Received: 28 May 2019 | Revised: 5 June 2019 | Accepted: 16 June 2019

DOI: 10.1111/chd.12821

NURSES FORUM

Congenital Heart Disease WILEY

Alternative approach to pediatric cardiac quality assessment for low-volume centers

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Abstract

Background: In pediatric cardiac care, many centers participate in multiple, national, domain-specific registries, as a major component of their quality assessment and improvement efforts. Small cardiac programs, whose clinical activities and scale may not be well-suited to this approach, need alternative methods to assess and track quality.

Methods: We conceived of and piloted a rapid-approach cardiac quality assessment, intended to encompass multiple aspects of the service line, in a low-volume program. The assessment incorporated previously identified measures, drawn from multiple sources, and ultimately relied on retrospective chart review.

Results: A collaborative, multidisciplinary team formed and came to consensus on quality metrics pertaining to 3 chosen areas of clinical activity in the program. Despite the use of multiple different data sources and the need for manual chart review in data collection, a rich assessment of these program components was completed for presentation in 6 weeks.

Conclusions: While small programs may not participate in the spectrum of cardiac care registries available, these same centers can benefit from them by adapting some of their validated metrics for use in internal, self-maintained quality reports. Our pilot of this alternative approach revealed opportunities for improved quality assessment practices; the product can serve as a baseline for future prospective assessment and reporting, as well as longitudinal internal benchmarking.

KEYWORDS

congenital heart disease, health care quality assessment, outcomes assessment, pediatric hospitals

1 | BACKGROUND

1.1 | Context

The utilization of structured quality measurement and reporting tools enriches our understanding of pediatric cardiac care and can improve patient outcomes. Important quality measures have been developed through professional societies or national quality improvement collaboratives. As an example, quality in ambulatory pediatric cardiac care has been the focus of the American College of Cardiology's Adult Congenital and Pediatric Cardiology (ACPC) Quality Network, whose endorsed metrics form the basis of a web-based data collection and reporting platform.[1,2] Examples of established cardiac procedure-based registries include the Society for Thoracic Surgery (STS) National Database and the IMproving Pediatric and Adult Congenital Treatments (IMPACT) catheterization

Registry.[3,4] Participation in these registries plays a vital role in allowing many US centers to track performance over time, benchmark internally and relative to peers, and guide improvements. Despite these benefits, participation in even the most penetrant clinical registries is not universal.[5] It bears noting that these large registries typically contain volumes of information on specific areas of program activity, but may be inefficient for small programs attempting to gain understanding of overall cardiac program quality.

1.2 | Problem

Cardiac programs with limited scope of services, low-volume procedural programs (ie, those performing fewer than 70 surgeries annually), or exclusively ambulatory services, may have different quality profiles than larger ones and may be disadvantaged when developing a comprehensive quality program.[6-8] At large centers, a cumulative approach to assessing quality across the entire cardiac service line can be accomplished by participating in a number of the aforementioned domain-specific registries. As the most prevalent registries are largely procedure- and inpatient-based (surgery, catheterization, invasive electrophysiology, intensive care), they may return little value to the many programs/practices which are exclusively or predominantly ambulatory. When small programs do participate, limitations of sample size in individual registries may lessen the ability to draw statistically robust conclusions. Furthermore, smaller programs may be at risk for insufficient, or inconsistent, resources to participate in multiple domain-specific registries. Thus, we perceived a need for a single, comprehensive quality assessment capable of reflecting the full range of activities in a small program.

2 | METHODS

2.1 | Initial approach

A longstanding, low-volume cardiac program at an urban academic center with a children's hospital-within-a-hospital organization sought to conduct a rapid, comprehensive, quality assessment. The program had not previously participated in the larger, domain-specific registries, despite procedural activity. We intended to identify a single set of quality measures encompassing all aspects of care within the scope of the program, rather than investing in multiple separate, resource-intensive domain-specific registries. Ultimately, the product would constitute an efficient dashboard with which to gain visibility to overall program quality.

