

# The Society of Thoracic Surgeons Adult Cardiac Surgery Database: 2018 Update on Research: Outcomes Analysis, Quality Improvement, and Patient Safety



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The Society of Thoracic Surgeons Adult Cardiac Surgery Database (ACSD) is an international voluntary registry that provides adult cardiac surgery programs with risk-adjusted outcome reports for quality improvement. With more than 6,300,000 procedural records in adult cardiac surgery, the ACSD has proven to be a leading instrument for clinical outcomes research. The ACSD generated numerous major original contributions that

were either published or accepted for publication in 2017. These works significantly contributed to the practice of adult cardiac surgery through outcome measurement and quality improvement. This paper summarizes the recent ACSD contributions to the literature.

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Since its inception in 1989, The Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database (ACSD) has exceeded 6.3 million patient records to become one of the preeminent clinical data registries in the world. The STS, in cooperation with the Duke Clinical Research Institute as its data warehouse and analytic center, has leveraged the ACSD for more than 2 decades to provide leadership in the areas of statistical risk modeling, quality improvement, voluntary public reporting, and clinical research. The database currently includes 1,088 US participants, 31 international participants, and 3,108 surgeons. The ACSD represents more than 95% of all US cardiac operations performed annually, with yearly audits to certify data quality, accuracy, and completeness [1–4].

The ACSD has facilitated establishing several national trends in cardiac surgical practice. These have included data-driven decision making, observational outcomes research, and cost assessments. Analyses from the ACSD have been used for value-based reimbursement, best-practice protocols, voluntary public reporting, and clinical guideline development. Risk-adjusted quality metrics, developed by STS and endorsed by the National Quality Forum, provide comprehensive perspectives on

cardiac surgical quality. Linkage of the ACSD to additional government health care registries now permit longer-term analysis of late results and readmissions [4]. This report summarizes the contributions of the ACSD in the areas of clinical outcome analyses and quality improvement that were either published or accepted for publication in 2017.

## Clinical Outcome Analyses

### *Coronary Artery Bypass Graft Surgery*

Two studies investigated contemporary topics in coronary artery bypass graft surgery (CABG) [5, 6]. Schwann and colleagues [5] highlighted contemporary 30-day or in-hospital operative outcomes for multiarterial CABG stratified by the conduit type other than the left internal thoracic artery [5]. All patients received a left internal thoracic artery graft. There were 73,054 patients who received bilateral internal thoracic artery (BITA) multiarterial bypass grafts (MABG), 97,623 who received a radial artery (RA) MABG, and 1,334,511 whose additional grafts were saphenous vein (SABG). The groups showed distinctly different patient characteristics: SABG (73.8% men; median age, 66 years); BITA-MABG (85.1% men; median age, 59 years); and RA-MABG (82.5% men; median age, 61 years). Operative mortality for SABG was 1.91%, which was higher than for BITA-MABG (1.19%,

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### Abbreviations and Acronyms

ACSD	= Adult Cardiac Surgery Database
BITA	= bilateral internal thoracic arteries
CABG	= coronary artery bypass graft surgery
CI	= confidence interval
HR	= hazard ratio
MABG	= multiarterial bypass graft
MVRR	= mitral valve repair/replacement
O/E	= observed-to-expected ratio
ONCABG	= on-pump coronary artery bypass graft surgery
OPCABG	= off-pump coronary artery bypass graft surgery
OR	= odds ratio
RA	= radial artery
SABG	= saphenous vein bypass graft
SAVR	= surgical aortic valve replacement
STS	= The Society of Thoracic Surgeons
TAVR	= transcatheter aortic valve replacement
TVR	= tricuspid valve repair

$p < 0.001$ ) and RA-MABG (1.19%,  $p < 0.001$ ). The incidence of deep sternal wound infection for SABG was 0.73%, lower than that associated with BITA-MABG (1.08%,  $p < 0.001$ ) yet similar to that of RA-MABG (0.71%,  $p = 0.55$ ). BITA-MABG showed a marginally and not clinically significant increased risk-adjusted operative mortality to SABG (odds ratio [OR] 1.14, 95% confidence interval [CI]: 1.00 to 1.30) but a doubled risk for deep sternal wound infection (OR 2.09, 95% CI: 1.80 to 2.43). RA-MABG had operative mortality (OR 1.01, 95% CI: 0.89 to 1.15) and deep sternal wound infection risk (OR 0.97, 95% CI: 0.83 to 1.13) similar to that of SABG. The researchers conclude that MABG in the United States is associated with mortality risk comparable to that of SABG but an increased deep sternal wound infection risk exists with BITA-MABG. These short-term results should not in any way dissuade the use of MABG, given its well-established long-term survival advantage.

