Solutions for Minimizing Preventable Infant Deaths: Quality Improvement for Perinatal Care

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Professor of Clinical Pediatrics (Neonatology)

University of California San Diego

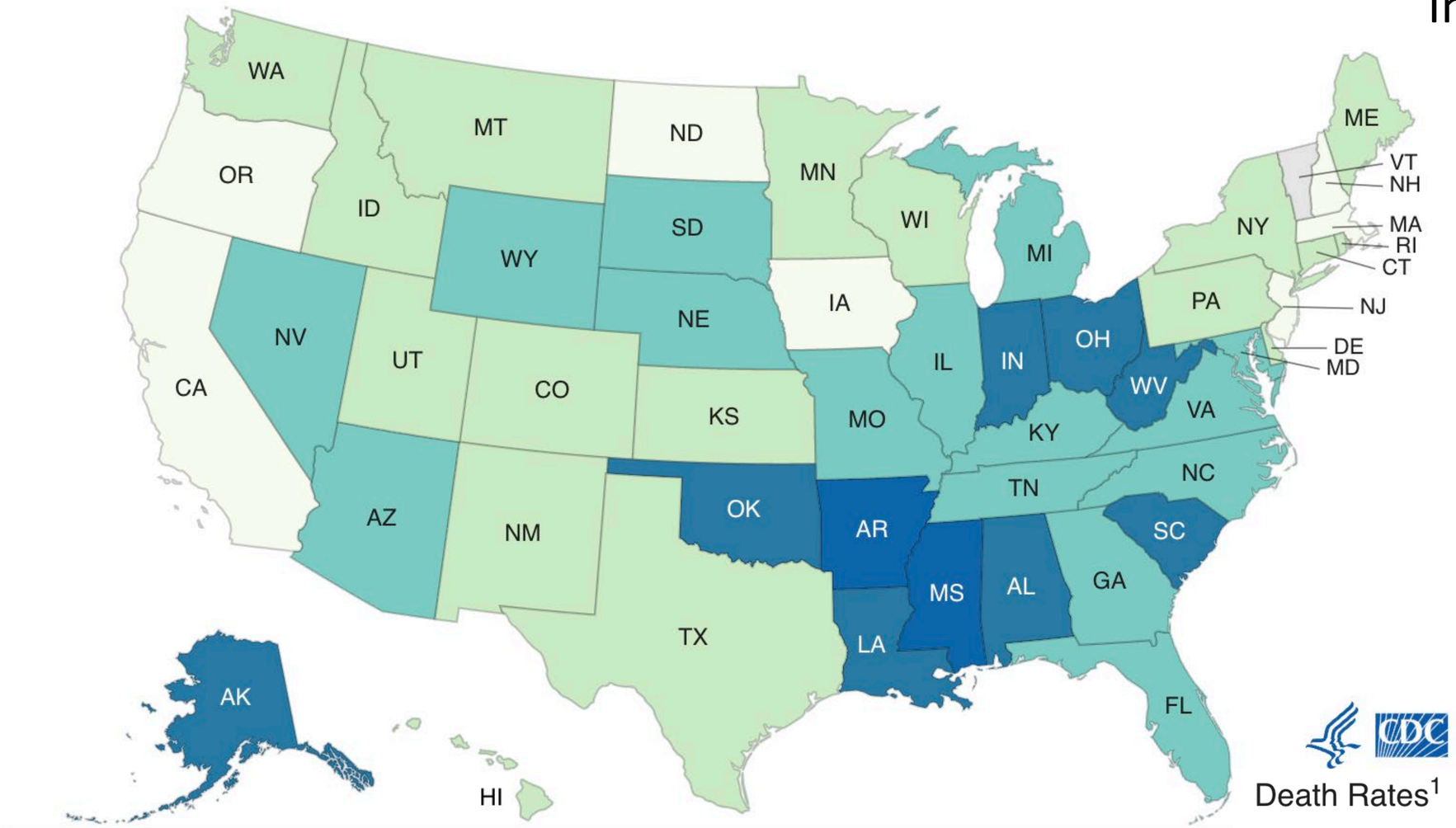
APEC conference on Empowering the Next Generation - Investment in Preventable Infant Deaths by a Healthy Start

March 2024

Infant Mortality by State (per 1000 live births)

Year

2021



Death Rates[1]

- 2.77 - < 4.09
- 4.09 - < 5.42
- 5.42 - < 6.74
- 6.74 - < 8.07
- 8.07 - 9.39

Healthy Beginnings / Reducing Infant Mortality

California's infant mortality rate is lower than the nation's and has reached a record low.[1]

Infant mortality is an important indicator of the overall health and well-being of the population. The infant mortality rate is regarded as a highly sensitive measure of population health because there is an association between the causes of infant mortality and other factors that influence the status of whole populations such as economic development, general living conditions, social well-being, rates of illness, quality and access to medical care, public health practices, and quality of the environment. The infant mortality rate is measured as the number of infant deaths before one year of age for every 1,000 live births in that population. About two-thirds of infant deaths occur before a baby is one month old, and the remaining third between two and 12 months of life.[2]

California Perinatal Quality Care Collaborative

Founded 1997

Currently 138 NICUs – levels 2, 3, and 4 including 11 children's hospitals

* Review of data
* Share best practices
* Toolkit dissemination
* Networking

Shih Z, Lee HC. Pediatric Medicine 2019

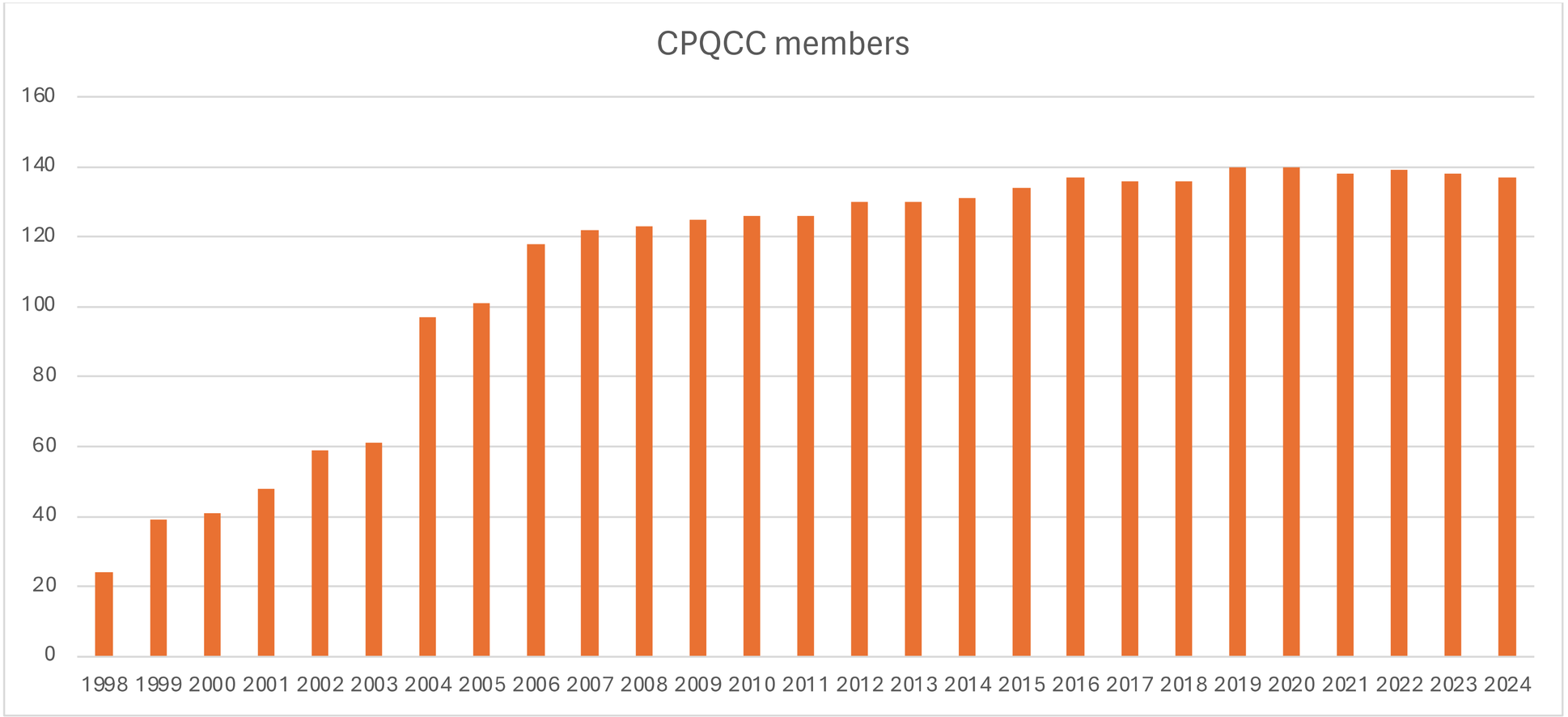
“COLLABORATIVE”

- **Learning from each other**

- **Learning together**

CPQCC membership

the first state perinatal (data driven) QI collaborative



- 2023-2024 - 138 member hospitals ~50,000 NICU admissions annually
- More detailed data collection on ~17,000 infants

Shih Z, Lee HC. Pediatric Medicine 2019

ADMISSION/DISCHARGE FORM FOR INFANTS BORN IN 2024

DO NOT mail or fax this form to the CPQCC Data Center. This form is for internal use ONLY.

NETWORK ID: ☐☐☐☐☐ **HOSPITAL ID:** ☐☐☐☐

Do not use this form if this infant qualifies as a delivery room death (DRD). If this infant is a DRD please fill out the DRD form.

- The **"Identification and Demographics"**, **"Maternal History"** and **"Delivery Room and First Hour After Birth"** sections **must** be filled out when an eligible infant is admitted to your NICU.
- The "**Post-Delivery Diagnoses and Interventions-Respiratory"** (respiratory, infections, other diagnoses, surgeries, and surgical complications, neurological, and congenital malformations) and the "**Initial Disposition"** sections must be filled out when the baby is discharged for the first time from your center.
- The **"Transport Information"** section only needs to be filed out if the infant was transported after its initial stay.

SELECTION CRITERIA

To be eligible, you MUST answer YES to at least one of the possible criteria (A-C)

A.	**≤ 1500 grams**	☐ **Yes** (If Yes go to item #1)	☐ **No** (If No go to Part B)
B.	**GA ≤ 31 6/7 weeks**	☐ **Yes** (If Yes go to item #1)	☐ **No** (If No go to Part C)
C.	**If > 1500 grams**	☐ **Yes** (If Yes select criteria below)	☐ **No**

MUST check at least one to be eligible.

