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ORIGINAL RESEARCH

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Implementation and impact of a surgical dashboard on pediatric tonsillectomy outcomes: A quality improvement study

Quynh-Chi L. Dang BA, BS | Emily Román MPAS, PA-C | Kimberly Donner MPAS, PA-C | Emily Carsey BSN, MSHA | Ron F. Mitchell MD | Stephen R. Chorney MD MPH | Romaine F. Johnson MD, MPH

Department of Otolaryngology, Head and Neck Surgery, University of Texas, Southwestern Medical Center at Dallas, Dallas, Texas, USA

Correspondence
Romaine F. Johnson, Department of Otolaryngology, Head and Neck Surgery, University of Texas, Southwestern Medical Center at Dallas, 2350 N. Stemmons Freeway, F6.207, Dallas, TX 75207, USA.
Email: romaine.johnson@utsouthwestern.edu

Abstract

Introduction: In pediatric tonsillectomy management, the consistent tracking of surgical outcomes and adherence to guidelines are vital. This study explores how a surgical dashboard can serve as a tool in research analysis, translating AAO-HNSF guidelines into measurable performance improvements.

Methods: Using a prospective registry from three pediatric hospitals, a Tableau dashboard was constructed to graphically visualize key demographic and postoperative outcomes (including intensive care unit [ICU] utilization, 30-day emergency department (ED) visits, and postoperative bleed rates) in children undergoing tonsillectomy from 2020 to 2024. From the dashboard data, a retrospective cohort study analyzing 6767 tonsillectomies was conducted from January 2, 2020, to June 20, 2023. Patients were categorized into low-risk, OSA-only (by ICD-10 codes), and high-risk groups based on comorbidities. Logistic regression identified factors influencing ED revisits and unplanned nursing calls. Three quality initiatives were assessed: preoperative school absence notes, perioperative dexamethasone recording, and post-tonsillectomy parental education.

Results: A total of 2122 (31%) were low-risk, 2648 (39%) were OSA-only, and 1997 (30%) high risk. Risk factors that increased the likelihood of ED visits were high-risk comorbidities (OR = 1.46; 95% CI = 1.24–1.74; $p < 0.001$) and older age (OR = 1.05; 95% CI = 1.03–1.08; $p < 0.001$). Risk factors that increased the likelihood of an unplanned nursing communication were high-risk comorbidities (OR = 1.53; 95% CI = 1.34–1.75; $p < 0.001$), older age (OR = 1.03, 95% CI = 1.01–1.04; $p = 0.001$), and Medicaid insurance (OR = 1.25; 95% CI = 1.09–1.43; $p = 0.002$). Postoperative

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bleed control was generally comparable between the groups, at 2.8% (low risk), 2.7% (OSA), 3.2 (high risk) ($p = 0.651$).

Conclusion: The dashboard aided in data collection, data visualization, and data analysis of quality improvement initiatives, effectively translating guidelines into tangible measures to enhance care.

Level of evidence: NA.

KEYWORDS

otolaryngology, surgical dashboard, tonsillectomy

1 | INTRODUCTION

Over 500,000 pediatric tonsillectomies are performed in the United States each year for recurrent tonsillitis or obstructive sleep-disordered breathing.[1] Despite the frequency of this procedure, postoperative complications such as hemorrhage, pain, dehydration, respiratory compromise, and infection are not uncommon.[2] There are many retrospective cohort studies delineating the rates of these complications and barriers to recovery, including analyses of large national databases (i.e., Kids' Inpatient Database, Nationwide Ambulatory Surgery Sample, Healthcare Cost and Utilization Project, Nationwide Readmissions Database).[2–5]

In a retrospective cohort study[6] about pediatric tonsillectomy in low-risk children across 36 US pediatric hospitals, authors found great variability in the rates for 30-day revisits (ranging from 3% to 12%) and reasons for revisits, even when standardizing for covariates. Additionally, some pediatric hospitals followed current postoperative antibiotic and dexamethasone guidelines while others did not. There exists great variation in quality of care for tonsillectomy, and that differences in processes of care must be explored through quality improvement initiatives at individual pediatric hospitals.

Moreover, according to the updated 2019 AAO-HNSF Clinical Practice Guideline on Tonsillectomy,[7] there remains a need for new methods to collect and evaluate real-time data that reflect complication and readmission rates, postoperative care coordination, and guideline compliance within pediatric surgery centers. These findings emphasize the importance of creating dynamic data collection platforms within individual institutions to track the outcomes of real-time quality improvement outcomes. One potential solution involves surgical dashboards. Their ability to capture real-time data, and utility in various healthcare settings, has previously demonstrated their potential to improve patient care and outcomes.

Thus, we piloted a pediatric tonsillectomy dashboard to prospectively analyze postoperative outcomes of our pediatric population. The main aim of this study was to demonstrate the successful construction of a dynamic tonsillectomy dashboard that reflected preoperative and postoperative outcomes of interest to medical, nursing, and administrative stakeholders. A secondary aim was to demonstrate various applications of the aggregate data collected, which included a retrospective analysis of post-tonsillectomy outcomes between children of different risk levels and analysis of the efficacy of three departmental quality improvement initiatives.

2 | METHODS AND MATERIALS

This retrospective quality improvement study employed a cohort analysis via a surgical dashboard, documenting tonsillectomy cases from January 1, 2020, to June 30, 2023, at a single institution encompassing three Children's Health-affiliated sites within the Dallas–Fort Worth Metroplex. The locations varied in capacity and specialization, including a primary teaching hospital, a community-based hospital in Plano, Texas, and an outpatient surgery center.

The surgical dashboard was created in response to the release of the Pediatric Tonsillectomy Guidelines released by the American Academy of Otolaryngology in 2011[8] and the subsequent update in 2019.[7] Based on the recommendations of the AAO-HNSF guidelines, key stakeholders in pediatric tonsillectomy care were convened starting 2014. The primary end goal was the production of institution-specific clinical guidelines to align with the evidence-based national recommendations. Stakeholders included clinicians (otolaryngologist, advance practice providers, anesthesiology, etc.) and nurses (otolaryngology nurse, postanesthesia care unit nursing leadership) directly involved in the care of children being considered and subsequently undergoing tonsillectomy. Hospital quality leadership and service lines chiefs provided oversight and eventually approved institution-specific clinical guidelines. These guidelines were fully implemented in 2015 and were updated in 2019 coinciding with the AAO-HNSF's update. With the update, it became apparent that a robust method of tracking clinical outcomes and adherence to certain recommendations were needed.

