

Association of National Guidelines With Tonsillectomy Perioperative Care and Outcomes

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abstract

OBJECTIVE: To investigate the association of the 2011 American Academy of Otolaryngology Head and Neck Surgery guidelines with perioperative care processes and outcomes in children undergoing tonsillectomy.

METHODS: We conducted a retrospective cohort study of otherwise healthy children undergoing tonsillectomy between January 2009 and January 2013 at 29 US children's hospitals participating in the Pediatric Health Information System. We measured evidence-based processes suggested by the guidelines (perioperative dexamethasone and no antibiotic use) and outcomes (30-day tonsillectomy complication-related revisits). We analyzed rates aggregated over the preguideline and postguideline periods and then by month over time by using interrupted time series.

RESULTS: Of 111 813 children who underwent tonsillectomy, 54 043 and 57 770 did so in the preguideline and postguideline periods, respectively. Dexamethasone use increased from 74.6% to 77.4% ($P < .001$) in the preguideline to postguideline period, as did its rate of change in use (percentage change per month, -0.02% to 0.29% ; $P < .001$). Antibiotic use decreased from 34.7% to 21.8% ($P < .001$), as did its rate of change in use (percentage change per month, -0.17% to -0.56% ; $P < .001$). Revisits for bleeding remained stable; however, total revisits to the hospital for tonsillectomy complications increased from 8.2% to 9.0% ($P < .001$) because of an increase in revisits for pain. Hospital-level results were similar.

CONCLUSIONS: The guidelines were associated with some improvement in evidence-based perioperative care processes but no improvement in outcomes. Dexamethasone use increased slightly, and antibiotic use decreased substantially. Revisits for tonsillectomy-related complications increased modestly over time because of revisits for pain.

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WHAT'S KNOWN ON THIS SUBJECT: Tonsillectomy guidelines make evidence-based recommendations for the perioperative use of dexamethasone, no routine use of antibiotics, and discharge education of families and for surgeons to monitor bleeding complication rates. The impact of the guidelines on processes and outcomes is unknown.

WHAT THIS STUDY ADDS: The guidelines were associated with improvement in perioperative care processes but no improvement in outcomes. Perioperative dexamethasone use increased slightly, and antibiotic use decreased substantially. Bleeding rates were stable, but revisit rates for complications increased because of revisits for pain.

Tonsillectomy is one of the most common surgical procedures performed in children. Typical indications include sleep-disordered breathing and recurrent throat infections.¹ More than 500 000 ambulatory tonsillectomies are performed yearly in the United States.² Tonsillectomy ranks as the ninth most cumulatively expensive reason for care at children's hospitals.³ It is generally a safe procedure, and deaths after tonsillectomy occur rarely, about 1 in 30 000 cases.⁴ Revisits to hospital for complications occur in 5% to 15%, with the most common reasons related to bleeding, vomiting or dehydration, and pain.⁵⁻⁷

In January 2011, the American Academy of Otolaryngology and Head and Neck Surgery (AAOHNS) published guidelines for high-quality tonsillectomy care, including specific recommendations about perioperative care.¹ The guideline recommends perioperative dexamethasone to prevent postoperative nausea and vomiting and the avoidance of perioperative prophylactic antibiotics because they do not prevent infections or bleeding. Both recommendations are based on evidence from randomized controlled trials.^{8,9} In our previous study of children undergoing same-day tonsillectomy at children's hospitals before guideline publication, 69.6% received dexamethasone and 31.3% received antibiotics.⁷

The guidelines also make recommendations for hospitals to implement effective pain management strategies, with discharge education to caregivers for pain assessment and management at home. Furthermore, the guidelines suggest that postoperative hemorrhage rates be monitored for quality improvement purposes.

The objective of this study was to investigate the association of the 2011 AAOHNS guidelines with tonsillectomy perioperative care and

outcomes in US children's hospitals. Specifically, we were interested in examining whether the evidence-based processes recommended by the guideline, namely administration of dexamethasone and no use of antibiotics, changed after publication of the guidelines. We also examined the outcome of tonsillectomy-related complications, including bleeding, after publication of the guideline.

