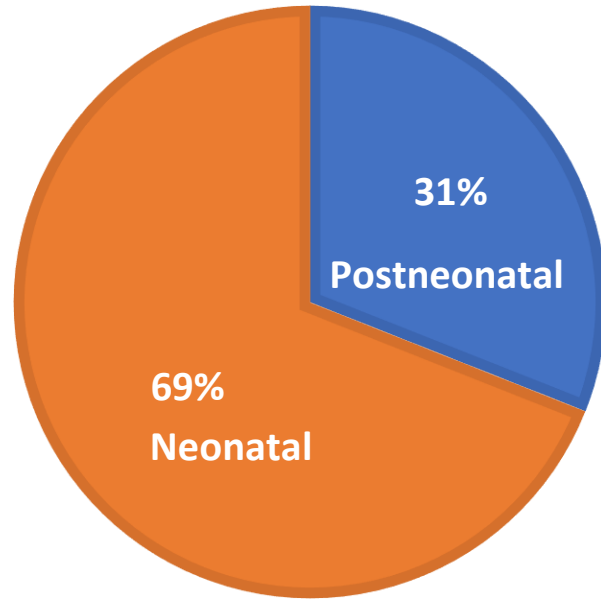
Source: State Center for Health Statistics, 2014 mortality data



Neonatal Mortality Rate: Age of death

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



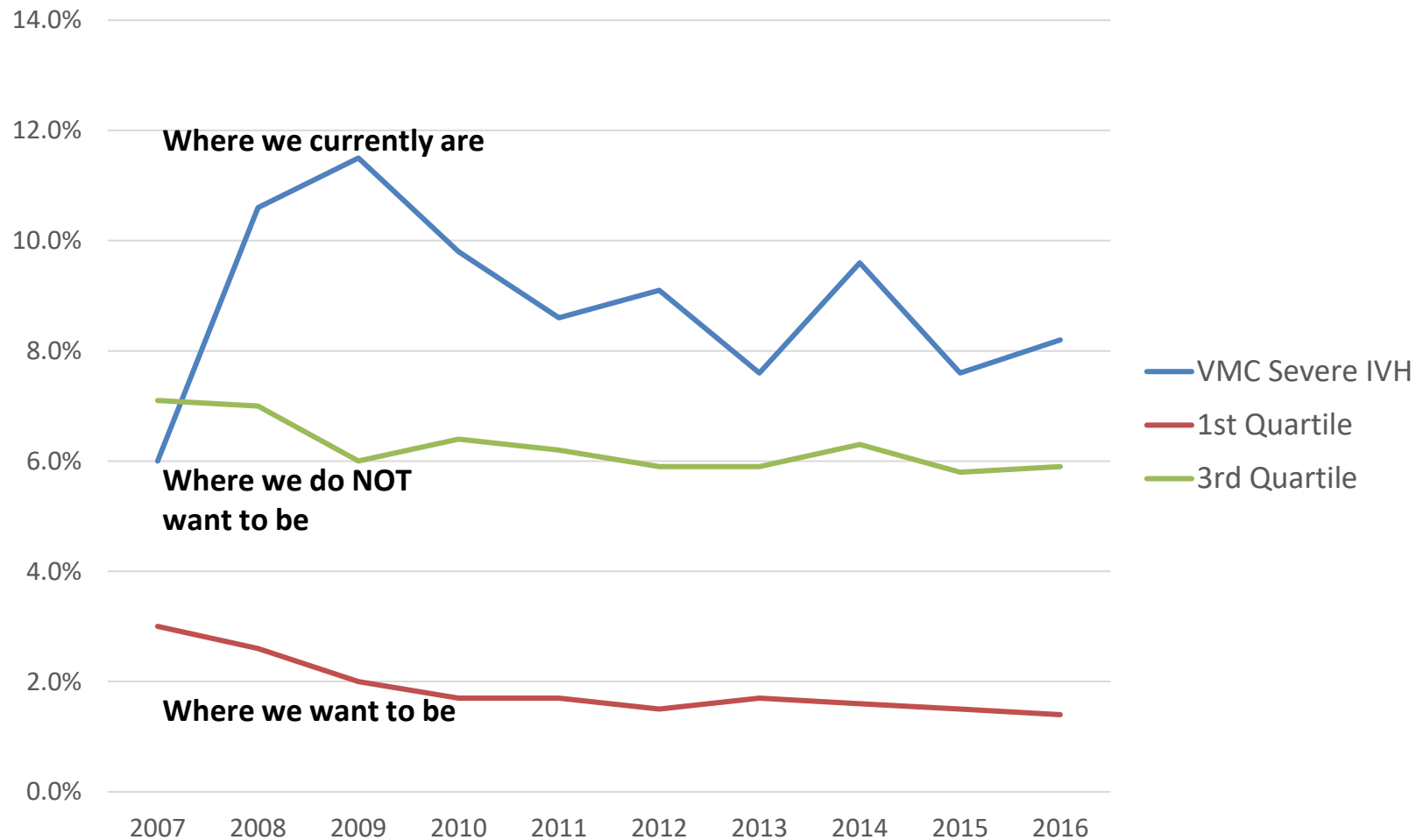
➔ More than **2/3** of infant deaths occur in the **first 28 days** of life

