IMPROVING APPENDECTOMY OUTCOMES USING ADVANCED ANALYTICS AND TEAM STRUCTURES

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In this article...
Learn how Texas Children's Hospital in Houston, developed a robust population health analytics platform for appendectomy care.

IMPROVING APPENDECTOMY CARE HAS PROVEN to be an important — and successful — initiative for Texas Children's Hospital in Houston, the nation's largest pediatric care facility. A not-for-profit organization consistently ranked among the top children's hospitals in the nation, Texas Children's has long been committed to delivering high-quality care.

Yet, as with most health care organizations across the nation, the hospital found it challenging to quantify patient outcomes, quality improvements and the subsequent cost savings. Amid the transformation of the reimbursement system from fee-for-service to value-based payments, these measurements quickly became an imperative.

When hospital leaders embarked in early 2012 on an assessment of our clinical programs to determine the most likely areas for quality and cost improvement, appendectomy quickly became a target. Preliminary analyses revealed tremendous variability in length of stay (LOS), costs and outcomes for children having the procedure.

We felt the combination of a high-volume procedure with appreciable variation in practice presented a significant opportunity for improvement. In addition, we sought to address the higher costs and increased morbidity related to patients with higher-risk complicated appendicitis.

CHALLENGES: LACK OF DATA, LACK OF BUY-IN — Texas Children's statistics for appendectomy care are consistent with nationwide trends. Appendicitis is the most common acute surgical condition of the abdomen, accounts for an estimated 1 million hospital days per year and consumes 11.8 percent of all hospital discharges for gastrointestinal diseases. Research has shown that the mean LOS for appendectomy procedures can vary significantly based on a number of factors, including disease severity, operating room availability, surgeon preferences, nursing policies and hospital systems. As a result, there are ample opportunities to improve outcomes by streamlining processes and implementing best practices.

Texas Children's first task was to identify the best practices that would be most effective in improving appendectomy care. The hospital's Evidence Based Outcomes Center (EBOC), which develops evidence-based clinical guidelines and evidence summaries to help clinicians manage the complexity of care and minimize variations in clinical practice, created evidence-based practice guidelines and disseminated them among clinicians. However, there was no system in place to track clinician adherence to the guidelines or to monitor outcomes after implementation of the guidelines without extensive manual chart abstraction. The team quickly realized that publishing new guidelines was insufficient to ensure adoption.

Another challenge Texas Children's faced was establishing a uniform, reliable and systematic process to obtain and review data. Historically, specific research questions triggered intermittent, retrospective data inquiries and analyses that were carried out by clinical research residents and postdoctoral fellows. This effort was important in that it generated answers to research hypotheses, but it lacked the flexibility, efficiency and speed in providing near-real time outcomes data necessary to guide patient care. Additionally, it consumed resources and required frequent training as residents completed their research rotations.
THE SOLUTION: APPLYING THE “THREE SYSTEMS” APPROACH — Texas Children’s turned to a technology-driven, systematic approach for value-based transformation that would enable clinicians to deliver higher-quality and lower-cost appendectomy care. The hospital implemented a clinical, analytic and process-based framework, known as the Three Systems Approach, that:

1. Improves measurement and analytics.
2. Creates permanent cross-functional workgroup teams focused on identifying, deploying and monitoring the effectiveness of quality improvements.

Specifically, the program incorporated the following elements:

- An enterprise data warehouse (EDW) platform developed by Health Catalyst. The EDW organizes the hospital’s data into a single source of truth that serves as a foundation for data-driven improvement. The data warehouse enabled Texas Children’s to significantly reduce the manual data gathering process and automate data distribution. Analysts could then devote their time to discovering patterns in the data that could be used to understand where changes needed to be made. On top of the EDW platform, the team deployed an analytics application that enables them to actively measure the effectiveness and outcomes of care improvement interventions for the specific patient population. Using an agile development process that involved an integrated workgroup of clinicians and technical personnel, Texas Children’s was able to promptly define and refine its patient populations — and achieve buy-in from clinicians on the power and legitimacy of this outcomes measuring instrument.

- Permanent, integrated workgroup teams that identify areas for care improvement and build evidence-based practice improvements into the care delivery workflow. The workgroup consisted of clinicians (surgeons), a research nurse, a data specialist and a data architect. The workgroup also had ad-hoc representation as needed from other groups, such as the emergency department (ED) clinicians, the pediatric hospitalists and finance personnel. The team worked with clinicians and staff on the front lines of care to evaluate and develop clinician training, nursing plans and patient education materials, ensuring effective system-wide implementation of best practices. The team received support from Texas Children’s quality department including the senior vice president of quality, chief quality officers for surgery and medicine, and the chief of clinical systems integration. They also received support from the chief information officer and senior vice president for information services. The partnership between quality and information systems, at the highest levels of the
organization, was critical to the successful execution of this new data-driven care delivery paradigm.

- **Evidence-based best practices, which guided the workgroup as it identified areas where care could be improved and standardized.** To determine the points in the appendectomy care process where evidence-based best practices could be applied to standardize and improve care, the team identified the appendectomy procedure workflow, from diagnosis to after care. The team researched the latest evidence-based recommended practices. One such practice that the team incorporated into the workflow was the use of the antibiotic piperacillin-tazobactam to help reduce surgical site infections by tailoring treatment to address the local microbiology of complex appendicitis. As the appendectomy work group identified gaps in the existing evidence-based guidelines, they were studied and systematic evidence recommendations were generated.

