Variation in Quality of Tonsillectomy Perioperative Care and Revisit Rates in Children’s Hospitals

WHAT’S KNOWN ON THIS SUBJECT: Tonsillectomy is one of the most commonly performed surgeries in children and is one of the most cumulatively expensive conditions in pediatric hospital care. Little is known about how the quality of tonsillectomy care varies across hospitals.

WHAT THIS STUDY ADDS: In a large cohort of low-risk children undergoing same-day tonsillectomy, there was substantial variation in quality measures of process, dexamethasone and antibiotic use, and outcome, revisits to the hospital within the first 30 days after surgery.

abstract

OBJECTIVE: To describe the quality of care for routine tonsillectomy at US children’s hospitals.

METHODS: We conducted a retrospective cohort study of low-risk children undergoing same-day tonsillectomy between 2004 and 2010 at 36 US children’s hospitals that submit data to the Pediatric Health Information System Database. We assessed quality of care by measuring evidence-based processes suggested by national guidelines, perioperative dexamethasone and no antibiotic use, and outcomes, 30-day tonsillectomy-related revisits to hospital.

RESULTS: Of 139,715 children who underwent same-day tonsillectomy, 10,868 (7.8%) had a 30-day revisit to hospital. There was significant variability in the administration of dexamethasone (median 76.2%, range 0.3%–98.8%) and antibiotics (median 16.3%, range 2.7%–92.6%) across hospitals. The most common reasons for revisits were bleeding (3.0%) and vomiting and dehydration (2.2%). Older age (10–18 vs 1–3 years) was associated with a greater standardized risk of revisits for bleeding and a lower standardized risk of revisits for vomiting and dehydration. After standardizing for differences in patients and year of surgery, there was significant variability (P < .001) across hospitals in total revisits (median 7.8%, range 3.0%–12.6%), revisits for bleeding (median 3.0%, range 1.0%–8.8%), and revisits for vomiting and dehydration (median 1.9%, range 0.3%–4.4%).

CONCLUSIONS: Substantial variation exists in the quality of care for routine tonsillectomy across US children’s hospitals as measured by perioperative dexamethasone and antibiotic use and revisits to hospital. These data on evidence-based processes and relevant patient outcomes should be useful for hospitals’ tonsillectomy quality improvement efforts. Pediatrics 2014;133:280–288

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ABBREVIATIONS
AAO-HNS—American Academy of Otolaryngology–Head and Neck Surgery
APR-DRG—All Patient-Refined Diagnosis-Related Groups
CI—confidence interval
ED—emergency department
ICD-9-CM—International Classification of Diseases, Ninth Revision, Clinical Modification
OR—odds ratio
PHIS—Pediatric Health Information System

(Continued on last page)
More than 500,000 tonsillectomies are performed each year in children in the United States, most commonly for sleep-disordered breathing and recurrent throat infections.\(^1,2\) It is the second most common and the ninth most cumulatively expensive reason for care in US children’s hospitals.\(^3\) The 2011 American Academy of Otolaryngology—Head and Neck Surgery (AAO-HNS) practice guidelines delineate high-quality tonsillectomy perioperative care.\(^2\) The guidelines recommend routine perioperative administration of dexamethasone and no antibiotics. These recommendations are based on evidence gathered from trials over the past 2 decades,\(^2,4,5\) which showed that dexamethasone, administered on the day of surgery, reduces postoperative nausea, vomiting, and pain,\(^4\) whereas perioperative antibiotics do not reduce postoperative bleeding, pain, or infections.\(^5\) The guideline recommends monitoring bleeding rates, as bleeding is the most common and serious complication.\(^6,7\)

To understand potential opportunities for quality improvement around tonsillectomy care, information is needed on perioperative evidence-based processes suggested by guidelines, such as dexamethasone and antibiotic use. Furthermore, information is needed on outcomes, such as the prevalence, patterns, and risk factors for revisits to the hospital after tonsillectomy and variations in revisit rates across hospitals. The objective of this study was to describe the quality of perioperative tonsillectomy care by assessing perioperative dexamethasone and antibiotic use and revisit rates in a large multicenter cohort of low-risk children undergoing same-day tonsillectomy at US children’s hospitals.

