

A Quality Improvement Intervention to Decrease Hypothermia in the Delivery Room Using a Checklist

Alexandra Vinci, MD, FAAP*†; Shahidul Islam, MPH, PStat®*†; Lyn Quintos-Alegheband, MD*†; Nazeeh Hanna, MD*†; Amrita Nayak, MD*†

Abstract

Introduction: Premature babies are at increased risk of hypothermia, core body temperature <97°F. Delivery room environment may contribute and lead to complications. The objective was to reduce hypothermia in babies <32 weeks of gestation in the delivery room to <40% using a checklist and sustain it for 6 months. **Methods:** We created a delivery room checklist in 2012. Chart review established a baseline rate of hypothermia (<97°F). The team analyzed the checklist's effect on hypothermia from 2012 to 2018 and utilized numerous interventions to maintain compliance. Chi-square test and Fisher's exact test analyzed hypothermia and hyperthermia as a balancing measure. All calculations performed in SAS 9.3. **Results:** The checklist reduced hypothermia from a baseline of 50% in 2011 (n = 104) to 33% in 2012 (n = 106). In 2013, the proportion of hypothermia slightly increased to 36% (n = 81). The year 2014 brought larger drift, and proportion of hypothermia increased to 44% (n = 117). In 2015, we reinforced the use of the checklist and proportion of hypothermia improved to 36% (n = 99). Further interventions through 2018 decreased hypothermia further to 14% to achieve statistical significance. **Conclusions:** A checklist is a simple tool that may yield beneficial changes in practice and helped to decrease the proportion of neonatal hypothermia. (*Pediatr Qual Saf* 2018;3:e125; doi: 10.1097/pq9.000000000000125; Published online December 6, 2018.)

INTRODUCTION

Hypothermia is a complication of prematurity that results in increased morbidity and mortality. It may lead to unwanted outcomes, such as hypoglycemia, acidosis, neurological deficits, intraventricular hemorrhage, and longer hospital stays.¹⁻⁴ One study demonstrated an increase in mortality of 28% with every decrease of 1°C in core body temperature.⁵

Premature newborns are susceptible to hypothermia for various reasons. Gestational

age and birth weight are inversely related to its development.¹ Evaporative heat loss, a lesser amount of subcutaneous fat, and immature neurological function result in increased susceptibility. Premature newborns are unable to shiver, hindering effective thermogenesis.⁶ Evaporative, conductive, radiant, and convective heat loss occur simultaneously.⁵ As a result, premature newborns require extra measures to maintain body temperature. Interventions incorporated into routine resuscitation measures (radiant warmers, plastic bags/wraps, heated transport incubators) decrease the incidence of neonatal hypothermia and improve neonatal survival.^{4,5,7} However, hypothermia remains an all too common global problem, especially in resource-deprived regions.^{8,9}

Checklists have long been adopted for use by the aviation industry to ensure safety.¹⁰ Checklists serve as useful tools in healthcare for reducing medical errors that lead to morbidity and mortality.¹¹ One study by Berenholtz et al¹² in the intensive care unit at John Hopkins Hospital demonstrated that checklists decreased the incidence of central line-associated infection as well as improved patient care and communication. The World Health Organization incorporated this concept in 2006 into their Surgical Safety Checklist and Guidelines for Safe Surgery.¹³ The Safety Checklist significantly reduced morbidity and mortality in a multicenter study.¹⁴ In addition to reducing medical error and near misses, checklists ensure adherence to updated clinical practice guidelines.^{15,16}

Checklists have long been adopted for use by the aviation industry to ensure safety.¹⁰ Checklists serve as useful tools in healthcare for reducing medical errors that lead to morbidity and mortality.¹¹ One study by Berenholtz et al¹² in the intensive care unit at John Hopkins Hospital demonstrated that checklists decreased the incidence of central line-associated infection as well as improved patient care and communication. The World Health Organization incorporated this concept in 2006 into their Surgical Safety Checklist and Guidelines for Safe Surgery.¹³ The Safety Checklist significantly reduced morbidity and mortality in a multicenter study.¹⁴ In addition to reducing medical error and near misses, checklists ensure adherence to updated clinical practice guidelines.^{15,16}

From the *NYU Winthrop Hospital Children's Medical Center, Mineola, N.Y.; and †State University Of New York (SUNY) Stony Brook Medical College.