➔ Thus, **2/3** of infant deaths are as much an **obstetrical issue** as they are a pediatric issue

- 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.

Vidant Medical Center: Severe Intraventricular Hemorrhage (2007-2016)

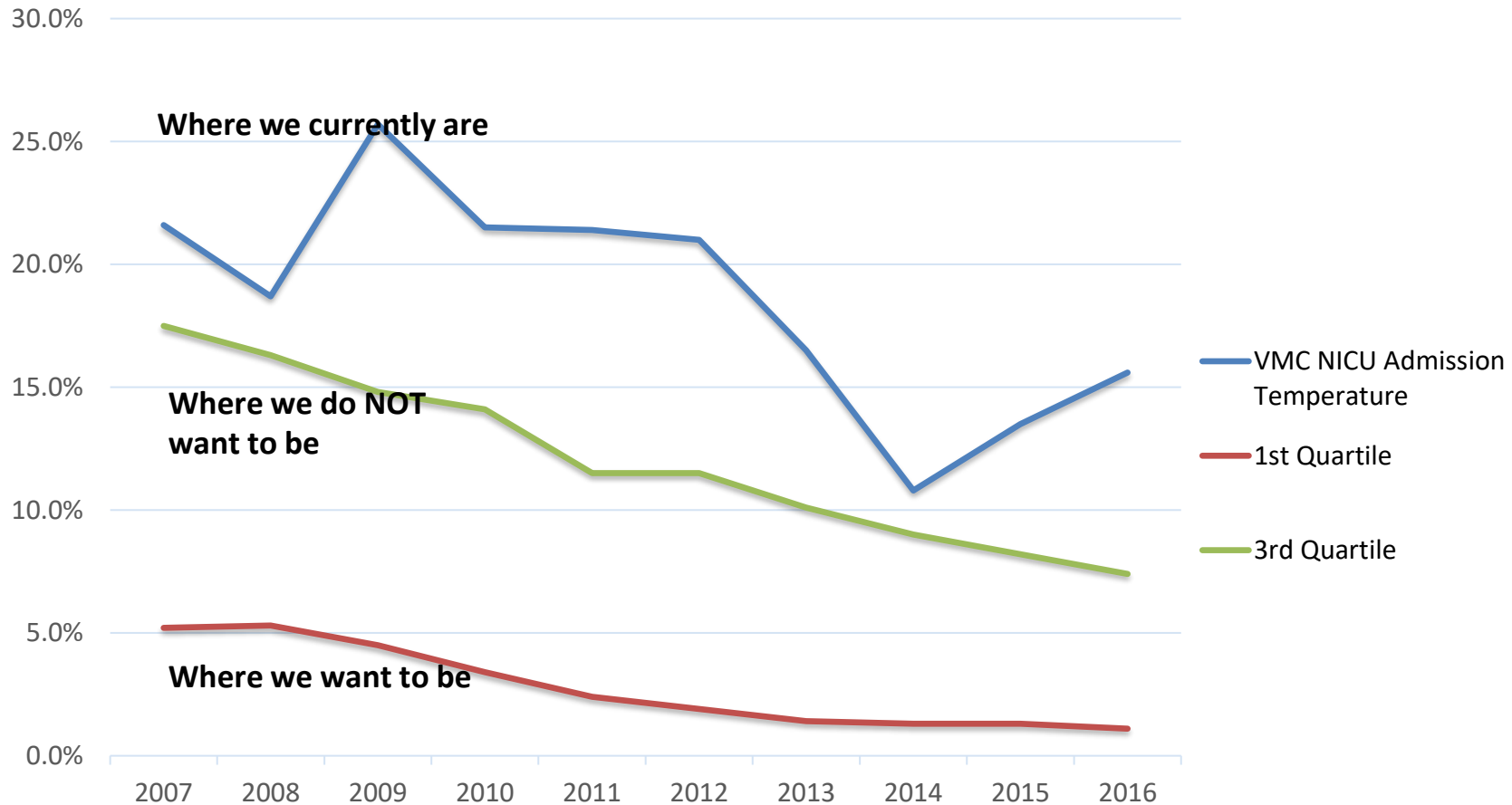


Source: Vermont Oxford Network

Our rates of severe intraventricular hemorrhage are not where we want them to be – **why?**



Vidant Medical Center: Rates of Admission Temperature to the NICU (32-35 °C)



Source: Vermont Oxford Network

Hypothermia in newborns contributes to complications such as respiratory distress, bradycardia, hypotension, and **intraventricular hemorrhage**



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 ².

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



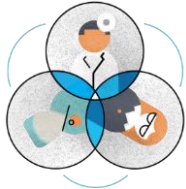
To reduce the incidence of newborn hypothermia at Vidant Medical Center

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



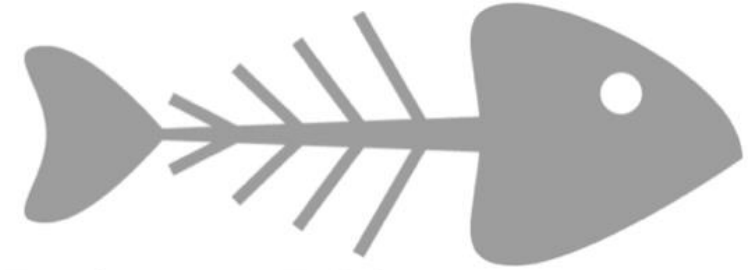
- ⌋ Pooja Sarin, MS4
- ⌋ James deVente, MD, PhD
- ⌋ Angela Still, RN
- ⌋ Kristen Hardison, BSN, RNC-OB
- ⌋ Junette Harper, RNC
- ⌋ Elaine Henry, BSN, RNC-NIC