NOTE: **Any infant that was previously discharged home and re-admitted to any location in our hospital (On or before Day 28) for Total Serum Bilirubin=>25mg/dl (427 Micromols/Liter) and/or exchange transfusion is CPQCC NICU eligible.**

- ☐ Death
- ☐ Major Surgery with general anesthesia or equivalent
- ☐ Intubated Vent > 4hrs
- ☐ Non-Intubated Vent > 4hrs
- ☐ Suspected Encephalopathy or Suspected Perinatal Asphyxia
- ☐ Acute Transport-In
- ☐ Acute Transport-Out
- ☐ Early Bacterial Sepsis
- ☐ Hyperbilirubinemia
- ☐ Active Therapeutic Hypothermia
- ☐ Seizures

SELECTION CRITERIA

To be eligible, you MUST answer YES to at least one of the possible criteria (A-C)

A.	**401 – 1500 grams**	☐ **Yes** (If Yes go to item #1)	☐ **No** (If No go to Part B)
B.	**GA range 22 0/7 – 31 6/7 weeks**	☐ **Yes** (If Yes go to item #1)	☐ **No** (If No go to Part C)
C.	**If > 1500 grams**	☐ **Yes** (If Yes select criteria below)	☐ **No**

MUST check at least one to be eligible.

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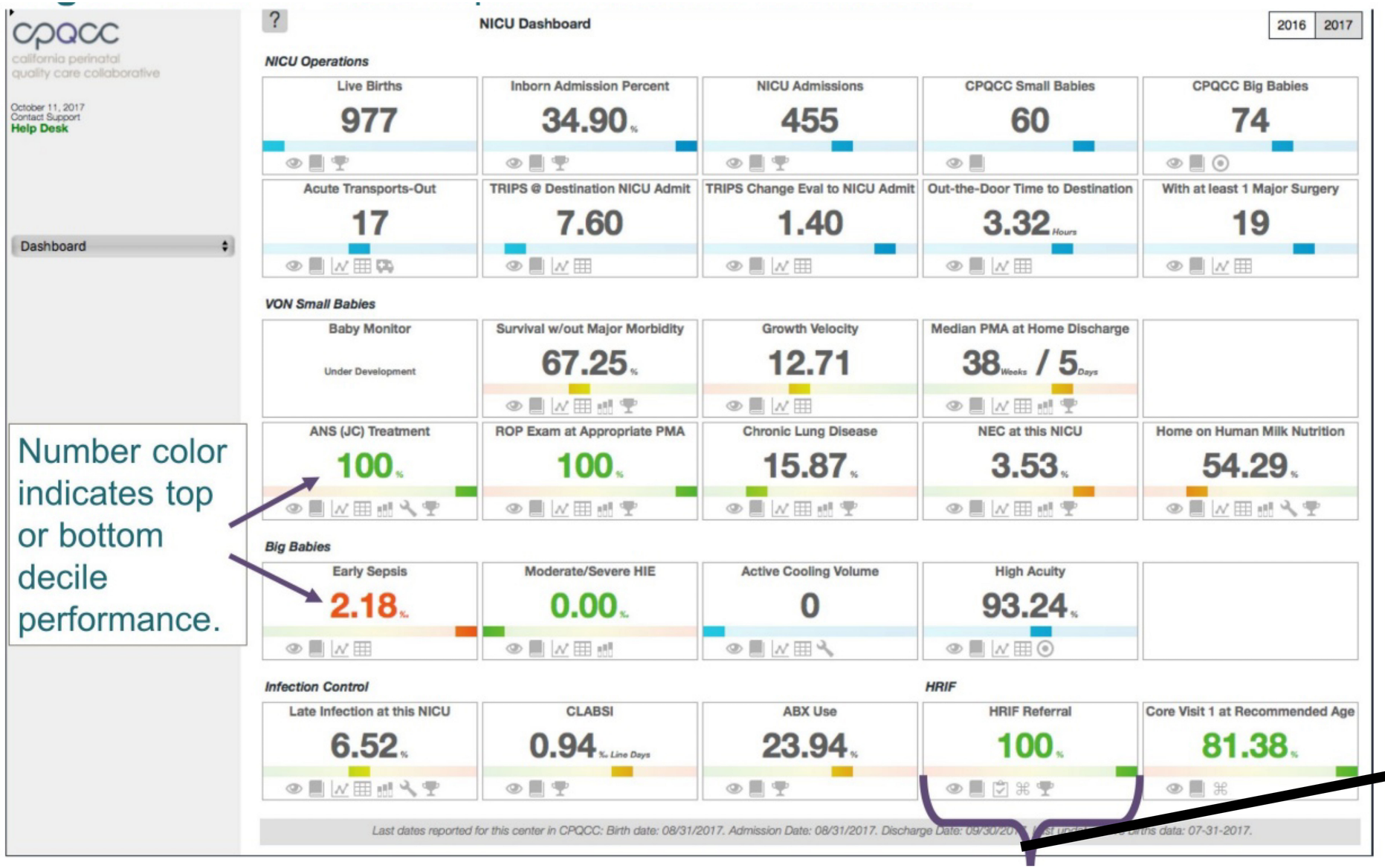
- ☐ Hyperbilirubinemia
- ☐ Active Therapeutic Hypothermia
- ☐ Seizures

INITIAL DISPOSITION

56. Enteral Feeding at Discharge

- ☐ None
- ☐ Human Milk Only
- ☐ Human Milk with Fortifier or Formula
- ☐ Formula Only
- ☐ Unknown

CPQCC Report Interactive Dashboard - Demo Hospital



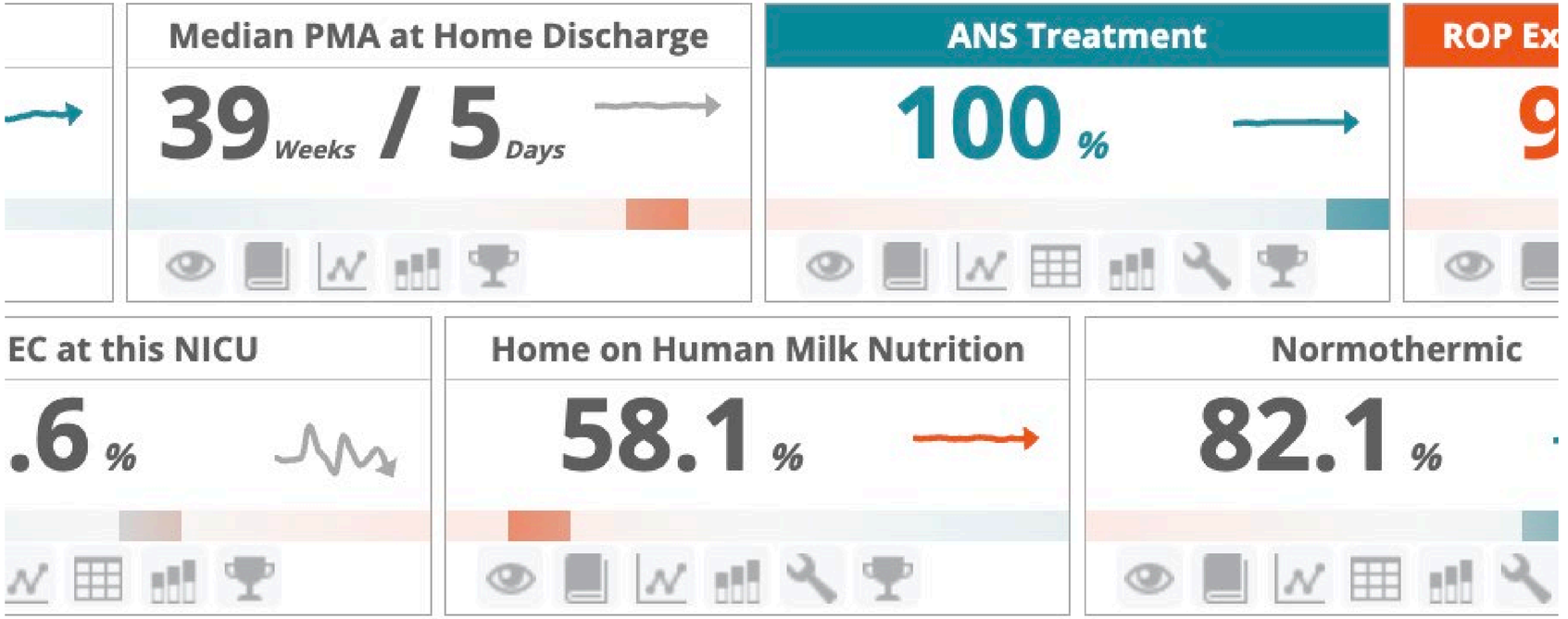
Number color indicates top or bottom decile performance.

Color-coded quality indicators

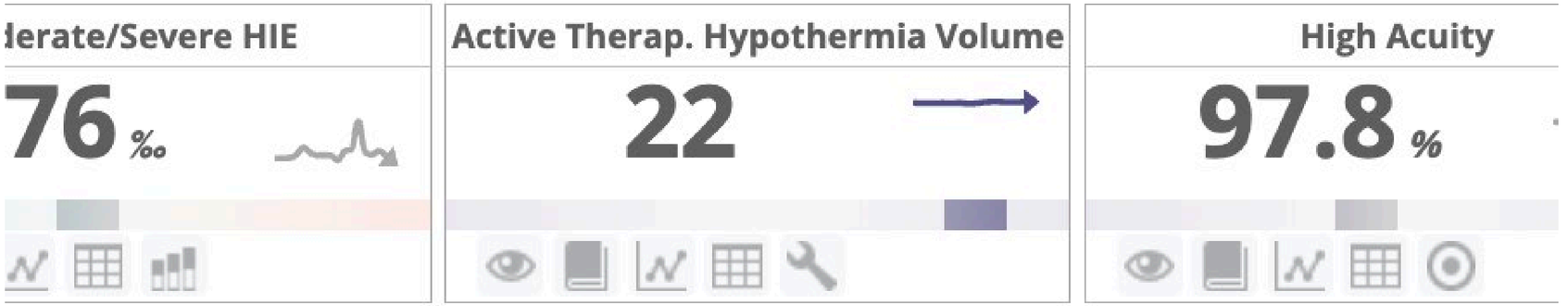
- *Red – low performance*
- *Green – high performance*
- *Blue – no quality judgment*

Bars below each number indicate which decile a hospital falls into compared to the rest of the CPQCC network.

