ADULT CARDIAC SURGERY

in New York State

2015-2017

NEW YORK STATE | **Department of Health**

Members of the New York State Cardiac Advisory Committee

Chair

Spencer King III, M.D.
Professor of Medicine, Emeritus
Emory University School of Medicine
Atlanta, GA

Members

David Adams, M.D.
Cardiac Surgeon-in-Chief
Marie-Josée and Henry R. Kravis Professor and Chairman
Mount Sinai Health System
Icahn School of Medicine at Mount Sinai and The Mount Sinai Hospital
New York, NY

M. Hashmat Ashraf, M.D.
Chief, Department of Cardiothoracic Surgery
Kaleida Health
Buffalo, NY

Peter B. Berger, M.D.
Cardiology Consultant

Frederick Bierman, M.D.
Director of Graduate Medical Education
Westchester Medical Center
Valhalla, NY

Joanna Chikwe, M.D.
Professor and Chair
Department of Cardiac Surgery
Smith Heart Institute
Cedars-Sinai Medical Center
Los Angeles, CA

Jeptha Curtis, M.D.
Asst. Professor, Dept. of Internal Medicine (Cardiology)
Director, Outcomes Research & Evaluation Data Analytic Center
Yale University School of Medicine
Yale-New Haven Hospital Center
New Haven, CT

Leonard Girardi, M.D.
Chairman, Department of Cardiothoracic Surgery
Cardiothoracic Surgeon-in-Chief
New York Presbyterian Hospital
Weill Cornell Medical College
New York, NY

Jeffrey P. Gold, M.D.
Chancellor, University of Nebraska Medical Center
University of Nebraska - Omaha
Omaha, NE

Alice Jacobs, M.D.
Professor of Medicine
Vice Chair for Clinical Affairs, Department of Medicine
Boston University School of Medicine
Boston Medical Center
Boston, MA

Desmond Jordan, M.D.
Clinical Professor of Anesthesia, Division of Cardiac Anesthesia and Critical Care Medicine
NY Presbyterian Hospital – Columbia
New York, NY

Barry Kaplan, MD
Assistant Professor of Medicine
Northwell Hofstra School of Medicine
Manhasset, NY

Thomas Kulik, M.D.
Director, Pulmonary Hypertension Program
Children's Hospital Boston
Boston, MA

Stephen Lahey, M.D.
Chief, Division of Cardiothoracic Surgery
Professor of Surgery
University of Connecticut Health Center
Farmington, CT

Vice Chair

Gary Walford, M.D.
Associate Professor of Medicine
Johns Hopkins Medical Center
Baltimore, MD

Frederick S. Ling, M.D.
Professor of Medicine (Cardiology)
University of Rochester Medical Center
Rochester, NY

Ralph Mosca, M.D.
Vice Chairman, Department of Cardiac Surgery
Director, Congenital Cardiac Surgery
NYU Medical Center
New York, NY

Robert H. Pass, M.D.
Chief of Pediatric Cardiology
Professor of Pediatrics
Mount Sinai Kravis Children's Hospital
The Icahn School of Medicine at Mount Sinai
New York, NY

Carlos E. Ruiz, M.D., Ph.D.
Professor of Cardiology in Pediatrics and Medicine
Director, Structural and Congenital Heart Center
Hackensack University Medical Center
The Joseph M. Sanzari Children's Hospital
Hackensack, NJ

Craig Smith, M.D.
Johnson & Johnson Distinguished Professor
Valentine Mott Professor of Surgery
Columbia University Medical Center
New York Presbyterian Hospital
New York, NY

Thoralf Sundt, III, M.D.
Chief, Cardiac Surgical Division
Co-Director, Heart Center
Massachusetts General Hospital
Boston, MA

Jacqueline Tamis-Holland, M.D.
Senior Attending Physician
Mount Sinai St. Luke's
Mount Sinai West
New York, NY

James Tweddell, M.D.
Surgical Director and Executive Co-Director
The Heart Institute
Professor of Surgery
Cincinnati Children's Hospital Medical Center
Cincinnati, OH

Ferdinand Venditti, Jr., M.D.
Executive VP for System Care Delivery
Hospital General Director
Albany Medical College
Albany, NY

Andrew S. Wechsler, M.D.
Emeritus Professor, Cardiothoracic Surgery
Drexel University College of Medicine
Philadelphia, PA

Consultant

Edward L. Hannan, Ph.D.
Distinguished Professor Emeritus
Department of Health Policy, Management & Behavior
Associate Dean Emeritus
University at Albany, School of Public Health
Rensselaer, NY

Cardiac Surgery Reporting System Subcommittee

Members & Consultants

Craig Smith, M.D. (Chair)
Johnson & Johnson Distinguished Professor
Valentine Mott Professor of Surgery
Columbia University Medical Center
New York Presbyterian Hospital

M. Hashmat Ashraf, M.D.
Chief, Department of Cardiothoracic Surgery
Kaleida Health

Joanna Chikwe, M.D.
Professor and Chair
Department of Cardiac Surgery
Smith Heart Institute
Cedars-Sinai Medical Center

Leonard Girardi, M.D.
Chairman, Department of Cardiothoracic Surgery
Cardiothoracic Surgeon-in-Chief
New York Presbyterian Hospital
Weill Cornell Medical College

Jeffrey P. Gold, M.D.
Chancellor
University of Nebraska Medical Center
University of Nebraska - Omaha

Edward L. Hannan, Ph.D.
Distinguished Professor Emeritus
Department of Health Policy, Management & Behavior
Associate Dean Emeritus
University at Albany, School of Public Health

Desmond Jordan, M.D.
Clinical Professor of Anesthesia, Division of Cardiac
Anesthesia and Critical Care Medicine
NY Presbyterian Hospital – Columbia

Stephen Lahey, M.D.
Chief, Division of Cardiothoracic Surgery
Professor of Surgery
University of Connecticut Health Center

Ralph Mosca, M.D.
Vice Chairman, Department of Cardiac Surgery
Director, Congenital Cardiac Surgery
NYU Medical Center

Robert H. Pass, M.D.
Chief of Pediatric Cardiology
Professor of Pediatrics
Mount Sinai Kravis Children's Hospital
The Icahn School of Medicine at Mount Sinai

Carlos E. Ruiz, M.D., Ph.D.
Professor of Cardiology in Pediatrics and Medicine
Director, Structural and Congenital Heart Center
Hackensack University Medical Center
The Joseph M. Sanzari Children's Hospital

Thoralf Sundt, III, M.D.
Chief, Cardiac Surgical Division
Co-Director, Heart Center
Massachusetts General Hospital

James Tweddell, M.D.
Surgical Director and Executive Co-Director
The Heart Institute
Professor of Surgery
Cincinnati Children's Hospital Medical Center

Andrew S. Wechsler, M.D.
Emeritus Professor, Cardiothoracic Surgery Department
Drexel University College of Medicine

Staff to CSRS Analysis Workgroup – New York State Department of Health

Office of Quality and Patient Safety

Marcus Friedrich, M.D., M.B.A.
Chief Medical Officer

Jeanne Alicandro, M.D.
Medical Director

Cardiac Services Program

Kimberly S. Cozzens, M.A.
Program Director

Ashraf Al-Hamadani, M.D., M.P.H.
Clinical Review Coordinator

Diane Fanuele, M.S.
Clinical Data Coordinator

Lori Frazier
Project Assistant

Jessica Kincaid
Quality Improvement Project Coordinator

Rosemary Lombardo, M.S.
CSRS Coordinator

Feng (Johnson) Qian, MD, PhD, M.B.A
Associate Professor of Health Policy and Management

Zaza Samadashvili, M.D., M.P.H.
Research Scientist

TABLE OF CONTENTS

INTRODUCTION

For over twenty-five years, the NYS Cardiac Data Reporting System has been a powerful resource for quality improvement in the areas of cardiac surgery and percutaneous coronary interventions (PCI). Building on this strong foundation, we are pleased to include in one report information on mortality after coronary artery bypass graft (CABG) surgery, valve repair or replacement surgery, transcatheter aortic valve replacement (TAVR), and readmissions after CABG.