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

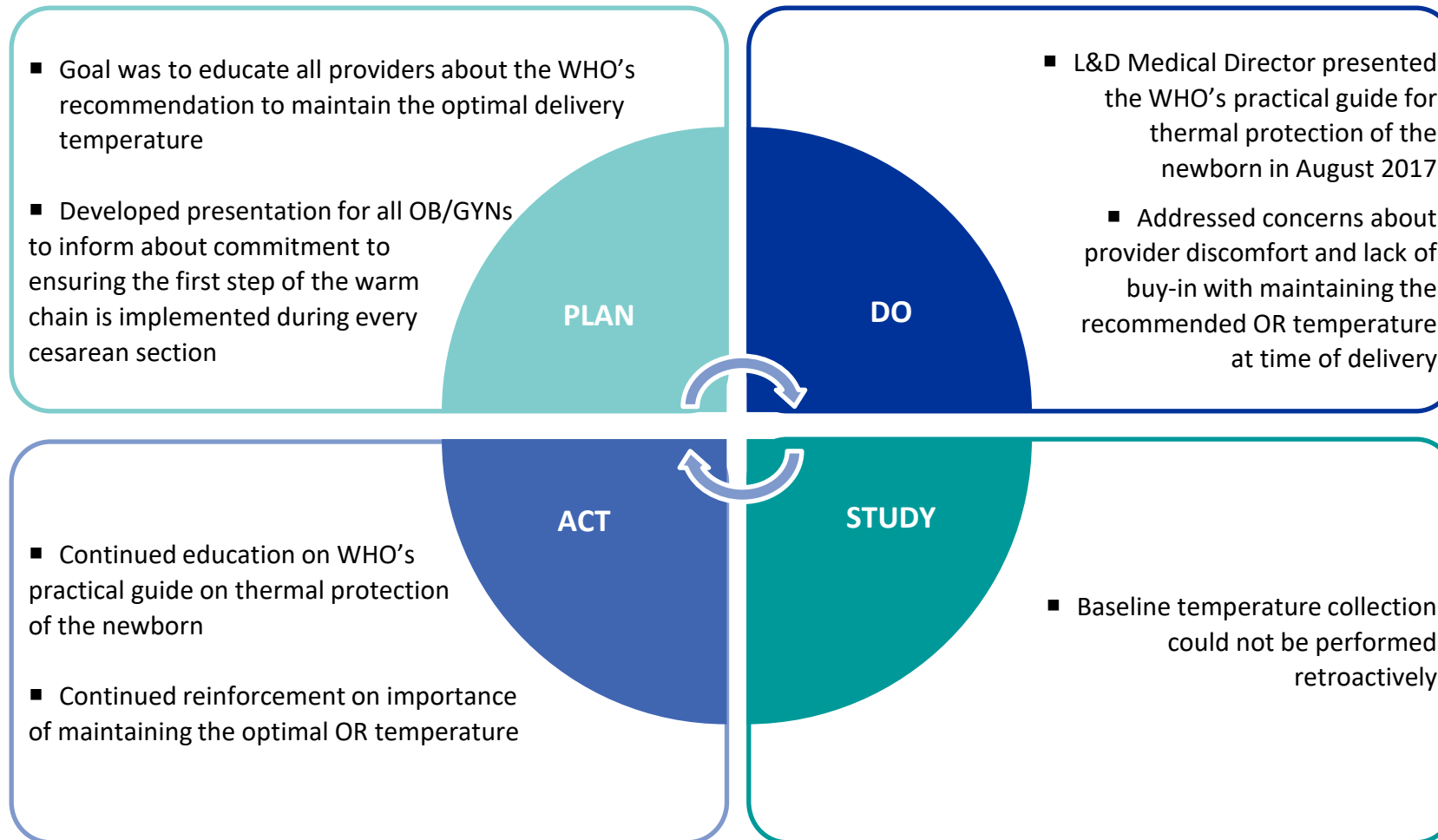
Identifying root causes



- ⌋ 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

PDSA #1: Provider Education

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.



PDSA #2: Thermometers and thermostats

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.

- 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

PLAN



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

- Develop improved data collection system
- Continued reinforcement on importance of maintaining optimal OR temperature

