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Association between Neonatal Intensive Care Unit Admission and Supine Sleep Positioning, Breastfeeding, and Postnatal Smoking among Mothers of Late Preterm Infants

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Objective: evaluate the association between NICU admission and breastfeeding practices, infant supine sleep positioning, and postnatal smoking among mothers of late preterm infants.

Study design: analysis using the Pregnancy Risk Assessment Monitoring System (PRAMS) from 2000 to 2013. Data from 36 US states were included.

Table I. PRAMS questions used to assess outcomes of interest

Outcomes	PRAMS questions
Breastfeeding initiation	"Did you ever breastfeed or pump breast milk to feeds your new baby after delivery?"
Breastfeeding continuation	"Are you currently breastfeeding or feeding pumped milk to your new baby?" and "How many weeks or months did you breastfeed or pump milk to feed your baby?"
Supine sleep position	"In which one position do you most often lay your baby down to sleep now?"
Postnatal maternal smoking	"How many cigarettes do you smoke on an average day now?"

RESULTS

- During the study period from 2000 to 2013, 63 249 infants were born late preterm, representing a population estimate of 1 441 451 infants and comprising approximately 14.8% of all births. Among late preterm infants, 48.7% spent time in a NICU.

Table III. Unadjusted prevalence for recommended care practices by NICU status

	Breastfeeding initiation		Breastfeeding continuation*		Supine sleep position		Postnatal smoking	
	n†	Prevalence (95% CI)	n†	Prevalence (95% CI)	n†	Prevalence (95% CI)	n†	Prevalence (95% CI)
Overall	55 266		39 358		57 887		58 430	
NICU hospitalization	26 952	76.3 (75.2-77.5)	19 999	53.0 (51.5-54.4)	28 227	66.6 (65.6-67.7)	28 474	18.9 (18.1-19.7)
No NICU hospitalization	28 314	71.6 (70.6-72.5)	19 359	54.3 (53.0-55.6)	29 660	64.4 (63.3-65.6)	29 956	19.8 (18.9-20.6)

*Defined as breastfeeding for ≥10 weeks after delivery among those who initiated breastfeeding.
†Exclude observations with missing/unknown values for either the dependent variable or for any of the control variables.

RESULTS

Table IV. APR and 95% CI for the likelihood of breastfeeding initiation, breastfeeding continuation, supine sleep position, postnatal smoking by NICU status adjusted for maternal, and infant characteristics

	Breastfeeding initiation*	Breastfeeding continuation*,†	Supine sleep position‡	Postnatal smoking§
NICU hospitalization	1.07 (1.05-1.09)	0.98 (0.94-1.0)	1.04 (1.01-1.06)	0.96 (0.90-1.01)
No NICU hospitalization	ref	ref	ref	Ref

*Adjusted for maternal age, race/Hispanic ethnicity, education, marital status, history of previous live birth, insurance before pregnancy, prepregnancy BMI, diabetes during pregnancy, first trimester prenatal care initiation, method of delivery, infant birth weight, on WIC during pregnancy, and smoking during or after pregnancy.

†Defined as breastfeeding for ≥10 weeks after delivery among those who initiated.

‡Adjusted for maternal age, race/Hispanic ethnicity, education, marital status, history of previous live birth, insurance before pregnancy, first trimester prenatal care initiation, on WIC during pregnancy, and smoking during or after pregnancy.

§Adjusted for maternal age, race/Hispanic ethnicity, education, marital status, history of previous live birth, insurance before pregnancy, first trimester prenatal care initiation, and on WIC during pregnancy.

CONCLUSIONS

- Mothers of late preterm infants admitted to a NICU were more likely to initiate breastfeeding and practice supine sleep position than mothers of late preterm infants not admitted to a NICU. Future work should seek to identify the drivers of these differences to develop effective strategies to engage mothers in these health promoting infant care practices.