**METHODS**

**Study Design and Data Sources**

We conducted a retrospective multi-center observational study of children undergoing same-day tonsillectomy at US children’s hospitals from 2004 to 2010. Data were obtained from the Pediatric Health Information System (PHIS), a database of administrative and billing data from 43 freestanding children’s hospitals in 18 states and the District of Columbia, affiliated with the Children’s Hospital Association. The database contains detailed information on demographics, diagnosis and procedure codes, service locations, and their charges. Charges are mapped to a common set of clinical transaction codes, which include imaging studies, clinical services, laboratory tests, pharmacy, supplies, and room charges. Patients have unique identifiers, which permit longitudinal analysis of hospital encounters. Data quality and reliability are ensured through a joint effort between the Children’s Hospital Association and participating hospitals.\(^8\)

The institutional review board of the Children’s Hospital of Philadelphia deemed this study exempt from review under 45 CFR 46.102(b)(2), as the participants were not readily identifiable.

**Study Population**

Eligibility criteria were chosen to assemble a relatively homogeneous, low-risk cohort of children for which the AAO-HNS guidelines recommend routine use of dexamethasone and no antibiotics.\(^2\) Children 1 to 18 years who underwent tonsillectomy with or without adenoidectomy and who were discharged on the same day as the surgery at a hospital that submitted data to PHIS from January 1, 2004, to December 31, 2010, were eligible. 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 if they had tonsillectomy and/or adenoidectomy in the previous 2 years; a peritonsillar abscess or malignancy; an emergency department (ED) charge or admission through the ED; additional procedures including tympanostomy tubes; or a complex chronic condition,\(^9\) craniofacial abnormalities,\(^10\) diabetes, or a disorder in hemostasis (Supplemental Table 4). We also excluded children if the hospital submitted incomplete or no data for the index same-day surgery or revisits. To exclude records in which there was a high likelihood of coding errors, we excluded cost outliers at the bottom and top 0.1% of total standardized cost\(^3\) and also those surgeries without a perioperative room or clinical service charge.

**Covariates**

Demographic characteristics analyzed were age (1–3, 4–9, and 10–18 years), gender, race (white, black, other), and insurance type (government or non-government, including commercial, or self-pay). Age categories were chosen based on known associations with increased risk of complications (eg, age <3 or 4)\(^11\) and to ensure homogeneous risk within categories. A diagnosis of asthma, assessed using ICD-9-CM codes,\(^12\) was included as a covariate, as it is associated with increased risk of complications.\(^13,14\) is prevalent, and is not an excluded chronic condition in the AAO-HNS guidelines. Patient illness severity was classified using the APR-DRG (All Patient-Refined Diagnosis-Related Groups) severity classification system\(^15\) into 1 of 2 severity levels: minor (level 1) or nonminor (level 2 [moderate], 3 [major], 4 [extreme]). We classified the indication for surgery into 2 categories: infection (children who had an infection-related code) or not infection related (children who had an airway obstruction or other diagnosis code), based on a previous ICD-9-CM classification.\(^1\)

**Outcome Measures**

**Evidence-based Process Measures**

We determined whether children received dexamethasone and antibiotics
on the day of surgery based on the presence of pharmacy clinical transaction codes. For each hospital, we calculated a summary performance score, defined as the number of times a hospital administered dexamethasone but not antibiotics to an individual child, divided by the number of children who had a tonsillectomy at the hospital, multiplied by 100.

Revisits to Hospital
We evaluated revisits to the hospital by day after discharge to 30 days after the index surgery. Revisits included those to the ED and admission to the hospital. Two of the investigators (S.M., R.S.) reviewed all ICD-9-CM principal diagnoses related to revisits and classified them as tonsillectomy-related or unrelated. Only tonsillectomy-related revisits were included. For example, a revisit for fracture of the humerus was categorized as an unrelated revisit and excluded. Tonsillectomy-related revisits were then classified into 5 reasons based on the ICD-9-CM principal diagnosis code on the revisit: (1) bleeding, (2) vomiting and dehydration (codes related to dehydration, vomiting, or poor feeding), (3) pain, (4) infection (infections related to tonsillectomy or those that could be acquired during hospital care), (5) respiratory, and (6) other (including unspecified surgical complications and drug reactions).

Analysis
To estimate the hazards of revisits over time from surgery, we implemented a series of reason-specific discrete time-failure models using logistic regression. Data were processed into person-period format, with an observation representing each day from discharge to day 30 for each child. We further expanded the data to allow for a separate observation for each potential reason for revisit (eg, bleeding, vomiting, and dehydration). Using these data, we then constructed discrete time-failure models to estimate the hazard of revisit as a function of in-hospital processes (dexamethasone, antibiotics), the day postdischarge, the patient-level covariates, year of surgery, and hospital. We divided the 30 days into 5-day categories (1–2, 3–5, 6–7, 8–14, 15 or more). We modeled the hazard of revisit separately by reason for revisit to permit maximum flexibility in estimating reason-specific associations of patient-level covariates and outcome.