ACT

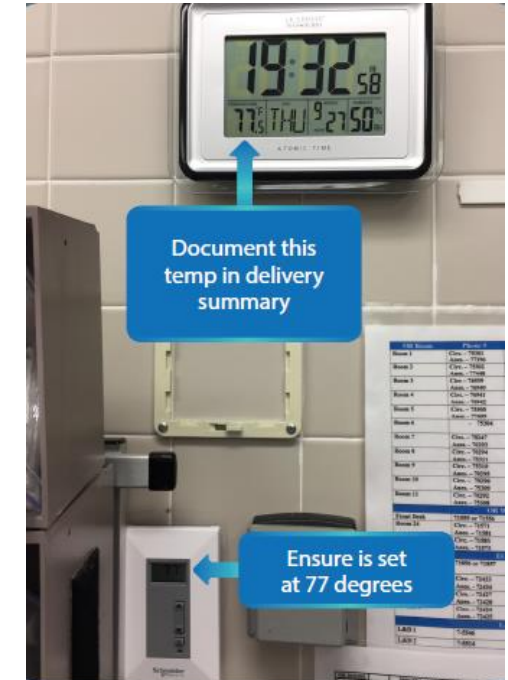
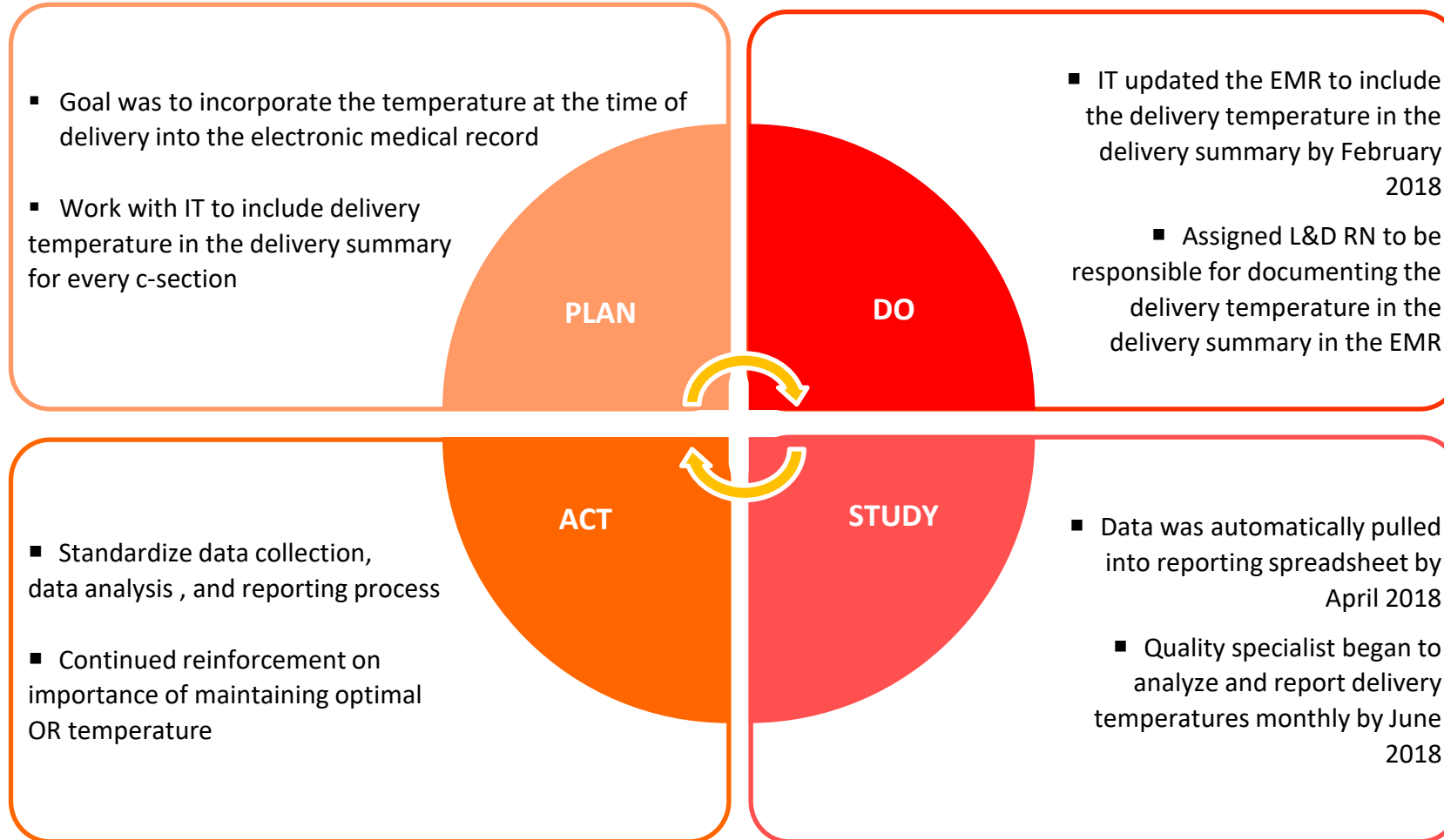
STUDY

