**Supplemental Table 1.** The Society of Thoracic Surgeons STS Adult Cardiac Surgery Database Adult Cardiac Anesthesiology Section Participant Groups

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **STS Adult Cardiac Surgery Database Anesthesia Section Participant Groups** | | | | |
| **Participant Hospital Name** | **Participant Anesthesiology Group** | **City** | **State** | **Country** |
| AdventHealth Celebration | U.S. Anesthesia Partners | Celebration | Florida | USA |
| AdventHealth Orlando | U.S. Anesthesia Partners | Orlando | Florida | USA |
| Adventist Health Castle | Adventist Health Castle Perioperative Services | Kailua | Hawaii | USA |
| Ascension Providence Hospital | Northland Anesthesia Associates | Southland | Michigan | USA |
| Baptist Medical Center Jacksonville | U.S. Anesthesia Partners | Jacksonville | Florida | USA |
| Baton Rouge General Medical Center | Parish Anesthesia of Baton Rouge | Baton Rouge | Lousiana | USA |
| Baylor St. Lukes Medical Center | Baylor College of Medicine Department of Anesthesiology | Houston | Texas | USA |
| Bethesda Hospital, Inc. | Seven Hills Anesthesia, LLC | Cincinnati | Ohio | USA |
| Borgess Medical Center | Kalamazoo Anesthesiology, PC | Kalamazoo Township | Michigan | USA |
| Bristol Regional Medical Center | Bristol Anesthesia Services | Bristol | Virginia | USA |
| Bryan Medical Center | Associated Anesthesiologists, PC | Lincoln | Nebraska | USA |
| CHI Health Creighton University Medical Center – Bergan Mercy | Alegent Creighton Clinic | Omaha | Nebraska | USA |
| CHI Health Good Samaritan | Mid Plains Anesthesia & Critical Care Group | Kearney | Nebraska | USA |
| CHI Health Nebraska Heart | The Physician Network | Lincoln | Nebraska | USA |
| CHI Memorial | American Anesthesiology Associates | Chattanooga | Tennessee | USA |
| CHI Saint Vincent Infirmary Medical Center | Southern Regional Anesthesiology Consultants | Little Rock | Arkansas | USA |
| CHI St Alexius Health | Anesthesiology CHI St. Alexius Health Bismarck Medical Center | Bismarck | North Dakota | USA |
| CHI St. Vincent Hospital Hot Springs | Southern Regional Anesthesiology Consultants PLLC | Hot Springs | Arkansas | USA |
| Christus Highland Medical Center | Christus Highland Medical Center Department of Anesthesiology | Shreveport | Lousiana | USA |
| Doctors Hospital of Laredo | AnesthesiaCare | Laredo | Texas | USA |
| Duke University Medical Center / Duke Health | Duke Health Division of Adult Cardiothoracic Anesthesiology and Critical Care Medicine | Durham | North Carolina | USA |
| Essentia Health - St. Mary's Medical Center | The Duluth Clinic, LTD. Anesthesia Section | Duluth | Minnesota | USA |
| Florida Hospital Tampa | Envision Physician Services | Tampa | Florida | USA |
| Garfield Medical Center | Monterey Park Hospital Anesthesiology | Monterey Park | California | USA |
| Geisinger Medical Center | Geisinger Medical Center Department of Anesthesiology | Danville | Pennsylvania | USA |
| Grady Memorial Hospital | Emory Department of Anesthesiology | Atlanta | Georgia | USA |
| Harris Health Ben Taub Hospital | Baylor College of Medicine Department of Anesthesiology | Houston | Texas | USA |
| Harrison Medical Center | Harrison Health Partners | Bremerton | Washington | USA |
| Hartford Hospital | Integrated Anesthesia Associates, LLC | Hartford | Connecticut | USA |
| HCA Houston Healthcare North Cypress | U.S. Anesthesia Partners | Cypress | Texas | USA |
| HealthPark Medical Center | U.S. Anesthesia Partners | Ft. Meyers | Florida | USA |
| Jupiter Medical Center, Inc. | Envision Physician Services | Jupiter | Florida | USA |
| Kaiser Foundation Hospital - Santa Clara | Kaiser Foundation Hospital Department of Anesthesiology | Santa Clara | California | USA |
| Maine Medical Center | Spectrum Medical Group Cardiac Anesthesia | Portland | Maine | USA |
