

# Transforming Safety and Effectiveness in Pediatric Hospital Care Locally and Nationally

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## KEYWORDS

- Quality improvement • Transformation • Safety
- Reliability • Measurement • Leadership

Although most pediatric care is provided in the community-based primary care setting, much of the care required by children who have complex and chronic conditions is provided by hospitals,<sup>1</sup> making them a high-priority focus for assessing and improving the safety and effectiveness of pediatric care delivery. Yet, despite significant efforts, national measures of the quality of hospital-based pediatric health care reveal that gaps persist in each of the quality dimensions defined by the Institute of Medicine (ie, safety, effectiveness, timeliness, patient-centeredness, equity, and efficiency).<sup>2</sup>

Achieving dramatic, sustainable improvements in the safety and effectiveness of care for children requires a transformational approach to how hospitals individually focus on improvement and how they learn from each other to achieve national goals. On the basis of the authors' journey at Cincinnati Children's Hospital Medical Center, knowledge acquired from other sites, and national transformation initiatives, this article describes how the following theoretic framework can locally and nationally transform the safety and effectiveness of hospital-based pediatric care.

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## STRATEGIC APPROACH TO QUALITY AND SAFETY

Through a strategic planning effort based on clear direction from the board of directors, hospitals can achieve transformational change in their delivery system. Five steps are recommended: (1) set system-level priorities, (2) match a single measure or family of measures to each system-level priority, (3) identify breakthrough targets for each priority, (4) pilot test interventions to get results, and (5) spread successful interventions throughout the organization.

A strong strategic plan confirms quality as a core business strategy and commits the institution to achieving sustainable breakthroughs in improving clinical outcomes, reducing medical errors, delivering cost-effective care, improving care coordination, and enhancing access to care and timeliness of services delivered.<sup>3</sup> A plan that emphasizes the importance of integrating research with delivery system design to accelerate transfer of new knowledge to the bedside achieves the best medical and quality-of-life outcomes.

Establishing system-level improvement priorities with broad-based input from providers and patients and families is essential; these priorities could be modeled on the Institute of Medicine's six quality dimensions.<sup>2</sup> Examples include access to care, delays in the system, safe care, clinical excellence (including evidence-based care), reduced hassles, team well-being, and family-centered care (**Fig. 1**). Whatever the choice, system-level priorities should be clearly defined and consistently communicated to the entire staff.

A set of system-level measures is linked to each strategic improvement priority. System-level measures reflect performance across the entire organization or system of care, as opposed to measures of project- or condition-specific performance. A parsimonious set of system-level measures is preferable to a large set of highly-specific measures that reflects discrete aspects of hospital performance.<sup>4</sup> Monthly review of system-level measures by senior leadership and the board of directors keeps teams focused and moving forward (**Table 1**).

Underlying the system-level priorities is a horizontal integrating improvement structure that promotes integration across traditional boundaries (**Fig. 2**). System-level improvement priorities are aligned with quality improvement efforts within the academically organized clinical units, with measures and progress toward goals reported to senior leadership on a quarterly basis. Within clinical divisions, performance measures at the individual provider level<sup>5,6</sup> are vertically aligned with the strategic improvement priorities.

Perfection (100% performance and 0 defects) and breakthrough improvement goals reinforce the focus on transformation, as opposed to incremental improvement. Senior leadership designates specific initiatives underlying the strategic improvement priorities and works closely with improvement team leaders to establish annual and quarterly milestone goals linked to aim statements that are specific, measurable, achievable, realistic, and timely.<sup>7</sup> Improvement teams organize their work around 90-day improvement cycles (M. Pugh, unpublished data, 2003) and produce monthly reports that document progress toward goals and describe tests of change.<sup>8</sup>

Beyond transforming care within the local delivery system, there also needs to be a focus on impacting pediatric populations at the regional, state, national, and international levels through strategic partnerships (**Fig. 3**). A few examples from Cincinnati Children's Hospital Medical Center are reviewed in a later section.