New York State (NYS) has taken a leadership role in setting standards for cardiac services, monitoring outcomes and sharing performance data with patients, hospitals and physicians. Hospitals and doctors involved in cardiac care have worked in cooperation with the NYS Department of Health (Department of Health) and the NYS Cardiac Advisory Committee (Cardiac Advisory Committee) to compile accurate and meaningful data that can and have been used to enhance quality of care. We believe that this process has been instrumental in achieving the excellent outcomes that are evidenced in this report for centers across NYS.

The information contained in this report is intended for health care providers, patients and families of patients who are considering cardiac surgery. It includes:

- Mortality rates, adjusted for patient severity of illness, for CABG surgery, valve repair or replacement surgery, and TAVR at NYS hospitals.
- Readmission rates, adjusted for patient severity of illness, following CABG at NYS hospitals.
- Mortality rates, adjusted for patient severity of illness, following CABG and/or valve surgery for surgeons performing the procedure.
- Volume (number of cases) of all cardiac surgery for NYS hospitals and surgeons.
- Description of the patient risk factors associated with mortality for CABG and valve surgery and TAVR, and those associated with readmissions after CABG surgery.

The data that serve as the basis for this report are collected by the NYS Department of Health cooperatively with hospitals throughout the state. Careful auditing and rigorous analysis assure that these reports represent meaningful outcome assessments. The report was developed with clinical guidance from the NYS Cardiac Advisory Committee, an advisory body to the Commissioner of Health consisting of nationally recognized cardiac surgeons, cardiologists and others from related disciplines working both in New York State and elsewhere. The Cardiac Advisory Committee is to be commended for sustained leadership in these efforts.

As they develop treatment plans, we encourage doctors to discuss this information with their patients and colleagues. While these statistics are an important tool in making informed health care choices, individual treatment plans must be made by doctors and patients together after careful consideration of all pertinent factors. It is important to recognize that many factors can influence the outcome of cardiac surgery. These include the patient's health before the procedure, the skill of the operating team and general after-care. In addition, keep in mind that the information in this booklet does not include data after 2017. Important changes may have taken place in hospitals during that time period.

It is important that patients and physicians alike give careful consideration to the importance of healthy lifestyles for all those affected by heart disease. While some risk factors, such as heredity, gender and age cannot be controlled, others certainly can. Controllable risk factors that contribute to a higher likelihood of developing coronary artery disease are high cholesterol levels, cigarette smoking, high blood pressure, obesity and sedentary lifestyle. Careful attention to these risk factors after surgery will continue to be important in promoting good health and preventing recurrence of disease.

Hospitals and physicians in NYS can take pride in the excellent patient care provided and in their role in contributing to this unique collaborative quality improvement system. The Department of Health will continue to work in partnership with hospitals and physicians to ensure that continued high-quality cardiac surgery is available to NYS residents.

CORONARY ARTERY BYPASS GRAFT SURGERY (CABG)

Heart disease is the leading cause of death in NYS, and the most common form of heart disease is atherosclerotic coronary artery disease. Different treatments are recommended for patients with coronary artery disease. For some people, changes in lifestyle, such as dietary changes, not smoking and regular exercise, can result in great improvements in health. In other cases, medication prescribed for high blood pressure or other conditions can make a significant difference.

Sometimes, however, an interventional procedure is recommended. The two common procedures performed on patients with coronary artery disease are CABG surgery and percutaneous coronary intervention (PCI).

CABG surgery is an operation in which a vein or artery from another part of the body is used to create an alternate path for blood to flow to the heart muscle, bypassing the arterial blockage. Typically, a section of one of the large (saphenous) veins in the leg, the radial artery in the arm or the mammary artery in the chest is used to construct the bypass. One or more bypasses may be performed during a single operation, since providing several routes for the blood supply to travel is believed to improve long-term success for the procedure. CABG surgery is one of the most common, successful major operations currently performed in the United States.

As is true of all major surgery, risks must be considered. The patient is totally anesthetized and there is generally a substantial recovery period in the hospital followed by several weeks of recuperation at home. Even in successful cases, there is a risk of relapse causing the need for another operation.

Those who have CABG surgery are not cured of coronary artery disease; the disease can still occur in the grafted blood vessels or other coronary arteries. In order to minimize new blockages, patients should continue to reduce their risk factors for heart disease.

CARDIAC VALVE PROCEDURES

Heart valves control the flow of blood as it enters the heart and is pumped from the chambers of the heart to the lungs for oxygenation and back to the body. There are four valves: the tricuspid, mitral, pulmonary and aortic valves. Heart valve disease occurs when a valve cannot open all the way because of disease or injury, thus causing a decrease in blood flow to the next heart chamber. Another type of valve problem occurs when the valve does not close completely, which leads to blood leaking backward into the previous chamber. Either of these problems causes the heart to work harder to pump blood or causes blood to back up in the lungs or lower body.

When a valve is stenotic (too narrow to allow enough blood to flow through the valve opening) or incompetent (cannot close tightly enough to prevent the backflow of blood), one of the treatment options is to repair the valve. Repair of a stenotic valve typically involves widening the valve opening, whereas repair of an incompetent valve is typically achieved by narrowing or tightening the supporting structures of the valve. The mitral valve is particularly amenable to valve repairs because its parts can frequently be repaired without having to be replaced.

In many cases, defective valves are replaced rather than repaired, using either a mechanical or biological valve. Mechanical valves are built using durable materials that generally last a lifetime. Biological valves are made from tissue taken from pigs, cows or humans. Mechanical and biological valves each have advantages and disadvantages that can be discussed with referring physicians.

The most common heart valve surgeries involve the aortic and mitral valves. Patients undergoing heart surgery are totally anesthetized and are usually placed on a heart-lung machine, whereby the heart is stopped for a short period of time using special drugs. As is the case for CABG surgery, there is a recovery period of

several weeks at home after being discharged from the hospital. Some patients require replacement of more than one valve and some patients with both coronary artery disease and valve disease require valve replacement and CABG surgery. This report contains outcomes for the following valve surgeries when done alone or in combination with CABG: Aortic Valve Replacement, Mitral Valve Repair, Mitral Valve Replacement and Multiple Valve Surgery.

