Is There a Minimum Number of Thyroidectomies a Surgeon Should Perform to Optimize Patient Outcomes?

Mohamed Abdelgadir Adam, MD, Samantha Thomas, MS,† Linda Youngwirth, MD,* Terry Hyslop, PhD,† Shelby D. Reed, PhD,‡ Randall P. Scheri, MD,* Sanziana A. Roman, MD,* and Julie A. Sosa, MD MA*‡*

Objective: To determine the number of total thyroidectomies per surgeon per year associated with the lowest risk of complications.

Background: The surgeon volume–outcome association has been established for thyroidectomy; however, a threshold number of cases defining a ''high-volume'' surgeon remains unclear.

Methods: Adults undergoing total thyroidectomy were identified from the Health Care Utilization Project-National Inpatient Sample (1998–2009). Multivariate logistic regression with restricted cubic splines was utilized to examine the association between the number of annual total thyroidectomies per surgeon and risk of complications.

Results: Among 16,954 patients undergoing total thyroidectomy, 47% had thyroid cancer and 53% benign disease. Median annual surgeon volume was 7 cases; 51% of surgeons performed 1 case/y. Overall, 6% of the patients experienced complications. After adjustment, the likelihood of experiencing a complication decreased with increasing surgeon volume up to 26 cases/y ($P < 0.01$). Among all patients, 81% had surgery by low-volume surgeons ($\leq$25 cases/y). With adjustment, patients undergoing surgery by low-volume surgeons were more likely to experience complications (odds ratio 1.51, $P = 0.002$) and longer hospital stays (+12%, $P = 0.006$). Patients had an 87% increase in the odds of having a complication if the surgeon performed 1 case/y, 68% for 2 to 5 cases/y, 42% for 6 to 10 cases/y, 22% for 11 to 15 cases/y, 10% for 16 to 20 cases/y, and 3% for 21 to 25 cases/y.

Conclusions: This is the first study to identify a surgeon volume threshold (>25 total thyroidectomies/y) that is associated with improved patient outcomes. Identifying a threshold number of cases defining a high-volume thyroid surgeon is important, as it has implications for quality improvement, criteria for referral and reimbursement, and surgical education.

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Thyroidectomy is one of the most commonly performed surgical procedures, with >130,000 thyroid operations done annually in the United States.[1] The procedure represents the principal treatment modality for both benign and malignant thyroid disease, such as hyperthyroidism, symptomatic goiter, indeterminate thyroid nodules, and thyroid cancer.

Surgical thyroid disease is an important public health issue. Thyroid nodules are now identified in as many as 68% of healthy adults[2]; this, in turn, has led to a significant increase in the number of thyroid biopsies performed and in the utilization of thyroidectomy.[1] The incidence of thyroid cancer has increased at a faster rate than any other malignancy in the United States, with 62,450 new diagnoses anticipated in 2015.[3] It is projected that thyroid cancer incidence will continue to rise to become the third most common cancer among women by 2019, surpassing colorectal and endometrial cancers.[4]

Although total thyroidectomy is generally safe, it can result in life-altering complications, such as recurrent laryngeal nerve injury, hematoma, and symptomatic hypoparathyroidism. Incidence of postoperative complications varies greatly depending on extent of surgery and, importantly, surgeon experience.[5,6] Published data have demonstrated that surgeons who perform more thyroidectomies have superior outcomes, with fewer complications, shorter hospitalization, and lower costs. Therefore, higher surgeon volume has been identified as an important predictor of improved outcomes after thyroidectomy.[7,8] However, the definition of a high-volume thyroid surgeon has remained unclear. Identification of a threshold number of cases defining a high-volume thyroid surgeon would be helpful for surgeons, referring physicians, and patients. Minimum case volume threshold has been incorporated by some professional societies into the credentialing process of physicians in other specialties, such as bariatric surgery and interventional cardiology.[9,10] In addition, identification of a surgeon volume threshold may have direct implications regarding the ongoing efforts for volume-based referral initiatives led by the Leapfrog Group—a growing consortium of >140 large public and private healthcare purchasers providing health benefit to >34 million Americans.[11] More recently, some major health systems in the United States have pledged to impose minimum-volume standards within their systems for certain procedures.[12]

Thus, we sought to determine if there is a minimum number of total thyroidectomies per surgeon per year that is associated, on average, with superior outcomes. Only total thyroidectomies were included in the analysis, as the surgeon volume–outcomes relation is less evident for thyroid lobectomy.[5,6] We hypothesize that there is a number of thyroidectomies performed by a surgeon per year that is associated with the lowest risk of complications.

