The Society of Thoracic Surgeons General Thoracic Surgery Database: 2016 Update on Research

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The Society of Thoracic Surgeons General Thoracic Surgery Database has grown to more than 500,000 case records. Clinical research supported by the database is increasingly used to advance patient outcomes. This research review from the General Thoracic Surgery Database in 2014 and 2015 discusses 6 recent publications and an ongoing study on longitudinal outcomes in lung cancer surgery from The Society of Thoracic Surgeons Task Force for Linked Registries and Longitudinal Follow-up. A lack of database variables specific for certain uncommon procedures limits the ability to study these operations; inclusion of clinical descriptors for selected infrequent but clinically important thoracic disorders is suggested.

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This update is one in a series of publications on The Society of Thoracic Surgeons (STS) National Databases after last year's introductory report by Jacobs and associates [1]. Their purpose is to inform the thoracic surgical community and the STS membership about the current state of each of the three databases.

The 14-year-old General Thoracic Surgery Database (GTSD) is the youngest STS database and currently comprises approximately 500,000 procedure records. Among the three STS Databases, the GTSD is somewhat unique given the many different thoracic disorders, the continued year-to-year growth of database records with an untapped potential for future expansion, and low morbidity and mortality event rates. Thus, thoracic research funded by the Society faces certain limitations at present while holding great promise for the future. A detailed comparison of the status of the three national databases is provided in the Jacobs report (Table 1) [1].

Like the other two STS national databases, the GTSD is representative of the practice of participating board-certified thoracic surgeons. However, unlike the cardiac and congenital heart databases, and despite a rising United States share of general thoracic surgeon participants, the database does not yet reflect national thoracic surgical practice. Nonparticipating thoracic and general surgeons generate a case volume substantial in number and unknown in quality. Because the GTSD aspires to reflect national practice and has documented the superior clinical outcome of surgical care delivered by database participants compared with other nonselective databases [2, 3], the STS welcomes as a participant in the database every surgeon with a practice in general thoracic surgery, regardless of board certification in thoracic surgery or STS membership. Growing participation strengthens the role of the general thoracic database as a quality improvement tool. Clinical research supported by the database demonstrates the commitment of participating STS member surgeons to the advancement of their own specialty.

In a further distinction from its companion databases, the thoracic database collects surgical data on multiple organ systems, each with separate diseases or procedures that have specific and essential clinical variables. Many of these are still not included in the GTSD. The additions of variables during previous database updates had as their main purpose the creation of risk models for lung and esophageal resections to enable early participation in

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Abbreviations and Acronyms

A&P = Access and Publications
ARDS = adult respiratory distress syndrome
CMS = Centers for Medicare and Medicaid Services
DLCO = diffusion capacity for carbon monoxide
DVT = deep venous thrombosis
EPP = extrapleural pneumonectomy
FEV_1 = forced expired volume in the first second
GTSD = General Thoracic Surgery Database
MI = myocardial infarction
PE = pulmonary embolus
PD = pleural decortication
STS = Society of Thoracic Surgeons
ThRCRI = Thoracic Revised Cardiac Risk Index
VATS = video-assisted thoracic surgery

national quality initiatives. As a result, the number of primary database variables rose from 154 in 2006 to 245 in 2015, and the number of individual diagnoses and procedures codes also markedly increased. These database revisions, as initiated by the national database leadership, have consistently improved the information available to STS-sponsored investigators.

To date, 22 publications have resulted from clinical, STS-funded research based on the GTSD. Two common high-volume diseases, lung and esophageal cancer, were the primary subject matter of early clinical papers and continue to dominate current studies: lung cancer is the subject in 5 of the 6 papers discussed in this update. Unfortunately, the Access & Publications (A&P) Task Force currently reviews and rejects other excellent proposals because central questions relating to the study cannot be answered with currently available data in the GTSD. Table 1 lists selected variables that are presently missing from the GTSD.

The GTSD at present includes many procedures but does not have enough variables specific to low-volume thoracic diseases and procedures; this deficit reduces our capacity to answer relevant clinical questions. Delaying clinical research analyses with the hope of improving case numbers has been the approach used with success for high-volume procedures. In uncommon operations, however, case numbers may rise while accumulated cases still do not enable relevant research studies if disease-specific variables are not collected now. The General Thoracic Proposal Review Subcommittee continues to defer STS-sponsored clinical research of important proposals related to uncommon diseases, a disappointing development to investigators with particular research interests in these areas.