In recent years, a new technique for replacement of the aortic valve has been tested

and approved for use in the United States under certain circumstances. This procedure, known as Transcatheter Aortic Valve Replacement (TAVR, also sometimes called Transcatheter Aortic Valve Implantation or TAVI), differs from traditional surgical valve replacement in that the replacement valve is delivered to the heart through a catheter rather than through a standard surgical incision. The procedure is performed collaboratively by cardiologists and cardiac surgeons.

THE DEPARTMENT OF HEALTH PROGRAM

For many years, the Department of Health has been studying the effects of patient and treatment characteristics (called risk factors) on outcomes for patients with heart disease. Detailed statistical analyses of the information received from the study have been conducted under the guidance of the Cardiac Advisory Committee, a group of independent practicing cardiac surgeons, cardiologists and other professionals in related fields.

The results have been used to create a cardiac profile system which assesses the performance of hospitals and surgeons over time,

independent of the severity of each individual patient's pre-operative conditions.

Designed to improve health in people with heart disease, this program is aimed at:

- understanding the health risks of patients that adversely affect how they will fare in coronary artery bypass surgery and/or valve surgery;

- improving the results of different treatments of heart disease;

- improving cardiac care; and

- providing information to help patients make better decisions about their own care.

PATIENT POPULATION

This report is based on data for patients discharged between December 1, 2014, and November 30, 2017, provided by all non-federal hospitals in NYS where cardiac surgery is performed. The analysis period for this report includes patients discharged in December 2014 but not those discharged in December 2017. This strategy allows for more timely report publication by eliminating the need to track patients for 30-day mortality into the following calendar year. Inclusion of cases from the previous December allows for meaningful comparison of 12-month volume as found in previous reports. The single year analysis for 2017 cases includes patients discharged from December 1, 2016 through November 30, 2017. In total there were 66,177 cardiac surgical procedures performed during this time period.

For various reasons, some of these cases are excluded from analysis in this report. The reasons for exclusion and number of cases affected are described below.

Records for 171 patients residing outside the United States were excluded because these patients could not be followed after hospital discharge. There were 6 cases excluded from analysis because each 30-day mortality can only be associated with a single cardiac surgery.

Beginning with patients discharged in 2006, the Department of Health, with the advice of the Cardiac Advisory Committee, began a trial period of excluding data from publicly released reports for any patients meeting the Cardiac Data System definition of pre-operative cardiogenic shock (now called

refractory cardiogenic shock). Cardiogenic shock is a condition associated with severe hypotension (very low blood pressure). [The technical definition used in this report can be found on page 45.] Patients in cardiogenic shock are extremely high-risk, but for some, cardiac surgery may be their best chance for survival. Furthermore, the magnitude of the risk is not always easily determined using registry data. These cases were excluded after careful deliberation and input from NYS providers and others in an effort to ensure that physicians could accept these cases where appropriate without concern over a detrimental impact on their reported outcomes. In total, 540 cases with refractory cardiogenic shock were removed from the data. This accounts for 0.82 percent of all cardiac surgeries (CABG, valve surgery and other cardiac surgery reported in this data system) in the three years.

After all of the above exclusions, there were 65,460 cardiac surgeries analyzed in this report. Isolated CABG surgery represented 39.46 percent of all adult cardiac surgery included in this report. Valve or combined valve/CABG surgery represented 31.12 percent of all adult cardiac surgery for the same period. TAVR represented 15.53 percent of all cardiac surgeries reported. Total cardiac surgery, isolated CABG, valve surgery and other cardiac

surgery volumes are tabulated in Table 8 by hospital and surgeon for the period 2015 through 2017.

While there were 8,782 CABG cases included in the mortality analysis for 2017 discharges, some additional exclusions were required for the readmission analysis. Records belonging to patients residing outside NYS were excluded because there is no reliable way to track out-of-state readmissions. This accounted for 353 cases. Another 103 patients were excluded because they died in the same admission as their index CABG, so readmission was impossible. Fifty-three cases were transferred to another acute care facility after CABG and so were excluded from readmission analysis. Finally, 10 cases with a discharge status of 'left against medical advice' were excluded from the readmission analysis.

In total, the number of excluded cases was 518 (some patients had more than one reason for exclusion), leaving 8,264 cases to be examined for 30-day readmission rates.

Note on Hospitals Not Performing Cardiac Surgery During Entire 2015-2017 Period

Mount Sinai - Beth Israel closed their cardiac surgery program in December 2016.

RISK ADJUSTMENT
FOR ASSESSING PROVIDER PERFORMANCE

Provider performance is directly related to patient outcomes. Whether patients recover quickly, experience complications, require another hospitalization, or die following a procedure is, in part, a result of the kind of medical care they receive. It is difficult, however, to compare outcomes across hospitals when assessing provider performance because different hospitals treat different types of patients. Hospitals with sicker patients may have higher rates of death and readmission than other hospitals in the state. The following describes how the Department of Health adjusts for patient risk in assessing provider outcomes.

Data Collection, Data Validation and Identifying In-Hospital/30-Day Deaths and 30-Day Readmission

As part of the risk-adjustment process, NYS hospitals where cardiac surgery is performed provide information to the Department of Health for each patient undergoing that procedure. Cardiac surgery departments collect data concerning patients' demographic and clinical characteristics. Approximately 40 of these characteristics (called risk factors) are collected for each patient. Along with information about the procedure, physician and the patient's status at discharge, these data are entered into a computer and sent to the Department of Health for analysis.

Data are verified through review of unusual reporting frequencies, cross-matching of cardiac surgery data with other Department of Health databases and a review of medical records for a selected sample of cases. These activities are extremely helpful in ensuring consistent interpretation of data elements across hospitals.

The analyses in this report base mortality on deaths occurring during the same hospital stay in which a patient underwent cardiac surgery or TAVR and on deaths that occur after discharge but within 30 days of surgery.

An in-hospital death is defined as a patient who died subsequent to CABG or valve surgery or TAVR during the same admission or was discharged to hospice care and expired within 30 days.

Deaths that occur after hospital discharge but within 30 days of surgery are also counted in the risk-adjusted mortality analyses. This is done because hospital length of stay has been decreasing and, in the opinion of the Cardiac Advisory Committee, most deaths that occur after hospital discharge but within 30 days of surgery are related to complications of surgery.

Data on deaths occurring after discharge from the hospital are obtained from the Department of Health, the New York City Department of Health and Mental Hygiene Bureau of Vital Statistics, and the National Death Index.

Data on readmissions are obtained from the Department of Health's acute care hospital dataset, the Statewide Planning and Research Cooperative System (SPARCS), which contains data pertaining to all acute care hospital discharges in the state.

Thirty-day readmission is defined as an unplanned admission to a NYS non-Federal hospital within 30 days of discharge from the index hospitalization. Unplanned readmissions are identified using criteria published by the Center for Medicare and Medicaid Services.

Assessing Patient Risk

Each person who develops heart disease has a unique health history. A cardiac profile system has been developed to evaluate the risk of treatment for each individual patient based on his or her history, weighing the important health factors for that person based on the experiences of thousands of patients who have undergone the same procedures in recent years. All important risk factors for each patient are combined to create a risk profile. For example, an 80-year-old patient with renal failure requiring dialysis has a very different risk profile than a 40-year-old with no renal failure.