| Medical University of South Carolina | Medical University of South Carolina Division of Cardiothoracic Anesthesiology | Charleston | South Carolina | USA |
| Memorial Health System of East Texas - Lufkin | HB Anesthesiology Group P.A. | Lufkin | Texas | USA |
| Mercy General Hospital | Mercy General Hospital Division of Cardiovascular Anesthesiology | Sacramento | California | USA |
| Mercy Medical Center - Des Moines | Medical Center Anesthesiologists, P.C. | Des Moines | Iowa | USA |
| Montefiore Medical Center | Montefiore Medical Center Department of Anesthesiology | Bronx | New York | USA |
| Munroe Regional Medical Center | Cardiovascular Anesthesia Associates | Ocala | Florida | USA |
| North Shore University Hospital | North American Partners in Anesthesia | Manhasset | New York | USA |
| Northern Light Eastern Maine Medical Center | Northern Light Anesthesiology | Bangor | Maine | USA |
| Northridge Hospital Medical Center | Stephen Farnum, MD., INC. | Los Angeles | California | USA |
| Penrose Hospital | Anesthesia Associates | Colorado Springs | Colorado | USA |
| Porter Adventist Hospital | U.S. Anesthesia Partners | Denver | Colorado | USA |
| Portneuf Medical Center | SEI Anesthesia | Pocatello | Idaho | USA |
| Providence Health | Cardiovascular Anesthesia, LLC | Columbia | South Carolina | USA |
| Rapid City Regional Hospital | Rapid City Regional Hospital Department of Anesthesia | Rapid City | South Dakota | USA |
| Ronald Reagan University of California - Los Angeles Medical Center | University of California - Los Angeles Department of Cardiac Anesthesiology | Los Angeles | California | USA |
| Saint Joseph Hospital | Anesthesia Associates, PSC | Lexington | Kentucky | USA |
| Spectrum Health | West Michigan Anesthesia | Grand Rapids | Michigan | USA |
| Spring Valley Hospital Medical Center | U.S. Anesthesia Partners | Las Vegas | Nevada | USA |
| St. Anthony Hospital | Anesthesia Consultants | Denver | Colorado | USA |
| St. Joseph Medical Center | Pacific Anesthesia | Tacoma | Washington | USA |
| St. Luke's The Woodlands Hospital | U.S. Anesthesia Partners | The Woodlands | Texas | USA |
| Stanford University Medical Center / Stanford Health Care | Stanford Health Care Department of Anesthesiology | Stanford | California | USA |
| SUNY Downstate Medical Center | SUNY Downstate Department of Anesthesiology | Brooklyn | New York | USA |
| The Nebraska Medical Center | The Nebraska Medical Center Department Of Anesthesia | Omaha | Nebraska | USA |
| The Queen's Medical Center | The Queen's Medical Center Department of Anesthesia | Honolulu | Hawaii | USA |
| The University of Kansas Hospital | The University of Kansas Department of Anesthesiology | Kansas City | Kansas | USA |
| Toronto General Hospital | University of Toronto Department of Anesthesia & Pain Management | Toronto | Ontario | Canada |
| University of California - Davis Medical Center | University of California - Davis Medical Center Cardiovascular and Thoracic Anesthesia | Sacramento | California | USA |
| University of Colorado Health | University of Colorado Department of Anesthesiology | Denver | Colorado | USA |
| University of Mississippi Medical Center | University of Mississippi Division of Anesthesiology | Jackson | Mississippi | USA |
| University of Rochester Medical Center | University of Rochester Department of Anesthesiology | Rochester | New York | USA |
| University of Washington Medicine | University of Washington Division of Cardiothoracic Anesthesia | Seattle | Washington | USA |
| Wellstar Kennestone Hospital | Georgia Anesthesiologists, PC | Marietta | Georgia | USA |
| West Penn Hospital | Anesthesia Associates of West Penn Hospital | Pittsburgh | Pennsylvania | USA |
| William P. Clements Jr. University Hospital | Department of Anesthesiology and Pain Management | Dallas | Texas | USA |
| Yuma Regional Medical Center | Arizona Consultants-Anesthesiology | Yuma | Arizona | USA |

