The Society of Thoracic Surgeons General Thoracic Surgery Database 2018 Update on Outcomes and Quality

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For nearly 15 years The Society of Thoracic Surgeons General Thoracic Surgery Database (STS GTSD) has provided participating institutions with risk-adjusted feedback reports that allow outcome comparisons relative to national benchmarks. With more than 300 contributing centers across North America, the STS GTSD now includes more than 530,000 cases. In 2017 the STS GTSD Task Force revised the data collection form with the goal of collecting more detailed and accurate information for the most important thoracic surgical cases without increasing the workload of registrars. In addition, the learning curve for thoracoscopic lobectomy was examined, online public reporting was initiated, institutional feedback reports were made more user-friendly, and collaboration with the European Society of Thoracic Surgery continued. The STS GTSD Task Force continues to work to improve the quality of care and support research initiatives in general thoracic surgery. This report summarizes current aggregate national outcomes in general thoracic surgery and reviews related activities in the areas of quality measurement, performance improvement, and transparency from the STS GTSD during the past 12 months.

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With more than 300 participating centers across North America contributing more than a half million cases, The Society of Thoracic Surgeons General Thoracic Surgery Database (STS GTSD) is the largest thoracic surgical database in the world [1]. The STS GTSD Task Force is a voluntary committee that works to maintain the database and support quality improvement, outcomes analysis, and research initiatives in general thoracic surgery. Multiple projects were completed in 2017, including revision of the STS GTSD data collection form (DCF) and institutional feedback reports, a cumulative sum (CUSUM) analysis examining the learning curve for thoracoscopic lobectomy, and creation of the first Data Transfer and Usage Agreement (DTUA) to establish a joint data set with the European Society of Thoracic Surgery (ESTS) Registry. The annual Advances in Quality and Outcome (AQO) meeting was held in Chicago in October 2017, and routine data audits continue as the STS GTSD Task Force strives to improve the quality and completeness of the database. This review summarizes all national aggregate outcomes, quality measurement, and improvement initiatives from the STS GTSD during the past 12 months.

Database Participation

Participation in the STS GTSD has increased each year since its establishment in 2002, with 306 participants submitting data for the Fall 2017 Data Analysis Report (July 2014 through June 2017). As of December 31, 2017, the STS GTSD included data from 970 physicians (942 thoracic surgeons, 1 pulmonologist, and 27 general surgeons) at 290 United States institutions in 44 states, for a total of 530,764 operations. In addition, the STS GTSD currently has 8 participation agreements pending. Two international sites, the United Arab Emirates and Singapore, also currently contribute data to the STS GTSD.

Revised DCF

Every 3 years, the STS GTSD Task Force upgrades the DCF with the goal of capturing relevant data and

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eliminating unnecessary variables. Ideally, this revision is performed without significantly increasing the workload of data abstracters. The STS GTSD Task Force met in January 2016 to discuss upgrading version 2.3 of the DCF to version 2.4. Subcommittees were formed to revise (1) demographics, preoperative evaluation, and comorbidities, (2) lung cancer staging, (3) esophageal cancer staging, (4) benign esophagus, (5) mediastinum, (6) diagnosis and operating room, (7) major and minor procedures, and (8) postoperative events, discharge, quality measures, and reason for readmission. Input from database managers was obtained and incorporated into the STS GTSD Task Force proposed upgrades.

The major change to the DCF with version 2.4 is the transition from major and minor cases to analyzed and nonanalyzed cases. Data from all lung resections for suspected cancer and all esophageal cancer cases will continue to be mandatory and will be analyzed. Three new optional modules have been included for analysis, if submitted: hiatal hernia, tracheal resection, and thymectomy/mediastinal tumor resection. The flow of the DCF has also been changed from prior versions. The registrar will start with demographics and preoperative variables, followed by category of diagnosis and operation, then move to the lung, esophageal, thymus/mediastinal mass, tracheal, or hiatal hernia section, then proceed to the disposition, discharge, and follow-up sections. Other cases will not be submitted to the Duke Clinical Research Institute but can be entered for institutional data tracking purposes.