Led by the quality improvement director of pediatric otolaryngology, alongside clinical guideline authors and the informatics team, the dashboard underwent field testing in 2019 before its 2020 launch. A 2023 update refined key metrics tracking based on institutional guidelines.

All pediatric patients scheduled for tonsillectomy or tonsillectomy with adenoidectomy were enrolled in the study using the institution's electronic medical record (EMR) system, Epic. The inclusion criterion was the completion of the surgical case log by the operating room nursing staff, which served as the trigger for automatic entry into the surgical dashboard. This system ensured that the study captured a comprehensive dataset of all relevant surgical procedures performed within the specified timeframe. Data were visualized using Tableau Desktop to create the interactive dashboards. Tableau Desktop enabled data visualizations to support monitoring clinical guidelines adherence, thus understanding patient outcomes post-tonsillectomy and facilitating quality improvement in pediatric tonsillectomy care. The dashboard was updated at the start of each calendar day by automatically pulling data from Epic EMR. The dashboard was made accessible to the otolaryngologists, nursing team leads in otolaryngology, and hospital informatics personnel responsible for ongoing builds and maintenance of the dashboard. The dashboard was reviewed quarterly at a department-wide quality and safety conference.

The patient risk category was originally divided into high risk and not high risk to align with the clinical practice guidelines recommendations for the care and management of tonsillectomy patients. High-risk patients were recommended to be observed after surgery for at least 24 h. Subsequently the category of OSA was added to support an additional risk stratification (low-risk, OSA, high-risk). The risk category was determined from the Pediatric Health Information System (PHIS) database, which extracted medical conditions from the patient's problem list. If a patient had both OSA and a high-risk condition, he/she was assigned to the high-risk category in the dashboard. Therefore, a high-risk patient could have OSA, but an OSA-only patient would not be categorized as high risk. The OSA-only group also included obese patients who otherwise lack another high-risk disorder. High-risk patients were designated as patients with morbid/severe obesity (BMI ≥99th percentile), severe asthma, failure to thrive, prematurity, sickle cell anemia, neuromuscular disease, Stickler syndrome, hemifacial microsomia, Down syndrome, Pierre Robin syndrome, craniosynostosis, myotonia, high-risk congenital cardiac malformation (such as Tetralogy of Fallot), and myasthenia gravis. Patients with nonmorbid obesity (BMI ≥95th percentile and ≤99th percentile) and no other high-risk features were sorted in either the low-risk group or OSA-only group.

The following demographic and clinical background data were captured: age (in years), sex (male or female), equity race category (Asian, Hispanic, non-Hispanic Black, non-Hispanic White, multiracial, or other), and body mass index (BMI). Next, the following socioeconomic data were captured: predicted median household income, economic connectedness, insurance type (commercial, Medicaid, other government, self-pay, other payor), and child opportunity index (very low, low, moderate, high, and very high). Economic connectedness (EC)[9] is defined as the degree of interaction between low and high SES individuals and ranges, and child opportunity index (COI) is defined as a measure of the quality of resources available to children in educational, social, and health/economic areas.[10] To determine EC and COI, patient zip code data were collected for geomapping purposes, and socioeconomic measures were cross validated through the Pediatric Health Information System (PHIS) database. Comorbidities recorded included obesity, tonsillar hypertrophy, Down syndrome, obstructive sleep apnea, asthma, prematurity, and complex chronic condition (as defined by ICD-10 code).

The following objective postoperative data were collected: 30-day patient-initiated phone calls, total and 30-day emergency department (ED) visits and reasons for return, 30-day inpatient readmissions, ICU admissions, and rates of tonsillar hemorrhage requiring OR takeback. Additionally, perioperative administrative dexamethasone administration was recorded. Sleep study metrics for obstructive sleep apnea (OSA) included percentage of patients undergoing polysomnography (PSG) within 6 months of tonsillectomy, average apnea-hypopnea index (AHI) values before and after surgery, and average time to postoperative PSG.

Descriptive statistics outlined the cohort, while inferential analyses that included linear regression and χ^2 tests investigated differences between risk groups. Multiple logistic regression analyses further examined risk factors for readmissions and nursing communication follow-ups, with models validated via jackknife regression and presented as odds ratios with confidence intervals. This exploratory analysis, conducted with Stata Statistical Software (version 18), served to generate hypotheses for future studies and evaluate risk stratification against clinician expectations. A significance level was set at $p < 0.05$. The retrospective review of this data was approved by the UT Southwestern IRB (#2023-0260) as exempt for needing consent.