*Abbreviations:* ACSD, Adult Cardiac Surgery Database; STS, Society of Thoracic Surgeons.

**Supplemental Table 2.** MIPS Measures Relevant to Cardiothoracic Surgery and Anesthesia

|  |  |  |
| --- | --- | --- |
| **MIPS Measures Relevant to Cardiothoracic Surgery and Anesthesia** | | |
| **Measure ID** | **Measure Title** | **Measure Description** |
| MIPS #044 (NQF #236) | Coronary Artery Bypass Graft (CABG): Preoperative Beta-Blocker in Patients with Isolated CABG Surgery: | *Percentage of isolated Coronary Artery Bypass Graft (CABG) surgeries for patients aged 18 years and older who received a beta-blocker within 24 hours prior to surgical incision.* |
| MIPS #076 (NQF #2726) | Prevention of Central Venous Catheter (CVC) - Related Bloodstream Infections: | *Percentage of patients, regardless of age, who undergo central venous catheter (CVC) insertion for whom CVC was inserted with all elements of maximal sterile barrier technique, hand hygiene, skin preparation and, if ultrasound is used, sterile ultrasound techniques followed* |
| MIPS #131: | Pain Assessment and Follow Up: | *Percentage of visits for patients aged 18 years and older with documentation of a pain assessment using a standardized tool(s) on each visit AND documentation of a follow-up plan when pain is present.* |
| MIPS #164 (NQF #129) | Coronary Artery Bypass Graft (CABG) - Prolonged Intubation: | *Percentage of patients aged 18 years and older undergoing isolated CABG surgery who require postoperative intubation > 24 hours.* |
| MIPS #166 (NQF #131) | Coronary Artery Bypass Graft (CABG) - Stroke: | *Percentage of patients aged 18 years and older undergoing isolated CABG surgery who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours.* |
| MIPS # 167 (NQF #114) | Coronary Artery Bypass Graft (CABG) - Postoperative Renal Failure: | *Percentage of patients aged 18 years and older undergoing isolated CABG surgery (without pre-existing renal failure) who develop postoperative renal failure or require dialysis.* |
| MIPS #424 (NQF #2681) | Perioperative Temperature Management: | *Percentage of patients, regardless of age, who undergo surgical or therapeutic procedures under general or neuraxial anesthesia of 60 minutes duration or longer for whom at least one body temperature greater than or equal to 35.5 degrees Celsius (or 95.9 degrees Fahrenheit) was achieved within the 30 minutes immediately before or the 15 minutes immediately after anesthesia end time.* |
| MIPS #445 (NQF #119) | Risk-Adjusted Operative Mortality for Coronary Artery Bypass Graft (CABG): | *Percent of patients aged 18 years and older undergoing isolated CABG who die, including both all deaths occurring during the hospitalization in which the CABG was performed, even if after 30 days, and those deaths occurring after discharge from the hospital, but within 30 days of the procedure.* |
| MIPS #426\* | Post-Anesthetic Transfer of Care Measure: Procedure Room to PACU: | *Percentage of patients, regardless of age, who are under the care of an anesthesia practitioner and are admitted to a PACU or other non-ICU location in which a post-anesthetic formal transfer of care protocol or checklist which includes the key transfer of care elements is utilized.* |
| MIPS #427\* | Post-Anesthetic Transfer of Care Measure: Procedure Room to ICU: | *Percentage of patients, regardless of age, who undergo a procedure under anesthesia and are admitted to an Intensive Care Unit (ICU) directly from the anesthetizing location, who have a documented use of a checklist or protocol for the transfer of care from the responsible anesthesia practitioner to the responsible ICU team or team member.* |

\*The above quality measures MIPS #426 and MIPS #427 are no longer required for reporting via MIPS.

The table describes all measures and indicators required for reporting by CMS via MIPS. Each measure or indicator is identified as per MIPS codification (and NQF whenever applicable), their full name and a detailed description are also provided.

*Abbreviations:* CMS, Centers for Medicare and Medicaid Services; ID, identification, MIPS, Merit-Based Incentive Payment System; NQF, National Quality Forum.

**Supplemental Table 3.** National Quality Forum (NQF) Measures Relevant to Cardiothoracic Surgery and Anesthesia

|  |  |
| --- | --- |
| **National Quality Forum (NQF) Measures Relevant to Cardiothoracic Surgery and Anesthesia** | |
| **Measure ID** | **Measure Title** |
| NQF #236 (MIPS #044) | Coronary Artery Bypass Graft (CABG) - Preoperative Beta-Blocker in Patients with Isolated CABG Surgery. |
| NQF #2726 (MIPS #076) | Prevention of Central Venous Catheter (CVC) - Related Bloodstream Infections. |
| NQF #119 (MIPS #445) | Risk-Adjusted Operative Mortality for Coronary Artery Bypass Graft (CABG). |
| NQF #129 (MIPS #164) | Risk-Adjusted Postoperative Prolonged Intubation (ventilation). |
| NQF #114 (MIPS #167) | Risk-Adjusted Postoperative Renal Failure. |
| NQF #2681 (MIPS #424) | Perioperative Temperature Management. |
| NQF #300 | Cardiac Surgery Patients with Controlled Postoperative Blood Glucose: |
| *Cardiac surgery patients with controlled postoperative blood glucose (less than or equal to 180 mg/dL) in the timeframe of 18 to 24 hours after Anesthesia End Time.* |

The table outlines all measures endorsed by NQF. Each measure is identified as per NQF codification and its full name is also provided.

Abbreviations: ID, identification, MIPS, Merit-Based Incentive Payment System; NQF, National Quality Forum

**Supplemental Table 4.** Anesthesia Quality Institute (AQI)/NACOR/QCDR Measures Relevant to Cardiothoracic Anesthesiology