A thoughtful programmatic growth of the database requires a balance among diverse aims. Neglecting low-volume but important operations relevant to thoracic surgical practice would diminish the GTSD as a unique national repository of our specialty. By committing to a goal of capturing all thoracic surgical operations in the GTSD, thus affording access to detailed research, STS will assert and retain its dominance in this domain of professional competence. Conversely, we risk losing diseases or procedures that are not detailed in the database and available for research. The STS goals of advancing patient safety and quality of care cannot be limited to resections of lung and esophageal cancer. A commitment to dedicate additional resources to uncommon procedures, however, will require practical compromises between a desirable database expansion and the concerns of participant surgeons over rising database complexity, data collection burden, and cost.

Where appropriate, thoracic investigators have been encouraged to pursue cooperative, multiinstitutional research not anticipated in the submitted proposal. Some inclusive research cooperations have improved research projects, enlarged investigator participation, and enhanced the critical discussion of ongoing projects. As examples, a shared discussion of clinical T2 N0 esophageal cancer highlighted problems in the accuracy of preoperative staging and patient selection for neoadjuvant therapy [4]. The cooperation of 3, counting the STS mentor's institution, 4 academic centers of excellence on the surgical treatment of malignant mesothelioma extracted the most detailed information under

Table 1. Information Presently Not Provided by the Thoracic Database[a]

Category	Missing Information
Organ system	
Thymus	Myasthenia gravis: presence and severity
	Thymic tumors: staging and pathology
	Myasthenic crisis: postoperative event
	Preoperative drugs/preparation
Chest wall	Tumor types: benign or malignant
	Extent of resection
	Type of reconstruction
Esophagus	Categories of disease for resection other than cancer
Diaphragm	Category of disease: diaphragmatic paralysis
	Preoperative evaluation of paralysis
Trachea	Tumor types: benign or malignant
	Type of benign stricture
	Length of resection
	Approach: cervical, cervical-mediastinal, thoracic
Malignant mesothelioma	Disease-specific staging
Procedure	
Pleural decortication	Category of disease
	Indication
Phase of care	
Readmission	Cause or relation to operation

[a] A selection of variables from this list may be considered for inclusion in the next database collection form.

the above-mentioned constraints of variables, as explained below [5]. More recently, investigators from 7 institutions found common ground, despite different viewpoints, to describe the current state of robotic-assisted lobectomy [6].

In each instance, initial investigator concerns regarding the direction of research efforts were replaced by a group interest in a superior research outcome. A record of successful study outcomes among cooperative research projects gives us great confidence to encourage future collaboration. In addition to a competition among research proposals, a competitive selection of investigators for selected proposals that are awarded STS-funding appears possible.

Outcome Analysis Research

Research From the STS Task Force for Longitudinal Follow-Up and Linked Registries

Despite having many advantages, the STS National Database has been limited by the absence of information regarding outcomes beyond the immediate post-operative period of 30 days or hospital discharge. As cardiothoracic procedural morbidity and death decrease, the confirmation of long-term vital status, resource utilization, and costs takes on increasing importance. Because many important events occur after the index hospitalization, limited long-term follow-up is a critical barrier to the optimal use of the STS National Database. This limitation has been overcome in the STS Adult Cardiac Surgery Database by linkage to Centers for Medicare and Medicaid Services (CMS) data [7].

Through the STS Task Force for Longitudinal Follow-up and Linked Registries, STS members can submit research proposals that use linkages of the STS database with external data sources, such as CMS. These proposals generally seek to investigate questions related to long-term survival, reintervention, or resource utilization after cardiothoracic procedures. Linkage of the STS database to other data sources, typically by matching of indirect identifiers, is complicated and may require significant analytic time. Therefore, most proposals to this task force will seek to obtain funding from federal or foundation grants for their research.

