Exemplar Pediatric Collaborative Improvement Networks: Achieving Results

abstract
A number of pediatric collaborative improvement networks have demonstrated improved care and outcomes for children. Regionally, Cincinnati Children’s Hospital Medical Center Physician Hospital Organization has sustained key asthma processes, substantially increased the percentage of their asthma population receiving “perfect care,” and implemented an innovative pay-for-performance program with a large commercial payor based on asthma performance measures. The California Perinatal Quality Care Collaborative uses its outcomes database to improve care for infants in California NICUs. It has achieved reductions in central line–associated bloodstream infections (CLABSI), increased breast-milk feeding rates at hospital discharge, and is now working to improve delivery room management. Solutions for Patient Safety (SPS) has achieved significant improvements in adverse drug events and surgical site infections across all 8 Ohio children’s hospitals, with 7700 fewer children harmed and >$11.8 million in avoided costs. SPS is now expanding nationally, aiming to eliminate all events of serious harm at children’s hospitals. National collaborative networks include ImproveCareNow, which aims to improve care and outcomes for children with inflammatory bowel disease. Reliable adherence to Model Care Guidelines has produced improved remission rates without using new medications and a significant increase in the proportion of Crohn disease patients not taking prednisone. Data-driven collaboratives of the Children’s Hospital Association Quality Transformation Network initially focused on CLABSI in PICUs. By September 2011, they had prevented an estimated 2964 CLABSI, saving 355 lives and $103,722,423. Subsequent improvement efforts include CLABSI reductions in additional settings and populations. Pediatrics 2013;131:S196–S203

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KEY WORDS quality improvement, improvement networks, pediatric care

ABBREVIATIONS
AAP—American Academy of Pediatrics
ADEs—adverse drug events
CCHMC—Cincinnati Children’s Hospital Medical Center
CLABSI—central line–associated bloodstream infections
CPQCC—California Perinatal Quality Care Collaborative
IBD—inflammatory bowel disease
ICN—ImproveCareNow
IHI—Institute for Healthcare Improvement
PHO—physician-hospital organization
QI—quality improvement
QTN—Quality Transformation Network
SPS—Solutions for Patient Safety
VCHIP—Vermont Child Health Improvement Program
VON—Vermont Oxford Network

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www.pediatrics.org/cgi/doi/10.1542/peds.2012-3786F
doi:10.1542/peds.2012-3786F

Accepted for publication Feb 27, 2013

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PEDIATRICS (ISSN Numbers: Print, 0031-4005, Online, 1098-4275).

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Regional and national pediatric collaborative improvement networks have achieved results demonstrating that these efforts can lead to improved care and outcomes for children and families. This article describes 5 such collaborative initiatives that have documented improved outcomes and demonstrate the impact that networks can have on children’s health: the Cincinnati Children’s Hospital Medical Center (CCHMC) Physician Hospital Organization (PHO), the California Perinatal Quality Care Collaborative (CPQCC), Ohio Solutions for Patient Safety (SPS), ImproveCareNow (ICN), and the Children’s Hospital Association Quality Transformation Network (QTN). These exemplars showcase networks that have focused on distinct topics, have targeted health care providers in diverse settings, and have varied funding mechanisms (Table 1). All the pediatricians who participate in these networks and meet the requirements receive the full amount of Part 4 Maintenance of Certification credit from the American Board of Pediatrics.

In addition, we also include brief descriptions of several network initiatives at the state or subspecialty level to highlight the growth of collaborative improvement efforts.

### REGIONAL NETWORKS

**Physician-Hospital Organization Affiliated With CCHMC**

Tri State Child Health Services, Inc is a pediatric physician-hospital organization (PHO) that strives to improve regional, population-based care and outcomes for ∼200,000 children across greater Cincinnati, representing ∼40% of the region’s pediatric population. Created in 1996, the PHO comprises Cincinnati Children’s Hospital Medical Center; Ohio Valley Primary Care Associates, LLC (an independent practice association of community-based pediatric practices); and hospital and community-based pediatric specialists. The PHO launched a large-scale asthma improvement effort in October 2003; this initiative is still active, currently having an impact on nearly 13,000 children with asthma across 40 community-based pediatric practices. Key drivers of improved outcomes that have been sustained include (1) multidisciplinary practice quality improvement (QI) leadership teams; (2) measurable practice participation requirements that are defined each year; (3) practice workflow redesign strategies linked to highly reliable use of a combined asthma decision support/data collection tool during the patient encounter; (4) a Web-based registry that provides practices with “real-time,” actionable patient and practice-level data/reports, transparent comparative practice data on process and outcome measures, and network-level performance reports; and (5) a Web-based asthma decision support tool developed by CCHMC’s Asthma Center, which is based on the National Heart, Lung and Blood Institute asthma centre.