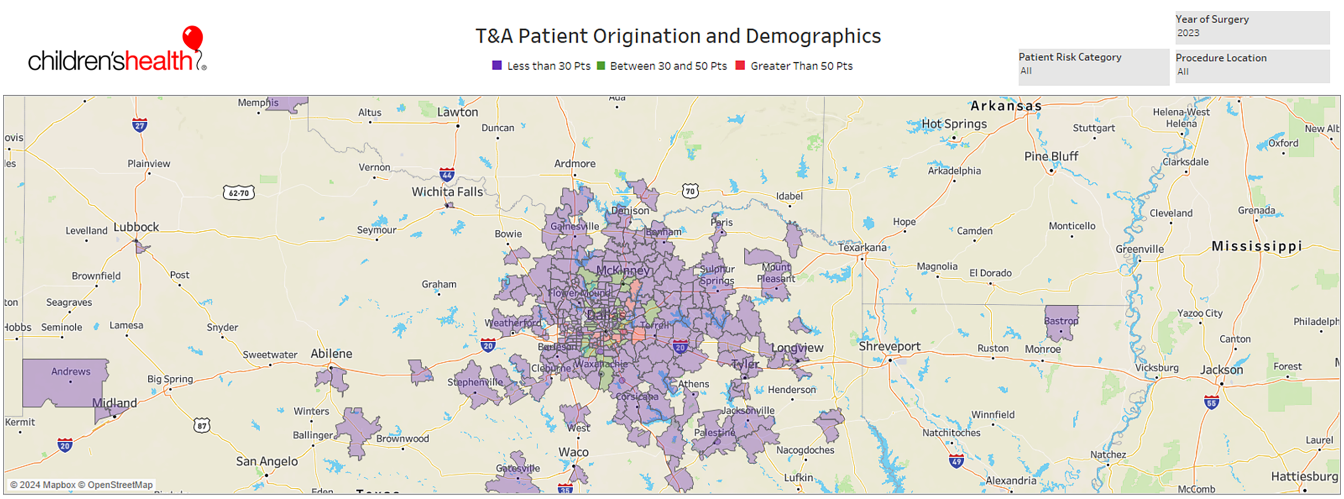
3 | RESULTS

The Tableau dashboard we constructed had different pages that summarized aggregate data on key outcomes tracked by the pediatric otolaryngology department. Information was represented by a combination of bar graphs, run charts, bubble graphs, maps, and tables. The dashboard sorted data based on predetermined low-risk, high-risk, and OSA categories. Users of the dashboard could filter by year and location (out of three affiliated sites) of the tonsillectomy. Hovering over specific data points revealed more specific details about patient volume and percentages. Refer to Figures 1–7.

In total, 6767 children underwent tonsillectomy between January 2, 2020 and June 20, 2023. The cohort consisted of 31.4% ($n = 2122$) low-risk patients, 39.1% ($n = 2648$) OSA patients, and 29.5% ($n = 1997$) high-risk patients. The median age was 5.95 (interquartile range [IQR] = 4.95) years. 53.5% were male ($n = 3619$) and 46.5% were female ($n = 3148$). Race and ethnicity characteristics consisted of 38.2% Hispanic ($n = 2586$), 29.4% Non-Hispanic White ($n = 1987$), 23.5% Non-Hispanic Black ($n = 1593$), 3.0% Asian ($n = 203$), 0.2% multiracial ($n = 15$), and 5.7% other ($n = 383$). The median BMI of the cohort was 17.82 (IQR = 8.08), and the OSA group had the highest median BMI of 19.03 (IQR = 10.42; $p < 0.001$). According to the tonsillectomy dashboard, preoperative BMI percentiles have decreased and stabilized across all three groups from 2020 to 2024. Refer to Table 1 and Figure 3.

Within the total cohort, comorbidities tracked included obesity (16.3%, $n = 852$), Down Syndrome (2.8%, $n = 146$), asthma (2.3%, $n = 118$), prematurity (0.3%. $n = 18$), and complex chronic conditions (9.9%, $n = 516$). As expected, the OSA group had the highest prevalence of tonsillar hypertrophy (96.7%, $n = 2023$; $p < 0.001$) and

FIGURE 1 Overview of tonsillectomy dashboard.



		Patient Count	% of Total Patients
High Risk Patient	Severe asthma	1,373	43.6%
	failure to thrive	951	30.2%
	Prematurity	317	10.1%
	Sickle cell anemia	103	3.3%
	Neuromuscular disorder	92	2.9%
	Stickler	64	2.0%
	Hemifacial microsomia	63	2.0%
	Down SYNDROME	42	1.3%
	Pierre Robin	42	1.3%
	Craniosynostosis	37	1.2%
	Myotonia	28	0.9%
	HIGH RISK CARDIAC MALFO..	22	0.7%
	Micrognathia	11	0.3%
	Myasthenia gravis	3	0.1%
Low Risk Patient	Low Risk	3,073	100.0%
OSA	OSA	4,565	100.0%
Grand Total		10,786	100.0%

	Pt Volume	% of Pts
High Risk Patient	3,148	29.2%
Low Risk Patient	3,073	28.5%
OSA	4,565	42.3%

	Pt Volume	% of Pts
Male	5,851	54.2%
Female	4,935	45.8%

AGE GROUP	Pt Volume	% of Pts
0-1	336	3.1%
2-5	4,959	46.0%
6-10	3,821	35.4%
11-15	1,284	11.9%
16-21	386	3.6%

	Pt Volume	% of Pts
Alive	10,782	100.0%
Deceased	4	0.0%

	Pt Volume	% of Pts
Non-Hispanic	5,946	55.1%
Hispanic	4,688	43.5%
Unknown	126	1.2%
Patient Refused	26	0.2%

	Pt Volume	% of Pts
White or Caucasian	6,577	61.0%
Black or African American	2,638	24.5%
Other	880	8.2%
Asian	349	3.2%
Unknown	139	1.3%
Hispanic	95	0.9%
American Indian and Alaska N..	59	0.5%
Patient Refused	36	0.3%
Native Hawaiian and Other Pa..	11	0.1%
Null	2	0.0%

FIGURE 2 T&A patient origination and demographics.