The first successful grant of this effort relates to lung cancer as the leading cause of cancer-related death in our country [8]. Many early-stage lung cancers may be cured with surgical resection [9–11]. The detection of early-stage lung cancer is increasing, as the findings of the National Lung Screening Trial have increased the screening of patients at high risk for lung cancer [12]. Increased detection of early-stage disease is creating opportunities to cure more lung cancers with surgical intervention. Excellent surgical outcomes are necessary to convert these early-stage cancers into cures with minimal associated morbidity or death. Minimally invasive approaches have advanced this goal, including video-assisted thoracic surgery (VATS) and more limited pulmonary resections that preserve lung tissue and reduce procedural morbidity [13, 14]. These techniques have the potential to increase the application of surgical intervention in patients considered to be at high risk for surgical complications and also benefit standard-risk patients.

However, important questions remain about the completeness of cancer removal with these operations and, therefore, survival outcomes [15, 16]. The long-term efficacy of (1) minimally invasive approaches (VATS techniques) and (2) limited pulmonary resection (sublobar resection) must be compared with the standard techniques of more invasive thoracotomy and lobectomy for the treatment of early-stage lung cancer to provide the evidence needed for complete adoption of these less morbid surgical strategies. On August 1, 2014, the STS was awarded a research grant (R01-HS-022279) from the Agency for Healthcare Research and Quality to study long-term outcomes after lung cancer resection.*

A description of the rationale for the study and planned investigations follows. A long-term goal of the STS is to improve patient outcomes including survival after surgical therapy for lung cancer. Capturing unique patient-level demographic, medical history, treatment, and complication details not found in other cancer outcomes databases makes the STS GTSD uniquely suited for comparative effectiveness studies examining lung cancer surgical strategies. However, the STS GTSD does not provide survival data beyond 30 days or hospital discharge, a limitation overcome by linkage to CMS data as for prior studies in cardiac surgery [17, 18].

The specific aims of the project are the following:

1. Create a risk prediction model for long-term survival after lung cancer resection.
2. Compare survival based on surgical approach (minimally invasive vs thoracotomy) and extent of resection (sublobar resection vs. lobectomy) for early-stage lung cancer.
3. Compare resource use, cost, and Medicare payments according to surgical approach and extent of pulmonary resection for early-stage lung cancer.

The objective of the ongoing study is to identify those patients at risk for worse long-term survival after operations for lung cancer and to answer the following specific questions:

1. Does long-term survival after operations for lung cancer vary on independent patient clinical, provider, and treatment characteristics?
2. Do minimally invasive surgical approaches (VATS) and limited pulmonary resection techniques (sublobar resection) worsen long-term survival compared

*The project, "National Longitudinal Outcomes Following Surgical Therapy for Lung Cancer," is led by STS members Felix G. Fernandez, MD, MS, Joe B. Putnam, MD, Anthony P. Furnary, MD, Mark W. Onaitis, MD, Cameron D. Wright, MD, Daniel J. Boffa, MD, and Jeffrey P. Jacobs, MD, as well as Duke Clinical Research Institute faculty Andrzej Kosinski, PhD, and Patricia Cowper, PhD.

with prior established standard strategies of a thoracotomy approach and lobectomy?

3. Are minimally invasive approaches and limited pulmonary resection techniques associated with more favorable economic outcomes than thoracotomy and lobectomy?

Work from the GTSD has previously demonstrated that short-term outcomes after operations for lung cancer vary according to unique patient characteristics and surgical strategies, as do long-term outcomes [13, 15] A better understanding of long-term risk-adjusted clinical and economic outcomes associated with surgical treatment for early-stage lung cancer will facilitate the choice of optimal and personalized therapy for patients, thereby improving individual patient outcomes.

This study is expected to have a positive effect on the care of lung cancer patients by increasing the focus on individual patient characteristics and allowing for better-informed treatment decisions. The analytic framework for this project is illustrated in Figure 1. Early results from this work are beginning to be disseminated through presentations at national meetings and publications. Updates on this work will be provided in future general thoracic surgery research summaries in the *Annals*. In addition, other research proposals are in development by the task force that seek to answer important research questions using linkages to the GTSD.