ORIGINAL ARTICLE

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Early fluid overload is associated with mortality and prolonged mechanical ventilation in extremely low birth weight infants

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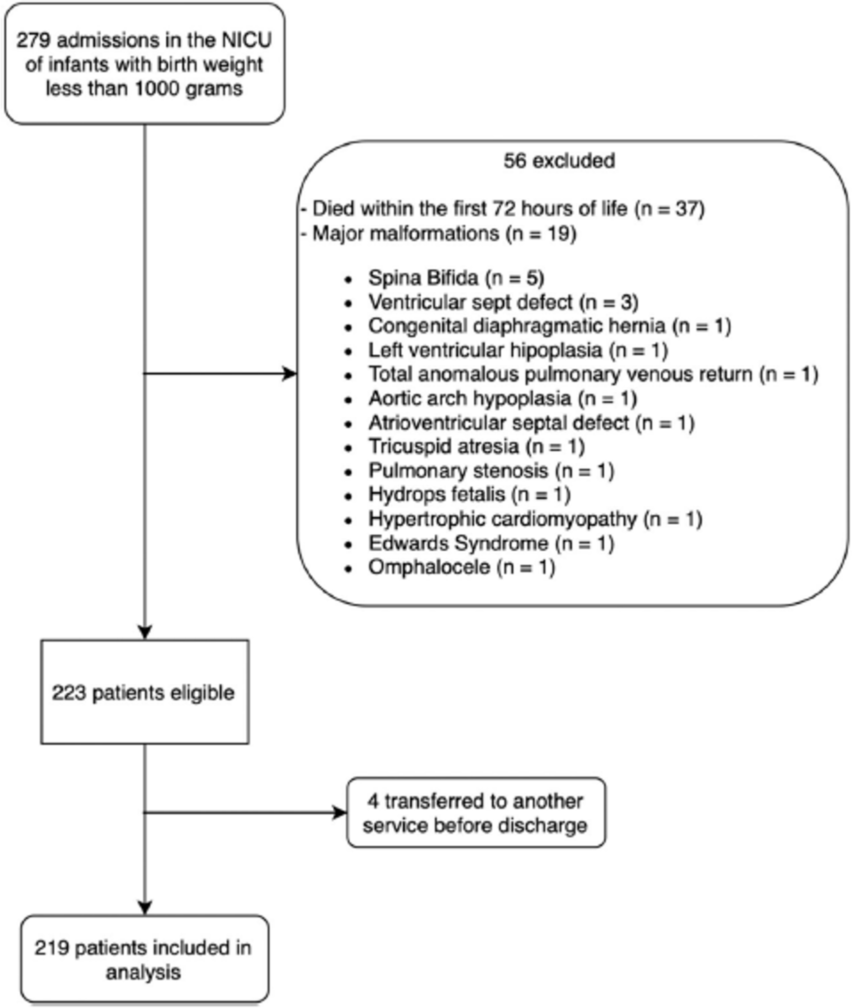
Objective: evaluate the association between fluid overload and adverse outcomes in extremely low birth weight infants admitted to the NICU.

Study design: retrospective cohort study which included newborns with birth weight less than 1000 g born between January 2012 and December 2017. São Paulo, Brazil.

Outcomes: the primary outcome was death before discharge from the NICU. The secondary outcome was the duration of invasive mechanical ventilation and values of mean airway pressure in the first 7 days of life.

Fig. 1 Inclusion flowchart. NICU, neonatal intensive care unit



INTERVENTIONS

$$\text{Cumulative fluid balance (\%)} = \left(\frac{\text{Cumulative fluid input (mL)} - \text{output in milliliter}}{\text{Admission weight (kg)}}\right) \times 100$$

- Fluid input: all intravenous fluids, medications, enteral nutrition, parenteral nutrition, and blood products.
- Fluid loss: urine output, gastric aspirate, stool, chest drainage loss. Insensitive losses were not calculated.
- The fluid balance was arbitrarily categorized into 4 groups according to the accumulated value at 72 h of life.

RESULTS

Table 1 Comparison between clinical characteristics and mortality in extremely low birth weight infants, univariate analysis