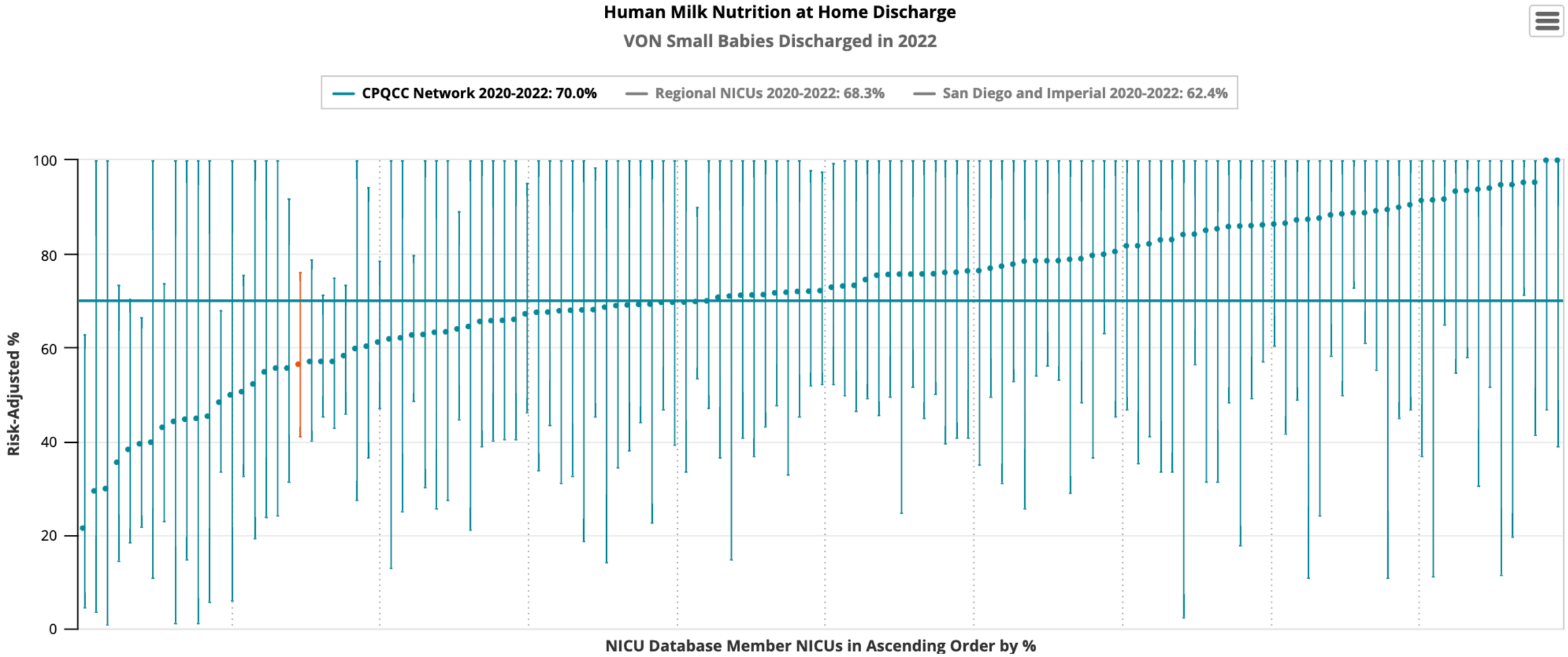
Small Babies

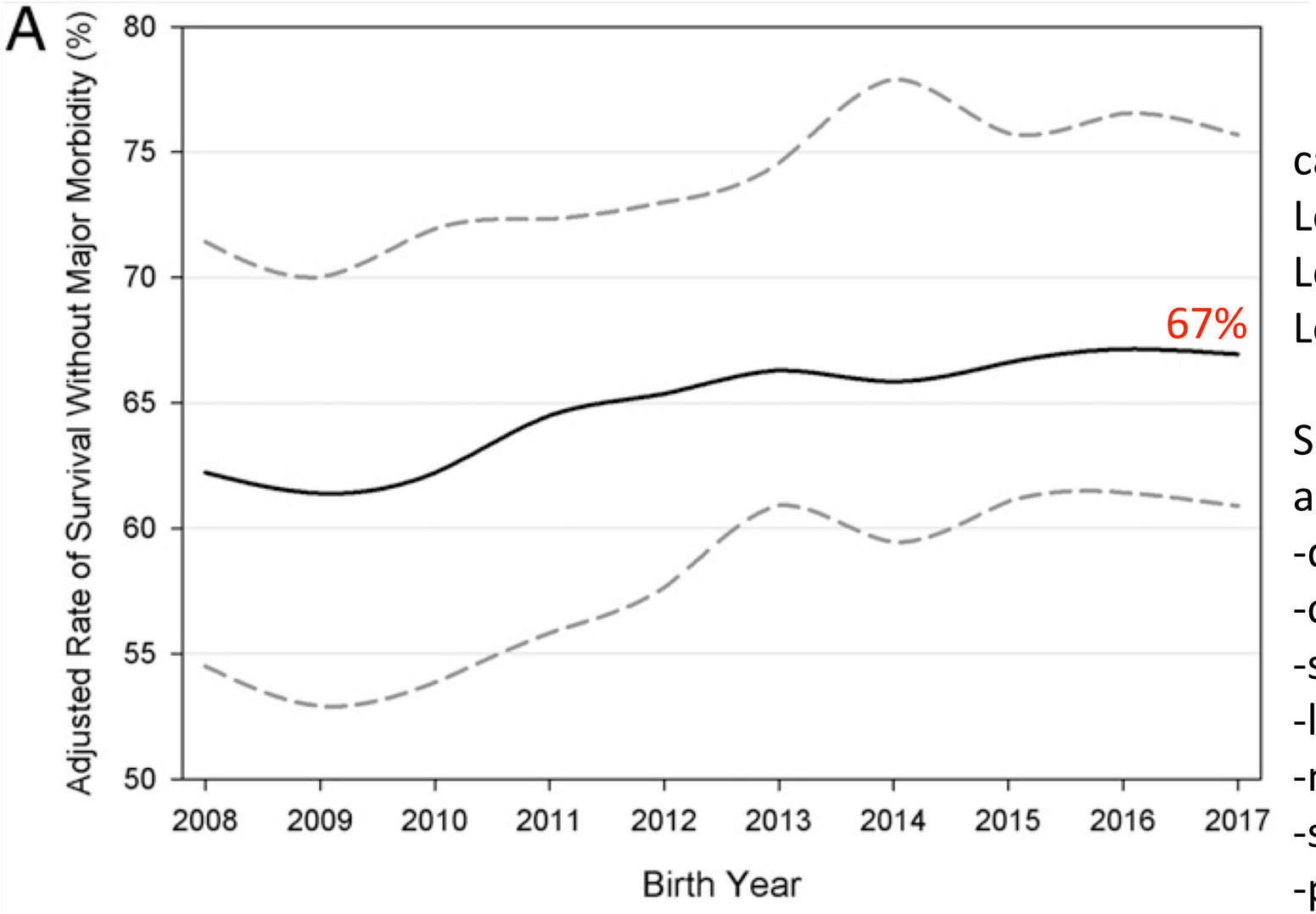


Big Babies



Risk adjusted comparisons



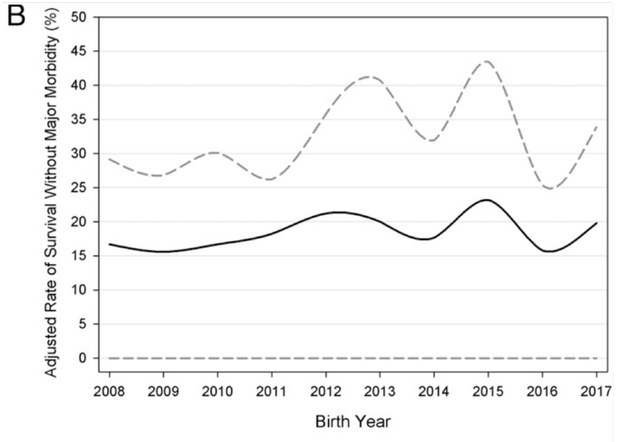


<u>10 year period - 49,333 VLBW infants</u>

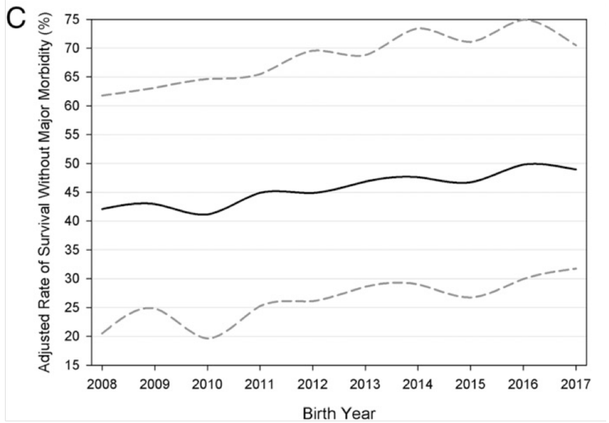
cared for in…
Level 4 - 17.5%
Level 3 - 62.2%
Level 2/N - 19.5%

Survival without major morbidity:
absence of…
-death
-chronic lung disease
-severe intraventricular hemorrhage
-late infection
-necrotizing enterocolitis
-severe retinopathy
-periventricular leukomalacia

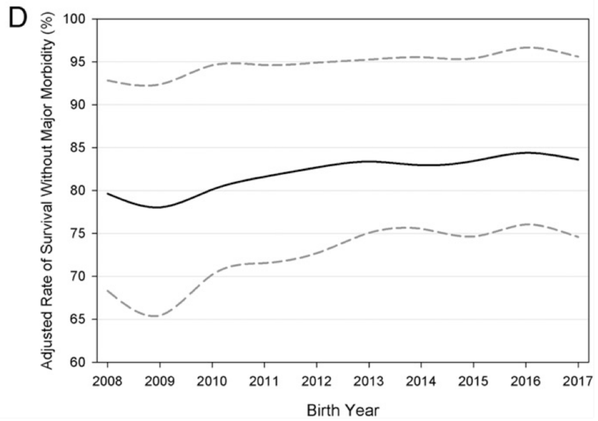
Survival without Major Morbidity among Very Low Birth Weight Infants in California. Pediatrics. 2020 146(1)



< 25 weeks - 19% improvement —
SwMM- 20%



25 - 27 weeks - 17% improvement —
SwMM - 50%



> 27 weeks - 5% improvement —
SwMM - 85%

Survival without Major Morbidity among Very Low Birth Weight Infants in California. Pediatrics. 2020 146(1)

