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Use of a Pediatric Cardiovascular Nursing Consortium for Development and Evaluation of Quality Measures: The C4-MNP Experience

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Background: The evidence linking nursing care and patient outcomes has been globally demonstrated. Thus, it is time for translation and application of this evidence to robust measurement that uniquely demonstrates the value of nursing care and the characteristics of the nursing workforce that contribute to optimal patient outcomes.

Objective: The aim of this study was to identify and develop standardized measures representative of pediatric nursing care of the cardiovascular patient for benchmarking within freestanding children's hospitals.

Methods: Using a consensus-based approach, the Consortium of Congenital Cardiac Care-Measurement of Nursing Practice (C4-MNP) members developed quality measures within working groups and then individually critiqued all drafted measures. Final draft measures were then independently reviewed and critiqued by an external nursing quality measurement committee. The final quality measures were also made available to a national parent support group for feedback.

Outcomes: The development process used by C4-MNP resulted in 10 measures eligible for testing across freestanding children's hospitals. Employing a collaborative consensus-based method plus implementing the criteria of the National Quality Forum and external vetting period provided a strong framework for the development and evaluation of standardized measures.

Next Steps: The Consortium will continue with implementation and testing of each measure in 9 of our 28 collaborating centers. This activity will support initial development of benchmarks and evaluation of the association of the measures with patient outcomes.

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Background and Problem Statement

The evidence linking nursing care and patient outcomes has been globally demonstrated (Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Cho et al., 2015; Hickey, Gauvreau, Curley, & Connor, 2013; Ma, McHugh, & Aiken, 2015). The next mandate is for translation and application of this evidence to robust measures that uniquely demonstrate the

value of nursing work and the characteristics of the nursing workforce that contribute to optimal patient outcomes. The absence of nurse-sensitive measures is particularly apparent in the field of pediatric nursing. The characteristics of this patient population necessitate specialized nursing care that historically has not been well delineated or evaluated (Curley & Hickey, 2006; Lacey, Klaus, Smith, Cox, & Dunton, 2006). Within the field of pediatrics, care for children with cardiac diseases is even more specialized, requiring a highly-skilled nursing staff with the knowledge and

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experience necessary to manage a complex and fragile population of patients.

To address this specialized care and quality measurement, we created the Consortium of Congenital Cardiac Care-Measurement of Nursing Practice (C4-MNP) by recruiting nurse leaders with clinical, administrative, and research expertise from pediatric cardiovascular programs across the United States. The goal of C4-MNP was to establish a national collaborative to identify nursing care actions or measurement in the complex pediatric cardiovascular care environment. The first step or phase I to accomplishing this broad objective was to learn the current state of pediatric cardiovascular nursing measurement (structure, process, and outcome measurement) in freestanding children's hospitals across the country (Connor, Mott, Green, Larson, & Hickey, 2016).

In the initial phase I qualitative study, nurse experts from pediatric cardiovascular programs participated in in-depth interviews about their existing quality measurement practices and the challenges they faced in documenting and evaluating the quality of nursing care within their programs. At the time of these interviews, there were 43 freestanding children's hospitals with cardiovascular programs that had annual volumes of greater than 50 cases. Nursing directors from each of these programs were invited to participate, and 20 responded. These programs had a median annual congenital heart defect repair volume of 279 cases (range: 107–806). In many cases, the program director was the nurse leader who was interviewed, but in other cases, alternate nurse leaders participated. All of the leaders interviewed had decision-making authority for nursing practice within their programs and were at the manager level or above.

Each interview was conducted using a semi-structured interview guide by two doctorally-prepared nurse researchers and audio-recorded for subsequent transcription. After each interview, the researchers conducted a debriefing to discuss initial interpretations and generate questions that could inform subsequent interviews. During the analytical phase, interview transcripts were coded by members of the research team, and these codes were used to generate broader themes. To ensure the integrity of the analytical process, the team returned to six of the participants for member-checking of the generated codes and themes.

