



Improving outcomes for preterm infants in the California Perinatal Quality Care Collaborative

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Abstract: Through the collaboration of hospitals, partners in the state government, communities, foundations, and academic institutions, the California Perinatal Quality Care Collaborative (CPQCC) has contributed to improving outcomes for preterm infants. Specific strategies have included real-time data reports, toolkits of evidence-based practice, dissemination through educational meetings, and collaborative quality improvement projects.

Keywords: Quality improvement; collaboration; very low birth weight (VLBW)

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Introduction

The past half-century has seen broad improvements worldwide in infant mortality, both in developed and developing countries. The main causes of infant mortality in both contexts include: birth defects, preterm birth and low birth weight, maternal pregnancy complications, sudden infant death syndrome, and injuries (1).

Despite these improvements, the United States, at 5.8 deaths per 1,000 live births as of 2017, has a higher infant mortality rate than economically similar countries in Europe (2,3). However, from 2014 to 2016, California, with a perinatal mortality rate of 4.79 (per 1,000 live births and fetal deaths past 28 weeks of gestation), was the only state amongst 50 that reported a decrease in perinatal deaths (3). Although there are many factors that would have contributed to this improvement, it is plausible that this improvement is at least in part due to the collaboration of hospitals and other stakeholders across the state. One of the organizations that focuses on improvement at the level of hospital neonatal intensive care units (NICUs) is the California Perinatal Quality Care Collaborative (CPQCC),

founded in 1997 (4). CPQCC seeks to “improve the quality care for California’s most vulnerable infants,” and has aimed to contribute to the reduction in mortality and morbidity for very low birth weight (VLBW) and other sick infants through the collection of data that leads to action in research, collaboration, and education.

History of CPQCC

CPQCC initiated as an outgrowth of the California Association of Neonatologists, which sought to establish a community of clinical and educational partners across the state (5). Supported in part by the David and Lucile Packard Foundation alongside the California Department of Public Health, the collaborative has built a real-time risk adjusted perinatal data system (*Figure 1*) so that hospitals can track data statistically adjusted for each location, accounting for the latest admissions. While the data center and administrative and research leadership are based in the Division of Neonatology at Stanford School of Medicine under the leadership of Dr. Jeffrey Gould, the activities of CPQCC are led by a geographically diverse statewide

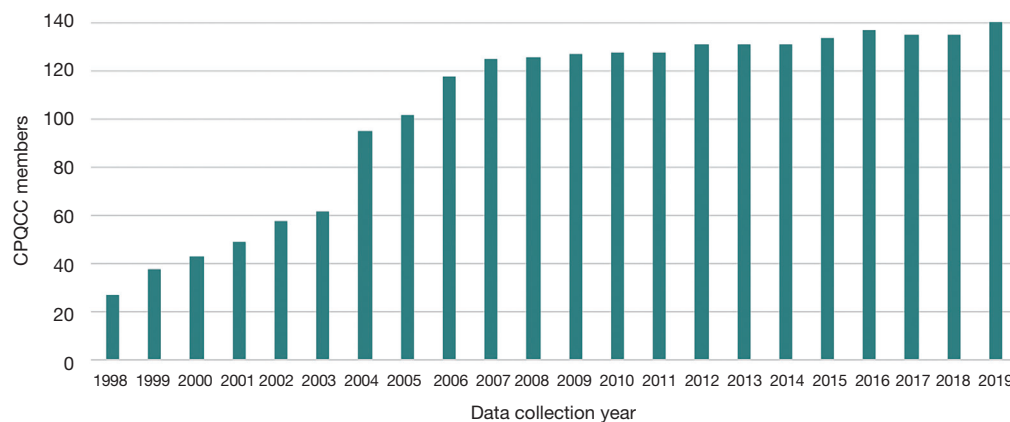


Figure 1 Over the course of a little more than 20 years, the CPQCC has grown to account for 17,000 NICU admissions annually across 140 member hospitals. CPQCC, California Perinatal Quality Care Collaborative; NICU, neonatal intensive care unit.

group of representatives from community, academic, and state organizations. Over the past two decades, this group has guided the development and use of a statewide database on clinical data from NICUs, in order to facilitate innovative quality improvement collaborative projects, providing customized data reports and one-on-one guidance from peers.

Since 2006, a sister organization focused on maternal data and quality improvement was formed as the California Maternal Quality Care Collaborative (CMQCC) (6). With similar strategies of data collection and reporting and collaborative quality improvement, the CMQCC has led statewide improvements in morbidities such as postpartum hemorrhage, preeclampsia, and reduction of maternal mortality.