For estimating the risk for revisit at 30 days, we used logistic regression with a covariate for each hospital to adjust for confounding by hospital arising out of the differences across hospitals in the risk of revisit and the concomitant variation in the use of treatments across hospitals. For that reason, all estimates represent the within-hospital association of the risk of revisit and in-hospital processes or patient-level covariates. Results from logistic regression were standardized, using predictive margins, by other patient-level covariates, as well as by hospital and year of admission to produce adjusted probabilities and their 95% confidence.
bounds of revisit according to given patient and treatment characteristics. Standardization was to the characteristics of the population of children across all hospitals.

We estimated variation across hospitals in the risk for revisit at 30 days, and the relative rankings of hospitals by reason for revisit, by using mixed effects logistic regression with fixed effects for patient characteristics and random intercepts for hospitals. These models generated hospital-level predictions of revisit rates that not only adjust for interhospital differences in patient characteristics but also compensate for the inherent instability of raw hospital rates arising out of finite numbers of revisit events per hospital.22,23

To assess the trends in antibiotic and dexamethasone use and total revisit rates over time, we divided the study period into 6-month intervals. We estimated the trend over time within hospitals using both marginal and fixed-effects models adjusting for the patient-level covariates. Then we used likelihood ratio tests to evaluate the possibility of different trends across hospitals. Finally, we estimated probabilities of antibiotic and dexamethasone use and revisits at the start and end of the study period, standardized by patient characteristics. This allowed us to evaluate hospital-level changes over time adjusted for possible differences in patients across hospitals and over time.

Loss of data to missing covariates was minimal (n = 7). Observations with missing data were excluded in multi-variable models. All models were generated by using Stata version 12.1 (Stata Corp, College Station, TX).

RESULTS
Study Population

Of 297 155 children who underwent tonsillectomy during the study period, 139 715 children from 36 hospitals met the eligibility criteria (Fig 1 and Table 1).

The mean age of the cohort was 7.0 years (SD 3.8), and the illness severity was low in 94%. Almost all patients had tonsillectomy with adenoidectomy (91.0%) and the indication for surgery was most commonly airway obstruction (58.4%) and infection (33.4%).

Evidence-based Process Measures

Of the 139 715 admissions for tonsillectomy, 69.6% received dexamethasone and 31.1% received antibiotics on the day of surgery. Hospitals varied in their use of both dexamethasone and antibiotics (Fig 2). At the hospital level, the median percentage of patients who received dexamethasone was 76.2% (range 0.3%–98.8%) and antibiotics was 16.3% (range 2.7%–92.6%). The median summary performance score across hospitals was 43.4% (range 0.2%–91.3%).

Revisits to Hospital

Patient Level

A total of 10 868 (7.8%) children had a revisit within 30 days of the surgery, 6897 (63.5%) to the ED and 3971 (36.5%) admitted to the hospital; 4182 (30.0%) had a revisit for bleeding, 3011 (22.0%) for vomiting and dehydration, 1073 (0.8%) for infection, 1060 (0.8%) for infections, 542 (0.5%) for respiratory problems, and 1000 (0.7%) for other reasons. Most revisits (93.8%) occurred within 15 days after surgery and our analysis identified distinct patterns of revisits for the 2 most common reasons: bleeding and vomiting and dehydration (Fig 3).

The highest rate of revisits for vomiting and dehydration was on days 1 and 2 (4.52 per 1000 days of follow-up [95% confidence interval CI 4.27–4.77]) and 98.6% of revisits occurred by day 15. In contrast, the highest rate of revisits for bleeding was delayed occurring at the day 6 and 7 time interval (4.32 per 1000 days of follow-up [95% CI 4.08–4.56]) and 97.8% of revisits occurred by day 15.

Revisits and Patient-level Covariates

Age was the covariate most associated with standardized risk of revisits for the most common reasons for revisits. Older age, relative to youngest age (1–3 years), was associated with an increased risk of revisits for bleeding: age
In this large multicenter low-risk cohort of children undergoing same-day tonsillectomy, we observed substantial variation across US children’s hospitals in the quality of tonsillectomy care, measured in terms of perioperative process measures (use of dexamethasone and antibiotics) and outcomes (standardized revisits to hospital). Some hospitals provided almost no patients with the current recommended

Evidence-based Processes Measures and Revisits
There was no significant association between dexamethasone or antibiotic use and 30-day cumulative risk of total revisits (see Table 3).