The findings revealed variable practices across the country, universal difficulty generating cardiovascular-specific measures, and an inability to effectively evaluate existing measures due to the lack of national benchmarks. Many of the repeated concerns related to the need to ensure that knowledgeable, experienced nurses were available in sufficient numbers to deliver necessary care to patients and families, particularly during periods of program growth (Connor et al., 2016). Nurse leaders verbalized the importance of cardiovascular nursing-focused measurement to help justify optimal staffing models in the current environment of cost reduction and capacity needs. Measures encompassing experience, education, and retention were

perceived as key for benchmarking. The quality of the work environment, adult-based care, patient/family-centered care, nutrition, pain management, prevention of device related pressure ulcers, and clinical deterioration were additional items highlighted as priority areas for measurement (Connor et al., 2016). Participants were asked about their interest in continuing involvement in the consortium and were encouraged to identify additional nurses from their sites with clinical and/or measurement expertise who would be willing to engage in the consortium's activities. Using the information gained in this study, the phase II activities described below focused on measurement development for each of the seven topics areas as well as an internal and external review of the proposed measures.

Intended Improvement and Study Question

The objective of C4-MNP phase II work was to identify and develop standardized measurement representative of pediatric nursing care of the cardiovascular patient for benchmarking within freestanding children's hospitals.

Methods

Setting

C4-MNP is a collaborative forum with representation from freestanding pediatric hospitals in the United States. Boston Children's Hospital serves as the lead site and is responsible for the coordination of consortium activities and data management. The membership of C4-MNP includes nursing administrators, clinical nurse specialists, researchers, and bedside clinicians. As the work of the consortium was disseminated, additional members were added. The 28 programs currently participating are listed in Figure 1 and have a median annual volume of 324 congenital heart defect repairs (range: 167–943). Recognizing that care of the pediatric patient is a synergy between nurse and family, the consortium partnered with the national parent support group Mended *Little* Hearts. The parent partners from Mended *Little* Hearts provided insight about family concerns and expectations. In addition, they helped to critique developed measures and generate ideas for future measure development.

Planning the Intervention

Phase II began in fall 2013 with the dissemination of the results of the phase I work via an all-site conference call. Over 40 leaders from across the sites participated in the call and committed to active involvement in the consortium's continued work. These leaders included nurses from a variety of roles within their programs, ranging from clinical nurse specialists responsible for the quality of clinical care on an individual unit to directors with oversight of an entire cardiovascular program. The themes from phase I generated discussion about areas of focus for measurement development and aided in the formation of workgroups. Utilizing member consensus, participants identified and agreed on

Site Name	Location
Advocate Children's Hospital	Chicago, IL
All Children's Hospital	St Petersburg, FL
Ann & Robert H Lurie Children's Hospital of Chicago	Chicago, IL
Arkansas Children's Hospital	Little Rock, AR
Boston Children's Hospital (Lead Site)	Boston, MA
Brenner Children's Hospital	Winston-Salem, NC
Children's Hospital Colorado	Aurora, CO
Children's Hospital Los Angeles	Los Angeles, CA
Children's Hospital of Philadelphia	Philadelphia, PA
Children's Healthcare of Atlanta at Egleston	Atlanta, GA
Children's Hospital of Pittsburgh	Pittsburgh, PA
Children's Hospitals and Clinics at Minneapolis	Minneapolis, MN
Children's Medical Center of Dallas	Dallas, TX
Children's National Medical Center	Washington, DC
Cincinnati Children's Hospital Medical Center	Cincinnati, OH
Doernbecher Children's Hospital, Oregon Health and Science University	Portland, OR
Johns Hopkins Children's Center	Baltimore, MD
Lucile Packard Children's Hospital at Stanford	Palo Alto, CA
Miami Children's Hospital	Miami, FL
Nationwide Children's Hospital	Columbus, OH
Nemours/Alfred I. duPont Hospital for Children	Wilmington, DE
Phoenix Children's Hospital	Phoenix, AZ
Primary Children's Medical Center	Salt Lake City, UT
Rady Children's Hospital San Diego	San Diego, CA
Golisano Children's Hospital, University of Rochester Medical Center	Rochester, NY
Riley Hospital for Children	Indianapolis, IN
Texas Children's Hospital	Houston, TX
University of Michigan C.S. Mott Children's Hospital	Ann Arbor, MI