METHODS

This was a retrospective review of hospital discharge data of patients undergoing total thyroidectomy between 1998 and 2009 in the Health Care Utilization Project National Inpatient Sample datasets (HCUP-NIS). HCUP-NIS is maintained by the Agency for Healthcare Research and Quality, and represents a stratified 20% sample of inpatient discharges to acute care hospitals across the United States.

Adult patients undergoing total thyroidectomy for benign or malignant thyroid disease were identified from the dataset using the

From the *Department of Surgery, Duke University Medical Center, Durham, NC; †Department of Biostatistics, Duke University, Durham, NC; and ‡Duke Clinical Research Institute, Durham, NC.

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Reprints: Julie A. Sosa, MD, MA, Professor of Surgery and Medicine, Chief, Section of Endocrine Surgery, Department of Surgery, Duke University Medical Center #2945, Durham, NC 27710. E-mail: Julie.sosa@duke.edu.

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International Classification of Diseases, Ninth Revision (ICD-9) procedure code 6.4. Unique surgeon identifiers were not available in the HCUP-NIS for cases performed after 2009. Only data files from states that provided unique surgeon identifiers (18 states) were included.

Patient demographic characteristics such as age, sex, race, and payer were obtained from the dataset. Thyroid diagnoses were determined using the corresponding ICD-9 diagnosis code(s), which were then grouped into 3 major categories: thyroid cancer, benign thyroid neoplasm, and other benign disease (Graves disease and other forms of hyperthyroidism). Patient comorbidities were characterized using a modified Charlson-Deyo scoring system, and categorized into 3 groups: 0 (no comorbidities), 1, and $\geq$2.[13,14] Annual surgeon volume was calculated for each surgeon as the number of total thyroidectomies performed by a surgeon per year.

In-hospital complications were derived from secondary ICD-9 diagnoses and procedures codes corresponding to the index admission. Complications were grouped into endocrine-related (hypoparathyroidism and/or recurrent laryngeal nerve injury), bleeding, wound, respiratory, cardiac, urologic, in-hospital mortality, and overall complications[6] (Supplemental Table 1).

Hospital costs were calculated by multiplying hospital charges from the discharge records by the specific HCUP-NIS hospital cost-to-charge ratios. Costs were then adjusted to 2014 US dollars using rates from the Bureau of Labor Statistics Consumer Price Index Inflation Calculator.[15] The study was granted exempt status by our Institutional Review Board.

Statistical Analysis

The primary outcome of this study was incidence of at least 1 in-hospital complication. Secondary outcomes included the incidence of endocrine-specific in-hospital complications and hospital length of stay.

To estimate the association between annual surgeon volume and incidence of any complication, a multivariate logistic regression model with restricted cubic splines (RCS) was used to specify the functional form of annual surgeon volume. The RCS methodology provides a flexible model to examine the adjusted effect of a continuous predictor on an outcome, and allows for visualization of the relationship without prior knowledge of the functional form of the association.[16] Using this model, we identified a range of annual surgeon volumes that corresponded to a change in the relative log odds of experiencing any postoperative complication. A bootstrap simulation that incorporated a Monte Carlo Markov Chain procedure was conducted to estimate the point that corresponded to the maximum change from this range of annual surgeon volumes.[17,18] The following factors were accounted for in this multivariable model: patient age, sex, race, comorbidities, year of the procedure, thyroid-related diagnosis, hospital teaching status, and hospital volume.

Based on the identified annual surgeon volume threshold, the cohort was dichotomized into 2 groups: high-volume surgeons ($>$threshold surgeon volume) and low-volume surgeons ($\leq$threshold threshold surgeon volume). Chi-square and Fisher exact tests were used to compare categorical variables as appropriate, and the Wilcoxon rank-sum test was used to compare continuous variables. multivariable logistic regression was used to examine the adjusted association between low- versus high-volume surgeons and incidence of any postoperative complication, and negative binomial regression was used to examine the association with hospital length of stay and costs. These models were built in the generalized estimating equation framework to account for within-surgeon correlation.