METHODS

This multicenter retrospective, longitudinal study used data from the Pediatric Health Information System (PHIS). PHIS includes administrative and billing data from 47 freestanding children's hospitals that are located in 26 states and the District of Columbia and affiliated with the Children's Hospital Association. The database contains information on demographics, diagnosis and procedure codes, service locations, and charges. Encrypted medical record numbers permit identification of patients across multiple hospitalizations. Data quality and reliability are maintained by the Children's Hospital Association and participating hospitals.¹⁰ The institutional review board of Cincinnati Children's Hospital deemed this study exempt from review under 45 CFR 46.102(bf) because the participants were not readily identifiable.

Study Population

We included children aged 1 to 18 years undergoing tonsillectomy who were either discharged the same day as surgery or the day after surgery; only patients from the 29 hospitals that provided continuous data into PHIS throughout the entire study period, January 1, 2009 to January 31, 2013, were included. Children were identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure codes of tonsillectomy (28.2) or tonsillectomy and

adenoidectomy (28.3). We excluded children for the following reasons: diagnosis codes for peritonsillar abscess; children with chronic complex conditions¹¹ including malignancies, diabetes, bleeding disorders, trisomy 21, and craniofacial disorders¹² who are excluded from the AAOHNS guidelines; a malignancy diagnosis during the index admission or in the year after tonsillectomy; tonsillectomy performed after transfer from another hospital or from the emergency department (ED), because these were considered nonelective; and who had concomitant procedures (eg, esophagogastroduodenoscopy with biopsy, tooth extraction, circumcision, orchiopexy). By creating a cohort that follows the inclusion criteria of the 2011 AAOHNS guidelines and excludes these other groups, we attempted to minimize patient characteristics and circumstances that may warrant deviation from guideline recommendations.

We defined the preguideline period from January 1, 2009 to December 31, 2010 and the postguideline period from January 1, 2011 to January 31, 2013.

Covariates

We analyzed the following covariates: age (1-3, 4-9, 10-18 years), gender, insurance type (government vs nongovernment), race, and a diagnosis code of asthma.¹³ We included asthma as a covariate because it is a chronic condition that meets inclusion criteria for the guidelines and has been associated with an elevated complication rate.^{14,15} We also classified the indication for surgery into the following categories: infection related (children who had an infection-related code), airway obstruction related (children who had an airway obstruction-related code), both infection related and airway obstruction related, or other (neither an infection or airway

obstruction-related code) based on a previous ICD-9-CM classification.¹

Outcomes

Dexamethasone and Antibiotic Use

We determined whether children were prescribed dexamethasone and antibiotics on the day of surgery based on the presence of pharmacy billing codes.

Revisits to Hospital for Tonsillectomy Related Complications

We evaluated revisits to the same hospital in the first 30 days after surgery. Revisits included visits to the ED and also admissions to the hospital (inpatient unit or observation unit) and ambulatory surgical center. Revisits were classified as tonsillectomy related or unrelated based on our previously defined an ICD-9-CM classification scheme; we included only tonsillectomy-related revisits in our analysis.⁷ We also examined specific reasons for revisits: bleeding, vomiting or dehydration, pain, infections, respiratory, and other (including unspecified surgical complications and drug reactions), based on the ICD-9-CM principal diagnosis code on the revisit.⁷ Furthermore, we evaluated readmissions due to bleeding and those that necessitated a procedure to control bleeding (ICD-9-CM procedure codes 28.7 control of hemorrhage after tonsillectomy and adenoidectomy and 39.98 control of hemorrhage not otherwise specified).