Presented at the Eastern Society of Pediatric Research, March 2014; Winthrop University Hospital Annual Research Day, April 2014; Winthrop University Hospital Quality Symposium, November 2014; Eastern Society of Pediatric Research, March 2015; and Pediatric Academic Society, April 2015.

*Corresponding author. Address: Alexandra Vinci, Department of Pediatrics, NYU Winthrop Hospital, 259 First Street, Mineola, NY 11501PH: 516-641-5963 Fax: (516) 663-8955. Email: alexandra.vinci@nyulangone.org

Copyright © 2018 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

To cite: Vinci A, Islam S, Quintos-Alegheband L, Hanna N, Nayak A. A Quality Improvement Intervention to Decrease Hypothermia in the Delivery Room Using a Checklist. *Pediatr Qual Saf* 2018;3:e125.

Received for publication March 20, 2018; Accepted October 30, 2018.

Published online December 6, 2018.

DOI: 10.1097/pq9.000000000000125



This quality improvement (QI) effort devised a delivery room checklist to decrease hypothermic admission temperatures for premature newborns admitted to the neonatal intensive care unit (NICU). Our SMART aim was “to decrease the incidence of hypothermia in babies born at <32 weeks estimated gestational age (EGA) by 25% from a 2011 baseline of 50% to <40% by December 2012 and sustain for 6 months.”

METHODS

Context

NYU Winthrop Hospital (NYU-WH) is a suburban tertiary care academic hospital in Mineola, New York, with an accredited residency training program in general pediatrics. NYU-WH is also a Children’s Medical Center and designated regional perinatal center with over 4,800 newborn deliveries per year. A level 4 forty-five-bed NICU receives approximately 700 admissions per year, approximately 100 are born at < 32 weeks of gestation. A QI initiative began in 2012 when staff recognized that 50% of all NICU admissions for babies born at <32 weeks EGA had hypothermic rectal temperatures <97°F upon admission to the NICU.⁴ This finding is significantly different from the average proportion of hypothermia of 25% seen by the Vermont Oxford Network, an international NICU database.

Live-born deliveries at NYU-WH are graded on a progressive acuity scale from level 1 to level 3, with the delivery of a baby born at 32 weeks of gestation or less designated as a level 3. One NICU attending, 1 NICU advanced practitioner, 1 pediatric resident, and 1 NICU nurse in addition to 2 Labor and Delivery nurses, 1 to 2 obstetric attending physicians, and 1 obstetric resident comprise the team typically present at a level 3 delivery.

Stakeholders of the project included neonatologists, pediatric residents, advanced practitioners, and registered nurses working in the NICU and Labor and Delivery staff. The partnership between the Pediatrics and the Obstetrics and Gynecology departments facilitated its implementation. The overall goal was to reduce hypothermia and preventable harm for premature newborns.

Establishment of Baseline Data

Retrospective chart review established a baseline proportion of hypothermia of 50% of all babies born at gestational age <32 weeks admitted to the NYU-WH NICU.

Measures

The primary outcome measure was the proportion of hypothermia (core temperature <97°F) among babies less than 32 weeks EGA admitted to the NICU. The team designated the proportion of babies <32 weeks EGA admitted with hyperthermia, or core temperature ≥100.4°F as the balancing measure. The team also tracked individual defective checklist components (ie, specific components of the checklist that were not followed or documented)

among all cumulative checklist components throughout the project as a process measure.

Interventions

A multidisciplinary process improvement team composed of attending neonatologists and obstetricians, house staff, nurses (NICU, Labor, and Delivery), and quality specialists formed. The team created a 10-item Delivery Room Checklist to standardize the process for preventing hypothermia in the delivery room. The checklist outlined specific instructions for preparing the delivery room for the birth of a baby born at less than 32 weeks gestation (Table 1). It included routine practices as dictated by Neonatal Resuscitation Program in addition to actions the team felt would positively impact outcome measure.⁴ For instance, despite the common practice of using polyethylene bags for only babies born before 30 weeks of gestation (at that time), the polyethylene bag was to be used regardless of gestational age. With collaboration from the Obstetrics department, delivery room thermostats in the operating rooms for cesarean sections were set to 75°F upon notification of an impending delivery.¹⁷ The checklist included documentation of operating room temperatures at the time of birth. NICU staff measured rectal temperatures upon admission to the NICU (within 30 minutes of birth) to ensure quick delivery of care shown to be beneficial to the survival of premature newborns.^{18,19} Any staff member present at the delivery could complete the checklist.