A 2-sided significance level of 0.05 was used for all statistical tests. Statistical analyses were performed using SAS 9.4 (Cary, NC).

RESULTS

A total of 16,954 patients who underwent total thyroidectomy by 4627 surgeons met inclusion criteria. The most frequent indication for surgery was a diagnosis of thyroid cancer [n = 8012 (47%)]. Table 1 details demographic and clinical characteristics of the patient cohort.

Surgeon Volume and Incidence of Any Complication

Median annual surgeon volume was 7 cases, with a range of 1 to 157 cases. Overall, 1006 (6%) patients experienced at least 1 complication after total thyroidectomy. Of these patients, 366 (2%) experienced hypoparathyroidism and/or a recurrent laryngeal nerve injury. After adjustment for patient demographic, clinicopathologic, and hospital type and volume, increasing annual surgeon procedural volume was significantly associated with a decreasing likelihood of the patient experiencing a postoperative complication ($P < 0.001$). The RCS plot of the number of total thyroidectomies performed by a surgeon versus the log odds of experiencing any complication demonstrated that increasing surgeon volume was associated with decreasing odds of experiencing a postoperative complication up to 26 cases/y (Fig. 1). The simulation analysis confirmed the threshold at 26 cases/y [95% confidence interval (CI) 22–32]. A subset analysis that only included patients with thyroid cancer identified a similar threshold of 26 total thyroidectomies per year (data not shown).

Patient Outcomes and Surgeon Volume Status

Based on the threshold identified by the RCS and simulation analyses, high-volume surgeons were defined as surgeons who performed an average of $>$25 cases/y and low-volume surgeons as surgeons who performed an average of $\leq$25 cases/y.

A comparison of patient demographic and clinical characteristics by surgeon volume is detailed in Table 1. Compared with patients in the high-volume surgeon group, patients in the low-volume surgeon group were more often non-white (20% vs 30% low-volume), uninsured (2% vs 7%), and treated at hospitals that were nonteaching (18% vs 43%) and in rural areas (1% vs 4%; all $P < 0.0001$). The majority of patients (81%) underwent total thyroidectomy by low-volume surgeons, with half of the surgeons (51%) performing an average of just 1 case of total thyroidectomy per year. There were no significant differences between patients in the high- and low-volume surgeon groups regarding age, sex, comorbidities, and diagnosis category. Patients undergoing total thyroidectomy by low- versus high-volume surgeons were more likely to experience endocrine-related complications (2.3% vs 1.6%; $P = 0.01$), bleeding (1.6% vs 1.0%; $P = 0.006$), respiratory complications (1.3% vs 0.6%; $P = 0.0002$), or any complication (6.4% vs 4.1%; $P < 0.0001$) (Table 2). Hospital length of stay was significantly longer for patients who underwent surgery by low-volume surgeons compared with those who had surgery by high-volume surgeons (median 2 vs 1 d; $P < 0.0001$). Surgical care of patients in the low-volume surgeon group was significantly more costly by a median margin of $559 (10%) per patient ($P < 0.0001$).

After adjustment, factors associated with receiving surgical care from a low-volume surgeon were younger patient age, non-white race, Medicare/Medicaid insurance, lack of insurance, and treatment at nonteaching and rural hospitals (Fig. 2). Patients treated by low versus high-volume surgeons were more likely to experience a complication [odds ratio (OR) 1.51, 95% CI 1.16–1.97, $P = 0.002$) and longer hospital stay (12% increase, 95% CI 3–21%, $P = 0.006$) (Table 3).