Parameter	Total ($n = 219$)	Survivors ($n = 148$)	Non-survivors ($n = 71$)	p value
Gestational age (wk), median (IQR)	27.3 (26.1–29.4)	28 (26.5–30.1)	26.2 (25.3–27.7)	< 0.001[a]
Birth weight (g), median (IQR)	770 (610–900)	822 (700–937)	620 (520–785)	< 0.001[a]
CRIB II score, median (IQR)	11 (10–13)	11 (9–12)	13 (11–15)	< 0.001[a]
Small for gestational age, n (%)	108 (49.1)	73 (49.3)	35 (49.3)	0.997[b]
Female gender, n (%)	105 (47.7)	74 (50)	31 (43.7)	0.380[b]
APGAR 5, median (IQR)	8 (7–9)	8 (7–9)	8 (6–9)	0.026[a]
Vaginal birth, n (%)	31 (14.1)	13 (8.8)	18 (25)	0.001[b]
Twin birth, n (%)	58 (26.4)	33 (22.3)	25 (35.2)	0.043[b]
Antenatal corticoid, n (%)	117 (53.2)	79 (53.4)	38 (52.8)	0.933[b]
Maternal chorioamnionitis, n (%)	24 (10.9)	12 (8.1)	11 (15.5)	0.095[b]
Culture-positive early-onset sepsis, n (%)	13 (5.9)	7 (4.7)	6 (8.7)	0.252[b]
Accumulated fluid balance at 72 h of life, median (IQR)	0.59 (− 4.97–6.55)	− 0.02 (− 4.55–5.40)	1.91 (− 6–8.54)	0.229[a]
Mean airway pressure at 72 h of life (cmH_2O), mean (SD)	9.4 (2.3)	8.3 (1.5)	10.6 (2.6)	< 0.001[c]
Severe fluid overload at 72 h of life, n (%)	18 (8.2)	5 (3.4)	13 (18.3)	< 0.001[b]
Urine output in the first 72 h of life (mL/kg/h), mean (SD)	4.41 (1.36)	4.31 (1.22)	4.63 (1.61)	0.144[c]

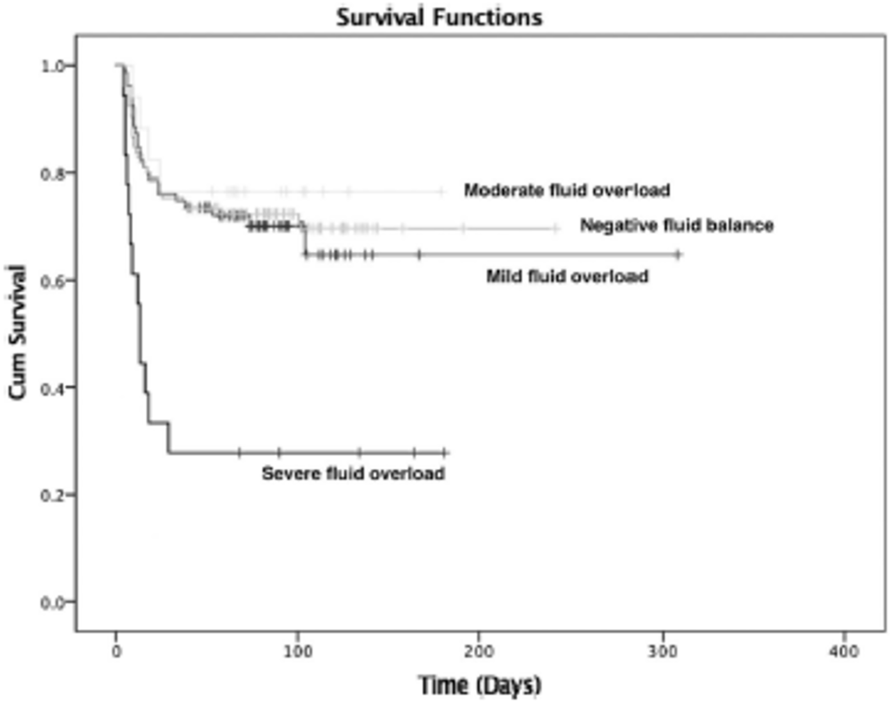
[a] Mann-Whitney U test

[b] Chi-square test

[c] T test

RESULTS

Fig. 2 Kaplan-Meier curve. Survival was followed up until hospital discharge. Infants with severe fluid overload at 72 h of life died significantly earlier ($p < 0.0005$)