Because the permanent core workgroup owns improvement for one particular care family over the long-term and is able to work with the EDW data in near-real time via easy-to-use dashboards, they are successfully standardizing excellence in their care delivery work processes.

**COSTS FOR SIMPLE APPENDECTOMIES WERE REDUCED BY 19 PERCENT.**

**RESULTS: PERFORMANCE IMPROVEMENT AND CULTURAL TRANSFORMATION** — Although clinical transformation is an ongoing, iterative process, Texas Children’s appendectomy team has had impressive, measurable success in a short amount of time.

Using the EDW and the analytics application, Texas Children’s has developed a robust population health analytics platform for appendectomy care. Data from multiple source systems are now quickly integrated to enable prospective analytics in health care.

This means that the team can assess outcomes for the population over an extended period of time and relate those outcomes to factors such as treatment protocols and suspected risk. Because clinicians were involved in developing the platform, they trust the data and use them as their single source of truth about outcomes for appendectomy.

Visualizations available in the analytics application allow for easy identification of improvement opportunities and quick recognition of data quality issues (point and click). It is easy for individual clinicians and analysts to delve into the data themselves without having to request a report from the IT department. These clinicians and analysts are now able to compare data across all Texas Children’s locations where appendectomies are performed and stratify data based on patient characteristics such as age, gender, disease severity, etc., creating data managers at the clinician level.

In the Three Systems Approach that Texas Children’s adopted, all systems — analytics, deployment and content — work together to establish an organization whose culture is one of data-driven improvement. The following results stem from the interaction of these three systems. Implementation of these systems creates a unique culture where clinicians on the front lines of care use data and technology to make a difference in patients' lives.

1. **CULTURAL TRANSFORMATION** — Combining a single, agreed-upon source of truth with clinician engagement enables the Texas Children’s team to use data in an ongoing cycle of continuous improvement. This effort has required concerted efforts to educate clinicians. Here is just one example of how engaging clinicians with data is driving cultural transformation. Surgeons are trained to document the severity of the case in the operative note. The team leverages an appendectomy visualization to estimate the number of severity changes that are made, which helps identify potential gaps in documentation.

In a patient-centric model, cultural transformation efforts have also involved nurse and family education. For nursing education and engagement, the team worked with operating room nurses on a wound classification initiative that was designed to help educate them on how to accurately code wound class for simple and complex appendicitis.

Surgical wound class is an important and useful quality measure for risk stratification. This information is reportable to the public and third-party payers, and may be linked to reimbursement for treatment of surgical site infections. The impact of training on surgical wound classifications has resulted in the following positive year-over-year results:

- Increased the accuracy of coding by 9 percent.
- Increased the accuracy of coding as demonstrated by the fact that “clean” wound classifications decreased by 5 percent, while “contaminated” and “dirty or infected” classifications increased by 30 percent and 29 percent, respectively.

For family and patient education, the team developed a pamphlet — for simple, uncomplicated appendicitis — to help set expectations for parents or designated caregivers of patients undergoing surgery for simple appendicitis. This education begins in the post-anesthesia care unit and continues throughout the care process.

2. **IMPROVED PATIENT OUTCOMES AND REDUCED COSTS** — Using evidence-based interventions and education, Texas Children’s successfully improved outcomes following appendectomy while reducing costs. By creating standardized processes that follow evidence-based guidelines — and ensuring the adoption of these protocols across the enterprise — the hospital has realized the following positive year-over-year outcomes:
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- Patrick Brophy, MD, co-chief executive officer, University of Iowa Health System
Reduced simple appendectomy postoperative length of stay by 36 percent.
Reduced average variable direct costs for simple appendectomies by 19 percent.
Increased postoperative simple order set adoption rates by 36 percent and postoperative complex order set adoption rates by 9 percent.
Increased percentage of patients receiving recommended antibiotic (piperacillin-tazobactam) as first antibiotic by 53 percent.

3. END-TO-END WORKFLOW OPTIMIZATION — The team has identified workflow activities and is examining process metrics such as hours from presentation to diagnosis, diagnosis to surgery and surgery to discharge, and how these affect clinical outcomes. Data about workflow have enabled the team to understand differences in patient flow at their two campuses.

Based on data, the surgical team worked with radiology to develop a standardized ultrasound reporting template that facilitated communication among providers, ultimately reducing the time interval from diagnosis to surgery and leading to prompt disposition from the emergency department. Through these efforts, they have decreased the time from presentation to diagnosis for simple appendicitis by 2 percent and decreased the time from diagnosis to surgery by 19 percent for the same types of cases.

The appendectomy team continues to identify opportunities to drive ongoing improvements and reductions in costs. The hospital as a whole is applying the Three Systems Approach to improve several clinical work processes throughout the enterprise.

Appendectomy is the first surgical care process the hospital has addressed. Building on this successful strategy, we plan to extend this methodology to improve clinical outcomes for other surgical procedures. Similar processes have been undertaken with pediatric and obstetrical diseases. These efforts have demonstrated a successful approach to population health by improving the patient experience, improving the population outcomes and reducing the per capita cost of care.

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REFERENCES