DISCUSSION

The hospital median 30-day total revisit rate was 7.8%, but this varied across hospitals from 3.0% to 12.6%. The hospital median revisit rate for bleeding was 3.0% (range 1.0%–8.8%), and for vomiting and dehydration was 1.9% (range 0.3%–4.4%). Variability in all these outcomes remained after standardizing for patient-level covariates and year (P < .001) (Fig 4).

Trends Over Time
Dexamethasone usage was flat over time, with an OR of 1.00 for each 1-year change in time. By contrast, antibiotic usage dropped significantly over time (OR of 0.97 per year). For both process measures, trends in usage as well as level of usage varied widely across hospitals. Total revisit rates did not change over time (OR 1.00). The levels of rates did vary significantly across hospitals, however. Variation in trends across hospital remained significant, but far less so than with the antibiotics and dexamethasone trends.

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Variation in 30-day probability of revisits across 36 children’s hospitals. Variation in 30-day probability of revisits by reason for revisit (all reasons, bleeding, or vomiting and dehydration) across 36 children’s hospitals after adjusting for patient-level factors. A dark circle indicates each hospital’s 30-day probability of revisit by reason. The dashed lines connecting the 3 probabilities (all reasons, bleeding, and vomiting and dehydration) indicate values from a single hospital. Probabilities were estimated using mixed effects logistic regression models with a random intercept for hospital, and with fixed effects for patient age, race, insurance (government or private), diagnosis of asthma, indication for tonsillectomy, and year of surgery to account for possible differences across hospitals and over time in types of patients treated. Probabilities are further adjusted to improve prediction (of these probabilities) and to avoid overstating the degree of interhospital variation, via a weighted average of hospital-specific estimates and the overall estimates of all hospitals. For all revisits, and those from bleeding and dehydration/vomiting, the dispersion across hospitals of these adjusted probabilities was significantly greater ($P < .001$) than expected at random.

**TABLE 2** Patient-Level Covariates and 30-Day Cumulative Risk of Revisits

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total Revisits</th>
<th>Bleeding Revisits</th>
<th>Vomiting/Dehydration Revisits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30-d Cumulative Risk (95% CI)</td>
<td>Adjusted OR (95% CI)</td>
<td>30-d Cumulative Risk (95% CI)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–3</td>
<td>8.2 (7.8–8.5)</td>
<td>1 [Reference]</td>
<td>1.8 (1.6–2.0)</td>
</tr>
<tr>
<td>4–9</td>
<td>7.2 (7.0–7.4)</td>
<td>0.84 (0.74–0.95)**</td>
<td>2.6 (2.5–2.7)</td>
</tr>
<tr>
<td>10–18</td>
<td>9.1 (8.8–9.4)</td>
<td>1.05 (0.91–1.21)</td>
<td>4.9 (4.7–5.2)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7.8 (7.6–8.0)</td>
<td>1 [Reference]</td>
<td>3.1 (3.0–3.2)</td>
</tr>
<tr>
<td>Female</td>
<td>7.8 (7.6–8.0)</td>
<td>1.01 (0.97–1.04)</td>
<td>2.9 (2.8–3.0)</td>
</tr>
<tr>
<td>Severity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 1</td>
<td>7.7 (7.8–7.8)</td>
<td>1 [Reference]</td>
<td>3.0 (2.9–3.0)</td>
</tr>
<tr>
<td>Level 2, 3</td>
<td>8.8 (8.3–9.4)</td>
<td>1.16 (1.08–1.28)***</td>
<td>3.0 (2.6–3.3)</td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>7.5 (7.4–7.7)</td>
<td>1 [Reference]</td>
<td>3.0 (3.0–3.1)</td>
</tr>
<tr>
<td>Present</td>
<td>9.7 (9.3–10.0)</td>
<td>1.33 (1.25–1.41)***</td>
<td>3.3 (3.0–3.6)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>7.7 (7.5–7.9)</td>
<td>1 [Reference]</td>
<td>3.0 (2.9–3.2)</td>
</tr>
<tr>
<td>Black</td>
<td>8.1 (8.7–9.5)</td>
<td>1.20 (1.13–1.27)***</td>
<td>3.0 (2.7–3.2)</td>
</tr>
<tr>
<td>Other</td>
<td>7.0 (6.8–7.4)</td>
<td>0.90 (0.84–0.95)**</td>
<td>2.6 (2.5–3.0)</td>
</tr>
<tr>
<td>Payer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nongovernment</td>
<td>7.0 (6.8–7.2)</td>
<td>1 [Reference]</td>
<td>3.0 (2.9–3.1)</td>
</tr>
<tr>
<td>Government</td>
<td>9.2 (8.9–9.5)</td>
<td>1.33 (1.30–1.42)***</td>
<td>3.0 (2.9–3.2)</td>
</tr>
<tr>
<td>Indication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non–infection related</td>
<td>7.5 (7.3–7.7)</td>
<td>1 [Reference]</td>
<td>3.1 (3.0–3.2)</td>
</tr>
<tr>
<td>Infection related</td>
<td>8.1 (7.9–8.3)</td>
<td>1.08 (1.04–1.13)***</td>
<td>2.9 (2.7–3.0)</td>
</tr>
</tbody>
</table>

