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Honorable Joseph R. Pitts
Chairman
Committee on Energy and Commerce
Subcommittee on Health
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

Honorable Frank Pallone
Ranking Member
Committee on Energy and Commerce
Subcommittee on Health
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Pitts and Ranking Member Pallone:

Thank you for the opportunity to present my testimony on behalf of The Society of Thoracic Surgeons (STS) and thank you for your thoughtful questions. As you know, STS is the largest organization representing cardiothoracic surgeons in the United States and the world. Founded in 1964, STS is an international, not-for-profit organization representing more than 6,600 surgeons, researchers, and allied health care professionals in 85 countries who are dedicated to providing patient-centered high quality care to patients with chest and cardiovascular diseases, including heart, lung, esophagus, transplantation, and critical care. The mission of the Society is to enhance the ability of cardiothoracic surgeons to provide the highest quality patient care through education, research, and advocacy.

Additional Questions for the Record
The Honorable Joseph R. Pitts

1. From your testimony, it appears that the Society of Thoracic Surgeons have been doing measurement development and promotion for years. Do you believe that specialties that may not be as advanced as thoracic surgery can catch up?

Yes, in fact many specialties are already in the process of developing their own, specialty-specific clinical registries. Importantly, we believe that implementation of a pay-for-quality program should not wait for all of medicine to be at the same place at the same time. We recommend that policymakers consider ways to reward providers for incremental steps towards these quality assessment goals outlined in Phase II of the Committee's discussion draft, while allowing those medical specialties that already have the requisite infrastructure in place to engage in this new system as soon as possible and reap some reward for their efforts.

Short, medium, and long term infrastructure, measure, and quality assessment benchmarks should be set up as intermediate goals, shortening the "period of stability" for those able to meet those steps. For example, incremental steps towards Phase II readiness can include reporting of data to a clinical database

under construction, working on various "Clinical Improvement Activities" as defined in the Committees' concept document, receiving feedback on quality measure performance (even while such measures are being considered for approval), or observing process or structural measures that have been approved or are in the process of being approved by a consensus-based entity, among others.

2. How beneficial can a system of primary care and specialty-specific quality and efficiency measures be to our seniors, taxpayers, and the Medicare program as a whole?

The fundamental principle underlying the STS database initiative has been that engagement in the process of collecting information on every case, robust risk-adjustment based on pooled national data, and feedback of these risk-adjusted data to the individual practice and institution will provide the most powerful mechanism to change and improve the practice of cardiothoracic surgery for the benefit of patients and the public. In fact, published studies indicate that the quality of care has already improved as a result of research and feedback from the STS National Database.

For example, ElBardissi and colleagues studied 1,497,254 patients who underwent isolated primary Coronary Artery Bypass Graft (CABG) surgery at STS National Database-participating institutions from 2000 to 2009. They found that:

- Patients received more indicated care processes in recent years, including a 7.8% increase in the use of angiotension-converting enzyme inhibitors preoperatively and a significant increase in the use of the internal thoracic artery (88% in 2000 vs. 95% in 2009).
- The observed mortality rate over this period declined from 2.4% in 2000 to 1.9% in 2009, representing a relative risk reduction of 24.4% despite the predicted mortality rates (2.3%) remaining consistent between 2000 and 2009.
- The incidence of postoperative stroke decreased significantly from 1.6% (2000) to 1.2% (2009), representing a relative risk reduction of 26.4%.
- There was also a 9.2% relative reduction in the risk of reoperation for bleeding and a 32.9% relative risk reduction in the incidence of sternal wound infection from 2000 to 2009.

In addition, participation in initiatives that rely on data from the STS National Database have proven that access to information on patient outcomes helps physicians to identify best practices in quality and efficiency that can help save money and critical resources. For example, funded by the National Heart Lung and Blood Institute (NHLBI) at the National Institutes of Health (NIH), the ASCERT (American College of Cardiology Foundation-The Society of Thoracic Surgeons Collaboration on the Comparative Effectiveness of Revascularization Strategies) study was designed to examine the comparative long-term effectiveness of Coronary Artery Bypass Graft (CABG) and percutaneous coronary intervention (PCI) revascularization strategies in real world populations, including specific subgroups of patients such as those with diabetes, severely impaired heart function (low ejection fractions), chronic lung disease, and kidney dysfunction. ASCERT examined 86,244 patients undergoing CABG and 103,549 patients treated with PCI. The study uses data from STS Database and ACC registry along with CMS Medicare Provider

Analysis and Review (MEDPAR) data. STS views the ASCERT study as a paradigm for a comparative effectiveness research enterprise based on linked clinical and administrative data. Clinically robust, broadly generalizable data from thousands of patients, linked with longitudinal outcomes from claims data, could quickly and cost-effectively answer a broad range of questions. The results of these studies will be a unique and innovative source of information for patients, providers and various third party payers concerning the potential long-term results of different treatments in specific subgroups. Such information could feasibly be used to change how physicians treat their patients, patients experience their treatments, and payors reimburse for care.

At the regional level, the Virginia Cardiac Surgery Quality Initiative (VCSQI) has demonstrated that improving quality reduces cost. For example, using evidence-based guidelines derived from an analysis of data from the STS National Database combined with patients' claims data, VCSQI has generated more than $43 million in savings through blood product conservation efforts and more than $20 million by providing the best treatment to patients with atrial fibrillation at the right time.

3. You mention in your testimony the importance of linking administrative and outcome data for providers in the field. How important in such a process as outlined in the Committees legislative framework will it be for providers to have timely access to their own performance data? How early and often in the process of measurement should such access happen?

The issue of linking robust clinical data with resource utilization data such as Medicare or private payor claims information is an essential part of any program that attempts to improve quality and efficiency in health care. Clinical data registries have previously been limited to short-term outcomes. To mitigate this limitation, STS has linked our clinical registry data to administrative sources such as CMS MEDPAR to obtain long term clinical outcomes and long term data on resource utilization. Clinical registries provide detailed diagnostic and therapeutic data (including data about risk factors and severity of disease) not present in administrative databases, while administrative databases provide information about long-term outcomes and cost not present in clinical databases. Linkage of clinical and administrative databases is essential for the assessment of resource use and value (quality/cost). The linkage of clinical data with resource utilization data provides the mechanism to risk-adjust both clinical outcomes and resource utilization and thereby to assess the value of care being delivered. We anticipate that feedback of these linked clinical and resource utilization data to the practice/institutional level will be associated with further improvements in both the quality and cost, i.e., value of cardiothoracic surgical practice. We urge that the CMS MEDPAR data be made available on a regular basis to qualified registries that have robust patient privacy protections and formalized standards for assessment of providers' performance that relies on *both* clinical and claims data, such as the STS National Database.

A significant roadblock to the acquisition of long-term survival data has recently been established by the Social Security Administration. In November 2011, the Social Security Administration rescinded its policy of sharing state-reported death data as a part of the Social Security Death Master File (SSDMF). There are continuing efforts to further restrict access to

the SSDMF so as to "protect" those listed in the file from identity theft. Balanced against these legitimate privacy concerns is the value of the unique survival information that can be provided from the SSDMF data. Linking clinical registries to the SSDMF allows for the verification of 'life status" of patients who otherwise would be lost for follow up after their treatment, and as indicated previously, this longitudinal survival data is vital in assessing the long term efficacy of many treatment algorithms for important diseases, including heart disease, cancer, and many other chronic diseases.
Research based on this information helps physicians to provide information to today's patients and families to help them with shared decision making. Outcomes data give patients confidence in their medical interventions and demonstrate to patients and their families the durability and long-term benefits of medical procedures. It is important to note that STS, through its contracts with the Duke Clinical Research Institute, maintains the patient identifier data separately from the actual clinical and other demographic data, and the only patient level identified information that ever leaves the database is simply that the patient has a record in the database. When the follow-up information is returned from external entities, such as the SSDMF, it can be linked back to the records in the de-identified database, but the flow of information is only in this direction. The externally derived data are used to supplement the data in the individual record, but these data never leaves the database except in de-identified form.

Importantly, STS believes that meaningful quality measures and rewards for physician performance cannot be applied simply to administrative data, including claims data, reported by hospitals and physicians alone. While administrative data provide information on longitudinal medical treatments and resource utilization across settings of care and by various physicians, their clinical accuracy have been shown to be poor, and they exclude pertinent information on patient risk factors, disease severity, and clinical outcomes. This critical information is only found in clinical datasets where there is input of clinical data by clinicians. Publication of claims data, without the clinical context and robust demographic information essential to risk-adjustment, could have extremely harmful effects. For that reason we oppose current efforts by the administration to provide general public access to Medicare Claims data and request significant revisions to S. 1180 and/or any similar legislation that is considered in the House.

Finally, in responding to this question, we feel it is important to define the terms physician-reported data, physician performance based on quality measures, and physician feedback reports. I have provided an example of a physician data entry form (available here: http://www.sts.org/sites/default/files/documents/STSAdultCVDataCollectionForm2_73_Annotated.pdf) and a physician feedback report (available here: http://www.sts.org/sites/default/files/documents/pdf/ndb2010/Report_OV_General_5-37.pdf). You will note that the data collection form records raw data drawn from a patient's chart. Quality measures provide statistically and clinically relevant ways to interpret those data. The feedback report uses these data and measures to generate analyses across the specialty, allowing cardiothoracic surgeons to compare themselves against national aggregate data in a statistically valid and clinically credible fashion. We wish to again emphasize the motivational power of this type of feedback data in influencing physician practice.

4. Your testimony and past feedback to this committee raised a concern about the sharing of best practices should a system of quality measurement be linked to payment in the wrong way. Do you have any recommendations for appropriate ways to apply such measurement that would not negatively impact the sharing of best practices among providers?

While the creation of a reward/penalty system of physician reimbursement is not inherently wrong and could potentially be an effective method of improving health care quality and efficiency, it is the method of implementation that is logistically problematic. If such a system is designed to operate on the individual physician level, intra- and inter-hospital cooperation and sharing of best practices will almost certainly suffer. In addition, from a purely statistical perspective when low frequency events are being evaluated, it is virtually impossible to distinguish different levels of performance between one clinician and another because the total number of patients / outcomes / events created by the individual practitioners is far too small to yield any meaningful interpretation. For example: 95% of 25 patients equals 23.75 and 92% of 25 patients is 23 (essentially no difference). However, 95% of 10,000 patients equals 9500 and 92% of 10,000 is 9200 (a much more easily appreciated difference). On the other hand, a national or perhaps regional construct will enhance cooperation and "cross-fertilization" of information. Cardiothoracic surgical examples of these structures include not only the STS National Database efforts, but also state and regional efforts such as the Virginia Cardiac Surgical Quality Initiative, the Michigan STS collaboration on adult cardiac surgery, and the Northern New England Cardiovascular Study Group. Placing incentives at a higher organizational level (e.g. state, region, or national) can encourage collaborative learning and quality improvement that should be inherent aspects of professionalism and can avoid incentives to "game the system" or to refrain from sharing knowledge and clinical experience. We believe that using competition to create economic winners and losers among physicians can only lead to reduced cooperation, collaboration, and information sharing that we all believe is essential to improving the practice of medicine.

Finally, placing the focus on the individual practitioner detracts from the team approach to patient care that is the hallmark of many of the advances in medicine and surgery of late. For example, in order for the heart team, which consists of the cardiothoracic surgeon, cardiologist, anesthesiologist, and advanced practice nurses and physician assistants (among others), to function at its highest level, there must be shared responsibility for patient care and patient outcomes. Similar relationships exist throughout medicine including the multidisciplinary team of heath care providers necessary to provide optimal care to patients with cancer and many other diseases. Assessing care quality at the institutional, regional, or national level allows the component parts of the health care team to share accountability, ensuring the patient receives the best care from the appropriate health care provider.

STS believes that any new, alternative payment methodology should align incentives along specialty or disease process lines at the regional or national level. This type of payment system would foster and incentivize physicians to act as members of a profession and fulfill their professional responsibilities to collaborate and share knowledge and practices with their peers. There are several alternatives to current Medicare physician and hospital payment mechanisms

which could advance these goals, including specialty-specific conversion factors for physician payment and global payments to hospitals and physicians for specified procedures such as isolated coronary bypass procedures. STS believes that the most powerful and reliable method to affect physician practice is to engage physicians in the collection of outcomes data on the services that they provide, and to provide meaningful, risk-adjusted feedback that allows them to compare these outcomes to those of their peers. We believe that the reimbursement system should promote physician practices that exemplify the profession's responsibilities to not only improve the quality of the care that is given to patients but also to wisely allocate societal healthcare resources. We also believe that responsible professional organizations provide important database and educational resources that can provide the infrastructure to support the needed improvements in physician practice and resource utilization.

5. How important will specialty specific clinical registries be for a process such as the one outlined in the Committee's legislative framework? Could such a registry serve as a source of continual physician feedback and data as some have stated will be so important?

The STS National Database is an example of an initiative that was designed precisely for the purposes described in this question. It is our strong belief that specialty-specific registries are the most appropriate source of this information and the best tool available to meet the goals of physician payment reform that achieves quality improvement. Peer pressure is an important factor in changing practice, and the closest medical peers are members of the same specialty. Most physicians identify directly with their specialty and also with their specialty or sub-specialty societies. We also believe that these databases should be independently and randomly audited, as the STS database has been for several years, in order to provide credibility and comfort to the American public and to payors in the validity of the data.

Any modernization of the physician payment system should ensure that individual medical specialties can—and have incentive to—control the growth rate of their services and payments by identifying the most effective and appropriate treatment for the patient. At the very least, specialties should not be penalized if their quality and value improvement activities result in lower Medicare utilization and expenditures. As the STS National Database and registries of other specialties have demonstrated, feedback of credible, risk-adjusted outcomes data encourages physicians to change their practice patterns to achieve better outcomes, more efficient care delivery, and thereby, increased patient value. The following should be included in any Medicare physician payment reform initiatives:

- Mandate and incentivize the development and utilization of specialty- specific clinical data registries;
- Require the Centers for Medicare and Medicaid Services (CMS) and other payers to make administrative (cost and claims) data available to registries for use in their analyses so that resource utilization becomes an outcome variable to be assessed in the same manner as traditional clinical outcomes such as mortality or complication rates. The STS believes that the improvement in clinical outcomes without significantly reducing out- of-control medical resource utilization is ultimately self-defeating ;
- Address barriers imposed by federal and state privacy regulations including, but not limited to the inability of our clinical registry to also collect administrative claims data

and "outcomes" data contained in the SSDMF. Preventing the STS and any other legitimate specialty specific data registry from having access to information as to the patient's final outcome (i.e. mortality) severely limits the power of clinical registries. Of course, the onus of protecting the privacy of patients should be required of the specialty societies and has been demonstrated for years by the STS National Database and its sound method of data encryption;

- Allow physicians to share the savings generated by their quality improvement efforts and consider providing economic incentives and disincentives at higher levels than the individual physician or practice.
- Utilize audited clinical registries and other resources to generate comparative effectiveness research; and
- Consider significant changes to reimbursement systems for both hospitals and physicians that promote wise use of resources and improved clinical outcomes.

STS urges Congress to consider quality incentive programs that encourage the coordination of Medicare claims data with existing clinical registries to enhance patient monitoring and physician performance, and improve quality. Without linking the administrative data collected by health plans and CMS with the clinical information reported by clinicians, patients cannot be effectively monitored. By using linked longitudinal registries, physicians can more broadly monitor patients for readmissions or care transitions. Similarly, longitudinal patient histories allow physicians to assess the long-term success of surgical or other medical interventions. The successful linking of the STS database with CMS administrative data in Virginia, for example, has led to a clinical/financial tool that brings quality improvement and cost containment to reality through a focus on reductions in costly complications and the redesign of care delivery models in order to promote high quality efficient care.

A new STS public reporting initiative was launched in September 2010. By January, 2011 more than 20% of Adult Cardiac Surgery Database participants began to voluntarily report their heart bypass surgery performance score to the public on www.sts.org[1]. As of July 2013, approximately 43% of Database participants are voluntarily reporting their results for Coronary Artery Bypass Graft (CABG) and/or aortic valve replacement on the Consumer Reports and/or STS websites, and STS is universally regarded as the leading professional society in these activities.

6. While primary care and some specialty groups have a long standing history of measure development and performance, others unfortunately lag behind. Do you believe that all provider groups adopting a system of quality measurement will be good for the provision of care in this country, and do you believe that provider specialties that are advanced in these areas might be able to help those who lag behind?

As outlined previously, STS strongly believes that this process of collection of reliable outcomes data, central risk adjustment, and feedback is a strong motivator for practice improvement. We believe that these same principles apply across all areas of medicine. In some disciplines, the outcomes may be more difficult to precisely define, but we believe that outcomes measurement

[1] http://www.nejm.org/doi/pdf/10.1056/NEJMp1009423

must be an integral part of quality improvement. STS and other surgical groups are recognized as leaders in this type of activity, but there are multiple other examples including collection of data on the treatment of cystic fibrosis and childhood cancers, to name a few. This approach is not new, but its expansion across all areas of medicine will require the appropriate incentives and support to overcome the important financial and motivational barriers that exist.

STS as a professional society, and our individual members who have experience in working with the STS National Database are eager to help in the effort to proliferate best practices in clinical data collection and analysis to bring about a change in how care is provided in this country. We believe that we have the tools to ensure that the right patients receive the right care at the right time, every time.

The Honorable John Shimkus

1. Page 21 of the legislative framework released last week calls for the development of a "process by which physicians, medical societies, health care provider organizations, and other entities may propose" Alternative Payment Models for adoption and use in the Medicare program. Do you believe that model development from private payers and providers like those at Independent Health can lead to reforms that could benefit patients, providers, and taxpayers?

While we appreciate that the current proposal, and the preponderance of our comments to date have addressed Medicare Fee For Service (FFS) payments, we feel strongly that the health care system should begin to move away from FFS and towards models of payment that promote provider collaboration in the treatment of a single patient. STS members are committed to the concept of team-care as exemplified by the heart team and cancer team. For example, STS worked to build the heart team concept into CMS's coverage with the evidence development decision for Transcatheter Aortic Valve Replacement therapy (TAVR). TAVR is covered for the treatment of severe aortic stenosis when furnished according to an FDA-approved indication. The TAVR National Coverage Decision requires that two cardiac surgeons have independently examined the patient and the patient is under the care of a heart team: a cohesive, multidisciplinary team of medical professionals that includes a cardiothoracic surgeon and a cardiologist. We have learned from cardiothoracic surgeons who practice in other countries that the heart team is so valued that the heart team actually receives payments for time spent consulting about the best treatment option for a given patient. While we may still be a few steps away from such an integrated payment system, STS members are committed to the practice of patient oriented care and STS is very supportive of the Alternative Payment Model proposals. The STS recognizes the inevitability and enormous value of the concept of a bundled payment initiative.

However, we also recognize the need to stabilize the FFS system before such wholesale reforms are able to take place inasmuch as some specialties are not able to accommodate a full transition, as yet. More importantly, however, the true value in the Committee's proposal is the commitment to the development of a robust clinical registry infrastructure that is critical to quality-focused reforms. Without such an infrastructure, physicians, who use evidence-based medicine as the basis for their daily practice, will have no ability to document their outcomes and

compliance with evidence based medicine. We have focused our efforts at the specialty level, primarily because that reflects the organizational structure of much of medicine. It is not difficult to envision linkage of specialty level data along disease entity lines, much as the STS and ACC have linked their data in the ASCERT trial comparing the effectiveness of coronary bypass and percutaneous catheter based treatments for coronary artery disease. The critical issue is constructing a system and a professional ethic that emphasizes the collection of robust clinical and resource utilization data.

The Honorable Cathy McMorris Rodgers

1. Phase II of the House Energy and Commerce, health Subcommittee's proposal to repeal and replace the flawed Sustainable Growth (SGR) formula requests that providers submit "clinical practice improvement activities" to the HHS Secretary for approval. Clinical practice improvement activities are defined as activities that improve care delivery and, when effectively executed, are likely to result in improved health outcomes.

It has come to my attention that other medical providers are already using clinical decision support tools (embedded with medical specialty society appropriateness criteria) as an example of a clinical improvement activity. These tools are both software and web based.

One example is in the area of advanced diagnostic imaging. Clinical decision support tools, designed and used by radiologists, have demonstrated savings of health care dollars by reducing inappropriate utilization; reduction of patient exposure to unnecessary radiation; better care coordination; and shared decision making between the doctor and patient.

In light of this doctor-initiated success, please comment on the merits and concerns about using such technology in other areas of medicine.

Do you think it is feasible to consider this use of clinical decision support tools as one tool in the tool box of improving quality in healthcare?

Clinical decision support tools, and the evidence-based development of such tools, are an invaluable asset to the practice of medicine. However, these tools should never be construed as usurping a physician's medical expertise and judgment. Yet it is the critical interplay between the physician's judgment and the various clinical support tools available to him/her that is emerging as the new construct for medical care. The STS believes that the various clinical support tools (e.g. the ACC/AHA Guidelines for Coronary Artery Bypass Graft surgery and Percutaneous Coronary Intervention [stent/angioplasty]), are meant to augment and not supplant the physicians' decision making expertise.

The STS Risk Calculator is a publicly available, web-based tool that is used by surgeons to determine the best course of treatment, particularly when faced with a frail patient or one who has comorbid (i.e., co-existing) conditions. With millions of patients in its data repository, the STS Risk Calculator is so powerful that it is frequently cited in FDA approval and CMS coverage decisions as a criterion for the appropriate use of a treatment or therapy. For more

information about the STS Risk Calculator, please visit: http://www.sts.org/quality-research-patient-safety/quality/risk-calculator-and-models

The Society has developed several dozen risk-adjustment models for cardiothoracic surgery, all of which were derived using granular clinical data from thousands of patient records. STS has also developed sophisticated quality performance measures in all three sub-specialties of cardiothoracic surgery (Adult Cardiac Surgery, General Thoracic Surgery, and Congenital Cardiac Surgery), and 32 of these measures have either been endorsed or are in the process of being considered for endorsement by the National Quality Forum. In 2007, STS began developing a family of composite performance measures for the major procedures in CT Surgery, each one of which encompasses multiple domains of quality (e.g., mortality, morbidity, adherence to process measures). STS began this initiative with a composite measure for CABG, one of the most common cardiac surgical procedures. We have begun adding one new procedural composite measure each year (e.g., isolated aortic valve replacement, aortic valve replacement combined with CABG, mitral valve repair, etc.). The goal is develop a portfolio of these multidimensional composite measures that, in aggregate, will provide a broad perspective on the quality of a cardiac surgical practice."

In 2012, the STS National Database formed an Appropriateness Task Force. The goal of this task force is to map the variables in the STS National Database to specific guidelines recommendations and appropriate use criteria for coronary revascularization and CABG, as developed jointly by the American College of Cardiology, American Heart Association, and the Society of Thoracic Surgeons. Once this mapping is accomplished, it will be possible to immediately determine from the patient's medical history and coronary artery symptoms/anatomy, as entered in the STS Database, whether the patient meets nationally accepted recommendations for surgery. This information, in addition to patient-specific risk estimates from the STS National Database, will be extremely valuable elements of truly informed consent and shared decision making.

In the context of the Committee's proposal, STS believes that utilization of clinical decision support tools, or even steps towards adoption of clinical support tools, should be considered "Clinical Improvement Activities." We would suggest that such activities could be used to allow physicians to ramp up to full Phase II implementation, allowing the committee to reward providers who attempt to advance from Phase I more quickly.

Clearly, encouraging providers to engage in certain Clinical Improvement Activities will help to set a level playing field among providers and specialties. This variable will be an important component of the program at its inception and provides a mechanism for policy-makers to signal recognition of innovations in health care delivery that they deem to be useful for future quality improvement. Like the quality measures, the list of clinical practice improvement activities can be updated regularly to promote growth and improvement. We support the proposal that physicians have the ability to choose from a menu of clinical practice improvement activities.