A number of minor revisions to each section have been made, including replacement of the Zubrod score with the Eastern Oncology Cooperative Group score, updating to the Eighth Edition of the American Joint Committee on Cancer staging system, and inclusion of 5-year follow-up survival data. The new DCF will also capture lung resections on nodules suspicious for lung cancer so that we can better understand our rates of therapeutic resection.

In addition, the STS GTSD transitioned from intermittent to continuous data harvesting in 2017. Continuous data harvests allow participants to continuously upload data to the data warehouse as opposed to the previous biannual data submission schedule.

The updated DCF was provided to vendors in the Fall of 2017, and version 2.4 is planned to go live on July 1, 2018. With these upgrades, the STS GTSD Task Force hopes to reduce the work of the registrars and obtain more detailed and accurate data for the most important cases in general thoracic surgery.

Understanding the Thoracoscopic Lobectomy Learning Curve

In 2017 Dr Varun Puri and the STS GTSD Task Force completed a project aimed at defining the learning curve required for thoracoscopic lobectomy [Puri, in press]. Cumulative sum (CUSUM) analysis is an analytical technique based on sequential monitoring of cumulative performance over time, resulting in real-time assessment of

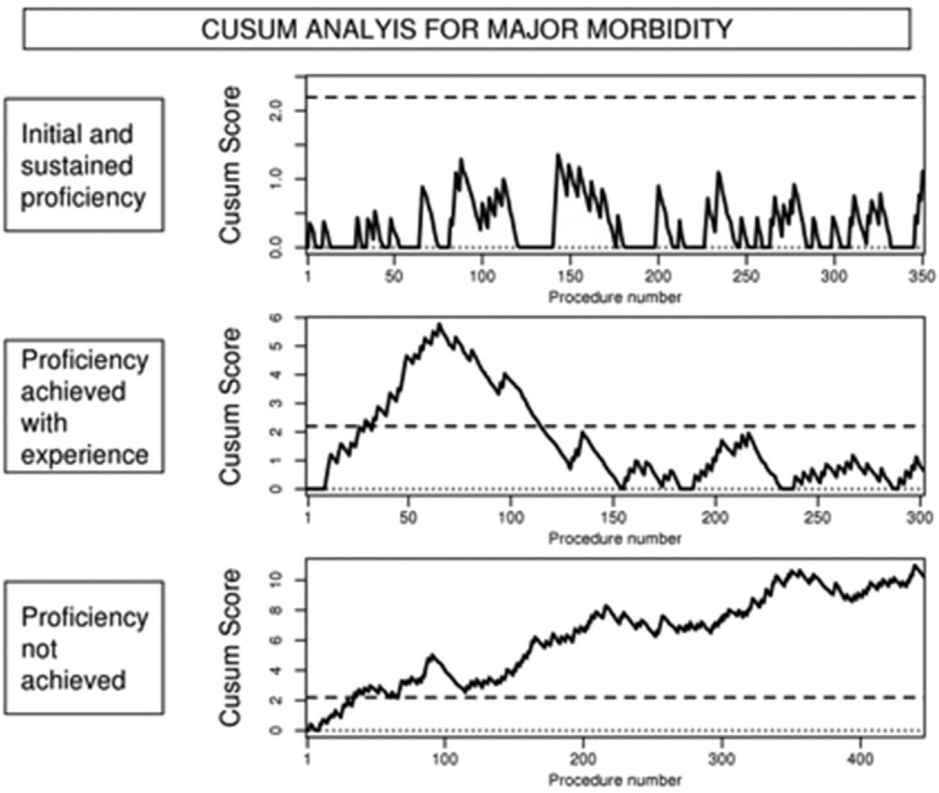

Fig 1. Risk-adjusted cumulative sum (CUSUM) analysis curves demonstrate three distinct patterns of performance for major morbidity at centers performing thoracoscopic lobectomy. Upward spikes represent failures, and decrements signify successes.

performance. CUSUM analysis can incorporate risk adjustment for variables predictive of success and allows programs and, potentially, individual surgeons, to be evaluated anonymously. To understand the learning curve for thoracoscopic lobectomy, major morbidity, death, and blood transfusion were chosen as the primary outcomes, with the expected incidence determined from risk-adjusted regression models. Acceptable and unacceptable event rates for each outcome were determined a priori. Thoracoscopic lobectomy performance was then examined considering major morbidity, death, and blood transfusion for the entire cohort and for each participating center.