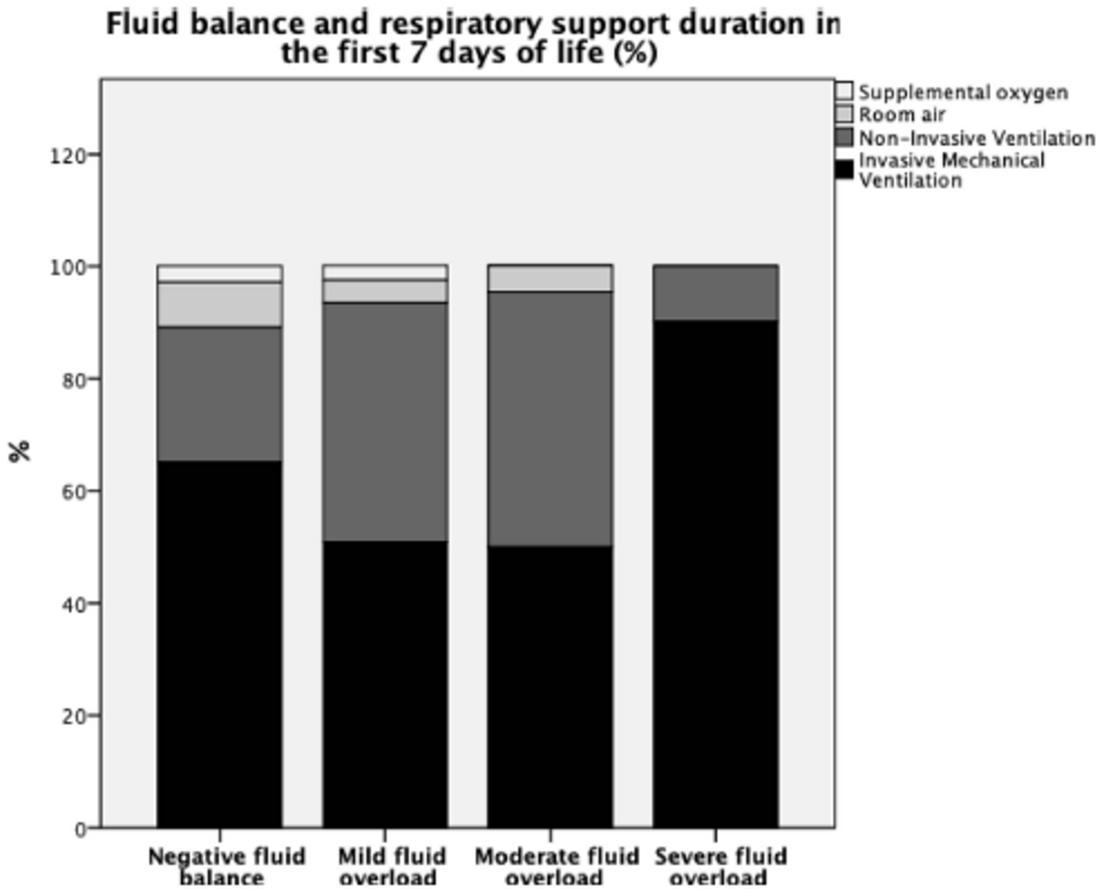


Fig. 3 Infants with severe fluid overload had a significant longer invasive mechanical ventilation necessity (conventional mechanical ventilation + high-frequency ventilation) ($p = 0.002$—one-way ANOVA)

Table 3 Comparison between mean airway pressure (MAP) and mortality in extremely low birth weight infants

Parameter	Survivors	Non-Survivors	*p* value	Negative fluid balance	Mild fluid overload	Moderate fluid overload	Severe fluid overload	*p* value
MAP 24 h	8.2 (1.4)	9.1 (1.9)	0.002	8.4 (1.6)	8.9 (1.9)	9.1 (1.8)	9.2 (1.3)	0.145
MAP 48 h	8.4 (1.4)	9.7 (2.2)	<0.001	8.7 (1.7)	9.2 (2.4)	9 (2.1)	9.8 (1.5)	0.198
MAP 72 h	8.3 (1.5)	10.5 (2.6)	<0.001	9 (2)	9.5 (2.5)	9.1 (1.9)	10.8 (3)	0.041
MAP 96 h	8.2 (1.4)	10.5 (2.8)	<0.001	8.8 (1.8)	9.2 (2.2)	8.4 (1.6)	11.5 (3.8)	<0.001
MAP 120 h	8 (1.5)	9.8 (2.7)	<0.001	8.3 (1.8)	9.1 (2.4)	8.3 (1.6)	10.7 (3.3)	0.002
MAP 144 h	7.9 (1.3)	9.5 (2.5)	<0.001	8.2 (1.9)	8.8 (2.2)	8.6 (1.5)	10 (2.4)	0.032
MAP 168 h	7.6 (1.6)	9.6 (2.6)	<0.001	7.9 (2.1)	9 (2.4)	9 (2.2)	9.5 (2.8)	0.036

MAP, mean airway pressure expressed in cmH_2O

CONCLUSIONS

- In conclusion, we have shown that severe fluid overload in the first 3 days of life in extremely low birth weight infants is an independent risk factor for mortality and a longer duration of mechanical ventilation.