A group of three experienced cardiology providers and the Pediatric Medical Director of Quality met and agreed upon the goal of performing a rapid, unified, cardiac quality assessment for the purpose of reporting internally. The scope of the immediate project was discussed and was informed by the providers' first-hand knowledge of the specifics of cardiac services. Information was shared about published sources of evaluable metrics in pediatric cardiac practice, and from these sources, specific measures were concisely reviewed. The work group began selecting and discussing relevant measures, focusing initially on cardiac surgical services, catheterization services, and the ambulatory clinic. Potential areas for expansion, such as fetal echocardiography and invasive electrophysiology measures were discussed as areas for second-stage expansion of the project. Early in this process, the team recognized the need to engage a broader group of stakeholders (cardiology, cardiac surgery, cardiac anesthesia, the pediatric intensive care staff, and pediatric nursing leadership).

In general, the formal quality training of the clinical group involved in designing and conducting the exercise was variable, and fairly basic. Thus, they were guided by quality improvement methodology provided by the Pediatric Medical Director of Quality. Much of the work to complete the report ultimately relied on the core group, who completed the vast majority of the chart review, with intermittent supplemental help from support staff.

2.2 | Identification of measures

The team relied heavily on published metrics endorsed by STS, the National Cardiovascular Date Registry (NCDR),[9-11] and the American College of Cardiology (ACC).[2] A brief review of these metric sources is provided.

For the surgical services, we drew from the STS Congenital Heart Surgery Database. According to the June 2016 report, more than 95% of centers in North America with programs for surgical management of pediatric and congenital heart disease participated.[3] This registry calculates operative mortality rates risk adjusted for patient and procedural variables. Observed and adjusted mortality rates are reported overall, and by group based on complexity categories (STAT category) as recognized by the STS and the European Association for Cardiothoracic Surgery (STS-EACTS). In addition to outcome measures, the STS also collects center-specific data on care processes. These process measures address program characteristics such as the availability of specific services (eg, extracorporeal membrane oxygenation) and utilization of recognized best-practices (eg, multidisciplinary review).

For catheterization services, we referenced the Improving Pediatric and Adult Congenital Treatments (IMPACT) registry, which collects information regarding patients undergoing hemodynamic or interventional cardiac catheterization procedures enrolled at participating congenital cardiac programs.[4] Patient- and procedure-specific data, including adverse events and radiation dose, are entered voluntarily on all cases. Center-specific benchmark reports can be reviewed internally and allow comparison with a national aggregate. For our quality report, we selected IMPACT outcomes and modified them slightly based on knowledge of the case types performed at our center. We chose to capture 2 additional outcomes, pulse loss, and its management. Program characteristic metrics constituted the remainder of the catheterization module.

With regard to ambulatory services, we referred to the list of 18 measures established by Chowdhury and colleagues and included

in the larger list of ambulatory measures currently endorsed by the ACC's ACPC Quality Network.[1,2] A fundamental principle of the metric development work conducted by the ACPC Ambulatory Pediatric Cardiology Group was that metrics should target areas of practice in which the metrics could be supported by evidence-based guidelines or widespread consensus. The field of candidate measures was significantly limited by the paucity of guidelines or consensus regarding ambulatory pediatric cardiac practice, particularly that practice relevant to a general ambulatory population free of major cardiac disease. The initial 18 metrics were focused on 5 clinical domains; 4 of which pertained only to patients with established cardiac diagnoses (eg, those at endocarditis risk, or with Kawasaki disease, tetralogy of Fallot, or transposition of the great arteries). In the practice environment of our current quality exercise, the majority of patients evaluated were ineligible for these domains, ie, had no known heart disease. Thus, the 5 ambulatory metrics we selected for attempted data collection were drawn from either the 5th domain (chest pain) or from 8 additional general measures later endorsed by the ACPC.

In summary, a total of 52 candidate measures were selected for potential data collection: 49 from the components of these reference registries (27 surgical, 20 catheterization, and 5 ambulatory), and 3 metrics (1 surgical and 2 catheterization) which were identified by participating clinicians to be of interest in our center.

