

Quality Improvement Initiative to Prevent Admission Hypothermia in Very-Low-Birth-Weight Newborns

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ABSTRACT

Objective: To decrease rates of admission hypothermia (<36 °C) in very-low-birth-weight (VLBW) newborns (<1,500 g).

Design: Quality improvement initiative.

Setting/Local Problem: Urban, Level IV NICU with 32 patient beds. The number of VLBW newborns admitted with Q4
temperatures less than 36 °C was greater than in comparable NICUs in the Vermont Oxford Network.

Participants: Neonates born in 2016 who weighed less than 1,500 g at birth.

Intervention/Measurements: Based on the literature and the needs of our unit, our team decided to focus efforts on equipment (chemical mattresses and polyurethane-lined hats for newborns who weighed <1,000 g and polyurethane-lined hats for newborns who weighed <1,500 g), staff education/awareness, and temperature documentation and workflow. Axillary temperature measurements for all neonates who weighed less than 1,500 g were tracked on admission.

Results: The processes involved in this quality improvement initiative were successfully implemented, and use of new equipment began January 1, 2016. In 2016, only 9.6% ($n = 7$) of VLBW newborns were admitted with temperatures less than 36 °C, compared with 20.2% ($n = 19$) in 2015 and 32.4% ($n = 24$) in 2014 ($p = .003$). Overall, the mean admission temperature for neonates who weighed less than 1,500 g rose from 36.2 °C in 2014 to 36.6 °C in 2016 ($p = .001$).

Conclusion: We reduced the number of VLBW neonates admitted with temperatures less than 36 °C and increased overall admission temperatures for neonates who weighed less than 1,500 g with the addition of polyurethane-lined hats and chemical mattresses.

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Problem Description

In 2014, after comparison of unit data with data from the Vermont Oxford Network (see Figure 1), the NICU team determined a need to reassess the birth resuscitation process to prevent hypothermia on admission for very-low-birth-weight (VLBW) newborns (<1,500 g). The Vermont Oxford Network is a nonprofit organization to which NICUs voluntarily report data on neonates who weigh less than 1,500 g at birth to evaluate quality and safety of care (Vermont Oxford Network, 2018). Routine thermal care interventions already in place to reduce hypothermia in the VLBW population included preheated rooms (74–77 °F), polyurethane bags, and a specialized incubator called the Giraffe OmniBed (GE Healthcare, Little Chalfont, UK). Regular stocking net hats were

standard in the delivery room for neonates of all sizes. Despite these measures in our unit, in 2014, 32.4% ($n = 24$) of VLBW newborns were admitted with moderate hypothermia (<36.0 °C). According to data from the Vermont Oxford Network at the time, some of the best-performing units had a 5% or less rate of hypothermia on admission. Despite diligent routine thermal care in the delivery room, since 2010 hypothermia rates worsened when the rates for other NICUs of comparable acuity improved.

Available Knowledge

All neonates rely on external help to maintain normal body temperature, particularly in the first Q5
hour of life (Castrodale & Rinehart, 2014). Heat

Despite adherence to recommended guidelines, our admission hypothermia rates for very-low-birth-weight newborns were worsening when rates for other comparable neonatal units were improving.

can be lost very quickly in the delivery room via conduction, convection, radiation, and evaporation (World Health Organization, 1997). Compared with term neonates, preterm neonates can quickly become dangerously hypothermic if specific supports are not in place at the time of birth. The rapid decline in the temperature of preterm neonates is exacerbated by the inability to produce nonshivering thermogenesis, poor vasomotor control, large surface area-to-body ratio, and immature skin, which result in increased, insensible water losses (Bissinger & Annibale, 2010). According to the World Health Organization (1997), normal body temperature for a newborn is between 36.5 °C and 37.5 °C. Mild hypothermia (cold stress) is classified as 36 °C to 36.5 °C, moderate hypothermia is 32 °C to 36°C, and severe hypothermia is less than 32 °C (World Health Organization, 1997). The World Health Organization has not updated guidelines on thermoregulation ranges in 20 years, and these guidelines continue to be the standard for evaluation of thermoregulation status. Maintenance of normal temperatures immediately after

birth and resuscitation is challenging for all newborns but even more so for preterm neonates.

Hypothermia has a significant effect on morbidity and mortality in VLBW newborns (<1,500 g; Chang et al., 2015; Wilson et al., 2016; World Health Organization, 1997). Thermoregulation of preterm neonates is a challenge globally, and lack of appropriate thermoregulation causes significant adverse outcomes that can affect neonates in the short and long term (Ahmad et al., 2016; Boo & Guat-Sim Cheah, 2013; Chang et al., 2015; Miller, Lee, & Gould, 2011; Wilson et al., 2016). In one study, researchers reported that for every 1 °C decrease in admission temperature, the odds of death increased by 28%, and the odds of late-onset sepsis increased by 11% (Laptook, Salhab, & Bhaskar, 2007). In the literature, hypothermia has also been associated with hypoglycemia, hypoxia, metabolic acidosis, coagulation defects, and severe intraventricular hemorrhage (McCall, Alderdice, Halliday, Jenkins, & Vohra, 2010). Therefore, prevention of hypothermia at birth is important for survival and for long-term outcomes.

In the United States, the Neonatal Resuscitation Program (NRP), developed by the American Heart Association and the American Academy of Pediatrics (Weiner, 2016), teaches an evidence-based approach to newborn care. The goal of

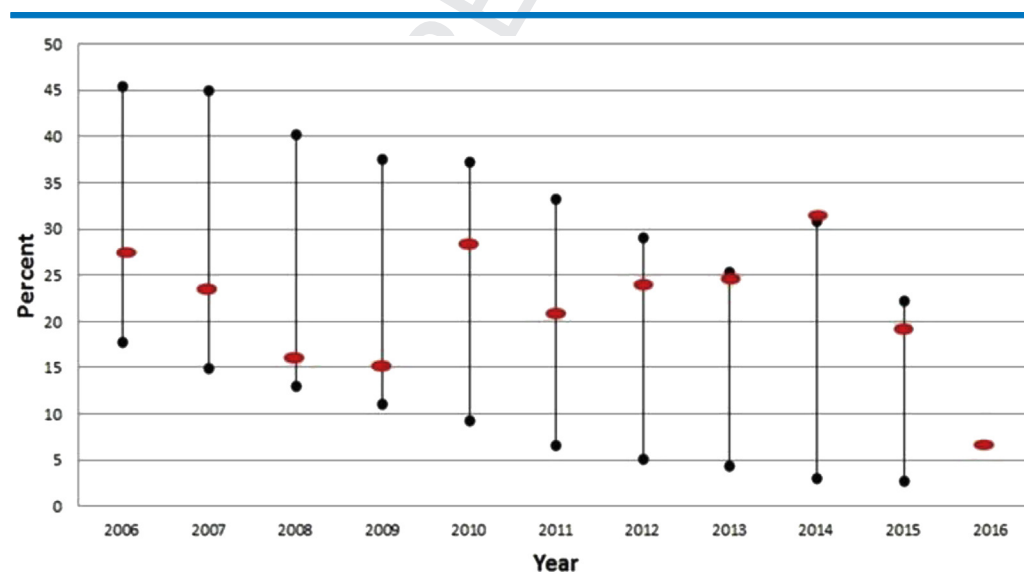


Figure 1. Percentage of very-low-birth-weight newborns (<1,500 g) with hypothermic admission temperatures (<36 °C) at our institution (red dot) compared with the Vermont Oxford Network quartiles. For this criterion, a lower percentage indicates less hypothermia (improved).

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