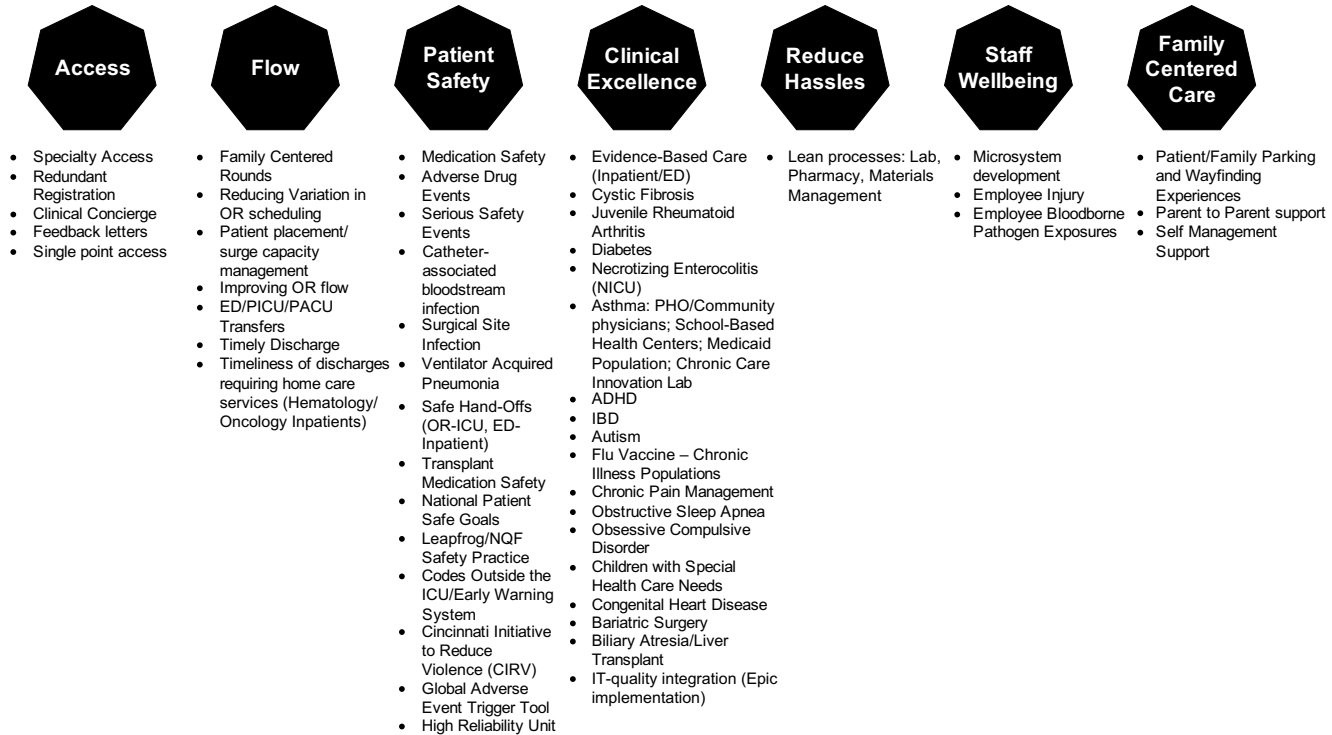
On the basis of this general framework, the authors believe the following key drivers of transformation are essential (**Table 2**).