### TABLE 1 Focus, Timeline, Size, and Funding of 5 Pediatric Collaborative Improvement Networks

<table>
<thead>
<tr>
<th>Network</th>
<th>Topic(s)</th>
<th>Date Began</th>
<th>Number of Sites</th>
<th>Location</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician Hospital Organization Affiliated with CCHMC (Tri State Child Health Services, Inc)</td>
<td>Asthma</td>
<td>October 2003</td>
<td>40 community-based pediatric practices</td>
<td>Greater Cincinnati, OH</td>
<td>Annual PHO membership dues</td>
</tr>
<tr>
<td>CPQCC</td>
<td>Perinatal care</td>
<td>1997</td>
<td>131 hospitals</td>
<td>California</td>
<td>David and Lucile Packard Foundation seed funding at inception; State of California, Department of Public Health, Maternal, Child and Adolescent Health Program; yearly participant fees</td>
</tr>
<tr>
<td>SPS</td>
<td>Serious safety events and harm</td>
<td>January 2009</td>
<td>8 in Ohio at inception; expanded nationally to 25 additional hospitals in 2012; 50 additional planned in 2013</td>
<td>Ohio, national spread</td>
<td>Cardinal Health Foundation, Centers for Medicare and Medicaid Services Innovation Center, participant fees</td>
</tr>
<tr>
<td>ICN</td>
<td>IBD</td>
<td>January 2007</td>
<td>43 pediatric gastrointestinal care centers</td>
<td>Nationally and 1 center in London</td>
<td>American Board of Pediatrics Foundation grant, federal grants, participant fees, donations</td>
</tr>
<tr>
<td>Children’s Hospital Association QTN</td>
<td>PICU/CICU CLABSI prevention; hematology/oncology CLABSI prevention; nephrology peritonitis and exit-site infection prevention</td>
<td>2006</td>
<td>90</td>
<td>Nationally</td>
<td>American Board of Pediatrics Foundation grant, federal grants, participant fees</td>
</tr>
</tbody>
</table>
guidelines; (6) automated notification of pediatric practices of emergency department/urgent care visits and admissions occurring at hospitals across the region, supplemented by a formal “root cause” analysis process to identify and address factors underlying asthma exacerbations; and (7) a set of network and practice-level sustainability measures and related improvement interventions. In addition, the PHO implemented an innovative pay-for-performance program with the region’s largest commercial payor in 2004, with rewards based on a combination of network and practice-level performance measures; this effort informed a subsequent publication that described a conceptual model for aligning quality reward programs with large-scale improvement initiatives. The commercial payor partnership has continued and currently involves using all-payor data from the PHO registry to determine practice rewards for the 2 asthma-related measures (flu shot percentage, controller medication use percentage) linked to a community-wide pediatric physician incentive program. The PHO asthma initiative is approved by the American Board of Pediatrics for the Maintenance of Certification program and involves a combination of practice- and physician-level criteria that need to be met for physicians to be awarded credit. Including practice-level criteria has had a powerful effect in promoting and sustaining a focus on system-level change within the pediatric practices. Currently, the percentage of the network asthma population receiving “perfect care,” a composite measure of severity classification, written management plan, and controller medications (if patient has “persistent” asthma), is 94%. The network-level asthma flu shot percentage has increased from a baseline of 22% (2003–2004 flu season) to 67% (2011–2012 flu season). There has also been improvement in population-based outcome measures, including parental work days missed, school days missed, parent confidence in managing asthma, activity limitation, parent and physician rating of asthma control, and decreased cost reflected in significantly lower asthma-related admission and emergency visit rates. Going forward, the PHO is designing interventions to improve outcomes for the broader population of children with special health care needs.