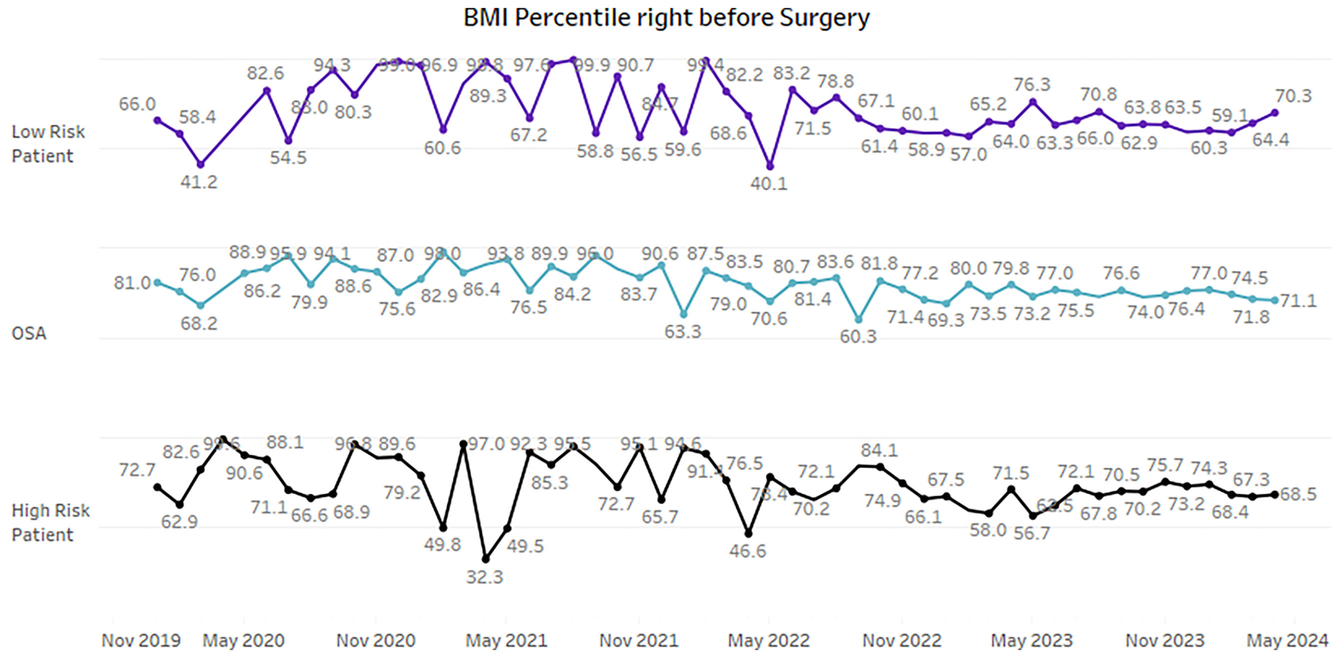


FIGURE 3 Preoperative body mass index trends.

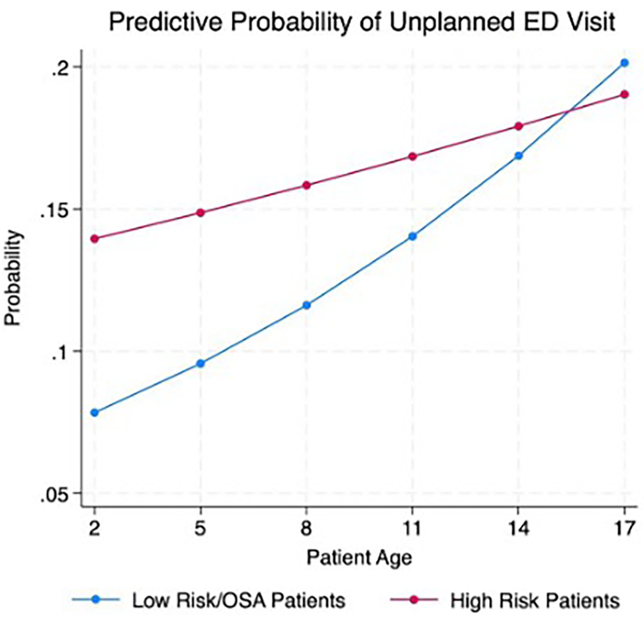


FIGURE 4 Predictive probability of unplanned emergency department (ED) visits after tonsillectomy by age and risk status. OSA, obstructive sleep apnea.

obesity (23.7%, $n = 495$; $p < 0.001$). The high-risk group had the highest prevalence of asthma (4.8%, $n = 75$; $p < 0.001$), prematurity (1.0%, $n = 16$; $p < 0.001$), Down syndrome (4.1%, $n = 65$; $p < 0.001$), and complex chronic conditions (19.1%, $n = 299$; $p < 0.001$). The most common comorbidity in the low-risk group was obesity, and it was present in 8.2% ($n = 127$) of the group. Refer to Table 2.

The median household income of the total cohort was \$49,554.67 (\$18,592.42), and the low-risk group had the highest median household income (\$51,979,59; IQR = \$19,147.26; $p < 0.001$), followed by the OSA group (\$48987.06; IQR = 18,516.59), and then the high-risk group (\$47,901.23, IQR = 17,889.45). 29.3% ($n = 1985$) of children had commercial insurance while 64.8% ($n = 4386$) had Medicaid. Medicaid usage was most prevalent among the OSA group (68.8%, $n = 1822$; $p < 0.01$), followed by the high-risk group (67.8%, $n = 1353$), and then the low-risk group (57.1%, $n = 1211$). Commercial insurance was most used in the low-risk group (36.1%, $n = 766$; $p < 0.001$), followed by the OSA group (26.5%, $n = 702$), and then the high-risk group (25.9%, $n = 517$).

3.1 | Retrospective analysis of post-tonsillectomy outcomes

All children with OSA in the high-risk groups were hospitalized overnight post-tonsillectomy (length of stay = 1 day) per institution-specific guidelines. The perioperative administrative of dexamethasone was 95% without difference between the groups. In total, 862 children (12.7%) visited the ED postoperatively. Within 30 days, ED revisit rates were highest at 7.4% ($n = 148$) in the high-risk group, 6.3% ($n = 167$) in the OSA group, and 4.9% ($n = 105$) in the low-risk group ($p < 0.005$). Based on ICD-10 codes, the most common reason for ED visit was for a postoperative problem ($n = 539/6767$, 8.0%). Other reasons were fever, vomiting, pain, and concerns for bleeding, which likely constituted as a postoperative problem but were not coded as such. Refer to Figure 5.