Between November 2001 and June 2016, 24,196 patients underwent thoracoscopic lobectomy at 159 centers with a median volume of 103 cases (range, 30 to 760 cases). Overall rates of operative mortality, major morbidity, and transfusion were 1% (244 of 24,189), 17.1% (4,145 of 24,196), and 4% (975 of 24,196), respectively. During the study period, operative mortality (first vs last recent decile: 1.6% vs 0.7%, $p = 0.009$) and transfusion (first vs last decile: 5.4% vs 2.5%, $p < 0.001$) declined, whereas major morbidity remained unchanged.

Of participants performing more than 100 cases during the study period, 84.4% (65 of 77) and 81.8% (63 of 77) were proficient by major morbidity standards by their 50th and 100th cases, respectively. Similarly, 92.2% (71 of 77) and 89.6% (69 of 77) of centers demonstrated proficiency by transfusion standards by their 50th and 100th cases, respectively. Three performance patterns were observed: (1) initial and sustained proficiency, (2) crossing unacceptability thresholds, followed by improved performance, and (3) crossing unacceptability thresholds without subsequent improved performance (Fig 1).

Based on these data, the STS GTSD Task Force concluded that thoracoscopic lobectomy outcomes have improved over time with lower mortality and transfusion rates. Although most high-volume centers demonstrate proficiency after 50 cases, maintenance of proficiency is not guaranteed. CUSUM analysis is an innovative way to examine performance and can be used to prompt internal audits and quality improvement initiatives.

Updated Program Feedback Reports

In an ongoing effort to provide useful feedback to participants, the STS GTSD Task Force made substantial improvements to the feedback reports released in January 2018. This included the addition of two new sections that will play important roles in future public reporting initiatives. The "Participant Performance for Lobectomy Compared to STS and National Inpatient Sample (NIS) Database" section is new and contains comparisons of participant, STS, and national data for discharge mortality and postoperative length of stay. The "STS Composite Quality Rating" section contains the composite scores for lobectomy for lung cancer patients. Of the 189 analyzed participants, 10 were assigned a 3-star rating for overall performance and absence of deaths (Fig 2). Finally, two new report sections were included that explain updated clinical staging and pathology fields, and new blood product variables were added to the report. The feedback report was also reorganized so that the risk models are placed first and descriptive data follow. The composite score for esophagectomy for esophageal cancer is scheduled for inclusion in June 2018.

STS GTSD Public Reporting Website Was Launched

This year the STS GTSD launched a public reporting initiative similar to the STS Adult Cardiac Surgery Database and the STS Congenital Heart Surgery Database [2]. It allows participants to voluntarily report their lobectomy for lung cancer composite measure scores and star ratings on the STS public reporting website. A list of participating institutions and associated surgeons was published on the STS website in January 2017. This was replaced in the summer by public reporting of participant-level outcomes for lobectomy compared with the STS GTSD and the NIS. Death at discharge, median postoperative length of stay, and a two-domain lobectomy for lung cancer composite measure (including risk-adjusted mortality and absence of major complications) are reported for programs that choose to enroll in public reporting. By reporting the excellent outcomes achieved by STS GTSD participants relative to the NIS, the STS GTSD Task Force hopes to encourage database participation and improve penetrance.