Outcomes Research 2014 to 2015

The process for review and selection of research proposals to the three STS databases was revised in August 2014 [19]; therefore, most projects reported below predate the current review process. Currently, proposals are due by March 1 and September 1 in a biannual competitive review cycle. The General Thoracic Proposal Review Committee is composed of 8 STS surgeon members and 2 Duke Clinical Research Institute members. After initial review, a first selection of projects undergoes statistician review at Duke Clinical Research Institute before a final selection by the entire committee. The decision is reviewed and communicated to investigators by an administrative oversight committee. Each current project is selected in a competitive process that grades scientific merit, project feasibility given current database variables, potential effect of the study, appropriateness of database use, and investigative team. Because each Proposal Review Subcommittee is asked to consider the nature of the investigative team, the review process is not blinded. Additional data may be requested for suitable proposals between a first and second round of review. In this A&P Task Force review process, six publications resulted from STS-sponsored research in 2014 to 2015.

Quantifying the Safety Benefits of Wedge Resection: A Propensity-Matched Analysis

Linden and associates [20] performed a propensity-matched analysis of nearly 7,500 patients undergoing wedge or anatomic resection among more than 19,000 patients with stage I and II lung cancer. Operative mortality was 1.2% after wedge and 1.9% after anatomic resection, and the major morbidity was 4.5% after wedge and 9% after anatomic resection. In patients with poor lung function, defined as a preoperative forced expired volume in 1 second (FEV_1) of 60% or less of predicted, the differences in mortality (1.4% vs 2.9%) and morbidity

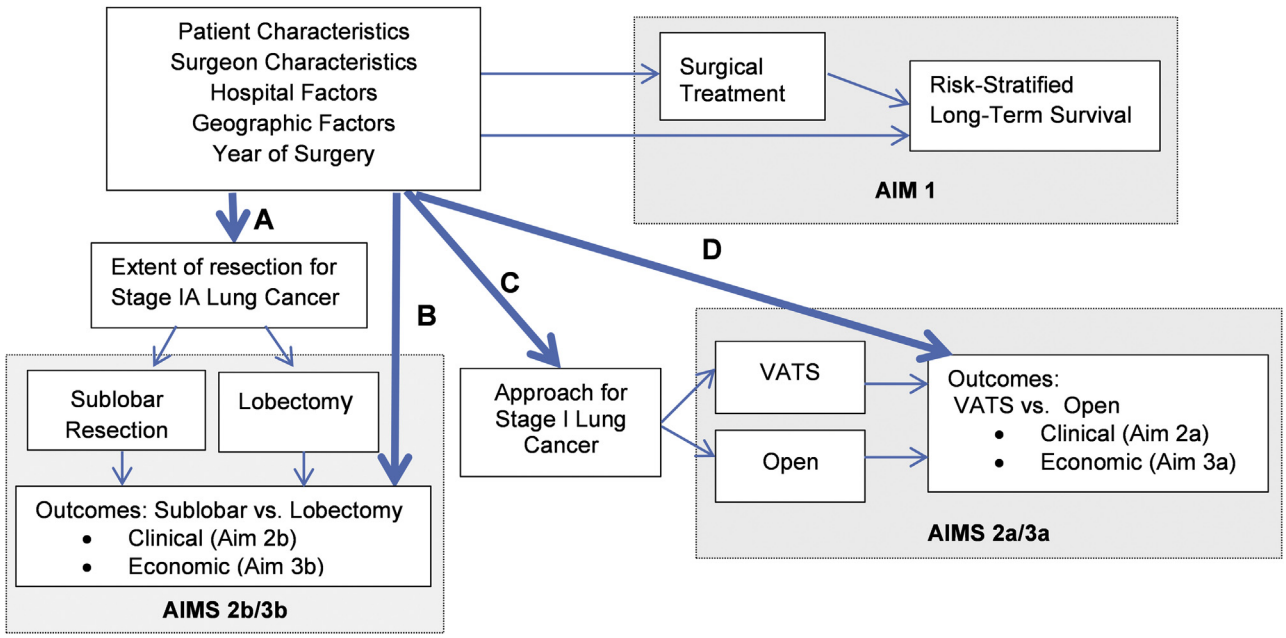

Fig 1. Analytic framework of longitudinal follow-up using linkage of The Society of Thoracic Surgeons (STS) and Centers for Medicare and Medicaid Services databases. The bold arrows represent causal effects of explanatory factors on treatment selection (A and C) and outcomes (B and D). (VATS = video-assisted thoracic surgery.)