Strategic Priorities

Current Improvement Projects

## Transformation of a Delivery System

### Strategic Improvement Projects and Teams FY09



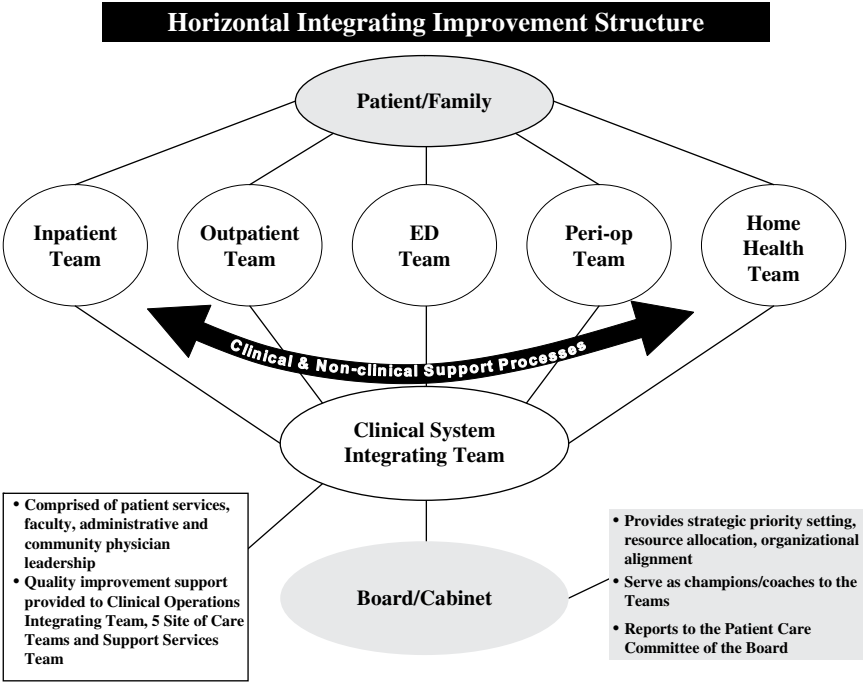
**Fig. 1.** An example of strategic priorities and portfolio of improvement projects at Cincinnati Children's Hospital Medical Center. ADHD, attention-deficit/hyperactivity disorder; ED, emergency department; IBD, inflammatory bowel disease; IT, information technology; NICU, neonatal ICU; NQF, National Quality Forum; OR, operating room; PHO, physician-hospital organization; PICU, pediatric ICU; PACU, postanesthesia care unit.

Table 1 Examples of system-level measures linked to strategic improvement priorities at Cincinnati Children’s Hospital Medical Center		
Strategic Priorities	System-level Measures	Definitions
Access	Third next available appointment	Percentage of outpatient specialty clinics with new patients waiting ≤10 d for the third next available appointment
Flow	Patients who have delays	Percentage of patients delayed in transfers from the emergency department to an inpatient bed (≤1 h), pediatric ICU to an inpatient bed (≤1 h), and postanesthesia care unit to an inpatient bed (≤10 min)
Patient safety	Adverse drug events Bloodstream infection rate Surgical site infection rate Ventilator-associated pneumonia rate Serious safety events Codes outside the ICU	Adverse drug events per 1000 doses (overall; preventable) Catheter-associated bloodstream infections per 1000 catheter days Surgical site infections per 100 procedure days (Classes I and II procedures) Ventilator-associated pneumonias per 1000 ventilator days Serious safety events per 10,000 adjusted patient days; days between serious safety events Codes per 1000 non-ICU patient days (total; preventable)
Clinical excellence	Standardized pediatric ICU mortality ratio Evidence-based care for eligible patients	Actual/expected mortality rate Percentage of patients receiving care according to evidence-based guideline recommendations
Reduced hassles	Touch time for care givers	Percentage of time direct-care providers spend in patient and procedure rooms
Staff well-being	Voluntary staff turnover Accident rate for staff with workdays lost	Percentage of nurses who voluntarily leave Number of work-related injuries/illnesses per 100 full-time employees
Family-centered care	Patient satisfaction	Percentage of respondents who have overall satisfaction rating of 10/10 Percentage of respondents who have overall satisfaction rating of ≤6/10

LEADERSHIP

Leadership is critical to transformation. The Institute for Healthcare Improvement framework for leadership improvement defines five transformation principles: establishing a mission, vision, and strategy; building a foundation for an effective leadership system; building will; generating ideas; and executing change.<sup>9</sup>

Although the best ideas for innovation come from the front lines, leadership provides the will and support to accomplish the goals. Key roles of leadership are to establish system-level strategic improvement priorities and related measures; demonstrate a commitment to values and actions that accelerate system transformation (eg, transparency, patient and family as the locus of control); communicate the business case for quality; understand and manage the inherent risks (eg, transparency); and maintain a high level of accountability for results.