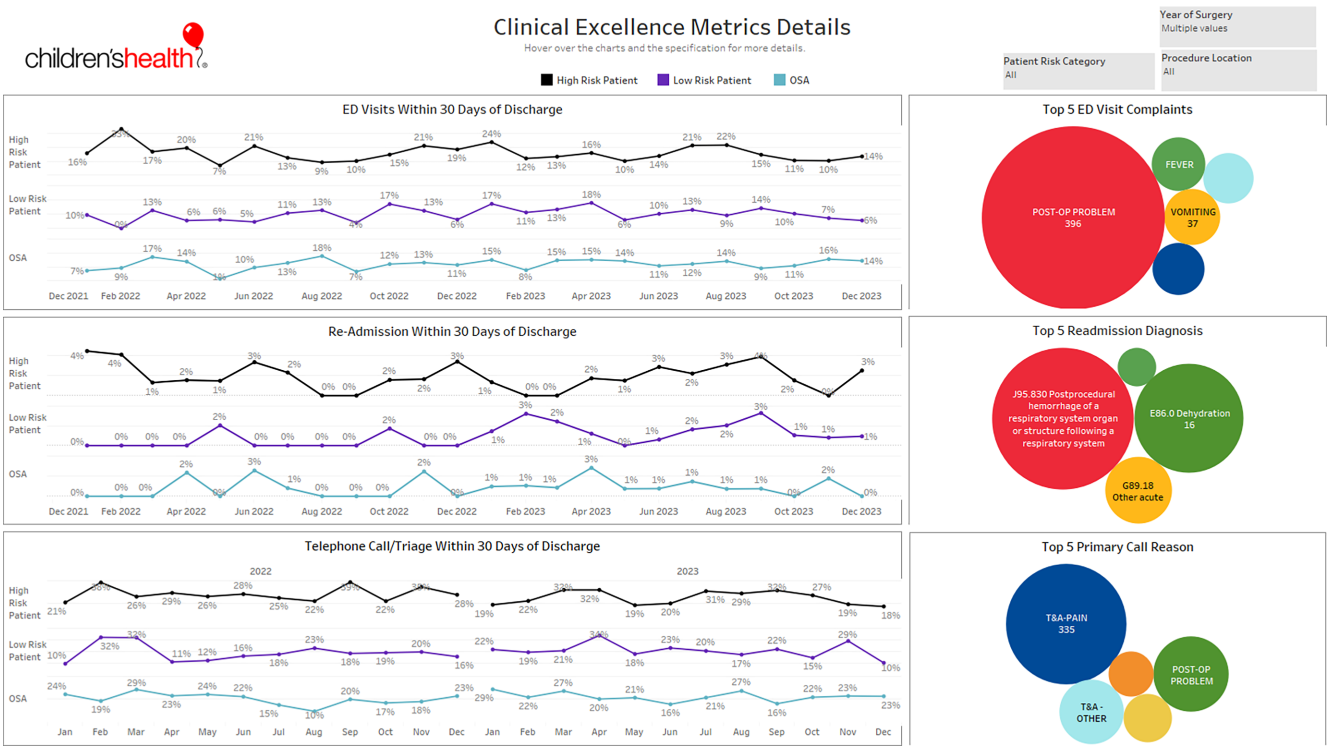


FIGURE 5 Effects of quality improvement initiatives on key postoperative outcomes.

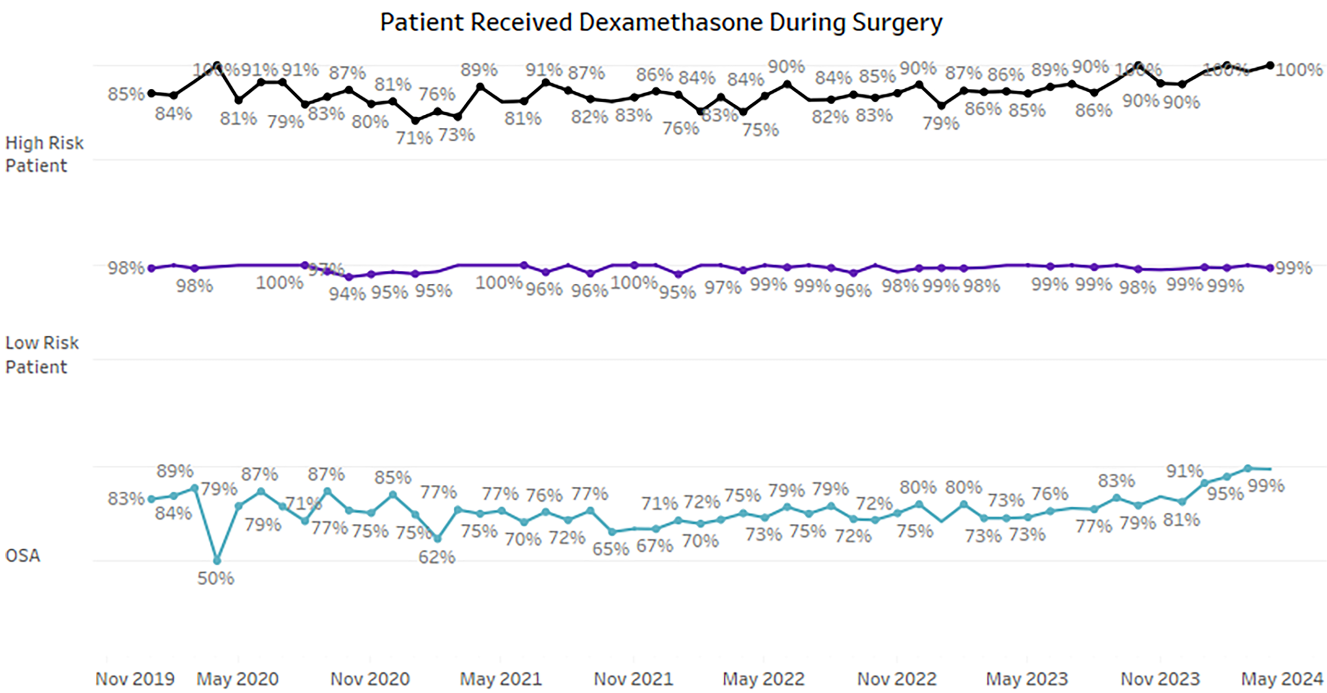


FIGURE 6 Dexamethasone administration rates by risk category.

In total, 4.2% ($n = 283$) of children were readmitted to the inpatient floor within 30 days after surgery. The high-risk group had the highest rate of inpatient readmission (6.0%, $n = 120$, $p < 0.001$), followed by the OSA group (3.5%, $n = 93$), and then the low-risk group (3.3%, $n = 70$).

2.4% ($n = 165$) of children were hospitalized in the intensive care unit (ICU). The OSA group had the highest ICU hospitalization rate (3.9%, $n = 103$; $p < 0.001$), followed by the high-risk group (2.9%, $n = 57$), and then the low-risk group (0.2%, $n = 5$). 2.9% ($n = 194$) of

