



# The Society of Thoracic Surgeons Adult Cardiac Surgery Database: 2018 Update on Outcomes and Quality

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Through nearly 3 decades of iterative refinement, The Society of Thoracic Surgeons Adult Cardiac Surgery Database has evolved into one of the most comprehensive and respected clinical data registries in health care. It is a widely acknowledged exemplar for accurately benchmarking risk-adjusted outcomes in cardiac surgery and underpins all quality measurement and improvement activities of The Society of Thoracic Surgeons. This

is the latest in a series of annual reports that outlines current national aggregate outcomes and volume trends in cardiac surgery and summarizes database-related work in quality measurement and performance improvement during the past year.

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The Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database (ACSD) was established in 1989 to address the shortcomings of coronary artery bypass grafting (CABG) mortality data published by the federal government 3 years earlier. STS leaders recognized that these mortality results, derived from administrative data, did not adjust for the differences in the inherent risk of patients and that to do so would require a far more comprehensive clinical data set than available then [1, 2]. From the outset, the primary objective of the ACSD has been to provide highly accurate and clinically relevant information to ACSD participants to support self-assessment and quality improvement efforts.

The ACSD now contains more than 6.28 million cumulative patient records. Information generated from this extensive data set supports nationally benchmarked performance assessment and feedback, statistically robust risk-adjustment models [3–5], performance measurement [6, 7], quality improvement efforts, and voluntary public reporting [8]. Current and future initiatives linking the ACSD with other data registries provide a foundation for efforts in longitudinal outcomes assessment, device surveillance, comparative effectiveness research, and health policy development.

Here we report current national aggregate cardiac surgical volume trends and outcomes and review quality measurement and performance improvement activities derived from the ACSD during the past year.

## Updated Overview of the ACSD

As of September 2017, the ACSD includes 1,119 participant groups comprising 3,107 surgeons from all 50 states in the United States, 10 sites in Canada, and 21 participants in 7 other countries. The anesthesiology module has 68 participants comprising 637 anesthesiologists, and the atrial fibrillation module has 15 participants.

From previously published data regarding expanding penetration of the ACSD, we estimate that it currently contains information on more than 95% of the adult cardiac operations performed each year in the United States [8, 9]. The STS data warehouse and analytical center is located at Duke Clinical Research Institute. In prior years, ACSD participants submitted data in four quarterly harvests each year. Beginning in early 2017, this was changed to a continuous data submission model [10]. Rather than submitting data only during a 2-week period each quarter, participants now submit data on an ongoing basis. New data submission is embargoed each quarter during a 3-week “lock period” to finalize files and data completeness checks. In essence, participant sites now have 2.5 working months to incrementally submit, cross-check, and edit data during each 3-month cycle. This

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**Abbreviations and Acronyms**

ACSD	=	Adult Cardiac Surgery Database
AF	=	atrial fibrillation
AVR	=	aortic valve replacement
CABG	=	coronary artery bypass grafting
EMR	=	electronic medical record
FHIR	=	Fast Healthcare Interoperability Resources
MV	=	mitral valve
MVR	=	mitral valve replacement
NQF	=	National Quality Forum
PRO	=	patient-reported outcomes
QMTF	=	Quality Measurement Task Force
STS	=	The Society of Thoracic Surgeons

alleviates the substantial workload associated with the prior quarterly bulk submissions and associated data completeness checks.

Ongoing data submission is also essential to meeting the ACSD goal of providing real-time performance feedback to participants through a web-based report dashboard that will be operational in early 2018. For the present, the ACSD will continue with the current format of quarterly reports, including semiannual performance on National Quality Forum (NQF)-endorsed STS measures and composite quality scores, eventually transitioning to an entirely web-based performance report in the future.

The STS has prioritized data integrity since inception of the ACSD. In addition to a routine extensive internal validation process performed for all sites upon submission of data, 10% of sites (110 in 2017) are randomly selected for the ACSD's annual independent external audit. The method has been previously described [10] and has shown nearly 100% of cases are appropriately captured and that concordance rates between the medical record and submitted data elements consistently exceed 95% [11, 12].

Data completeness is particularly critical to the data fields regarding operative mortality because they underlie the validity of risk models, benchmarking, and composite scores. As of January 2017, STS has further tightened the data completeness threshold for fields related to operative mortality ("discharge status," "status at 30 days after discharge," and "operative death"). Records with "unknown" or "missing" operative mortality data are designated incomplete and will not be included in the benchmark population used for performance analyses. Furthermore, participants who exceed a 2% threshold of missing or unknown data for operative mortality fields will not be eligible to receive a composite score.

A major focus for the ACSD Task Force during the past year was a substantive revision of the data element set. Because a primary objective of the ACSD is to provide risk adjustment models for the assessment of outcomes and quality, data elements must reflect current and

evolving surgical practice. Consequently, ACSD data elements are revised every 3 years to ensure they remain clinically relevant and also to address suggestions made by participating sites. Version 2.9 became operational on July 1, 2017. The new version includes additional data fields to better assess preoperative liver disease, heart failure, frailty, and the use of novel anticoagulants. The sections involving coronary, valve, and atrial fibrillation surgery were modified to reflect current etiologic nomenclature, to capture newer techniques, and to provide greater clarity and granularity to coding. In recognition of the increasing frequency and complexity of thoracic aortic surgery, the STS formed a new Task Force on Aortic Surgery under the Workforce on National Databases. Working closely with members of this task force, the sections pertaining to aortic root and thoracic aortic surgery were rewritten to reflect the many new and evolving open and endovascular surgical technical advances in the field.

### National Outcomes and Volume Trends in Adult Cardiac Surgery

The relative distribution of major cardiovascular operations performed in calendar year 2016 is shown in [Figure 1](#). CABG remains the most commonly performed procedure, followed by isolated aortic valve replacement (AVR), combined CABG and AVR (CABG+AVR), mitral valve (MV), and operations for aortic aneurysms. The STS ACSD has developed risk-adjustment models [3–5] and composite quality ratings [13–16] for seven major procedures that include isolated CABG, isolated AVR, AVR+CABG, MV replacement (MVR), MV repair, MVR+CABG, and MV repair+CABG. These seven operations now comprise approximately 77% of all cardiac procedures performed nationally. The 17% of procedures listed as "other" in [Figure 1](#) include procedures such as tricuspid valve repair/replacement, surgical ablation of atrial fibrillation, implantation of ventricular assist device, and septal defect repair, among others, performed in isolation or in combination with other procedures.

Selected aggregate national outcomes for more commonly performed cardiac operations in calendar year 2016 are presented in [Table 1](#). Operative mortality remains essentially unchanged from prior reports [10, 17] for the listed procedures, ranging from a high of 9.5% for MVR+CABG to a low of 1.1% for MV repair. As in prior years, MVR+CABG has the highest incidence of major morbidity among the listed procedures. New-onset atrial fibrillation remains the most commonly encountered postoperative complication after cardiac operations, and rates of postoperative atrial fibrillation have not changed since prior reports [10, 17]. Atrial fibrillation increases resource utilization and has a detrimental effect on postoperative outcomes [18]. Despite years of investigation and numerous proposed management strategies, atrial fibrillation remains a consistently vexing problem in one-third of patients.

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