In recent years, these organizations have monitored approximately 500,000 births annually through CMQCC, with approximately 50,000 of those having NICU admissions. The CPQCC collects detailed data on about 17,000 of those admissions, those which are VLBW or meet other eligibility criteria such as requirement of mechanical ventilation or surgery. Further data are collected through the California Children's Services/High Risk Infant Follow-up Quality Care Initiative, with about 9,000 high-risk infants referred for outpatient developmental care up to three years of age. Membership in CPQCC is now at 140 units, which accounts for more than 95% of the state's VLBW infants.

The CPQCC, in conjunction with the California Perinatal Transport System, also monitors information for acute neonatal transports. This system has allowed for ongoing research into the quality of care for those neonates that require ongoing intensive care from one

hospital to another hospital during the neonatal period (7-9). The TRIPS score, modified from the Canadian Neonatal Network, gives an indication of clinical status of the transported neonate, and has been used to measure the quality of transport teams (10,11).

Data reports in CPQCC

The current data collection for CPQCC is based largely on standardized data definitions provided by the Vermont Oxford Network. Quality measures that are collected and derived from collected data include: survival without major morbidity, growth velocity, median post-menstrual age at home discharge, antenatal steroid treatment, retinopathy exam at appropriate post-menstrual age, chronic lung disease, and necrotizing enterocolitis. While data are available online with real-time reporting, it has been recognized that the use of these reports varies widely across centers (12). In order to improve usability and uptake, the data center and partners across the state continue to work on improving the interface of the reports (*Figures 2,3*). Consistent collection and report of these data facilitates California's general improvement in perinatal care, giving teams at each hospital the ability to track their own individual progress over time and prioritize initiatives suitable for the population that they serve.

An example of this cycle of data use for quality improvement was reported in the Huffington Post, where Dr. Elizabeth Rogers led a multidisciplinary team in order to reduce intraventricular hemorrhage at the University of California San Francisco (13). This team recognized that

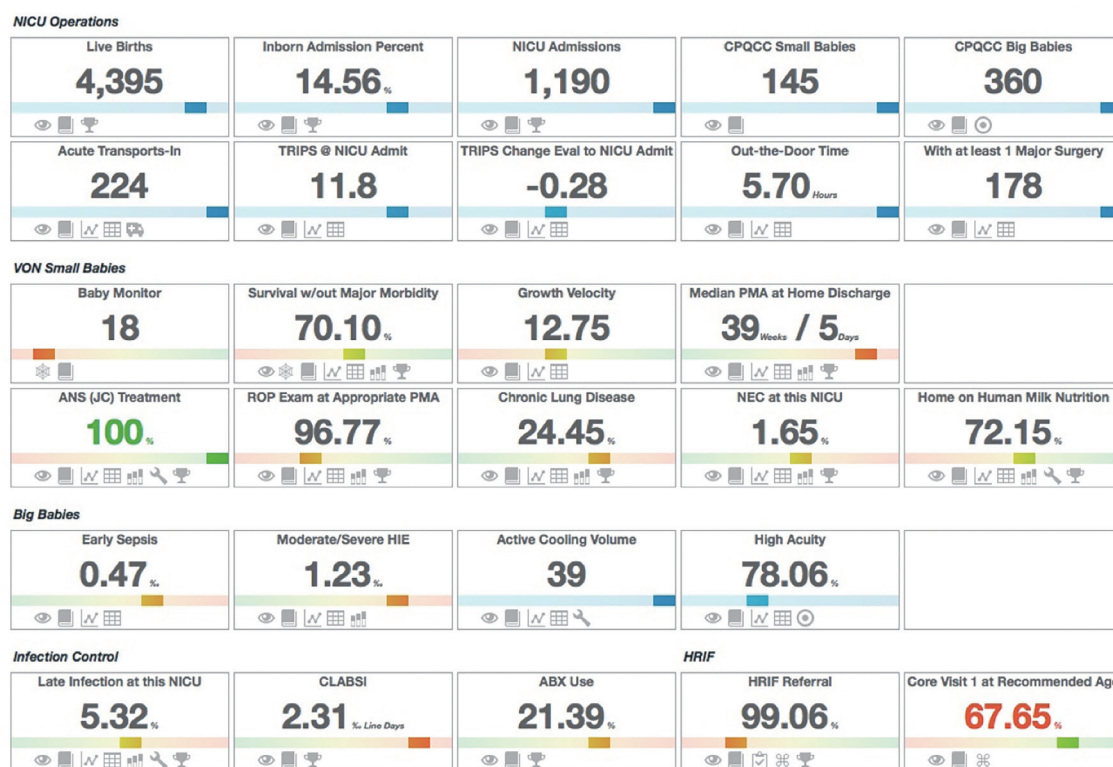


Figure 2 An example of a quality report dashboard on the CPQCC website for a member hospital. CPQCC, California Perinatal Quality Care Collaborative.