TABLE 1. Demographic, Clinical, and Hospital Characteristics by Surgeon Volume Status

	High-volume (>25 Cases/y), n = 3180	Low-volume (≤25 Cases/y), n = 13,774	All patients, N = 16,954	*P*
Patient age, y (median, IQR)	51 (40–62)	50 (39–62)	50 (39–62)	0.14
Female sex	2562 (81%)	11257 (82%)	13819 (82%)	0.13
Race				<0.0001
White	2180 (69%)	8633 (63%)	10813 (64%)	
Black	313 (10%)	1913 (14%)	2226 (13%)	
Hispanic	131 (4%)	1226 (9%)	1357 (8%)	
Other	198 (6%)	962 (7%)	1160 (7%)	
Insurance type				<0.0001
Private	2325 (73%)	9097 (66%)	11422 (67%)	
Medicare	637 (20%)	2952 (21%)	3589 (21%)	
Medicaid	143 (4%)	826 (6%)	969 (6%)	
Self-pay	32 (1%)	415 (3%)	447 (3%)	
Other/no charge	42 (1%)	328 (4%)	500 (3%)	
Charlson-Deyo score				0.29
0	2576 (81%)	11119 (81%)	13695 (81%)	
1	535 (17%)	2289 (17%)	2824 (17%)	
≥2	69 (2%)	366 (3%)	435 (3%)	
Diagnosis				0.72
Adenoma	207 (6%)	946 (7%)	1153 (7%)	
Malignant	1518 (48%)	6494 (47%)	8012 (47%)	
Other benign disease	1413 (44%)	6065 (44%)	7478 (44%)	
Annual hospital volume (median, IQR)	82 (54–163)	20 (9–40)	28 (12–65)	<0.0001
Hospital type				<0.0001
Teaching	2607 (82%)	7848 (57%)	10455 (62%)	
Nonteaching	573 (18%)	5925 (43%)	6498 (38%)	
Hospital location				<0.0001
Urban	3155 (99%)	13210 (96%)	16365 (96%)	
Rural	25 (1%)	563 (4%)	588 (4%)	

IQR indicates interquartile range.

We then quantified the adjusted relative odds of having a postoperative complication among the low-volume surgeon group (Table 4). Compared with patients of a high-volume surgeon, patients of low-volume surgeons had a 87% increase in the odds of having a complication if the surgeon performed 1 case/y, 68% for 2 to 5 cases/y, 42% for 6 to 10 cases/y, 22% for 11 to 15 cases/y, 10% for 16 to 20 cases/y, and 3% increase for 21 to 25 cases/y.

DISCUSSION

In this large study of 16,954 patients who underwent total thyroidectomy for thyroid disease, we demonstrated that increasing surgeon procedural volume was associated with improved postoperative outcomes. After adjustment for patient, disease, and hospital characteristics, the likelihood of experiencing a postoperative complication decreased with increasing surgeon volume in a dose-dependent fashion up to 26 (95% CI 22–32) total thyroidectomies per year. Whereas there were no differences in patients' clinical characteristics between those who had surgery by low (≤25 cases/y) versus high-volume surgeons (>25 cases/y), patients undergoing surgery by low-volume surgeons were more likely to experience complications and longer hospitalization. The vast majority of patients underwent total thyroidectomy by low-volume surgeons. This is the first study to identify a surgeon volume threshold for total thyroidectomy associated with the lowest risk of complications.

There is a large body of literature exploring the relationship between surgeon volume of thyroidectomies and postoperative outcomes.[6,8,19–22] Although these studies consistently have demonstrated significant associations between higher surgeon volumes and improved outcomes from thyroid surgery,[6,19,20,22] the threshold used to define a high-volume thyroid surgeon has remained unclear.[19] Sosa et al analyzed the effect of surgeon volume on patient outcomes in 5860 adult patients, and categorized surgeons based on the overall number of cases performed into 4 groups: (1) 1 to 9 cases; (2) 10 to 29 cases; (3) 30 to 100 cases; and (4) >100 cases across 6 years. After adjustment for case mix and hospital volume, higher surgeon volume was associated with lower complication rates, shorter hospitalization, and reduced costs, with the greatest improvement in the highest-volume surgeons (>100 cases/6 y).[6] In another population-based study of 21,270 thyroidectomy cases, Gourin et al analyzed outcomes based on 3 surgeon-volume groups: (1) low-volume (<23 cases/y); (2) intermediate-volume (23–100 cases/y); and (3) high-volume (>100 cases/y). They demonstrated that patients who underwent surgery by "high-volume" surgeons enjoyed a lower incidence of complications and shorter length of hospitalization.[21] Others have defined high-volume providers as those surgeons who have performed 30 to 50 thyroidectomies per year.[23]