The Honorable Gus Bilirakis

1. How much of these quality measures should be developed for the physician in general or should we have measures for specific diseases? How do we develop quality measures for rare diseases? These are hard to diagnose diseases with small populations. If we do develop metrics for specific conditions, how do we responsibly develop measurements for these conditions when research may be more limited?

Risk adjustment for rare procedures is difficult because of the limited numbers of patients to develop risk adjusted models. However, in these situations, one can still collect clinical data including patient demographics and risk factors, as well as outcomes and processes and structures. These aggregate data can, when done on a national basis, contribute to assessing performance, but in particular add information that could be useful in improving treatment quality and value.

Quality measures for the treatment of rare diagnoses, therefore, are best developed from national aggregate data, as exemplified by the STS National Database. The STS National Database was established in 1989 as an initiative for quality assessment, improvement, and patient safety among cardiothoracic surgeons. The STS National Database has three components—Adult Cardiac, General Thoracic, and Congenital Heart Surgery and is organized around specific procedures within all three of those categories. The Database houses more than five million surgical records and gathers information from more than 90% of the approximately 1,100 groups that perform cardiac surgery in the United States. Anesthesiology participation is available within the Congenital Heart Surgery Database and will be added to the Adult Cardiac Surgery Database in 2013. In 2011, the Database expanded to include international participants; currently, Brazil, Israel, Turkey and Jordan have surgeons participating in the Database. STS also operates the STS/ACC TVT Registry™ in a joint effort with the American College of Cardiology (ACC)[2].

In general, the STS National Database provides:

- a standardized, independently audited, nationally benchmarked tool for assessing the care of patients undergoing cardiothoracic operations;
- the opportunity to participate in national quality improvement efforts for cardiothoracic surgery that have an impact at the local, regional, and national levels;
- a mechanism to target specific areas for clinical practice improvement;
- the ability to investigate regional and national practice patterns in cardiothoracic surgery; and
- the ability to conduct clinical and comparative effectiveness research using national aggregate data sets.

[2] The TVT Registry™ is a benchmarking tool developed to track patient safety and real-world outcomes related to the transcatheter aortic valve replacement (TAVR) procedure. Created by The Society of Thoracic Surgeons (STS) and the American College of Cardiology (ACC), the TVT Registry is designed to monitor the safety and efficacy of this new procedure for the treatment of aortic stenosis. https://www.ncdr.com/TVT/Home/Default.aspx

We feel that the best way to organize a clinical registry, particularly as it relates to cardiothoracic surgery, is to develop it around specific procedures. Doing so facilitates the risk adjustment and public reporting models highlighted above. To the extent that a procedural model is not accessible for other specialties or primary care providers, disease-specific or other models may be usefully employed. Disease and procedure-specific registries are the building blocks, and these registries can be linked together to provide more comprehensive assessments of physicians, groups, hospitals, or systems.

The STS believes that it is the concept of a national data registry with continuous physician feedback that 1) allowed us to realize enormous success in improving care within our own specialty, and 2) becomes a blueprint for the creation of similar national data registries that will positively affect clinical care in other medical disciplines. Instead of focusing on outcomes following coronary artery bypass, the primary care physician might be more interested in guidelines for the treatment of community-acquired pneumonia and more importantly with the continuous feedback that helps him/her assess clinical effectiveness with better outcomes and decreased utilization of precious medical resources. The medical oncologist might be able to, for the first time, have an objective yardstick to measure not only how the patients are doing as compared to national standards but also how he/she is performing relative to medical peers.

We also believe that the physicians who best understand individual disease processes are in the best position to determine the most clinically relevant quality and outcomes measures, and we believe that external random audit processes will be essential for public and payor credibility. We recognize that there must be input and oversight from outside the specialty, but existing organizations, such as the National Quality Forum and the AMA PCPI that can provide this type of oversight. A measure that is appropriate for a cardiothoracic surgeon will surely not be appropriate for a primary care provider, but each medical and surgical specialty should determine clinically relevant outcomes to measure and should engage in the collection of outcomes data on important clinical diseases.

2. How much input should patient groups have and what type of input into the process should they have when determining these measures?
Input from patients is critical in the new era of health care delivery. The existence of national data registries and all of the clinical decision making tools is designed to facilitate the concept of shared decision making between the medical team and the patient. Significant improvements in quality outcomes will simply never be fully realized without meaningful patient participation in medical decisions.

Clinical registries can and should track outcomes that are uniquely important to patients such as use of metrics for patient satisfaction, quality of life, and adequacy of communication with providers, etc. As outlined in question 1, STS believes that a medical specialty should not be the sole developer of quality outcomes measures, and that patients and other interested parties should be able to participate in providing input on the types of outcomes to be measured. However, STS believes that each specialty or sub-specialty should be given the responsibility to receive input from patients and other interested groups and develop outcomes measures.

3. Should the system evolve to allow a direct feedback loop to the doctor? For example, the physician would know that they were paid X because they did or did not do Y to patient Z. Do we want that granular a system, or should the information and payment be done on a more aggregate level?

The STS National Database and related initiatives (public reporting, physician feedback reports, risk calculator, etc.) are structured around measuring patient outcomes using NQF-endorsed outcomes measures that rely on data reporting and analysis of aggregate data. If cost data were available, we would suggest that it too is only relevant in the context of patient outcomes, in the aggregate. STS is not in favor of piecemeal incentives or penalties at the individual procedure, disease, patient, or physician level for the reasons outlined previously.

4. Is it possible to use physician quality measures to encourage patients to better follow doctor's plan to manage diseases? For example, a newly diagnosed diabetic getting a follow up call by the doctor reminding them to check their blood sugar or reminding them to schedule an appointment with a nutritionist. Should these metrics be limited to what is done inside the physician's office?

We believe that outcomes measures should be given more weight in a pay-for quality scenario, but that process and structural measures are a valid way to begin to measure quality. In fact, this is another area where we feel that specialties can begin to make strides towards Phase II implementation in a ramp-up scenario. We would endorse the development and utilization of process measures, an example of which would be receiving credit for executing a "follow-up" call to a newly diagnosed diabetic to remind him to check his blood sugar, etc. Ultimately, however, the system should move toward measurement of longitudinal outcomes for the diabetic patient, such as Hemoglobin A1C levels, vision loss, limb loss, and ultimately survival. Structure and process measures can be used as a basis for registry reporting and physician feedback while data collection for the development of outcomes measures is underway.

5. Should the quality measures be weighted? If there are 10 things that a doctor can do to increase their performance measure, should they be rated equally for payment bonuses or weighted to account for time or difficulty?

We agree that measures should be weighted and propose the following breakdown, based on Donabedian's Triad of Structure, Process, and Outcome[3]:

- Outcomes: 50%
- Process: 30%
- Structural: 20%

[3] Donabedian A. Evaluating the quality of medical care. Milbank Mem Fund Q. 1966 Jul;44(3):Suppl:166-206.

Member Requests for the Record

The Honorable John D. Dingell

1. During the hearing, you agreed that Congress should look at the innovations and changes being made in the private sector when considering reforms to SGR. Would you please list some suggestions of what you feel might be useful?

Examples of such innovations include:

1. Global payments for episodes of care such as an operative procedure with single payments being made for all physician and hospital services (Medicare demonstration project, payments by some private payors for congenital heart operations).
2. The Virginia Cardiac Surgery Quality Initiative outlined above, and other regional initiatives including the Michigan-STS collaboration on adult cardiac surgery, and the Northern New England Cardiovascular Study Group.

The Honorable Michael Burgess

1. During the hearing, you mentioned the difficulty of obtaining some of the hospital data that CMS is releasing for developing performance metrics. You mentioned that asking CMS each time you request access to the data has become a bottleneck. Are there any other bottlenecks that you would identify for the committee?

As per above, since survival and resource utilization information is such an important part of the outcomes for cardiothoracic surgery and the associated quality improvement efforts, we urge that steps be taken to insure that clinical registries have access to claims data from CMS (and, hopefully, other payors) and outcomes (death) data from the Social Security Administration or another, accessible source. It is imperative that the committees' bill address this foundational issue. As mentioned earlier, the existence of a national registry that collects enormous amounts of clinical data on every patient without ever knowing the patient's ultimate outcome (e.g., alive or dead) is a critical impediment to the relevancy of the data registry. Similarly, not knowing whether a given outcome can be achieved with far less utilization of medical resources appears to be in direct contradistinction to the intent of the proposed legislation.

The ability to link clinical data with administrative data has opened up important new ways to assess the effectiveness of treatment options and offered new avenues for medical research. Clinical data yield sophisticated risk-adjustment assessments, while administrative data provide information on long-term outcomes such as late mortality rate, readmission diagnoses, follow-up procedures, medication use, and total costs. STS has successfully linked its clinical data with CMS MEDPAR information, on a project-by-project basis, to obtain longitudinal outcomes data for a wide array of cardiothoracic surgery operations. Linked data are particularly useful in conducting comparative effectiveness research (CER) and establishing appropriateness of care. However, the value of claims data without the context provided by clinical information can be misconstrued and even dangerous to quality improvement because administrative data lack granularity in the clinical domains of diagnosis and therapy (including data about risk factors and severity of disease).

The longitudinal long-term outcomes information derived from these administrative data sources, along with the Social Security Death Master File (SSDMF), helps physicians to provide information to today's patients and families that can help them with shared decision making. Valid and reliable outcomes data give patients confidence in their medical interventions and demonstrate to patients and their families the durability and long-term benefits of medical procedures. It is important to note that STS, through its contracts with the Duke Clinical Research Institute, maintains the patient identifier data separately from the actual clinical and other demographic data, and the only patient level identified information that ever leaves the database is simply that the patient has a record in the database. When the follow-up information is returned from external entities, such as the SSDMF, it is linked back to the records in the de-identified database, but the flow of information is only in this direction. The externally derived data are used to supplement the data in the individual record, but these clinical, patient level data never leaves the database except in de-identified form.

Unfortunately, in November 2011, the Social Security Administration rescinded its policy of sharing state-reported death data as a part of the SSDMF. There are continuing efforts to further restrict access to the SSDMF so as to protect those listed in the file from identity theft. Balanced against these legitimate privacy concerns are the many advantages that SSDMF data can provide for quality improvement and medical research initiatives in the domains of comparative effectiveness research and outcomes assessment. Alternatively, the National Death Index could be supported with the appropriation of significantly greater resources to both lower the substantial cost of data (that makes is use not practical for most large clinical registries) and speed the availability of data from the current two year lag from death to availability of data documenting the death in the NDI.

However, we caution, again, that publication of claims data, without the clinical context and robust demographic information essential to risk-adjustment could have extremely harmful effects. For that reason we oppose current efforts by the administration to provide general public access to Medicare Claims data and request significant revisions to S. 1180 and/or any similar legislation that is considered in the House.

Additional barriers to implementation include the following:

Healthcare providers are now being required to produce objective evidence of the quality, safety and value of care to a variety of healthcare stakeholders. These quality related efforts necessitate the collection, analysis and reporting of different clinical data for each payor. Meaningful data collection often relies on the ability to use individually identifying patient information (particularly in analyses related to the value or sustainability of treatment interventions) in a careful manner that protects patient privacy. Risk-adjusted data collected in this way reliably results in the generation of new knowledge. The current regulatory structure fails to recognize that data collection for quality improvement purposes (including the retention of Personal Health Information) and the generation of "new knowledge" pose no substantial risk to the patient. In the STS National Database environment, privacy risk is minimized since individual patient records exist in the clinical registry in a rigorously de-identified format. As the HIPAA Privacy

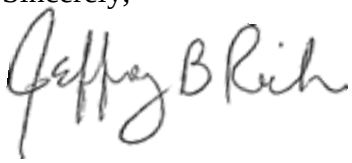
Rule already addresses many of these patient privacy risks by imposing restrictions on how certain identifiable health information is collected by health plans, healthcare clearinghouses, and healthcare providers (‘‘covered entities’’ and their “business associates”) and how it may be used and disclosed, it would appear superfluous and counterproductive to impose Common Rule consent requirements since compliance with HIPAA patient protections are already in place.

In addition, STS requests that Congress instruct CMS to work with the Department of Health and Human Services Office for Human Research Protections (OHRP) and Office for Civil Rights (OCR) to establish appropriate standards for quality improvement (QI) activities that will adequately protect patients without unnecessarily burdening QI efforts. Until that guidance is made available, it is inevitable that significant variability in interpreting and applying the Privacy and Common Rules will persist. Specifically, we ask that OHRP issue guidance that the Common Rule does not apply to the collection and analysis of identifiable patient information for quality assessment and improvement purposes where the entities collecting and analyzing the data (such as clinicians and a corresponding clinical data registry) are engaged in standard patient care and are in compliance with all applicable HIPAA requirements. Moreover, we ask that definitive language be included in federal guidance to allow for a clear differentiation between “human subjects research” and the processes related to the essential prospective analyses directed at advancing our national quality care objectives. In particular, the generation of new knowledge should be recognized as an expected and desired outcome of healthcare quality improvement projects; the processes related to the generation of such knowledge (through quality improvement initiatives that are part of healthcare operations) should therefore be exempt from a requirement for informed consent (on the basis that all HIPAA related regulations are adhered to in the course of clinical data collection and analysis).

STS believes that the most effective mechanisms to improve practice are the collection of clinical data on every case, the submission to a central registry to allow risk adjustment, and the feedback of these risk-adjusted data to the individual physician and practice. Removal of barriers to this process and provision of incentives to encourage participation in this process is essential, including addressing patient privacy issues. We also feel that the practice of defensive medicine is, perhaps, the biggest challenge physicians face when working with patients to identify the best plan for treatment. Having clinical data that support practice guidelines and clinical decision making gives both providers and patients’ confidence that the best care at the right time is being provided and received. Reforming the tort system to rely on these advances can only serve to promote provider buy-in to the provisions outlined above. The issue of overutilization will never be fully addressed without a significant and meaningful level of tort reform.

Thank you again for the opportunity to provide testimony and respond to the Committee's questions If you need additional information, or if STS can be of any assistance, please contact Phil Bongiorno, STS Director of Government Relations, at pbongiorno@sts.org or 202-787-1221.

Sincerely,



Jeffrey B. Rich, MD
Past President

cal improvement of protocols or consent forms.[3] On the contrary, this practice seems to pose a significant risk of diminishing studies' ethical integrity. Fortunately, some ways of changing this system are being explored. Recently, the Office for Human Research Protections put out for public comment a proposal to receive direct authority to take action against IRBs — as distinct from the institutions conducting the research — for noncompliance with regulations.[4] The intent is to encourage greater reliance on outside (and central) IRBs by assuring the individual institutions participating in multisite studies that they would not be blamed if an outside IRB were responsible for violations.

Another approach to reducing the number of IRB reviews would be to have sponsors require the use of a central IRB as a condition for participating in a study. Nothing in the existing U.S. regulations would prevent them from doing so. The Department of Veterans Affairs currently operates exactly such a system for a select group of studies. In an attempt to constrain the duplication of review efforts for international multisite studies, the European Union is taking a different approach: it now restricts each participating country to a "single opinion" representing the ethics review for that country, "notwithstanding the number of Ethics Committees" involved.[5]

Any one or a combination of these approaches may turn out to be satisfactory. But recognizing that the problem with multiple-IRB review relates not merely to wasted time and effort but also to less-than-optimal protection of people who volunteer to participate in research should add urgency to our efforts to solve this problem.

The views expressed in this article are those of the author and are not necessarily those of the U.S. Department of Health and Human Services or its operating division, the Office of the Assistant Secretary for Health.

Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

Dr. Menikoff is the director of the Office for Human Research Protections, Rockville, MD.

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Public Release of Clinical Outcomes Data — Online CABG Report Cards

Timothy G. Ferris, M.D., M.P.H., and David F. Torchiana, M.D.

On September 7, 2010, Consumers Union (publisher of *Consumer Reports*) reported the results of coronary-artery bypass grafting (CABG) procedures at 221 U.S. cardiac surgery programs.[1] The voluntary reporting of risk-adjusted outcomes in approximately 20% of U.S. cardiac surgery programs is a watershed event in health care accountability.

The reported ratings derive from a registry developed by the Society of Thoracic Surgeons (STS) in 1989. More than 90% of the approximately 1100 U.S. cardiac surgery programs participate in the registry. Registry data are collected from patients' charts and include key outcomes such as complications and death, the severity of preoperative illness, coexisting conditions, surgical technique, and medications. These data are maintained by the Duke Clinical Research Institute and are analyzed with the use of well-tested statistical methods. The data-collection and auditing methods, specifications of the measures, and statistical approaches have evolved over the course of two decades and reflect a substantial commitment by cardiac surgeons and their leadership.[2,3]

For years, participants in the STS registry have been examining these data and using them to make improvements. What does the public now get to see? Each surgical program that has chosen to make its data public is assigned a rating of one, two, or three stars. Stars are assigned on the basis of results on 11 performance measures (see table) that have been endorsed by the National Quality Forum. The rating depends on whether the risk-adjusted outcomes in a program fall be-

Measures of Quality Used by the Society of Thoracic Surgeons in the Ratings of Coronary-Artery Bypass Grafting (CABG) Programs.

Measure	Description
Postoperative renal failure	Percentage of patients (without preexisting renal failure) undergoing isolated CABG in whom postoperative renal failure developed or dialysis was required
Surgical reexploration	Percentage of patients undergoing isolated CABG who required a return to the operating room because of bleeding, tamponade, graft occlusion, or other cardiac reason
Antiplatelet medication at discharge	Percentage of patients undergoing isolated CABG who were receiving aspirin, safety-coated aspirin, or clopidogrel at discharge
Beta-blockade at discharge	Percentage of patients undergoing isolated CABG who were receiving beta-blockers at discharge
Antilipid treatment at discharge	Percentage of patients undergoing isolated CABG who were receiving a statin or other pharmacologic lipid-lowering regimen at discharge
Risk-adjusted operative mortality after CABG	Percentage of patients undergoing isolated CABG who died during the hospitalization in which the CABG was performed or within 30 days after the procedure
Preoperative beta-blockade	Percentage of patients undergoing isolated CABG who received beta-blockers within 24 hours before surgery
Prolonged intubation (ventilation)	Percentage of patients undergoing isolated CABG (without preexisting intubation or tracheostomy) who required intubation for more than 24 hours
Rate of deep sternal-wound infection	Percentage of patients undergoing isolated CABG in whom a deep sternal-wound infection developed within 30 days after the procedure
Stroke or cerebrovascular accident	Percentage of patients (without preexisting neurologic deficit) undergoing isolated CABG in whom a postoperative neurologic deficit developed that persisted for more than 24 hours
CABG using an internal thoracic artery	Percentage of CABG performed using an internal thoracic artery

low, are equal to, or exceed the average performance range. The performance thresholds are designed to ensure a 99% probability that outlier programs — those rated significantly below or above the mean and therefore given one and three stars, respectively — are truly below or above average. With the use of this method, 23 to 27% of the programs have been identified as outliers over the past 3 years. In addition to the star rating for overall performance, consumers see the star rating and actual performance scores (on a scale from 0 to 100) in four subcategories: 30-day survival ("patients have a 98% chance of surviving at least 30 days after the procedure and of being discharged from the hospital"), complications ("patients have an 89% chance of avoiding all five of the major complications"), use of appropriate medications ("patients have a 90% chance of receiving all four of the recommended medications"), and surgical technique ("patients have a 98% chance of receiving at least one optimal surgical graft").

The move on the part of the STS to make results available to the public will certainly trigger a cascade of responses. Advocates of transparency will point to the shortcomings of the ratings — the voluntary and therefore selective participation of programs (50 of the programs that have chosen to report their data have received three stars, whereas only 5 have received one star), the lack of long-term outcomes (e.g., 10-year survival, graft patency, and functional improvement), and the lack of physician-specific ratings. Expect such advocates to push for more. Nonparticipating cardiac surgery programs will come under pressure to allow the outcomes in their programs to be reported. Physicians in other surgical specialties that are amenable to this type of approach, such as orthopedics or vascular surgery, may be expected to follow suit. And this event will fuel the debate regarding the risks and benefits of public reporting, including the question of whether it assists patients in discriminating among sites of care. While these issues play out, several aspects of this release of ratings deserve attention.

First, years of pressure from policymakers, health care purchasers, and patient-advocacy groups to provide greater accountability played a major role in bringing this publication to fruition. Public reporting of outcomes has widespread support, and cardiac surgeons have been among the principal targets of these efforts. The first statewide report card on cardiac surgical performance was mandated in New York in 1989. Early experiences with pub-

lic reporting of the outcomes of cardiac surgery spurred efforts by the STS and others to improve cardiac surgery.[4] Although some consumer advocates pushing for transparency may view this release as a glass four-fifths empty — given the selectivity and number of programs reporting — the external pressure has been critical in stimulating improvement efforts within the medical profession.

Second, the publication of definitive analyses derived from clinical data can be a double-edged sword for providers. When performance reports are based on administrative data, physicians often justifiably argue that the data are flawed and the conclusions suspect. In contrast, with these new ratings, not only have the participants endorsed the methods, but they have volunteered to display performance results that carry the imprimatur of the physicians' specialty society. Experience with performance reporting in Massachusetts has shown that when the data and analyses are as good as possible, a public report of suboptimal performance requires a substantive public response: state Department of Public Health officials suspended a Massachusetts cardiac surgery program to conduct an external review, amidst substantial media attention, when the program was identified as a high-mortality outlier.

Third, the process of moving clinical data from the STS registry into the public domain has been long, complex, and expensive. As a member-supported organization, the STS navigated treacherous waters to bring its members to the point of permitting the publication of their data. Some key decisions facilitated this process: the STS reported group-level rather than physician-level data, rigorously validated its data-collection and risk-adjustment models, and selected a performance-classification system that maximized specificity. Such choices helped to mitigate physicians' biggest fear: the risk of misclassification. Moreover, cardiac surgery programs have been looking at these data for years, so there shouldn't be any surprises. The success that the STS has had in leading a nontrivial fraction of its members to agree to participate suggests that public reporting can be done in a way that doesn't alienate the profession.

There is no question about the need for accountability on the part of health care providers or the central role of measurement in the improvement of health care. Nonetheless, questions remain about the role of public reporting in improving health care. Performance measurements audited by regulators are one alternative, especially in situations in which the information is too complex for patients to use in discriminating among care sites. Insofar as public reporting drives improvement of all outcomes, it benefits everyone; insofar as risk aversion leads to changes in the population receiving an indicated service, the net effect can be nil or even negative.[5] Given the heterogeneity in the delivery of medical services, it should come as no surprise that we have developed multiple methods for assessing performance and encouraging accountability. Regardless of which approach proves most beneficial to patients, public reporting will increasingly be a fact of life for physicians.

By publishing ratings using the best available data, the STS has responded to the public in a way that attempts to both inform patients and mitigate physicians' fears. We hope that the experience of the STS can be applied to other initiatives that are aimed at bringing performance data derived from clinical sources to the public, thereby reducing the time and expense of this process. For example, this experience may contain lessons for the Centers for Medicare and Medicaid Services as it prepares to handle the wave of clinical data it will receive through the Physician Quality Reporting Initiative and the "meaningful use" program for electronic health records. At least some of these data will almost certainly be publicly reported. The STS's success suggests that reporting can be done in a way that physicians will support. Whether the STS approach is an anomaly or a precedent that other specialty groups will emulate remains to be seen.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

From the Massachusetts General Physicians Organization, Massachusetts General Hospital, Boston.

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Report Overview – General
STS Report – Period Ending 12/31/2009

I. Introduction

The Data Analyses of The Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database are published following each quarterly database harvest and the report is provided to each eligible STS database participant. This report is an important quality improvement tool for participants, allowing them to compare their risk-adjusted performance with that of similar participants, participants in their geographic region and the entire body of STS database participants.