Analysis

We summarized preguideline and postguideline categorical variables by using frequencies with percentages and compared them by using χ^2 tests. We described continuous variables by using median with interquartile range values and compared them by using Wilcoxon rank-sum tests. Segmented regression analysis of interrupted time series was used for modeling monthly rates of the outcomes, clustering on hospital. From these

models, we were able to estimate the baseline rate, the preguideline monthly change in the rate, the level change in the rate at the point the guideline was released, and the difference in the monthly change in the rate from preguideline to postguideline. All statistical analysis was performed using SAS version 9.3 (SAS Institute, Inc, Cary, NC), and $P < .05$ were considered statistically significant.

RESULTS

There were 111 813 children across 29 hospitals who were included in the study, with 54 043 and 57 770 in the preguideline and postguideline periods, respectively (Fig 1). The majority of children had a tonsillectomy with adenoidectomy (91.8%), were 4 to 9 years old (58.0%), had an airway obstruction indication diagnosis code (66.3%), and had same-day surgery (77.3%). Table 1 describes the demographic characteristics by guideline period.

Evidence-Based Care Processes

Among patients, there was an increase in the use of dexamethasone from 74.6% to 77.4% ($P < .001$) and a reduction in the use of antibiotics from 34.7% to 21.8% ($P < .001$) in the preguideline period compared with the postguideline period (Table 2). Similarly, among hospitals there was an increase in median dexamethasone use from 84.1% to 89.3% ($P = .86$) and a reduction in median antibiotic use from 25.9% to 11.1% ($P = .02$) during the same comparison periods (Table 2).

Analysis by interrupted time series provides trends in the rate of change over time from the preguideline period to the postguideline period for dexamethasone and antibiotic use among patients (Fig 2 A and B). For dexamethasone, the rate of use was 74.2% at the beginning of the preguideline period, and there was a nonsignificant reduction in use of 0.02% per month during the preguideline period ($P = .65$). After

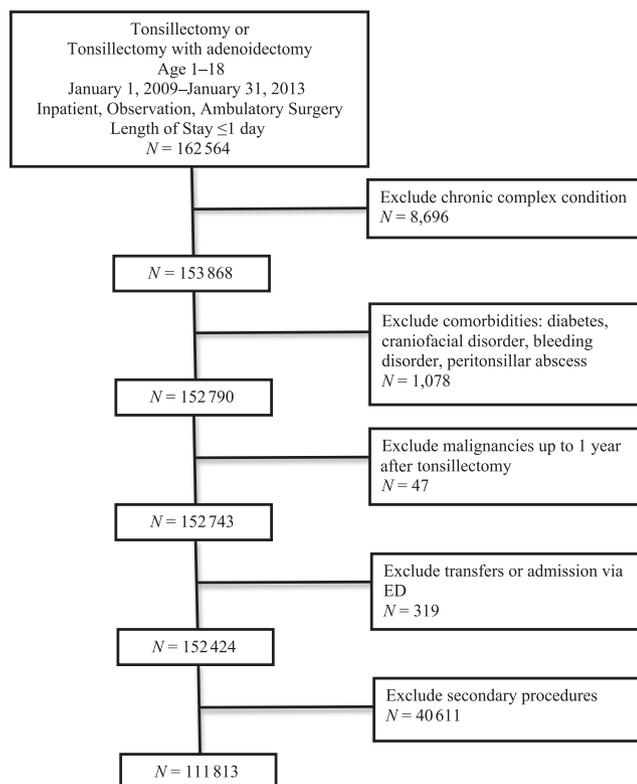


FIGURE 1
Cohort flow diagram.

TABLE 1 Study Population Demographics by Preguideline and Postguideline Periods Across 29 Children's Hospitals