- 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



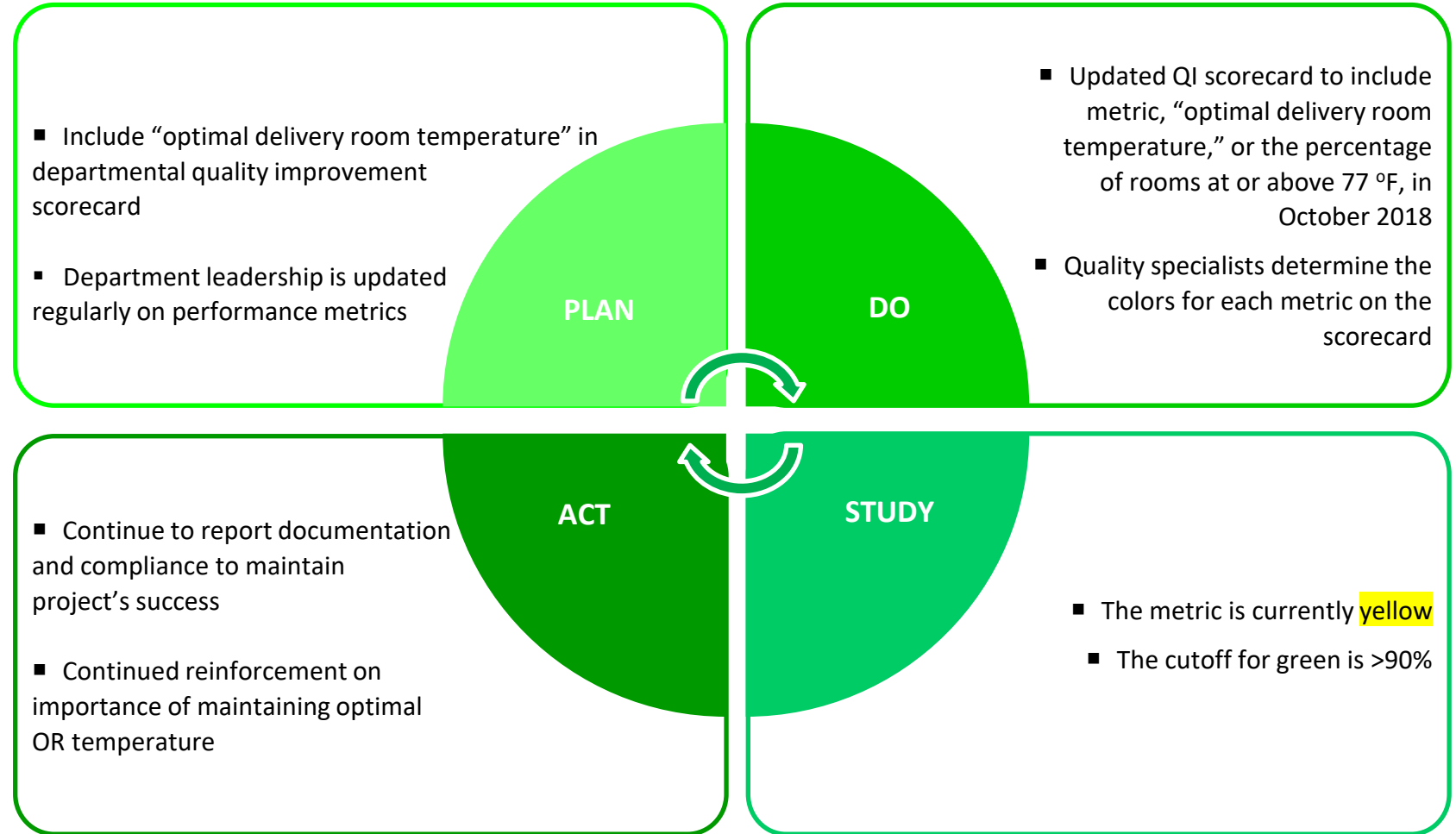
PDSA #3: Incorporating delivery temperature into electronic medical record

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.