**Fig. 2.** An example of a clinical system improvement integrating structure at Cincinnati Children’s Hospital Medical Center. ED, emergency department; Peri-op, perioperative.

Transformation can be accelerated by the board of directors’ full commitment to transparency, by establishing improvement as the core business strategy, by requiring progress updates relative to annual safety and quality goals, and by ensuring the availability of resources to achieve goals. The board chair and senior leadership team make rounds on inpatient units to learn first-hand about issues and challenges; each board meeting begins with an update on safety issues and sentinel events, including a review of root cause analyses and actions taken; and a portion of the chief executive officer/management’s compensation is tied to achieving goals for strategic improvement priorities.

**BUILDING WILL**

Relative to building will for transformation, a sense of urgency shared among providers, patients and families, and policymakers is essential.<sup>10</sup> This sense of



**Fig. 3.** Organizing for quality and transformation.

<b>Table 2</b> <b>Key drivers of organizational transformation with examples of interventions from Cincinnati Children's Hospital Medical Center</b>	
<b>Key Driver</b>	<b>Interventions</b>
Leadership	Delivery system goals defined in strategic plan Annual review of strategic improvement priorities Vertical alignment of system-level measures throughout the organization Quarterly review of system-level measures Cabinet champions on improvement teams Monthly meeting of the Patient Care Committee of the board to review progress on quality initiatives Chief financial officer leads business case for quality efforts Incentive compensation linked to strategic improvement priorities/goals
Building will	100% performance and 0 defect goals Quarterly review of projects by external experts Physician academic track for quality improvement
Transparency	Internal transparency of monthly reports for strategic improvement projects External transparency of system-level measures
Business case for quality	Financial impact from reducing hospital-acquired infections (eg, surgical site infections, ventilator-associated pneumonia, catheter-associated blood stream infections)
Patient/family engagement	Family Advisory Council Parents on improvement teams Family faculty: parents working full-time on quality and transformation Parents on board committees
Infrastructure: quality improvement and data analysis	Centralized and department-based quality improvement experts Use of statistical process control methods Clinical system improvement infrastructure to address horizontal integration across boundaries Evidence-based practice teams
Improvement capability	Intermediate improvement science training program Advanced improvement methods training program Quality improvement training program for residents Quality improvement fellowship program
Reliability and standardization	Learning from other industries (eg, industrial engineering principles, human factors science) Learning from innovators (eg, Agency for Healthcare Research and Quality; Institute for Healthcare Improvement high-reliability network) Microsystem-based approach to improvement High-reliability inpatient unit Error-prevention training

urgency is created by communicating the organization's vision, mission, values, and expectations to all employees in a way that energizes, guides, and focuses them and allows them to assess their personal role in the transformation change process. Newsletters, "town hall" meetings, presentations, storyboards and posters, personal letters from senior leaders to all staff, postings on the intranet and internet sites, annual reports, and special brochures are used to accomplish this goal.

## TRANSPARENCY

Internal transparency has a powerful effect in raising the level of collective accountability for quality and transformation. Improvement data, including organizational scorecards, graphic displays of process and outcome measures, and monthly reports for strategic improvement initiatives, are made available to all employees by way of an intranet site. For example, at Cincinnati Children's Hospital Medical Center, the intranet home page features a patient safety tracker that is updated daily and indicates the number of days since the last serious safety event. Extensive information on safety initiatives is posted, including details of actual safety events and lessons learned through root cause analyses. The patient safety officer also communicates with all employees on a weekly basis through a journal posted on the intranet.

Regarding external transparency, system-level measures, measure specifications, and links to other sites where data are publicly reported (eg, the Leapfrog Group, the Joint Commission) are available on a hospital's public Web site.

## BUSINESS CASE FOR QUALITY

Lack of a "business case for quality" (ie, improved financial outcomes as a result of investing in quality improvement<sup>11,12</sup>) is often cited as a major barrier to committing to transformational change.<sup>13</sup> Documenting the internal business case for quality is important to inspiring and sustaining improvement efforts from an individual hospital perspective, whereas articulating the external business case for quality is essential to recruiting support for improvement from purchasers and commercial and governmental payors. Independent validation of the financial impact of quality improvement efforts by the hospital finance team is important.