The statistical analyses conducted by the Department of Health consist of determining which of the risk factors collected are significantly related to death or readmission following CABG and/or valve surgery and determining how to weigh the significant risk factors to predict the chance each patient will have of dying or being readmitted, given his or her specific characteristics.

Doctors and patients should review individual risk profiles together. Treatment decisions must be made by doctors and patients together after consideration of all the information.

Predicting Patient Mortality Rates for Providers

The statistical methods used to predict mortality on the basis of the significant risk factors are tested to determine whether they are sufficiently accurate in predicting mortality for patients who are extremely ill prior to undergoing the procedure as well as for patients who are relatively healthy. These tests have confirmed that the models are reasonably accurate in predicting how patients of all different risk levels will fare when undergoing cardiac surgery.

The mortality rate for each hospital and surgeon is also predicted using the relevant statistical models. This is accomplished by summing the predicted probabilities of death for each of the provider's patients and dividing by the number of patients. The resulting rate is an estimate of what the provider's mortality rate would have been if the provider's performance were identical to the state performance. The percentage is called the predicted or expected mortality rate (EMR). A hospital's EMR is contrasted with its observed mortality rate (OMR), which is the number of patients who died divided by the total number of patients.

Computing the Risk-Adjusted Mortality Rate

The risk-adjusted mortality rate (RAMR) represents the best estimate, based on the associated statistical model, of what the provider's mortality rate would have been if the provider had a mix of patients identical to the statewide mix. Thus, the RAMR has, to the extent possible, ironed out differences among providers in patient severity of illness, since it arrives at a mortality rate for each provider for an identical group of patients. To calculate the RAMR, the OMR is first divided by the provider's EMR. If the resulting ratio is larger than one, the provider has a higher mortality rate than expected on the basis of its patient mix; if it is smaller than one, the provider has a lower mortality rate than expected from its patient mix. For isolated CABG patients the ratio is then multiplied by the overall statewide mortality

rate of 1.58 percent (in-hospital/30-day mortality in 2017) to obtain the provider's RAMR. For the three-year period 2015-2017, the ratio is multiplied by 1.60 percent (in-hospital/30-day mortality rate) for isolated CABG patients or 3.00 percent (in-hospital/30-day mortality rate) for valve or valve/CABG patients.

There is no Statewide EMR or RAMR, because the statewide data is not risk-adjusted. The Statewide OMR (number of total cases divided by number of total deaths) serves as the basis for comparison for each hospital's EMR and RAMR.

Interpreting the Risk-Adjusted Mortality Rate

If the RAMR is significantly lower than the statewide mortality rate, the provider has a significantly better performance than the state as a whole; if the RAMR is significantly higher than the statewide mortality rate, the provider has a significantly worse performance than the state as a whole.

The RAMR is used in this report as a measure of quality of care provided by hospitals and surgeons. However, there are reasons that a provider's RAMR may not be indicative of its true quality. For example, extreme outcome rates may occur due to chance alone. This is particularly true for low-volume providers, for whom very high or very low mortality rates are more likely to occur than for high-volume providers. To prevent misinterpretation of differences caused by chance variation, confidence intervals are reported in the results. The interpretations of those terms are provided later when the data are presented.

Differences in hospital coding of risk factors could be an additional reason that a provider's RAMR may not be reflective of quality of care. The Department of Health monitors the quality of coded data by reviewing samples of patients' medical records to ascertain the presence of key risk factors. When significant coding problems are discovered, hospitals are required to correct these data and are subjected to subsequent monitoring.

Although there are reasons that RAMRs presented here may not be a perfect reflection of quality of care, the Department of Health feels that this information is a valuable aid in choosing providers for cardiac surgery.

Predicting Patient Readmission and Computing and Interpreting Risk-Adjusted Readmission Rates

Patient risk of 30-day readmission is assessed using the same methods used for assessing mortality risk as described above. All potential risk factors are considered and those that are independently related to readmission are identified and given weights so as to best predict the risk of 30-day readmission for each patient. Observed readmission rates (ORR), expected readmission rates (ERR) and risk-adjusted readmission rates (RARR) are calculated in the same way that OMR, EMR and RAMR are calculated. ERR and RARR are compared to the statewide observed readmission rate (11.98 percent in 2017).

This analysis is based on unplanned readmission, and may include readmission not directly related to the CABG procedure. Not all readmissions represent a poor patient outcome or reflect poor patient care. However, by risk-adjusting and comparing the results across the many hospitals that perform this procedure we are able to look for meaningful differences from the overall statewide experience. If the RARR is significantly lower than the statewide readmission rate, the hospital has a better performance than the state as a whole; if the RARR is significantly higher than the statewide readmission rate, the hospital has a worse performance than the state as a whole.

As described above for mortality, there are reasons that a provider's RARR may not be indicative of its true quality. Confidence intervals and careful attention to data quality are used in the same way for readmission as they are for mortality.

How This Initiative Contributes to Quality Improvement

One goal of the Department of Health and the Cardiac Advisory Committee is to improve the quality of care related to cardiac surgery in NYS. Providing the hospitals and cardiac surgeons in NYS with data about their own outcomes for these procedures allows them to examine the quality of the care they provide and to identify areas that need improvement.

The data collected and analyzed in this program are reviewed by the Cardiac Advisory Committee. Committee members assist with interpretation and advise the Department of Health regarding hospitals and surgeons that may need special attention. Committee members have also conducted site visits to particular hospitals and have recommended that some hospitals obtain the expertise of outside consultants to design improvements for their programs.

The overall results of this program of ongoing review show that significant progress is being made. In response to the program's results for surgery, facilities have refined patient criteria, evaluated patients more closely for pre-operative risks and directed them to the appropriate surgeon. More importantly, many hospitals have identified medical care processes that have led to less than optimal outcomes, and have altered those processes to achieve improved results

DEFINITIONS OF KEY TERMS

The **observed mortality rate (OMR)** is the observed number of deaths divided by the total number of cases.

The **expected mortality rate (EMR)** is the sum of the predicted probabilities of death for all patients divided by the total number of patients.

The **risk-adjusted mortality rate (RAMR)** is the best estimate, based on the statistical model, of what the provider's mortality rate would have been if the provider had a mix of patients identical to the statewide mix. It is obtained by first dividing the OMR by the EMR, and then multiplying by the relevant statewide mortality rate (for example, 1.58 percent for Isolated CABG patients in 2017 or 3.00 percent for Valve or Valve/CABG patients in 2015-2017).

The **observed readmission rate (ORR)** is the observed number of 30-day readmissions divided by the total number of analyzed cases.

The **expected readmission rate (ERR)** is the sum of the predicted probabilities of readmission for all patients divided by the total number of analyzed cases.

The **risk-adjusted readmission rate (RARR)** is the best estimate, based on the statistical model, of what the provider's readmission rate would have been if the provider had a mix of patients similar to the statewide mix. It is obtained by first dividing the ORR by the ERR, and then multiplying that quotient by the statewide readmission rate (11.98 percent 30-day readmission rate for all CABG patients discharged in 2017).