For those infants who survive…

number of morbidities has decreased —>

Morbidities	2008	2017	Change per year, %
0	62.4	67.3	0.7
1	20.7	20.1	-0.1
2	11.4	9.3	-0.3
3	4.3	2.6	-0.2
4	1.2	0.7	-0.1

Survival without Major Morbidity among Very Low Birth Weight Infants in California. Pediatrics. 2020 146(1)

Potential for improvement if all hospitals performed at level of top quartile of hospitals (over 3 year period)

	Current rate	Top quartile	Average potential improvement / decrease in outcome annually
Survival w/o major morbidity	67%	81%	6.6%
Death	8.3%	4.3%	-15.6%
Chronic lung disease	20.6%	5.7%	-24.9%
Nosocomial infection	8.5%	2.8%	-22.1%
Necrotizing enterocolitis	3.2%	0	-33.3%

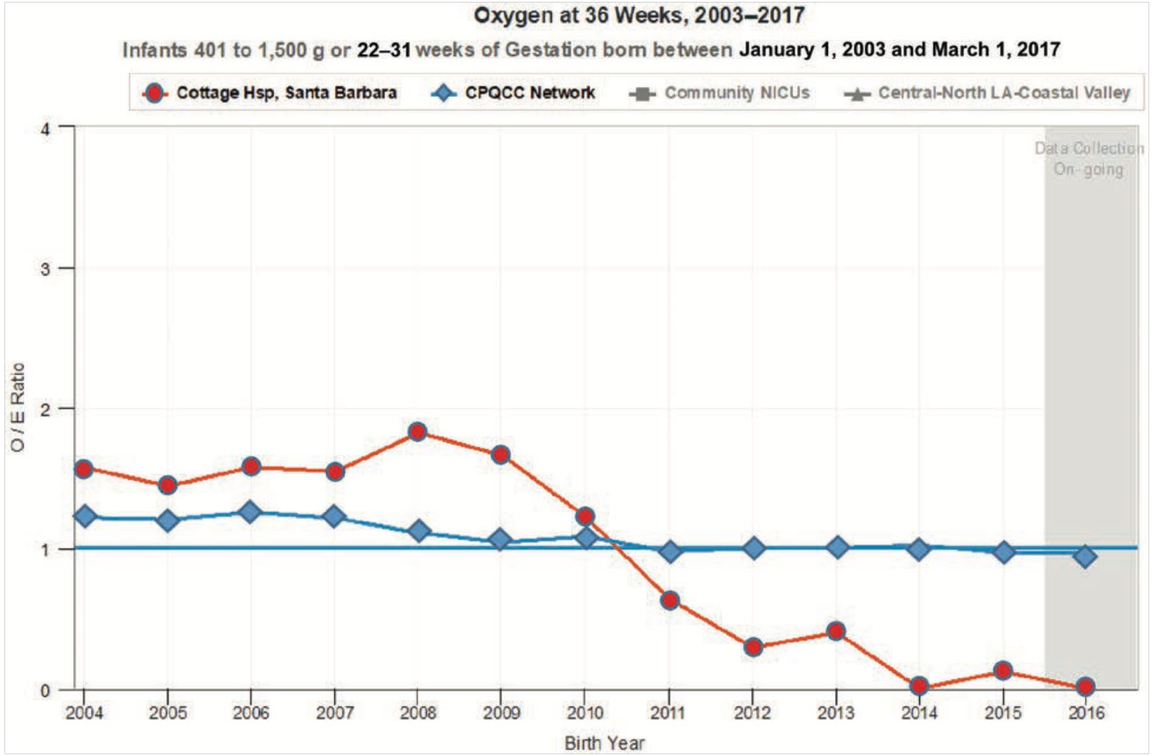
Survival without Major Morbidity among Very Low Birth Weight Infants in California. Pediatrics. 2020 146(1)

Decreasing Chronic Lung Disease Associated with Bubble CPAP Technology: Experience at Five Years

Tricia A. Miller, PhD; Jing Li, MA†; Stella Riddell, CNS, RN†; Steven C. Barkley, MD†*

Pediatric Quality & Safety 2020

- Pre - 45 / Post - 87
- Median GA 27 weeks / BW ~1000g
- Primarily implementation of bubble CPAP
- Chronic lung disease 30% —> 4%



Elimination of Admission Hypothermia in Preterm Very Low-Birth-Weight Infants by Standardization of Delivery Room Management

Madhu Manani, RNC; Priya Jegatheesan, MD; Glenn DeSandre, MD;
Dongli Song, MD, PhD; Lynn Showalter, RNC; Balaji Govindaswami, MBBS, MPH

Perm J 2013 Summer;17(3):8-13, S1-2

http://dx.doi.org/10.7812/TPP/12-130

- Population < 33 weeks / < 1500 grams
- multidisciplinary Thermoregulation committee
- standardized approach to delivery room resuscitation including DCC
- staff education and awareness

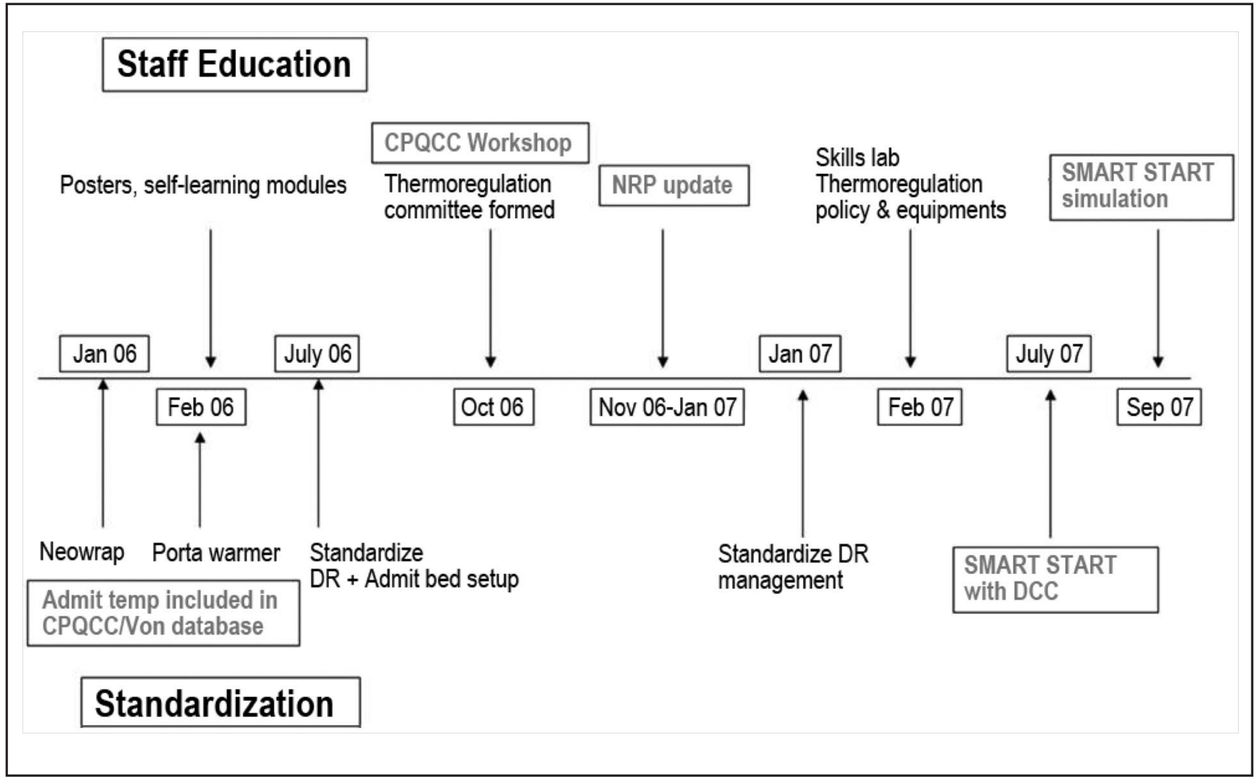


Table 3. Process, Outcome, and Balancing Measures, 2006 to 2011						
Measure	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Process Utilization of thermal equipment in delivery room, %	84	95	100	100	100	100
Outcome Hypothermia (< 36°C), %	45	23	16	0	6	0
Balancing Hyperthermia (> 37.5°C), %	2	3	8	6	2	0

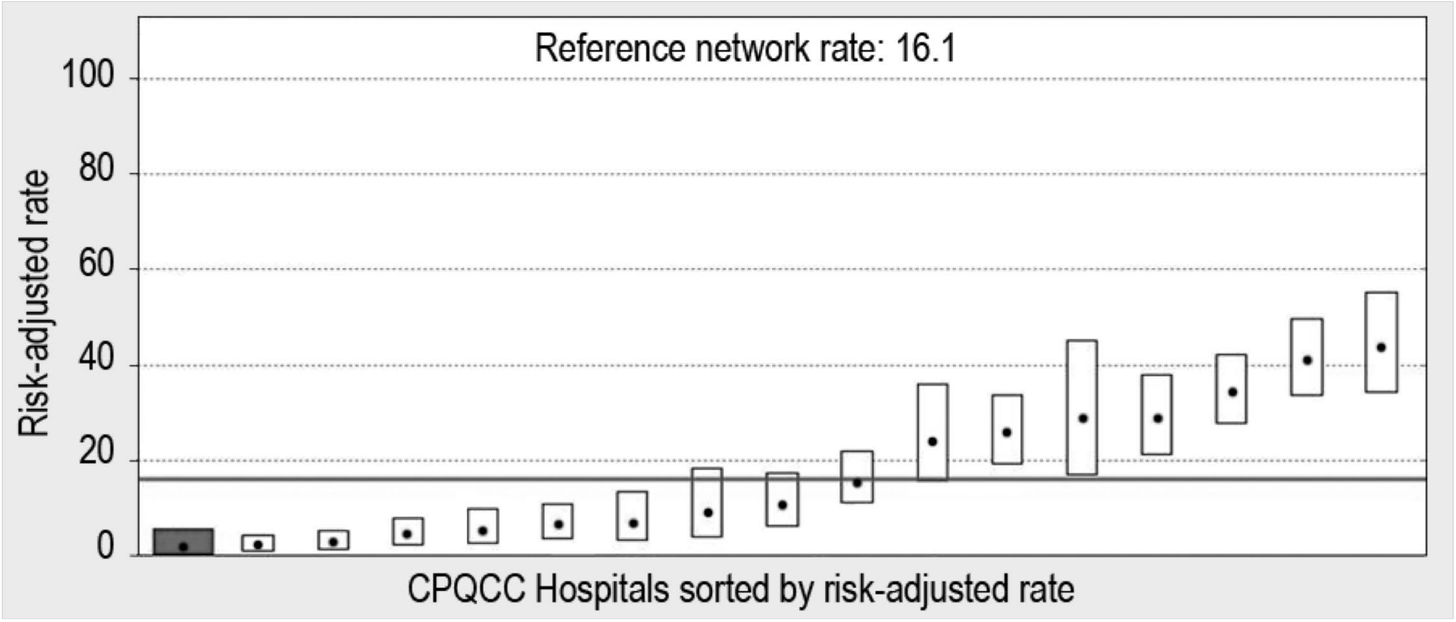


Figure 4. Risk-adjusted hypothermia rates for inborn infants at our center compared with other regional NICUs in California, 2009 to 2011.[a]