	Overall	Preguideline	Postguideline	<i>P</i>
<i>N</i>	111 813	54 043 (48.3)	57 770 (51.7)	
Surgery type, <i>n</i> (%)				
Tonsillectomy with adenoidectomy	102 646 (91.8)	49 345 (91.3)	53 301 (92.3)	<.001
Tonsillectomy	9167 (8.2)	4698 (8.7)	4469 (7.7)	
Age, <i>y</i> , <i>n</i> (%)				
Median [IQR]	6.2 [4.2–9.1]	6.2 [4.2–9.1]	6.2 [4.2–9.1]	.61
1–3	24 698 (22.1)	12 084 (22.4)	12 614 (21.8)	.10
4–9	64 807 (58.0)	31 183 (57.7)	33 624 (58.2)	
10–18	22 308 (20.0)	10 776 (19.9)	11 532 (20.0)	
Gender, <i>n</i> (%)				
Male	54 916 (49.1)	26 695 (49.4)	28 221 (48.9)	.07
Race, <i>n</i> (%)				
Non-Hispanic white	63 736 (57.0)	30 779 (57.0)	32 957 (57.0)	<.001
Non-Hispanic black	16 728 (15.0)	8268 (15.3)	8460 (14.6)	
Hispanic	18 643 (16.7)	9564 (17.7)	9079 (15.7)	
Asian	1794 (1.6)	867 (1.6)	927 (1.6)	
Other	10 912 (9.8)	4565 (8.4)	6347 (11.0)	
Payer, <i>n</i> (%)				
Government	51 208 (45.8)	23 341 (43.2)	27 867 (48.2)	<.001
Private	52 271 (46.7)	26 157 (48.4)	26 114 (45.2)	
Other	8334 (7.5)	4545 (8.4)	3789 (6.6)	
Asthma, <i>n</i> (%)	13 394 (12.0)	6248 (11.6)	7146 (12.4)	<.001
Indication diagnosis, <i>n</i> (%)				
Infection	24 230 (21.7)	12 270 (22.7)	11 960 (20.7)	<.001
Airway obstruction	74 163 (66.3)	35 269 (65.3)	38 894 (67.3)	
Both infection and airway obstruction	13 284 (11.9)	6440 (11.9)	6844 (11.8)	
Other	136 (0.1)	64 (0.1)	72 (0.1)	
Region, <i>n</i> (%)				
Northeast	5605 (5.0)	2527 (4.7)	3078 (5.3)	<.001
South	42 526 (38.0)	20 992 (38.8)	21 534 (37.3)	
North central	38 478 (34.4)	18 379 (34.0)	20 099 (34.8)	
West	25 204 (22.5)	12 145 (22.5)	13 059 (22.6)	
Length of stay, <i>n</i> (%)				
Same-day surgery	86 435 (77.3)	42 472 (78.6)	43 963 (76.1)	<.001
Overnight stay	25 378 (22.7)	11 571 (21.4)	13 807 (23.9)	
Monthly hospital volume, median [IQR]	74 [39–108]	71 [41–103]	78 [39–110]	.21

IQR, Interquartile range. Preguideline period was from January 1, 2009 to December 31, 2010; postguideline period was from January 1, 2011 to January 31, 2013.

publication of the guideline, there was a significant increase in the use of dexamethasone to 0.29% per month ($P < .001$) and 79.3% by the end of the postguideline period. If the preguideline trajectory had been maintained, the projected use at the end of the study period would have been 73.2%.

The rate of antibiotic use was 37.1% at the beginning of the preguideline period, and there was a significant reduction in use of 0.17% per month before guideline publication ($P = .007$). At the time of guideline publication, antibiotic use dropped by 4.0% ($P < .001$). After publication of the guidelines, there was a significant

reduction in its use of 0.56% per month ($P < .001$) to 15.1% at the end of the postguideline period. If the preguideline trajectory had been maintained, the projected use at the end of the study period would have been 28.8%.

Tonsillectomy-Related Revisits to Hospital for Complications

Over the entire 48-month study period, 9624 (8.6%) of 111 813 children returned to hospital within 30 days for a tonsillectomy-related complication. Of children who had a revisit, 68.3% ($n = 6578$) had a revisit to the ED, 31.8% ($n = 3065$) had a revisit necessitating hospital

admission, and 4.9% ($n = 470$) had a revisit to the ambulatory surgical center. There was an increase in the 30-day revisit rate to hospital from 8.2% to 9.0% ($P < .001$), attributed to an increase in ED revisits from the preguideline to postguideline period (Table 2). Similarly, among hospitals there was an increase in the 30-day revisit rate, again caused by an increase in ED revisits from a median hospital rate of 8.0% to 8.8%, although this increase was not statistically significant ($P = .22$) (Table 2).