2.3 | Data collection

Following metric selection, we prepared for chart review and data collection. First, it was necessary to tabulate and validate procedural volume, since this had not previously been centralized. Surgical volume included all operations performed by the institutional pediatric cardiac surgical service (excluding chest closure, wound washout, ECMO cannulation). Next, we consulted a wide variety of sources to maximize capture: clinical group calendars, booking schedules, providers' procedural logs, minutes of critical care peer review meetings, and administrative reports. All cases initially identified through any of these sources were then verified by chart review. Among verified surgical cases, we further categorized to a STAT level according to STS/EACTS specifications. The use of this established classification system allowed analysis of complication rates by STAT category in the surgical quality assessment. Catheterization volumes included minimally invasive procedures performed by the pediatric invasive cardiology providers in the fluoroscopy suite (excluding drain placements).

Prior to conducting the outcomes assessment, the quality director and one of the clinical content experts created a data dictionary, specifically defining the events of interest. The team initially set out to identify outcome measures by searching billing/administrative data for outcomes of interest by International Classification of Diseases (ICD) code. However, when we attempted to validate these reports through chart review and by review of other sources such as peer review records, it became apparent that ICD coding alone was not sufficient to identify certain post-procedural events.

Thus, we relied on manual chart review, performed by a team of 4 individuals, (a cardiology nurse practitioner, a cardiac surgical physician assistant, an experienced catheterization technologist, and the Medical Director of Quality) as our gold standard in outcome assessment and identification of adverse event occurrences). Following initial review, the quality director audited 10% of the charts read by other providers to ensure consistency of review. In the event of discrepancy, or when content questions arose, the medical director and the appropriate clinical content expert discussed directly to arrive at consensus.

2.4 | Iteration and pivots

Strategies were adopted to expedite acquisition of certain data elements. For example, when conducting chart review for surgical patients, variables such as postoperative length-of-stay, and 7- and 30-day readmission rates were obtained by searching note-type (discharge, admission) within a specified date frame. In contrast, determination of the percentage of patients complication-free at 60 days postoperatively required more focused content review within inpatient records. In some instances, we chose to forego assessment of specific outcome measures due to the practical time and resource constraints of our rapid review. Within the STS registry, timing of perioperative antibiotic administration and verification of weight-appropriate dosing are recorded. However, given the need for manual search through multiple documents, we elected not to attempt collection of dose times, or to re-verify weight and calculate doses as part of our review.

Assessment of ambulatory measures proved to be uniquely challenging. Though we initially selected 5 ambulatory metrics, we retained only 3 after chart review: measurement of body mass index (BMI), provision of counseling with regard to BMI, and adverse events with sedated pediatric echocardiography. The primary obstacle to the collection of ambulatory metrics was the variability of outpatient encounter documentation, which generally consisted of free-text fields within notes. For example, identification of patients with *exertional* chest pain (the denominator of a diagnostic metric) would have required extremely close and consistent reading of each note and some subjective interpretations of the degree of exertion associated with activities. Incomplete documentation and lack of contextual historical information are well-recognized limitations of ambulatory quality metric development and negatively impact feasibility. To avoid resource-intense exhaustive chart review, some centers have adopted small-sample audit approaches with success. Alternatives utilizing automatic electronic data capture from large volumes of records may be feasible at some centers with sufficient IT support.[12]

We initially experienced difficulty in locating data on the sedated pediatric echocardiography metric. Comments on clinical events were not routinely included in the cardiology documentation, or in the echocardiogram reports. Through our efforts to identify these events, we became aware of, and then were given access to, an anesthesia departmental quality database. This prospectively accumulated database ultimately proved a valuable source of information regarding the clinical course during the diagnostic studies performed with sedation or anesthesia.