The board of directors must truly believe that quality improvement is essential to long-term success and viability, with board decisions regarding budgeting and capital allocation linked to providing demonstrably better, safer care for patients and families. At the same time, there must be a firm belief that better care also makes good business sense. Improvement initiatives have been shown to reduce costs, increase demand, promote more efficient use of scarce hospital resources, generate higher margins, and offer families improved overall value. For example, the authors found that, on average, the length of stay for each patient who had a preventable surgical site infection is increased by 10.6 days (15.0 days versus 4.4 days for children who do not develop a surgical site infection);<sup>14</sup> avoiding these infections would have resulted in an additional 1 million dollars per year in revenue through increased bed capacity for other patients.

## ENGAGING PATIENTS AND FAMILIES

The patient and family as the locus of control is key to transformation. Patients and families help drive priorities and refocus the system on what matters most. Full commitment to the following areas is essential to successful transformation: (1) having patients and families involved on all improvement teams to ensure their values and perspectives are incorporated into the design of the care delivery system, to keep teams focused on priorities important to patients, and to promote the role of families as active advocates and partners; (2) full transparency of outcomes data for populations; and (3) allowing patients and parents to access the medical record. Parents participate on board committees and serve as advisors to improvement teams. With patients and families as equal partners, even the most reluctant participants can be persuaded to change and resistance can be overcome.

## INFRASTRUCTURE

Responsibility for quality should be embedded into line management, rather than a separate quality structure or council. Improvement teams are accountable for achieving goals and are co-led by a physician and a nonphysician, with patient or parent involvement or a combination of the two. There is a persistent, intense focus on improving outcomes. Monthly reports document progress and include annotated run and control charts;<sup>15</sup> descriptions of Plan-Do-Study-Act (PDSA) cycles<sup>8</sup> accelerate the pace of change. Monthly meetings with the senior leader champion keep teams focused on data, PDSA cycles, and achieving 90-day goals. The senior leader champion also helps teams overcome organizational barriers, obtain resources, foster energy for change, and plan for spread to other parts of the organization. Improvement teams must be supported by a robust infrastructure that includes highly skilled and experienced quality improvement consultants and decision support analysts (who have at least a master's degree) who can effectively mine data and develop predictive models to drive improvement.

## IMPROVEMENT CAPABILITY

To transform care delivery, a hospital needs leaders and staff who have improvement capability. Advanced improvement training programs (eg, Intermountain Healthcare<sup>16</sup>) help build a strong critical mass of improvement leaders. To sustain progress and accelerate the pace of cultural change, however, it is important to rapidly increase the number of individuals who have expertise in leading and executing improvement initiatives. To accomplish this, hospitals need to develop their own intermediate and advanced improvement programs to prepare staff to execute and teach improvement science and to lead improvement teams. For academic institutions, the use of improvement science methods, including planned experimentation, factorial designs, and control charts to understand common and special-cause variation, is critical.<sup>17</sup> When quality improvement is not fully embraced as a science, discipline and will can be lost and coalitions can degrade. Integrating improvement science with pediatric residency programs and establishing a quality improvement fellowship program are vital to ensuring that the next generation of clinicians has the quality improvement knowledge and skills to improve care delivery and patient outcomes.

## RELIABILITY AND STANDARDIZATION

In health care, reliability is defined as the measurable capability of a process, procedure, or health service to perform its intended function in the required time, under commonly occurring conditions.<sup>12</sup> Weick and colleagues<sup>18</sup> identified five characteristics common to organizations that practice high reliability. Leaders are *preoccupied with failure* and extract the maximum learning from each failure, flaw, and near miss. There is a *reluctance to simplify interpretations*; instead, diverse opinions and experiences are embraced. High-reliability organizations are *sensitive to operations*; with a high level of situational awareness, they recognize that successful frontline operations are key to failure prevention. High-reliability organizations are *committed to resiliency*, with an increased ability to predict and respond to potential errors; they also believe that issues should be addressed as close to the front line as possible, with deference to local expertise in times of crisis (*underspecification of structures*). The principles of reliability science can be used to prevent failures, to identify and mitigate the impact of failures that inevitably occur, and to redesign the system to prevent future failures.<sup>17,19</sup>