(6.3 vs 13.1%) were even more pronounced (Table 2). The paper won the Richard E. Clark Award at the STS 2014 annual meeting.

This study highlights the opportunities in a progressively larger database of comparing with greater precision the optimal surgical approaches to lung cancer, ultimately with the aim of supporting the perioperative decisions of thoracic surgeons. In the future, the thoracic database will provide follow-up information on patients and linkage with CMS data, a project already initiated for lung cancer as explained above. The knowledge of disease and vital status will prove invaluable to track early and late surgical results and consequently improve thoracic surgical practice.

Sex Differences in Early Outcomes After Lung Cancer Resection

The known survival advantage of women after resection for lung cancer led Tong and associates [21] to hypothesize that gender-associated differences in long-term outcome originate in the perioperative period. They studied a 6-year cohort of more than 34,000 resections and found that women had lower rates in all categories of morbidity as well as lower rates of hospital and 30-day mortality. Women had a different preoperative risk profile, higher rates of stage I disease, and higher rates of sublobar resection. Thus, women arrived at the operating room in better health and with a lower disease burden. In the multivariable analysis of discharge and 30-day deaths among more than 15,500 patients with complete data of the examined variables, male gender, age, diffusion capacity of the lung for carbon monoxide (DLCO), preoperative radiotherapy, thoracotomy, and postoperative empyema predicted death.

The study's significance lies in the recognition that women as a group enter the operating room with different risk factors, more frequently undergo less extensive resections, and sustain fewer complications for reasons other than the extent of resection or disease stage. Their start toward better long-term survival occurs early, even before their resection.

The study pointed to the challenges inherent to all projects analyzing the early database years: missing data precluded use of more than half of all cases before the multivariable analysis and prevented an analysis of smoking as a risk factor. In the early database versions, some data variables remained imprecise, when, for example, "preoperative radiation" collectively described treatment for lung cancer or any other tumor at any other site at any time before the operation.

Table 2. Comparison of Mortality Rates in Propensity-Matched Patients Undergoing Wedge Resection or Lobectomy/Segmentectomy According to Predicted Levels of Forced Expiratory Volume in 1 Second[a]

Subgroup	Mortality Rate Wedge Resection	Mortality Rate Anatomic Resection	*p* Value	No. (Matched Cohort)
FEV_1 <85%	1.12	1.73	0.096	4,284
FEV_1 <80%	1.14	2.39	0.0031	3,846
FEV_1 <75%	1.25	2.26	0.0269	3,358
FEV_1 <70%	1.33	2.53	0.0173	2,850
FEV_1 <60%	1.39	2.88	0.0231	1,872

[a] Once patients with the best FEV_1 values are excluded, perioperative mortality is consistently lower after wedge resection.

Reprinted from *The Annals of Thoracic Surgery*, 98;5, Philip A. Linden, Thomas A. D'Amico, Yaron Perry, Paramita Saha-Chaudhuri, Shubin Sheng, Sunghee Kim, Mark Onaitis, Quantifying the Safety Benefits of Wedge Resection: A Society of Thoracic Surgery Database Propensity-Matched Analysis, pp. 1705-12, 2014, with permission from The Society of Thoracic Surgeons.

FEV_1 = forced expiratory volume in 1 second.

Prediction of Major Cardiovascular Events After Lung Resection

An interest in identifying patients in need for further preoperative cardiac testing has led to the introduction of a cardiac risk index for general surgical procedures. Brunelli and associates [22] found more precise risk stratification for thoracic patients when adapting a thoracic index composed of renal function, coronary artery disease, heart failure, stroke, and pneumonectomy as predictors. Using the thoracic database, Ferguson and colleagues [23] applied this Thoracic Revised Cardiac Risk Index to a retrospective validation cohort of 26,000 patients for the prediction of major cardiovascular complications. The score consists of four weighted values for clinical variables as summarized in Table 3 [23] stratified into four categories according to increasing cardiac risk. The authors concluded that the Thoracic Revised Cardiac Risk Index score identified patients at increased risk of cardiovascular complications who may be considered for additional preoperative testing or more intense postoperative care.