their rates of intraventricular hemorrhage in VLBW infants were at nearly four times the rate at other hospitals, and utilized this data collected through CPQCC in order to motivate institutional changes, collaborating with hospital administrators and the medical team, as well as building a training manual, ultimately leading to improved outcomes.

Quality improvement

A large component of the CPQCC's reach has been through quality improvement toolkits that equip healthcare professionals to provide optimal care for patients, using evidence-based research and practical guidance. These toolkits have come to include guides for antenatal steroid treatment for preterm birth, growth and nutrition emphasizing the importance of breast milk, and delivery room management.

Antenatal steroids

Respiratory morbidity, such as respiratory distress

syndrome, is highly prevalent in preterm babies. The administration of corticosteroids to the mother prior to birth has been shown to reduce perinatal death (relative risk 0.69), respiratory distress syndrome (relative risk 0.66), and intraventricular hemorrhage (relative risk 0.54) (14). While the benefit of this therapy has been known for quite some time, the implementation of this practice has been slow in uptake. The CPQCC has worked to provide information for implementation through toolkits, dissemination of quality and performance improvement worksheets (15,16).

The use of antenatal steroids have steadily improved over time in the CPQCC, with those that participated in early quality improvement projects, and those that appear to be in networks that promote quality of care, having had more effective implementation (17,18).

Hypothermia

Hypothermia soon after birth in preterm infants has been recognized as a risk for mortality and morbidity. In California, it was recognized that hypothermia