Figure 1 C4-MNP participating sites.

seven key topic areas that required further work. These topics were: (1) clinical deterioration, (2) care of the adult CHD patient, (3) patient and family-centered care, (4) nutrition, (5) pain management, (6) prevention of pressure ulcers, and (7) work environment for nursing staff. Work continued via seven smaller working groups. Consortium members were encouraged to participate in one or more working groups. The project lead and a quality improvement specialist coordinated working group communication and facilitated measurement development. The quality improvement specialist was an MPH-prepared, CPHQ-certified employee of the lead site who had responsibility for that program's quality improvement initiatives.

Each of the seven workgroups adopted one of these topic areas and met monthly to review available literature and current practice. The initial meetings helped to establish the state of the science and current mechanisms for measurement for each topic of interest. Based on these findings, the individual measures and corresponding measurement plans were developed between November 2013 and March 2014. A template for development of the measurement plan was provided for each group in order to promote standardization and to ensure the comprehensive formation of each measure. As part of the development process, the type of measure and Institute of Medicine quality domain (safe, effective, timely, efficient, equitable, and/or patient and family-centered) were identified. Measures were classified as

structure, process, outcome, or balancing. Balancing measures are those that are tracked to ensure that the pursuit of improvement in one domain does not result in unintended consequences in other domains. Each workgroup also identified the background/rationale, operational definition, data collection and sampling method, data analysis and display, and potential target score for each measure (Figure 2). A final requirement for the workgroups was to provide supportive references for each measure, in order to help the consortium at large evaluate the existing evidence base for the measure. Each workgroup drafted a series of measures related to their topic, with the understanding that each measure would need to fulfill measurement criteria prior to pilot testing. Any measure that did not meet that standard would be returned to the respective groups for further development.

Methods of Evaluation

In April 2014, 28 draft measures from across the seven topic areas were presented by the project lead to the consortium members. During this session, each member was able to offer a verbal critique and suggestions for further modifications. Discussion centered on feasibility of the proposed measure, scientific rigor, relevance, and potential for it to be automated within the electronic medical record to support abstraction of measurement data.

Title	
Measure	
Type	<input type="checkbox"/> Outcome <input type="checkbox"/> Process <input type="checkbox"/> Balancing
IOM Domain	<input type="checkbox"/> Safety <input type="checkbox"/> Efficient <input type="checkbox"/> Effective <input type="checkbox"/> Equitable <input type="checkbox"/> Timely <input type="checkbox"/> Patient Centered
Background/Rationale	
Definition	Numerator – Denominator – Inclusion criteria – Exclusion criteria –
Data Collection & Sampling Method	
Data Analysis	
Data Display	
Target	<input type="checkbox"/> External <input type="checkbox"/> Internal Indicate target (ex: 100%, 50%, etc.)
Sources/References	
Last Updated	

Figure 2 Quality measurement template.

Consortium members then participated in an online survey to evaluate the measures using the National Quality Forum (NQF) criteria (National Quality Forum, 2009). Each measure was scored on the following elements: evidence; performance gap and priority; reliability and validity; feasibility; usability and use; comparison to related or competing measures; and the ability to automate data collection. Additionally, each survey participant gave the measure a final recommendation. The possible choices for this recommendation were to move to pilot testing, return the measure to working groups for additional revisions, or discontinue development of the measure. The evaluation criteria used for each measure are shown in Figure 3. Each participating program was allowed to complete one survey to represent the collective opinion of their program’s consortium participants, and 18 of the then 22 active sites completed the survey. After compiling the results of these surveys, 11 of the total 28 measures that emerged from the workgroups met criteria for pilot testing, based on a high overall score of ≥ 20 and strong internal endorsement $\geq .65$ of the measure (Table 1). The remaining 18 measures were returned to the working groups for further development.