Confidence Intervals are used to identify which hospitals had significantly more or fewer deaths or readmissions than expected given the risk factors of their patients. The confidence interval identifies the range in which the risk-adjusted rate may fall. Hospitals with significantly higher rates than expected after adjusting for risk are those where the confidence interval range falls entirely above the statewide mortality rate. Hospitals with significantly lower rates than expected, given the severity of illness of their patients before surgery, have confidence intervals entirely below the statewide mortality rate. The more cases a provider performs, the narrower their confidence interval will be. This is because as a provider performs more cases, the likelihood of chance variation in the risk-adjusted rate decreases.

2017 HOSPITAL OUTCOMES FOR CABG SURGERY

Table 1 and Figure 1 present the CABG surgery results for the 37 hospitals performing this operation in NYS in 2017. The table contains, for each hospital, the number of isolated CABG operations (CABG operations with no other major heart surgery earlier in the hospital stay) for patients discharged in 2017, the number of in-hospital/30-day deaths, the OMR, the EMR based on the statistical model presented in Appendix 1, the RAMR and a 95 percent confidence interval for the RAMR.

As indicated in Table 1, the overall in-hospital/ 30-day mortality rate for the 8,782 CABG surgeries was 1.58 percent. In-hospital/30-day OMRs ranged from 0.00 percent to 4.10 percent. The range of EMRs, which measure patient severity of illness, was 0.65 percent to 3.41 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 4.83 percent. Three hospitals (Ellis Hospital in Schenectady, Montefiore Weiler in the Bronx, and Rochester General Hospital) had RAMRs that were significantly higher than the statewide rate. Two hospitals (NYU - Winthrop in Mineola, and St. Joseph's in Syracuse) had RAMRs that were significantly lower than the statewide rate.

The 2017 in-hospital/30-day mortality rate of 1.58 percent for Isolated CABG is slightly lower than the 1.67 percent observed in 2016.

The in-hospital OMR for 2017 Isolated CABG discharges (not shown in Table 1) was 1.18 percent for all 8,782 patients included in the analysis.

Figure 1 provides a visual representation of the data displayed in Table 1. For each hospital, the black dot represents the RAMR and the gray bar represents the confidence interval, or potential statistical error, for the RAMR. The black vertical line is the NYS in-hospital/30-day mortality rate. A gray bar that extends far above and/

or below the statewide average indicates that a hospital has a wide confidence interval. This is common when the hospital has a very small number of cases. It does not necessarily mean that the risk-adjusted mortality rate is very high or very low. For any hospital where the gray bar crosses the state average line, the RAMR is not statistically different from the state as a whole. Hospitals that are statistical outliers will have gray bars (confidence intervals) that are either entirely above or entirely below the line for the statewide rate.

Table 2 presents the 30-day readmission results for the 37 Non-Federal hospitals performing CABG in NYS in 2017. The table contains, for each hospital, the number of CABGs resulting in 2017 discharges in the readmission analysis, the number of 30-Day readmissions, the ORR, the ERR based on the statistical model presented in Appendix 2, the RARR and a 95 percent confidence interval for the RARR.

The overall ORR for the 8,264 CABGs included in this 2017 analysis was 11.98 percent. Observed readmission rates ranged from 3.92 percent to 25.00 percent. The range in ERRs, which measure patient severity of illness, was between 9.86 percent and 14.89 percent. The RARRs, which measure hospital performance, range from 4.00 percent to 20.83 percent.

Based on confidence intervals for RARRs, two hospitals (Motefiore - Moses in the Bronx and Montefiore- Weiler in the Bronx) had RARRs that were significantly higher than the statewide average. Three hospitals (NYU Hospitals Center in Manhattan, St. Joseph's Hospital in Syracuse, and St. Peter's Hospital in Albany) had RARRs that were significantly lower than the statewide average.

Figure 2 provides a visual representation of the data displayed in Table 2. It is interpreted in the same way as Figure 1 described above.

Table 1

In-hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for Isolated CABG Surgery in New York State, 2017 Discharges

(Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	220	5	2.27	1.67	2.16	(0.70, 5.03)
Arnot Ogden Med Ctr	55	1	1.82	1.68	1.72	(0.02, 9.55)
Bassett Medical Center	80	2	2.50	2.18	1.82	(0.20, 6.57)
Bellevue Hospital Ctr	170	1	0.59	1.04	0.89	(0.01, 4.97)
Buffalo General Med Ctr	441	7	1.59	1.52	1.66	(0.66, 3.41)
Ellis Hospital	195	8	4.10	1.41	4.61*	(1.98, 9.08)
Good Sam - Suffern	76	2	2.63	1.28	3.26	(0.37,11.76)
Good Sam-West Islip	228	2	0.88	2.21	0.63	(0.07, 2.27)
Lenox Hill Hospital	339	1	0.29	1.30	0.36	(0.00, 2.00)
Maimonides Medical Ctr	201	3	1.49	1.65	1.44	(0.29, 4.19)
Mercy Hospital-Buffalo	345	6	1.74	1.76	1.56	(0.57, 3.40)
Montefiore - Moses	191	2	1.05	1.32	1.26	(0.14, 4.55)
Montefiore - Weiler	181	6	3.31	1.09	4.83*	(1.76,10.52)
Mount Sinai Beth Israel	10	0	0.00	3.41	0.00	(0.00,17.03)
Mount Sinai Hospital	361	3	0.83	1.21	1.09	(0.22, 3.19)
Mount Sinai St. Lukes	262	4	1.53	1.35	1.79	(0.48, 4.59)
NYP-Brooklyn Methodist	139	1	0.72	1.54	0.74	(0.01, 4.13)
NYP-Columbia Presby.	455	8	1.76	1.35	2.06	(0.89, 4.06)
NYP-Queens	175	2	1.14	0.65	2.78	(0.31,10.03)
NYP-Weill Cornell	191	2	1.05	1.47	1.13	(0.13, 4.06)
NYU Hospitals Center	255	4	1.57	1.04	2.38	(0.64, 6.11)
NYU Winthrop Hospital	246	0	0.00	1.75	0.00**	(0.00, 1.35)
North Shore Univ Hosp	507	4	0.79	1.43	0.87	(0.23, 2.23)
Rochester General Hosp	449	18	4.01	1.85	3.44*	(2.04, 5.43)
Southside Hospital	176	0	0.00	1.36	0.00	(0.00, 2.43)
St. Elizabeth Med Ctr	189	7	3.70	2.14	2.74	(1.10, 5.64)
St. Francis Hospital	584	7	1.20	1.73	1.10	(0.44, 2.26)
St. Josephs Hospital	477	3	0.63	1.96	0.51**	(0.10, 1.49)
St. Peters Hospital	378	7	1.85	1.91	1.54	(0.62, 3.17)
Staten Island Univ Hosp	192	2	1.04	1.42	1.16	(0.13, 4.21)
Strong Memorial Hosp	223	5	2.24	1.49	2.38	(0.77, 5.56)
UHS-Wilson Med Ctr	136	4	2.94	1.72	2.71	(0.73, 6.94)
Univ. Hosp-Brooklyn	62	2	3.23	2.55	2.00	(0.22, 7.22)
Univ. Hosp-Stony Brook	193	2	1.04	2.00	0.82	(0.09, 2.95)
Univ. Hosp-Upstate	69	1	1.45	1.72	1.34	(0.02, 7.44)
Vassar Bros. Med Ctr	135	4	2.96	1.88	2.50	(0.67, 6.40)
Westchester Med Ctr	196	3	1.53	1.82	1.33	(0.27, 3.89)
STATEWIDE TOTAL	**8782**	**139**	**1.58**			

* Risk-adjusted mortality rate significantly higher than the statewide rate based on 95 percent confidence interval.