Cumulative risk per 100 patients and ORs standardized (adjusted) for all other patient levels, covariates, year of admission, and hospital by using logistic regression and predictive margins.

* $P < .05$; ** $P < .01$; *** $P < .001$. 

The 3.0% rate of revisits for bleeding found in our study is similar to the rates of secondary bleeding requiring hospital care reported in prospective studies. Also consistent with previous studies, we observed a delayed peak rate in secondary bleeding that corresponds with sloughing of the fibrin clot that coats the tonsillar fossae formed as part of the healing process. A UK prospective multicenter study that included 21 063 children reported a secondary bleeding rate of 1.9% to 3.0% depending on age category. It did not include ED revisits and found care of dexamethasone and no antibiotics compared with 91% at other hospitals. Revisits occurred in 7.8% of children within 30 days after this elective surgery, with bleeding and vomiting and dehydration accounting for three-quarters of total revisits. There was a fourfold difference across hospitals in revisit rates even after accounting for time and types of patients.
Further investigation is necessary to understand the reasons for the substantial variation in dexamethasone and antibiotic use and revisits across hospitals. Given the relatively few hospitals in our cohort, we had limited statistical power to examine hospital factors associated with better performance. The wide variation in dexamethasone use may relate to a concern of increased bleeding risk as reported in 1 trial.22 However, the AAO-HNS guidelines,2 and a subsequent trial,28 have concluded that there is no clinically important increased risk. The variation in revisits may indicate differences in processes of care during the index hospitalization (eg, surgical technique,25 anesthesia, pain management, discharge education) or postdischarge (eg, follow-up care, pain management). Although the variation might also reflect differences in patient factors such as health status, this explanation is less likely as we restricted our cohort to a low-risk population and accounted for hospital differences in patients in our analyses. Whatever the reasons, it is safe to say that hospitals with 12.6% revisit rates would be interested in understanding how to reduce their revisit rates down to the 3.0% rate observed at some of their peer institutions.

Our detailed data on tonsillectomy-related revisits in children can be used in several ways to inform quality measurement around tonsillectomy care. For example, given that more than 90% of revisits occurred in the first 15 days after surgery, this time period (versus 30 days) may be more appropriate for assessment of revisits. Also, our data on patient-level covariates reveal that age is an important variable for risk adjustment when reporting tonsillectomy revisit data. Furthermore, as the most common reasons for revisits (bleeding and vomiting and dehydration) are driven in different directions by this factor, one would not expect to see a reduction in revisits, unless there were a significant number of antibiotic-associated adverse events that resulted in revisits.

That the most common reasons for re-admission in children and adults were for bleeding followed by pain, vomiting, and then fever. This study also observed wide variation in bleeding complications, from 0% to 12%, after adjusting for patient factors, surgical technique, and surgeon experience across a large number of hospitals.

We did not detect an important association between process measures and the outcome of total revisits. Although dexamethasone is effective in reducing postoperative nausea and vomiting,4 this may not translate into reductions in revisits. Outcomes, such as length of postoperative stay and unplanned overnight admission, may be more closely linked to a reduction in postoperative nausea and vomiting. As antibiotics have not been shown to reduce posttonsillectomy morbidity,5 one would not expect to see a reduction in revisits, unless there were a significant number of antibiotic-associated adverse events that resulted in revisits.