TABLE 1 Included metrics by domain

Domain	Source	Measure
Surgery-Program	STS	Participation in a national database for pediatric and congenital heart surgery
		Multidisciplinary rounds involving multiple members of the healthcare team
		Total surgical volume for pediatric and congenital heart surgery
		Surgical volume for pediatric and congenital heart surgery stratified by the five STAT Mortality Categories
		Surgical volume for ten pediatric and congenital heart benchmark operations
		Multidisciplinary preoperative planning conference to plan pediatric and congenital heart surgery operations
		Use of an expanded pre-procedural and post-procedural time out
		Regularly scheduled Quality Review to occur no less frequently than every 2 months
		Event Review to occur no less frequently than every 2 months
		Availability of intraoperative TEE and epicardial echo
Surgery-Outcomes	STS[a]	Length of stay
		Postoperative length of stay
		7-day readmission rate[a]
		30-day readmission rate
		Occurrence of new postoperative renal failure requiring dialysis
		Occurrence of new postoperative neurologic deficit persisting at discharge (stroke)
		Occurrence of vocal cord dysfunction
		Occurrence of arrhythmia necessitating permanent pacemaker insertion
		Occurrence of diaphragm paralysis
		Occurrence of need for ECMO
		Occurrence of cardiac arrest during or following procedure
		Occurrence of chylothorax
		Occurrence of wound infection
		Occurrence of unplanned reoperation or interventional catheterization procedure within same admission
		Occurrence of unplanned reoperation or interventional catheterization procedure within 2 months
		Operative mortality
		Free of mortality and major complications
Catheterization-Program	IMPACT	Total volume
		Volume of interventional catheterization cases
		Pediatric cardiac catheterization conference (not currently in existence, but plan to fold in with surgical planning conference)
		Regularly scheduled quality review to occur no less frequently than every 2 months (cardiac QI committee)
		Event review to occur no less frequently than every 2 months (recommend future pediatric cardiology M and M)
Catheterization-Outcomes	IMPACT[b]	Occurrence of CPR
		Occurrence of ECMO
		Mortality
		Occurrence of arrhythmia requiring cardioversion
		Occurrence of arrhythmia requiring defibrillation
		Occurrence of arrhythmia requiring medication
		Occurrence of arrhythmia requiring temporary pacemaker
		Occurrence of arrhythmia requiring permanent pacemaker

(Continues)

TABLE 1 (Continued)

Domain	Source	Measure
		Occurrence of new post procedure neurologic deficit persisting at discharge (stroke)
		Occurrence of device complication (malposition, embolization or thrombus)
		Occurrence of unplanned cardiac surgery
		Total radiation dose
		Occurrence of unplanned vascular surgery
		Occurrence of pulseless limb (>48 hours no pulse)[b]
		Occurrence of pulseless limb requiring discharge on anticoagulation[b]
Ambulatory	ACC	Proportion of patients, 3-18 years old, who had their BMI measured and BMI percentile calculated
		Proportion of patients, 3-18 years old, with a BMI greater than 85% who received appropriate counseling
		Adverse events with sedated pediatric echocardiography

[a]7-day readmission rate was included in this assessment, though not specified by STS.
[b]metrics regarding occurrence of pulseless limb were included in this assessment, though not specified by IMPACT.

3 | RESULTS

Following record review, we retained all of the surgical and catheterization metrics, but only 3 ambulatory measures. Retained surgical and catheterization metrics included 17 outcomes and 10 programs, and 15 outcomes and 5 programs, respectively (see Table 1).[2,10,11]

Despite the need for manual chart review and the challenges we faced, we were able to complete a broad, overall quality assessment over roughly a six-week period. Within months of the initial conceptualization of our project, a quality dashboard was created consisting of procedural volumes, surgical volumes by STAT category, programmatic capability/process characterization, and outcome measures, including adverse events. This information set could be presented in a structured fashion to summarize program activity and comment on quality. When possible, data were discussed in light of published, national benchmarks. In sharing the product of our work, we emphasized two important limitations: (a) comparison with other centers was not possible, aside from reference to publicly available data and (b) interpretation of our own center's data should be considered in light of the relatively small numbers of included events. We advocated use of our tool internally, over time, to track trends and to create a structure for prospective quality documentation and data collection.