Perinatal quality improvement bundle to decrease hypothermia in extremely low birthweight infants with birth weight less than 1000 g: single-center experience over 6 years

Dilip R Bhatt,[1] Nirupa Reddy,[1] Reynaldo Ruiz,[2] Darla V Bustos,[3] Torria Peacock,[1] Roman-Angelo Dizon,[1] Sunjeeve Weerasinghe,[1] David X Braun,[1] Rangasamy Ramanathan [4]

J Invest Med 2020

- 200 ELBW infants
- mean BW 767g / GA 26 weeks
- Cesarean 76%
- Thermoregulation bundle
- Dedicated OR set temp 74 degrees
- Achieved > 90% normothermia 2014 and later

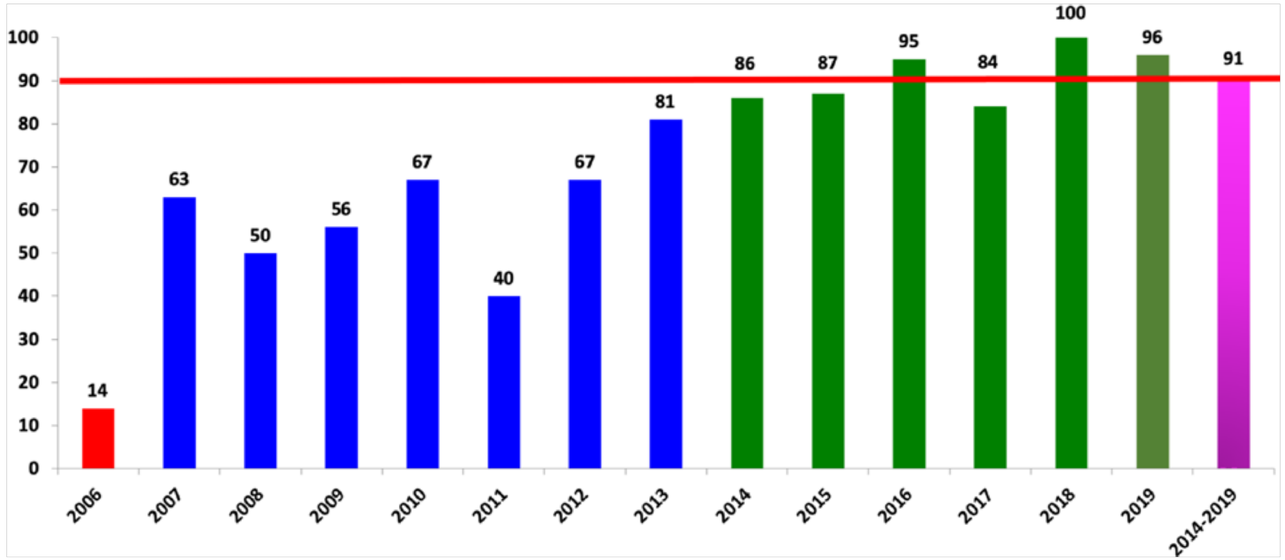


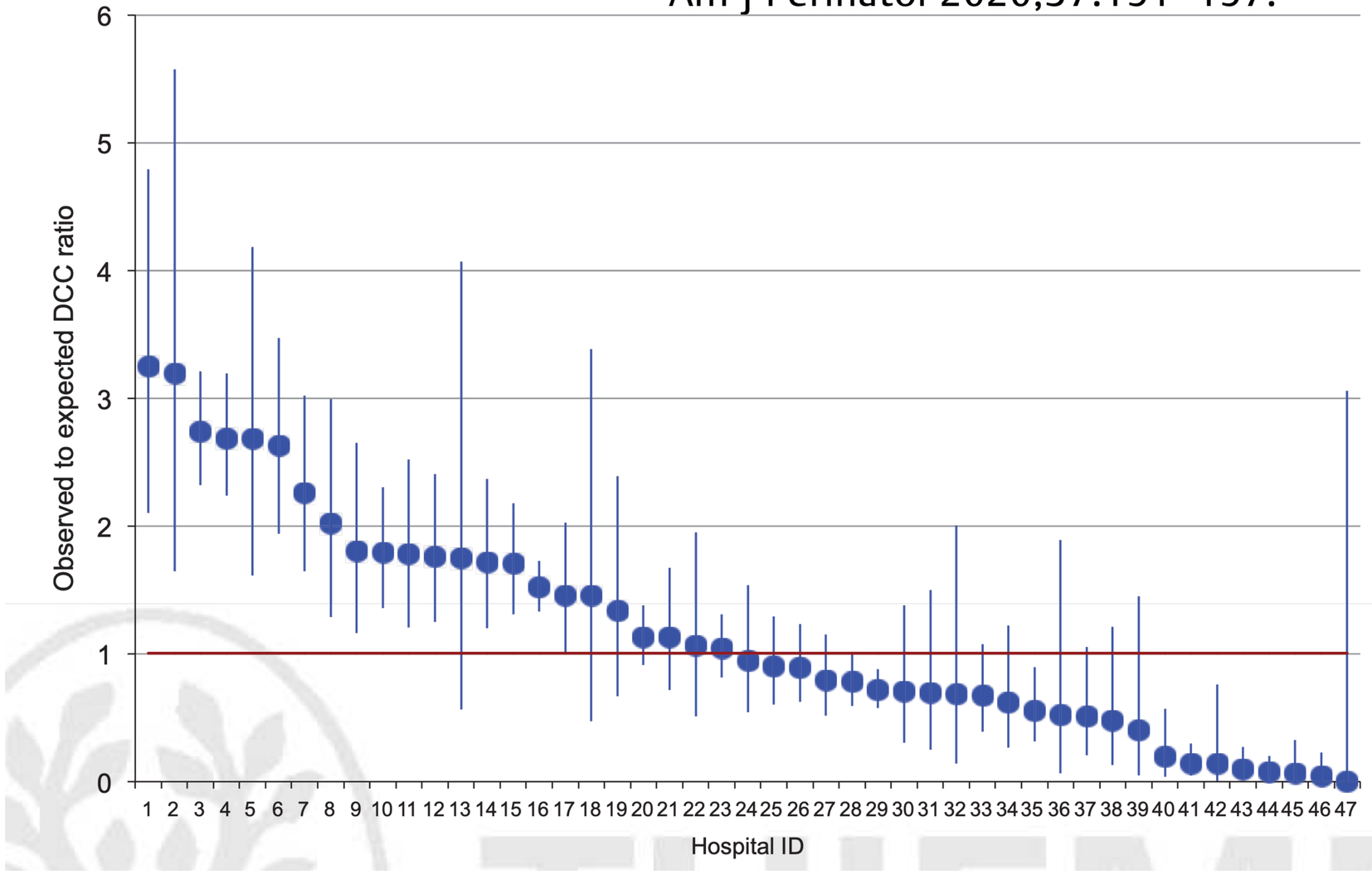
Figure 1 Per cent normothermia (36.5°C–37.5°C) in extremely low birthweight infants by year.

Delayed Cord Clamping and Umbilical Cord Milking among Infants in California Neonatal Intensive Care Units

Chinh L. Tran, MPH[1,2] Janella M. Parucha, BS[2] Priya Jegatheesan, MD[3] Henry C. Lee, MD[2,4]

Am J Perinatol 2020;37:151–157.

- Year 2016
- Amongst 52 NICUs in CPQCC…
- 50% had DCC rate <20%
- 2 NICUs DCC rate > 80%