The team brainstormed to define strategies to drive frontline buy-in, resulting in the Key Driver Diagram (Fig. 1).

Implementation of Checklist (April 2012)

The first major intervention of education built provider knowledge and engaged the frontline in fostering a teamwork effort. The team educated NICU staff, labor and delivery staff, and house officers on complications of hypothermia and how to properly use the checklist. The official roll-out date for checklist implementation occurred in April 2012. To reinforce knowledge and

Table 1. Delivery Room Checklist to Prevent Hypothermia

Premature Infants <32 wk GA* Delivery Room Checklist			
Patient Name:	MR#	Date:	
1	Before delivery: NICU charge nurse and respiratory therapy aware of pending delivery/admission	YES	NO
2	OR temperature set at 75°F	YES	NO
3	OR temperature at time of delivery	Temperature:	
4	Infant warmer turned on	YES	NO
5	Warm blankets under radiant warmer	YES	NO
6	Gel pad placed under infant	YES	NO
7	Polyethylene bag on warm blankets	YES	NO
8	Temperature probes plugged into warmer	YES	NO
9	Transport incubator turned on	YES	NO
10	After delivery: Rectal temperature within 30 minutes of birth	Temperature:	

GA = gestational age

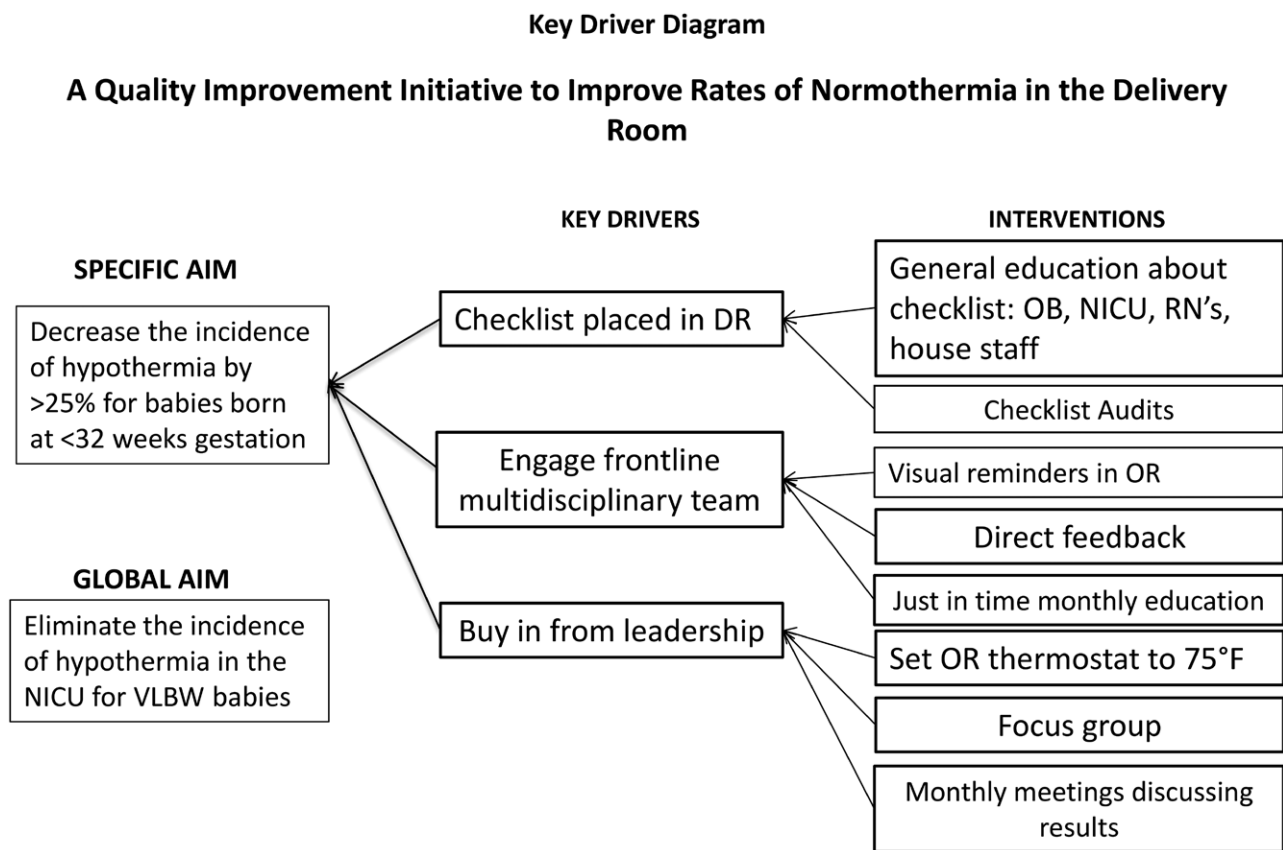


Fig. 1. Key Driver Diagram.

encourage reliability, monthly reminders, recurring focus group discussions, and just-in-time educational coaching followed checklist roll-out.