## RELIABILITY EXAMPLES FROM CINCINNATI CHILDREN'S HOSPITAL MEDICAL CENTER

The following examples demonstrate how this framework for transformation can be used to improve safety (such as reducing surgical site infections and ventilator-associated pneumonias [VAPs]) and to achieve highly reliable delivery of evidence-based care for common, important conditions. These examples were selected to emphasize the alignment of improvement initiatives with system-level priorities and measures.

### *Application of Evidence for Common Conditions*

The system-level priority target in this instance is clinical excellence: providing evidence-based care. The system-level measure is a composite measure of the percentage of patients receiving care according to evidence-based guideline recommendations for five common conditions (bronchiolitis, acute gastroenteritis, fever of uncertain source, acute exacerbation of asthma, and community-acquired pneumonia). The leadership champion for two teams (one in the emergency department and one for inpatient care) is the chief of staff, a practicing physician. A quality improvement consultant and a data analyst provide 1 to 1.5 days of support each week. The goal is to improve the reliability of care delivery and to achieve 95% compliance with guideline recommendations.

The most fundamental step toward high reliability is standardizing key processes and decision making. Through education forums (eg, presentations at medical and nursing grand rounds and resident teaching conferences), educational materials (eg, posters and pocket cards with guideline summaries), and companion documents and tools (eg, electronic order sets, clinical pathways, parent versions of the guidelines, discharge goals, discharge instruction sheets, and education records)<sup>20</sup>, the authors' institution achieved 82% adherence to key guideline recommendations.<sup>21</sup> To increase adherence, the authors used a quasi-experimental approach to examine the separate and combined effect of two interventions—a clinical protocol and a method to identify and mitigate failures. The clinical protocol gave nurses and respiratory therapists permission to administer appropriate evidence-based recommendations for guideline-eligible patients. No physician order was required to initiate the protocol; of note, a physician order was necessary if the protocol was not followed. Thus, the desired action was the default. The second intervention designated a charge nurse to identify guideline-eligible patients each shift. When a guideline-eligible patient did not receive care according to the guideline recommendations, the nurse identified the cause and attempted to remedy or mitigate the situation by speaking with the staff or physician assigned to the patient, thus identifying and preventing a potential error. The composite measure of compliance increased to 92% with the “identify and mitigate” strategy, with sustained results.

### *Reducing Ventilator-associated Pneumonias*

The system-level priority is improving patient safety. Reliable application of evidence is the key to decreasing VAPs. The improvement team was co-led by the medical director of the pediatric ICU, an intensivist. The project was modeled as an internal learning collaborative between all the hospital ICUs, led by respiratory therapists on each unit and supported by a quality improvement consultant and a data analyst. Ambitious targets were set.<sup>22</sup> A key driver diagram (**Fig. 4**) was created to clarify and prioritize improvement interventions. Interventions were designed using reliability principles, with the goal to achieve 95% for the composite measure of the care bundle. The VAP rate dropped from a baseline average of 5.6 infections per 1000 ventilator days to 0.3 infections per 1000 ventilator days over a 9-month period.<sup>22</sup>