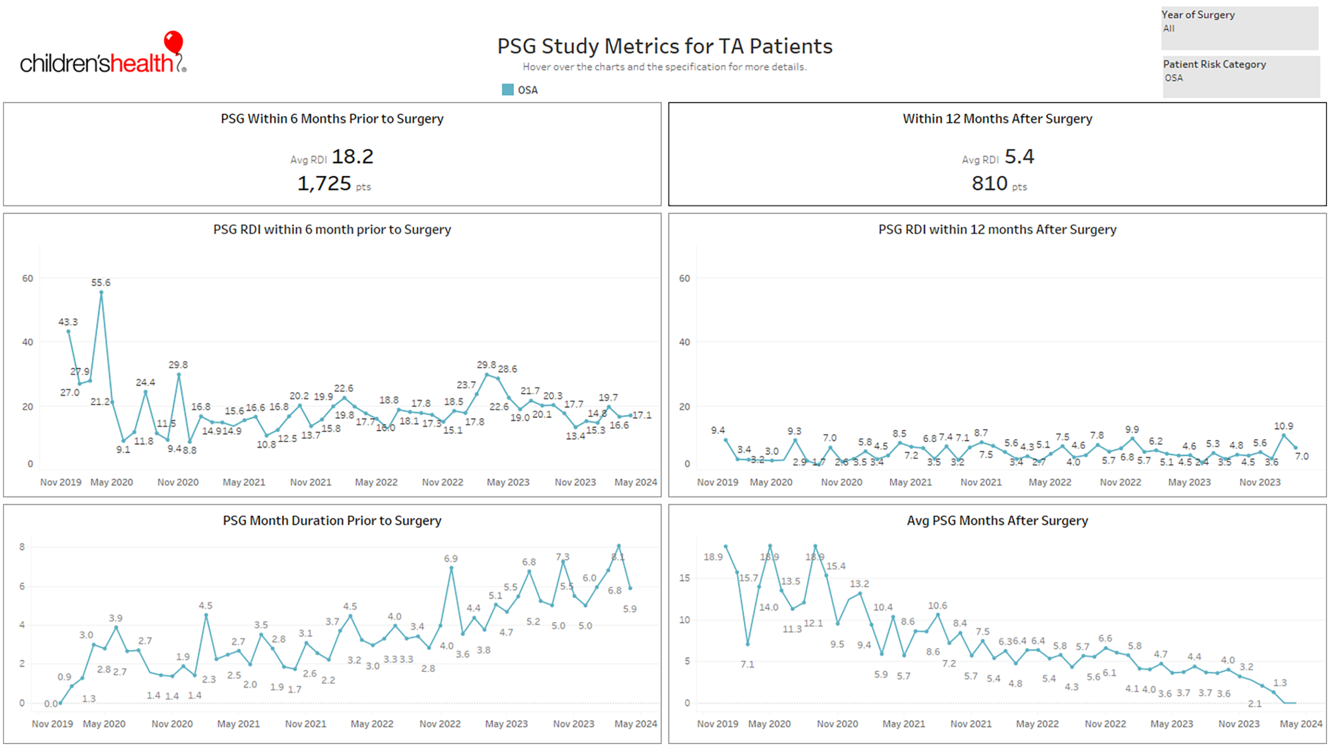


FIGURE 7 Preoperative and postoperative polysomnography scheduling trends in obstructive sleep apnea patients.

TABLE 1 Demographics of study population.

	Low risk $N = 2122$ (31.4%)	OSA $N = 2648$ (39.1%)	High risk $N = 1997$ (29.5%)	Total $N = 6767$ (100.0%)	p value
Age (years)	6.19 (4.48)	5.72 (5.28)	5.91 (5.08)	5.95 (4.95)	<0.001
Median (IQR)					
BMI (kg/m^2)	17.13 (5.59)	19.03 (10.42)	17.57 (7.11)	17.82 (8.08)	<0.001
Median (IQR)					
Gender, *n* (%)					
Male	975 (45.9%)	1485 (56.1%)	1159 (58.0%)	3619 (53.5%)	<0.001
Female	1147 (54.1%)	1163 (43.9%)	838 (42.0%)	3148 (46.5%)	
Equity Race Category, *n* (%)					
Asian	77 (3.6%)	71 (2.7%)	55 (2.8%)	203 (3.0%)	<0.001
Hispanic	744 (35.1%)	1139 (43.0%)	703 (35.2%)	2586 (38.2%)	
Multiracial	4 (0.2%)	6 (0.2%)	5 (0.3%)	15 (0.2%)	
Non-Hispanic Black	360 (17.0%)	651 (24.6%)	582 (29.1%)	1593 (23.5%)	
Non-Hispanic White	777 (36.6%)	637 (24.1%)	573 (28.7%)	1987 (29.4%)	
Other	160 (7.5%)	144 (5.4%)	79 (4.0%)	383 (5.7%)	

Abbreviation: OSA, obstructive sleep apnea.

the cohort had secondary tonsil bleeding that required return to the operating room (OR) for hemorrhage control. Rates of hemorrhage control in the OR were similar between the low-risk, OSA, and high-risk groups (2.8% vs. 2.7% vs. 3.2%; $p = 0.651$). Refer to Table 3.

25.3% ($n = 1712$) of the total cohort utilized postoperative phone calls within 30 days after surgery. The high-risk group had the highest rate of postoperative phone calls (30.3%, $n = 605$; $p < 0.001$), followed by the OSA group (23.5%, $n = 623$), and then the low-risk group (22.8%, $n = 484$). Refer to Table 3.

Two thousand seven hundred and fifteen patients underwent preoperative PSG up to 12 months prior to tonsillectomy and 1237 patients underwent a postoperative PSG with 6 months. The

TABLE 2 Clinical features of the study population.

Clinical features no. (%)	Low risk, $N = 2122$ (31.4%)	OSA, $N = 2648$ (39.1%)	High risk, $N = 1997$ (29.5%)	Total, $N = 6767$ (100.0%)	p value
Obesity, n (%)	127 (8.2%)	495 (23.7%)	230 (14.7%)	852 (16.3%)	<0.001
Tonsillar hypertrophy, n (%)	1432 (92.3%)	2023 (96.7%)	1430 (91.2%)	4885 (93.7%)	<0.001
Down Syndrome, n (%)	0 (0.0%)	81 (3.9%)	65 (4.1%)	146 (2.8%)	<0.001
Asthma, n (%)	7 (0.5%)	36 (1.7%)	75 (4.8%)	118 (2.3%)	<0.001
Prematurity, n (%)	0 (0.0%)	2 (0.1%)	16 (1.0%)	18 (0.3%)	<0.001
Complex chronic condition, n (%)	13 (0.8%)	204 (9.8%)	299 (19.1%)	516 (9.9%)	<0.001

Abbreviation: OSA, obstructive sleep apnea.

TABLE 3 Dashboard-recorded postoperative surgical outcomes.