Delayed cord clamping uptake and outcomes…

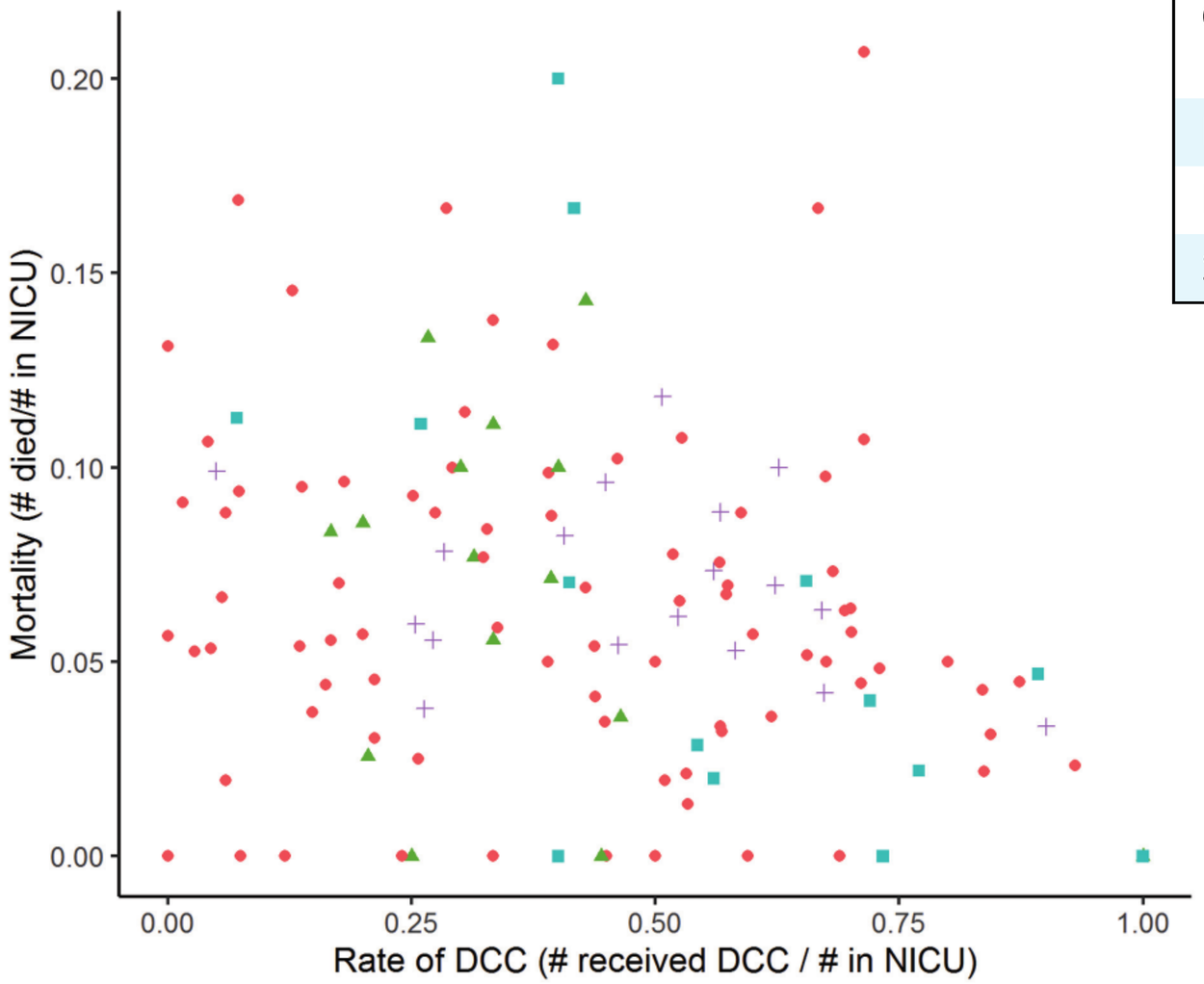


Table 2 The association between delayed cord clamping and neonatal outcomes at the individual level

Outcome	Unadjusted risk ratio[a] (95% CI)	Adjusted risk ratio[b] (95% CI)
Mortality	0.38 (0.32–0.46)	0.57 (0.47–0.68)
IVH	0.89 (0.79–1.01)	1.00 (0.88–1.15)
Severe IVH	0.57 (0.47–0.69)	0.80 (0.66–0.98)

Quinn MK AJP 2022

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Delayed Cord Clamping

Recent analysis has shown that Delayed Cord Clamping (DCC) in preterm infants is associated with a reduced need for blood transfusion and a reduced risk of intraventricular hemorrhage (IVH) and necrotizing enterocolitis (NEC) in preterm infants

Randomized clinical trials have also shown other benefits of DCC including improved cardiovascular stability, cerebral oxygenation, and lower risks for both severe IVH and late-onset sepsis. Delayed Cord Clamping of up to 1 minute for preterm infants has been recommended by the WHO, NRP, and ACOG.

CPQCC has collected a variety of resources to help hospitals implement and collect data on DCC. Following a DCC data collection pilot project, CPQCC now requires members to submit data on DCC in their hospitals.


DELAYED CORD CLAMPING
PILOT PROJECT

In 2016, delayed cord clamping (DCC) was recommended by the American College of Obstetrics and Gynecology (ACOG) for all babies, yet few hospitals were practicing it. Enter a committed group of California hospitals, determined to make DCC a routine practice, which approached CPQCC to start collecting DCC data on a pilot basis. Says Priya Jegathesan, a neonatologist and Associate Director of the NICU at Santa Clara Valley Medical Center and one of the driving forces behind the pilot, "if you really want to make things happen for all babies, you have to have strong commitment to your cause and methodically influence change."

Santa Clara Valley Medical Center (SCVMC) started practicing DCC in 2007 with the goal of decreasing their rates of intraventricular hemorrhage (IVH). The hospital had already worked on standardized delivery room management guidelines for infants born at less than 27 weeks' gestation, including thermo-regulation and early continuous positive airway pressure (CPAP), and decided that DCC of 30 seconds was critical to the delivery room bundle. By 2011, the SCVMC team had decided that they had developed enough comfort with DCC of 30 seconds for preterm infants to extend the time to a

and reenergized, the team continued to promote the practice and to see improvements. By 2016, SCVMC had increased the duration of DCC to a minimum of two minutes and in 2018 they successfully increased it again, to a minimum of three minutes.

Despite her team's success, Jegathesan recognizes that practice change is not easy. Every time the team decided to increase the duration of DCC they faced frustration and pushback from other members of the care team. Frequent communication proved critical to combating this pushback. DCC advocates shared data on improved outcomes with reluctant team members.

"If you really want to make things happen for all babies, you have to have strong commitment to your cause and methodically influence change."

- Priya Jegathesan, MD, Associate NICU Medical Director, Santa Clara Valley Medical Center

explaining the rationale behind increasing durations,

Related Links:

- September 2018 Webinar Recording
- February 2018 Webinar Recording
- February 2018 Webinar Slides
- November 2017 Webinar Recording
- November 2017 Webinar Slides
- August 2017 Webinar Recording
- August 2017 Webinar Slides
- 2016-2017 Webinar Recordings
- 2016-2017 Webinar Slides
- Case Study Video

DCC Implementation:
Sharing our Decade Long Experience

Santa Clara Valley Medical Center Team – NICU and L&D

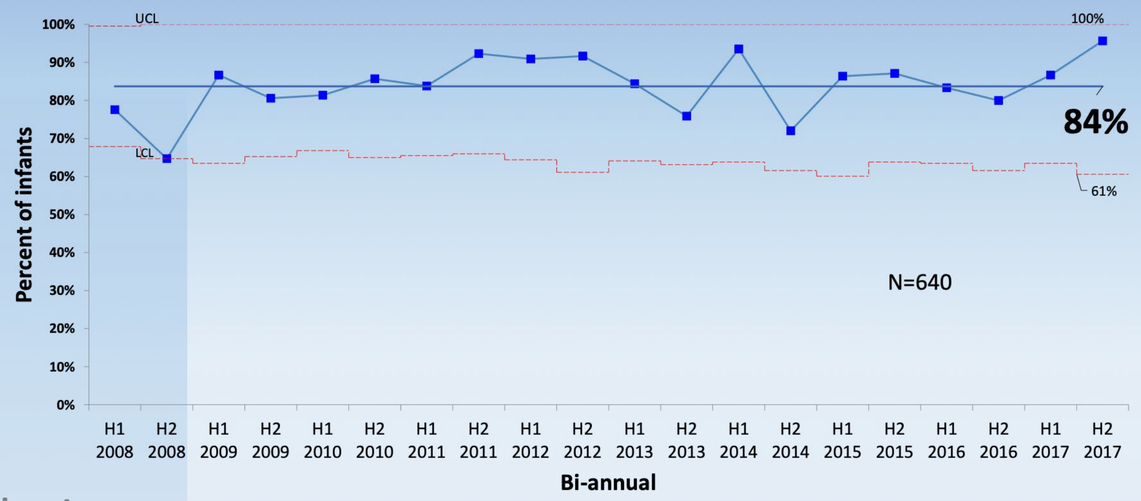
CPQCC Webinar 2.23.18

Team Members

- NICU Providers – House staff, NNP, Hospitalist, Neonatologist
- NICU Nurses
- Respiratory Therapists
- OB Providers – House staff, Obstetricians, Perinatologists
- L&D Nurses

- **Number Needed to Influence = >300**

DCC in Preterm Infants 33 weeks

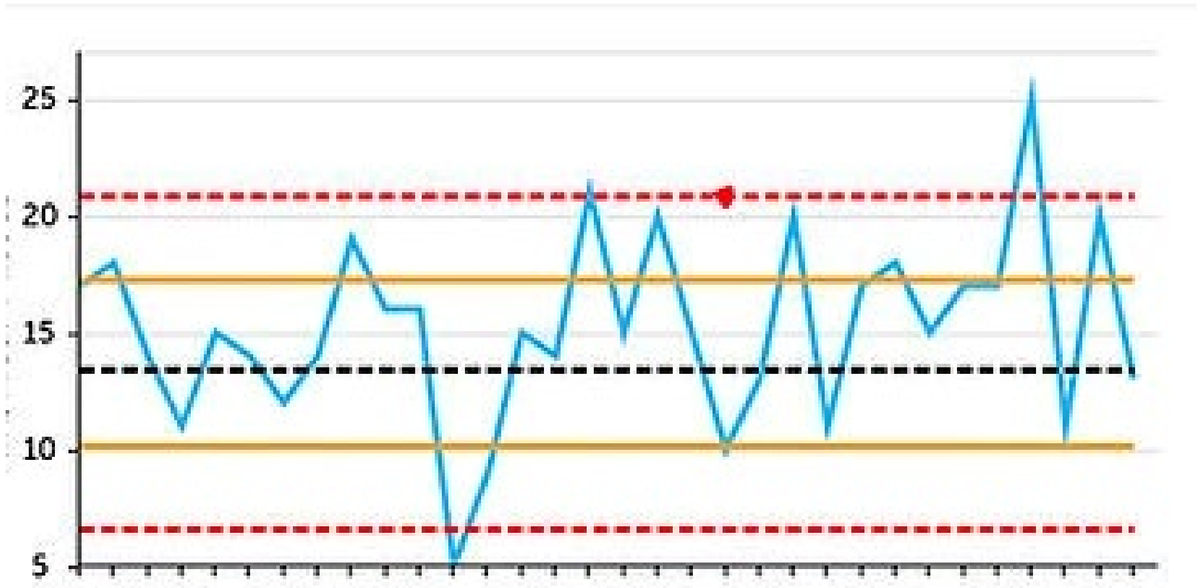


Learning from each other

Learning together

Collaborative quality improvement
Principles

- Multidisciplinary teams from member NICUs
- Meeting together
  - in-person meetings
  - web-based meetings
  - expert panel
- Regular communication
  - data sharing
  - experience sharing



PROMOTING ANTENATAL STEROID USE FOR FETAL MATURATION: RESULTS FROM THE CALIFORNIA PERINATAL QUALITY CARE COLLABORATIVE

David D. Wirtschafter, MD, Beate H. Danielsen, PhD, Elliott K. Main, MD, Lisa M. Korst, MD, PhD, Kimberly D. Gregory, MD, Andrew Wertz, MD, David K. Stevenson, MD, and Jeffrey B. Gould, MD, MPH, for the California Perinatal Quality Care Collaborative*

Journal of Pediatrics 2006

- 1999-2000 educational materials / toolkits
- Distributed through in-person meetings and web
- 25 participating hospitals
- Eligible babies - very low birth weight (< 1500 grams) and < 34 weeks gestational age

Table II. Comparison of antenatal steroid use in the CPQCC: 1998 (baseline) and 2001 (postintervention) Yrs

	Sample size		Antenatal steroid use (%)		
	1998	2001	1998	2001	P*
Hospitals	25	25			
Total VLBWs	1668	1636	73%	81%	.0001
Eligible VLBWs	1524	1475	76.1	86.2	.001
Gestational age (weeks)					
24 to 28	765	794	77.6	87.3	.001
29 to 32	705	626	75.6	86.6	.001
33	54	55	61.1	67.3	.507
Level of care					
Regional	805	799	75.8	88.0	.001
Community	578	551	75.6	84.4	.001
Non-CCS	141	125	80.1	83.2	.522

Eligible infants are 24 to 33-6/7 weeks of gestation.
*P is 2-sided.