** Risk-adjusted mortality rate significantly lower than the statewide rate based on 95 percent confidence interval.

Figure 1

In-Hospital/30-Day Risk-Adjusted Mortality Rates for Isolated CABG in New York State, 2017 Discharges

* Risk-adjusted mortality rate significantly higher than the statewide rate based on 95 percent confidence interval.

** Risk-adjusted mortality rate significantly lower than the statewide rate based on 95 percent confidence interval.

Table 2

30-Day Observed, Expected and Risk-Adjusted Readmission Rates for Isolated CABG Surgery in New York State, 2017 Discharges
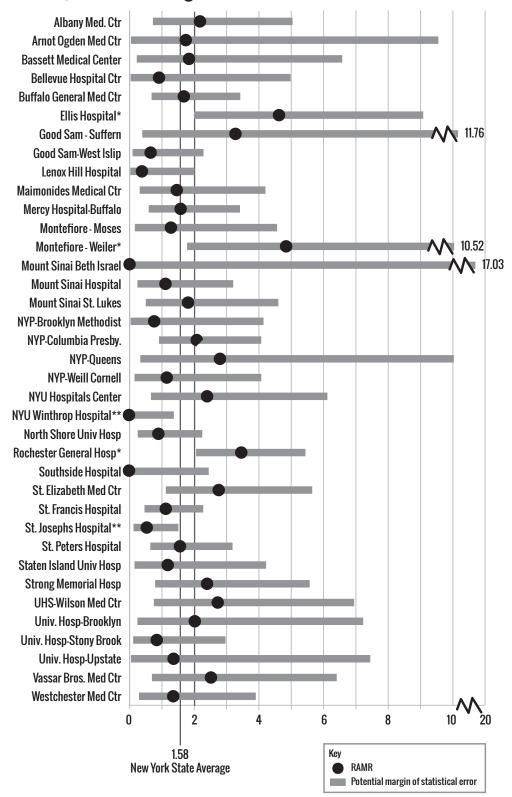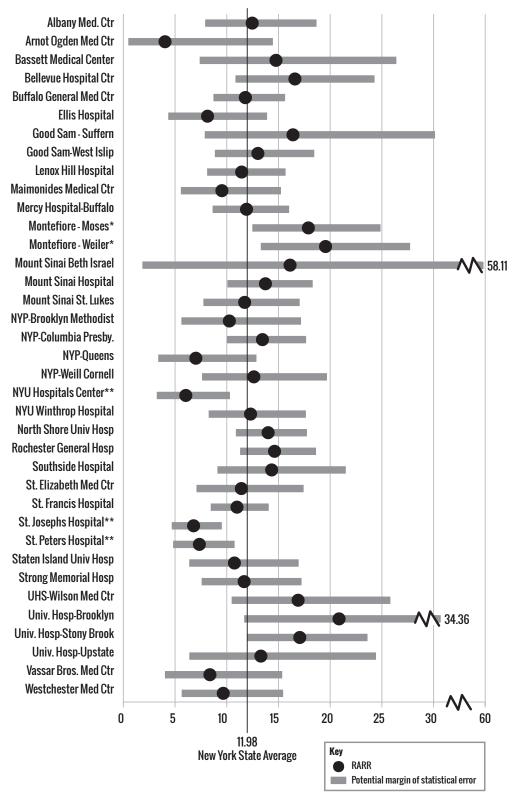
(Listed Alphabetically by Hospital)

Hospital	Cases	Readmits	ORR	ERR	RARR	95% CI for RARR
Albany Med. Ctr	198	23	11.62	11.20	12.43	(7.88,18.65)
Arnot Ogden Med Ctr	51	2	3.92	11.75	4.00	(0.45,14.43)
Bassett Medical Center	76	11	14.47	11.77	14.73	(7.35,26.37)
Bellevue Hospital Ctr	166	26	15.66	11.33	16.56	(10.81,24.26)
Buffalo General Med Ctr	415	48	11.57	11.77	11.77	(8.68,15.61)
Ellis Hospital	168	13	7.74	11.43	8.11	(4.31,13.87)
Good Sam - Suffern	65	10	15.38	11.26	16.37	(7.84,30.11)
Good Sam-West Islip	223	31	13.90	12.83	12.98	(8.82,18.43)
Lenox Hill Hospital	313	38	12.14	12.75	11.41	(8.07,15.66)
Maimonides Medical Ctr	194	17	8.76	11.05	9.50	(5.53,15.21)
Mercy Hospital-Buffalo	337	43	12.76	12.87	11.88	(8.60,16.00)
Montefiore - Moses	183	35	19.13	12.83	17.86*	(12.44,24.84)
Montefiore - Weiler	173	31	17.92	11.00	19.52*	(13.26,27.70)
Mount Sinai Beth Israel	10	2	20.00	14.89	16.09	(1.81,58.11)
Mount Sinai Hospital	324	46	14.20	12.41	13.71	(10.03,18.28)
Mount Sinai St. Lukes	238	27	11.34	11.62	11.70	(7.71,17.02)
NYP-Brooklyn Methodist	136	14	10.29	12.07	10.22	(5.58,17.15)
NYP-Columbia Presby.	367	51	13.90	12.41	13.42	(9.99,17.64)
NYP-Queens	174	10	5.75	9.86	6.98	(3.34,12.84)
NYP-Weill Cornell	153	19	12.42	11.82	12.59	(7.58,19.66)
NYU Hospitals Center	234	13	5.56	11.08	6.01**	(3.20,10.28)
NYU Winthrop Hospital	245	29	11.84	11.56	12.27	(8.22,17.62)
North Shore Univ Hosp	495	68	13.74	11.78	13.97	(10.85,17.72)
Rochester General Hosp	425	65	15.29	12.56	14.59	(11.26,18.60)
Southside Hospital	173	23	13.29	11.13	14.31	(9.07,21.48)
St. Elizabeth Med Ctr	182	21	11.54	12.15	11.38	(7.04,17.40)
St. Francis Hospital	570	63	11.05	12.08	10.96	(8.42,14.03)
St. Josephs Hospital	464	33	7.11	12.61	6.76**	(4.65, 9.49)
St. Peters Hospital	357	26	7.28	11.92	7.32**	(4.78,10.73)
Staten Island Univ Hosp	183	18	9.84	11.01	10.71	(6.34,16.92)
Strong Memorial Hosp	218	25	11.47	11.79	11.65	(7.54,17.20)
UHS-Wilson Med Ctr	123	21	17.07	12.12	16.87	(10.44,25.79)
Univ. Hosp-Brooklyn	60	15	25.00	14.38	20.83	(11.65,34.36)
Univ. Hosp-Stony Brook	191	36	18.85	13.26	17.03	(11.93,23.58)
Univ. Hosp-Upstate	68	10	14.71	13.28	13.27	(6.35,24.40)
Vassar Bros. Med Ctr	129	10	7.75	11.14	8.34	(3.99,15.33)
Westchester Med Ctr	183	17	9.29	11.56	9.63	(5.61,15.42)
STATEWIDE TOTAL	**8264**	**990**	**11.98**			

* Risk-adjusted readmission rate significantly higher than the statewide rate based on 95 percent confidence interval.