Recognizing the need for an additional layer of robust evaluation, the consortium next sought feedback from external audiences with a key stake in the measurement of pediatric cardiovascular nursing care quality and/or expertise in the development and testing of pediatric nursing quality measures. The initial round of external evaluation was conducted by the Boston Children’s Hospital Nursing Measurement Committee, a hospital-wide standing committee charged with oversight of nursing quality measurement. The committee is comprised of nurse scientists, nursing administrators, clinical nursing leaders, and quality improvement specialists. The committee members reviewed each of the proposed measures individually and provided feedback that was incorporated into the final measures. This committee’s largest area of concern was with the topic of clinical deterioration. Two measures had met criteria from the membership review expert consensus process related to this topic: one on use of early warning scores and another on unplanned transfers to the intensive care unit. Concerns were raised about the definition of unplanned transfer and the usefulness of that construct as a measure of quality. Unplanned transfers are not necessarily a measure of poor

Measurement Evaluation Form				
Evidence, performance gap, and priority (impact)- Importance to measure and report	Not Applicable	Weak	Moderate	Strong
Reliability and Validity-Scientific acceptability of measure properties	Not Applicable	Weak	Moderate	Strong
Feasibility	Not Applicable	Weak	Moderate	Strong
Usability and Use	Not Applicable	Weak	Moderate	Strong
Comparison to Related or Competing Measures	Not Applicable	Weak	Moderate	Strong
Ability to Automate Data Collection (Site-Specific)	Not Applicable	Weak	Moderate	Strong
Final Recommendation	Discontinue development of this measure	Return measure to working groups for further revisions	Proceed with pilot testing	
Comments	(Free text)			

Figure 3 Quality measurement evaluation criteria (based on National Quality Forum criteria).

quality, if they occur in a timely manner that helps the child to receive necessary care. Feedback from the committee led to the creation of a combined measure for this domain; the new measure evaluates use of an early warning score to facilitate appropriate and timely interventions aimed at preventing further clinical deterioration.

During the course of the workgroup-based measure development, several members recognized the opportunity to elevate the consortium's work by involving patients and families. This is consistent with a growing movement towards full incorporation of patients and families into all aspects of care design and delivery, research, and quality improvement efforts. Consortium leaders from Boston Children's Hospital leveraged a developing relationship with Mended *Little* Hearts, a national support group for patients with congenital heart disease and their families, to incorporate patient and parent representatives into the consortium. In a series of calls beginning in November 2014, a group of 10 Mended *Little* Hearts members learned about the consortium's work, reviewed the measures that had been accepted from the expert consensus process, and provided feedback about the relevance of the identified measures to their experience as healthcare consumers and as families dealing with congenital heart disease. The patient/parent participants immediately validated the importance of the proposed measures, highlighting the ways each of the identified topics impacted their experience in the inpatient setting. Using a process similar to that undertaken by members of the consortium, the wider membership of Mended *Little* Hearts was invited to complete a survey wherein they could rank the importance of the measure in terms of the greatest impact on their or their child's care. They were also invited to offer suggestions about other measures that they would like to see designed and implemented for evaluation. There were 55 survey participants, representing patients/parents from across the United States. The largest proportions of participants came from the South and Pacific regions of the country (26.8 and 25%, respectively). No additional demographics were collected

from the patient/parent participants, since the goal of this activity was to solicit feedback from a convenience sample of engaged parents, rather than to assure adequate representation and generalizability. Survey participants had a wide variety of suggestions for further measurement development, ranging from discharge and home care education to sleep during the hospital admission. These suggestions have been recorded for integration into subsequent phases of measurement development as the work of the consortium continues.