The most common reason for a revisit was bleeding, followed by vomiting and dehydration, and there was no difference in their rates over the guideline periods (Table 3). However, there was a significant increase in revisits due to pain from the preguideline period to the postguideline period that was evident at both the patient and the hospital level ($P < .001$) (Table 3). Readmissions due to bleeding and those that necessitated a procedure to control bleeding did not change significantly over the guideline periods (Table 4).

The analysis of the 30-day revisit rate over time revealed that the increase in revisits predated publication of the guidelines (Fig 2C). The rate at the beginning of the preguideline period was 8.0% and was increasing at a rate of 0.02% per month during this period ($P = .39$). After publication of the guidelines, the rate continued to increase by 0.01% per month ($P = .77$). The 30-day revisit rate at the end of the study period was 9.2%. If the preguideline rate had been maintained, the rate would have been 9.1%.

DISCUSSION

In a multicenter cohort of children undergoing tonsillectomy at children's hospitals, we observed a small increase in dexamethasone use and a substantial reduction in antibiotic use in the first 2 years after publication of the 2011 AAOHNS guidelines. Revisits for tonsillectomy-related

TABLE 2 Tonsillectomy Evidence-Based Processes of Care and Outcomes in the Preguideline and Postguideline Periods Across 29 Children's Hospitals

	Patient Level, <i>n</i> (%)			
	Overall, <i>n</i> = 111 813	Preguideline, <i>n</i> = 54 043	Postguideline, <i>n</i> = 57 770	<i>P</i>
Evidence-based processes of care				
Dexamethasone	85 009 (76.0)	40 316 (74.6)	44 693 (77.4)	<.001
Antibiotic	31 338 (28.0)	18 758 (34.7)	12 580 (21.8)	<.001
30-d tonsillectomy-related revisits for complications				
ED	6578 (5.9)	2977 (5.5)	3601 (6.2)	<.001
Inpatient + observation admissions	3065 (2.7)	1465 (2.7)	1600 (2.8)	.55
Ambulatory surgery	470 (0.4)	212 (0.4)	258 (0.4)	.16
Total	9624 (8.6)	4436 (8.2)	5188 (9.0)	<.001
	Hospital Level, Median % [IQR]			
	Overall	Preguideline	Postguideline	<i>P</i>
Evidence-based processes of care				
Dexamethasone	85.8 [62.3–96.6]	84.1 [62.3–96.6]	89.3 [63.3–95.7]	.86
Antibiotic	21.4 [9.7–39.0]	25.9 [15.9–50.5]	11.1 [6.5–33.5]	.02
30-d tonsillectomy-related revisits for complications				
ED	5.6 [3.9–7.5]	5.1 [3.9–6.4]	6.3 [4.1–8]	.14
Inpatient + observation admissions	2.7 [1.7–3.7]	2.7 [1.6–3.8]	2.7 [1.9–3.6]	.80
Ambulatory surgery	0.1 [0.1–0.6]	0.1 [0.1–0.3]	0.1 [0.0–0.7]	.66
Total	8.4 [6.4–10.9]	8.0 [6.2–10.3]	8.8 [6.7–11.3]	.21

IQR = interquartile range. Preguideline period was from January 1, 2009 to December 31, 2010; postguideline period was from January 1, 2011 to January 31, 2013.

complications have increased modestly over time; bleeding rates remained stable, and revisits for pain increased. These findings suggest that perioperative processes of care are more consistent with evidence-based practice, but tonsillectomy complication-related outcomes have not improved. These results were consistent at both the patient and hospital levels.