Keeling and colleagues [6] examined the outcomes of patients for planned off-pump CABG (OPCABG) in whom a conversion to an on-pump CABG (ONCABG) was required. A total of 196,576 patients undergoing planned OPCABG within the ACSD from July 2007 to June 2014 were evaluated. Patients were grouped according to the reason for intraoperative conversion to cardiopulmonary bypass: (1) planned conversion; (2) unplanned conversion for visualization; (3) unplanned conversion for hemodynamic instability; and (4) no conversion. The overall rate of OPCABG conversion to ONCABG was 5.5%, with 49.6% of the conversions being planned. Patients not undergoing conversion had an observed-to-expected ratio [O/E] 30-day mortality of 0.8. Patients undergoing conversion to ONCABG had worse outcomes regardless of etiology of conversion (planned conversion O/E 1.4, unplanned conversion for visualization O/E 1.6, and unplanned conversion for hemodynamic instability O/E 2.7). Similar

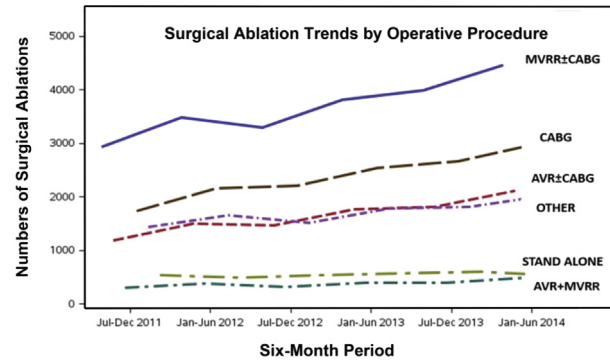


Fig 1. Trends of surgical ablation in the United States by operative procedure. (Reproduced from [7] with permission from The Society of Thoracic Surgeons.) (AVR = aortic valve replacement; CABG = coronary artery bypass graft surgery; MVRR = mitral valve repair/replacement.)

O/E ratios were observed for renal failure and prolonged ventilation after conversion. Logistic regression analysis showed advanced age, ejection fraction less than 35%, preoperative intraaortic balloon pump placement, increasing number of diseased coronary arteries, preoperative heart failure within 2 weeks, and urgent procedural status were all independent predictors for conversion to ONCABG ( $p \leq 0.01$ ). The investigators concluded that intraoperative conversion from OPCABG to ONCABG remains a morbid event with a risk of mortality much higher than expected and that surgeons should instead consider elective ONCABG for cases with a high predictive risk for conversion.

### Atrial Fibrillation

Two studies involved perioperative management of atrial fibrillation. The first examined the contemporary outcomes of surgical ablation in the United States [7]. This study of 86,941 patients with preoperative atrial fibrillation undergoing primary nonemergent operations from July 2011 to June 2014 revealed an increased application of surgical ablation across all operative categories (Fig 1). Overall, 48.3% (42,066 of 86,941) underwent surgical ablation, with the highest rate occurring with mitral valve repair or replacement (MVRR) operations at 68.4% (14,693 of 21,496) and the lowest with isolated CABG at 32.8% (9,156 of 27,924). After propensity matching of two groups of 28,739 patients with or without surgical ablation, it was found that adding an ablation resulted in a clear reduction of operative mortality and stroke (Table 1). This paper supports current guideline recommendations [8] for a wider application of surgical ablation for atrial fibrillation, when appropriate, as a method of increasing quality outcomes.

For patients with atrial fibrillation undergoing cardiac surgery, Friedman and colleagues [9] utilized the STS ACSD to analyze the impact of surgical left atrial appendage obliteration on longitudinal thromboembolism. The researchers examined 10,524 patients undergoing surgery with preoperative atrial fibrillation of whom 3,892 underwent surgical obliteration of the left

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