Creation of a Joint STS GTSD-ESTS Registry Data Set

The STS GTSD and ESTS Registry were each developed to promote quality improvement, surgeon education, and institutional benchmarking. Every year, a joint STS GTSD-ESTS Registry Task Force meeting is held at the STS Annual Meeting to discuss current and future collaborative efforts. The meeting in January 2018 in Ft. Lauderdale focused on finalizing a DTUA that will allow the creation, maintenance, and analysis of the first joint STS GTSD-ESTS Registry data set. The creation of a repository that combines matched data from the STS GTSD and ESTS Registry will allow multiple new and

	Overall	Absence of Mortality	Absence of Morbidity
1 Star	4	0	2
2 Stars	175	189	177
3 Stars	10	0	10

Fig 2. Distribution of star rating for overall performance, absence of morbidity, and absence of mortality from The Society of Thoracic Surgeons General Thoracic Surgery Database December 2017 feedback report.

innovative research and quality improvement initiatives. However, the drafting of this agreement has proven to be challenging due to the legal and patient privacy considerations that accompany international data sharing.

A number of issues have to be overcome to draft the first DTUA. First, it must be ensured that the privacy laws of different countries are abided by when data are exported across international borders. The agreement will only include North American and European Union centers to avoid double counting institutions that contribute to both databases. The ESTS will act as the data controller and ensure that the data are processed in accordance with international data protection regulations. All data will be irreversibly deidentified with removal of first and last names and unique identifiers (birthdays, date of operation, etc). Individual countries and hospitals will be coded (hospital 1, 2, 3, etc, and country A, B, C, etc) to ensure deidentification but allow for appropriate clustering of hospitals and countries in the future.

Additional issues that must be addressed include how data will be transferred to Duke Clinical Research Institute, which will act as the data warehouse and analysis center. The DTUA must include how securely the data will be stored and what controls will be placed on the use of the data. Furthermore, expectations for cost-sharing and balanced visibility of both societies in publications and presentations must be established. Finally, the DTUA must establish the fate of the joint repository once the prespecified project(s) are completed. Creating a joint STS GTSD-ESTS Registry repository has the potential to generate important, large-scale, current data that may differ from historical reports.

AQO Meeting

The STS hosted the annual AQO meeting for database managers in 2017 in Chicago. The goal of the AQO meeting is to educate database registrars and address frequently asked questions. Popular from the previous year, a case-based learning format was used, and the meeting included an "AQO Jeopardy" session, where four teams of database managers competed against each other. STS GTSD Task Force members teamed with database managers to discuss the DCF upgrade and star rating designation, describe the STS GTSD audit process, and review case-based lung, esophageal, and thymus coding, including diagnosis, staging, surgical procedures, and complications.

Initiatives for 2018

The STS GTSD has several important projects planned for 2018. In the Spring, the STS GTSD plans to finalize the initial intersocietal DTUA with the ESTS, followed by the release of version 2.4 of the DCF. In addition, multiple new ventures are on the horizon for the STS GTSD. One quality initiative is to explore the implications of tobacco use, a modifiable variable, on the lobectomy composite model. Because tobacco use is a modifiable variable, it is important to understand the variation in current tobacco use among STS GTSD participants and whether or not adjusting for it affects star ratings in the lobectomy quality composite. There is also interest in creating a lung cancer resection composite model that includes all procedures, not just lobectomy. Furthermore, the development of a lung cancer resection risk calculator, similar to that available for cardiac procedures through the STS ACD, remains an interest of the STS GTSD Task Force in 2018.

Finally, STS GTSD continues to work to improve database penetrance and completeness. This primarily relates to the large number of general surgeons and primarily cardiac surgeons who perform thoracic surgical procedures but do not contribute to the database. Promoting public reporting of STS GTSD outcomes relative to the NIS is one strategy to increase penetrance and program participation.

Conclusion

It was another busy year for the STS GTSD Task Force. In 2017, the DCF was upgraded to version 2.4 and optimized without increasing the workload of data abstracters. In addition, the learning curve for thoracoscopic lobectomy was examined, online public reporting went live, institutional feedback reports were revised, and progress was made in creating the first joint STS-ESTS data set. The STS GTSD Task Force has multiple exciting projects planned for 2018, with the same overarching goal of quality improvement and promoting research in general thoracic surgery.

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