A recent study evaluated the impact of the 2011 AAOHNS guidelines by surveying 280 US otolaryngologists within a year after guideline publication.¹⁶ Almost half (46%) reported continuing to prescribe perioperative antibiotics, and 90% reported administering perioperative steroids. Our study findings differ because we did not rely on self-report but assessed the use of dexamethasone and antibiotics using administrative billing data in a large cohort of children and up to 2 years after guideline publication. We also examined the rate of change in these process measures to provide a better understanding of temporal changes in practice in relation to guideline publication. Furthermore, we not only evaluated process measures but also

evaluated patient outcomes relevant to the tonsillectomy perioperative phase.

Dexamethasone use increased only slightly after guideline publication despite the strong recommendation that all children receive it perioperatively. There are many reasons why physicians may not adhere to clinical practice guideline recommendations. They include a lack of awareness and familiarity with the guideline, lack of agreement with guideline recommendations, lack of self-efficacy, belief that guideline recommendations will not improve outcomes, inability to overcome the inertia of previous practice, and presence of external barriers.¹⁷ Uncertainty about the safety of dexamethasone and disagreement with guideline recommendations may explain the lack of greater adoption, as 1 trial published before our study period reported a greater risk of bleeding with dexamethasone.¹⁸ Subsequent safety evidence published during or after the postguideline period in this study has been conflicting, and thus the use of dexamethasone has been a point of controversy.¹⁹

A noninferiority trial found that there was no increased risk of bleeding associated with dexamethasone; however, this trial has been criticized as having set an inappropriately large noninferiority margin for bleeding that necessitated reoperation (ie, 5%).^{20,21} A meta-analysis and a large observational study concluded that there is no clinically important risk of bleeding associated with dexamethasone use.^{22,23} However, another meta-analysis, which specifically examined the need for reoperation for bleeding, found an increased risk of bleeding necessitating reoperation with dexamethasone use.²⁴

Antibiotic use was dropping before the publication of the guidelines, and this reduction accelerated after guideline publication. The reduction in antibiotic use over the study period was both clinically and statistically significant and important given that tonsillectomy is such a common surgery. This reduction in unnecessary antibiotic use minimizes the potential for antibiotic adverse events and emergence of antimicrobial resistance,