Visual tools displayed in delivery rooms reminded the frontline staff to use the checklist. The team audited and analyzed reliability to checklist components. De-briefing sessions addressed gaps and opportunities. The checklist and corresponding interventions served as the primary approaches for preventing hypothermia at the time.

Improving Checklist Accessibility (January 2013)

Staff identified access to the checklist (physical location) as a barrier to timely completion. During the initial year of intervention, we located checklists in only 1 location in the NICU. Investigators placed them in several more convenient locations, namely in the delivery rooms themselves and in different areas of the NICU (house staff office and advance practitioner office). During focus group discussions, staff agreed that this made accessing the checklists easier.

Data Sharing with Frontline (June 2013)

The team presented data from the first 12 months of implementation to all NICU and Labor and Delivery staff in addition to the proportion of hypothermia at NYU-WUH as compared with Vermont Oxford Network.

Addressing Practice Drift (August 2014)

The team noted a drift in reliability in the second and third quarters of 2014. We stepped in to again reinforce the importance of the checklist and its beneficial effects via data sharing with appropriate staff. Monthly focus groups switched to weekly. Staff huddle discussions at each change of shift included the checklist in daily safety discussion.

Simulation (2015)

An increased emphasis on the appropriate steps taken to prevent hypothermia occurred at mock codes attended by residents, nurses, attending physicians, and advanced practitioners.

Revised SMART Aim and Increased Transparency (2016)

The favorable results from 2012 to 2015 pleased the investigators, and so the team reevaluated our SMART aim to: "To further decrease the incidence of hypothermia in babies born at <32 weeks EGA from a baseline of 37% to <25% by December 2016 and sustain for 6 months." New interventions were employed to accomplish this. Checklist data became part of the discussion during monthly Town Hall-style meetings with NICU staff. The team displayed a "Days Since Last Hypothermic Event" in the NICU for full transparency with parents and families.

New resident house staff members joined the team after original resident members graduated.

Data Analysis

The team designated a core body temperature cutoff of 97°F (<97°F versus ≥97°F). The proportion of hypothermia and hyperthermia were analyzed using chi-square test and Fisher's exact test as appropriate. Bonferroni adjustments were performed to adjust for multiple comparisons, one for each observation year (7 in total) with the alpha level adjusted to 0.007 (0.05/7). Relative risks and 95% confidence intervals were calculated for each pairwise comparison. The team used Minitab 18 software to produce statistical process control charts of ongoing data points. SAS 9.4 (SAS Institute Inc., Cary, N.C.) performed all analyses.

Ethical Considerations

There were no ethical concerns or conflicts of interest in our initiative. As it did not affect human subjects, NYU Winthrop's Institutional Review Board did not require full review and approval.

RESULTS

The baseline period consisted of 104 babies in 2011. Of the 107 babies born in 2012, 34 had rectal temperatures <97°F on admission. The rate of hypothermia decreased from 50% in 2011 to 33% in 2012. Data analysis using chi-square test revealed a significant difference (P value = 0.013; RR, 0.66; 95% CI, 0.47–0.92) between the baseline and study period data (Table 2).

In 2013, of the 88 babies born at <32 weeks of gestation and admitted to the NICU, 31 had hypothermic admission temperatures. The difference between 2011 and 2013 again showed no significance [from 50% to 36%, P value = 0.058 (RR, 0.73; 95% CI, 0.52–1.02)].

After 2 years in practice, however, there was a process drift from January 2014 until August 2014. The proportion of hypothermia increased from 36% to approximately 44% (51/117). With new interventions, the proportion of hypothermia decreased back to 36% in 2015 (35/99).

A control p-chart of the data from 2012 to 2018 (Fig. 2) shows the first centerline shift indicating a decline in the

mean proportion of hypothermia of 37.47% for those observation years and a significant P value of < 0.001.