This participant-specific report is unique to your organization. The data presented were collected during harvests from 2007, 2008 and 2009 of the STS Adult Cardiac Surgery Database at the Duke Clinical Research Institute (DCRI). The most recent procedure date included in this report is 12/31/2009. Data from previous harvests, when available, were also analyzed for the Executive Summary Section that presents longitudinal 10-year trends. Data in this report were subjected to identical data quality programs to make them consistent with the data specifications of the Adult Cardiac Surgery Database.

This Report Overview is provided as background to help participants understand and interpret the results. Throughout this document, variable short names are used. Detailed information on the STS variables, including variable short names and clinical definitions can be found at the STS website - http://www.sts.org under the STS National Database tab.

II. Report Organization

Beginning in 2008, with the introduction of quarterly harvests, STS Adult Cardiac Surgery Database participants receive harvest reports with alternating content. This change allows distribution of analysis results to database participants in a timelier manner and is consistent with the STS policy to provide NQF Measure and Composite Quality Ratings results based on a full 12 months of data ending each June or December. The table below shows which sections will be provided after each of the four annual harvests:

Table 1. Quarterly Report Content

	Harvest 1 *data through 12/31*	Harvest 2 *data through 3/31*	Harvest 3 *data through 6/30*	Harvest 4 *data through 9/30*
Report Overview				
General	X	X	X	X
Risk-Adjustment Supplement	X	X	X	X
Composite Quality Ratings/NQF Measures	X		X	
Composite Quality Ratings	X		X	
NQF Measures	X		X	
Executive Summary	X	X	X	X
Major Procedures Mortality	X	X	X	X
Participant-Specific Cardiac Procedures	X	X	X	X
Regional Outcomes Comparison	X		X	
Other Procedures	X	X	X	X
Appendix: Participant-Specific Data Quality Summary	X		X	

Report Overview - General: Important information on the structure and content of the report, including risk-adjusted results.

Report Overview - Risk-adjustment Supplement: Information about how participants can utilize STS risk-adjustment locally including instructions for calculating certain risk-adjustment statistics.

Report Overview - STS Composite Quality Rating and NQF Measures Summary: Information about the calculation and interpretation of the STS Composite Quality Rating and the NQF measure results. (Harvest 1 and 3 only)

STS Composite Quality Rating and NQF Measures: This section contains the participant STS Composite Quality Rating and the participant and STS overall results on the NQF Cardiac Surgery Quality Measures. (Harvest 1 and 3 only)

Executive Summary: This section displays overall database participant volume and procedure volume along with mortality and length of stay summaries. It displays annual distribution of all database procedures.

Major Procedures Mortality: This section displays unadjusted and risk-adjusted mortality for the combined group of major procedures for which a risk-adjustment model exists: Isolated CAB, Isolated Valve Replacement, and Valve Replacement + CAB procedures.

Participant-Specific Cardiac Procedures: The following sections display data for participant, a like-participant comparison group, and the overall STS for the following procedure classifications.

Isolated Coronary Artery Bypass	**(CAB)**
Isolated Aortic Valve Replacement	**(AV Replace)**
Aortic Valve Replacement + CAB	**(AV Replace + CAB)**
Isolated Mitral Valve Replacement	**(MV Replace)**
Mitral Valve Replacement + CAB	**(MV Replace + CAB)**
Isolated Mitral Valve Repair	**(MV Repair)**
Mitral Valve Repair + CAB	**(MV Repair + CAB)**

CAB data are also stratified into the following subsets: On-Pump, Off-Pump, First Operation, Reoperation.

Regional Outcomes Comparison: This section displays participant data alongside regional comparison data for selected outcomes. (Harvest 1 and 3 only)

Other Procedures: This section displays only overall STS data for other cardiac procedures - includes AVR+MVR, Pulmonic Valve, Tricuspid Valve, LVA, VSD, ASD, SVR, and Aortic Aneurysm procedures, and Ventricular Assist Device.

Appendix: Participant-Specific Data Quality Summary: This section provides a summary of your participating organization's specific data quality issues among CAB cases. (Harvest 1 and 3 only)

III. How to Read this Report

a. Patient Population

Records were included in this report if they met the following criteria:

- Patient age 18 or older
- Valid procedure classification (see Section III.b. below)
- Valid date of surgery

Please note that individual records have been excluded from certain analyses for which they are irrelevant. Footnotes about these exclusions have been provided throughout the report and a summary table of the exclusions has been provided in Section III.d.

The time window of procedures presented in this report varies depending on the section of the report:

STS Composite Quality Rating and NQF Measures (Harvest 1 and 3 only)	CAB:	Last 12 months
	Valve, Valve + CAB:	Last 60 months
Executive Summary	Last 10 calendar years	
Major Procedures Mortality Summary	Last 3 calendar years	
Participant-Specific Cardiac Procedures	Participant:	Last 3 calendar years
	Like Group:	Last calendar year
	STS:	Last calendar year
Regional Outcomes Comparison (Harvest 1 and 3 only)	Participant:	Last calendar year
	Region:	Last calendar year
Other Procedures	Last calendar year	

NOTE:

Not all participants have submitted data for the entire time period presented in this report.

b. Procedure Classification

The majority of this report represents the following seven procedure classifications:

Isolated Coronary Artery Bypass	(CAB)
Isolated Aortic Valve Replacement	(AV Replace)
Aortic Valve Replacement + CAB	(AV Replace + CAB)
Isolated Mitral Valve Replacement	(MV Replace)
Mitral Valve Replacement + CAB	(MV Replace + CAB)
Isolated Mitral Valve Repair	(MV Repair)
Mitral Valve Repair + CAB	(MV Repair + CAB)

Records were classified as one of the above if there were no other cardiac or non-cardiac procedures performed at the same time [exception: OCarACD (arrhythmia correction devices) was not a classification exclusion criterion]. See Table 12 for more details.

Lower volume cardiac procedures are summarized for the STS as a whole in the Other Procedures section. These include:

Aortic Valve + Mitral Valve Replacement
Pulmonic Valve
Tricuspid Valve
Left Ventricular Aneurysm
Ventricular Septal Defect
Atrial Septal Defect
Surgical Ventricular Restoration
Aortic Aneurysm: Ascending Aorta, Aortic Arch, Descending Aorta, and Thoracoabdominal Aorta
Ventricular Assist Device (VAD)

Except for Aortic Valve + Mitral Valve Replacement, these procedures are considered independently. It is possible, for instance, for a record to contain both a Pulmonic Valve procedure and a Tricuspid Valve procedure; that record would be counted in both categories.

c. Reporting Levels

Participant: Your Participant ID is used as the grouping identifier for reporting. The definition of participant varies among data contributors. A participant may be surgeon(s) from a single hospital or across multiple hospitals.

Like Group: The Like Group is a comparison group of STS participants that are most similar to the report participant with respect to annual site case volume and presence or absence of a surgical residency program. Like Groups are determined annually following Harvest 1. For each participant two Like Groups are created. The CAB Like Group is based on the participant's CAB procedure volume, and the Valve Like Group is based on the participant's valve procedure volume. The CAB Like Group is displayed for the Major Procedures Mortality summary and the CAB portion of the Participant-Specific Cardiac Procedures section. The Valve Like Group is displayed for the remainder of the Participant-Specific Cardiac Procedures section. See the Table below for details on Like Group determination. Annualized procedure volume is an average based on the past 3 years of data. The groups are structured such that an adequate number of participants/cases are assigned to each one. The smallest CABG like group (number of cases) contains 13,076 cases. The smallest CABG like group (number of participants) contains 12 participants. The smallest Valve like group (number of cases) contains 2,367 cases. The smallest Valve like group (number of participants) contains 28 participants.

NOTE: Infrequently, risk-adjusted results cannot be calculated for a Like Group due to small sample size and/or zero outcome events. In such instances, a '-' will be presented in place of a statistic.

Table 2. Definition of Like Group

	Annualized Procedure Volume	Surgical Residency*
CAB Like Groups		
	0-199 (low)	No
	0-199 (low)	Yes
	200-399 (moderate)	No
	200-399 (moderate)	Yes
	400+ (high)	No
	400+ (high)	Yes
Valve Like Groups		
	0-49 (low)	No
	0-49 (low)	Yes
	50-119 (moderate)	No
	50-119 (moderate)	Yes
	120+ (high)	No
	120+ (high)	Yes

* A participant is considered to have a surgical residency program if at least one of the hospitals for which data were submitted has a known residency program. Residency programs are identified via annual review of the list of accredited programs specializing in Thoracic Surgery of the American Council for Graduate Medical Education (ACGME), a private, non-profit council that evaluates and accredits medical residency programs in the United States.

Participant's Region: Participant data are compared to regional benchmark data in the Regional Outcomes Comparison section. For most participants the region is the state or province in which they are located. However, for states and provinces that do not contain enough participants to provide a meaningful comparison group, region is defined according to the following table (derived from the Dartmouth Atlas of Health Care).

Please refer to the map in the Regional Outcomes Comparison section (Harvest 1 and 3 only) to identify your region.

Table 3. Regions

Region	States / Provinces
New England	Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont
Middle Atlantic	New Jersey, New York, Pennsylvania
South Atlantic	Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
Great Lakes	Illinois, Indiana, Michigan, Ohio, Wisconsin
East South Central	Alabama, Kentucky, Mississippi, Tennessee
Great Plains	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
West South Central	Arkansas, Louisiana, Oklahoma, Texas
Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
Pacific	Alaska, California, Hawaii, Oregon, Washington
Canada	Alberta, British Columbia, Manitoba, Nova Scotia, New Brunswick, Ontario, Quebec

d. Data Handling

Missing data
For dichotomous and categorical variables, percentages are calculated using all records, unless otherwise specified (See Inclusion/Exclusion Criteria below for specific restrictions). For continuous variables, missing data are not calculated into summary results or into mean and median calculations. The Case Count Report provided along with each harvest report indicates the number of cases used for each result in the report.

Zero values
For the analysis of Perfusion Time (PerfusTm) and Cross Clamp Time (XClampTm), zeros are not included in the calculation of means and medians.

Outlier Values
Values that have been determined to be aggregate outliers (see the Participant-Specific Data Quality Summary for more information on outliers – Harvest 1 and 3 only) are **bolded** within this report.

Inclusion/Exclusion Criteria
In nearly all cases, results represent the entire group of cases eligible for that section of the report (e.g. all isolated CAB procedures in the isolated CAB section of the report). However, certain variables must be analyzed using a restricted population. An example of such a variable is Discharge Location (DisLoctn). Analysis of this variable should only include those patients discharged from the hospital alive. Footnotes about such case selection restrictions appear in the report. Table 4 below contains a summary of these restrictions.

Table 4. Analysis Restrictions*

Data element	Inclusion/exclusion criteria
Hemodynamics & Catheterization	
EF < 40	Patients with measured EF
Pulmonary Hypertension	Patients with measured PA mean pressure
Comorbidities	
Previous PCI Stent	Patients with previous PCI
Preoperative and Discharge Medications	
Preop: ADP Inhibitors Discontinuation	Patients on ADP Inhibitors within 5 days
All Medications – eligible	Excludes contraindicated/not indicated
Operative Information	
Vein Harvest Technique	Patients with at least 1 harvested vein
Internal Mammary Artery Used	Excludes patients with prior CAB surgery
Postoperative Information:	
Initial Ventilation <6 Hours	Excludes patients extubated in OR
Additional Ventilation Hours	Patients reintubated
Additional ICU hours	Patients readmitted to the ICU
Complication	
Leg infection	Excludes patients with zero vein grafts
Arm infection	Excludes patients with zero vein grafts
Renal Failure	Excludes patients with preop dialysis
Atrial Fibrillation	Excludes patients with preop AFib
Discharge & Readmission	
Discharge Location	Excludes in-hospital mortalities
Discharge Medications	Excludes in-hospital mortalities
Readmission	Excludes in-hospital mortalities
Smoking Cessation Counseling	Excludes in-hospital mortalities and N/A responses
Cardiac Rehabilitation Referral	Excludes in-hospital mortalities and N/A responses

* See Table 2 of the STS Composite Quality Rating and NQF Measures Report Overview (Harvest 1 and 3 only) for specifics on inclusion/exclusion criteria for the STS Composite Quality Rating and NQF Measures sections of the report.

Data Warehouse Edits

When data arrive at the data warehouse, they are checked carefully for logical inconsistencies and parent/child variable relationship violations. Any inconsistencies or violations are communicated to participants in the detailed Data Quality Report that is generated automatically following each harvest file submission. If the data inconsistencies are not changed by the participant prior to harvest close, the data warehouse performs consistency edits and/or parent/child edits on the data in order for them to be analyzable. Participants are informed of such edits to their data in the Data Quality Report.

A complete list of data edits performed at the data warehouse is available at the STS website - http://www.sts.org - under the STS National Database tab.

NOTE: Commercial software vendors are encouraged, but not required, to incorporate edit checks for such data inconsistencies into their STS-certified software packages to reduce the number of data edits that must take place at the data warehouse.

e. Reported Variables

Because we have found that lengthy clinical outcomes reports are hard to read, this report does not contain every variable collected as part of the STS Adult Cardiac Surgery Database. Members of the STS and the DCRI carefully select the variables for inclusion in the report. Feedback from the participant sites is vital to this decision-making process.

The variables and data definitions used in this report are from Versions 2.35, 2.41, 2.52.1, and 2.61 Adult Cardiac Database Specifications.

PROCEDURE TIME WINDOW	ALLOWABLE DATA VERSION(S)
1/1999 - 12/2001	2.35
1/2002 - 6/2002	2.35, 2.41
7/2002 - 12/2003	2.41
1/2004 - 12/2004	2.41, 2.52.1
1/2005 - 6/2007	2.52.1
7/2007 - 12/2007	2.52.1, 2.61
1/2008 - 9/2009	2.61

Calculated Variables
Several report variables, such as Obesity, and Observed Operative Mortality are calculated using the STS variables and data definitions. Please refer to Table 13 at the back of this section of the Report Overview for a complete list of calculated variables.

f. Data Presentation

The tables and figures in this report primarily show variable means, medians, 25th and 75th percentiles, or percents.

Mean: A measure of central tendency that is computed by adding up all the individual values in the group and dividing by the number of the values in the group.

Median: A measure of central tendency that is the value under and over which 50% of the individual values lie.

25th percentile: The value under which 25% of the individual values lie.

75th percentile: The value under which 75% of the individual values lie.

The risk-adjusted outcomes in this report are presented as O/E ratios, estimated Odds Ratios, and risk-adjusted rates (see Section IV below for details). Each of

these is presented with **95% confidence intervals (CI)** – the range of values in which the analysts are 95% confident that the true value for the underlying population falls.

Indentation
Throughout the report, indentation indicates that indented lines are related to the un-indented lines in a hierarchical manner. Results on indented lines are generally not based upon a smaller denominator than the un-indented lines unless there is an explicit footnote to that effect. For instance for Isolated CABs in the *Participant-Specific Cardiac Procedures* report section, 'Previous PCI' is an un-indented line and the timing of the previous PCI (≤ 6hours prior to surgery, >6 hours prior to surgery) is on subsequent indented line(s). The denominator for both of these items is the same – the total number of isolated CAB procedures.

Dashes
A value of '-' indicates that there were no occurrences of a value for that variable in the data for that time period.

g. Comparisons to Like Group, Region and Overall STS

While we encourage participants to focus on how their results compare with those from their region, their like group, and national STS outcomes, a few words of caution are needed:

- There is a wide range in the volume of procedures submitted among participants. Those participants with low volume must be aware that their measured results are less stable as compared with those from a high volume participant (indicated by the wide confidence intervals surrounding low volume estimates).

- If an individual participant's results in a given region vary considerably from their peers, they can potentially alter that region's results. For example, if a participant erroneously reported their CAB patients all have a post-op stroke, then that region's aggregate stroke rate may be falsely elevated. Because of its size, the more stable benchmark will always be the overall STS results.

- Finally, it must be recalled that the current STS data have not been fully validated. While we believe that participants generally report accurate results, participants may vary in the degree to which they identify certain events (e.g. postoperative complications and 30-day mortality).

IV. Risk-Adjusted Results: Overview

a. What is risk adjustment?

The purpose of risk adjustment is to allow STS database participants to compare their performance with other participants (e.g. overall STS, like participants, region or state). By accounting for and controlling patient risk factors that are present prior to surgery, risk adjustment "levels the playing

field" as best as possible. Unadjusted event rates are not used for such comparisons because they are influenced by patient case-mix and disease severity, which vary from participant to participant. Comparing unadjusted event rates would unfairly penalize participants that perform operations on higher-risk patients. Risk adjustment more accurately represents a participant's performance relative to that of a reference group presented with the same patient population. Importantly, as these are indirectly standardized rates, it is often not appropriate to directly compare the risk-adjusted mortality rates of two specific participants unless their patient populations are relatively similar (Shahian DM, Normand S-LT. Comparison of "risk-adjusted" hospital outcomes. Circulation. 2008 Apr 15;117(15):1955-63).

b. STS risk-adjustment models

In conjunction with the 2.61 data version update, the STS Quality Measurement Taskforce substantially revised all existing risk models and introduced several new ones. The models were developed and tested using all cases from 1/1/2002-12/31/2006. These new models are referred to as the 2008 STS models. The previous STS risk models distributed with data version 2.52.1 are referred to as the 2004 STS models. Work is well underway on a set of manuscripts that will provide the details of model development process and the models themselves.

Beginning with cases performed in 2008 all risk-adjustment analyses for the STS Adult Cardiac Surgery Database report will be performed with the 2008 STS models. With the exception of STS Composite Quality Rating analyses, cases performed prior to 1/1/2008 will be analyzed with the previous set of models. See below for more details about the 2008 risk models.

NOTE:

- **Risk-adjusted results will only be provided for a time period of 6 or more months of data due to concerns for small sample size.**
- **Newly introduced models for valve and valve + CAB combinations will not be added into the report until at least 2009.**

The STS currently has 3 risk models: CAB, Valve, and Valve + CAB. The models apply to 7 specific surgical procedure classifications:

Table 5. Surgical procedure classifications for STS risk models

CAB model	
1. Isolated Coronary Artery Bypass	(CAB Only)
Valve model	
2. Isolated Aortic Valve Replacement	(AV Replace)
3. Isolated Mitral Valve Replacement	(MV Replace)
4. Isolated Mitral Valve Repair	(MV Repair)

Valve+CAB model	
5. Aortic Valve Replacement + CAB	(AV Replace + CAB)
6. Mitral Valve Replacement + CAB	(MV Replace + CAB)
7. Mitral Valve Repair + CAB	(MV Repair + CAB)

See Table 12 below for detailed definitions of these procedure classifications.

c. Model endpoints

Table 6 contains a complete listing and definition of all model outcomes. The STS is pleased to now have mortality and morbidity models for all of the procedure classifications in Table 5 above. Previously, morbidity endpoints were only modeled for the isolated CAB population.

NOTE: Newly introduced models for valve and valve + CAB combinations will not be added into the report until at least 2009.

Table 6. Definition of STS Risk Model Outcomes

Endpoint	Description
Operative Mortality	STS v2.61 Sequence number 3050 (MtOpD): Operative mortality includes both (1) all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure unless the cause of death is clearly unrelated to the operation.
Permanent Stroke	STS v2.61 Sequence number 2830 (CNStrokP): Postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in cerebral blood supply) that did not resolve within 24 hours.
Renal Failure	STS v2.61 Sequence number 2890 (CRenFail): Acute or worsening renal failure resulting in one or more of the following: 1. Increase of serum creatinine to > 2.0, and 2x most recent preoperative creatinine level. 2. A new requirement for dialysis postoperatively.
Prolonged Ventilation > 24 hours	STS v2.61 Sequence number 2860 (CPVntLng): Prolonged pulmonary ventilator > 24 hours. Include (but not limited to) causes such as ARDS, pulmonary edema, and/or any patient requiring mechanical ventilation > 24 hours postoperatively.

Endpoint	Description
Deep Sternal Wound Infection	STS v2.61 Sequence number 2780 (CIStDeep): Deep sternal infection, within 30 days postoperatively, involving muscle, bone, and/or mediastinum REQUIRING OPERATIVE INTERVENTION. Must have ALL of the following conditions: 1. Wound opened with excision of tissue (I&D) or re-exploration of mediastinum 2. Positive culture 3. Treatment with antibiotics.
Reoperation For any reason	STS v2.61 Sequence numbers 2720 (COpReBld), 2730 (COpReVlv), 2740 (COpReGft), 2750 (COpReOth), 2760 (COpReNon): Reoperation for bleeding/tamponade, valvular dysfunction, graft occlusion, other cardiac reason, or non-cardiac reason
Major Morbidity or Operative Mortality	A composite endpoint defined as any of the outcomes listed in the first six rows of this table.
Short Stay: PLOS < 6 days *	Discharged alive and within 5 days of surgery
Long Stay: PLOS >14 days	Failure to be discharged within 14 days of surgery

*NOTE: The definition of the short length-of-stay endpoint differs from previous versions of the STS risk model. In the new definition, patients must be discharged alive in order to receive credit for a PLOS < 6 days.

d. Model patient populations

The models can be applied to all adult patients who fall into one of the 7 surgical procedure populations described above in Table 5 above, except as follows:

- The models will only calculate a predicted risk value for adult patients age 18 to 110 years.
- The models will only calculate a predicted risk value for those patients for whom both age and gender are known.
- The models for renal failure will NOT calculate a predicted risk value for any patients who are on dialysis preoperatively.

e. Missing data handling for models

It is important to understand how missing data values are handled when the STS risk-adjustment models are applied to patients with incomplete data. With the exception of age and gender, missing data values are imputed by assigning a likely substitute value. The algorithm used for missing data imputation is described below:

Required variables: Age and gender are required variables for all models. If either is missing, no value for predicted risk will be calculated.

Categorical variables: Missing data are generally assumed to have the lowest risk category. For example, if diabetes was not coded, it would be assumed to be "No"; if procedure priority were not coded, the procedure would be assumed to be "Elective." In most cases, the lowest risk category is also the most frequent.

Continuous variables: Table 7 shows the values assigned to missing data for continuous model variables.

Table 7. Imputation of Missing Continuous Variables

Model Variable	Model Imputation Information
Body Surface Area (BSA)	If gender is "Male" set BSA = 2.00m^2 If gender is "Female" set BSA = 1.75m^2
Ejection Fraction (EF)	CAB Model If CHF is no or missing, set EF = 50% If CHF is yes and gender is Male, set EF = 35% If CHF is yes and gender is Female, set EF = 45% Valve Model Set EF = 50% Valve+CAB Model If CHF is yes and gender is Male, set EF = 40% Otherwise, set EF = 50%
Last Preop Creatinine	Set CreatLst = 1.0

f. Discrimination and calibration of risk-adjustment models

At the time the 2008 STS risk models were developed, each model was tested to ensure there was a close fit between the model and the data. Outcomes may have changed since the time of model development, therefore it is important to assess whether the models continue to perform well on each subsequent harvest. Two important aspects of model performance that are assessed on a continual (per harvest) basis are calibration and discrimination.

Calibration: A model is said to be well calibrated if there is a close match between the observed number of deaths and the number of deaths predicted by the model. Typically, calibration is assessed on the population of interest overall, as well as in several subgroups. For example, it is common to compare observed vs. predicted event rates within 10 subgroups based on deciles of predicted risk.

In the past, we have found that risk-adjustment models that were developed several years ago are not well calibrated when applied to a contemporary data set. In general, older models tend to over-estimate risk relative to contemporary

experience because outcomes have improved over time. **To make the models more accurate, each model is re-calibrated each harvest.** This recalibration ensures that the total number of "events" predicted by the model will exactly match the actual number of events that was observed in the data. After this initial recalibration, calibration is then assessed graphically by plotting and comparing observed vs. predicted event rates within several patient subgroups. Because of the large number of models and subpopulations, these graphs are not provided in the report overview but are available on request.