The project advances a concept of preoperative clinical evaluation based on the analysis of postoperative outcome for a contemporary cohort of selected patients who already had some type of cardiac evaluation. This approach assumes that a new cardiac evaluation would reduce the risk further, a notion awaiting further supporting evidence.

Malignant Pleural Mesothelioma: An Analysis of Surgical Morbidity and Death

The research proposals of three investigator teams interested in malignant mesothelioma, each applying independently from each other for STS funding, arrived at the same time, a propitious situation for the A&P Task Force to suggest a cooperative research endeavor. The project exemplified from the start the current challenges of studying low-volume procedures within the thoracic database. Despite more than 10 years of data collection, Burt and associates [5] were limited to collecting cases only from 2 years, 2009 to 2011, because prior variables were of insufficient specificity. After data review, a comparison of pleural decortication in 130 and extrapleural pneumonectomy in 95 patients was conducted with cases from 48 centers. When high-volume centers were defined as five or more operations per year, only 5 centers, as

Table 3. Cardiovascular Morbidity and Mortality Separated Into Four Different Risk Categories, Indicating a Greater Likelihood of Complications in the Presence of Preoperative Risk Factors

	ThRCRI Score Category					
Cardiovascular Complications	A	B	C	D	Total	*p* Value
Overall, No.	465	474	31	155	1,125	<0.0001
Overall, %	2.87	5.77	11.88	11.12	4.31	
MI, No.	36	67	6	23	132	<0.0001
MI, %	0.22	0.82	2.30	1.65	0.51	
ARDS, No.	158	176	13	51	398	<0.0001
ARDS, %	0.97	2.14	4.98	3.66	1.53	
Ventricular arrhythmia, No.	114	103	5	31	253	<0.0001
Ventricular arrhythmia, %	0.70	1.25	1.92	2.22	0.97	
Mortality, No.	245	269	21	91	626	<0.0001
Mortality, %	1.51	3.27	8.05	6.53	2.40	

Reprinted from *The Annals of Thoracic Surgery*, 97;4, Mark K. Ferguson, Paramita Saha-Chaudhuri, John D. Mitchell, Gonzalo Varela, Alex Brunelli, Prediction of Major Cardiovascular Events After Lung Resection Using a Modified Scoring System, pp. 1135-40, 2014, with permission from The Society of Thoracic Surgeons.

ARDS = adult respiratory distress syndrome; MI = myocardial infarction; ThRCRI = Thoracic Revised Cardiac Risk Index.

shown in Figure 2, achieved this distinction. One or more major morbidity or death was present in 4.6% of pleural decortication patients and in 25% of extrapleural pneumonectomy patients. The multivariate analysis showed extrapleural pneumonectomy and cerebrovascular disease were the strongest predictors of major postoperative morbidity and death.

Important initial research considerations in malignant mesothelioma include descriptions of various surgical therapies, the separation into high-volume and low-volume centers, and estimation of the difference in surgical risk between the two procedures. Should future versions of the database contain more information about mesothelioma? Clearly, additional staging, comorbidity, and event information is needed, and the STS GTSD is the best available repository. With more granular data, reporting of far greater detail of postoperative outcome should be possible in the future.

Thoracoscopic Lobectomy in Patients With Predicted Postoperative FEV_1 or DLCO of Less Than 40% of Normal

This analysis compared the effect of marginal lung function on outcome after thoracoscopy or thoracotomy in patients undergoing lobectomy for cancer. Burt and associates [24] calculated the derivations of postoperative FEV_1 and DLCO to correct for the resected lobe, although not for differences in anatomic destruction commonly noted in emphysema between the upper and lower lobes. The study included more than 6,000 patients each in the thoracoscopy (VATS) and thoracotomy groups. Significant differences between the two groups existed in 23 of 26 preoperative variables and in 9 of 12 cardiopulmonary complications. A multivariate analysis identified predicted preoperative FEV_1 and DLCO as well as predicted postoperative FEV_1 and DLCO as predictors of death and cardiopulmonary events in thoracotomy and