** Risk-adjusted readmission rate significantly lower than the statewide rate based on 95 percent confidence interval.

Figure 2

30-Day Risk-Adjusted Readmission Rates for Isolated CABG in New York State, 2017 Discharges

* Risk-adjusted readmission rate significantly higher than the statewide rate based on 95 percent confidence interval.
** Risk-adjusted readmission rate significantly lower than the statewide rate based on 95 percent confidence interval.

2015-2017 HOSPITAL OUTCOMES FOR VALVE SURGERY

Table 3 and Figure 3 present the combined Valve Only and Valve/CABG surgery results for the 38 hospitals performing these operations in NYS during the years 2015-2017. The table contains, for each hospital, the combined number of Valve Only and Valve/CABG operations resulting in 2015-2017 discharges, the number of in-hospital/30-day deaths, the OMR, the EMR based on the statistical models presented in Appendices 3-4, the RAMR and a 95 percent confidence interval for the RAMR.

As indicated in Table 3, the overall in-hospital/30-day mortality rate for the 20,367 combined Valve Only and Valve/CABG procedures performed at the 38 hospitals was 3.00 percent. The OMRs ranged from 0.77 percent to 9.23 percent. The range of EMRs, which measure patient severity of illness, was 1.61 percent to 4.36 percent.

The RAMRs, which are used to measure performance, ranged from 0.72 percent to 8.05 percent. Four hospitals (Albany Medical Center, Mercy Hospital in Buffalo, Strong Memorial Hospital in Rochester, and United Health Services - Wilson in Johnson City) had RAMRs that were significantly higher than the statewide rate. Four hospitals (Mount Sinai Hospital in Manhattan, Southside Hospital in Bayshore, St. Joseph's Hospital in Syracuse, and Vassar Brothers Medical Center in Poughkeepsie) had RAMRs that were significantly lower than the statewide rate.

Figure 3 provides a visual representation of the data displayed in Table 3. It is interpreted in the same way as Figure 1 described above.

Table 4 presents valve procedures performed at the 38 cardiac surgery hospitals in NYS during 2015-2017. The table contains, for each hospital, the number of valve operations (as defined by eight separate groups: Aortic Valve Replacements, Aortic Valve Repair or Replacements plus CABG, Mitral Valve Replacement, Mitral Valve Replacement plus CABG, Mitral Valve Repair, Mitral Valve Repair plus CABG, Multiple Valve Surgery and Multiple Valve Surgery plus CABG) resulting in 2015-2017

discharges. In addition to the hospital volumes, the rate of in-hospital/30-day death for the state (Statewide Mortality Rate) is given for each group. Unless otherwise specified, when the report refers to Valve or Valve/CABG procedures it is referring to the last column of Table 4.

The 2015-2017 in-hospital/30-day OMR of 3.00 percent for Valve and Valve/CABG surgeries is lower than the 3.12 percent observed for 2014-2016. The in-hospital OMR for 2015-2017 valve surgeries (not shown in Table 3) is 2.48 percent for the 20,367 patients included in this analysis.

Table 5 presents the results for transcatheter aortic valve replacement (TAVR) procedures performed at the 27 hospitals performing TAVR during the 2015-2017 discharge period. The table contains, for each hospital, the number of TAVR procedures resulting in 2015-2017 discharges, the number of in-hospital/30-day deaths, the OMR, the EMR based on the statistical model presented in Appendix 5, the RAMR and a 95 percent confidence interval for the RAMR. Please note, some hospitals listed in Table 5 began performing the procedure during the 2015-2017 reporting period and the number of cases listed does not represent a full three year's program activity. Other hospitals may have begun performing the procedure more recently than the timeframe covered by this report.

As indicated in Table 5, the overall in-hospital/30-day mortality rate for the 10,163 TAVR procedures performed at the 27 hospitals was 2.77 percent. The OMRs ranged from 0.00 percent to 6.06 percent. The range of EMRs, which measure patient severity of illness, was 1.68 percent to 4.38 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 5.83 percent. Two hospitals (Rochester General Hospital and Strong Memorial Hospital in Rochester) had RAMRs that were statistically higher than the statewide rate. One hospital (NY Presbyterian at Columbia in Manhattan) had a RAMR that was statistically lower than the statewide rate.
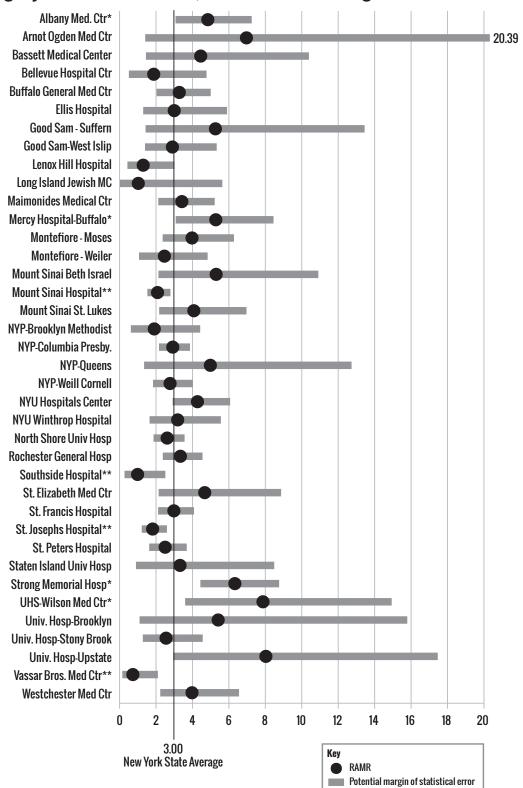
Table 3

In-hospital/30-Day Observed, Expected, and Risk-Adjusted Mortality Rates for Valve or Valve/CABG Surgery in New York State, 2015-2017 Discharges