4 | DISCUSSION

In a low-volume pediatric cardiac center, a multidisciplinary team successfully conceived of and performed a retrospective review of quality measures across the cardiac service line, in a short time, with limited resources. Our quality report owed much to the published approaches of large, established registries. While small volume centers may face challenges in interpreting outcome data due to low volumes, it is precisely the limited scope and volume of services in these centers which allows this type of manual exercise to be conducted.

Due to the fact that we did not have an established prospective data collection system within our cardiac program, we relied heavily on retrospective chart review. Supporting activities such as formal peer review of adverse events and standardization of documentation were identified as facilitators of accurate and comprehensive data collection. Our experience highlighted the importance of laying the groundwork for prospective quality documentation and monitoring in the future.

Characteristics of outpatient documentation limited our ability to fully develop the ambulatory portion of the quality assessment. Ambulatory cardiac programs may benefit most from prospective identification and structured documentation of predetermined outcome measures, chosen to align with the program's quality goals. However, effective implementation of ambulatory metrics depends on a host of resources, many of which may not be readily available in some low-volume settings. In a description of BMI metric quality improvement at a single, large-volume site, Hartwell et al noted the need to engage physician and nurse champions, dieticians, quality improvement specialists, parent focus groups, and information technologists, among others. This resource demand, though potentially well rewarded by improved quality, will prove a challenge at many centers.[12] A comprehensive listing of the challenges to implementation of each of the endorsed ambulatory metrics is provided on the publicly available website.[2]

Our exercise had clear limitations. In the interest of generating an assessment within a short time frame, we prioritized surgical, catheterization, and ambulatory services. Two examples of areas for further development include invasive electrophysiology services and fetal echocardiography. We chose not to include some metrics and program areas for which retrospective data collection could be complicated, or prohibitively time-consuming. Within the

areas we examined, we were confined to those readily abstracted retrospectively from the electronic medical record. The fact that we had four team members conducting chart review introduced the potential for variability in the data collection. However, to mitigate that risk, we created a standardized data dictionary and audited 10% of all charts.

5 | CONCLUSION

In pediatric cardiac care, many centers utilize participation in national registries to pursue quality improvement. Inclusion in these registries may require investment in the form of participation fees, retention of data-entry and reporting vendors, software acquisition, and/or additional human resources. Nonparticipating centers, often smaller or with less-developed quality infrastructure, may be constrained by limited resources, but must independently assess programmatic quality nonetheless. In the current exercise, a cardiac quality exercise was completed, and a curated, dashboard-type report was created for internal use in a small program. The assessment was constructed to utilize many measures drawn from existing published tools. The challenge of assessing quality in small volume programs is not unique to pediatric cardiology. A similar approach may be considered for small volume programs in other subspecialties and procedural services. Going forward, this alternative approach to quality assessment can be developed further by testing its use in small programs with varied constitutions and capacities. Additional metric sets, such as those considered but deferred early in our exercise, can be developed. In the future, there may be opportunities for small volume programs to collaborate and facilitate external benchmarking of quality data.

COMPLIANCE WITH ETHICAL STANDARDS

This article does not contain any studies with human participants or animals performed by any of the authors.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest with the contents of this article.

AUTHOR CONTRIBUTIONS

Amy Delaney, MSN, RN, CPNP-AC/PC is the primary author for this paper. All authors listed are part of the multidisciplinary team who were core members of the concept/design and data analysis/interpretation for the exercise described in this manuscript. The primary author drafted the article, and all were integral to the critical revision of article, adding to the content of quality expertise, and all authors approved content of the article.

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How to cite this article: Delaney AE, Dadlez NM, Marshall AC. Alternative approach to pediatric cardiac quality assessment for low-volume centers. *Congenital Heart Disease*. 2019;14:665–670. https://doi.org/10.1111/chd.12821