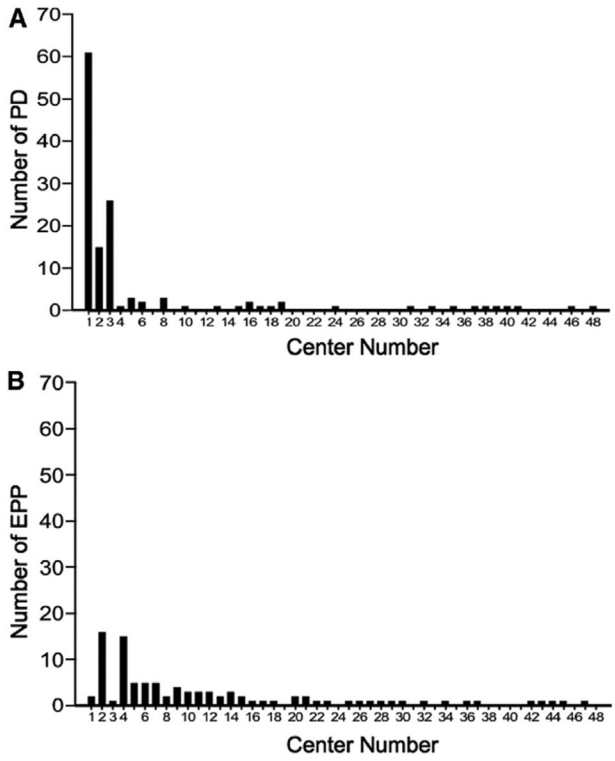

Fig 2. Number of (A) pleural decortications (PD) and (B) extrapleural pneumonectomies (EPP) performed for malignant pleural mesothelioma during the 3-year study period at each of 48 participating centers. Three centers in panel A and 2 centers in panel B had high volumes, defined as five or more procedures per year. (Reprinted from The Journal of Thoracic and Cardiovascular Surgery, 148;1, Burt BM, Cameron RB, Mollberg NM, et al, Malignant pleural mesothelioma and The Society Of Thoracic Surgeons Database: an analysis of surgical morbidity and mortality, pp. 30–5, 2014, with permission from the American Association for Thoracic Surgery.)

cardiopulmonary events in VATS. In 4,215 propensity-matched pairs, decreasing values for FEV_1 and DLCO increased complications or death far more after thoracotomy than after VATS.

The search for, and recurring discovery of, the benefit for VATS over thoracotomy in lung cancer resections remain a familiar theme of clinical studies from the GTSD. Although patient selection is corrected by propensity matching, residual concerns persist for unmeasured variables. The STS database has provided increasingly larger populations for retrospective studies to document the advantages of VATS, thereby partially compensating for the lack of prospective randomized trials. The result of STS-supported outcomes research by individual investigators has guided the pursuit of quality metrics for surgical therapy of lung cancer. The interest of STS investigators in this topic and the number of research proposals remain high.

Failure to Rescue and Pulmonary Resection for Lung Cancer

Failure to rescue refers to potentially preventable death after a treatable complication. The interest in the "failure to rescue" concept originates from the observation that differences in complication rates between health care facilities are outweighed by even greater differences among hospitals in deaths occurring after complications. Assuming complications are comparable in severity, failing to rescue therefore is believed to describe a composite of delayed diagnosis, delayed treatment, raised complication severity, and lack of salvage from life-threatening events. In this study of 30,000 patients undergoing pulmonary resection for cancer, risk-adjusted mortality rates varied by a factor of four among hospitals, whereas complication rates varied by a factor of two. Among patients with complications, mortality rates varied by a factor of four in magnitude between the lowest and the highest quintile of hospitals. As shown in Figure 3, the risk of dying after a complication increased in each quintile of hospitals with higher mortality rates. Farjah and associates [25] concluded that postoperative death was related less to the occurrence but more to the treatment of a complication.

A discussion of this study noted that the risk-adjusted mortality showed the same fourfold variation between the highest and lowest performers and questioned the validity of this new metric. Rates of congestive heart failure and peripheral vascular disease were lower in hospitals with low mortality rates, indicating that patient selection may influence the ability to save patients with complications. The A&P Task Force supported the study as a contribution to a current discussion that has not conclusively determined the incremental value of "failure to rescue" as a quality metric.