Surgical outcomes no. (%)	Low risk $N = 2122$ (31.4%)	OSA $N = 2648$ (39.1%)	High risk $N = 1997$ (29.5%)	Total $N = 6767$ (100.0%)	p value
Total length of stay (days), median (IQR)	0.0 (0.0)	1.00 (1.00)	1.00 (1.00)	1.00 (1.00)	<0.001
Patient-Initiated phone call within 30 days, n (%)	484 (22.8%)	623 (23.5%)	605 (30.3%)	1712 (25.3%)	<0.001
Total ED visits, n (%)	236 (11.1%)	318 (12.0%)	308 (15.4%)	862 (12.7%)	<0.001
Cumulative ED readmissions, n (%)					
At 7 days	91 (4.3%)	130 (4.9%)	110 (5.5%)	331 (4.9%)	193
At 14 days	100 (4.7%)	150 (5.7%)	130 (6.5%)	380 (5.6%)	0.043
At 30 days	105 (4.9%)	167 (6.3%)	148 (7.4%)	420 (6.2%)	0.005
ICU admission, n (%)	5 (0.2%)	103 (3.9%)	57 (2.9%)	165 (2.4%)	<0.001
OR takeback for bleeding, n (%)	59 (2.8%)	72 (2.7%)	63 (3.2%)	194 (2.9%)	0.651
Cumulative inpatient readmissions, n (%)					
At 7 days	60 (2.8%)	81 (3.1%)	98 (4.9%)	239 (3.5%)	0.001
At 14 days	69 (3.3%)	92 (3.5%)	110 (5.5%)	271 (4.0%)	<0.001
At 30 Days	70 (3.3%)	93 (3.5%)	120 (6.0%)	283 (4.2%)	<0.001

Abbreviation: ED, emergency department; OSA, obstructive sleep apnea.

preoperative mean AHI was 1.6 events/h for the low-risk group, 18.7 events/hr for the OSA group, and 14.3 events/h for the high-risk group ($p < 0.001$). The post-tonsillectomy values were 2.3 events/h, 5.5 events/h, and 7.5 events/h, respectively ($p < 0.001$).

Logistic regression analyses were used to predict the odds of unplanned ED visits based on patient risk category, patient age, and child opportunity index. High-risk patients had 46% greater odds of returning for an unplanned ED visit compared to non-high-risk patients (OR = 1.46, 95% CI = 1.24–1.74, p < 0.001). Additionally, for every 1-year increase in age, the odds of an ED revisit increased by 5% (OR = 1.05, 95% CI = 1.03–1.08, $p < 0.001$). Children with a high opportunity index had 23% lower odds of an ED visit (OR = 0.77, 95% CI = 0.61–0.97, $p = 0.026$). Furthermore, a significant interaction between high-risk patients and age was found—for every 1-year increase in age, the odds that a high-risk patient had an unplanned ED visit decreased by 5% (OR = 0.95, 95% CI = 0.91–0.99, $p = 0.022$). The intercept was found to be statistically significant (OR = 0.07, 95% CI = 0.06–0.10, $p < 0.001$), indicating that even in the absence of risk category, age, and opportunity index, there is still a small but significant risk of an unplanned ED visit after tonsillectomy. Refer to Table 4 and Figure 4.

Next, logistic regression analyses were used to predict the odds of unplanned patient-initiated calls. High-risk patients had 53% greater odds (OR = 1.53, 95% CI = 1.34–1.75, $p < 0.001$) of unplanned calls, and Medicaid patients had 25% greater odds of unplanned calls (OR = 1.25, 95% CI = 1.09–1.43, $p = 0.002$). Patients with a high opportunity index had 36% lower odds of an unplanned call (OR = 0.64, 95% CI = 0.53–0.77, $p < 0.001$). For every 1-year increase in age, the odds of an unplanned call increased by 3% (OR = 1.03, 95% CI = 1.01–1.04, $p = 0.001$). The intercept was found to be statistically significant (OR = 0.24, 95% CI = 0.20–0.28, $p < 0.001$), indicating that even in the absence of risk category, age, insurance type, and opportunity index, there is still a small but significant risk of an unplanned nursing line communication. Refer to Table 5.

TABLE 4 Odds of an unplanned emergency department revisit.

	Odds ratio	Std err	*p* value	95% CI
Main effects				
High-risk category patient	1.46	0.12	<0.001	1.24–1.74
Patient age in years	1.05	0.01	<0.001	1.03–1.08
High opportunity index	0.77	0.09	0.026	0.61–0.97
Interaction				
High-risk category × age	0.95	0.10	0.022	0.91–0.99
Intercept	0.07	0.01	< 0.001	0.06–0.10

Note: Pearson X^2 goodness of fit test—$p = 0.56$.

TABLE 5 Odds of an unplanned nursing communication.

	Odds ratio	Std err	*p* value	95% CI
High-risk category patient	1.53	0.10	<0.001	1.34–1.75
Patient age in years	1.03	0.01	0.001	1.01–1.04
Medicaid insurance	1.25	0.09	0.002	1.09–1.43
High opportunity index	0.64	0.06	<0.001	0.53–0.77
Intercept	0.24	0.02	<0.001	0.20–0.28

Note: Pearson X^2 goodness of fit test—$p = 0.78$.

3.2 | Effect of quality improvement interventions

The effectiveness of three quality improvement (QI) initiatives was tracked using the tonsillectomy dashboard. The first initiative focused on improving patient education about tonsillectomy complications to reduce emergency department (ED) readmissions. A mixed-methods study conducted in the pediatric otolaryngology clinic during the spring and summer of 2022 identified knowledge gaps among caregivers. To address this, parental education was emphasized in the fall of 2022, leading to the establishment of an educational texting program, "Tonsil Text," in December 2022.[11] The dashboard showed that between December 2022 and February 2023, high-risk groups had a noticeable decrease in 30-day ED visits, 30-day inpatient readmissions, and unplanned telephone calls. Refer to Figure 5.

The second QI initiative involved providing school and work absence notes to reduce patient-initiated nursing phone calls. Early dashboard reviews in 2019 showed a high volume of calls for school notes. To streamline this process, a standardized post-tonsillectomy school excuse note, including diet and physical activity restrictions, was created and otolaryngology, PACU, and inpatient staff were instructed on how to utilize it. Comprehensive school excuse notes were then routinely provided at discharge, resulting in a reduction in follow-up phone calls and improved postoperative communication. Refer to Figure 5.