Discrimination: A model is said to have good discrimination if it is able to distinguish patients who are likely to have an event from those who are not likely to have an event. A commonly used measure of discrimination is the C statistic (also known as the area under the ROC curve). The C statistic represents the probability that a patient who experienced an event (e.g. died) had a higher predicted risk compared to a patient who did not experience the event. The C statistic generally ranges from 0.5 to 1.0 with 0.5 representing no discrimination (i.e. a coin flip) and 1.0 representing perfect discrimination. C statistics for all STS models for the time period included in this report are presented in the Table 8 below.

Table 8. STS Model C Statistics (Discrimination) – 2009 Harvest 3
2004 STS Models – January 1, 2006 – December 31, 2007
2008 STS Models – January 1, 2008 – December 31, 2009

Isolated CAB

Model Endpoint	2004 STS Models	2008 STS Models
Operative Mortality	0.801	0.806
Permanent Stroke	0.701	0.708
Renal Failure	0.748	0.774
Prolonged Ventilation	0.746	0.755
Deep Sternal Wound Infection	0.657	0.686
Reoperation for any reason	0.653	0.659
Major Morbidity or Operative Mortality	0.717	0.725
Short Length of Stay	0.710	0.719
Prolonged Length of Stay	0.760	0.767

Isolated Valve

Model Endpoint	2004 STS Models	2008 STS Models
Operative Mortality	0.764	0.783
Permanent Stroke	NA	0.684
Renal Failure	NA	0.752
Prolonged Ventilation	NA	0.749
Deep Sternal Wound Infection	NA	0.659
Reoperation for any reason	NA	0.646
Major Morbidity or Operative Mortality	NA	0.718
Short Length of Stay	NA	0.744
Prolonged Length of Stay	NA	0.769

Valve + CAB

Model Endpoint	2004 STS Models	2008 STS Models
Operative Mortality	0.737	0.748
Permanent Stroke	NA	0.635
Renal Failure	NA	0.715
Prolonged Ventilation	NA	0.716
Deep Sternal Wound Infection	NA	0.704
Reoperation for any reason	NA	0.627
Major Morbidity or Operative Mortality	NA	0.699
Short Length of Stay	NA	0.729
Prolonged Length of Stay	NA	0.727

g. Predicted risk values

After information has been entered on a given case, the STS risk model (either from your STS software vendor or internal system) will provide a risk percentage for each of the outcomes. The risk percentage is the estimated percent chance of the outcome for a patient with the indicated risk factors. Please note that depending upon your vendor software, a risk percentage for each outcome might be calculated *as each question is answered*; therefore, the most reliable risk percentage will appear only after all available data have been entered.

Note on interpretation of values:
The inherent limitations of statistical risk-adjustment models should be kept in mind when interpreting risk percentage values for an individual patient. Risk adjustment attempts to take into account as many of the patient's risk factors as possible. However, there are some rare or difficult to measure factors that are not included in the STS risk-adjustment models and which may increase or decrease a patient's risk of an adverse outcome.

As with any statistical estimates, the risk percentage values should be supplemented by the professional judgment of the patient's healthcare provider, particularly their cardiac surgeon.

Impact of new models on predicted risk values
The STS is committed to updating its risk models approximately once every 3 years. The risk profiles of cardiothoracic surgery patients have been consistently worsening through time at the same time that outcomes of cardiothoracic surgery have improved through time. Therefore, it is normal and expected that predicted risk values calculated with the new model will be on average lower than those calculated with the old model.

h. Risk-adjusted summary statistics

The STS report uses two types of summary statistics to present risk-adjusted results: i) observed to expected (O/E) Ratios; and ii) model-based Odds Ratio (OR) estimates. Because each of these statistics has advantages, the STS has decided to provide both in the report. As discussed in the interpretation manual (next section of this report overview), the interpretations of the Odds Ratio and O/E Ratio are similar. It is the method of estimating these quantities that differs.

O/E Ratio
The O/E Ratio is the ratio of a participant's number (or percent) of observed outcome events relative to the number (or percent) of outcome events that is expected (predicted) by the STS risk-adjustment model, based on the participant's case mix. See Section IV.d. for information on how to interpret the O/E Ratio.

Estimated Odds Ratio
The other main summary statistic, the estimated Odds Ratio, is obtained by fitting a set of hierarchical logistic regression models to the harvested data. These models are estimated every six months in conjunction with generating the report. They are only used for the current report and are not used subsequently. Unlike the "STS risk-adjustment models" described in Section IV.b., these models cannot be incorporated into your STS certified software.

In a hierarchical logistic regression model, the probability that a patient experiences an adverse event is assumed to depend on both patient characteristics (e.g. patient risk factors) as well as the participant (e.g. performance). The Odds Ratio measures the effect that the participant has on a patient's probability of experiencing an adverse event. The interpretation of the Odds Ratio is similar to that of the O/E Ratio in that smaller Odds Ratios imply better performance. See Section IV.d. for information on how to interpret the Odds Ratio.

Comparison of O/E Ratios and Odds Ratios
Because each of these statistics has its advantages, the STS has decided to provide both in the report. The benefit of O/E Ratios is that they are familiar to many surgeons and are simple to compute using an STS-certified software package. The hierarchical models used to create the estimated Odds Ratios do not provide a formula that can be incorporated into a software package. The main benefit of Odds Ratios obtained from hierarchical models is that they provide a more reliable estimate of performance for hospitals with a small number of patients.

Because hierarchical models borrow information across participants when estimating performance for each individual participant, risk-adjusted statistics are closer to the overall STS average than under the non-hierarchical approach. For example, although a participant might have zero events this year, the best estimate of long-run performance is not 0%, but something higher and closer to the overall STS average. How much higher depends on sample size. If a

participant has a very large sample size, then there is considerable evidence in support of 0% being the true value, and it does not move very much with the hierarchical "shrinkage estimators". However, if the participant has a relatively small sample size, it is a lot more likely that 0 events was simply a chance occurrence rather than a reflection of true performance. In such cases, the overall mean from all participants is given more weight and the observed 0% mortality is "shrunken" toward that mean.

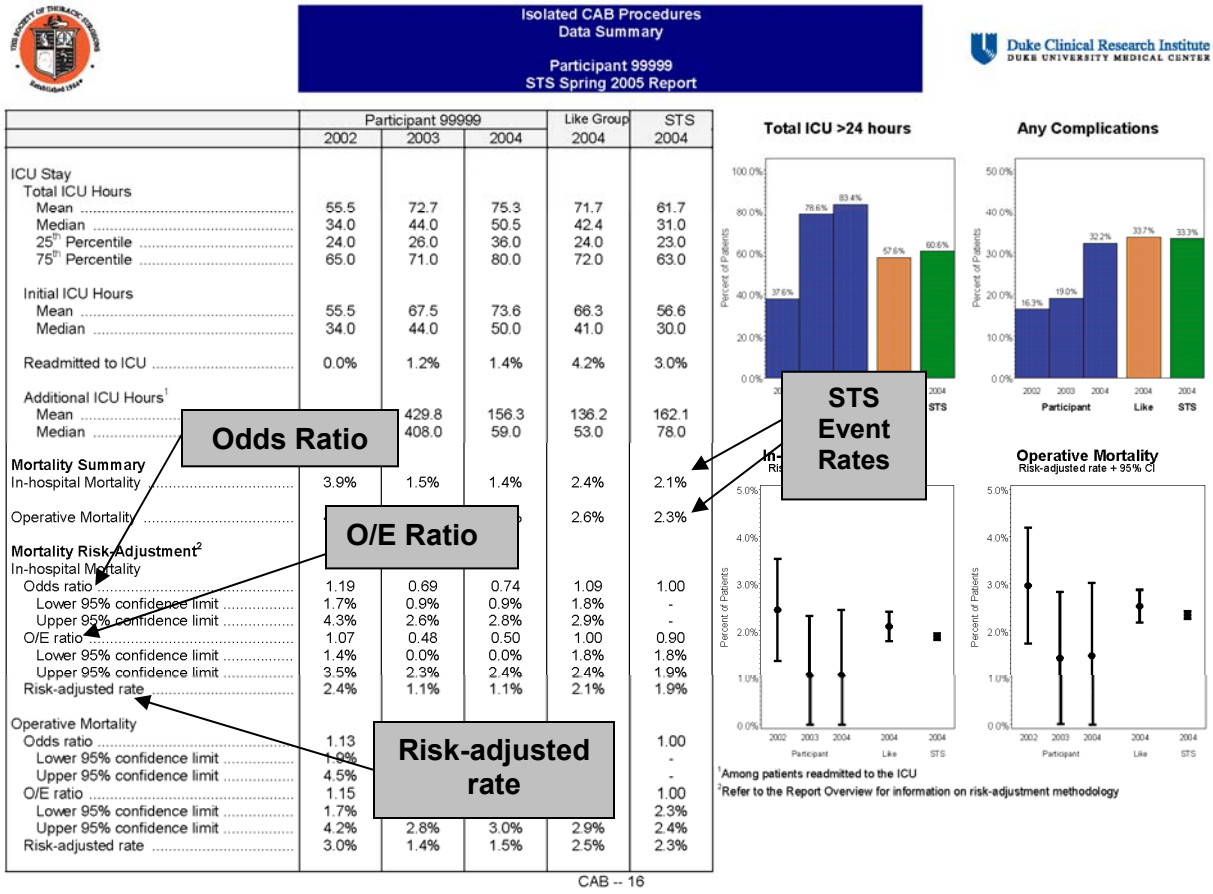
This approach, although intuitively not satisfying to the participant with 0 events, ultimately allows for more accurate risk-adjustment results since it removes some of the instability caused by smaller participants with extreme results. It also protects participants who might have very high observed mortality based on a very small sample size, when in reality that was a reflection of random chance. Their results would similarly be shrunk towards the STS mean.

The following journal article contains more detailed and technical discussion of the hierarchical approach to risk-adjustment: Christiansen CL, Morris CN. Improving the Statistical Approach to Health Care Provider Profiling. *Ann Intern Med*. 1997;127:764-768.

i. Interpretation manual

When the risk-adjustment models are applied for the purposes of this report, several statistics are computed that allow for performance comparison: O/E Ratios, Odds Ratios and Risk-adjusted rates. The following sample page illustrates how these risk-adjusted statistics appear in the report for mortality. **Please note that expected/predicted rates are no longer provided in the report**. Please see item *d. STS Certified Software Package Predicted Risk Scores* in the Report Overview Risk-adjustment Supplement for information on how to calculate expected/predicted rates using results from your STS data software vendor.

Report Overview – General
STS Report – Period Ending 12/31/2009



Isolated CAB Procedures
Data Summary

Participant 99999
STS Spring 2005 Report

Duke Clinical Research Institute
DUKE UNIVERSITY MEDICAL CENTER

	Participant 99999			Like Group	STS
	2002	2003	2004	2004	2004
ICU Stay					
Total ICU Hours					
Mean	55.5	72.7	75.3	71.7	61.7
Median	34.0	44.0	50.5	42.4	31.0
25th Percentile	24.0	26.0	36.0	24.0	23.0
75th Percentile	65.0	71.0	80.0	72.0	63.0
Initial ICU Hours					
Mean	55.5	67.5	73.6	66.3	56.6
Median	34.0	44.0	50.0	41.0	30.0
Readmitted to ICU	0.0%	1.2%	1.4%	4.2%	3.0%
Additional ICU Hours[1]					
Mean		429.8	156.3	136.2	162.1
Median		408.0	59.0	53.0	78.0
Mortality Summary					
In-hospital Mortality	3.9%	1.5%	1.4%	2.4%	2.1%
Operative Mortality				2.6%	2.3%
Mortality Risk-Adjustment[2]					
In-hospital Mortality					
Odds ratio	1.19	0.69	0.74	1.09	1.00
Lower 95% confidence limit	1.7%	0.9%	0.9%	1.8%	-
Upper 95% confidence limit	4.3%	2.6%	2.8%	2.9%	-
O/E ratio	1.07	0.48	0.50	1.00	0.90
Lower 95% confidence limit	1.4%	0.0%	0.0%	1.8%	1.8%
Upper 95% confidence limit	3.5%	2.3%	2.4%	2.4%	1.9%
Risk-adjusted rate	2.4%	1.1%	1.1%	2.1%	1.9%
Operative Mortality					
Odds ratio	1.13				1.00
Lower 95% confidence limit	1.9%				-
Upper 95% confidence limit	4.5%				-
O/E ratio	1.15				1.00
Lower 95% confidence limit	1.7%				2.3%
Upper 95% confidence limit	4.2%	2.8%	3.0%	2.9%	2.4%
Risk-adjusted rate	3.0%	1.4%	1.5%	2.5%	2.3%

[1]Among patients readmitted to the ICU
[2]Refer to the Report Overview for information on risk-adjustment methodology

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O/E Ratio

The O/E Ratio is a statistic that allows a participant to gauge whether their observed outcomes were better, the same, or worse than what would be expected given the existing underlying risk factors of the patients. Table 9 below contains details for interpreting specific O/E Ratio values. In general, smaller O/E Ratios imply better performance. See Section IV.c and the Report Overview Risk-adjustment Supplement for more details about how the O/E Ratio is calculated.

Starting in 2005, STS risk-adjustment models are re-calibrated each year to make them as up-to-date as possible when assessing performance during a given year. This re-calibration is needed because overall STS performance improves in the interval between development and subsequent updating of the STS risk-adjustment models. While updating the STS Risk-adjustment models more frequently is the alternative to re-calibration, it is currently not a feasible option since vendors currently only update their risk-adjustment models at the time of a data specification upgrade. Because the models are re-calibrated for each year included in the report, the O/E Ratio reflects performance relative to the STS average during that calendar year. This allows participants to benchmark their performance relative to a contemporary standard. Model recalibration was not performed prior to the Spring 2005 report so participants

may have seen a shift in their performance from the last time O/E Ratios were provided in the report without recalibration (Spring 2004).

The following is an example of why the re-calibration is needed and why a participant may have seen a shift in their performance. For a hypothetical participant 99999 the 2003 CAB operative mortality O/E Ratio was 0.90 in the Spring 2004 report. Because the risk-adjustment model was estimated using data from 1997-1999, an appropriate interpretation would be that participant 99999 performed better in 2003 than the average participant performed during1997-1999. Under the same methods and for the same time period, the overall STS mortality O/E Ratio was 0.80. In this light, participant 99999's O/E of 0.90 is actually worse than the STS overall O/E of 0.80. Because of the dynamic of overall improving participant performance through time, a more appropriate comparison group for participants is their current peer groups – the average STS participant during a given year. With the new approach to re-calibrate the models each year, the overall STS O/E is always 1.0 and for the above example, participant 99999's O/E becomes 1.125 (=0.90/0.80).

Because of this calibration, STS certified software cannot directly produce the O/E Ratios in this report. However, we have used a re-calibration method that makes it easy for participants to reproduce our results, if desired. See the Report Overview - Risk Adjustment Supplement for information about how the re-calibrated O/E Ratios can be achieved locally.

Odds Ratio
Similar to the O/E Ratio, the Odds Ratio is a statistic that allows a participant to gauge its performance relative to other participants after adjusting for patient risk factors. More specifically, the Odds Ratio is the ratio of the predicted odds of an outcome for a patient relative to what it would be if the surgery were to be performed by an "average" STS participant. The "odds" of an outcome is closely related to the probability of an outcome and is used in these calculations for technical reasons. See Section IV.c for additional details about the Odds Ratio and how it differs from the O/E Ratio. The interpretation of the estimated Odds Ratio is similar to the interpretation of the O/E Ratio with smaller Odds Ratios implying better performance.

The following table illustrates the possible interpretations of the O/E Ratio.

Table 9. O/E Ratio Interpretations*

Statistic	Interpretation
O/E Ratio > 1	When the O/E Ratio is greater than 1, the participant had an observed outcome level that was greater than expected. The participant performed worse than expected.
O/E Ratio < 1	When the O/E Ratio is less than 1, the participant had an observed outcome level that was less than expected. The participant performed better than expected
O/E Ratio = 1	When the O/E Ratio is 1, the participant had an observed outcome level equal to expected. The participant performed as expected.

***** The interpretations in this table can also be roughly extended to Odds Ratios - values less than 1 imply better than average performance, values of 1 imply average performance and values over 1 imply worse than average performance. Note that the Odds Ratio will generally be closer to 1.0 than the O/E Ratio. It is possible that these two measures will be discrepant, but only if they are close to 1.0.

Risk-adjusted rates

Risk-adjusted rates are calculated by multiplying the O/E Ratio by the overall STS unadjusted event rate for that time period (See the Report Overview Risk Adjustment Supplement for more details on calculation of the risk-adjusted rate). Because the risk-adjusted rate is so closely related to the O/E Ratio, the information provided by these two statistics is similar and the choice of which statistic to use is really only a choice of unit of measure. Although one advantage of the O/E Ratio is that it is centered around 1.0 regardless of the outcome being measured, the risk-adjusted rates have the advantage that they can be easily interpreted as a clinically meaningful outcome event percent on a familiar scale.

The following table illustrates the possible interpretations of the risk-adjusted rate.

Table 10. Risk-adjusted Rate Interpretations

Statistic	Interpretation
Risk-adjusted rate > STS event rate	When the risk-adjusted rate for a particular adverse outcome is greater than the STS average rate, then the participant had more of those outcomes than expected given their case-mix.
Risk-adjusted rate < STS event rate	When the risk-adjusted rate for a particular adverse outcome is less than the STS average rate, then the participant had less of those outcomes than expected given their case-mix.
Risk-adjusted rate = STS event rate	When the risk-adjusted rate for a particular adverse outcome is equal to the STS average rate, then the participant had the same number of those outcomes as expected given their case-mix.

95% Confidence Intervals
The estimated Odds Ratios and the O/E Ratios provided in the report are accompanied by upper and lower 95% Confidence Intervals. The 95% Confidence Intervals indicate the range of values within which the analysts are 95% confident that the true value for the underlying population falls. (The true population value is the value that would be observed hypothetically in a very large sample of patients.) If the upper and lower bounds of the 95% Confidence Intervals for a participant contain the overall STS value, then the value for the participant is not statistically different from the STS overall.

Sample risk-adjustment data and interpretation
Table 11a below contains hypothetical data on 3 participants and the overall STS. This information is provided as a tool to aid in the interpretation of report data. The table is followed by text descriptions of how each of the 3 hypothetical participants' results would be interpreted. Table 11b below contains the same sample data with a brief interpretation summary next to each value or set of values.

Table 11a. Sample Data

Example – CAB Mortality				
	Participant A	Participant B	Participant C	STS
# procedures	495	575	1462	345,674
# outcome events	5	13	37	6,913
Observed mortality %	1.0%	2.3%	2.5%	2.0%
Expected mortality %	3.4%	2.1%	2.5%	2.0%
Odds Ratio	0.40	1.02	1.00	1.00
Odds Ratio 95% CI	(0.30, 0.82)	(0.63, 1.64)	(0.73, 1.40)	—
O/E Ratio	0.29	1.10	1.00	1.00
O/E Ratio 95% CI	(0.00, – 0.75)	(0.86 – 1.34)	(0.69 – 1.40)	—
Risk-adjusted rate	0.58% (0.29 x 2.0%)	2.2% (1.10 x 2.0%)	2.0% (1.00 x 2.0%)	—

NOTE: Because the numbers in the table were calculated using nonrounded values, you may not be able to duplicate identical values.

Participant A:
Participant A had a higher than average expected mortality (3.4%) but lower than average observed mortality (1.0%) which combined to produce a highly favorable O/E Ratio (0.29 = 1.0/3.4; well below 1.0). The risk-adjusted rate (0.58%) also points to lower-than-expected mortality in that it is lower than the overall STS mortality rate. The estimated Odds Ratio is 0.40, which is less than 1.0. This means that the predicted odds of mortality for a patient undergoing surgery at participant A is lower than it would be if the same patient were instead having surgery at an "average" STS hospital. The predicted odds of death for any patient treated at participant A is lower compared to an average hospital by a factor of 40% (= 0.40 x 100%). Because the 95% confidence interval on both the Odds Ratio and the O/E Ratio do not include the STS value (1.0) the favorable mortality results are unlikely to be due to chance variation. In other words, the lower-than-expected mortality is statistically significant.

Participant B:
Participant B's observed mortality rate was 2.3% (= 13/575 x 100). The expected mortality rate of 2.1% is obtained from the STS CAB mortality model. It is a function of the participant's patient case-mix and cannot be derived from other numbers in the table. The O/E Ratio is 1.10 (= 2.3/2.1). The fact that the O/E is greater than 1.0 implies that the observed mortality (2.3%) was larger than the expected mortality rate (2.1%). Specifically, the observed mortality exceeded the expected rate by 10% (= 100% x [O/E – 1]). Finally, the estimated Odds Ratio (1.02) is greater than 1.0. This means that the predicted risk of death for a patient having surgery at participant B is larger than the predicted risk if the same patient was instead having surgery at an "average" STS hospital. The confidence interval on the Odds Ratio extends from below 1.0 to above 1.0 (from 0.63 to 1.64). Because both the Odds Ratio and the O/E Ratio confidence intervals

include the STS value (1.0), there is uncertainty about whether the true risk of mortality for a future hypothetical patient is lower or higher than average. The excess mortality observed at participant B may be attributable to chance variation; it is not statistically significant.

Participant C:
Participant C's observed mortality rate (2.5%) is higher than the overall STS average mortality rate (2.0%). However, its expected mortality rate (2.5%) is also higher than average (2.0%), reflecting a riskier than average patient population. By coincidence, the observed mortality rate matches the expected mortality rate exactly. As a result, the O/E is exactly equal to 1.0 and the participant's risk-adjusted mortality rate is equal to the overall STS average (2.0% = 1.0 x 2.0%). This is uncommon. Because the expected number of deaths is usually a fraction, whereas the observed number is a whole number, the observed mortality rate is rarely equal to the expected rate.

Table 11b. Sample Data and Interpretation

Example – CAB Mortality				
	Participant A	Participant B	Participant C	STS
# procedures	495	575	1462	345,674
# outcome events	5	13	37	6,913
Observed mortality %	1.0% **↓ Expected 2.0%**	2.3% **↑ Expected 2.0%**	2.5% **↑ Expected 2.0%**	2.0%
Expected mortality %	3.4% **↑ Expected 2.0%**	2.1% **↑ Expected 2.0%**	2.5% **↑ Expected 2.0%**	2.0%
Odds Ratio	0.40 **<1.0; Odds of death are better than at average STS site**	1.02 **>1.0; Odds of death are worse than at average STS site**	1.00 **=1.0; Odds of death are same as at average STS site**	1.00
Odds Ratio 95% CI	(0.30, 0.82) **Does not include STS 1.0=Statistically Significantly different**	(0.63, 1.64) **Does include STS 1.0=Not Statistically Significantly different**	(0.73, 1.40) **Does include STS 1.0=Not Statistically Significantly different**	—
O/E Ratio	0.29 **<1.0=Better than Expected**	1.10 **>1.0=Worse than Expected**	1.00 **=1.0=As Expected**	1.00
O/E Ratio 95% CI	(0.00 – 0.75) **Does not include STS 1.0=Statistically Significantly different**	(0.86 – 1.34) **Does include STS 1.0=Not Statistically Significantly different**	(0.69 – 1.40) **Does include STS 1.0=Not Statistically Significantly different**	—
Risk-adjusted rate	0.58% (0.29 x 2.0%) **O/E*STS National** **↓ STS**	2.2% (1.10 x 2.0%) **O/E*STS National** **↑ STS**	2.0% (1.00 x 2.0%) **O/E*STS National** **= STS**	—

A note on interpretation
Participants that have results that are statistically different from the STS (the range between participant Confidence Intervals does not contain the STS value) should approach the use of that information with caution. Despite the utility of risk-adjustment to allow for fair comparisons, certain limitations should be kept in mind:

Extreme values are possible due to chance. If a surgeon only operated one time, the surgeon's observed mortality rate would either be 0% (= 0/1 x 100%) or 100% (= 1/1 x 100%). A mortality rate of 0% would be extremely low; 100% would be extremely high. Neither outcome would accurately reflect the surgeon's true ability, which probably lies somewhere between 0% and 100%. Because surgical outcomes have a random component, a large sample of patient operations is required in order to accurately measure a surgeon's performance. Even with one hundred patients, the death of a single patient can cause the mortality rate to jump by 1%. (The risk-adjusted mortality will also be substantially changed by a single patient outcome.) The exact value of a statistic such as the observed mortality rate or the observed to expected ratio must always be considered in conjunction with its confidence Interval, which shows the range of plausible values based on the sample size.