Conclusions

The linkage of the STS database with CMS data will substantially improve and influence the direction of clinical oncologic research. This linkage adds cost to thoracic studies seeking to include long-term follow-up and limits the availability of STS-funded research projects that are focused on these outcomes. The Society will therefore pursue research support from government and other outside sources as well as investigator-funded research.

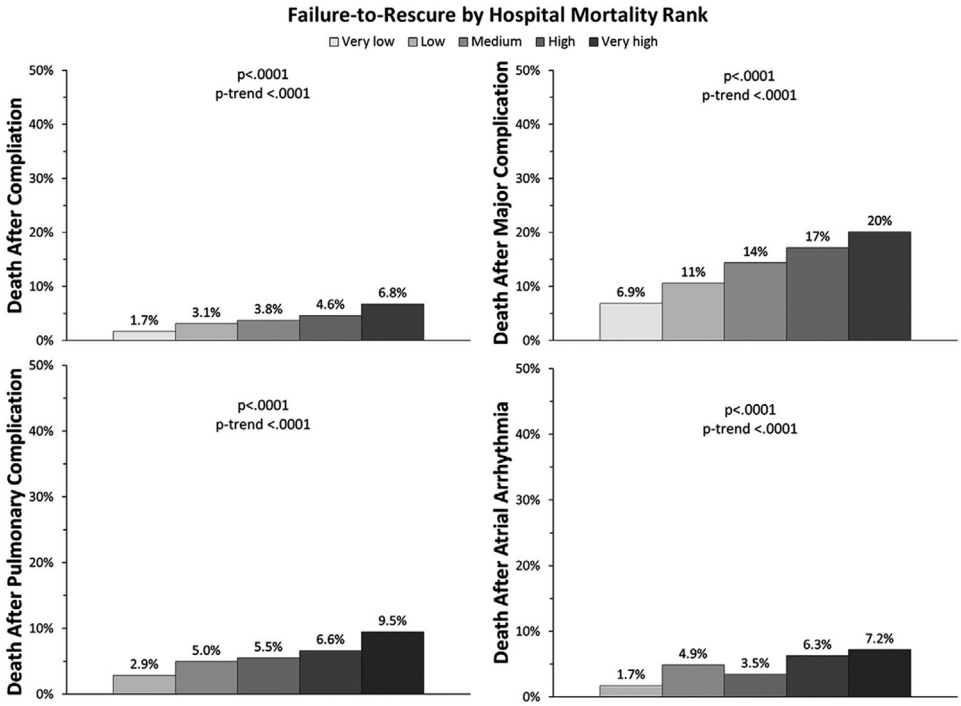

Fig 3. Comparison of hospital mortality rates in patients with complications among hospitals ranked in quintiles according to mortality rank. Acute death after complication shows far greater variation between the lowest and highest quintile than overall hospital deaths. (Reprinted from The Journal of Thoracic and Cardiovascular Surgery, 149;5, Farjah F, Backhus L, Cheng A, et al. Failure to rescue and pulmonary resection for lung cancer, pp. 1365–71, 2015, with permission from the American Association for Thoracic Surgery.)

Despite the financial burden associated with database research conducted by individual researchers, the Society's pursuit of clinical research remains essential to the generation of ideas and innovations in clinical practice. At present, longitudinal follow-up is not available for GTSD projects through the A&P Task Force process, but plans are in place to make this available in the future.

The General Thoracic Proposal Review Subcommittee supports a deliberate and progressive inclusion of variables specific to selected uncommon diseases or procedures to permit research in these infrequent but important conditions. A limited set of specific variables should be added to the next revision of the general thoracic data collection for at least five to seven uncommon procedures to enable their basic analysis at a future date.

To improve the process of general thoracic research, opportunities are sought to broaden the appeal of collaborative, multiinstitutional research, based on shared funding through the STS. The advantages of collaborative research are obvious: an inclusion of diverging viewpoints among passionate investigators is most desirable from the time the research questions are posed, and early critical review often leads to additional analysis and influences the maturity of conclusions. The subcommittee is acutely aware that recent review cycles have enabled less than 15% of investigators to pursue their projects, but plans are in place to expand these opportunities.

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