Reliability to checklist components saw an initial decrease in defective components after initial education period (Fig. 3). Reliability subsequently hovered around the mean centerline for the majority of 2013 to 2015.

When comparing individual observation years to the baseline and incorporating Bonferroni corrections for all years, statistical significance was not reached until 2016. P chart data from 2016 to 2018 display yet another mean centerline shift with the proportion of hypothermia decreasing further to a mean of 14% from 37% (P value < 0.001).

Although the number of hyperthermic (core temperature ≥100.4°F) babies did increase after the introduction of the checklist, the balancing measure of hyperthermia showed no statistically significant results (P value < 0.0007; Table 3).

DISCUSSION

The checklist and subsequent interventions successfully decreased overall rates of hypothermia for preterm babies born at 32 weeks gestational age or less from a baseline of 50% to proportions exceeding the goal of <40%. The team achieved sustainability for subsequent years with numerous ongoing efforts, including continued use of the checklist. This result can support the benefit and effectiveness of incorporating checklists to achieve desired outcome measures and reduce potential complications.

The initial intervention of education increased staff knowledge on hypothermia and its potentially detrimental effects. The checklist itself and instructions for use were explicitly described. This baseline of education supported by monthly reminders, focus group discussions, and just-in-time coaching achieved a dramatic decrease in the rate of hypothermia from 50% to 33% in the initial year of the project.

Further interventions followed in subsequent years and thus, as a further intervention, they were placed in multiple areas of the NICU and delivery rooms.

The checklist yielded favorable results over time with common cause variation occurring throughout the observation period (Fig. 3). There were 3 points of unfavorable

Table 2. Hypothermia Pair-wise Comparison, 2011–2018

Year Comparison	Percent Hypothermia (Temp <36°c)	Relative Risk (95% CI)	P
2011 (n = 104) versus 2012 (n = 106)	50% versus 33%	0.66 (0.47–0.92)	0.013
2011 (n = 104) versus 2013 (n = 88)	50% versus 36%	0.73 (0.52–1.02)	0.058
2011 (n = 104) versus 2014 (n = 117)	50% versus 44%	0.87 (0.66–1.2)	0.340
2011 (n = 104) versus 2015 (n = 99)	50% versus 36%	0.73 (0.53–1.01)	0.05
2011 (n = 104) versus 2016 (n = 123)	50% versus 17%	0.34 (0.22–0.53)	<0.0001*
2011 (n = 104) versus 2017 (n = 144)	50% versus 13%	0.25 (0.16–0.40)	<0.0001*
2011 (n = 104) versus 2018 (n = 84)	50% versus 11%	0.24 (0.13–0.44)	<0.0001*

*Statistically significant after Bonferroni correction.