Wirtschafter et al. Journal of Pediatrics 2006

PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

PEDIATRICS Volume 130, Number 6, December 2012

A Quality Improvement Project to Increase Breast Milk Use in Very Low Birth Weight Infants

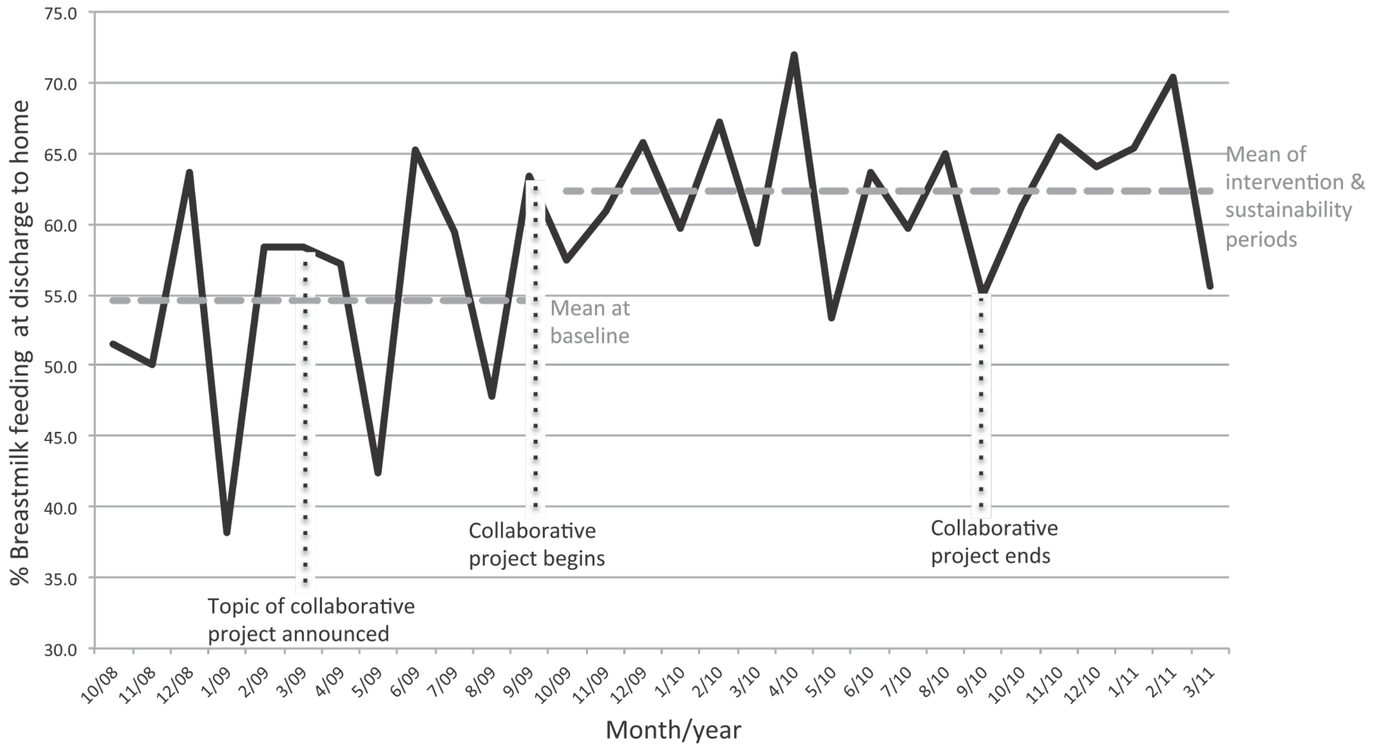
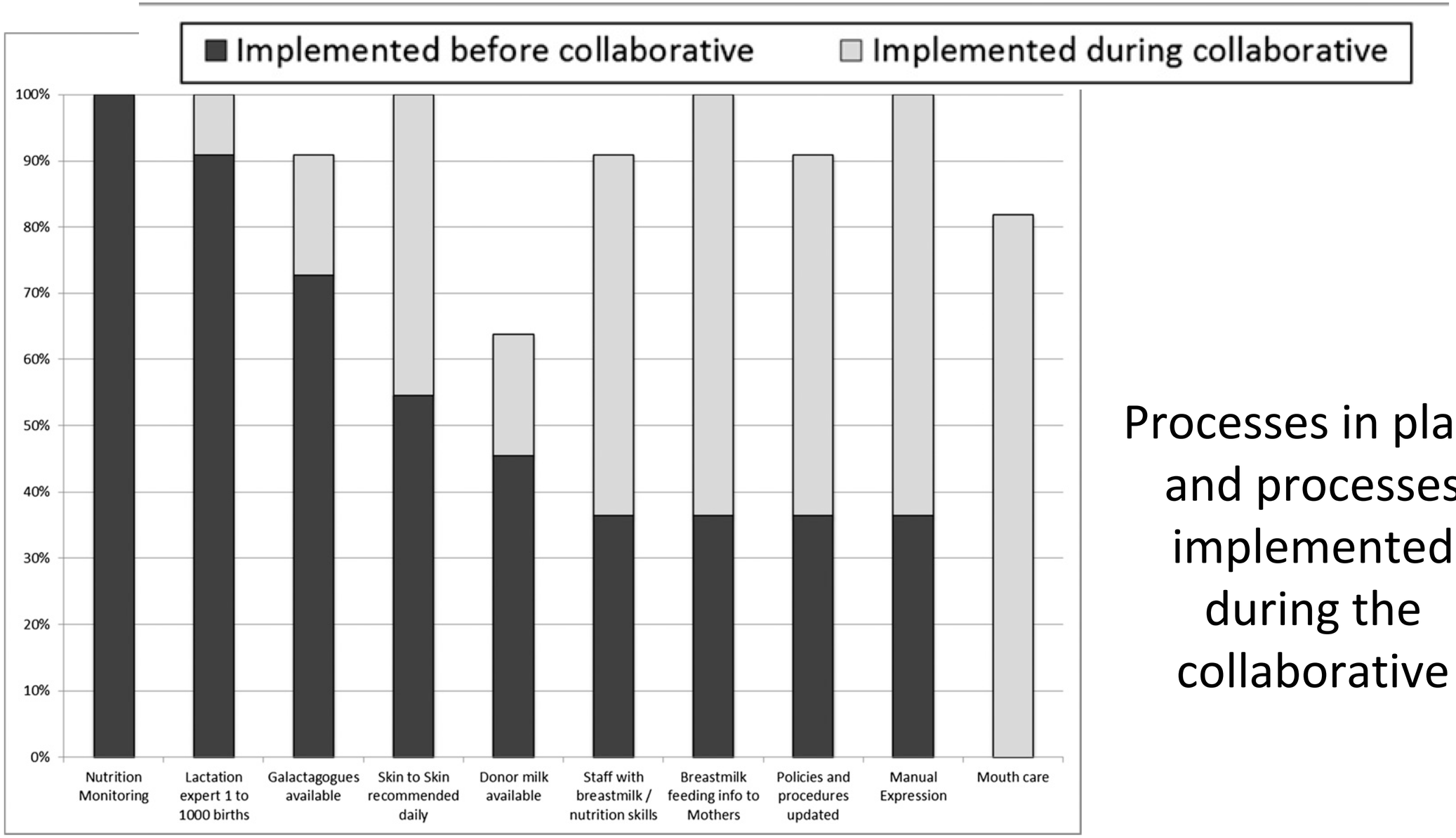


FIGURE 1
Annotated run chart of breast milk feeding at discharge for collaborative participants.

11 NICUs
VLBW infants

baseline rates lower than non-participants
55% vs 64%

participants rate increased to 61%
and then 64%



Processes in place and processes implemented during the collaborative

FIGURE 4
Percent of processes adopted by collaborative participants before and during the intervention.