The third initiative targeted improved documentation of perioperative dexamethasone administration. Earlier benchmarking using the Pediatric Health Information System Tonsillectomy Scorecard (PHIS) showed documentation rates in the low to mid-80th percentiles. The dashboard confirmed this data, revealing inconsistent record-keeping for discharge abstracts. After educating the anesthesia team, documentation compliance increased to the mid to high 90th percentiles across all risk groups. Refer to Figure 6.

The tonsillectomy dashboard also highlighted changes in the time between preoperative polysomnography (PSG) and tonsillectomy, showing an increasing delay from PSG to tonsillectomy while simultaneously revealing a decreasing delay between tonsillectomy and postoperative PSG in OSA patients. This unexpected trend sparked discussions about contributing factors, such as patient-related issues like financial resources and insurance challenges, along with institutional factors such as operating room availability and bed shortages. A key insight from the dashboard was the importance of scheduling postoperative PSG at the time of tonsillectomy to improve adherence to recommended follow-up. Refer to Figure 7.

4 | DISCUSSION

To our knowledge, this study represents one of the most comprehensive dynamic otolaryngology dashboards published to date. It tracks and visualizes various outcomes through bar graphs and trend lines, providing valuable insights before and after quality initiative interventions within the department.

Additionally, the dashboard aided in data collection for a retrospective statistical analysis of post-tonsillectomy outcomes of low-risk, OSA, and high-risk patients. In our cohort, the high-risk group had highest rates of ED visits, inpatient readmissions, and postoperative patient-initiated phone calls, and OSA patients had the highest rate of ICU hospitalizations. Across all three risk groups, the average tonsil hemorrhage rate requiring OR takeback was 2.9%, and postoperative bleeding rates were not statistically significant among the three groups. Logistic regression analyses showed that high-risk patients and older patients were more likely to have an ED readmission. Furthermore, high-risk patients, older patients, and Medicaid patients were more likely to initiate unplanned postoperative phone calls. Having a high opportunity index was inversely correlated with ED readmissions and unplanned phone calls. The dashboard also revealed increasing delays in preoperative PSG to tonsillectomy time in the OSA group.

Increasing literature has been published about the utility of surgical dashboards. Value-based surgical databases have been created to analyze surgeon performance, procedure costs, and patient outcomes for specific procedures like knee/hip arthroplasties and cholecystectomy.[12,13] Furthermore, an anesthesia department found that using dashboards to track anesthesiologist adherence to clinical guidelines was well-received, as they were able to adapt 10 dashboards for different types of operating rooms.[14] Very few real-time otolaryngology surgical dashboards have previously been published. One surgical center created a web-based dashboard to track patient satisfaction after rhinoplasty through preoperative and postoperative patient questionnaire scores.[15,16]

Multiple studies have demonstrated that scheduled post-tonsillectomy telephone follow-up calls improve patient satisfaction and lower the rate of follow-up clinic visits without increasing postoperative complication rates. A randomized control trial[17] assigned 771 children to either receive scheduled phone calls at 1, 3, 7, and 14 days after surgery or to follow up with the surgeon in person at the same time intervals. Compared to the in-person visit group, the phone call group was found to have lower pain scores, less vomiting, less constipation, and higher fluid intake on postoperative days 1 and 3. Another retrospective cohort study[18] found that after the implementation of a scheduled nursing communication (phone call or online portal messaging) 4–6 weeks after tonsillectomy, 98% caregivers declined an in-person clinic visit due to satisfaction about recovery. Notably, this study cohort included children with Down syndrome, airway comorbidities, and neurologic comorbidities, like our study.

Strengths of this tonsillectomy dashboard included efficient extraction of large amounts of data from the electronic health record. Because the variables of interest and patient data could be quickly downloaded from the dashboard, a high-power retrospective cohort analysis was successfully performed without the need for lengthy chart review process. Second, the dashboard created customizable visual and graphical representations of longitudinal data that can be easily shared with a multidisciplinary team. The run charts and bar graphs were automatically created by Tableau without the need for statistical coding experience. Third, the dashboard data were easily merged with data from other sources (i.e., PHIS, nursing phone logs) to provide a centralized hub for a diverse patient cohort. Finally, the dashboard was automatically updated daily to provide real-time data and ensured adequate protection and privacy of personal health information.

There were limitations of this tonsillectomy dashboard construction and utilization. First, because the dashboard relied on extracting information through ICD-10 coding, diagnoses and comorbidities could have been misclassified based on initial input. For example, nausea/vomiting, pain, and fever could have all been postoperative problems, but they were coded separately in the ED and therefore were reflected as separate problems in Tableau. Additionally, the dashboard could only be filtered by year, not by month or day, thus limiting short-term analysis. Postoperative return visits were potentially underreported if patients did not return to the same hospital for postoperative concerns and care. Finally, the efficacy of QI interventions may not directly correlate with a rudimentary run chart generated by the dashboard, as the analysis does not control for confounding variables. Rather, overarching trends detected by the dashboard should prompt discussion and more rigorous statistical analyses. Efforts to improve precision of ICD-10 coding in the ED, expanding filtering options, and extracting data from different hospital EMRs would be the next steps in improve the tonsillectomy dashboard.

4.1 | Conclusions

There are many further studies that can be extrapolated from this tonsillectomy dashboard. For instance, risk groups were only one way of stratifying patients. In the future, the dashboard could be restructured to compare key outcomes in different socioeconomic groups, races, or ethnicities to identify systemic barriers to health equity. This dashboard could also be expanded to track key outcomes in different types of otolaryngology procedures within the department. Additionally, the dashboard could be used to generate more research questions and aid in data collection for more research studies. There is even evidence that some dashboards have also expanded beyond tracking quality improvement initiatives and retrospective studies to aid in clinical trial monitoring.[19] Predictive modeling is also an emerging way to utilize dashboards,[20] and we could build a modeling system into the tonsillectomy dashboard to predict future ED visits and tonsillar hemorrhage rates.

In sum, this dynamic tonsillectomy dashboard was fundamental to monitoring outcomes of quality improvement initiatives, collecting and analyzing data for a retrospective cohort study, and identifying areas for improvement within a pediatric otolaryngology department.

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CONFLICT OF INTEREST STATEMENT

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ORCID

Kimberly Donner https://orcid.org/0000-0002-4624-8592
Ron F. Mitchell https://orcid.org/0000-0001-7890-0541
Stephen R. Chorney https://orcid.org/0000-0003-1419-6019
Romaine F. Johnson https://orcid.org/0000-0002-2322-5347

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