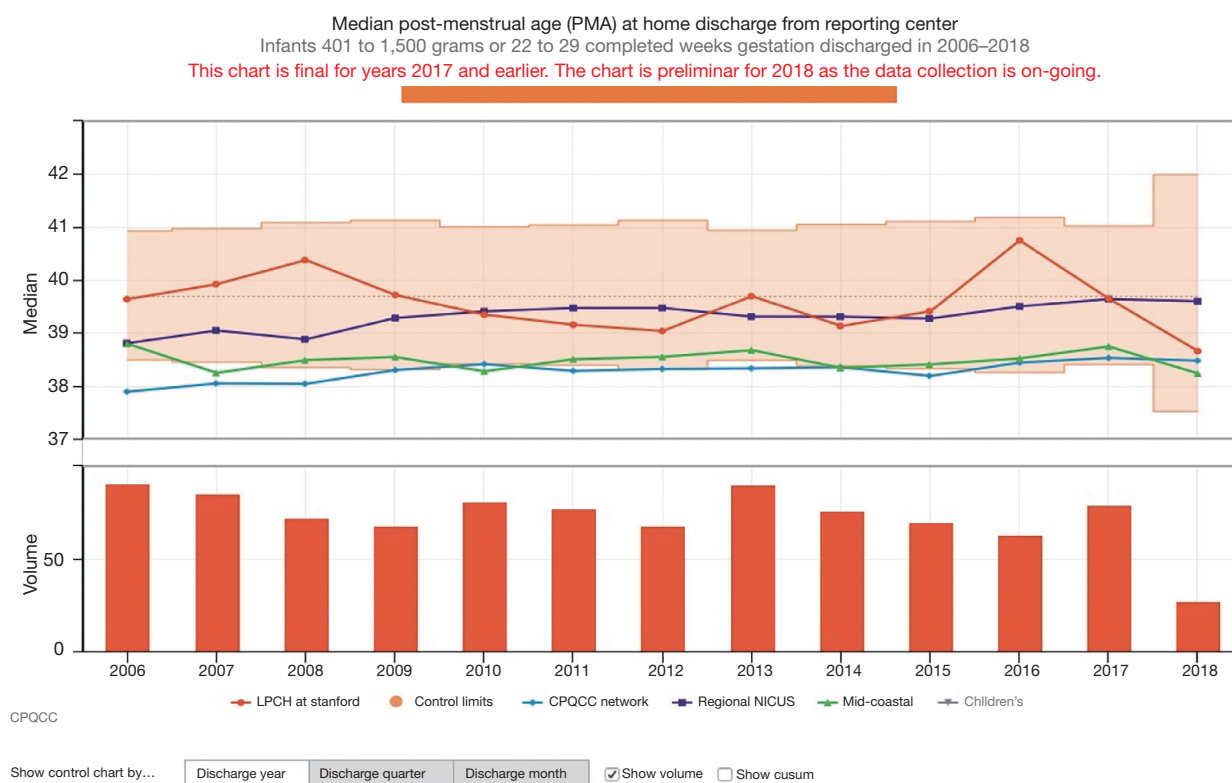


Figure 3 An example of a quality report on the CPQCC website, in which a member hospital may track their progress over time, and in comparison, to other hospitals. In this example, post-menstrual age at discharge is reported for preterm infants. CPQCC, California Perinatal Quality Care Collaborative.

on NICU admission affected a significant number of VLBW infants, up to 40% or more at one time, and had association with increased mortality and intraventricular hemorrhage (19). Through a series of workshops and dissemination of the delivery room management toolkit, there has been a concerted effort to reduce admission hypothermia for preterm infants, both at individual CPQCC centers and through collaborative quality improvement (20,21).

While reducing hypothermia has been a key objective of quality improvement, it is recognized that this is not an isolated activity and that delivery room quality improvement requires a comprehensive team approach (22). In this setting, interventions truly require multi-disciplinary team approaches, as one crucial strategy is to increase operating room environmental temperature, which involves the obstetrics team. Furthermore, the team will also be actively performing other aspects of neonatal resuscitation, which can be impacted by assigning roles and resources for thermoregulation.

Collaboration

While quality improvement science continues to advance, a consistent factor in order to facilitate optimal uptake of interventions in CPQCC has been collaboration. In recognizing that some hospitals may have lower resources and time commitment available from team members, there have been efforts to facilitate less intensive, non-collaborative projects in which CPQCC provides materials and guidance, but does not require regular group meetings, either in-person or remotely. Such initiatives have been less successful than ones in which there was active collaboration across sites.

Collaborative projects in CPQCC have followed a model outlined by the Institute for Healthcare Improvement and includes in-person learning sessions that involve an expert panel and representatives from hospital teams, monthly webcasts, and teamwork training with active data collection and reporting. Collaborative quality improvement in CPQCC has led to gains in breast milk use

with reduction of necrotizing enterocolitis in participating units (23). The delivery room management quality improvement collaborative led to decreased admission hypothermia, decreased intubation in the delivery room, and reduced chronic lung disease in preterm infants (21,24). A collaboration promoting discharge readiness, standardization of apnea and bradycardia monitoring, and optimizing nutrition practices led to reduced length of stay for preterm infants (25).

The collaborative environment in which hospital teams check in with one another periodically on their progress may benefit participants in several ways. One benefit may be motivational, as participation may encourage a friendly competition of sorts amongst hospital teams as they share their data. This may provide an advantage compared to those hospitals that are implementing a new initiative on their own, as they may lack a frame of reference. Furthermore, a motivated leadership team that is consistently learning about an issue, as well as the availability of experts, facilitation of data on progress, are likely to give strength in quality improvement efforts, both for morale and for practical implementation. The CPQCC has found true value in multi-hospital quality improvement.

While collaboration has proven to be of benefit, it has also been recognized that there remain challenges even amongst active collaborative participants. Overall improvement across centers may mask individual centers that do not see gains, and some centers may improve during an active implementation phase, but lack the ability to sustain those gains (25). Qualitative research in team factors that may optimize the ability for quality improvement initiatives to take stronger hold and be sustained are ongoing. Important factors for quality sustainment include a multi-disciplinary team that includes both physicians and nursing leaders that can provide ongoing education, data reporting, and building in the quality processes into daily workflow (26).

Conclusions

There have been and continue to be many lessons learned through statewide collaboration in quality improvement. These lessons have been translated to other state collaborative organizations (27). In California, there is active engagement to further advance quality improvement science through research projects and statewide committees. While many successes have been achieved, there remain significant challenges in order to increase involvement of

all member hospitals, to sustain gains, and reduce racial and socioeconomic disparities. There is optimism that the continued commitment of members and partners across the state will facilitate this progress.

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Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at <https://pm.amegroups.com/article/view/10.21037/pm.2019.10.03/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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