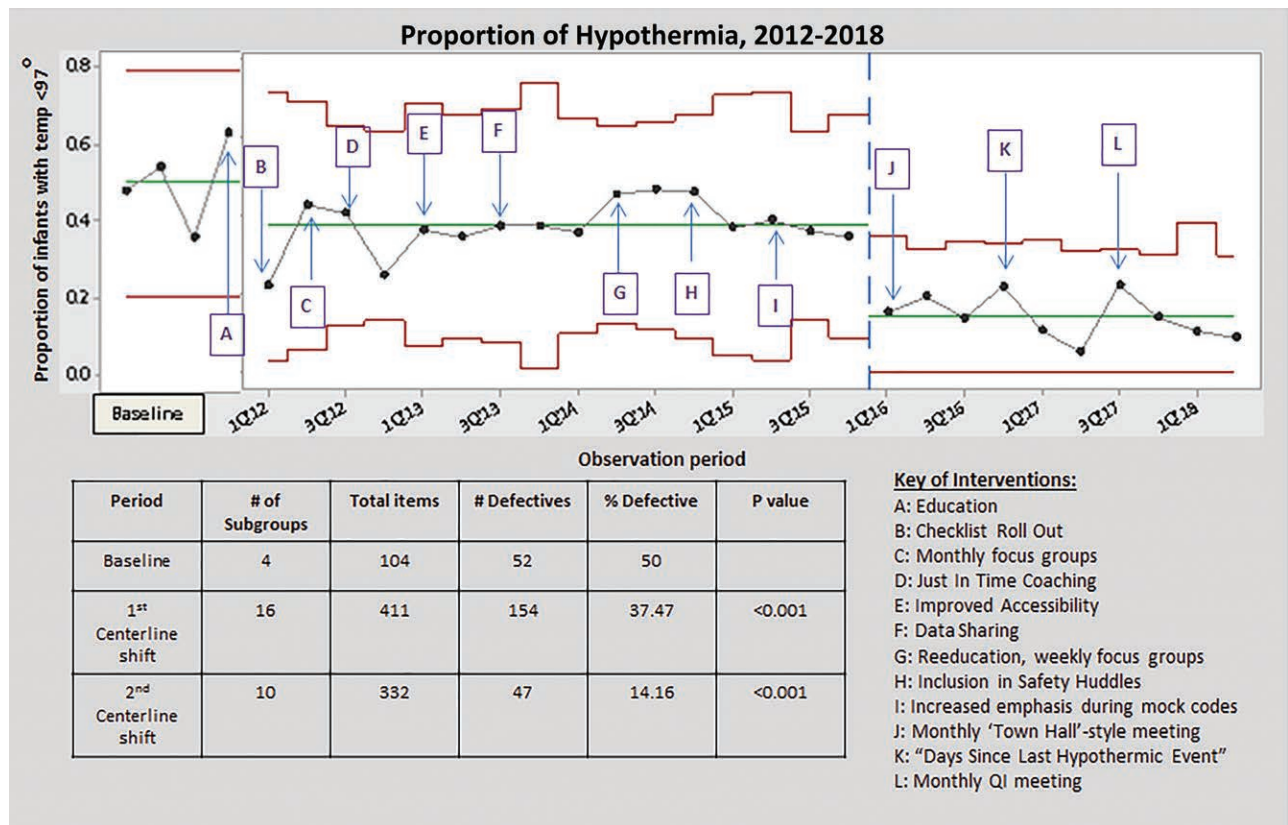


Fig. 2. Proportion of hypothermia, 2012–2018.

special cause variation noted in the starting years of the project in 2012 and 2013 and again in 2016. Reasons for these variations remain unclear to the QI team. However, we suspect that 2 transitions to an electronic medical record during the observation period—one at the end of

2012 and yet another at the start of 2016—played significant roles. The team addressed the drifts with interventions of more frequent reminders; focus groups made weekly, incorporation of the checklist into shift safety huddles, and simulation exercises.

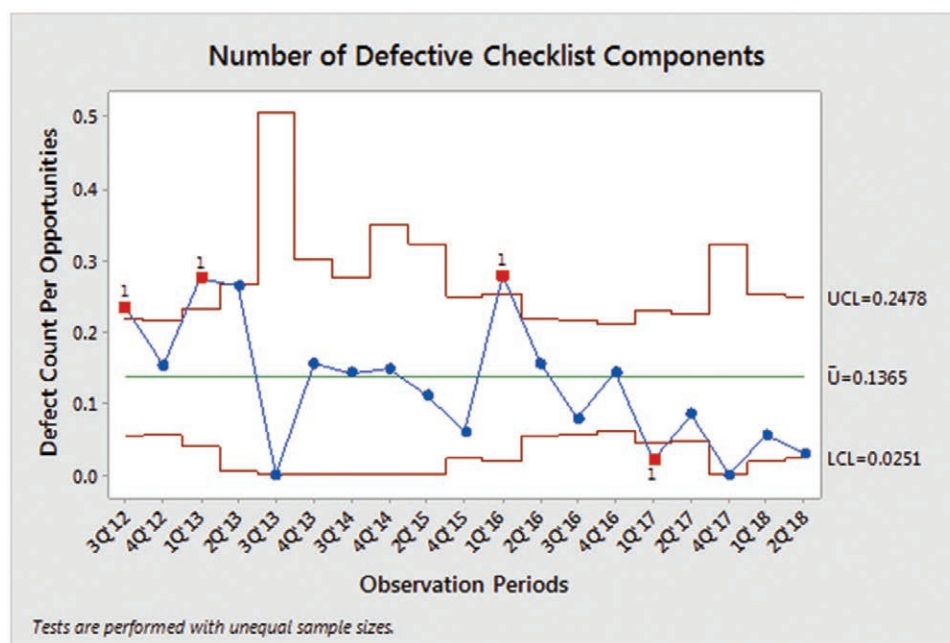


Fig. 3. Number of defective checklist components, 2012–2018.