|  |  |  |
| --- | --- | --- |
| **Anesthesia Quality Institute (AQI)/NACOR/QCDR Measures Relevant to Cardiothoracic Anesthesiology** | | |
| **Measure ID** | **Measure Title** | **Measure Description** |
| AQI #18 | Coronary Artery Bypass Graft: Prolonged Intubation –Inverse Measure | *Percentage of patients aged 18 years and older undergoing isolated CABG surgery who require postoperative intubation> 24 hours* |
| AQI #34 | Perioperative Cardiac Arrest | *Percentage of patients, regardless of age, who undergo a surgical, therapeutic or diagnostic procedure under anesthesia and who experience a cardiac arrest under the care of a qualified anesthesia provider prior to anesthesia end time.* |
| AQI #35 | Perioperative Mortality Rate | *Percentage of patients, regardless of age, who undergo a surgical, therapeutic or diagnostic procedure under anesthesia and who experience mortality under the care of an anesthesia provider prior to anesthesia end time.* |
| AQI #41 (NQF #131)\* | Coronary Artery Bypass Graft – Stroke. |  |
| AQI #42 (NQF #114)\* | Coronary Artery Bypass Graft - Postoperative Renal Failure. |  |
| AQI #44 (NQF #236) | Coronary Artery Bypass Graft: Preoperative Beta-Blocker in Patients with Isolated CABG Surgery. |  |
| AQI #49 | Adherence to Blood Conservation Guidelines for Cardiac Operations using Cardiopulmonary Bypass | *Percentage of patients aged 18 years and older, who undergo a cardiac operation using cardiopulmonary bypass for whom selected blood conservation strategies were used. This measure has four components used to calculate a combined score, those include: 1) Use of lysine analogues; 2) Use of mini-circuits or Retrograde Autologous Priming (RAP) or Ultrafiltration; 3) Use of red cell salvage using centrifugation; and 4) Use of a transfusion algorithm supplemented with point-of-care testing.* |
| AQI #52 | Treatment of Hyperglycemia with Insulin | *Percentage of patients, aged 18 years and older, who undergo elective inpatient surgery and who have a blood glucose level of > 200 mg/dL and who receive insulin prior to anesthesia end time.* |
| AQI #65 | Avoidance of Cerebral Hyperthermia for Procedures Involving Cardiopulmonary Bypass: Percentage | *Percentage of patients, aged 18 years and older, undergoing a procedure using cardiopulmonary bypass who did not have a documented intraoperative pulmonary artery, oropharyngeal, or nasopharyngeal temperature ≥37.0 degrees Celsius during the period of cardiopulmonary bypass.* |
| AQI #76 (NQF #2726) | Prevention of Central Venous Catheter - Related Bloodstream Infections. |  |
| AQI #424 (NQF #2681) | Perioperative Temperature Management. |  |

\*The quality measures AQI #41 (CABG-Stroke) and AQI #42 (CABG-Postoperative Renal Failure) have been recently rejected by CMS due to “high performance rate and lack of variability for improvement”. Therefore, they have been removed AQI NACOR registry for reporting”.

The table describes all measures required by AQI via reporting to NACOR/QCDR. Each measure or indicator is identified as per AQI codification (and NQF whenever applicable), their full name and a detailed description are also provided.

Abbreviations: AQI, Anesthesia Quality Institute; MIPS, Merit-Based Incentive Payment System; CMS, Centers for Medicare and Medicaid Services ID, identification, NACOR, National Anesthesia Clinical Outcomes Registry; NQF, National Quality Forum; QCDR, Qualified Clinical Data Registry.