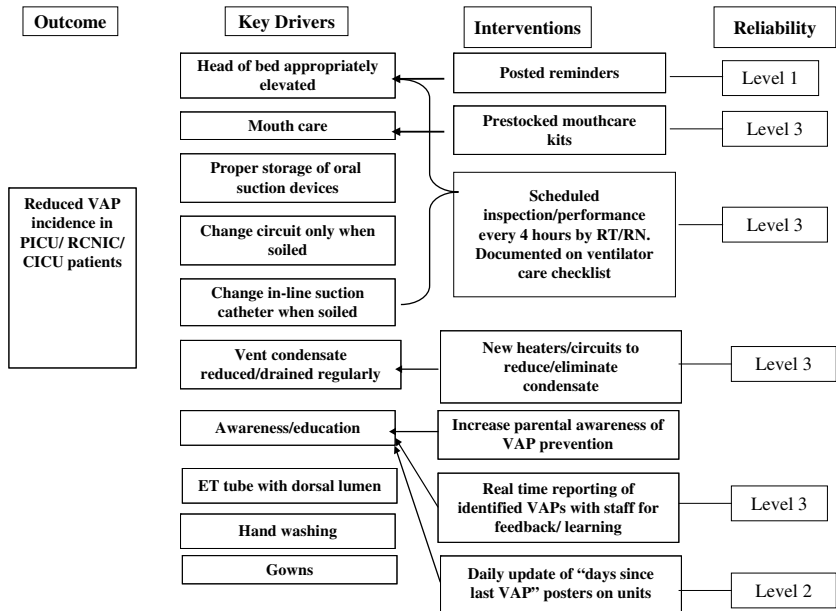


Fig. 4. Key driver diagram for reducing VAPs at Cincinnati Children’s Hospital Medical Center. CICU, cardiac ICU; ET, endotracheal tube; PICU, pediatric ICU; RCNIC, Regional Center for Newborn Intensive Care; RT/RN, respiratory therapist/registered nurse.

Linking system transformation, ambitious goals, and the use of reliability and improvement science, and executing with a robust improvement infrastructure and the laser-like focus of leadership, can lead to dramatic improvements in safety and evidence-based care. All of the components described earlier must be executed with a sense of urgency and a relentless pursuit of perfection to dramatically improve quality and safety.

TRANSFORMING CARE AT THE NATIONAL LEVEL

Transformation at individual sites is important; however, national evidence of poor performance requires us to work across hospitals to make care safer and more effective at all locations.

Hospitals providing pediatric care have a strong history of participating in multihospital improvement collaboratives, of supporting development of national quality measures (eg, asthma measures endorsed by the Joint Commission<sup>23</sup> and pediatric patient safety indicators developed by the Agency for Healthcare Research and Quality<sup>24</sup>), and of advocating for public policy changes at the state and national levels that promote efforts to measure and improve care to children.

Although these efforts are impressive in terms of scope and results achieved, moving national, system-level measures toward near-perfection goals will require more than hospital participation in a series of project-specific improvement collaboratives. Improving national system-level measures will require each hospital to pursue its own transformation journey and, at the same time, collaborate across hospitals and other organizations. To maximize success, the following issues need to be addressed: (1) creating a sense of urgency for improvement and raising the level of collective

accountability for improving quality measures at the national level,<sup>25</sup> (2) providing leadership for improvement at the board, senior-leadership, and management levels, (3) enhancing improvement capability and capacity, (4) increasing the level of patient and parent engagement, (5) documenting the business case for quality, and (6) pursuing a supportive policy environment.

Aligning efforts across organizations committed to quality and transformation is essential. An example of an integrating force in this regard at the national level is the Alliance for Pediatric Quality<sup>26</sup>, a collaboration among the American Academy of Pediatrics, the American Board of Pediatrics, the Child Health Corporation of America, and the National Association of Children's Hospitals and Related Institutions. A high-priority focus for the Alliance for Pediatric Quality is to raise the level of collective accountability for achieving near-perfection, transformational goals by defining a core set of national quality measures for pediatric care. Recognizing the complexity involved with establishing national system-level measures and near-perfection goals, the Alliance for Pediatric Quality can build on other national quality measurement development efforts (eg, the National Initiative for Children's Healthcare Quality, the Child and Adolescent Health Measurement Initiative, the National Quality Forum, the Agency for Healthcare Research and Quality, the Joint Commission, the Ambulatory Quality Alliance, the Hospital Quality Alliance, and the American Medical Association Physician Consortium for Performance Improvement). Potential system-level measures for assessing the quality of hospital-based care for children across the United States are shown in **Table 3**.<sup>4</sup>