Table 3. Hyperthermia as Balancing Measure, 2011–2018

Year Comparison	Percent Hyperthermia (Temp $\geq 100.4^{\circ}\text{F}$)	P*
2011 (n = 104) versus 2012 (n = 106)	0% versus 3%	0.247
2011 (n = 104) versus 2013 (n = 88)	0% versus 1%	0.458
2011 (n = 104) versus 2014 (n = 117)	0% versus 2%	0.500
2011 (n = 104) versus 2015 (n = 99)	0% versus 1%	0.488
2011 (n = 104) versus 2016 (n = 123)	0% versus 1%	~1.00
2011 (n = 104) versus 2017 (n = 144)	0% versus 3%	0.142
2011 (n = 104) versus 2018 (n = 84)	0% versus 4%	0.087

*P are from Fisher's exact test as at least 1 cell count for all comparisons was < 5 .

Beginning in 2016, another centerline shift in the proportion of hypothermia (Fig. 2) coincided with an improvement of defective checklist components indicated by 5 points below the centerline mean in a descending trend (Fig. 3). The intervention used during this time were inclusion in monthly Town Hall style meetings with NICU and OB staff and a posting of “Days of Last Hypothermic Event” in the NICU. New house staff members also brought a renewed enthusiasm to the project.

As the team learned the hard way, initial buy-in from frontline staff and success is not enough to maintain process reliability over extended periods of time. The run chart of defective checklist components displays common cause variation throughout the observation period that ultimately resulted in a favorable decreasing trend from 2016 onward.

At times, staff did not utilize the checklist or did not complete them despite reeducation and reminders. Reasons for this are likely multifactorial. The delivery or clinical condition of a preterm baby may have been too critical to allow staff to prioritize the checklist. Although we did not distribute a formal survey to elicit staff's perception of the checklist, we often overheard staff discussing the time spent utilizing the checklist unfavorably; this is not uncommon when compared with quality initiatives at other institutions.²⁰

Several actions on the checklist remained underutilized. Before 2016, staff least complied with using polyethylene bags to reduce evaporative heat loss, especially for babies born between 30 and 32 weeks.²¹ Since the revision of the Neonatal Resuscitation Program guidelines (seventh edition) published in 2016, the recommendation for use in infants with gestational age less than 32 weeks is currently standard practice.⁴ This change is potentially confounding and may contribute to the improvement in the proportion of hypothermia that was observed beginning in 2016.

Collaboration with the Obstetrics department allowed for placement of visual reminders and the checklists themselves in operating rooms as well as setting thermostats to 75°F. Unfortunately, this ideal room temperature remained unattainable a large proportion of the time from 2012 to 2018 (39%). Most of the completed checklists showed that, despite thermostat adjustment, time

often did not allow for the rooms to reach 75°F. This failure was especially true for emergent deliveries. Two of the patients delivered vaginally; labor room thermostats were only adjusted for cesarean deliveries.

With regard to hyperthermia, the lack of statistical significance of data from 2012 to 2018 as compared with 2011, illustrates that the increase in the proportion of hyperthermia is not necessarily a direct effect of the checklist. Rather, it is possibly random variation. A look into the proportion of hyperthermia before 2011 would be helpful.

Limitations

This project was conducted at a single institution and may or may not be generalizable to other pediatric hospitals. Baseline data (Fig. 2) are composed of only 4 data points. However, the proportion of hypothermia was elicited from the medical record software used at the time which the authors trust as accurate. Clinical and maternal factors that influence newborn thermogenesis and may contribute to confounding (ie, maternal fever, chorioamnionitis) are not accounted for on the checklist. There was a disparity between operating rooms and labor and delivery rooms; only operating room temperatures were set to 75°F.

CONCLUDING SUMMARY AND NEXT STEPS

Compliance with checklists may improve clinical outcomes and other industries outside of healthcare.^{15,16,20} This QI initiative supports the idea that successful implementation of a checklist with multiple interventions for enforcement may achieve desired outcome measures. Use of the checklist continues as it yielded highly desirable and sustainable results over some years. Several publications recently demonstrated the benefits of utilizing checklists and/or bundles in a delivery room setting to attain optimal outcomes, namely DeMauro²² in 2013 and Pinheiro²³ in 2014.

Education is an important first step in any QI project. However, it is simply not enough, given the overturning nature of residency programs and ever-changing house staff members. Compliance and process reliability is of utmost importance but is challenging when trying to influence a change in long-standing behaviors. Collaboration with stakeholders from other departments may strengthen any initiative that targets modifications in the protocol or clinical practice. Staff and all appropriate personnel should be reminded, reeducated, and peer-coached regularly to maintain cooperation.