Prior studies varied in estimating the case-volume threshold defining a high-volume thyroid surgeon, with a threshold ranging anywhere from 20 to 100 cases per year.[6,20,21,24,25] Surgeon volumes of 20 and/or 70 cases per year were considered high-volume in some studies,[6,25] but in other studies were analyzed as part of the low-volume group.[20,24,26] The reported variation in the definitions of a high-volume surgeon across studies is likely a result of how surgeon volume was analyzed in each of the studies. A common theme across these analyses was that surgeon-volume groups were arbitrarily divided into low- and high-volume groups. A significant difference in outcomes between the lowest- and highest-volume groups does not necessarily identify the threshold, given the confounding effect of outliers and loss of information of data points between these lowest- and highest-volume points.

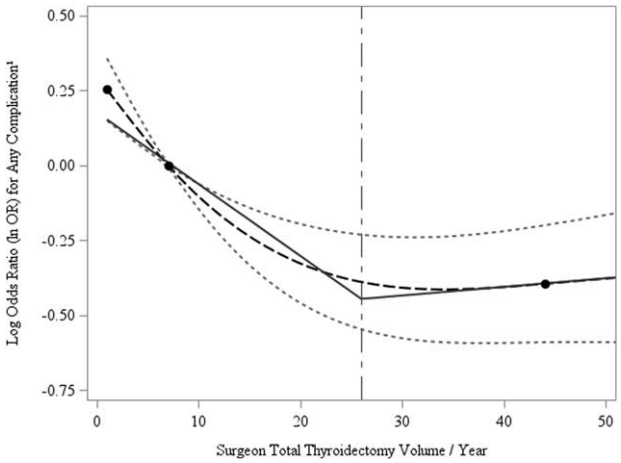

FIGURE 1. Smoothed restricted cubic spline plot of the adjusted log odds ratio of experiencing any complication versus the number of total thyroidectomies performed per surgeon per year in HCUP-NIS. The predicted hazards ratios were estimated from a proportional hazards model adjusting for covariates. The light dotted curves represent the 95% confidence intervals about the predicted odds ratio. The dark dashed curve represents the regression line in the change point estimation. The black dots correspond to the location of 3 knots used in the model. They intersect at a value of 26 cases per year, as indicated by the dashed vertical line. Adjusted for the effects of patient age, sex, race, comorbidities, year of diagnosis, diagnosis, and hospital type and volume.

The association between surgeon volume and patient outcomes has been also established for other surgical procedures; however, the majority of published data are limited by lack of adequate identification of a minimum threshold number of cases defining a high-volume surgeon.[27,28] Birkmeyer et al analyzed the relationship between surgeon volume and operative mortality for 8 cardiovascular and cancer surgeries in the United States. Surgeon volume was categorized into 3 evenly-sized groups: low-volume, medium-volume, and high-volume. For most procedures, the mortality rate was higher among patients of low-volume surgeons than those of high-volume surgeons.[29] However, others have pointed out that defining surgeon-volume status based on distributions of patients across volume groups (eg, tertiles, quartiles, or quintiles) is not generalizable, and may not be accurate.[27,28] To overcome this concern, RCS were used to determine the definition of a high-volume surgeon.[27,28]

In the current study, we analyzed surgeon volume as a continuous variable, without any prespecified definition or assumption about any potential case threshold. Our estimation of a surgeon-volume threshold was derived from a multivariate analysis with RCS in which we identified the case volume corresponding to an inflection point denoting the greatest change in the odds of a complication. This approach has significant advantages, including the ability to use all data points to estimate the shape of the relationship between surgeon-volume and morbidity, and obviating the need for prespecifying a possible threshold. RCS models are also beneficial in minimizing the possible effect of outliers at the tails compared with other utilized methods.[16]

Identification of thyroid surgeon-volume threshold is potentially important since this information is increasingly being utilized as a surrogate for quality of surgical care. For instance, the Leapfrog Group has established minimum surgeon-volume standards for several surgical procedures. Hospitals are considered fully adhering to the guidelines if they have no low-volume surgeons performing these procedures, for which they receive credit.[11,30]