Variations in coding of risk factors could explain extreme values. The validity of the risk-adjusted results relies on consistent and accurate coding of risk factors and surgical outcomes. In reality, there may be some variation in the way risk factors and outcomes are coded by two different participants. If one hospital tends to over-state the risk profiles of its patients while another hospital under-states the risk profiles of its patients, the hospital that over-states the risk profiles will have an unfair advantage. To minimize bias, it is essential to pay close attention to STS data definitions when coding events and risk factors.

Not all risk factors are captured in the model. Risk-adjustment attempts to level the playing field by adjusting for the risk profiles of the participant's patient population. However, there are potentially difficult to measure factors that are not included in the risk adjustment model and which may increase or decrease a patient's risk of an adverse outcome. For this reason, two patients having exactly the same *measured* risk factors prior to surgery might actually have substantially different real risks. If a participant tends to treat patients that are at greater or lower risk than they might appear based on the measured risk factors, this may bias their risk-adjusted results upward or downward.

V. Participant-Specific Data Quality Summary

Information about your participant organization's data quality is provided in the Participant-Specific Data Quality Summary (Harvest 1 and 3 only) to help you interpret and weight your reported results. We encourage you to review this information to help you assess the accuracy and reliability of your report.

Table 12. Procedure Identification Table

Variable Short Name	CAB Only	AV Replace	AV Replace + CAB	MV Replace	MV Replace + CAB	AV Replace + MV Replace	MV Repair	MV Repair + CAB
OpCAB	Yes	No/Missing	Yes	No/Missing	Yes	No/Missing	No/Missing	Yes
OpValve	No/Missing	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VAD	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OpAortic	No/Missing	Replacement	Replacement	No/Missing	No/Missing	Replacement	No/Missing	No/Missing
OpMitral	No/Missing	No/Missing	No/Missing	Replacement	Replacement	Replacement	**	**
OpTricus	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OpPulm	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OpONCard	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OpOCard	Do not use OpOCard for exclusions. Use specific variables below.							
OCarLVA	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarVSD	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarASD	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarBati	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarSVR	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarCong	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarLasr	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarTrma	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarCrTx	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarACD	Do not use OCarACD for exclusions.							
OCarAFib	None/Missing	None/Missing	None/Missing	None/Missing	None/Missing	None/Missing	None/Missing	None/Missing
ONCAoAn	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing
OCarOthr	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing	No/Missing

** Annuloplasty Only or Reconstruction w/ Annuloplasty or Reconstruction w/out Annuloplasty.

Table 13. Calculated Variables

Demographics	Body Mass Index (BMI)	BMI = (**WeightKg**) / (**HeightCm** / 100)^2. Note: BMI categories (underweight, normal, etc.) are those accepted by the National Institutes of Health and represent a departure from previous STS reports**.**
	Multiple Races	When more than one race is indicated: **RaceCaucasian, RaceBlack, RaceAsian, RaceNativeAm, RacNativePacific, RaceOther.** Multiple Races is only calculated for data version 2.61 records.
Hospitalization	Total Length of Stay	Total length of stay is the number of days from the date of admission (**AdmitDt**) to the date of discharge (**DischDT**).
	Post-procedure Length of Stay	Post-procedure length of stay is the number of days from the date of surgery (**SurgDT**) to the date of discharge (**DischDT**).
	Short Post-procedure Length of Stay	For the time period through 12/31/2007, a “short stay” was when the post-procedure length of stay was less than 6 days. Beginning 1/1/2008 this definition was changed to take into account inhospital mortality - a “short stay” is when the patient was *discharged alive* and the post-procedure length of stay is less than six days.
	Long Post-procedure Length of Stay	A “long stay” is when the post-procedure length of stay is greater than fourteen days.
Previous Interventions	Previous Cardiac Surgery	When the patient has undergone any previous CAB operations, valve operations, or other cardiac operations (with or without cardio-pulmonary bypass). For versions 2.35 and 2.41, the database variables involved in this determination are: **PrCBNum**, **PrCNNum, PrCAB, PrValve, PrOthCar**. Beginning with data version 2.52.1, the variables involved in this determination are **Incidenc, PrCAB, PrValve, PrOthCar**.

	First Reoperation/Second+ Reoperation	For those patients with a previous cardiac surgery, indication of the number of previous surgeries. For versions 2.35 and 2.41, the database variables involved in this determination are: **PrCBNum**, **PrCNNum**, **PrCAB**, **PrValve**, **PrOthCar**. Beginning with data version 2.52.1, the variables involved in this determination are **Incidenc**, **PrCAB**, **PrValve, PrOthCar**.
	Previous PCI	Whether the patient has undergone any previous PCI. For versions 2.35 and 2.41, the database variables involved in this determination are: **PrNSStnt** and **PrPTCA**. Beginning with data version 2.52.1, the variable involved in this determination is **POCPCI**.
	Timing of Previous PCI	For versions 2.35 and 2.41 if patient had both a **PrNSStnt** and a **PrPTCA**, timing was determined by the first to occur. Beginning with data version 2.52.1, timing is determined with the variable **POCPCIIn**.
Operative Information	Distal Anastomoses – Total	Total number of distal anastomoses is the number with arterial conduits plus the number with vein grafts.
	Internal Mammary Artery Used	Any of the following internal mammary arteries: left, right, both
	Radial Artery Used	Any of the following radial arteries used: left, right, both
	Off-Pump Procedure	For version 2.35 data, a procedure is assumed to be off-pump if cardioplegia is not indicated as used and perfusion time equals zero minutes. For version 2.41 data, the variable **CPBUsed** reflected the pump status of a procedure. For data versions 2.52.1 and 2.61, **CPBUtil** is used.
	Skin Incision Duration	Time interval between incision start date/time (**SIStartT**) and incision stop date/time (**SIStopT**).
	OR Duration	Time interval between OR entry date/time (**OREntryDT)** and OR exit date/time (**ORExitDT)**
	Clotting Agents	Any one of the following intraop medications were indicated: **IMedAprot, IMedEACA, IMedDesmo, IMedTran.** Clotting Agents is only calculated for data version 2.61 records.

Report Overview – General
STS Report – Period Ending 09/30/2009

Postoperative Information	Initial Ventilation Hours	Prior to data version 2.61 initial ventilation hours were captured in a single variable, **VentHrsI.** Beginning with data version 2.61 initial ventilation hours is a variable calculated as the number of hours between **ORExitDT** and **ExtubateDT**
	Total Ventilation Hours	Prior to data version 2.61 total postoperative ventilation hours were captured in a single variable, **VentHrs.** Beginning with data version 2.61 total postoperative ventilation hours is a variable calculated as the sum of the calculated initial ventilations hours and the variable additional ventilation hours (**VentHrsA**)
	Total Blood Products	The sums of the individual intraoperative and postoperative blood product units.
Complications	Any Major Complications or Mortality	This is a measure of combined outcomes. It is true if any of the following are indicated: Operative mortality, reoperation for any cause, permanent stroke, prolonged ventilation, deep sternal wound infection, or renal failure.
	Any Neurological Complications	Any of the neurological complications found on the STS data collection form.:
	Any Reoperation Complications	Reoperation for any of the reasons found on the STS data collection form.
	Any Vascular Complications	Any of the vascular complications found on the STS data collection form.
	Any Infection Complications	Any of the infection complications found on the STS data collection form.
	Any Pulmonary Complications	Any of the pulmonary complications found on the STS data collection form.
	Any Other Complications	Any of the other complications found on the STS data collection form.
Mortality	Observed Operative Mortality	Operative Mortality (**MtOpD**) adjusted for between-variable inconsistencies.

NOTE: Variable short names are bolded

Table 14. STS Risk Model Variables – 2008 Models

CAB	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Infx	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Patient Age (140)	X	X	X	X	X	X	X	X	X
Gender (150)	X	X	X	X	X	X	X	X	X
RaceBlack (192)		X	X	X	X	X	X	X	X
RaceAsian (193)		X	X	X	X	X	X	X	X
Ethnicity (199)		X	X	X	X	X	X	X	X
D. Risk Factors									
Weight (350)	X	X	X	X	X	X	X	X	X
Height (360)	X	X	X	X	X	X	X	X	X
Diabetes (400)	X	X	X	X	X	X	X	X	X
Diabetes Control (410)	X	X	X	X	X	X	X	X	X
Last Preop Creatinine Level (430)	X	X	X	X	X	X	X	X	X
Renal Failure-Dialysis (450)	X	X	NA	X	X	X	X	X	X
Hypertension (460)		X	X	X			X	X	X
Infectious Endocarditis Type (500)									
Chronic Lung Disease (510)	X		X	X	X	X	X	X	X
Immunosuppressive Treatment (520)	X		X	X		X	X	X	X
Peripheral Arterial Disease (530)	X	X	X	X	X	X	X	X	X
Cerebrovascular Disease (540)	X	X	X	X		X	X	X	X
Cerebrovascular Accident (552)	X	X	X	X		X	X	X	X
E. Previous Interventions									
Previous CAB (600)	X	X	X	X	X	X	X	X	X
Previous Valve (610)	X	X	X	X	X	X	X	X	X
Previous PCI Interval (670)	X		X	X		X	X	X	X
F. Preoperative Cardiac Status									
Previous Myocardial Infarction Timing (760)	X	X	X	X			X	X	X
Heart Failure (770)	X		X	X	X	X	X	X	X
Classification-NYHA (775)	X		X	X	X	X	X	X	X
Cardiac Presentation on Admission (791)	X		X	X					
Cardiogenic Shock (810)	X	X	X	X		X	X	X	X
Resuscitation (830)	X	X	X	X	X	X	X	X	X
Arrhythmia Afib / Aflutter (853)	X	X	X	X		X	X	X	X
G. Preoperative Medications									
Inotropes (970)	X		X	X		X	X	X	X
H. Hemodynamics and Cath									
Number of Diseased Vessels (1050)	X	X	X	X	X	X	X	X	X
Left Main Disease (1060)				X			X		
Ejection Fraction (1080)	X	X	X	X	X	X	X	X	X
Aortic Stenosis (1120)				X			X	X	X
Mitral Stenosis (1140)									
Aortic Insufficiency (1170)									X
Mitral Insufficiency (1180)	X			X		X	X	X	X
Tricuspid Insufficiency (1190)			X	X			X		X
I. Operative									
Incidence (1230)	X	X	X	X	X	X	X	X	X
Status (1240)	X	X	X	X	X	X	X	X	X
IABP-Timing (1440)	X		X	X		X	X	X	X

Valve (AVRepl, MV Repl, MVRepr)	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Infx	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Patient Age (140)	X	X	X	X	X	X	X	X	X
Gender (150)	X	X	X	X	X	X	X	X	X
RaceBlack (192)		X	X	X		X	X	X	X
RaceAsian (193)									
Ethnicity (199)		X	X	X		X	X	X	X
D. Risk Factors									
Weight (350)	X	X	X	X	X	X	X	X	X
Height (360)	X	X	X	X	X	X	X	X	X
Diabetes (400)	X		X	X	X	X	X	X	X
Diabetes Control (410)	X		X	X	X	X	X	X	X
Last Preop Creatinine Level (430)	X	X	X	X		X	X	X	X
Renal Failure-Dialysis (450)	X	X	NA	X	X	X	X	X	X
Hypertension (460)	X	X	X	X			X		X
Infectious Endocarditis Type (500)	X	X	X	X		X	X	X	X
Chronic Lung Disease (510)	X		X	X	X	X	X	X	X
Immunosuppressive Treatment (520)	X		X				X	X	
Peripheral Arterial Disease (530)	X	X				X	X	X	X
Cerebrovascular Disease (540)		X	X	X		X	X	X	X
Cerebrovascular Accident (552)		X	X	X		X	X	X	X
E. Previous Interventions									
Previous CAB (600)	X	X	X	X	X	X	X	X	X
Previous Valve (610)	X	X	X	X	X	X	X	X	X
Previous PCI Interval (670)									
F. Preoperative Cardiac Status									
Previous Myocardial Infarction Timing (760)	X			X		X	X	X	X
Heart Failure (770)	X		X	X		X	X	X	X
Classification-NYHA (775)	X		X	X		X	X	X	X
Cardiac Presentation on Admission (791)	X								
Cardiogenic Shock (810)	X	X		X		X	X	X	
Resuscitation (830)	X	X	X	X		X	X	X	X
Arrhythmia Afib / Aflutter (853)	X	X		X		X	X	X	X
G. Preoperative Medications									
Inotropes (970)	X		X	X	X	X	X	X	X
H. Hemodynamics and Cath									
Number of Diseased Vessels (1050)		X		X			X	X	X
Left Main Disease (1060)	X		X		X				
Ejection Fraction (1080)	X		X	X	X	X	X	X	X
Aortic Stenosis (1120)				X		X	X	X	X
Mitral Stenosis (1140)	X								
Aortic Insufficiency (1170)									
Mitral Insufficiency (1180)		X							
Tricuspid Insufficiency (1190)			X	X		X	X	X	X
I. Operative									
Incidence (1230)	X	X	X	X	X	X	X	X	X
Status (1240)	X	X	X	X	X	X	X	X	X
IABP-Timing (1440)	X		X	X	X	X	X	X	X
K. Valve Surgery									
Mitral Procedure (1640)	X	X	X	X	X	X	X	X	X

Valve+CAB (AVRepl+CAB, MVRepl+CAB, MVRepr+CAB)	**Operative Mortality**	**Stroke**	**Renal Failure**	**Prolonged Ventilation**	**Deep Stern Infx**	**Reop**	**Mortality/ Morbidity**	**Length of Stay>14**	**Length of Stay<6**
B. Demographics									
Patient Age (140)	X	X	X	X	X	X	X	X	X
Gender (150)	X	X	X	X	X	X	X	X	X
RaceBlack (192)			X	X		X	X	X	X
RaceAsian (193)									
Ethnicity (199)			X	X		X	X	X	X
D. Risk Factors									
Weight (350)	X	X	X	X	X	X	X	X	X
Height (360)	X	X	X	X	X	X	X	X	X
Diabetes (400)	X	X	X	X	X		X	X	X
Diabetes Control (410)	X	X	X	X	X		X	X	X
Last Preop Creatinine Level (430)	X	X	X	X		X	X	X	X
Renal Failure-Dialysis (450)	X	X	NA	X	X	X	X	X	X
Hypertension (460)		X	X	X	X		X	X	X
Infectious Endocarditis Type (500)	X	X	X	X		X	X	X	X
Chronic Lung Disease (510)	X		X	X	X	X	X	X	X
Immunosuppressive Treatment (520)	X		X	X		X	X	X	X
Peripheral Arterial Disease (530)	X	X	X	X		X	X	X	
Cerebrovascular Disease (540)	X	X	X	X	X	X	X	X	X
Cerebrovascular Accident (552)	X	X	X	X	X	X	X	X	X
E. Previous Interventions									
Previous CAB (600)	X	X	X	X	X	X	X	X	X
Previous Valve (610)	X	X	X	X	X	X	X	X	X
Previous PCI Interval (670)									
F. Preoperative Cardiac Status									
Previous Myocardial Infarction Timing (760)	X	X	X	X		X	X	X	
Heart Failure (770)	X	X	X	X		X	X	X	X
Classification-NYHA (775)	X	X	X	X		X	X	X	X
Cardiac Presentation on Admission (791)	X	X	X	X					
Cardiogenic Shock (810)	X	X	X	X		X	X	X	
Resuscitation (830)	X	X	X	X		X	X	X	X
Arrhythmia Afib / Aflutter (853)	X	X	X	X		X	X	X	X
G. Preoperative Medications									
Inotropes (970)	X		X	X		X	X	X	X
H. Hemodynamics and Cath									
Number of Diseased Vessels (1050)	X	X	X	X	X	X	X	X	X
Left Main Disease (1060)	X			X					
Ejection Fraction (1080)	X		X	X		X	X	X	X
Aortic Stenosis (1120)									
Mitral Stenosis (1140)	X							X	
Aortic Insufficiency (1170)									
Mitral Insufficiency (1180)							X		
Tricuspid Insufficiency (1190)	X		X	X			X		X
I. Operative									
Incidence (1230)	X	X	X	X	X	X	X	X	X
Status (1240)	X	X	X	X	X	X	X	X	X
IABP-Timing (1440)	X		X	X		X	X	X	X
K. Valve Surgery									
Mitral Procedure (1640)	X	X	X	X	X	X	X	X	X

The Society of Thoracic Surgeons

Adult Cardiac Surgery Database

Data Collection Form Version 2.73

January 14, 2011

A. Administrative

Participant ID: ParticID (40)	Record ID: (software generated) RecordID (50)	STS Cost Link: CostLink (60)	Patient ID: (software generated) PatID (80)

B. Demographics

Patient Last Name: PatLName (90)	Patient First Name: PatFName (100)	Patient Middle Name: PatMName (120)
Date of Birth: __ __/__ __/__ __ __ __ (mm/dd/yyyy) DOB (130)	Patient Age: _____ Age (140)	Sex: ☐ Male ☐ Female Gender (150)
Social Security Number: __ __ __ - __ __ - __ __ __ __ SSN (160)	Medical Record Number: MedRecN (170)	
Patient's Address:		
Street Address: PatAddr (180)	City: PatCity (190)	
Region: PatRegion (200)	ZIP Code: PatZIP (210)	Country: PatCountry (220)
Is This Patient's Permanent Address: ☐ Yes ☐ No PermAddr (230)		
(If No →) Patient's Permanent Address:		
Street Address: PatPermAddr (240)	City: PatPermCity (250)	
Region: PatPermRegion (260)	ZIP Code: PatPermZIP (270)	Country: PatPermCountry (280)

Race (Select all that apply:)

White: RaceCaucasian (290)	☐ Yes	☐ No	Black/African American: RaceBlack (300)	☐ Yes ☐ No
Asian: RaceAsian (310)	☐ Yes	☐ No	Am Indian/Alaskan Nat: RaceNativeAm (320)	☐ Yes ☐ No
Native Hawaiian/Pacific Islander: RacNativePacific (330)	☐ Yes	☐ No	Other: RaceOther (340)	☐ Yes ☐ No

Hispanic, Latino or Spanish Ethnicity: ☐ Yes ☐ No
Ethnicity (350)

Referring Cardiologist: RefCard (360)	Referring Physician: RefPhys (370)

C. Hospitalization

Hospital Name: _____ (If Not Missing →)
HospName (380)

Hospital ZIP Code: HospZIP (390)

Hospital State: HospStat (400)

Hospital National Provider Identifier: _____
HospNPI (410)

Payor - (Select all that apply↓)

Government Health Insurance: PayorGov (420) ☐ Yes ☐ No (If Yes, select all that apply ↓)

Medicare: ☐ Yes ☐ No (If Yes →)
PayorGovMcare (430)

Health Insurance Claim Number: _____ HICNumber (440)

Medicare Fee For Service: ☐ Yes ☐ No
PayorGovMcareFFS (450)

Medicaid: ☐ Yes ☐ No
PayorGovMcaid (460)

Military Health Care: ☐ Yes ☐ No
PayorGovMil(470)

State-Specific Plan: ☐ Yes ☐ No
PayorGovState (480)

Indian Health Service: ☐ Yes ☐ No
PayorGovIHS (490)

Correctional Facility: ☐ Yes ☐ No
PayorGovCor (500)

Commercial Health Insurance: ☐ Yes ☐ No
PayorCom (510)

Health Maintenance Organization: ☐ Yes ☐ No
PayorHMO (520)

Non-U.S. Insurance: PayorNonUS (530) ☐ Yes ☐ No

None / Self: PayorNS (540) ☐ Yes ☐ No

Arrival Date:__ __/__ __/__ __ __ __ (mm/dd/yyyy)	Arrival Time: __ __:__ __ (hh:mm 24-hour clock)	Admit Date:__ __/__ __/__ __ __ __ (mm/dd/yyyy)

ArrivalDt (550)	ArrivalTm (560)	AdmitDt (570)

Admit Source: AdmitSrc (580)
- ☐ Elective Admission
- ☐ Emergency Department
- ☐ Transfer in from another acute care facility (If Transfer →) Other Hospital Performs Cardiac Surgery ☐ Yes ☐ No OthHosCS (590)
- ☐ Other

Surgery Date: __ __/__ __/__ __ __ __(mm/dd/yyyy) SurgDt (610)

Discharge Date: __ __/__ __/__ __ __ __(mm/dd/yyyy) DischDt (620)

D. Risk Factors

Weight (kg): _____ WeightKg (630) | Height (cm): _____ HeightCm (640)

Cigarette Smoker: ☐ Yes ☐ No (If Yes →) CigSmoker (650) Current Cigarette Smoker: ☐ Yes ☐ No CigSmokerCurr (660)

Other Tobacco Use: ☐ Yes ☐ No OthTobUse (661)

Family History of Premature Coronary Artery Disease: ☐ Yes ☐ No FHCAD (670) | Last Hematocrit: _____ Hct (680) | Last WBC Count: _____ WBC (690)

Platelet Count Prior to Surgery: _____ Platelets (700) | International Normalized Ratio prior to Surgery: _____ INR (710)

HIT Antibodies ☐ Yes ☐ No ☐ Not Applicable HITAnti (711) | Total Bilirubin Prior to Surgery: _____ TotBlrbn (720)

Total Albumin Prior to Surgery:_____ TotAlbumin (730) | A1c Level prior to surgery: _____ A1cLvl (740) | Last Creatinine Level Prior to Surgery: _____ CreatLst (750)

Diabetes: ☐ Yes ☐ No (If Yes →) Diabetes (780) Diabetes-Control: ☐ None ☐ Diet ☐ Oral ☐ Insulin ☐ Other DiabCtrl (790)

Dyslipidemia: ☐ Yes ☐ No Dyslip (800) | Dialysis: ☐ Yes ☐ No Dialysis (810) | MELD Score: _____ (System Calculation) MELDScr (815) | Hypertension: ☐ Yes ☐ No Hypertn (820)

Infectious Endocarditis: ☐ Yes ☐ No InfEndo (830)
(If Yes →) Infectious Endocarditis Type: ☐ Treated ☐ Active InfEndTy (840)
Infectious Endocarditis Culture: InfEndCult (850)
☐ Culture negative ☐ Staphylococcus aureus ☐ Streptococcus species
☐ Coagulase negative staphylococcus ☐ Enterococcus species ☐ Fungal ☐ Other

Chronic Lung Disease: ☐ No ☐ Mild ☐ Moderate ☐ Severe ChrLungD (860)

Pulmonary Function Test Done: ☐ Yes ☐ No PFT (880)
(If Yes →) FEV1 % Predicted: _____ FEV1 (890)
DLCO Test Performed: ☐ Yes ☐ No DLCO (892) (If Yes →) DLCO % Predicted: _____ DLCOPred (893)

Arterial Blood Gas Performed: ☐ Yes ☐ No (If Yes →) ABG (900) Oxygen Level : _____ PO2 (910) Carbon Dioxide Level: _____ PCO2 (920)

Home Oxygen: ☐ Yes ☐ No HmO2 (930) | Inhaled Medication or Oral Bronchodilator Therapy: ☐ Yes ☐ No BDTx (940)

Sleep Apnea: ☐ Yes ☐ No SlpApn (950) | Liver Disease: ☐ Yes ☐ No LiverDis (960)