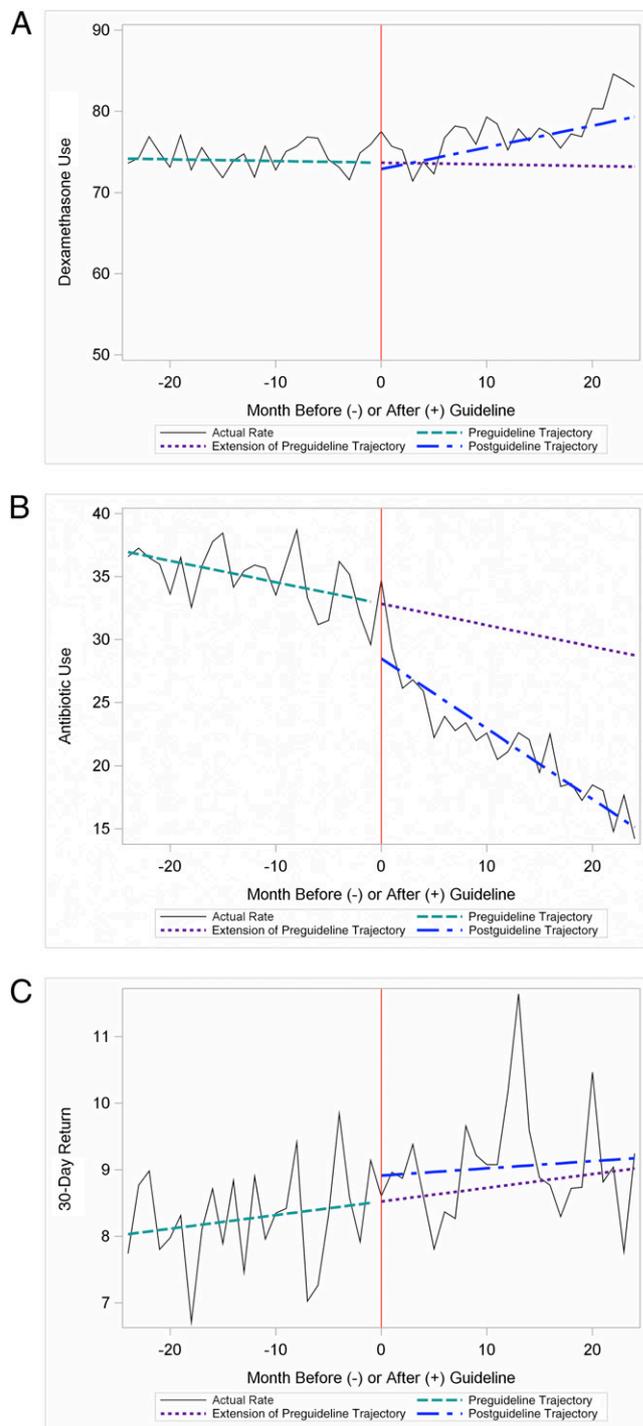


FIGURE 2 Actual, modeled, and projected trajectories of (A) dexamethasone use, (B) antibiotic use, and (C) 30-day tonsillectomy-related revisits across 29 children's hospitals, January 2009 to January 2013.

and it contributes to antibiotic stewardship efforts. These data on the change in the process measures over time suggest that the AAOHNS guidelines have had an impact on practice evident even in the first 2

years after publication. However, it is important to note that there are still outlier hospitals with inappropriately high antibiotic use and low dexamethasone use. It will be important to understand the reasons

for guideline nonadherence in hospitals to direct quality improvement interventions.

We did not observe a similar impact on tonsillectomy complication-related outcomes, because revisits did not decrease over time. This finding is not surprising because there is a lack of evidence on the most important factors or bundle of care necessary to reduce tonsillectomy-related revisits. The guidelines do make recommendations on the discharge education of families about posttonsillectomy pain management; however, the implementation of these recommendations or patient compliance may have been suboptimal. One would not expect a reduction in antibiotic use to have a significant impact on revisits. Although dexamethasone is effective in reducing postoperative nausea and vomiting, it has not been shown to reduce hospital revisits.⁷ Reducing revisits for tonsillectomy-related complications probably requires reliable implementation of a host of factors such as the optimal surgical technique, pain management, follow-up support for families, and revisit prevention strategies.

A concerning observation from our study was the increase in revisits due to pain at both the patient and hospital levels. During the study period, codeine-related deaths and respiratory depression in children after tonsillectomy were reported.^{25,26} The Food and Drug Administration then required that manufacturers of all codeine-containing products add a boxed warning of this risk related to codeine after tonsillectomy (and adenoidectomy) in children and a contraindication to its use in this population.²⁷ The AAOHNS also endorsed these requirements.²⁷ With this practice shift in pain management, it is possible that a lack of comfort with alternatives, such as ibuprofen or selective use of morphine, resulted in undertreatment of pain and an

TABLE 3 Reasons for 30-d Tonsillectomy-Related Revisits in Preguideline and Postguideline Periods Across 29 Children's Hospitals

Patient-Level Rates, % (95% Confidence Interval)				
	Overall	Preguideline	Postguideline	<i>P</i>
Bleeding	2.8 (2.7–2.9)	2.8 (2.7–2.9)	2.8 (2.7–3.0)	.61
Vomiting or dehydration	2.3 (2.2–2.4)	2.3 (2.2–2.4)	2.4 (2.3–2.5)	.33
Infection	1.0 (0.9–1.0)	0.9 (0.8–1.0)	1.0 (0.9–1.1)	.08
Other related	0.8 (0.8–0.9)	0.8 (0.7–0.9)	0.8 (0.7–0.9)	.59
Pain	1.2 (1.1–1.2)	0.9 (0.8–1.0)	1.4 (1.3–1.5)	<.001
Respiratory	0.5 (0.5–0.6)	0.5 (0.4–0.6)	0.6 (0.5–0.6)	.06
Hospital-Level Rates, Median % [IQR]				
	Overall	Preguideline	Postguideline	<i>P</i>
Bleeding	2.5 [2.0–3.2]	2.3 [1.8–3.2]	2.5 [2.2–2.9]	.85
Vomiting or dehydration	2.1 [1.5–3.1]	2.1 [1.6–3.1]	2.0 [1.5–2.7]	.96
Infection	0.9 [0.7–1.2]	0.9 [0.7–1.2]	0.9 [0.7–1.4]	.56
Other related	0.8 [0.5–1.1]	0.8 [0.5–1.1]	0.8 [0.6, 1.0]	.83
Pain	1.1 [0.8–1.5]	0.9 [0.7–1.2]	1.4 [1.0–1.6]	<.001
Respiratory	0.5 [0.4–0.7]	0.4 [0.4–0.7]	0.5 [0.4–0.7]	.46