This study also demonstrates the association of improved outcomes with higher-volume surgeons to volumes below the threshold of 26 cases/y in a dose-dependent fashion, which informs patients, providers, and hospitals in the situations where access to high-volume surgeons is scarce and may facilitate discussion about tradeoffs between risks and benefits associated with seeking higher-volume surgeons. The vast majority of patients in our study were treated by low-volume surgeons. This finding has been documented consistently, with the majority of thyroid patients (70%–85%) receiving treatment from low-volume surgeons.[6,21,22,31] Potential barriers to receiving surgical care by a high-volume thyroid surgeon include limited access to experienced surgical providers and/or lack of awareness among referring nonsurgeon physicians and patients. Similar to other studies, [32,33] patients receiving care by low-volume surgeons were more likely to be non-white, live in rural areas, have Medicare/Medicaid insurance or have no medical insurance, and/or receive surgical care at nonteaching hospitals.

TABLE 2. Clinical Outcomes, Hospital Length of Stay, and Inflation-adjusted Hospital Costs by Surgeon Volume Status

Complication	High-volume (>25 Cases/y)	Low-volume (≤25 Cases/y)	*P*
Endocrine-related	50 (1.6%)	316 (2.3%)	0.01
Bleeding	31 (1.0%)	223 (1.6%)	0.006
Wound	21 (0.7%)	146 (1.1%)	0.05
Respiratory	18 (0.6%)	183 (1.3%)	0.0002
Cardiac	9 (0.3%)	58 (0.4%)	0.35
Urologic	15 (0.5%)	66 (0.5%)	1
Overall	130 (4.1%)	876 (6.4%)	<0.0001
In-hospital mortality	0	*	0.59
Length of stay, d (median, IQR)			<0.0001
Mean, SD	1.5 (1.3)	2.0 (1.9)	
Median, IQR	1 (1–2)	2 (1–2)	
Inflated-adjusted costs†			<0.0001
Mean, SD	$7166 (5052)	$7550 (5683)	
Median, IQR	$5826 (4325, 8578)	$6385 (4800, 8674)	

*Suppressed due small cell size, per HCUP-NIS policy.
†Cost data are reported in 2014 US dollars.
IQR indicates interquartile range; SD, standard deviation.

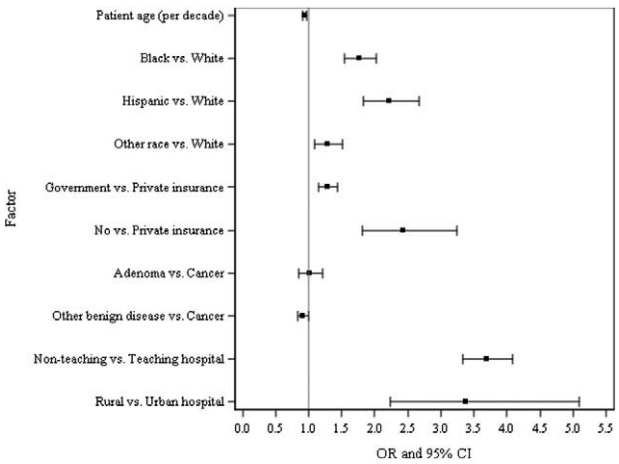

FIGURE 2. Factors independently associated with the likelihood of undergoing total thyroidectomy by a low- versus high-volume surgeon. Black squares represent log odds ratios for the independent association of each factor with undergoing surgery by a low-volume surgeon; 95% CI bounds are represented by the corresponding horizontal lines. Factors on the right of the vertical line at 0 are independently associated with undergoing total thyroidectomy by a low-volume surgeon.

Optimizing endocrine surgery training during residency, and promoting endocrine surgery fellowship training could potentially increase the number of high-volume thyroid surgeons. In a survey study of junior endocrine surgeons and endocrine surgery fellows, Solorzano et al reported that more than one-third of survey respondents felt that residency training did not prepare them to adequately perform endocrine surgery. Fellows graduated from endocrine surgery fellowships with a median of 150 (range 50–300) thyroid cases per year.[34] Efforts also are needed to expand the endocrine surgery job market. In a survey of 10 surgery recruiters, only 3 recruiters were familiar with endocrine surgery as a specialty, and all had <5 of their hiring institutions asking for endocrine surgeons.[35]

Published data suggest that some improvements have been made regarding directing referrals to high-volume thyroid surgeons. Boudourakis et al examined trends of surgeon-volume care for 8 procedures from 1999 to 2005. They found that the 12% increase in the proportion of patients undergoing thyroidectomy by high-volume surgeons lagged behind increases for gastrectomy (106%), lung lobectomy (100%), esophagectomy (49%), and pancreatectomy (17%).[32] This result highlights the need for continuing efforts to improve access to high-volume thyroid surgeons.