![FIGURE 4](image.png)

**FIGURE 4**
Standardized rates of revisit by reason for revisit between days 1 through 30 after discharge. Standardized rates of revisit between days 1 through 30 after discharge per 1000 patient days of observation and 95% confidence bounds by reason for revisit. Rates were estimated separately for each reason for revisit by using discrete time failure model implemented using logistic regression and with time of revisit categorized by day (1–2, 3–5, 6–7, 8–14, and 15–30) to allow for the effect of time to vary without the restriction of a particular parametric form (such as a linear trend). Adjacent days with similar rates of revisits were groups to avoid instability of estimates from small sample sizes. All rates are marginally standardized by patient characteristics (age, gender, race), severity (APR-DRG), indication for tonsillectomy, insurance (government or private), year of surgery, and hospital to represent within-hospital adjusted rates and avoid confounding by these factors or by hospital characteristics.

**TABLE 3** Antibiotic and Dexamethasone Use and 30-Day Cumulative Risk of Total Revisits

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. (n = 139708)</th>
<th>30-d Cumulative Risk of Total Revisits (95% CI)</th>
<th>Risk Difference (95% CI)</th>
<th>P Value</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic</td>
<td>43425</td>
<td>7.6 (7.3 to 7.8)</td>
<td>-0.3 (-0.7 to 0.1)</td>
<td>.12</td>
<td>0.96 (0.91 to 1.01)</td>
</tr>
<tr>
<td>No antibiotic</td>
<td>96283</td>
<td>7.9 (7.2 to 7.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>97242</td>
<td>7.9 (7.7 to 8.1)</td>
<td>0.3 (-0.1 to 0.8)</td>
<td>.12</td>
<td>1.02 (0.90 to 1.15)</td>
</tr>
<tr>
<td>No dexamethasone</td>
<td>42488</td>
<td>7.5 (7.2 to 7.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cumulative risk per 100 patients and ORs standardized (adjusted) for patient-level covariates (age, gender, severity level, asthma, race, payer, indication), year of admission, and hospital by using logistic regression and predictive margins.
over time, and are likely driven by different processes of care, it would be most useful if these data on revisits are reported by reasons, in addition to total revisits, for hospitals’ improvement efforts. Finally, revisits for vomiting and dehydration also account for a significant proportion of total revisits, and in the context of this common surgery should also be given priority for quality improvement measurement and reporting. Our study findings should be interpreted in light of several limitations. First, this study does not address the entire continuum of tonsillectomy care. The data source did not permit us to assess surgical appropriateness or important outcomes, such as resolution of sleep-disordered breathing, recurrent infections, or quality of life. Second, our data are representative of US children’s hospitals, which account for one-third of US pediatric hospitalizations, and may not be generalizable to other hospital settings. Third, we did not include children with chronic complex diseases or children admitted through the ED for emergent tonsillectomy. We might have observed greater variation in care had we included these groups. Fourth, we did not examine the issue of variation in post-tonsillectomy admission practices, which is an important quality of care issue. Fifth, although parents and children would likely return to the same hospital for complications, they may have sought follow-up at different hospitals, leading to underestimation of revisit counts. Sixth, given the administrative data source, there may be misclassification in measures due to coding differences across hospitals.

CONCLUSIONS

Nearly 40 years ago, Wennberg and Gittelsohn demonstrated small areas of variation in rates of tonsillectomy despite no apparent differences among populations of patients in the United States. Our study, which focuses on 1 aspect of tonsillectomy care, shows that variation in care processes and outcomes continues today. Recent developments in US health care reform and financing may serve to nudge hospitals in the right direction. As evolving payment models, such as bundled payments that reward high-value care, are implemented, hospitals will need to deliver quality care while avoiding revisits for complications to maintain their profit margins. Quality improvement initiatives are needed to implement current evidence into practice, understand and disseminate the practices of high-performing hospitals, and improve the value of health care delivered for children undergoing tonsillectomy.

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Dr Mahant conceptualized and designed the study, contributed to data analysis and interpretation of the data, and drafted and revised the article; Dr Keren contributed to the concept and design of the study, interpretation of the data, and drafting and critical revision of the manuscript; Dr Localio contributed to the design of the study, conducted the data analysis, and contributed to drafting and critical revision of the manuscript; Mr Luan and Mr Song contributed to the design of the study, acquisition of data, data analysis, interpretation of the data, and critical revision of the manuscript; Drs Shah, Tieder, Wilson, and Elden contributed to the design of the study, interpretation of the data, and critical revision of the manuscript; Dr Srivastava conceptualized and designed the study, contributed to data analysis and interpretation of data, and critically revised the article; and all authors gave final approval of the manuscript as submitted.

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