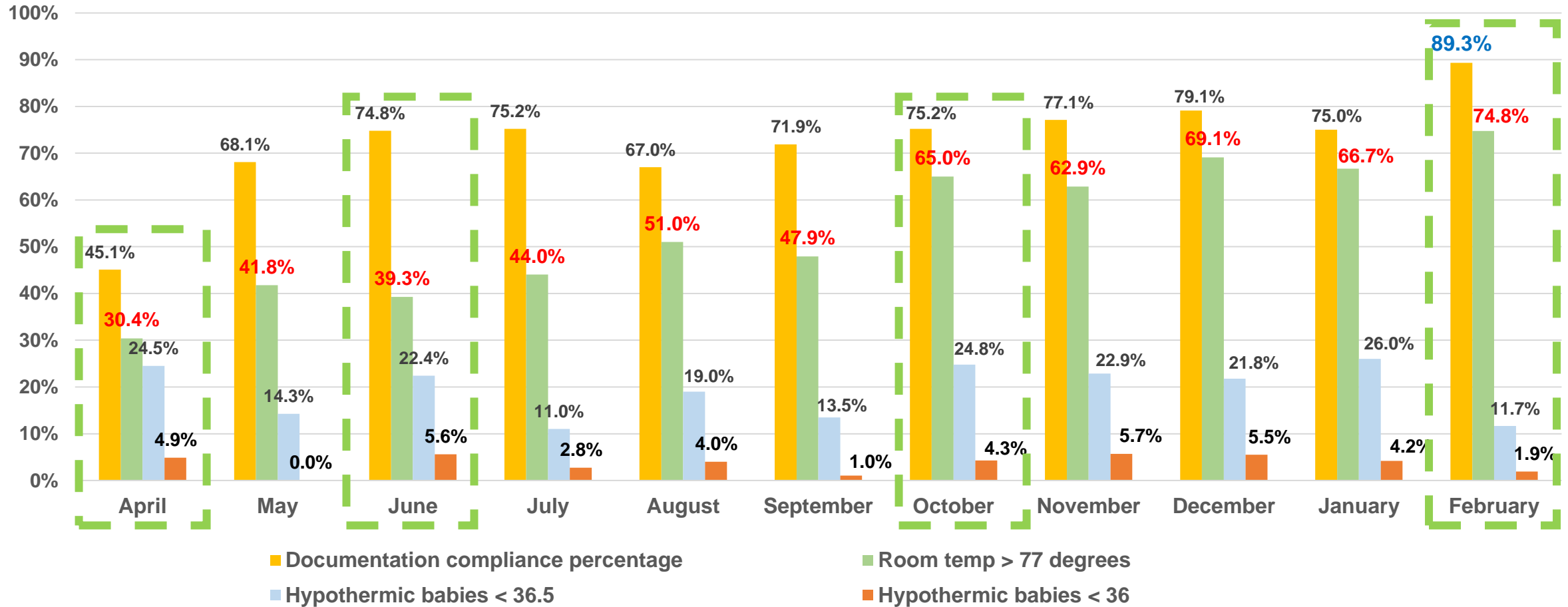


PDSA #4: Quality Improvement Scorecard

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.



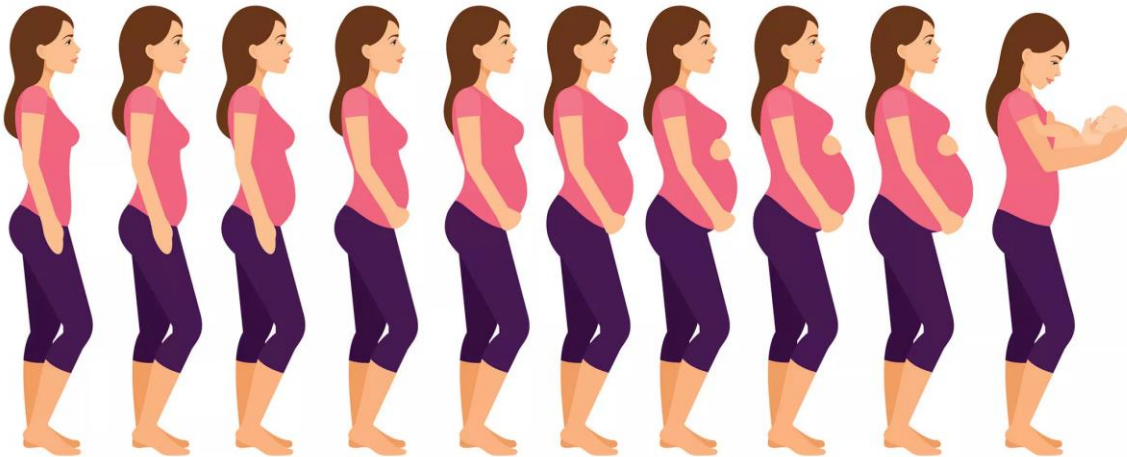
Results: Delivery room temperatures, documentation compliance, and hypothermic babies



Conclusions: Challenges and Outcomes

📌 Lessons Learned

- 📌 The temperature in the OR is just one part of a chain of steps to protect newborns from hypothermia
- 📌 Use clean freezer vests
- 📌 Nurse managers provided additional coaching to nurses who inconsistently recorded temperatures
- 📌 Ensure compliance with surgical temperature regulations
- 📌 Engage stakeholders early and often!



📌 Outcomes

- 📌 Standardized process to ensure that L&D ORs are maintained at the optimal delivery temperature
- 📌 Temperature is now a component of the official documentation within the electronic medical record
- 📌 Improved documentation and adherence to maintaining recommended temperatures
- 📌 VMC has seen a decline in rate of hypothermic newborns



References

1. Karlsen, K. A. (2013). The S.T.A.B.L.E. Program Post-Resuscitation/Pre-Transport Stabilization Care of Sick Infants Guidelines for Neonatal Healthcare Providers – 6th edition (6th ed.). Salt Lake City: S.T.A.B.L.E., Inc.
2. World Health Organization, Maternal and Newborn Health/Safe Motherhood. “Thermal Protection of the Newborn: a Practical Guide.” *Safe Motherhood*, WS 420 97TH , 1997, pp. 1–64., doi:https://www.who.int/maternal_child_adolescent/documents/ws42097th/en/.
3. Harner, K. L. (2012). Thermal protection of the newborn in resource-limited environments. *Journal of Perinatology*, 317-324.

Questions?



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