**CPQCC**

Established in 1997 as a regional outgrowth of the Vermont Oxford Network (VON), the California Perinatal Quality Care Collaborative (CPQCC) is a group of public and private leaders in health care who are committed to improving quality and outcomes for perinatal health in California. One hundred thirty-one hospitals are members, representing care for >90% of all very low birth weight infants cared for in California NICUs. The collaborative’s initial focus was the development of a perinatal and neonatal outcomes database that highlighted opportunities for QI and allowed for benchmarking throughout California. CPQCC’s major goal now is to translate the data within the robust CPQCC database into information that supports and promotes QI work statewide. Currently, this improvement focus is being supported by an established and sustained collaborative network of obstetric and neonatal providers, insurers, public health professionals, and business groups that oversees and facilitates benchmarking and performance improvement activities for perinatal care throughout California. Member hospitals submit data to the CPQCC Data Center. The Data Center continues to partner with VON to integrate existing California perinatal databases with VON’s existing national and international data system. CPQCC’s perinatal and obstetrical databases include the automated state birth and death files containing information that complements the current clinical and administrative data set. Data collected by hospitals for the Offices of Statewide Health Planning and Development includes maternal and newborn discharge, rehospitalization, and cost of care information. CPQCC’s organizational structure has been revised to accelerate statewide QI efforts. The Perinatal Quality Improvement Panel, a permanent subcommittee with a committed multidisciplinary membership, defines indicators and benchmarks, recommends QI objectives, and provides models for performance improvement. In addition to improvements achieved with toolkits and associated implementation workshops, the collaborative has transitioned to the Institute for Healthcare Improvement’s (IHI) Breakthrough Series collaborative QI model, and collaboratives have been undertaken for a number of perinatal topics. The first, run January 2008 through February 2009 in 19 CPQCC sites, achieved reductions in central line–associated blood stream infections (CLABSI) ranging from 35.7% to 78.9% in infants of <750 g up to >2500 g. Eleven sites participating in the second collaborative increased breast-milk feeding rates at hospital discharge from 54.6% at baseline to 61.7% during the collaborative intervention period. The rate increased to 64.9% in a subsequent 6-month sustainability period. The third collaborative, launched in June 2011 with 24 NICUs participating, is currently ongoing with a focus on improving delivery room management. The primary outcome metric, percent of resuscitated newborns with normothermia,
has increased from a baseline of 58% to a postintervention mean of 74% of all resuscitated newborns within a targeted body temperature range (Fig 1). All 3 of these efforts have been approved for Maintenance of Certification Part 4 credit.

In parallel, CPQCC is testing an innovative “QI Lite” model, established to support single-site QI efforts, the results of which will be compared with the ongoing IHI collaborative focus on the same topic of delivery room management.

Ohio Children’s Hospital SPS

Patient safety is a leading national health care priority. To begin to address issues of patient safety for Ohio’s pediatric population, in 2009, the 8 Ohio children’s hospitals and the business community launched the Ohio Children’s Hospital SPS collaborative with the aspiration of making Ohio the safest place in the nation for children to receive health care. At the outset, board leaders and CEOs agreed not to compete on patient safety and made a strategic decision to learn from high-reliability industries and apply high reliability organization theory across the collaborative. Shared goals and a common measurement strategy were developed for 2 specific safety areas, adverse drug events (ADEs) and surgical site infections. In addition to specific clinically focused change packages, key drivers for success included senior leadership commitment and participation, the private-public partnership, transparency, and building leadership and QI capacity.

Senior leadership engagement at the participating hospitals was facilitated by a series of 2 site visits during which leaders’ opinions on design of the network were elicited, and SPS staff familiarized themselves with the hospitals’ existing infrastructure relative to QI and safety systems. Quarterly Learning Sessions were initiated, hosted by each hospital in turn. Training has been held for members of participating improvement teams on important QI, safety and leadership topics, including Serious Safety Events and High Reliability Organizational Theory, Error Prevention Behaviors, Common Cause and Apparent Cause Analysis, Leadership Methods, and Sharing Lessons Learned—Good Catches and Learning From Failures. In 2012, the Ohio Business Roundtable and the Ohio Children’s Hospital Association reported that the SPS initiative achieved significant improvements in both ADEs and surgical site infections across all 8 children’s hospitals in its first 24 months. A 60% reduction in surgical site infections and a 34.5% reduction in adverse drug events was observed, resulting in >7700 fewer children harmed in children’s hospitals in Ohio and >$11.8 million in unnecessary health care costs avoided.