**Supplemental Table 5.** STS National Database Adult Cardiac Surgery and Anesthesia Quality and Outcome Indicators

|  |  |
| --- | --- |
| **STS National Database Adult Cardiac Surgery and Anesthesia Quality and Outcome Indicators** | |
| **Anesthesia Care Team Model:** | |
|  | *Type of Anesthesiology Team Model - AnesCareTeamMod (#7320)* |
|  | Anesthesiologist working alone |
|  | Attending Anesthesiologist teaching/medically directing fellow |
|  | Attending Anesthesiologist teaching/medically directing house staff |
|  | Attending Anesthesiologist medically directing CRNA (1:4 ratio or less) |
|  | Attending Anesthesiologist medically directing CRNA (1:5 ratio or greater) |
|  | Surgeon medically directing CRNA |
|  | CRNA practicing independently |
| **Perioperative Beta-Blockers:** | |
| 1 | MedBeta (#1030) - Beta Blockers Within 24 Hours (patient received beta blockers within 24 hours preceding surgery, or if beta blocker was contraindicated) |
| 2 | MedBetaTher (#1035) - Beta Blocker Therapy For More Than 2 Weeks Prior To Surgery (patient received beta blocker therapy for at least 2 weeks prior to surgery). |
| **Blood Conservation Strategies:** | |
| Equivalent to AQI #49 (Adherence to Blood Conservation Guidelines for Cardiac Operations using CPB) | |
| 1 | *Use of Lysine Analogues* |
| Intraop Antifibrinolytic Medications - Epsilon Amino-Caproic Acid - IMedEACA#2550 |
| Intraop Antifibrinolytic Medications - Tranexamic Acid-IMedTran #2555 |
| 2 | *Use of Mini-circuit or Retrograde Autologous Priming (RAP) or Ultrafiltration* |
| Circuit priming volume can be calculated by using: |
| Total Crystalloid Administered by Perfusion Team: TotCrystPerf (#7585) |
| Synthetic Colloid Administered by Perfusion Team: TotColloidPerf (#7590) |
| Albumin volume Administered by Perfusion Team: TotAlbumPerf (#7595) |
| Retrograde Autologous Priming of CPB Circuit - RetrAutolPrim (#7580) |
| Hemofiltration Volume Removed by Perfusion Team - HemofilPerf (#7600) |
| 3 | *Use of Red Cell Salvage* |
| Cell Saver Volume - CellSavVol (#7335) |
| 4 | *Use of a Transfusion Algorithm Supplemented with Point-of-Care Testing* |
| Algorithm to Guide Transfusion - TransfAlg (#7330) |
| Viscoelastic Testing Used Intraoperatively - IntraViscoTest (#7360) |
| 5 | *Coagulation Management* |
| Heparin Total Dose - TotHep (#7340) |
| Heparin Management (method used intraoperatively) - HepMgmt (#7345) |
| Protamine Total Dose - TotProt (#7350) |
| Antithrombin III Total Dose - AntithromDose (#7351) |
| **Pain Management: (included as part of MIPS #131)** | |
| 1 | Pain Score Baseline - PainScorePre (#7325) |
| 2 | Pain Score on Postoperative Day # 3 - PainScorePOD3 (#7730) |
| 3 | Pain Score at Discharge - PainScoreDisch (#7735) |
| **Anesthetic Agents & Postoperative Delirium:** | |
| 1 | *Selection of Inhaled General Anesthetic Agents* |
| Volatile Agent Used (Y/N) - VolAgentUsed(#7365) |
| Isoflurane Used (Y/N) - VolAgentIso(#7366) |
| Sevoflurane Used (Y/N) - VolAgentSevo(#7367) |
| Desflurane Used (Y/N) - VolAgentDes(#7368) |
| Other Agent Used (Y/N) - VolAgentOth(#7369) |
| 2 | *Timing of Inhaled Agents* |
| Volatile Agent Used Pre-CPB (Y/N) - VolAgentTimPre(#7370) |
| Volatile Agent Used During-CPB (Y/N) - VolAgentTimDur(#7375) |
| Volatile Agent Used Post-CPB (Y/N) - VolAgentTimPost(#7380) |
| Volatile Agent Used for Maintenance, if no CPB (Y/N) - VolAgentTimMaint(#7385) |
| 3 | *Intra- and Postoperative Choice of Intravenous Sedatives* |
| Intraoperative Dexmedetomidine Infusion (Y/N) - DexIntra(#7390) |
| Intraoperative Propofol Infusion (Y/N) - PropIntra(#7395) |
| Intraoperative Midazolam (mg) - MidazIntra(#7400) |
| Postoperative Dexmedetomidine (Y/N) - DexPost(#7710) |
| Postoperative Propofol (Y/N) - PropPost(#7715) |
| 4 | *Postoperative Delirium* |
| Postoperative Delirium Presence (Y/N) - PostopDel(#7720) |
| **Major Adverse Events:** | |
| 1 | Postoperative Stroke CNStrokP (#4810) |
| 2 | Prolonged ventilation – CPVntLng (#4835) |
| 3 | Renal failure – CRenFail (#4870) |
| 4 | Cardiac arrest - COtArrst (#4905) |
| 5 | Intraoperative Cardiac Arrest Related to Anesthesia Care - IntraCardArr (#7641) |
| 6 | Death in the Operating Room - ORDeath (#7645). |
| **Temperature Management:** | |
| 1 | Intraoperative Core Temperature Source - CoreTempSrc (#7435) |
| 2 | Maximum Intraoperative Core Temperature - CoreTempMax (#7440) |
| 3 | Core Temperature Measured upon Entry to PACU / ICU - PostTempMeas (#7650) |
| 4 | Postoperative Core Temperature - PostCoreTemp (#7655) |

The table provides a comprehensive description of all topics included in the Adult Cardiac Surgery and Anesthesia sections of the STS National Database collection form that are of relevance to professional practice of both, cardiothoracic surgery and anesthesia. Each topic has all specific variable fields identified by their full and short names, and the sequence number assigned by STS.

Abbreviations: AQI, Anesthesia Quality Institute; CPB, cardiopulmonary bypass; CRNA, certified registered nurse anesthetist; ICU, intensive care unit; MIPS, Merit-Based Incentive Payment System; PACU, post-anesthesia care unit; STS, Society of Thoracic Surgeons.

**Supplemental Table 6.** Blood conservation strategies, source of core temperature measurement, and frequency of anesthetic medication use