The impact of a quality improvement project to reduce admission hypothermia on mortality and morbidity in very low birth weight infants

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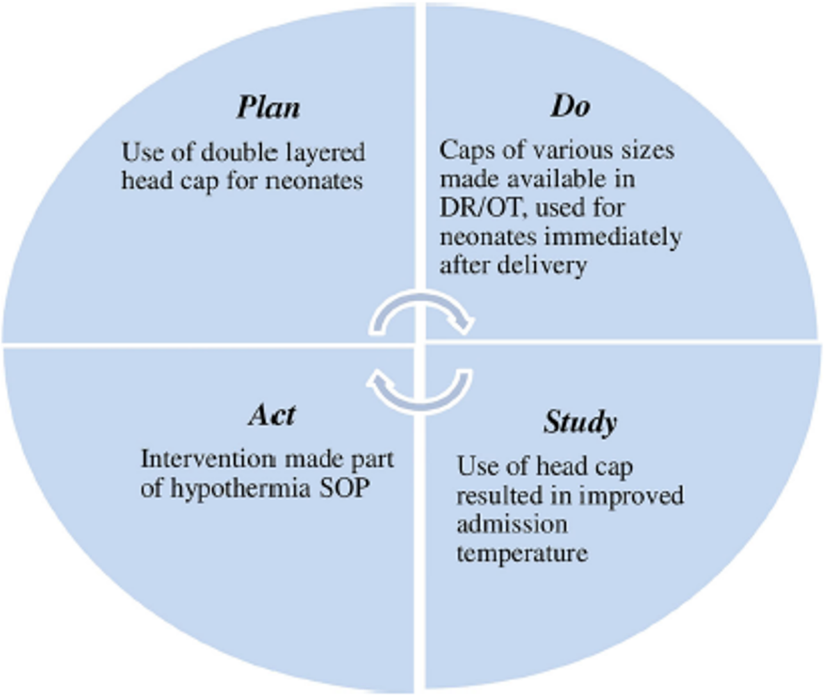
Objective: analyze the impact of a quality improvement project to reduce admission hypothermia on composite outcome of neonatal mortality and major morbidities.

Study design: prospective observational study conducted in neonatal intensive care unit (NICU) of Fernandez hospital, Hyderabad, India, from January 2018 to January 2020.

Outcomes: primary outcome was to evaluate the impact of QI on composite of death before discharge or any of major morbidity.

METHODS

Fig. 1 PDSA cycle showing planning to incorporation of intervention in standard of procedure for hypothermia



SOP

1. Switch on Radiant Warmer with 100% output 15 minutes prior to delivery
2. Keeping warm towels ready prior to delivery
3. Keep delivery room temperature >23°C
4. Reminding obstetrician to use warm towel/ plastic wrap to receive baby
5. Immediately wrapping newborn infant in warm towel/ plastic wrap (VLBW)
6. Use of Head cap after delivery
7. Use of transport embrace
8. No weight measurement in DR for VLBW babies
9. Temperature before shifting from DR and on reaching to NICU using digital thermometer

Fig. 2 Standard of procedure for preventing neonatal hypothermia followed at our center

RESULTS

Table 2 Comparison of baseline characteristics of neonates enrolled in three different phases of QI project