Immunocompromise Present: ☐ Yes ☐ No ImmSupp (970) | Peripheral Artery Disease: ☐ Yes ☐ No PVD (980)

Unresponsive Neurologic State: ☐ Yes ☐ No UnrespStat (1000) | Syncope: ☐ Yes ☐ No Syncope (1001)

Cerebrovascular Disease: ☐ Yes ☐ No CVD (1010)
(If Yes →) Prior CVA: ☐ Yes ☐ No CVA (1020) (If Yes →) Prior CVA-When: ☐ Recent (<=2 wk.) ☐ Remote (>2 wk.) CVAWhen (1030)
CVD TIA: ☐ Yes ☐ No CVDTIA (1050)
CVD Carotid stenosis: ☐ None ☐ Right ☐ Left ☐ Both CVDCarSten (1070)
(If "Right" or "Both" →) Severity of stenosis on the right carotid artery: ☐ 80 - 99% ☐ 100% CVDStenRt (1071)
(If "Left" or "Both" →) Severity of stenosis on the left carotid artery: ☐ 80 - 99% ☐ 100% CVDStenLft (1072)
History of previous carotid artery surgery and/or stenting: ☐ Yes ☐ No CVDPCarSurg (1080)

Illicit Drug Use: ☐ Yes ☐ No IVDrugAb (1130) | Alcohol Use: ☐ <=1 drink/week ☐ 2-7 drinks/week ☐ >=8 drinks/week Alcohol (1131)

Pneumonia: ☐ No ☐ Recent ☐ Remote Pneumonia (1140) | Mediastinal Radiation: ☐ Yes ☐ No MediastRad (1150) | Cancer Within 5 Years : ☐ Yes ☐ No Cancer (1160)

Five Meter Walk Test Done: ☐ Yes ☐ No FiveMWalkTest (1161)
(If Yes →) Time 1: _____ (secs) FiveMWalk1 (1170) Time 2: _____(secs) FiveMWalk2 (1180) Time 3 : _____ (secs) FiveMWalk3 (1190)

E. Previous Cardiac Interventions

Previous Cardiac Interventions: ☐ Yes ☐ No (If Yes ↓) PrCVInt (1200)

Previous CAB prior to current admission: ☐ Yes ☐ No PrCAB (1215)
Previous Valve: ☐ Yes ☐ No (If Yes ↓) PrValve (1216)
Previous Aortic Valve Replacement - Surgical: ☐ Yes ☐ No PrevProcAVReplace (1220)
Previous Aortic Valve Repair - Surgical : ☐ Yes ☐ No PrevProcAVRepair (1230)
Previous Mitral Valve Replacement - Surgical: ☐ Yes ☐ No PrevProcMVReplace (1240)
Previous Mitral Valve Repair - Surgical: ☐ Yes ☐ No PrevProcMVRepair (1250)
Previous Tricuspid Valve Replacement - Surgical: ☐ Yes ☐ No PrevProcTVReplace (1260)
Previous Tricuspid Valve Repair - Surgical: ☐ Yes ☐ No PrevProcTVRepair (1270)
Previous Pulmonic Valve Repair / Replacement - Surgical: ☐ Yes ☐ No PrevProcPV (1280)
Previous Aortic Valve Balloon Valvuloplasty: ☐ Yes ☐ No PrevProcAVBall (1285)
Previous Mitral Valve Balloon Valvuloplasty: ☐ Yes ☐ No PrevProcMVBall (1290)
Previous Transcatheter Valve Replacement: ☐ Yes ☐ No PrevProcTCVRep (1300)
Previous Percutaneous Valve Repair: ☐ Yes ☐ No PrevProcPercVRepair (1310)
Indication for Reoperation: ☐ Structural Prosthetic Valve Deterioration
IndReop (1340) ☐ Non-structural prosthetic valve dysfunction
(If Non-structural prosthetic →) Primary type: ☐ Paravalvular Leak ☐ Hemolysis
NonStVDys (1350) ☐ Entrapment by pannus, tissue, or suture
☐ Sizing or positioning issue
☐ Other
☐ Prosthetic Valve Endocarditis
☐ Valve Thrombosis
☐ Failed Repair
☐ Repeat valve procedure on a different valve
☐ Other
Exact Date of Previous Valve Procedure Known: ☐ Yes ☐ No PrValDtKnown (1410)
(If Yes →) Date of Previous Valve Procedure: __ __ /__ __ /__ __ __ __ PrValveDate (1420)
(If No →) Estimate Number of Months Since Previous Valve Procedure: _____ PrValveMonths (1430)
Previous Other Cardiac: ☐ Yes ☐ No PrOthCar (1440) (If Yes →) Previous Arrhythmia Surgery: ☐ Yes ☐ No POArr (1445)
Previous Congenital: ☐ Yes ☐ No PrOthCongen (1450)
Previous ICD (Implantable Cadioverter/Defibrillator): ☐ Yes ☐ No PrOCAICD (1460)
Previous Pacemaker: ☐ Yes ☐ No PrOCPace (1470)
Previous PCI (Percutaneous Cardiac Intervention): ☐ Yes ☐ No POCPCI (1480)
(If Yes →) PCI Performed Within This Episode Of Care: ☐ Yes, at this facility ☐ Yes, at some other acute care facility ☐ No
POCPCIWhen (1481)
(If Yes →) Indication for Surgery: ☐ PCI Complication
POCPCIndSurg (1490) ☐ PCI Failure without Clinical Deterioration
☐ PCI/CABG Hybrid Procedure
PCI Stent : ☐ Yes ☐ No (If Yes →) Stent Type: ☐ Bare metal ☐ Drug-eluting ☐ Unknown
POCPCISt (1500) POCPCIStTy (1510)
PCI Interval: ☐ <= 6 Hours ☐ > 6 Hours POCPCIIn (1520)
Other Previous Cardiovascular Intervention: ☐ Yes ☐ No POCO (1530)

F. Preoperative Cardiac Status

Prior Myocardial Infarction: ☐ Yes ☐ No (If Yes ↓) PrevMI (1540)
MI When: ☐ <=6 Hrs ☐ >6 Hrs but <24 Hrs ☐ 1 to 7 Days ☐ 8 to 21 Days ☐ >21 Days MIWhen (1550)

Anginal Classification Within 2 weeks: ☐ No Symptoms, No Angina ☐ CCA I ☐ CCA II ☐ CCA III ☐ CCA IV AnginalClass (1570)

Heart Failure Within 2 weeks : ☐ Yes ☐ No (If Yes→) Classification-NYHA: ☐ Class I ☐ Class II ☐ Class III ☐ Class IV
CHF (1580) ClassNYH (1585)

Prior Heart failure: ☐ Yes ☐ No PriorHF (1590)

Cardiac Presentation on Admission: ☐ No Symptoms,No Angina ☐ Symptoms Unlikely to be Ischemia ☐ Stable Angina
CardPres (1610) ☐ Unstable Angina ☐ Non-ST Elevation MI (Non-STEMI) ☐ ST Elevation MI (STEMI)

Cardiogenic Shock : ☐ Yes ☐ No CarShock (1620)

Resuscitation: ☐ Yes ☐ No Resusc (1630)

Arrhythmia When : ☐ None ☐ Remote ☐ Recent (If Recent ↓) ArrhythWhen (1650)
Arrhythmia Type: Vtach/Vfib: ☐ Yes ☐ No Second Degree Heart Block : ☐ Yes ☐ No
ArrhyVtach (1660) ArrhyVtachHrtBlk (1670)
Sick Sinus Syndrome: ☐ Yes ☐ No Third Degree Heart Block: ☐ Yes ☐ No
ArrhyVtachSicSinSyn (1680) ArrhyTHB (1690)
Afib/Aflutter : ☐ Yes ☐ No ArrhyAfib (1700)
(If Yes→) Type: ☐ Paroxysmal ☐ Continuous/Persistent ArrhyAfibTy (1701)

G. Preoperative Medications

Beta Blockers : ☐ Yes ☐ No ☐ Contraindicated MedBeta (1710)

ACE or ARB Inhibitors Within 48 Hours: ☐ Yes ☐ No MedACEI48 (1730)

Nitrates-I.V.: ☐ Yes ☐ No MedNitIV (1740)

Anticoagulants : ☐ Yes ☐ No (If Yes→) Medication Name : ☐ Heparin (Unfractionated) ☐ Heparin (Low Molecular)
MedACoag (1750) MedACMN (1760) ☐ Thrombin Inhibitors ☐ Other

Preoperative Antiarrhythmics: ☐ Yes ☐ No MedAArrhy (1770)

Coumadin: ☐ Yes ☐ No MedCoum (1780)

Inotropes : ☐ Yes ☐ No MedInotr (1790)

Steroids : ☐ Yes ☐ No MedSter (1800)

Aspirin: ☐ Yes ☐ No MedASA (1820)

Lipid Lowering: ☐ Yes ☐ No (If Yes→) MedLipid (1830) Medication Type : ☐ Statin ☐ Non-statin ☐ Both MedLipMN (1840)

ADP Inhibitors Within Five Days : ☐ Yes ☐ No (If Yes→) MedADP5Days (1850) ADP Inhibitors Discontinuation: _____ (# days prior to surgery) MedADPIDis (1860)

Antiplatelets Within 5 Days : ☐ Yes ☐ No MedAplt5Days (1870)

Glycoprotein IIb/IIIa Inhibitor: ☐ Yes ☐ No (If Yes→) MedGP (1880) Medication Name: ☐ Abciximab (ReoPro) ☐ Eptifibatide (Integrilin) ☐ Tirofiban (Aggrastat) MedGPMN (1890)

Thrombolytics within 48 hours: ☐ Yes ☐ No MedThrom (1900)

H. Hemodynamics/Cath/Echo

Cardiac Catheterization Performed : ☐ Yes ☐ No (If Yes→) CarCathPer (1910) Cardiac Catheterization Date: __ __/ __ __/__ __ __ __ CarCathDt (1920)

Number Diseased Vessels: ☐ None ☐ One ☐ Two ☐ Three NumDisV (1930)
Left Main Disease >= 50%: ☐ Yes ☐ No LMainDis (1940)
Proximal LAD >= 70%: ☐ Yes ☐ No ProxLAD (1941)

Ejection Fraction Done: ☐ Yes ☐ No (If Yes ↓) HDEFD (1950)
HDEF (1960) Ejection Fraction: _____ (%)
HDEFMeth (1970) Ejection Fraction Method: ☐ LV Gram ☐ Radionucleotide ☐ Estimate ☐ ECHO ☐ MRI/CT ☐ Other

LV Systolic Dimension: _____(mm) LVSD (1980) | LV End-Diastolic Dimension: _____ (mm) LVEDD (1990)

PA Systolic Pressure Measured: ☐ Yes ☐ No (If Yes→) PASYSMeas (2020) PA Systolic Pressure: _____ mmHg(highest prior to surgery) PASYS (2030)

Aortic Valve Disease: ☐ Yes ☐ No (If Yes ↓) VDAort (2040)

Aortic Etiology: VDAoEt (2090)
- ☐ Degenerative (senile)
- ☐ Endocarditis (If Endocarditis→) Root Abscess: ☐ Yes ☐ No VDEndAB (2110)
- ☐ Congenital (If Congenital→) Type: ☐ Bicuspid ☐ Other VDCongenT (2120)
- ☐ Rheumatic
- ☐ Primary Aortic Disease: (If PAD→) Type: VDPrimAo (2130) ☐ Marfans ☐ Other Connective tissue disorder ☐ Atherosclerotic Aneurysm ☐ Inflammatory ☐ Aortic Dissection ☐ Idiopathic Root Dilation
- ☐ LV Outflow Tract Obstruction: (If LV outflow tract obstruction↓) Type: VDLVOutOb (2140) ☐ HOCM ☐ Sub-aortic membrane ☐ Sub-aortic Tunnel
- ☐ Supravalvular Aortic Stenosis
- ☐ Tumor: (If Tumor→) Type: ☐ Myxoma ☐ Papillary fibroelastoma ☐ Carcinoid ☐ Other VDAortTumor (2150)
- ☐ Trauma
- ☐ Other

Aortic Stenosis: ☐ Yes ☐ No (If Yes ↓)VDStenA (2152)
Smallest Aortic Valve Area: _____ cm^2 VDAoVA (2153)
Highest Mean Gradient : _____ mmHg VDGradA (2154)

Aortic Insufficiency: ☐ None ☐ Trace/Trivial ☐ Mild ☐ Moderate ☐ Severe VDInsufA (2155)

Mitral Valve Disease: ☐ Yes ☐ No (If Yes ↓) VDMit (2160)

Mitral Etiology: VDMitET (2170)
- ☐ Annular or Degenerative Disease (If Annular or Degenerative Disease↓)
  - Location: ☐ Posterior Leaflet ☐ Anterior Leaflet ☐ Bileaflet VDMitDegLoc (2180)
  - Type: ☐ Pure Annular Dilation ☐ Mitral Annular Calcification VDMitAnDegDis (2190)
- ☐ Endocarditis
- ☐ Rheumatic
- ☐ Ischemic (If Ischemic→) Type: ☐ Acute (If acute →) Papillary Muscle Rupture: ☐ Yes ☐ No VDMitPMR (2220) ☐ Chronic VDMitIsTy (2210)
- ☐ Congenital
- ☐ Hypertrophic Obstructive Cardiomyopathy (HOCM)
- ☐ Tumor: (If Tumor→) Type: ☐ Myxoma ☐ Papillary fibroelastoma ☐ Carcinoid ☐ Other VDMitTumor (2221)
- ☐ Trauma
- ☐ Non-ischemic cardiomyopathy
- ☐ Other

Mitral Valve Disease Functional Class: ☐ Type I ☐ Type II ☐ Type IIIa ☐ Type IIIb VDMitFC (2230)
Mitral Stenosis: ☐ Yes ☐ No (If Yes ↓)VDStenM (2240)
Smallest Mitral Valve Area : _____ cm^2VDMVA (2250)

Highest Mean Gradient: _____ mm Hg VDGradM (2260)
Mitral Insufficiency: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe VDInsufM (2270)

Tricuspid Valve Disease: ☐ Yes ☐ No (If Yes ↓) VDTr (2280)
Tricuspid Etiology: VDTrEt (2290)
☐ Functional
☐ Endocarditis
☐ Congenital
☐ Tumor
☐ Trauma
☐ Other
Tricuspid Stenosis: ☐ Yes ☐ No VDStenT (2300)
Tricuspid Insufficiency: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe VDInsufT (2320)

Pulmonic Valve Disease: ☐ Yes ☐ No (If Yes ↓) VDPulm (2321)
Pulmonic Stenosis: ☐ Yes ☐ No VDStenP (2330)
Pulmonic Insufficiency: ☐ None ☐ Trace/trival ☐ Mild ☐ Moderate ☐ Severe VDInsufP (2340)

I. Operative

Surgeon: _____ Surgeon (2350)
Surgeon NPI: _____ SurgNPI (2360)
Taxpayer Identification Number: _____ TIN (2370)

Incidence: Incidenc(2380)
☐ First cardiovascular surgery
☐ First re-op cardiovascular surgery
☐ Second re-op cardiovascular surgery
☐ Third re-op cardiovascular surgery
☐ Fourth or more re-op cardiovascular surgery

Status: Status (2390)
☐ Elective
☐ Urgent (If Urgent↓) UrgntRsn (2400)
Reason: ☐ AMI ☐ IABP ☐ Worsening CP ☐ CHF ☐ Anatomy ☐USA ☐ Rest Angina ☐ Valve Dysfunction ☐Aortic Dissection ☐Angiographic Accident ☐Cardiac Trauma ☐ Infected Device ☐ Syncope ☐ PCI/CABG Hybrid ☐ PCI Failure w/out clinical deterioration
☐ Emergent (If Emergent↓) EmergRsn (2410)
Reason: ☐ Shock Circ Support ☐ Shock No Circ Support ☐ Pulmonary Edema ☐ AEMI ☐ Ongoing Ischemia ☐ Valve Dysfunction ☐ Aortic Dissection ☐ Angiographic Accident ☐ Cardiac Trauma ☐ Infected Device ☐ Syncope ☐ PCI/CABG Hybrid ☐ Anatomy
☐ Emergent Salvage

Was case previously attempted during this admission, but canceled: ☐ Yes ☐ No PCancCase (2415)
(If Yes→) Date of previous case: __ __/__ __/__ __ __ __ (mm/dd/yyyy) PCancCaseDt (2416)
Timing of previous case: PCancCaseTmg (2417)
☐ Prior to induction of anesthesia ☐ After induction, prior to incision
☐ After incision made

Reason previous case was canceled: PCancCaseRsn (2418)
☐ Anesthesiology event ☐ Cardiac arrest ☐ Equipment/supply issue
☐ Unanticipated tumor ☐ Other

Planned previous procedure:
CABG PCancCaseCAB (2419) ☐ Yes ☐ No
Valve PCancCaseVal (2420) ☐ Yes ☐ No
Mechanical Assist Device PCancCaseMech (2421) ☐ Yes ☐ No
Other Cardiac PCancCaseOC (2422) ☐ Yes ☐ No
Other Non-cardiac PCancCaseONC (2423) ☐ Yes ☐ No

Was the current procedure canceled: ☐ Yes ☐ No CCancCase (2424)
(If Yes→) Canceled Timing: CCancCaseTmg (2425)
☐ Prior to induction of anesthesia ☐ After induction, prior to incision
☐ After incision made

Canceled Reason: CCancCaseRsn (2426)
☐ Anesthesiology event ☐ Cardiac arrest ☐ Equipment/supply issue
☐ Unanticipated tumor ☐ Other

Planned procedure:
CABG CCancCaseCAB (2427) ☐ Yes ☐ No
Valve CCancCaseVal (2428) ☐ Yes ☐ No
Mechanical Assist Device CCancCaseMech (2429) ☐ Yes ☐ No
Other Cardiac CCancCaseOC (2430) ☐ Yes ☐ No
Other Non-cardiac CCancCaseONC (2431) ☐ Yes ☐ No

Operative Approach: ☐ Full conventional sternotomy ☐ Partial sternotomy ☐ Right or left parasternal incision ☐ Left Thoracotomy ☐ Right Thoracotomy ☐ Transverse sternotomy (includes clamshell)

☐ Minimally invasive OPApp (2435)

Robotic Technology Assisted: ☐ Yes ☐ No Robotic (2436)

Coronary Artery Bypass: ☐ Yes ☐ No OpCAB (2437)
(If "Yes" complete Section J)

Valve Surgery: ☐ Yes ☐ No (If Yes↓) (If "Yes" complete Section K) OpValve (2440)

Valve Prosthesis Explant: ☐ Yes ☐ No (If Yes ↓) ValExp (2450)

Explant Position: ValExpPos (2451) ☐ Aortic ☐ Mitral ☐ Tricuspid ☐ Pulmonic

Explant Type: ValExpTyp (2460) ☐ Unknown ☐ Mechanical Valve ☐ Bioprosthetic Valve ☐ Annuloplasty Device ☐ Mitral Clip ☐ Transcatheter Device

Device Manufacturer: ValExpMan(2461)

☐ None (Homograft or Pulmonary Autograft)
☐ ATS
☐ Baxter
☐ Biocore
☐ Björk-Shiley
☐ CarboMedics
☐ Carpentier-Edwards
☐ Cosgrove-Edwards
☐ Cryolife
☐ Cryolife O'Brien
☐ Edwards
☐ Genesee
☐ Hancock
☐ Ionescu-Shiley
☐ Labcor
☐ LifeNet
☐ Lillehei-Kaster
☐ MCRI
☐ Medtronic
☐ Medtronic Colvin Galloway
☐ Medtronic-Duran
☐ Medtronic-Hall
☐ Mitroflow
☐ OmniCarbon
☐ OmniScience
☐ Sorin
☐ Sorin-Puig
☐ St. Jude Medical
☐ St. Jude Tailor
☐ Starr-Edwards
☐ Ultracor
☐ Unknown
☐ Other

Explant Device: _____ (Refer to Explant Device Key below)ValExpDev (2462)

Second Valve Prosthesis Explant: ☐ Yes ☐ No (If Yes↓) ValExp2 (2463)

Explant Position: ValExpPos2 (2464) ☐ Aortic ☐ Mitral ☐ Tricuspid ☐ Pulmonic

Explant Type: ValExpTyp2 (2465) ☐ Unknown ☐ Mechanical Valve ☐ Bioprosthetic Valve ☐ Annuloplasty Device ☐ Mitral Clip ☐ Transcatheter Device

Device Manufacturer: ValExpMan2(2466)

☐ None (Homograft or Pulmonary Autograft)
☐ ATS
☐ Baxter
☐ Biocore
☐ Björk-Shiley
☐ CarboMedics
☐ Carpentier-Edwards
☐ Cosgrove-Edwards
☐ Cryolife
☐ Cryolife O'Brien
☐ Edwards
☐ Genesee
☐ Hancock
☐ Ionescu-Shiley
☐ Labcor
☐ LifeNet
☐ Lillehei-Kaster
☐ MCRI
☐ Medtronic
☐ Medtronic Colvin Galloway
☐ Medtronic-Duran
☐ Medtronic-Hall
☐ Mitroflow
☐ OmniCarbon
☐ OmniScience
☐ Sorin
☐ Sorin-Puig
☐ St. Jude Medical
☐ St. Jude Tailor
☐ Starr-Edwards
☐ Ultracor
☐ Unknown
☐ Other

Explant Device: _____ (Refer to Explant Device Key below)ValExpDev2 (2467)

Explant Device Key (Note this list is different from the implant list used below).