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reported Frequencies for Blood Conservation Strategies, Temperature Measurement and Anesthetic Medications Use** | | | | | |
| **Blood Conservation Strategies (see Figure 4)** | | | | | |
|  | **Year of Surgery** | | | | |
|  | **2015** | **2016** | **2017** | | **2018** | | |
|  | **n (%)** | **n (%)** | **n (%)** | | **n (%)** | | |
| Heparin management based on |  |  |  | |  | | |
| activated clotting time | 5744 (80.3) | 9163 (79.9) | 11395 (78.3) | | 14031 (81.0) | | |
| heparin concentration | 1406 (19.7) | 2223 (19.4) | 2957 (20.3) | | 3163 (18.3) | | |
| other method | 2 (0) | 81 (0.7) | 195 (1.3) | | 118 (0.7) | | |
| Transfusion algorithm used |  |  |  | |  | | |
| Yes, SCA/STS algorithm used | 3243 (44) | 4438 (37.7) | 5228 (34.1) | | 6256 (34.7) | | |
| Yes, other algorithm used | 858 (11.6) | 807 (6.9) | 2214 (14.5) | | 3245 (18) | | |
| No algorithm used | 3275 (44.4) | 6528 (55.4) | 7873 (51.4) | | 8510 (47.2) | | |
| Viscoelastic test used |  |  |  | |  | | |
| Yes | 1961 (26.3) | 2562 (21.5) | 1756 (22.7) | | 3863 (22.5) | | |
| No | 5483 (73.7) | 9344 (78.5) | 5989 (77.3) | | 13298 (77.5) | | |
| Aminocaproic acid use |  |  |  | |  | | |
| Yes | 219351 (73.2) | 216553 (71.9) | 192761 (64.9) | | 117712 (40.4) | | |
| No | 80420 (26.8) | 84469 (28.1) | 104267 (35.1) | | 173310 (59.6) | | |
| Tranexamic acid use |  |  |  | |  | | |
| Yes | 28647 (9.6) | 32625 (10.9) | 52901 (17.8) | | 117477 (40.4) | | |
| No | 270893 (90.4) | 267916 (89.1) | 244087 (82.2) | | 173435 (59.6) | | |
|  |  |  |  | |  | | |
| **Core Intraoperative Temperature Source and Temperature Measured Upon ICU Entry (see Figure 6)** | | | | | |
|  | **Year of Surgery** | | | | |
|  | **2015** | **2016** | **2017** | **2018** | | |
|  | **n (%)** | **n (%)** | **n (%)** | **n (%)** | | |
| Core temperature source |  |  |  |  | | |
| Esophageal | 182 (2.5) | 209 (1.8) | 352 (2.4) | 675 (3.9) | | |
| Bladder | 5232 (72) | 8229 (70.9) | 8856 (59.5) | 9639 (56.1) | | |
| Nasopharyngeal | 1328 (18.3) | 2620 (22.6) | 4547 (30.5) | 5559 (32.3) | | |
| Pulmonary artery catheter | 494 (6.8) | 523 (4.5) | 1039 (7) | 1169 (6.8) | | |
| Tympanic | 6 (0.1) | 6 (0.1) | 51 (0.3) | 98 (0.6) | | |
| Rectal | 22 (0.3) | 27 (0.2) | 49 (0.3) | 51 (0.3) | | |
| Core temperature upon entry to ICU/PACU |  |  |  |  | | |
| Yes | 7092 (95.8) | 11199 (94.5) | 14909 (92.1) | 17634 (92.1) | | |
| No | 314 (4.2) | 652 (5.5) | 1277 (7.9) | 1505 (7.9) | | |
|  |  |  |  |  | | |
| **Frequency of Anesthetic Medications Use (see Figure 7)** | | | | | |
|  | **Year of Surgery** | | | | |
|  | **2015** | **2016** | **2017** | **2018** | | |
|  | **n (%)** | **n (%)** | **n (%)** | **n (%)** | | |
| Intraoperative propofol |  |  |  |  | | |
| Yes | 2728 (36.8) | 4571 (38.5) | 7935 (49.7) | 9717 (50.8) | | |
| No | 4679 (63.2) | 7290 (61.5) | 8039 (50.3) | 9410 (49.2) | | |
| Intraoperative dexmedetomidine |  |  |  |  | | |
| Yes | 827 (11.4) | 2355 (19.8) | 4765 (29.8) | 6304 (33) | | |
| No | 6449 (88.6) | 9512 (80.2) | 11221 (70.2) | 12817 (67) | | |
| Volatile agent |  |  |  |  | | |
| Yes | 6109 (91.8) | 10133 (91.2) | 8700 (96.1) | 18458 (96.5) | | |
| No | 547 (8.2) | 972 (8.8) | 350 (3.9) | 674 (3.5) | | |
| Postoperative propofol |  |  |  |  | | |
| Yes | 2120 (28.6) | 4013 (33.8) | 6590 (40.6) | 7954 (41.6) | | |
| No | 5294 (71.4) | 7860 (66.2) | 9633 (59.4) | 11145 (58.4) | | |
| Postoperative dexmedetomidine |  |  |  |  | | |
| Yes | 1510 (20.4) | 3901 (32.9) | 6812 (42) | 8790 (46) | | |
| No | 5894 (79.6) | 7965 (67.1) | 9408 (58) | 10306 (54) | | |

**Supplemental Table 7.** Incidence of postoperative delirium, and observed-to-expected ratios of postoperative complications stratified by type of surgical interventions reported between 2015-2018