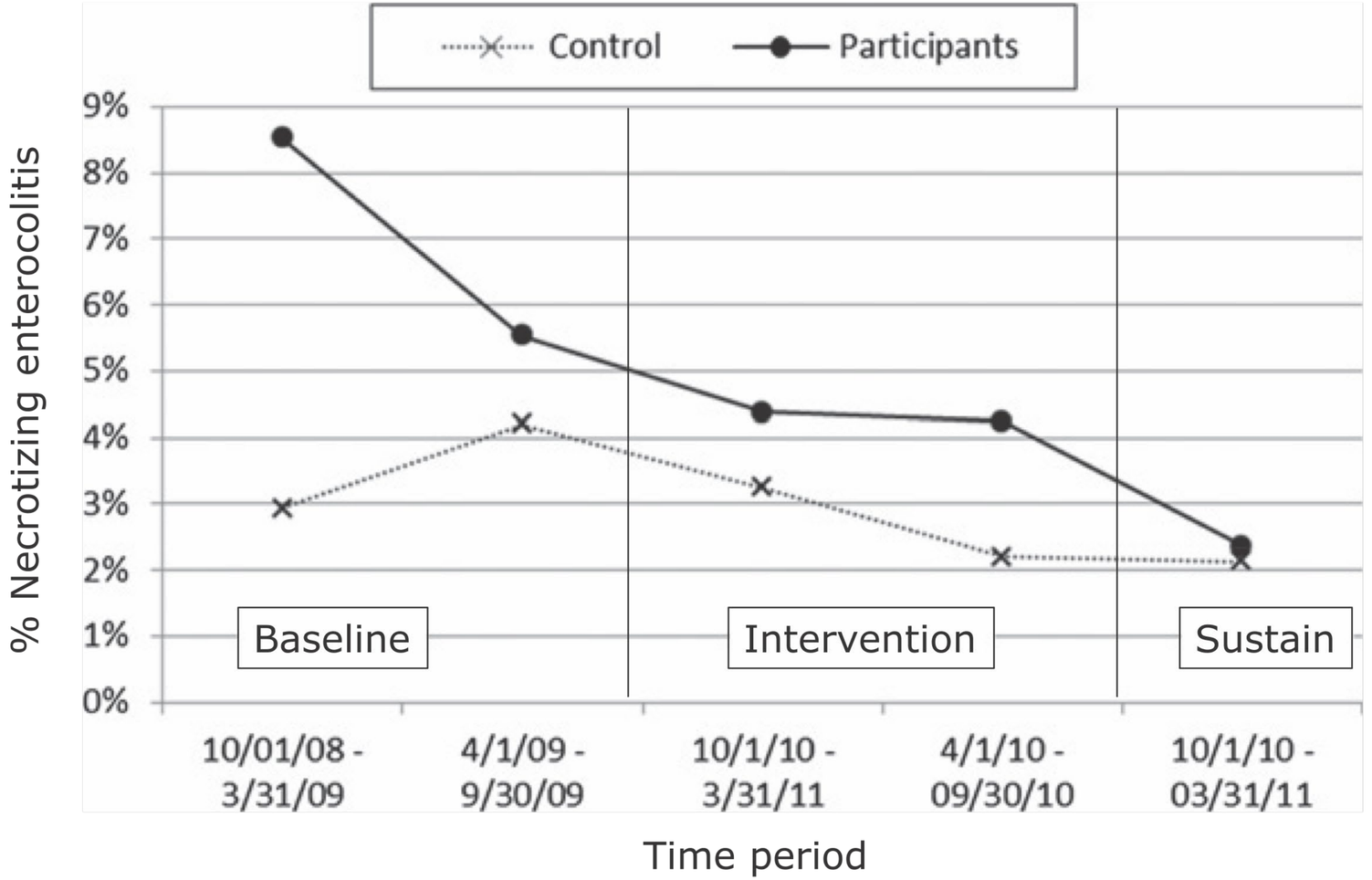


FIGURE 2

Percent of eligible infants with NEC by collaborative participation.

PEDIATRICS
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Implementation Methods for Delivery Room Management: A Quality Improvement Comparison Study

- 2011-2012

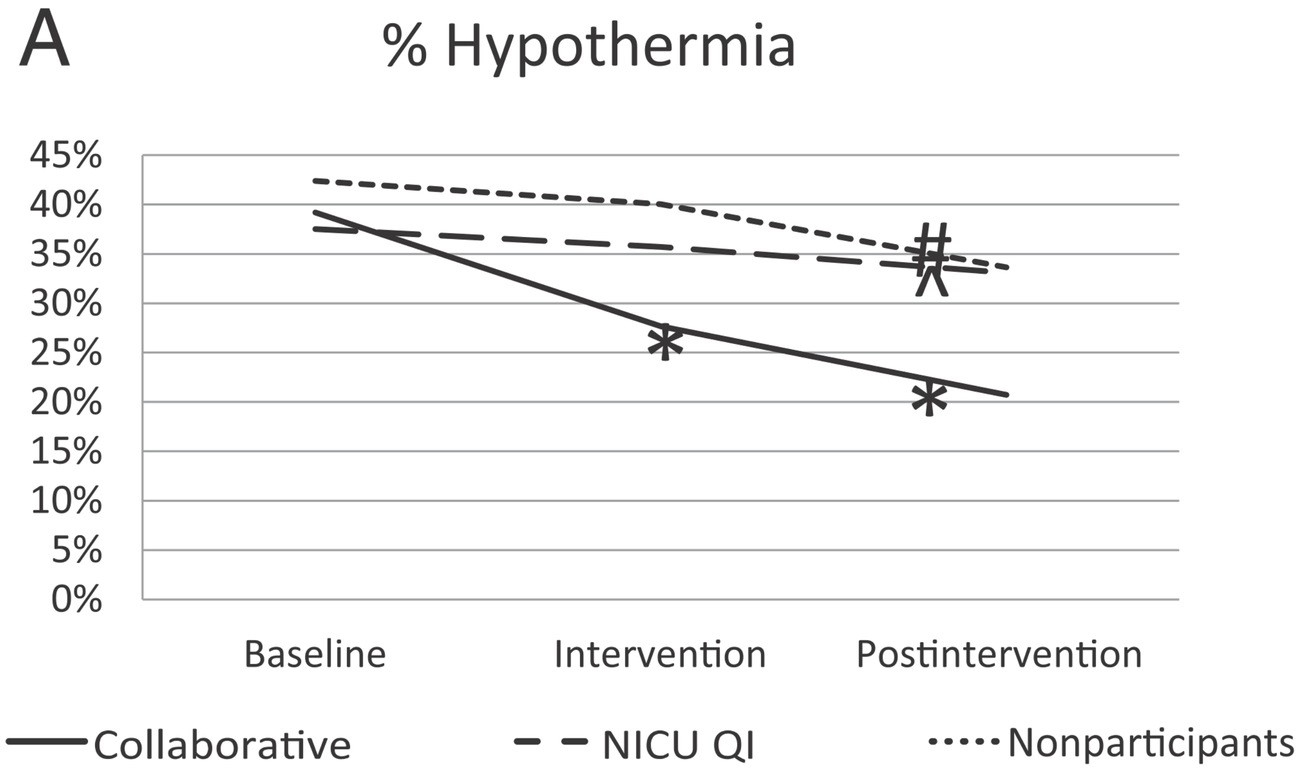
COLLABORATIVE	NICU QI
Toolkit + change package + expert panel	Toolkit + change package
Monthly report out - data + QI	Data reported to CPQCC monthly
3 in-person collaborative meetings + monthly web-based	Local QI team meetings

*Implementation methods for delivery room management: a quality improvement comparison study
*Effects of delivery room quality improvement on premature infant outcomes

Collaborative QI

Delivery room management

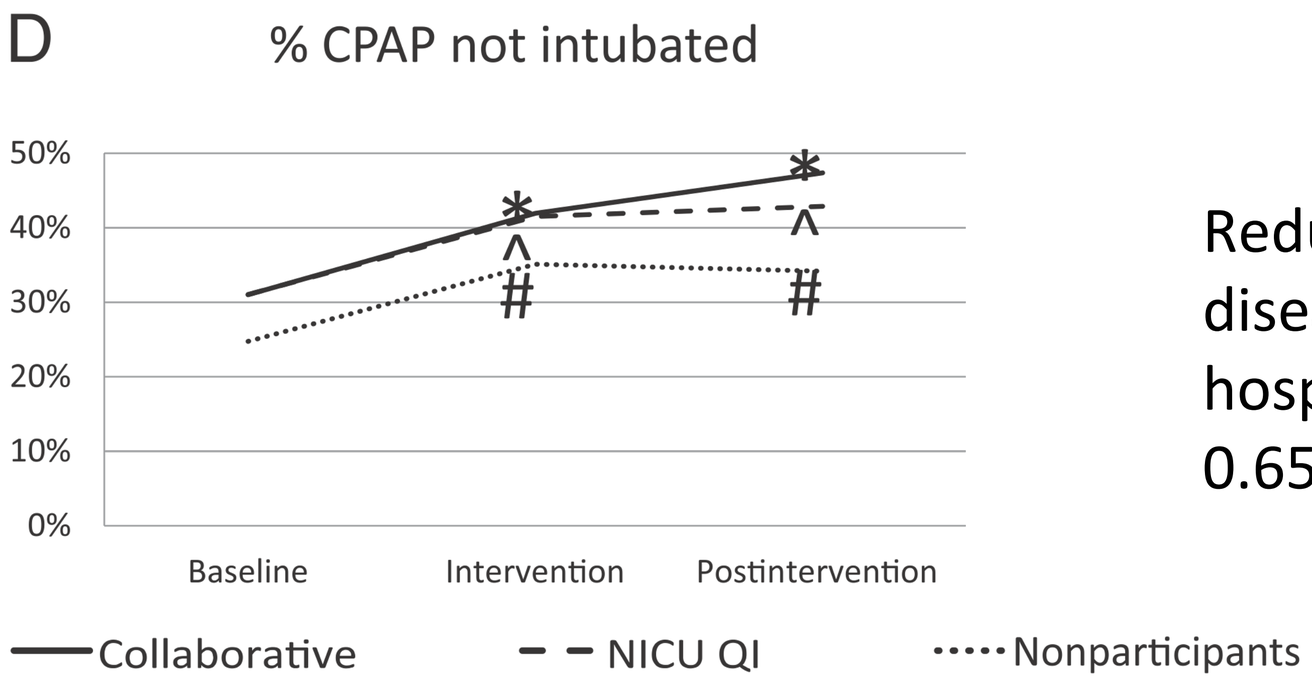
- Thermal management / Decrease invasive respiratory support / team briefing and debriefing



*Implementation methods for delivery room management: a quality improvement comparison study

*Effects of delivery room quality improvement on premature infant outcomes

Delivery room management - long term effects



Reduced odds of chronic lung disease in Collaborative hospitals - aOR (0.8, 95% CI, 0.65-0.99)

*Implementation methods for delivery room management: a quality improvement comparison study

*Effects of delivery room quality improvement on premature infant outcomes

2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

Nosocomial infection

Breastmilk nutrition

Delivery room management

Length of stay

Antibiotic stewardship

In situ simulation

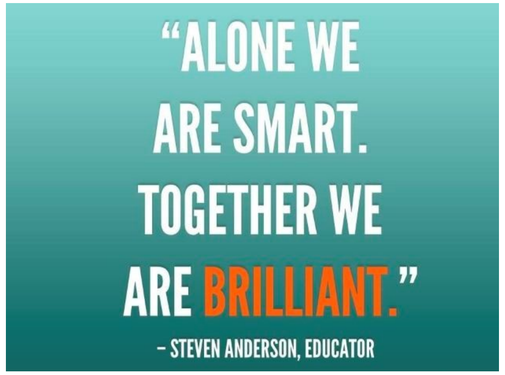
Grow Babies Grow

Maternal substance exposure

NeoBrain

OASCN - Abx Stewardship 2

GAIN x2



cpqcc
california perinatal quality care collaborative

Workgroups in CPQCC

Data Committee Advisory Group
Perinatal Quality Improvement Panel
-research
-data interface and opportunities (DIOC)
-infrastructure
-education
10.9 NICUs (daily census < 10.9)
Children’s hospitals
Maternal substance exposure (MatEx)
Health equity taskforce

Learning from each other

Learning together

Thank you!

AHRQ: P30HS023506
NICHD: R01HD087425-01
NICHD: R01HD098287

- @henryleeneo
- @cpqcc