![Temperature on admission to the NICU](image)

**FIGURE 1**

Improvement in hypothermia rates in infants admitted to NICU in 24 CPQCC sites between May 2011 and October 2012.
What began as a QI collaborative has become a robust learning network. During 2011, SPS expanded its focus, setting a goal of eliminating all events of serious harm at children’s hospitals across the state by the end of 2015. A Serious Harm Index was developed, which combines the 9 highest priority hospital-acquired conditions for the network hospitals (eg, ventilator-associated pneumonia and significant pressure ulcers). In addition, the network adopted a common measure of serious safety events. Focus on reduction in serious safety events has been shown to facilitate development of high-reliability culture. The network baseline data shows 40 to 50 events each month on the serious harm index; early results show a trend toward reduction for both Serious Harm Index and serious safety events.

Starting in 2012, with support from the Centers for Medicare and Medicaid Services Innovation Center, the network is expanding nationally to children’s hospitals in other states. An additional 25 hospitals have joined in 2012; 50 additional are planned in 2013.

Other Perinatal Efforts

The VON community of practice includes a significant focus on improving clinical outcomes (eg, nosocomial bacterial infection, lung damage) and family-centered care. In addition to CPQCC, 2 other regional perinatal efforts have also achieved nosocomial infection reduction in very low birth weight infants, reduced the incidence of late-onset bacterial infections in preterm infants, and reduced CLABI in NICUs. One of these perinatal networks, the Ohio Perinatal Quality Collaborative, has also documented improved birth outcomes by working with maternity hospitals, resulting in decreased premature births and fewer NICU admissions. Additional perinatal improvement networks have been initiated in Massachusetts, Michigan, North Carolina, and Tennessee. The Pediatrix Medical Group has also successfully undertaken multiple perinatal improvement efforts across their nationwide network of neonatal units.

State Primary Care Improvement Efforts

The Vermont Child Health Improvement Program (VCHIP) began in 2000 with initial support from the National Initiative for Children’s Healthcare Quality. VCHIP is a state population-based child and adolescent health services research and QI program of the University of Vermont that is currently funded by state and federal matching funds. VCHIP provides leadership to the National Improvement Partnership Network, a network of >15 states that have developed state or regional collaborations of public and private partners to advance quality and transform health care for children and their families. These partnerships usually involve the state chapter of the American Academy of Pediatrics (AAP) and state agencies (eg, department of health and state Medicaid). To date, they have engaged primary care practices in a range of topics including developmental and autism screening, asthma, obesity, and patient-centered medical homes.

The AAP Chapter Quality Network provides state chapters with the direct support necessary to lead a QI effort at the primary care practice level. The Chapter Quality Network is building a network of AAP chapters by enhancing their ability to lead QI collaboratives that have achieved measurable improvements in the health outcomes of children, particularly for those with asthma.

NATIONAL NETWORKS

ICN

ICN is an international practice-based improvement and research network, with ~300 pediatric gastroenterologists and 10,000 patients at 43 centers, that aims to improve care and outcomes for children with Crohn disease and ulcerative colitis (inflammatory bowel disease [IBD]). Participating centers strive to identify and enroll all of their IBD patients in a population registry and subsequently collect complete, accurate, and timely data at each visit. They receive electronic semimonthly and monthly reports of their performance on key measures of clinical and data quality performance and can compare their performance to that of other centers and to the entire network.

ICN has developed and implemented a model guideline for consistent and reliable IBD care, based on an integration of evidence and consensus, and an algorithm for nutrition and growth in children with IBD. In addition to the registry and associated data quality and enrollment activities, the major ICN interventions are population management, previsit planning, and self-management support. Participating centers receive ongoing training and development of their teams to build QI skills and capacity. The network has 2 monthly webinars during which teams share progress and changes they are testing, and twice-yearly face-to-face Learning Sessions. With the support of 2 federal grants, ICN is becoming a learning health care system, designing and testing electronic and personal innovations to make care more continuous, collaborative, efficient, and patient- and family-centered and to enable 1-time data entry in the electronic health record. The network has begun a blog, LOOP, and is developing an active social media presence on Twitter and Facebook.

Remission rates for patients at ICN centers have increased significantly without the use of new medications but rather through increased reliability.
and proactive adherence to its Model IBD Care guideline. A 3-year follow-up of 1188 patients from 6 of the initial centers showed that changes in care delivery were associated with an increase in the proportion of visits with complete disease classification, a significant increase in the proportion of Crohn disease patients not taking prednisone (86%–90%), and significant increases in the remission rates of Crohn disease (55%–68%, Fig 2) and ulcerative colitis (61%–72%). Remission rates after 5 years at several centers have increased to 80%.