Mechanical

2 = ATS Mechanical Prosthesis
3 = Björk-Shiley Convex-Concave Mechanical Prosthesis
4 = Björk-Shiley Monostrut Mechanical Prosthesis
6 = CarboMedics Mechanical Prosthesis
57 = CarboMedics Carbo-Seal Ascending Aortic Valved Conduit Prosthesis
58 = CarboMedics Carbo-Seal Valsalva Ascending Aortic Valved Conduit Prosthesis
59 = CarboMedics Reduced Cuff Aortic Valve
60 = CarboMedics Standard Aortic Valve
61 = CarboMedics Top-Hat Supra-annular Aortic Valve
62 = CarboMedics OptiForm Mitral Valve
63 = CarboMedics Standard Mitral Valve
64 = CarboMedics Orbis Universal Valve
65 = CarboMedics Small Adult Aortic and Mitral Valves
53 = Lillehei-Kaster Mechanical Prosthesis
10 = MCRI On-X Mechanical Prosthesis
8 = Medtronic-Hall/Hall Easy-Fit Mechanical Prosthesis
66 = Medtronic ADVANTAGE Mechanical Prosthesis
9 = OmniCarbon Mechanical Prosthesis
54 = OmniScience Mechanical Prosthesis
11 = Sorin Bicarbon (Baxter Mira) Mechanical Prosthesis
12 = Sorin Monoleaflet Allcarbon Mechanical Prosthesis
13 = St. Jude Medical Mechanical Heart Valve
67 = St. Jude Medical Masters Series Mechanical Heart Valve
68 = St. Jude Medical Masters Series Aortic Valve Graft Prosthesis
69 = St. Jude Medical Mechanical Heart Valve Hemodynamic Plus (HP) Series
70 = St. Jude Medical Masters Series Hemodynamic Plus Valve with FlexCuff Sewing Ring
71 = St. Jude Medical Regent Valve
14 = Starr-Edwards Caged-Ball Prosthesis
15 = Ultracor Mechanical Prosthesis
133 = Medtronic Hall Conduit

Bioprosthesis

108 = ATS 3f Aortic Bioprosthesis
72 = Edwards Prima Stentless Porcine Bioprosthesis - Subcoronary
73 = Edwards Prima Stentless Porcine Bioprosthesis - Root
19 = Biocor Porcine Bioprosthesis
74 = Biocor Stentless Porcine Bioprosthesis - Subcoronary
75 = Biocor Stentless Porcine Bioprosthesis - Root
21 = CarboMedics PhotoFix Pericardial Bioprosthesis
76 = Carpentier-Edwards Porcine Bioprosthesis
77 = Edwards Prima Plus Stentless Porcine Bioprosthesis - Subcoronary
78 = Edwards Prima Plus Stentless Porcine Bioprosthesis - Root
22 = Carpentier-Edwards PERIMOUNT Pericardial Bioprosthesis
85 = Medtronic Contegra Bovine Jugular Bioprosthesis
37 = Mitroflow Pericardial Bioprosthesis
39 = St. Jude Medical Toronto SPV Stentless Porcine Bioprosthesis
40 = St. Jude Medical-Bioimplant Porcine Bioprosthesis
86 = St. Jude Medical Biocor Stented Tissue Valve
87 = St. Jude Medical Epic Stented Porcine Bioprosthesis
88 = St. Jude Medical Toronto Root Stentless Porcine Bioprosthesis
38 = Sorin Pericarbon Stentless Pericardial Bioprosthesis
111 = Carpentier-Edwards PERIMOUNT MAGNA Pericardial Bioprosthesis with Carpentier-Edwards Thermafix Tissue Process
112 = Carpentier-Edwards PERIMOUNT Theon RSR Pericardial

103 = Carpentier-Edwards PERIMOUNT Pericardial Magna Bioprosthesis
23 = Carpentier-Edwards Standard Porcine Bioprosthesis
25 = Carpentier-Edwards Supra-Annular Aortic Porcine Bioprosthesis
79 = Cryolife O'Brien Stentless Porcine Bioprosthesis - Subcoronary
80 = Cryolife O'Brien Stentless Porcine Bioprosthesis - Root
55 = Hancock Standard Porcine Bioprosthesis
28 = Hancock II Porcine Bioprosthesis
29 = Hancock Modified Orifice Porcine Bioprosthesis
30 = Ionescu-Shiley Pericardial Bioprosthesis
31 = Labcor Stented Porcine Bioprosthesis
81 = Labcor Stentless Porcine Bioprosthesis - Subcoronary
82 = Labcor Stentless Porcine Bioprosthesis - Root
83 = Medtronic Freestyle Stentless Porcine Bioprosthesis - Subcoronary
84 = Medtronic Freestyle Stentless Porcine Bioprosthesis - Root
35 = Medtronic Intact Porcine Bioprosthesis
36 = Medtronic Mosaic Porcine Bioprosthesis
Bioprosthesis
113 = Carpentier-Edwards PERIMOUNT RSR Pericardial Bioprosthesis
114 = Carpentier-Edwards PERIMOUNT Theon Pericardial Bioprosthesis
115 = Carpentier-Edwards S.A.V. Porcine Bioprosthesis
116 = Edwards Prima Plus Stentless Bioprosthesis
117 = Carpentier-Edwards PERIMOUNT Plus Pericardial Bioprosthesis with Tricentrix Holder
118 = Carpentier-Edwards Duraflex Low Pressure Porcine Bioprosthesis
119 = Carpentier-Edwards Duraflex Low Pressure ESR Porcine Bioprosthesis
120 = Carpentier-Edwards PERIMOUNT Theon Pericardial Bioprosthesis with Tricentrix Holder.
121 = St. Jude Medical Biocor Supra Stented Porcine Bioprosthesis
122 = St. Jude Medical Epic Supra Stented Porcine Bioprosthesis.
134 = Carpentier Edwards Physio II
135 = Carpentier Edwards Perimount Magna Mitral Valve

Homograft

89 = CryoLife Aortic Homograft
90 = CryoLife Pulmonary Homograft
91 = CryoLife CryoValve SG(Decellularized)Aortic Homograft
92 = CryoLife CryoValve SG Pulmonary Homograft
41 = Homograft Aortic - Subcoronary
42 = Homograft Aortic - Root
43 = Homograft Mitral
44 = Homograft Pulmonic Root
93 = LifeNet CV Allografts

Autograft

45 = Pulmonary Autograft to aortic root (Ross Procedure)

Ring - Annuloplasty

109 = ATS Simulus Flex-O Ring
94 = CarboMedics AnnuloFlo Ring
95 = CarboMedics AnnuloFlex Ring
96 = CarboMedics CardioFix Bovine Pericardium with PhotoFix Technology
46 = Carpentier-Edwards Classic Annuloplasty Ring
104 = Carpentier-Edwards Geoform Ring
105 = Carpentier-Edwards IMR Etlogix Ring
47 = Carpentier-Edwards Physio Annuloplasty System Ring
48 = Cosgrove-Edwards Annuloplasty System Ring
97 = Edwards MC³ Tricuspid Annuloplasty System
98 = Genesee Sculptor Annuloplasty Ring
49 = Medtronic Sculptor Ring
50 = Medtronic-Duran AnCore Ring
51 = Sorin-Puig-Messana Ring
52 = St. Jude Medical Séguin Annuloplasty Ring.
106 = St. Jude Medical Rigid Saddle Ring
99 = St. Jude Medical Tailor Annuloplasty Ring
123 = ATS Simulus Flexible Annuloplasty ring.
124 = ATS Simulus Semi-Rigid Annuloplasty ring
125 = Carpentier-Edwards Classic Annuloplasty Ring with Duraflo Treatment
126 = Carpentier-Edwards Physio Annuloplasty Ring with Duraflo Treatment
127 = Cosgrove-Edwards Annuloplasty System with Duraflo Treatment
128 = Myxo Etlogix Annuloplasty Ring
131 = Sorin Memo 3D Ring
132 = UNIRING, Universal Annuloplasty System
137 = Medtronic Colvin Galloway Future Ring
138 = Medtronic Profile 3D Ring

Band - Annuloplasty

100 = Medtronic Colvin Galloway Future Band
101 = Medtronic Duran Band
102 = Medtronic Duran - Ancore Band
107 = St. Jude Medical Tailor Annuloplasty Band
110 = ATS Simulus Flex-C Band

Other

777 = Other

VAD Implanted or Removed: ☐ No ☐ Yes, implanted ☐ Yes, explanted ☐ Yes, implanted and explanted (If "Yes" complete Section L)
VADProc (2480)

Other Cardiac Procedure: ☐ Yes ☐ No (If "Yes" complete Section M)
OpOCard (2490)

Other Non-Cardiac Procedure: ☐ Yes ☐ No (If "Yes" complete Section N)
OpONCard (2500)

Unplanned Procedure: UnplProc (2501)
☐ No
☐ Yes, unsuspected patient disease or anatomy
☐ Yes, surgical complication
(If Yes ↓)

Unplanned CABG: ☐ Yes ☐ No UnplCABG (2502)
Unplanned Aortic Valve Procedure: ☐ Yes ☐ No UnplAV (2503)
Unplanned Mitral Valve Procedure: ☐ Yes ☐ No UnplMV (2504)
Unplanned Aorta Procedure: ☐ Yes ☐ No UnplAo (2505)
Unplanned VAD Insertion: ☐ Yes ☐ No UnplVAD (2506)
Unplanned Other Procedure: ☐ Yes ☐ No UnplOth (2507)

Enter up to 10 CPT-1 Codes pertaining to the surgery for which the data collection form was initiated:

1. _____	2. _____	3. _____	4. _____	5. _____	6. _____	7. _____	8. _____	9. _____	10. _____
CPT1Code1 (2510)	CPT1Code2 (2520)	CPT1Code3 (2530)	CPT1Code4 (2540)	CPT1Code5 (2550)	CPT1Code6 (2560)	CPT1Code7 (2570)	CPT1Code8 (2580)	CPT1Code9 (2590)	CPT1Code10 (2600)

OR Entry Date And Time: OREntryDT (2610) __ __/__ __/__ __ __ __ __ __: __ __ mm/dd/yyyy hh:mm - 24 hr clock)
OR Exit Date And Time: ORExitDT (2620) __ __/__ __/__ __ __ __ __ __: __ __ (mm/dd/yyyy hh:mm - 24 hr clock)
Initial Intubation Date and Time: IntubateDT (2670) __ __/__ __/__ __ __ __ __ __: __ __ (mm/dd/yyyy hh:mm - 24 hr clock)
Initial Extubation Date and Time: ExtubateDT (2680) __ __/__ __/__ __ __ __ __ __: __ __ (mm/dd/yyyy hh:mm - 24 hr clock)
Skin Incision Start Date and Time: SIStartDT (2690) __ __/__ __/__ __ __ __ __ __: __ __ (mm/dd/yyyy hh:mm - 24 hr clock)
Skin Incision Stop Date and Time: SIStopDT (2700) __ __/__ __/__ __ __ __ __ __: __ __ (mm/dd/yyyy hh:mm - 24 hr clock)

Appropriate Antibiotic Selection:	Appropriate Antibiotic Administration Timing:	Appropriate Antibiotic Discontinuation:
☐ Yes ☐ No ☐ Exclusion	☐ Yes ☐ No ☐ Exclusion	☐ Yes ☐ No ☐ Exclusion
AbxSelect (2710)	AbxTiming (2720)	AbxDisc (2730)

CPB Utilization: CPBUtil (2740)
☐ None
☐ Combination
(If Combination ↓)
Combination Plan: ☐ Planned

CPBCmb (2750) ☐ Unplanned

(If Unplanned↓)
Reason: CPBCmbR (2760)
☐ Exposure/visualization
☐ Bleeding
☐ Inadequate size and/or diffuse disease of distal vessel
☐ Hemodynamic instability (hypotension/arrhythmias)
☐ Conduit quality and/or trauma
☐ Other

☐ Full

(If "Combination" or "Full"↓)
Cardiopulmonary Bypass Time (minutes): _____ PerfusTm (2770)
Lowest Temperature (°C): _____ LwstTemp (2780)
Lowest Hematocrit : _____ LwstHct (2790)
Arterial Cannulation Site:

(Select all that apply→)				
	Aortic	☐ Yes ☐ No CanArtStAort (2851)	Axillary	☐ Yes ☐ No CanArtStAx (2853)
	Femoral	☐ Yes ☐ No CanArtStFem (2852)	Other	☐ Yes ☐ No CanArtStOth (2854)

Venous Cannulation Site:

(Select all that apply→)				
	Femoral	☐ Yes ☐ No CanVenStFem (2856)	Pulmonary Vein	☐ Yes ☐ No CanVenStPulm (2861)
	Jugular	☐ Yes ☐ No CanVenStJug (2857)	Caval/Bicaval	☐ Yes ☐ No CanVenStBi (2862)
	Right Atrial	☐ Yes ☐ No CanVenStRtA (2858)	Other	☐ Yes ☐ No CanVenStOth (2863)
	Left Atrial	☐ Yes ☐ No CanVenStLfA (2859)		

Circulatory Arrest: ☐ Yes ☐ No (If Yes↓) CircArr (2865)
Circulatory Arrest Without Cerebral Perfusion Time: _____ (min) DHCATm (2866)
Circulatory Arrest With Cerebral Perfusion: ☐ Yes ☐ No CPerfUtil (2867)
(If Yes→) Cerebral Perfusion Time: _____ (min) CPerfTime (2868)
Cerebral Perfusion Type: ☐ Antegrade ☐ Retrograde ☐ Both antegrade and retrograde CPerfTyp (2869)

Aortic Occlusion: AortOccl (2870)
☐ None - beating heart
☐ None - fibrillating heart
☐ Aortic Crossclamp (If "Aortic crossclamp" or "Balloon occlusion" →): Cross Clamp Time: _____ (min) XClampTm (2880)
☐ Balloon Occlusion

Cardioplegia Delivery: CplegiaDeliv (2900) ☐ None ☐ Antegrade ☐ Retrograde ☐Both
(If "Antegrade", "Retrograde" or "Both"→) Type of cardioplegia used: ☐ Blood ☐ Crystalloid ☐ Both ☐ Other CplegiaType (2901)

Cerebral Oximetry Used: ☐ Yes ☐ No (If Yes↓) CerOxUsed (2930)

Pre-Induction Baseline Regional Oxygen Saturation:	Left: _____ (%) PreRSO2Lft (2940)	Right: _____ (%) PreRSO2Rt (2950)
Cumulative Saturation Below Threshold:	Left: _____ (min -%) CumulSatLft (2960)	Right: _____ (min -%) CumulSatRt (2970)
Cerebral Oximeter Provided First Indication:	☐ Yes ☐ No COFirstInd (2980)	
Skin Closure Regional Oxygen Saturation:	Left: _____ (%) SCRSO2Lft (2990)	Right: _____ (%) SCRSO2Rt (3000)

Concentric Calcification: ☐ Yes ☐ No ConCalc (3005)
Echo Assessment of Ascending Aorta/Arch: ☐ Yes ☐ No (If Yes ↓) AsmtAscAA (3010)
Assessment of Aorta Disease: AsmtAoDx (3020)
☐ Normal Aorta
☐ Protruding Atheroma < 5 mm
☐ Mobile plaques
☐ Extensive intimal thickening
☐ Protruding Atheroma >= 5 mm
☐ Not documented
Assessment Altered Plan: ☐ Yes ☐ No AsmtAPln (3030)

Intraop Blood Products Used: ☐ Yes ☐ No IBldProd (3040)

(If No →) Intraop Blood Products Refused: ☐ Yes ☐ No IBldProdRef (3050)

(If Yes →)
Red Blood Cell Units: _____ IBdRBCU (3060)
Fresh Frozen Plasma Units: _____ IBdFFPU (3070)
Cryoprecipitate Units: _____ IBdCryoU (3080)
Platelet Units: _____ IBdPlatU (3090)
Factor VIIa: _____ IBdFactorVII (3091)

Intraop Antifibrinolytic Medications: Epsilon Amino-Caproic Acid: ☐ Yes ☐ No IMedEACA (3120) Tranexamic Acid: ☐ Yes ☐ No IMedTran (3140)

Intraoperative TEE Performed post procedure: ☐ Yes ☐ No (If Yes ↓) InOpTEE (3157)
Highest level aortic insufficiency found: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe PRepAR (3158)
Highest level mitral insufficiency found: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe PRepMR (3159)
Highest level tricuspid insufficiency found: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe PRepTR (3161)

J. Coronary Bypass

(If OpCAB = Yes ↓)

Hybrid Procedure CAB and PCI Performed: ☐ Yes ☐ No (If Yes ↓) CABHybrPCI (3165)
Status: ☐ Planned - concurrent ☐ Planned - staged ☐ Unplanned HybrStat (3170)
PCI Procedure Performed: ☐ Angioplasty ☐ Stent HybrProc (3180)

Number of Distal Anastomoses with Arterial Conduits: _____ DistArt (3190)

Number of Distal Anastomoses with Venous Conduits: _____(If >0 ↓) DistVein (3200)
Vein Harvest Technique: ☐ Endoscopic ☐ Direct Vision (open) ☐ Both ☐ Cryopreserved DistVeinHTech (3205)
(If "Endoscopic", "Direct Vision (open)" or "Both"→) Saphenous Vein Harvest Time: _____ (minutes) SaphHrvstT (3206)
Saphenous Vein Preparation Time: _____ (minutes) SaphPrepT (3207)

Internal Mammary Artery used for Grafts: ☐ Left IMA ☐ Right IMA ☐ Both IMAs ☐ No IMA IMAArtUs (3210)

(If No IMA→) Indicate **Primary** Reason: NoIMARsn (3220)
☐ The IMA is not a suitable conduit due to size or flow
☐ Subclavian stenosis
☐ Previous cardiac or thoracic surgery
☐ Previous mediastinal radiation
☐ Emergent or salvage procedure
☐ No LAD disease

(If Left, Right or Both IMAs→) Total # of Distal Anastomoses done using IMA grafts: _____ NumIMADA (3230)
IMA Harvest Technique: IMATechn (3240)
☐ Direct Vision (open) ☐ Thoracoscopy
☐ Combination ☐ Robotic Assist

Number of Radial Arteries Used for Grafts: _____ (If >0 ↓) NumRadArtUs (3260)
Number of Radial Artery Distal Anastomoses : _____ NumRadDA (3270)
Radial Distal Anastomoses Harvest Technique: ☐ Endoscopic ☐ Direct Vision (open) ☐ Both RadHTech (3280)
Radial Artery Harvest Time: _____ (minutes) RadHrvstT (3285)
Radial Artery Preparation Time: _____ (minutes) RadPrepT (3286)

Number Other Arterial Distal Anastomoses Used (other than radial or IMA): _____ NumOArtD (3300)

Native Coronary Disease Location Key:

1 = Left Main	4 = Distal LAD	7 = Circumflex	10 = OM 3	13 = PLB
2 = Prox LAD	5 = Diagonal 1	8 = OM 1	11 = RCA	14 = AM branches
3 = Mid LAD	6 = Diagonal 2	9 = OM 2	12 = PDA	15 = Ramus

For each question, check the one choice that applies for each graft:

CABG NUMBER		1	2	3	4	5	6	7	8	9	10
GRAFT DONE	Yes CAB[02 -10]	NA	3440	3530	3620	3710	3800	3890	3980	4070	4160
	No										
NATIVE CORONARY DISEASE LOCATION (See key above) CABDisLoc[01-10]		3355	3445	3535	3625	3715	3805	3895	3985	4075	4165
HIGHEST PERCENT STENOSIS IN NATIVE VESSEL CABPctSten[01-10]		3356	3446	3536	3626	3716	3806	3896	3986	4076	4166
PREVIOUS CONDUIT	Yes - Diseased CABPrevCon[01-10]	3357	3447	3537	3627	3717	3807	3897	3987	4077	4167
	Yes - No disease										
	No previous conduit										
PROXIMAL SITE	In Situ Mammary CABProximalSite[01-10]	3360	3450	3540	3630	3720	3810	3900	3990	4080	4170
	Ascending aorta										
	Descending aorta										
	Subclavian artery										
	Innominate artery										
	T-graft off SVG										
	T-graft off Radial										
	T-graft off LIMA										
	T-graft off RIMA										
PROXIMAL TECHNIQUE	In Situ Mammary CABProxTech[01-10]	3370	3460	3550	3640	3730	3820	3910	4000	4090	4180
	Running										
	Interrupted										
	Anastomotic Device										
	Anastomotic Assist Device										
CONDUIT	Vein graft CABConduit[01-10]	3380	3470	3560	3650	3740	3830	3920	4010	4100	4190
	In Situ LIMA										
	In Situ RIMA										
	Free IMA										
	Radial artery										
	Other arteries, homograft										
DISTAL INSERTION SITE	Right Coronary (RCA) CABDistSite[01-10]	3390	3480	3570	3660	3750	3840	3930	4020	4110	4200
	Acute Marginal (AM)										
	Posterior Descending Artery (PDA)										
	Posterolateral Branch (PLB)										
	Proximal LAD										
	Mid LAD										
	Distal LAD										
	Diagonal 1										
	Diagonal 2										
	Ramus										
	Obtuse Marginal 1										
	Obtuse Marginal 2										
	Obtuse Marginal 3										
	Other										
DISTAL TECHNIQUE	Running CABDistTech[01-10]	3400	3490	3580	3670	3760	3850	3940	4030	4120	4210
	Interrupted										
	Clips										
	Anastomotic device										
DISTAL POSITION	End to Side CABDistPos[01-10]	3410	3500	3590	3680	3770	3860	3950	4040	4130	4220
	Sequential (side to side)										
ENDARTERECTOMY	YesCABEndArt[01-10]	3420	3510	3600	3690	3780	3870	3960	4050	4140	4230
	No										
HYBRID	No CABHyPCI[01-10]	3430	3520	3610	3700	3790	3880	3970	4060	4150	4240
	Angioplasty										

	Stent										

K. Valve Surgery

(If Valve Surgery=Yes ↓)

Aortic Valve Procedure Performed: ☐ Yes ☐ No VSAV (4270)

(If Yes ↓)

Procedure Performed:

VSAVPr (4280):

- ☐ Replacement
- ☐ Repair / Reconstruction

(If Repair / Reconstruction ↓)

Primary Repair Type: (Select all that apply)

Commissural Annuloplasty VSAVRComA (4282)	☐ Yes ☐ No	Ring Annuloplasty VSAVRRingA (4283)	☐ Yes ☐ No
Leaflet plication VSAVRLPlic (4284)	☐ Yes ☐ No	Leaflet resection suture VSAVRLResect (4285)	☐ Yes ☐ No
Leaflet free edge reinforcement (PTFE) VSAVRPTFE (4286)	☐ Yes ☐ No	Leaflet pericardial patch VSAVRLPPatch (4287)	☐ Yes ☐ No
Leaflet commissural resuspension suture VSAVRComRS (4288)	☐ Yes ☐ No	Leaflet debridement VSAVRDeb (4289)	☐ Yes ☐ No
Division of fused leaflet raphe VSAVRRaphe (4290)	☐ Yes ☐ No		

- ☐ Root Reconstruction with valved conduit
- ☐ Replacement and insertion aortic non-valved conduit
- ☐ Resuspension AV without replacement of ascending aorta
- ☐ Resuspension AV with replacement of ascending aorta
- ☐ Apico-aortic conduit (Aortic valve bypass)
- ☐ Autograft with pulmonary valve-Ross procedure
- ☐ Homograft
- ☐ Valve sparing root reimplantation (David)
- ☐ Valve sparing root remodeling (Yacoub)

Transcatheter Valve Replacement: ☐ Yes ☐ No VSTCV (4295)

(If Yes →) Replacement approach: ☐ Transapical ☐ Transaxillary ☐ Transfemoral VSTCVR (4300)

Aortic Annular Enlargement: ☐ Yes ☐ No AnlrEnl (4310)

Resection of sub-aortic stenosis: ☐ Yes ☐ No ResectSubA (4311)

Implant Model Number :_____ Size: _____

VSAoIm (4330) VSAoImSz (4340)

Mitral Valve Procedure Performed: ☐ Yes ☐ No VSMV (4351)

(If Yes ↓)

Procedure Performed: VSMVPr (4352)

☐ Repair

(If Repair→) Repair Type: (Select all that apply↓)

Annuloplasty VSMitRAnnulo (4361)	☐ Yes ☐ No	
Leaflet Resection VSMitRLeafRes (4362)	☐ Yes ☐ No	(If Yes↓) Resection Type: ☐ Triangular ☐ Quadrangular ☐ Other VSLeafResTyp (4380) Location: ☐ Anterior ☐ Posterior ☐ Both Anterior and Posterior VSLeafRepLoc (4390)
Sliding Plasty VSMitRSlidP (4391)	☐ Yes ☐ No	
Annular decalcification VSMitRADecalc (4393)	☐ Yes ☐ No	
Neochords (PTFE) VSMitRPTFE (4394)	☐ Yes ☐ No	(If Yes ↓) Number of neochords inserted: _____ VSNeoChNum (4400)
Chordal /Leaflet transfer VSMitRChord (4401)	☐ Yes ☐ No	
Leaflet extension/replacement/patch VSMitRLeafERP (4402)	☐ Yes ☐ No	
Edge to Edge Repair VSMitREdge (4403)	☐ Yes ☐ No	
Mitral commissurotomy VSMitRMitComm (4404)	☐ Yes ☐ No	

☐ Replacement (If Replacement→) Repair attempted prior to Mitral Valve Replacement: ☐ Yes ☐ No MitralIntent (4410)

Implant Model Number:_____ Size: _____

VSMiIm (4430) VSMiImSz (4440)

Mitral Chords Preserved: ☐ None ☐Anterior ☐ Posterior ☐ Both VSChorPres (4450)

Tricuspid Valve Procedure Performed: OpTricus (4500)

☐ No
☐ Annuloplasty only
☐ Replacement

(If "Annuloplasty only" OR "Reconstruction with Annuloplasty" ↓)
Type of Annuloplasty: ☐ Pericardium ☐Suture ☐ Prosthetic Ring
OpTricusAnTy (4510)

☐ Reconstruction with Annuloplasty
☐ Reconstruction without Annuloplasty
☐ Valvectomy

Implant Model Number:_____ Size: _____
VSTrIm (4540) VSTrImSz (4550)

Pulmonic Valve Procedure Performed: OpPulm (4560)

☐ No
☐ Replacement
☐ Reconstruction
☐ Valvectomy

Implant Model Number:_____ Size: _____
VSPulm (4580) VSPulmSz (4590)

L. Mechanical Cardiac Assist Devices

Intra Aortic Balloon Pump (IABP): ☐ Yes ☐ No (If Yes ↓) IABP (4610)
IABP Insertion: ☐ Preop ☐ Intraop ☐ Postop IABPWhen (4620)
Primary Reason for Insertion: ☐ Hemodyn Instability ☐ PTCA Support ☐ Unstable Angina ☐ CPB Weaning Failure ☐ Prophylactic
IABPInd (4630)
Date IABP Removed: __ __/__ __/ __ __ __ __ (mm/dd/yyyy)
IABPRemDt (4640)

Catheter Based Assist Device Used: ☐ Yes ☐ No (If Yes ↓) CathBasAssist (4660)
Device: ☐ Impella ☐ Tandem Heart ☐ Other CathBasAssistDev (4670)
When Inserted: ☐ Preop ☐ Intraop ☐ Postop CathBasAssistWhen (4690)
Primary Reason for Insertion: ☐ Hemodynamic instability ☐ CPB weaning failure ☐ PCI failure ☐ Other CathBasAssistInd (4700)
Date Device Removed: __ __/__ __/ __ __ __ __ (mm/dd/yyyy)
CathBasAssistRemDt (4710)

Extracorporeal Membrane Oxygenation (ECMO): ☐ Yes ☐ No (If Yes ↓) ECMO (4730)
ECMO Initiated: ☐ Preop ☐ Intraop ☐ Postop ☐ Non-operative ECMOWhen (4740)
Clinical Indication for ECMO Placement: ☐ Cardiac Failure ☐ Respiratory Failure ☐ Hypothermia ☐ Rescue/salvage
ECMOInd (4750)

Previous VAD: ☐ Yes ☐ No (If Yes ↓) PrevVAD (4760)
Implanted at another facility: ☐ Yes ☐ No PrevVADF (4770)
Prev VAD Insertion Date: __ __ / __ __ / __ __ __ __ (mm/dd/yyyy) PrevVADD (4771)
Prev VAD Indication: ☐Bridge to Transplantation ☐ Bridge to Recovery ☐ Destination ☐ Post Cardiotomy Ventricular failure
PrevVADIn (4772) ☐ Device Malfunction ☐ End of Life
Prev VAD Type: ☐ RVAD ☐ LVAD ☐ BiVAD ☐ TAH PrevVADTy (4773)
Prev VAD Device: _____ (refer to current "On-Demand Device Lists" document) PrevVADDevice (4774)

(If VAD Implanted or Removed↓)

References to "Initial VAD" refer to the initial VAD for this hospitalization, not a VAD placed during a previous hospitalization.