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Postoperative Complications by Type of Surgical interventions for Anesthesia Section STS ACSD Participants** | | | | |
|  | **Year of Surgery** | | | |
|  | **2015** | **2016** | **2017** | **2018** |
|  | **n** | **n** | **n** | **n** |
| **Isolated CABG** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***3388*** | ***5836*** | ***8182*** | ***9788*** |
| Delirium | 61.0 | 204.0 | 259.0 | 346.0 |
| Readmission | 1523.0 | 1276.0 | 1911.0 | 2188.0 |
| Operative Mortality | 56.0 | 118.0 | 196.0 | 179.0 |
| Predicted Op. Mort. | 69.0 | 122.9 | 156.0 | 178.2 |
| Permanent Stroke | 52.0 | 93.0 | 101.0 | 164.0 |
| Predicted Perm. Stroke | 44.2 | 75.7 | 107.0 | 126.8 |
| Renal Failure (post-Op) | 50.0 | 124.0 | 165.0 | 212.0 |
| Predicted Renal Failure | 123.9 | 229.9 | 222.8 | 180.1 |
| RE-operation (post-Op) | 70.0 | 140.0 | 191.0 | 249.0 |
| Predicted Re-Operation | 178.3 | 309.4 | 288.4 | 220.1 |
| Prolonged Ventilator | 211.0 | 373.0 | 510.0 | 601.0 |
| Predicted Prolonged Ventilation | 361.1 | 635.3 | 744.1 | 778.3 |
| Morbidity & Mortality | 341.0 | 655.0 | 861.0 | 1062.0 |
| Predicted M&M | 516.1 | 908.8 | 1090.7 | 1153.4 |
| **Isolated AVR** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***827*** | ***1228*** | ***1568*** | ***1760*** |
| Delirium | 22.0 | 47.0 | 41.0 | 57.0 |
| Readmission | 268.0 | 296.0 | 322.0 | 349.0 |
| Operative Mortality | 17.0 | 24.0 | 30.0 | 20.0 |
| Predicted Op. Mort. | 19.6 | 28.5 | 30.6 | 30.8 |
| Permanent Stroke | 18.0 | 17.0 | 21.0 | 19.0 |
| Predicted Perm. Stroke | 11.4 | 16.4 | 17.6 | 18.4 |
| Renal Failure (post-Op) | 14.0 | 18.0 | 30.0 | 22.0 |
| Predicted Renal Failure | 32.6 | 45.0 | 40.0 | 30.4 |
| RE-operation (post-Op) | 26.0 | 54.0 | 58.0 | 57.0 |
| Predicted Re-Operation | 62.3 | 92.4 | 78.1 | 61.3 |
| Prolonged Ventilator | 57.0 | 64.0 | 88.0 | 83.0 |
| Predicted Prolonged Ventilation | 82.6 | 121.8 | 125.2 | 122.6 |
| Morbidity & Mortality | 95.0 | 131.0 | 165.0 | 157.0 |
| Predicted M&M | 134.8 | 198.6 | 201.5 | 192.3 |
| **Isolated MVR** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***265*** | ***464*** | ***604*** | ***859*** |
| Delirium | 5.0 | 30.0 | 29.0 | 43.0 |
| Readmission | 84.0 | 127.0 | 171.0 | 226.0 |
| Operative Mortality | 15.0 | 14.0 | 38.0 | 25.0 |
| Predicted Op. Mort. | 10.7 | 15.5 | 26.2 | 39.9 |
| Permanent Stroke | 5.0 | 12.0 | 18.0 | 16.0 |
| Predicted Perm. Stroke | 4.1 | 6.3 | 10.4 | 17.0 |
| Renal Failure (post-Op) | 11.0 | 15.0 | 28.0 | 35.0 |
| Predicted Renal Failure | 14.2 | 21.5 | 23.4 | 34.4 |
| RE-operation (post-Op) | 12.0 | 20.0 | 34.0 | 41.0 |
| Predicted Re-Operation | 24.0 | 38.1 | 40.9 | 48.6 |
| Prolonged Ventilator | 39.0 | 67.0 | 88.0 | 128.0 |
| Predicted Prolonged Ventilation | 43.8 | 64.0 | 103.5 | 155.7 |
| Morbidity & Mortality | 65.0 | 92.0 | 127.0 | 172.0 |
| Predicted M&M | 59.8 | 90.5 | 135.1 | 199.9 |
| **CABG+AVR** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***494*** | ***703*** | ***900*** | ***1031*** |
| Delirium | 17.0 | 43.0 | 64.0 | 75.0 |
| Readmission | 229.0 | 205.0 | 195.0 | 200.0 |
| Operative Mortality | 14.0 | 29.0 | 36.0 | 28.0 |
| Predicted Op. Mort. | 20.5 | 29.1 | 35.2 | 37.2 |
| Permanent Stroke | 12.0 | 19.0 | 16.0 | 23.0 |
| Predicted Perm. Stroke | 11.3 | 16.3 | 19.9 | 21.7 |
| Renal Failure (post-Op) | 14.0 | 22.0 | 45.0 | 34.0 |
| Predicted Renal Failure | 35.3 | 53.4 | 47.1 | 35.1 |
| RE-operation (post-Op) | 20.0 | 41.0 | 46.0 | 27.0 |
| Predicted Re-Operation | 47.7 | 67.6 | 60.1 | 46.2 |
| Prolonged Ventilator | 50.0 | 64.0 | 114.0 | 103.0 |
| Predicted Prolonged Ventilation | 80.4 | 114.8 | 131.4 | 131.8 |