Outcomes

The process yielded 10 measures eligible for testing across freestanding children's hospitals. Consistent with much of the discussion from cardiovascular nurse leaders during the initial phase I qualitative study [19], five of the measures are structural and focus on the quality of the work environment, including a measurement of the relative health of the environment, level of nursing education, years of nursing experience, specialty certification, and retention. These measures can be seen as foundational to high-quality nursing practice and are therefore a logical starting point for the development and implementation of quality measurement within this specialty.

The remaining five measures are patient-focused process, outcome, and balancing measures and reflect important aspects of pediatric cardiovascular nursing care. Two of the measures address post-surgical neonatal and infant feeding, and the remaining measures evaluate detection of clinical deterioration, timely and effective pain management, and prevention of device-related pressure ulcer development.

The Mended *Little* Hearts parent survey respondents identified three top measures impacting their children's care. Interestingly, these were the measures of years of nursing experience, nurse staffing retention and utilization of early warning scores (Figure 4). While there was not direct feedback as to why the members identified these three measures as highest impact, some of the free text comments focused on the importance of their nurse's clinical expertise

Table 1 Quality measurement internal evaluation results.

Rank	Measure	Evidence/ impact	Reliability and validity	Feasibility	Automate data collection	Usability and use	Comparison to related measures	Total aggregate score	Average recommendation
1	Device-related pressure ulcers	3.8	3.6	3.6	3.5	3.8	3.5	21.9	0.91
2	BSN education	3.8	3.8	3.8	3.5	3.7	3.4	21.8	0.83
3	Health of work environment	4.0	3.7	3.6	3.5	3.5	3.3	21.6	0.91
4	Certification	3.7	3.7	3.8	3.4	3.7	3.4	21.6	0.83
5	Early warning score	3.7	3.7	3.5	3.5	3.5	3.5	21.4	0.91
6	Weight gain within 72-hours of discharge	3.8	3.6	3.5	3.5	3.5	3.2	21.2	0.91
7	Staff retention	3.7	3.5	3.5	3.5	3.5	3.3	21.1	0.83
8	Nursing experience	3.7	3.6	3.6	3.3	3.5	3.2	21.0	0.83
9	Pain scores decreased in 120 minutes	3.5	3.5	3.4	3.5	3.6	3.3	20.8	0.67
10	Emergent, unplanned ICU transfer	3.5	3.5	3.4	3.2	3.4	3.2	20.2	0.71
11	Safety of feeding	3.7	3.7	3.3	3.1	3.2	3.0	20	0.83
12	Standardized patient hand-off	3.6	3.4	3.2	3.2	3.3	3.2	19.9	0.77
13	Adverse events in pain management	3.5	3.5	3.2	3.2	3.5	3.2	19.9	0.77
14	Patient/family-centered rounds	3.6	3.5	3.4	2.9	3.5	3	19.8	0.77
15	Staff certification in adult CPR	3.4	3.5	3.4	3.2	3.2	3.1	19.7	0.71
16	Documentation of nutrition	3.5	3.3	3.5	3.3	3.2	2.7	19.6	0.91
17	Frequency of errors in adult medications	3.3	3.4	3.2	3.2	3.3	3.1	19.5	0.77
18	Clinical inquiry	3.4	3.3	3.2	3.1	3.5	3.2	19.5	0.71
19	Adult care bundle	3.5	3.4	3.1	2.9	3.1	3.1	19.1	0.71
20	Pain prevention	3.25	3.2	3.3	3.1	3.3	3	19	0.56
21	Readiness to feed	3.5	3.3	3.3	3	3.1	2.8	18.9	0.83
22	G-tube at discharge	3.1	3.1	3.3	3.1	3.2	3	18.8	0.71
23	Preparation for transition	3.5	3.2	3	2.8	3.4	2.8	18.8	0.71
24	Healthcare proxy/guardianship documented	3.1	3.1	3.2	3.1	3	2.9	18.3	0.53
25	Transition to oral pain medication	3.25	3.1	3.1	2.9	3	2.8	18.2	0.56
26	Escalation of care	3.2	3.1	2.9	2.8	3	2.9	17.9	0.71
27	Access to adult resources	3	2.8	3	2.8	2.9	2.7	17.3	0.63
28	Continuity of care	3	3	2.8	2.8	2.7	2.7	16.9	0.5