VAD Implant Type: **Right VAD (RVAD)** **Left VAD (LVAD)** **Biventricular VAD (BiVAD)** **Total Artificial Heart (TAH)**

VAD Device: (refer to current "On-Demand Device Lists" document)

Explant Reason: **1. Cardiac Transplant 2. Recovery 3. Device Transfer 4. Device-Related Infection 5. Device Malfunction 6. End of Life**

Indication for this VAD: ☐ Bridge to Transplantation ☐ Bridge to Recovery ☐ Destination
VADInd (4790) ☐ Postcardiotomy Ventricular Failure ☐ Device Malfunction ☐ End of Life

Initial Implant Data

Implant Type	VAD Device	Implant Date	Explant	Explant Date	Explant Reason	Transplant Date
_____	_____	___ / __ / _____ mm dd yyyy	☐ Yes ☐ No	___ / __ / _____ mm dd yyyy	_____	___ / __ / _____ mm dd yyyy
VImpTy (4850)	VProdTy (4880)	VImpDt (4890)	VExp (4900)	VExpDt (4910)	VExpRsn (4920)	VTxDt (4930)

Additional Implant(s) Data

Second Device Implanted: ☐ Yes ☐ No (If Yes ↓) VImp2 (4940)

Implant Type#2	VAD Device #2	Implant Date#2	Explant#2	Explant Date#2	Explant Reason#2	Transplant Date#2
_____	_____	___ / __ / _____ mm dd yyyy	☐ Yes ☐ No	___ / __ / _____ mm dd yyyy	_____	___ / __ / _____ mm dd yyyy
VImpTy2 (4950)	VProdTy2 (4980)	VImpDt2 (4990)	VExp2 (5000)	VExpDt2 (5010)	VExpRsn2 (5020)	VTxDt2 (5030)

Third Device Implanted: ☐ Yes ☐ No (If Yes ↓) VImp3 (5040)

Implant Type#3	VAD Device #3	Implant Date#3	Explant#3	Explant Date#3	Explant Reason#3	Transplant Date#3
_____	_____	___ / __ / _____ mm dd yyyy	☐ Yes ☐ No	___ / __ / _____ mm dd yyyy	_____	___ / __ / _____ mm dd yyyy
VImpTy3 (5050)	VProdTy3 (5080)	VImpDt3 (5090)	VExp3 (5100)	VExpDt3 (5110)	VExpRsn3 (5120)	VTxDt3 (5130)

Primary VAD Complications Data:

Intracranial Bleed ☐ Yes ☐ No
PVCmpBld (5140)

Embolic Stroke ☐ Yes ☐ No
PVCmpESt (5150)

Driveline and/or cannula Infection ☐ Yes ☐ No
PVCmpDCI (5160)

Pump Pocket Infection ☐ Yes ☐ No
PVCmpPPI (5170)

Endocarditis ☐ Yes ☐ No
PVCmpEnd (5180)

Device Malfunction ☐ Yes ☐ No
PVCmpMal (5190)

Hemolysis ☐ Yes ☐ No
PVCmpHem (5191)

Bowel Obstruction ☐ Yes ☐ No
PVCmpBO (5200)

Additional Complications (not specific to initial VAD as above) to be collected in Postoperative Events section.

VAD Discharge Status: ☐ With VAD ☐ Without VAD ☐ Expired in Hospital
VADDiscS (5210)

M. Other Cardiac Procedure

(If Other Card = Yes ↓)

Left Ventricular Aneurysm Repair: ☐ Yes ☐ No OCarLVA (5220)

Ventricular Septal Defect Repair: ☐ Yes ☐ No OCarVSD (5230)

Atrial Septal Defect Repair: ☐ Yes ☐ No OCarASD (5240)
(If Yes →) ASD Type: ☐ Secundum ☐ Sinus Venosus ☐ PFO OCarASDTy (5241)

Surgical Ventricular Restoration: ☐ Yes ☐ No OCarSVR (5290)

Congenital Defect Repair: ☐ Yes ☐ No (If Yes ↓) OCarCong (5300)

Congenital Diagnoses: Select up to three most significant diagnoses: (refer to "Congenital Diagnoses/Procedures List" document)
Diagnosis 1: _____ Diagnosis 2: _____ Diagnosis 3: _____
OCarCongDiag1 (5310) OCarCongDiag2 (5320) OCarCongDiag3 (5330)
Congenital Procedures: Select up to three most significant: (refer to "Congenital Diagnoses/Procedures List" document)
Procedure 1: _____ Procedure 2: _____ Procedure 3: _____
OCarCongProc1 (5340) OCarCongProc2 (5350) OCarCongProc3 (5360)

Transmyocardial Laser Re-vascularization (TMR): ☐ Yes ☐ No OCarLasr (5370)

Cardiac Trauma: ☐ Yes ☐ No OCarTrma (5380)

Cardiac Transplant: ☐ Yes ☐ No OCarCrTx (5390)

Arrhythmia Correction Surgery: ☐ None ☐ Permanent Pacemaker
OCarACD (5400) ☐ Permanent Pacemaker with Cardiac Resynchronization Technique (CRT)
☐ Implantable Cardioverter Defibrillator (ICD) ☐ ICD with CRT
(If not None →) Arrhythmia Correction Surgery Lead Insertion or Replacement: ☐ Yes ☐ No OCarACDLI (5410)

Arrhythmia Correction Surgery Lead Extraction: ☐ Yes ☐ No OCarACDLE (5430)

Atrial Fibrillation Surgical Procedure: ☐ Yes ☐ No OCarAFibSur (5450)
(If Yes →) Surgical Procedure Location: ☐ Biatrial ☐ Left atrial only ☐ Right atrial only OCarAFibSurLoc (5451)
Left Atrial Appendage Obliterated ☐ Yes ☐ No OCarAFibSurLAA (5452)
Method of Lesion Creation: (Select all that apply↓)

Radio frequency	☐ Yes ☐ No OCarAFibMethRad (5455)	Cryo	☐ Yes ☐ No OCarAFibMethCryo (5457)	Laser	☐ Yes ☐ No OCarAFibMethLas (5459)
Ultrasound	☐ Yes ☐ No OCarAFibMethUltra (5456)	Microwave	☐ Yes ☐ No OCarAFibMethMicro (5458)	Cut-and-sew	☐ Yes ☐ No OCarAFibMethCAS (5460)

Atrial Fibrillation Ablation Procedure: OCarAFibAProc (5465)
☐ Primarily epicardial procedure (e.g., pulmonary vein isolation with or without connection to left atrial appendage).
☐ Primarily intracardiac procedure (e.g., Maze procedures; lesions to mitral annulus; etc.)

Aortic Procedure Type: OCAoProcType (5471)

	☐ None	
	☐ Aneurysm	(If Aneurysm ↓) Aortic Root: ☐ Yes ☐ No ONCAoRt (5473) (If Yes →) Dacron graft used: ☐ Yes ☐ No ONCAoGraft (5474) Repair of ascending aortic aneurysm: ☐ Yes ☐ No ONCAsc (5480) Repair of aneurysm in the arch of the aorta: ☐ Yes ☐ No ONCArch (5490) (If Yes →) Extent of repair: ☐ Hemi-arch ☐ Total arch ONCArchRepExt (5491) Repair of a descending aortic aneurysm: ☐ Yes ☐ No ONCDesc (5500) Repair of a thoracoabdominal aneurysm: ☐ Yes ☐ No ONCThAbd (5510) (If Yes →) Graft replacement used: ☐ Yes ☐ No ONCThAbdGraft (5511) (If Yes →) Intercostal vessels re-implanted: ☐ Yes ☐ No ONCThAbdInterVes (5512) CSF drainage utilized: ☐ Yes ☐ No ONCThAbdLumCSF (5513) Extent of descending aorta replacement: ONCThAbdExtent (5514) ☐ Proximal ☐ Mid ☐ Distal ☐ Proximal - Mid ☐ Proximal - Mid - Distal ☐ Mid - Distal
	☐ Dissection (including intramural hematoma) ☐ Trauma ☐ Coarctation ☐ Other	(If Disection ↓) Aortic dissection is acute: ☐ Yes ☐ No AoDisAc (5516) Dissection type: ☐ Stanford Type A ☐ Stanford Type B AoDisTyp (5517) (If Trauma →) Aortic Trauma type: ☐ Blunt ☐ Penetrating AoTrTyp (5518)
Endovascular Procedure (TEVAR): ☐ Yes ☐ No EndoProc (5520) (If Yes →)Endovascular Debranching: ☐ Yes ☐ No EndoProcDeb (5521)		
Tumor Resection: ☐ None ☐ Myxoma ☐ Fibroelastoma ☐ Hypernephroma ☐ Sarcoma ☐ Other OCTumor (5530)		
Pulmonary Thromboembolectomy: ☐ None ☐ Yes, Acute ☐ Yes, Chronic OCPulThromDis (5540)		
Other: ☐ Yes ☐ No OCarOthr (5550)		

N. Other Non Cardiac Procedures

(If Other Non-Card = Yes ↓)

Carotid Endarterectomy: ☐ Yes ☐ No ONCCarEn (5560)

Other Vascular: ☐ Yes ☐ No ONCOVasc (5570)

Other Thoracic: ☐ Yes ☐ No ONCOThor (5580)

Other: ☐ Yes ☐ No ONCOther (5590)

O. Post Operative

Postoperative Creatinine Level: _____ PostCreat (5610)

Blood Products Used Postoperatively: ☐ Yes ☐ No (If Yes ↓) BldProd (5620)

Red Blood Cell Units: _____ BdRBCU (5630) Fresh Frozen Plasma Units: _____ BdFFPU (5640) Cryoprecipitate Units: _____ BdCryoU (5650) Platelet Units: _____ BdPlatU (5660)

Extubated in OR: ☐ Yes ☐ No ExtubOR (5670)

Re-intubated During Hospital Stay: ☐ Yes ☐ No (If yes →) Additional Hours Ventilated: _____
ReIntub (5680) VentHrsA (5690)

ICU Visit: ☐ Yes ☐ No ICUVisit (5700) (If Yes →) Initial ICU Hours: _____ ICUInHrs (5710)

Readmission to ICU: ☐ Yes ☐ No ICUReadm (5720) (If Yes →) Additional ICU Hours: _____ ICUAdHrs (5730)

Post Op Echo Performed: ☐ Yes ☐ No (If Yes ↓) POpTTEch (5744)
Highest level aortic insufficiency found: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe POpTTAR (5745)
Highest level mitral insufficiency found: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe POpTTMR (5746)
Highest level tricuspid insufficiency found: ☐ None ☐ Trace/trivial ☐ Mild ☐ Moderate ☐ Severe POpTTTR (5747)

Post Op Ejection Fraction Done: ☐ Yes ☐ No (If Yes ↓) POpEFD (5748)
Post Op Ejection Fraction: _____ (%) POpEF (5749)

Cardiac Enzymes (biomarkers) Drawn: ☐ Yes ☐ No (If Yes →) Peak CKMB: _____ Peak Troponin I _____ Peak Troponin T _____
POpEnzDrawn (5750) POpPkCKMB (5751) POpPkTrI (5752) POpPkTrT (5753)

12-Lead EKG Findings: ☐ Not performed ☐ No significant changes ☐ New Pathological Q-wave or LBBB POpEKG (5754)

Imaging Study Findings: POpImagStdy (5755)
☐ Not performed
☐ Angiographic evidence of new thrombosis or occlusion of graft or native coronary
☐ Imaging evidence of new loss of viable myocardium
☐ No evidence of new myocardial injury

P. Postoperative Events

In Hospital Postoperative Event Occurred: ☐ Yes ☐ No (If Yes ↓) Complics (5759)

Operative

ReOp for Bleeding /Tamponade: ☐ Yes ☐ No COpReBld (5760) (If Yes →) Bleed Timing: ☐ Acute ☐ Late COpReBldTim (5770)

ReOp for Valvular Dysfunction: ☐ Yes ☐ No COpReVlv (5780)

ReOp for Graft Occlusion: ☐ Yes ☐ No COpReGft (5790)
ReOp for Other Cardiac Reasons: ☐ Yes ☐ No COpReOth (5800)
ReOp for Other Non-Cardiac Reasons: ☐ Yes ☐ No COpReNon (5810)
Open chest with planned delayed sternal closure: ☐ Yes ☐ No COpPlndDelay (5811)
Sternotomy Issue: ☐ Yes ☐ No CSternal (5830) (If Yes →) Sternal instability/dehiscence (sterile): ☐ Yes ☐ No CSternalDehis (5840)

Infection (see CDC definitions in training manual)
Surgical Site Infection: ☐ Yes ☐ No (If Yes ↓)SurSInf (5841)
- Sternal Superficial Wound Infection: ☐ Yes ☐ No CSternalSupInf (5850)
- Deep Sternal Infection: ☐ Yes ☐ No CIStDeep (5860)
- Mediastinitis: ☐ Yes ☐ No (If Yes ↓) CSternalMedia (5870)
  - Diagnosis Date: __ __/ __ __/ __ __ __ __ (mm/dd/yyyy) CSternalMediaDtDiag (5880)
  - Secondary Procedure Open with Packing/Irrigation: ☐ Yes ☐ No CSternalMediaSPOpen (5890)
  - Secondary Procedure Wound Vac: ☐ Yes ☐ No CSternalMediaSPWVac (5900)
  - Secondary Procedure Muscle Flap: ☐ Yes ☐ No CSternalMediaSPMuscle (5910)
  - Secondary Procedure Omental Flap: ☐ Yes ☐ No CSternalMediaSPOmental (5920)
- Thoracotomy: ☐ Yes ☐ No CIThor (5930)
- Conduit Harvest or Cannulation Site: ☐ Yes ☐ No CILeg (5940)
- Wound Intervention - Open with Packing/Irrigation: ☐ Yes ☐ No WndIntOpen (5960)
- Wound Intervention - Wound Vac - ☐ Yes ☐ No WndIntWVac (5970)

Sepsis: ☐ Yes ☐ No CSepsis (6010) (If Yes →) Positive Blood Cultures: ☐ Yes ☐ No CSepsisPBC (6020)

Neurologic
Postoperative Stroke (Perm>24 hours): ☐ Yes ☐ No CNStrokP (6030)
Transient Ischemic Attack (TIA): ☐ Yes ☐ No CNStrokTTIA (6040)
Encephalopathy: ☐ None ☐ Anoxic ☐ Embolic ☐ Drug ☐ Metabolic ☐ Intracranial Bleeding ☐ Other CNComaEnceph (6070)
Paralysis: ☐ Yes ☐ No CNParal (6110) (If Yes →) Paralysis Type: ☐ Transient ☐ Permanent CNParalTy (6120)

Pulmonary
Prolonged Ventilation: ☐ Yes ☐ No CPVntLng (6130)
Pneumonia: ☐ Yes ☐ No CPPneum (6150)
Venous Thromboembolism - VTE: ☐ Yes ☐ No CVTE (6160) (If Yes ↓)
- Pulmonary Thromboembolism: ☐ Yes ☐ No PulmEmb (6170)
- Deep Venous Thrombosis: ☐ Yes ☐ No DVT (6180)

Pleural Effusion Requiring Drainage: ☐ Yes ☐ No CPlEff (6190)

Renal
Renal Failure: ☐ Yes ☐ No CRenFail (6200) (If Yes ↓)
- Dialysis (Newly Required): ☐ Yes ☐ No (If Yes →) Required after Hospital Discharge: ☐ Yes ☐ No CRenDial (6210) DialDur (6220)

Ultra Filtration Required: ☐ Yes ☐ No CUltraFil (6230)

Vascular
Iliac/Femoral Dissection: ☐ Yes ☐ No CVaIlFem (6240)
Acute Limb Ischemia: ☐ Yes ☐ No CVaLbIsc (6250)

Other
Rhythm Disturbance Requiring Permanent Device: ☐ Pacemaker ☐ ICD ☐ Pacemaker/ICD ☐ None CRhythmDis (6270)
Cardiac Arrest: ☐ Yes ☐ No COtArrst (6280)
Anticoagulant Event: ☐ Yes ☐ No COtCoag (6290)
Tamponade (Non-Surgical Intervention): ☐ Yes ☐ No COtTamp (6300)
Gastro-Intestinal Event: ☐ Yes ☐ No COtGI (6310)
Multi-System Failure: ☐ Yes ☐ No COtMSF (6320)
Atrial Fibrillation: ☐ Yes ☐ No COtAFib (6330)
Aortic Dissection: ☐ Yes ☐ No CVaAoDis (6340)
Recurrent Laryngeal Nerve Injury: ☐ Yes ☐ No RecLarynNrvInj (6341)
Phrenic Nerve Injury: ☐ Yes ☐ No PhrenNrvInj (6342)
Other: ☐ Yes ☐ No COtOther (6350)

Q. Mortality

Mortality: ☐ Yes ☐ No Mortalty (6360)	Discharge Status: ☐ Alive ☐ Dead MtDCStat (6370)	Status at 30 days After Surgery: ☐ Alive ☐ Dead ☐ Unknown Mt30Stat (6380)

Primary method used to verify 30-day status: Mt30StatMeth (6381)
☐ Phone call to patient or family ☐ Evidence of life in medical record ☐ Social Security Death Master File
☐ Letter from medical provider ☐ Office visit to surgeon >= 30 days after procedure ☐ Other

(If Mortality = Yes ↓)
Operative Death: ☐ Yes ☐ No MtOpD (6390)
Mortality - Date __ __/__ __/__ __ __ __ (mm/dd/yyyy) MtDate (6400)
Location of Death: ☐ OR During Initial Surgery ☐ Hospital (Other than OR) ☐ Home ☐ Extended Care Facility MtLocatn (6410) ☐ Hospice ☐ Acute Rehabilitation ☐ OR During Reoperation ☐ Unknown ☐ Other
Primary Cause of Death (select only one) MtCause (6420)
☐ Cardiac ☐ Neurologic ☐ Renal ☐ Vascular ☐ Infection ☐ Pulmonary ☐ Valvular ☐ Unknown ☐ Other

R. Discharge

(If Discharge Status = Alive↓)

ADP Inhibitors:	☐ Yes ☐ No DCADP (6430)
Antiarrhythmics:	☐ Yes ☐ No DCAArhy (6440)
Aspirin:	☐ Yes ☐ No ☐ Contraindicated DCASA (6460)
ACE or ARB Inhibitors:	☐ Yes ☐ No, contraindicated ☐ No, not indicated DCACE (6470)
Beta Blockers:	☐ Yes ☐ No ☐ Contraindicated DCBeta (6480)
Lipid Lowering:	☐ Yes ☐ No ☐ Contraindicated (If Yes →) ☐ Statin ☐ Non Statin ☐ Both ☐ Other DCLipid (6490) DCLipMT (6500)
Coumadin:	☐ Yes ☐ No DCCoum (6510)
Direct Thrombin Inhibitors:	☐ Yes ☐ No DCDirThromIn (6511)
Discharge Location: DisLoctn (6520)	☐ Home ☐ Extended Care/Transitional Care Unit/Rehab ☐ Other Hospital ☐ Nursing Home ☐ Hospice ☐Other
Cardiac Rehabilitation Referral:	☐ Yes ☐ No ☐ Not Applicable CardRef (6530)
Smoking Cessation Counseling:	☐ Yes ☐ No ☐ Not Applicable SmokCoun (6540)

S. Readmission

(If Discharge Status = Alive↓)

Readmit <=30 Days from Date of Procedure: ☐ Yes ☐ No (If Yes ↓) Readm30 (6550)

Readmit Primary Reason: ReadmRsn (6560)

- ☐ Anticoagulation Complication - Valvular
- ☐ Anticoagulation Complication - Pharmacological
- ☐ Arrhythmia/Heart Block
- ☐ Congestive Heart Failure
- ☐ Myocardial Infarction and/or Recurrent Angina
- ☐ Pericardial Effusion and/or Tamponade
- ☐ Pneumonia or other Respiratory Complication
- ☐ Coronary Artery Dysfunction
- ☐ Valve Dysfunction
- ☐ Infection - Deep Sternum / Mediastinitis
- ☐ Infection - Conduit Harvest Site
- ☐ Renal Failure
- ☐ TIA
- ☐ Permanent CVA
- ☐ Acute Vascular Complication
- ☐ Subacute Endocarditis
- ☐ VAD Complication
- ☐ Transplant Rejection
- ☐ PE
- ☐ DVT
- ☐ Other - Related Readmission
- ☐ Other - Nonrelated Readmission

Readmit Primary Procedure: ReadmPro (6570)

- ☐ OR for Bleeding
- ☐ Pacemaker Insertion / AICD
- ☐ PCI
- ☐ Pericardiotomy / Pericardiocentesis
- ☐ OR for Coronary Arteries
- ☐ OR for Valve
- ☐ OR for Sternal Debridement / Muscle Flap
- ☐ Dialysis
- ☐ OR for Vascular
- ☐ No Procedure Performed
- ☐ Other Procedure
- ☐ Unknown