| Morbidity & Mortality | 83.0 | 119.0 | 169.0 | 149.0 |
| Predicted M&M | 120.2 | 172.3 | 195.1 | 196.5 |
| **CABG+MVR** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***79*** | ***130*** | ***173*** | ***251*** |
| Delirium | 3.0 | 10.0 | 10.0 | 25.0 |
| Readmission | 26.0 | 38.0 | 47.0 | 57.0 |
| Operative Mortality | 5.8 | 8.2 | 12.3 | 24.3 |
| Predicted Op. Mort. | 5.8 | 8.2 | 12.3 | 24.3 |
| Permanent Stroke | 5.0 | 7.0 | 4.0 | 10.0 |
| Predicted Perm. Stroke | 2.1 | 3.1 | 4.8 | 7.3 |
| Renal Failure (post-Op) | 1.0 | 12.0 | 11.0 | 18.0 |
| Predicted Renal Failure | 7.5 | 12.7 | 14.7 | 20.6 |
| RE-operation (post-Op) | 4.0 | 7.0 | 18.0 | 16.0 |
| Predicted Re-Operation | 10.1 | 14.8 | 14.1 | 15.8 |
| Prolonged Ventilator | 20.0 | 27.0 | 44.0 | 68.0 |
| Predicted Prolonged Ventilation | 21.0 | 30.2 | 44.8 | 81.7 |
| Morbidity & Mortality | 23.0 | 44.0 | 63.0 | 81.0 |
| Predicted M&M | 27.0 | 39.5 | 56.8 | 96.7 |
| **AVR + MVR** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***71*** | ***104*** | ***127*** | ***192*** |
| Delirium | 1.0 | 10.0 | 13.0 | 13.0 |
| Readmission | 15.0 | 27.0 | 33.0 | 59.0 |
| Operative Mortality | 8.0 | 10.0 | 10.0 | 19.0 |
| Predicted Op. Mort. |  |  |  |  |
| Permanent Stroke | 6.0 | 3.0 | 2.0 | 8.0 |
| Predicted Perm. Stroke |  |  |  |  |
| Renal Failure (post-Op) | 6.0 | 11.0 | 7.0 | 17.0 |
| Predicted Renal Failure |  |  |  |  |
| RE-operation (post-Op) | 7.0 | 14.0 | 9.0 | 18.0 |
| Predicted Re-Operation |  |  |  |  |
| Prolonged Ventilator | 21.0 | 24.0 | 35.0 | 45.0 |
| Predicted Prolonged Ventilation |  |  |  |  |
| Morbidity & Mortality | 28.0 | 35.0 | 45.0 | 63.0 |
| Predicted M&M |  |  |  |  |
| **Isolated MV repair** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***456*** | ***579*** | ***782*** | ***1112*** |
| Delirium | 8.0 | 15.0 | 18.0 | 31.0 |
| Readmission | 106.0 | 119.0 | 169.0 | 288.0 |
| Operative Mortality | 3.0 | 10.0 | 13.0 | 7.0 |
| Predicted Op. Mort. | 4.1 | 4.4 | 7.7 | 11.9 |
| Permanent Stroke | 5.0 | 9.0 | 14.0 | 9.0 |
| Predicted Perm. Stroke | 3.9 | 4.6 | 8.2 | 11.8 |
| Renal Failure (post-Op) | 4.0 | 4.0 | 12.0 | 7.0 |
| Predicted Renal Failure | 7.7 | 9.0 | 11.4 | 12.7 |
| RE-operation (post-Op) | 5.0 | 14.0 | 19.0 | 22.0 |
| Predicted Re-Operation | 21.6 | 24.4 | 28.0 | 33.7 |
| Prolonged Ventilator | 21.0 | 28.0 | 29.0 | 43.0 |
| Predicted Prolonged Ventilation | 24.2 | 25.2 | 41.1 | 63.9 |
| Morbidity & Mortality | 31.0 | 50.0 | 57.0 | 64.0 |
| Predicted M&M | 42.1 | 46.8 | 69.6 | 100.7 |
| **CABG + MV repair** |  |  |  |  |
|  |  |  |  |
| ***No. of Patients*** | ***107*** | ***206*** | ***250*** | ***284*** |
| Delirium | 2.0 | 11.0 | 17.0 | 15.0 |
| Readmission | 88.0 | 74.0 | 70.0 | 81.0 |
| Operative Mortality | 5.0 | 11.0 | 16.0 | 15.0 |
| Predicted Op. Mort. | 4.9 | 10.1 | 11.8 | 13.2 |
| Permanent Stroke | 7.0 | 8.0 | 9.0 | 5.0 |
| Predicted Perm. Stroke | 2.5 | 4.7 | 5.8 | 6.8 |
| Renal Failure (post-Op) | 3.0 | 9.0 | 14.0 | 11.0 |
| Predicted Renal Failure | 9.1 | 14.7 | 17.2 | 13.4 |
| RE-operation (post-Op) | 3.0 | 9.0 | 8.0 | 15.0 |
| Predicted Re-Operation | 10.6 | 19.0 | 17.5 | 13.6 |
| Prolonged Ventilator | 15.0 | 31.0 | 44.0 | 38.0 |
| Predicted Prolonged Ventilation | 20.9 | 39.9 | 49.3 | 52.6 |
| Morbidity & Mortality | 19.0 | 46.0 | 62.0 | 54.0 |
| Predicted M&M | 28.1 | 52.1 | 65.4 | 69.5 |

Abbreviations: ACSD, Adult Cardiac Surgery Database; AVR, aortic valve replacement; CABG, coronary artery bypass grafting surgery; MVR, mitral valve replacement; MV, mitral valve; STS, Society of Thoracic Surgeons.

The results presented were based on the analyses of data collected by centers participating in the Surgery and Anesthesia sections of the STS ACSD