Scoring: 1 = not applicable, 2 = weak, 3 = moderate, 4 = strong.

and their ability to recognize early changes in their child's condition as opposed to other members in the room. The inclusion of patients and families into the measurement review allowed for feedback about the relevance of the identified measures to their experience as healthcare consumers and as families caring for their child with congenital heart disease.

Conclusions

The results of this process yielded 10 measures eligible for testing across freestanding children's hospitals. The utilization of a collaborative, consensus-based method that incorporated the NQF criteria and an external review period provided a strong framework for standardized measurement development and evaluation.

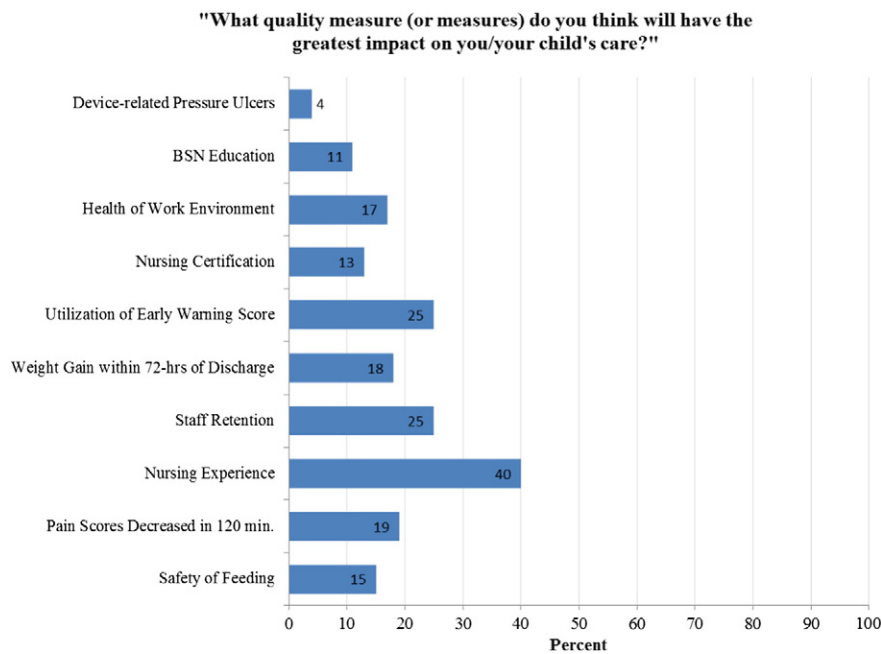


Figure 4 Quality measure results from Mended *Little* Hearts Parent Survey.

Implications for Practice

The field of pediatric nursing is in need of measures that accurately capture the unique care provided to patients and families and that demonstrate the impact of this care on outcomes. The work of C4-MNP provides a model by which such measures can be designed, implemented, and tested, using a collaborative approach that builds upon the knowledge and expertise of nurses from across the country and a variety of practice settings. The inclusion of patients and families in this process is an innovative, critical component that helps to ensure the relevance of the developed measures.

Next Steps

Consortium phase III work will continue with implementation of each measure in 9 of our 28 collaborating centers. Given the pilot nature of phase III, the consortium asked for volunteers for this phase; the group of centers who have volunteered has representation from across the United States and includes programs of varying sizes and compositions. This phase will also support initial development of benchmarks, and evaluation of the association of the measures with patient outcomes. In partnership with patient and family collaborators from Mended *Little* Hearts, the consortium will also continue to develop additional measures relevant to pediatric cardiovascular nursing practice.

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