Limitations to our study include those inherent to data from large administrative registries, such as the potential for coding errors. Complications were derived from ICD-9 secondary diagnoses and procedure codes for the index admission. As complications occurring after discharge are not captured in this study, the overall complication rate may be somewhat underestimated. However, it is reasonable to assume that the proportion of occurrences of major postthyroidectomy complication(s) would have manifested during the admission, and that the underestimation of complications should have been equal across both the low- and high-volume groups. Thyroid disease severity, such as thyroid cancer stage and size of the thyroid gland/goiter, is not reported in the database. Despite these limitations, the analysis included a large sample size culled from the population. The methods utilized in this analysis permitted us to determine the threshold minimum number of cases defining a high-volume thyroid surgeon in a more rigorous fashion.[28] Although the study is retrospective in nature, it is unlikely that a randomized clinical trial will be undertaken due to ethical and practical concerns.

Thyroid lobectomy data were not included in the analysis. The volume–outcome association in thyroid surgery has been shown to be strong for total thyroidectomy, but less so with thyroid lobectomy. Although a surgeon performing enough total thyroidectomies is likely equipped to safely perform thyroid lobectomy, the opposite cannot be assured. In addition, given that a majority of thyroid

TABLE 3. Summary of Adjusted Outcomes for Patients Treated by Low- Versus High-volume Surgeons

Outcome	Odds Ratio (95% CI)	Percent Increase (95% CI)	*P*
Overall complications	1.51 (1.16, 1.97)	—	0.002
Hospital length of stay	—	12 (3, 21%)	0.006
Hospital costs	—	2 (-5, 10%)	0.57

Outcomes were examined in separate multivariable models where the adjusted association of each outcome was modeled against surgeon volume status while accounting for the effects of patient age, sex, race, comorbidities, diagnosis, year of the procedure, and hospital type and volume.

TABLE 4. Adjusted Relative Odds of Postoperative Complications After Total Thyroidectomy Performed by Low-volume Surgeons Compared With High-volume Surgeons

Annual Surgeon Volume (Number of Cases/y)	Surgeons (n = 4627) %	Patients (n = 16,954) %	% Increase Odds of Complications (vs High-volume)*	95% CI*
1	51	16	87	48-136
2–5	34	29	68	39-104
6–10	7	15	42	24-62
11–15	3	10	22	13-32
16–20	1	7	10	5-14
21–25	1	5	3	1–4

*Relative percent estimates were derived from a multivariable restrictive cubic splines model where the odds of experiencing any complication modeled against annual surgeon volume, while adjusted for patient age, sex, comorbidities, year of procedure, and diagnosis.

lobectomies are performed in the ambulatory setting, and the HCUP-NIS database does not capture ambulatory thyroid lobectomy cases, estimates provided from this inpatient database would be incomplete and unrepresentative for this procedure.

Establishing a definition for a high-volume thyroid surgeon serves as a critical first step toward improving organization of patient care and training around thyroidectomy at a regional or national level, potentially bearing significant implications regarding quality-improvement initiatives, identification of criteria for referral and payer reimbursement, and surgical education. This volume threshold is also important for patients and referring physicians. Surgeons are generally aware of how many procedures they perform per year; in addition, with maintenance of certification and recertification requirements, they also must be able to report their outcomes. Patients should be able to ask a surgeon directly how many thyroidectomies they perform, on average, per year. Surgeons have an ethical responsibility to be honest and report their own case numbers.

Whereas previous attempts at implementation of high-volume care have not been well-embraced by small hospitals, the anticipated departure from the current model of fee-for-service to value-based reimbursement may shift the focus to volume-based practice, as the financial risks from complications will be imposed on hospitals.[36] In areas where access to high-volume surgeons is problematic, providers and hospital administrators could potentially designate a surgeon(s) to perform all thyroidectomies within a small practice. As such, these data potentially have important implications for patients, referring providers, surgeons, hospitals, and payers.

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