IQR = interquartile range. Preguideline period was from January 1, 2009 to December 31, 2010; postguideline period was from January 1, 2011 to January 31, 2013.

TABLE 4 30-d Tonsillectomy-Related Readmissions for Bleeding in Preguideline and Postguideline Periods Across 29 Children's Hospitals

Patient-Level Rates, % (95% Confidence Interval)				
	Overall	Preguideline	Postguideline	<i>P</i>
Readmissions for bleeding	1.6 (1.6–1.7)	1.7 (1.6–1.8)	1.6 (1.5–1.7)	.79
Readmissions for bleeding that necessitated a procedure	0.8 (0.8–0.9)	0.8 (0.7–0.8)	0.9 (0.8–0.9)	.09
Hospital-Level Rates, Median % [IQR]				
	Overall	Preguideline	Postguideline	<i>P</i>
Readmissions for bleeding	1.5 [0.7–2.3]	1.5 [0.6–2.3]	1.5 [0.7–2.1]	.96
Readmissions for bleeding that necessitated a procedure	0.7 [0.3–1]	0.7 [0.2–1.1]	0.5 [0.3–1]	.85

IQR = interquartile range. Preguideline period was from January 1, 2009 to December 31, 2010; postguideline period was from January 1, 2011 to January 31, 2013.

increase in revisits. Our observation of increased revisits due to pain warrants additional exploration to understand the actual practice of tonsillectomy pain medication prescription and management as an area for improvement.

There are several limitations to this study. We evaluated the impact of only the guideline recommendations with respect to perioperative care and not other recommendations, such as when to perform a tonsillectomy. Our data source did not allow us to track revisits across hospitals, which

may have led us to underestimate the rate of tonsillectomy-related complications. Our findings represent the practice and outcomes at large children's hospitals and may not be generalizable to other surgical practice settings. Although results were consistent at the patient and hospital level, some comparisons were not statistically significant at the hospital level, probably because we were underpowered for comparisons at the hospital level because of the small number of hospitals. We did not have data on postdischarge antibiotic

prescribing, a practice that is not supported by randomized controlled trials but is common among some surgeons.⁹ We did not have data on hospitals' guideline implementation strategies, which may have explained the variation across hospitals. We were also not able to examine the role of other variables important to understanding tonsillectomy-related complications, such as surgical technique and specific discharge management practices such as pain medication prescriptions and outpatient follow-up.

CONCLUSIONS

The 2011 AAOHN tonsillectomy guideline was associated with some improvement in tonsillectomy evidence-based processes of care but no improvement in complication-related outcomes in the first 2 years after publication. There was a small increase in perioperative dexamethasone use and a substantial reduction in perioperative antibiotic use. Revisits to hospital for tonsillectomy complications increased due to revisits for pain. Additional research and quality improvement efforts are needed to reduce complication-related revisits and, in particular, revisits due to pain.

ABBREVIATIONS

AAOHNS: American Academy of Otolaryngology–Head and Neck Surgery
 ED: emergency department
 ICD-9-CM: International Classification of Diseases Ninth Revision, Clinical Modification
 PHIS: Pediatric Health Information System

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