#### **CREATING URGENCY: THE NEED TO GO PUBLIC**

A sense of urgency that is shared among providers, patients and families, and policy-makers is essential to successful transformation at the national level.<sup>10</sup> This sense of urgency can be created by establishing a core set of measures that document the current state of quality of care within and across hospitals caring for children. Hospitals can proactively embrace this opportunity to take the lead in establishing the "national scorecard" and can communicate progress achieved in improving the system-level measures to various stakeholder groups, including the public-at-large, purchasers, payors, and government entities. Strong leadership from the Alliance for Pediatric Quality and each hospital is essential to documenting the current state of quality and will entail at least the following steps: (1) supporting standardized reporting among hospitals, (2) establishing a centralized data source to support comparative performance reporting and to meet private- and public-sector reporting requirements, and (3) committing to internal and external transparency of aggregate and comparative hospital data. Transparency will have a powerful effect in elevating the level of collective accountability for quality of care at the national level; in addition, the variation in comparative performance will fundamentally change the nature of how hospitals learn from each other and interact at all levels (eg, board, senior management, frontline care givers, parents/patients).

#### **SUPPORTIVE PUBLIC POLICY ENVIRONMENT**

Hospitals providing pediatric care are dramatically improving quality and safety, but these efforts would be greatly enhanced by a far more supportive policy environment. Although this is true for improvement initiatives for all populations, it is particularly salient for children due to the heavy reliance on publicly financed care (eg, Medicaid and the State Child Health Insurance Program [SCHIP]). The necessary federal and state authority and the attendant improvement capacity in terms of staff, expertise, and resources within

<b>Table 3</b> <b>Potential system-level measures for assessing the quality of hospital-based care for children across the United States (based in part on the Institute of Healthcare Improvement's Whole System Measures)</b>	
<b>Institute of Medicine</b>	
<b>Quality Dimension</b>	<b>National System-level Measure</b>
Safe	Adverse events: overall, drug-related, inpatient, outpatient
Effective	Standardized mortality ratio: overall, ICU
Effective	Composite measure of functional outcomes for populations that have chronic conditions
Effective	Composite measure of reliability of evidence-based care delivery: inpatient, emergency department, ICU
Effective, Safe	Nosocomial infection rates: catheter-associated bloodstream infections, surgical site infections, VAPs
Effective, Safe	Codes outside the ICU
Effective	Readmission rate
Effective	Admission rates for ambulatory-sensitive conditions
Patient/family centered	Satisfaction: inpatient and outpatient
Timely	Days to third next available appointment: primary care, specialty care
Efficient	Bed turnover rate
Efficient	Health care costs per capita
Efficient	Risk-adjusted cost per discharge
Efficient	Care giver time with patient/family
Efficient	Composite measure of delay in patient transfers: emergency department, postanesthesia care unit, ICU
Equitable	Above measures stratified by payor and race/ethnicity

*Data from* Institute of Medicine, Committee on Quality Health Care in America. Crossing quality chasm—new health system for the 21st century. Washington, DC: National Academy Press; 2001; and Martin L, Nelson E, Lloyd R, et al. Whole system measures. IHI innovation series white paper. Available at: <http://www.ihl.org/IHI/Results/WhitePapers/WholeSystemMeasuresWhitePaper.htm>. Accessed January 20, 2009.

Medicaid and SCHIP are insufficient compared to Medicare.<sup>27</sup> Although some progress can be made under current rules, congressional action is needed to provide these authorities and resources to Medicaid and SCHIP. The time for action is now because both of these programs are undergoing significant scrutiny and changes.

### SUMMARY

Hospitals providing pediatric care are uniquely positioned to accelerate improvement and achieve transformational goals for populations within and beyond their walls. The strong history of collaboration among hospitals providing pediatric care, especially children's hospitals, sets the stage for successfully transforming care at a national level; however, a parsimonious set of system-level measures, a collective commitment to ambitious goals, a clear business case for quality, and transparent comparative data are essential to create a sense of urgency and to drive change. A strong leadership commitment to accelerate the transformation journey within and across hospitals delivering pediatric care is crucial.

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