Characteristics	Pre-intervention phase (*n* = 87)	Intervention phase (*n* = 130)	Post-intervention phase (*n* = 151)	*P* value
Mean gestation, weeks (SD)	30.4 ± 2.1	30.2 ± 2.2	30.5 ± 1.9	0.910a
Mean birth weight, g (SD)	1216 ± 218	1193 ± 232	1224 ± 207	0.732a
Male sex, *n* (%)	49 (56.3)	68 (52.3)	83 (54.9)	0.827b
C-section, *n* (%)	61 (70.1)	99 (76.1)	112 (74.2)	0.608b
ELBW infants, *n* (%)	24 (27.6)	31 (23.8)	39 (25.8)	0.821b
Gestation < 28 weeks, *n* (%)	17 (19.5)	22 (16.9)	29 (19.2)	0.849b
Any antenatal steroids, *n* (%)	81 (93.1)	119 (91.5)	142 (94.1)	0.715b
Multiple gestation, *n* (%)	19 (21.8)	39 (30)	37 (24.5)	0.360b
PPROM > 12 h	26 (29.9)	27 (20.8)	41 (27.1)	0.269b
SGA, *n* (%)	21 (24.1)	46 (35.4)	49 (32.4)	0.206b
Abnormal antenatal Doppler, *n* (%)[#]	14 (16.1)	35 (26.9)	34 (22.5)	0.173b
Required resuscitation/respiratory support at birth, *n* (%)	68 (78.1)	103 (79.2)	116 (76.8)	0.887b
5 min APGAR score, median (IQR)	8 (7–8)	7 (7–8)	8 (7–8)	0.749c
Mean admission temperature, °C (SD)	35.3 (0.6)	36.0 (0.8)	36.4 (0.4)	0.037a
Neonates with moderate hypothermia, *n* (%)	78 (89.6)	63 (48.4)	17 (11.2)	< 0.001b
Neonates with hyperthermia, *n* (%)	1 (1.1)	3 (2.3)	8 (5.3)	0.166b
Received enteral feeds on day 1 of life*	72 (82.7)	102 (78.5)	119 (78.8)	0.705b
Time to reach full feeds, mean (SD)^	8.6 ± 3.5	8.4 ± 4.1	8.3 ± 3.9	0.813a
TPN days, mean (SD)	8.1 ± 3.3	7.8 ± 4.2	7.8 ± 4.1	0.896a
Exclusive human milk feeding during NICU stay	71 (81.6%)	124 (95.4%)	147 (97.3%)	< 0.001b

Values represented as mean (SD), median (IQR), or proportions; analysis done by (a) repeated measures ANOVA, (b) chi-square test, and (c) Friedman test

SD standard deviation, *VLBW* very low birth weight, *ELBW* extremely low birth weight, *PPROM* preterm premature rupture of membranes, *SGA* small for gestational age, *IQR* interquartile range, *TPN* total parenteral nutrition

[#] Abnormal antenatal Doppler was considered in case of absent or reversal of end diastolic flow in umbilical artery was present or "a" wave in ductus venosus was absent or reversed

*For infants who received > 10 ml/kg/day of feed within 24 h of birth

^One hundred fifty milliliters per kilogram per day were considered as full enteral feeds