**Children’s Hospital Association QTN**

The QTN, managed by Children’s Hospital Association (formerly the National Association of Children’s Hospitals and Related Institutions) for its member hospitals, is the largest QI network in pediatrics. As of 2012, 146 units from 82 children’s hospitals are participating; since inception, 171 units from 93 hospitals have participated. QTN engages in data-driven improvement work in “coordinated QI” collaboratives for high-impact topics, including those that have a large affected population and widespread opportunity for improvement. The network’s initiatives are long term, persisting until aims are achieved and improvement sustained, rather than with a predetermined end point.

Initial efforts were focused on preventing CLABSI in the nation’s PICUs by standardizing practice and reliably adhering and monitoring best practices. Participating children’s hospitals implemented a line insertion bundle (primarily physician practice) and a line maintenance bundle (primarily nurse practice) with local adaptations. Local teams, including physicians, infection control preventionists, nurses, and quality coordinators, design new tests of change every 4 to 8 weeks, depending on progress. Monthly, fully transparent data on CLABSI rates and percent compliance with bundle components are collected and reported using standardized measure definitions.

In 29 PICUs participating for the first 3 years, the average aggregate CLABSI rate decreased 56% from 5.2 CLABSIs per 1000 line days to 2.3 CLABSIs per 1000 line days \( (P < .0001) \). This CLABSI rate has continued to decline, to \( \sim 1.0 \) CLABSIs per 1000 line days at present (Fig 3). By September 2011, QTN had prevented an estimated 2964 central line infections, saved 355 children’s lives, and provided estimated cost savings of \$103 722 423. Table 2

![Figure 2](image1.png)

**Figure 2**

Increase in clinical remission rate (percent of patients with inactive disease, excluding those who were diagnosed in past 112 days) among children with IBD in an initial group of 6 care centers participating in the ImproveCareNow Network (July 2007–April 2010).

![Figure 3](image2.png)

**Figure 3**

initiatives with national goals to improve care of whole populations.

**Other National Subspecialty Improvement Efforts**

Several subspecialty or disease-focused pediatric collaborative initiatives exist. The National Initiative for Children’s Healthcare Quality\(^5\) is providing support for the development of 2 national networks: (1) Working to Improve Sickle Cell Healthcare, a portfolio of projects focused on improving the quality of care for individuals with sickle cell disease across the life span, and (2) the Autism Speaks Autism Treatment Network\(^38\).

The National Pediatric Cardiology Quality Improvement Collaborative,\(^59\) sponsored by the Joint Consortium on Congenital Heart Disease, involves 46 pediatric cardiology centers collaborating on a registry database and focused on improving the care and outcomes of infants with complex congenital heart disease.\(^40,41\) The Pediatric Rheumatology Care and Outcomes Improvement Network\(^42\) is an improvement initiative, including a registry database, focused on improving the health and well-being of children with juvenile idiopathic arthritis.

**CONCLUSIONS**

The 5 exemplar pediatric networks described in this article have documented improved health outcomes for children and are representative of a larger body of improvement work. They highlight the successful development and implementation of collaborative networks for improvement and research in various pediatric settings. Collaborative networks that engage patients, families, clinicians, and researchers to change care and outcomes should be accepted as a proven and transforming principle in pediatrics.

### Table 2: Impact of the QTN

<table>
<thead>
<tr>
<th>Data as of May 2012</th>
<th>Infections Prevented</th>
<th>Deaths Prevented</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematology oncology CLABSI Collaborative (across 2 cohorts: 2009, 2011)</td>
<td>280</td>
<td>34</td>
<td>$9,755,990</td>
</tr>
<tr>
<td>Totals</td>
<td>3706</td>
<td>444</td>
<td>$129,737,916</td>
</tr>
</tbody>
</table>

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FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: The conference on which the articles in this supplement were based was funded by the American Board of Pediatrics Foundation, the National Association of Children’s Hospitals and Related Institutions (now the Children’s Hospital Association), the James M. Anderson Center for Health Systems Excellence at Cincinnati Children’s Hospital Medical Center, and the pediatric Center for Education and Research on Therapeutics, supported by cooperative agreement U19HS021114 from the Agency for Healthcare Research and Quality.
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Pediatrics 2013;131:S196
DOI: 10.1542/peds.2012-3786F

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*Pediatrics* 2013;131;S196

DOI: 10.1542/peds.2012-3786F

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