Next steps include incorporation into yet another electronic medical record system launching in August 2019 with a built-in prompt to mandate completion.

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

REFERENCES

1. Chang HY, Sung YH, Wang SM, et al. Short- and long-term outcomes in very low birth weight infants with admission hypothermia. *PLoS One*. 2015;10:e0131976.
2. Miller SS, Lee HC, Gould JB. Hypothermia in very low birth weight infants: distribution, risk factors and outcomes. *J Perinatol*. 2011;31 Suppl 1:S49–S56.
3. Wycoff MH, Aziz K, Escobedo MB, et al. Neonatal resuscitation: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Pediatrics*. 2015;136:S196.
4. American Academy of Pediatrics and American Heart Assoc. *Textbook of Neonatal Resuscitation*. 7th ed. Elk Grove Village, IL: AAP and AHA; 2016.
5. Laptook AR, Salhab W, Bhaskar B; Neonatal Research Network. Admission temperature of low birth weight infants: predictors and associated morbidities. *Pediatrics*. 2007;119:e643–e649.
6. Baumgart S. *Fetal and Neonatal Thermal Regulation*. 2nd ed. St. Louis, Mo.: Mosby; 2005.
7. de Almeida MF, Guinsburg R, Sancho GA, et al.; Brazilian Network on Neonatal Research. Hypothermia and early neonatal mortality in preterm infants. *J Pediatr*. 2014;164:271–5.e1.
8. Mullany LC, Katz J, Khatry SK, et al. Risk of mortality associated with neonatal hypothermia in southern Nepal. *Arch Pediatr Adolesc Med*. 2010;164:650–656.
9. Lunze K, Bloom DE, Jamison DT, et al. The global burden of neonatal hypothermia: systematic review of a major challenge for newborn survival. *BMC Med*. 2013;11:24.
10. van Klei WA, Hoff RG, van Aarnhem EE, et al. Effects of the introduction of the WHO “Surgical Safety Checklist” on in-hospital mortality: a cohort study. *Ann Surg*. 2012;255:44–49.
11. Lacassie HJ, Ferdinand C, Guzmán S, et al. World Health Organization (WHO) surgical safety checklist implementation and its impact on perioperative morbidity and mortality in an academic medical center in Chile. *Medicine (Baltimore)*. 2016;95:e3844.
12. Berenholtz SM, P. P.-M. Eliminating catheter-related bloodstream infections in the intensive care unit. *Crit Care Med*. 2010;32(10):2014–2020.
13. World Health Organization. *Thermal Protection of the Newborn: A Practical Guide*. Geneva, Switzerland: World Health Organization; 1997.
14. Surgical safety checklist and implementation manual. World Health Organization website. Available at http://www.who.int/patientsafety/safesurgery/ss_checklist.en/. Published ---Accessed December 2015.
15. McLean TW, White GM, Bagliani AF, et al. The use of a checklist in a pediatric oncology clinic. *Pediatr Blood Cancer*. 2013;60:1855–1859.
16. Mendu ML, Schneider LI, Aizer AA, et al. Implementation of a CKD checklist for primary care providers. *Clin J Am Soc Nephrol*. 2014;9:1526–1535.
17. Lee HC, Ho QT, Rhine WD. A quality improvement project to improve admission temperatures in very low birth weight infants. *J Perinatol*. 2008;28:754–758.
18. Castrodale V, Rinehart S. The golden hour: improving the stabilization of the very low birth-weight infant. *Adv Neonatal Care*. 2014;14:9–14; quiz 15.
19. Lambeth TM, Rojas MA, Holmes AP, et al. First golden hour of life: a quality improvement initiative. *Adv Neonatal Care*. 2016;16:264–272.
20. Sewell M, Adebibe M, Jayakumar P, et al. Use of the WHO surgical safety checklist in trauma and orthopaedic patients. *Int Orthop*. 2011;35:897–901.
21. Knobel RB, Wimmer JE Jr, Holbert D. Heat loss prevention for preterm infants in the delivery room. *J Perinatol*. 2005;25:304–308.
22. DeMauro SB, Douglas E, Karp K, et al. Improving delivery room management for very preterm infants. *Pediatrics*. 2013;132:e1018–e1025.
23. Pinheiro JM, Furdon SA, Boynton S, et al. Decreasing hypothermia during delivery room stabilization of preterm neonates. *Pediatrics*. 2014;133:e218–e226.