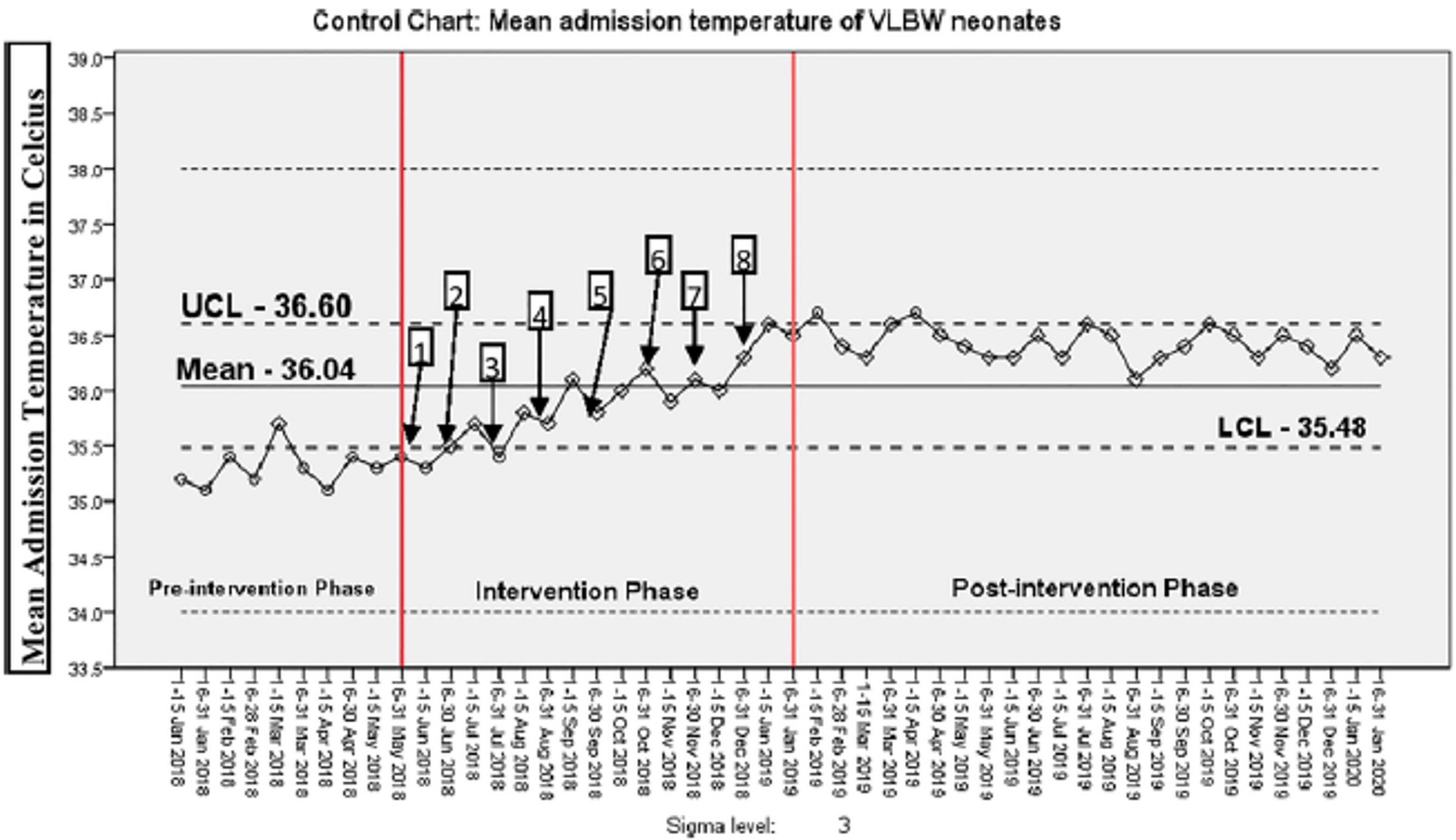


Fig. 3 Statistical control chart showing mean temperature of VLBW neonates at admission to NICU during baseline, intervention, and sustenance phase. Numbers in small squares represent sequential PDSA cycles. UCL upper control limit, LCL lower control limit

RESULTS

Table 3 Comparison of adverse outcomes among neonates enrolled in pre-intervention, intervention, and post-intervention QI phases

Outcome	Overall	Different QI phases			*P* value
		Pre-intervention ($N=87$)	Intervention ($N=130$)	Post-intervention ($N=151$)	
Composite outcome	73 (19.8)	27 (31.0)	26 (20)	20 (13.2)	0.004
Mortality	25 (6.8)	10(11.5)	9 (6.9)	6 (4.0)	0.09
NEC (Bell stage ≥ 2)	21 (5.7)	7 (8.0)	5 (3.8)	9 (5.9)	0.41
IVH (Papile grade 3/4)	8 (2.2)	2 (2.3)	3 (2.3)	3 (2.0)	0.97
Cystic PVL	4 (1.1)	2 (2.3)	1 (0.8)	1 (0.7)	0.46
BPD	38 (10.3)	13 (14.9)	15 (11.5)	10 (6.6)	0.11
ROP requiring treatment	14 (3.8)	6 (6.9)	4 (3.1)	4 (2.6)	0.22
RDS requiring surfactant	167 (45.4)	37 (42.5)	58 (44.6)	72 (47.7)	0.73
Hypoglycemia within first 24 h afterbirth	84 (22.8)	19 (21.8)	34 (26.1)	31 (20.5)	0.52

- Absolute incidence of composite outcome was 31%, 20%, and 13.2% during pre-intervention, intervention, and post-intervention phase, respectively, with 17.8% absolute reduction in adverse composite outcome in post-intervention phase as compared to pre-intervention phase.

CONCLUSIONS

- A significant proportion of VLBW neonates are hypothermic at admission to NICU.
- Implementation of various thermoregulatory interventions using PDSA methodology helped in significant reduction in hypothermia incidence.
- Reduction in hypothermia incidence resulted in improved neonatal outcomes.