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	552	23	4.17	2.58	4.85 *	(3.07, 7.27)
Arnot Ogden Med Ctr	55	3	5.45	2.34	6.98	(1.40,20.39)
Bassett Medical Center	134	5	3.73	2.51	4.46	(1.44,10.42)
Bellevue Hospital Ctr	264	4	1.52	2.43	1.87	(0.50, 4.78)
Buffalo General Med Ctr	735	21	2.86	2.61	3.28	(2.03, 5.01)
Ellis Hospital	268	8	2.99	2.98	3.00	(1.29, 5.91)
Good Sam - Suffern	87	4	4.60	2.62	5.27	(1.42,13.49)
Good Sam-West Islip	284	10	3.52	3.64	2.90	(1.39, 5.34)
Lenox Hill Hospital	445	5	1.12	2.61	1.29	(0.42, 3.02)
Long Island Jewish MC	84	1	1.19	3.52	1.02	(0.01, 5.65)
Maimonides Medical Ctr	431	21	4.87	4.27	3.42	(2.12, 5.23)
Mercy Hospital-Buffalo	413	17	4.12	2.33	5.29 *	(3.08, 8.47)
Montefiore - Moses	415	18	4.34	3.27	3.98	(2.36, 6.29)
Montefiore - Weiler	303	8	2.64	3.22	2.46	(1.06, 4.84)
Mount Sinai Beth Israel	141	7	4.96	2.81	5.31	(2.13,10.94)
Mount Sinai Hospital	2219	45	2.03	2.92	2.08 **	(1.52, 2.79)
Mount Sinai St. Lukes	282	13	4.61	3.39	4.08	(2.17, 6.98)
NYP-Brooklyn Methodist	209	5	2.39	3.78	1.90	(0.61, 4.43)
NYP-Columbia Presby.	1688	49	2.90	2.98	2.92	(2.16, 3.87)
NYP-Queens	116	4	3.45	2.07	4.99	(1.34,12.77)
NYP-Weill Cornell	1126	27	2.40	2.60	2.77	(1.83, 4.03)
NYU Hospitals Center	1352	31	2.29	1.61	4.28	(2.91, 6.08)
NYU Winthrop Hospital	375	12	3.20	3.01	3.19	(1.64, 5.57)
North Shore Univ Hosp	1228	39	3.18	3.65	2.61	(1.86, 3.57)
Rochester General Hosp	1005	39	3.88	3.49	3.34	(2.37, 4.56)
Southside Hospital	414	4	0.97	2.96	0.98 **	(0.26, 2.51)
St. Elizabeth Med Ctr	244	9	3.69	2.36	4.68	(2.14, 8.89)
St. Francis Hospital	1102	38	3.45	3.47	2.98	(2.11, 4.09)
St. Josephs Hospital	1299	29	2.23	3.70	1.81 **	(1.21, 2.60)
St. Peters Hospital	888	25	2.82	3.38	2.50	(1.62, 3.69)
Staten Island Univ Hosp	146	4	2.74	2.47	3.32	(0.89, 8.51)
Strong Memorial Hosp	718	36	5.01	2.37	6.34 *	(4.44, 8.78)
UHS-Wilson Med Ctr	187	9	4.81	1.83	7.89 *	(3.60,14.98)
Univ. Hosp-Brooklyn	50	3	6.00	3.32	5.42	(1.09,15.84)
Univ. Hosp-Stony Brook	392	11	2.81	3.30	2.55	(1.27, 4.57)
Univ. Hosp-Upstate	65	6	9.23	3.44	8.05	(2.94,17.52)
Vassar Bros. Med Ctr	392	3	0.77	3.19	0.72 **	(0.14, 2.10)
Westchester Med Ctr	259	15	5.79	4.36	3.98	(2.23, 6.57)
STATEWIDE TOTAL	**20367**	**611**	**3.00**			

* Risk-adjusted mortality rate significantly higher than the statewide rate based on 95 percent confidence interval.

** Risk-adjusted mortality rate significantly lower than the statewide rate based on 95 percent confidence interval.

Figure 3

In-Hospital/30-Day Risk-Adjusted Mortality Rates for Valve or Valve/ CABG Surgery in New York State, 2015-2017 Discharges

3.00
New York State Average

Key
● RAMR
▬ Potential margin of statistical error

* Risk-adjusted mortality rate significantly higher than the statewide rate based on 95 percent confidence interval.
** Risk-adjusted mortality rate significantly lower than the statewide rate based on 95 percent confidence interval.

Table 4

Hospital Volume for Valve Surgery in New York State, 2015-2017 Discharges

Hospital	Aortic Valve Replace Surgery	Aortic Valve and CABG	Mitral Valve Replace Surgery	Mitral Replace and CABG	Mitral Valve Repair Surgery	Mitral Repair and CABG	Multiple Valve Surgery	Multiple Valve and CABG	Total Valve or Valve/ CABG
Albany Med. Ctr	203	143	39	9	70	23	51	14	552
Arnot Ogden Med Ctr	25	20	2	1	4	1	2	0	55
Bassett Medical Center	63	49	7	1	2	4	5	3	134
Bellevue Hospital Ctr	95	31	73	10	7	4	40	4	264
Buffalo General Med Ctr	278	202	70	29	79	20	41	16	735
Ellis Hospital	115	76	25	13	8	11	13	7	268
Good Sam - Suffern	29	19	12	2	8	8	3	6	87
Good Sam-West Islip	97	69	8	12	29	29	26	14	284
Lenox Hill Hospital	122	45	77	17	103	18	50	13	445
Long Island Jewish MC	23	15	10	0	19	2	9	6	84
Maimonides Medical Ctr	108	58	78	34	16	17	110	10	431
Mercy Hospital-Buffalo	158	133	32	25	33	3	20	9	413
Montefiore - Moses	109	63	78	34	46	18	52	15	415
Montefiore - Weiler	79	56	58	14	17	22	39	18	303
Mount Sinai Beth Israel	35	35	5	4	6	12	28	16	141
Mount Sinai Hospital	435	143	61	10	250	52	1115	153	2219
Mount Sinai St. Lukes	53	47	25	17	45	32	51	12	282
NYP-Brooklyn Methodist	72	23	33	18	10	2	40	11	209
NYP-Columbia Presby.	575	293	178	46	231	51	249	65	1688
NYP-Queens	46	16	22	7	11	1	12	1	116
NYP-Weill Cornell	399	148	107	30	209	32	156	45	1126
NYU Hospitals Center	396	82	119	18	537	33	158	9	1352
NYU Winthrop Hospital	101	74	68	32	31	24	36	9	375
North Shore Univ Hosp	374	234	141	67	101	66	192	53	1228
Rochester General Hosp	343	255	60	29	94	99	72	53	1005
Southside Hospital	108	86	43	24	68	22	45	18	414
St. Elizabeth Med Ctr	72	80	20	4	29	20	11	8	244
St. Francis Hospital	382	218	91	46	122	64	129	50	1102
St. Josephs Hospital	388	228	118	75	224	59	149	58	1299
St. Peters Hospital	292	272	50	19	52	66	91	46	888
Staten Island Univ Hosp	54	38	7	6	22	5	11	3	146
Strong Memorial Hosp	325	109	82	8	141	14	34	5	718
UHS-Wilson Med Ctr	93	66	19	1	3	0	3	2	187
Univ. Hosp-Brooklyn	13	12	13	2	2	1	7	0	50
Univ. Hosp-Stony Brook	118	95	30	11	40	23	59	16	392
Univ. Hosp-Upstate	29	9	16	1	2	2	4	2	65
Vassar Bros. Med Ctr	156	90	49	28	29	8	20	12	392
Westchester Med Ctr	47	62	34	25	25	12	40	14	259
Statewide Total	**6410**	**3694**	**1960**	**729**	**2725**	**880**	**3173**	**796**	**20367**
STATEWIDE MORTALITY RATE (%)	**1.67**	**3.11**	**3.62**	**8.92**	**0.66**	**3.07**	**4.32**	**8.92**	**3.00**

Table 5

In-hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for TAVR in New York State, 2015-2017 Discharges (Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	604	22	3.64	2.92	3.46	(2.17, 5.24)
Buffalo General Med Ctr	573	12	2.09	2.55	2.28	(1.18, 3.98)
Lenox Hill Hospital	239	1	0.42	2.32	0.50	(0.01, 2.79)
Long Island Jewish MC	12	0	0.00	4.38	0.00	(0.00,19.34)
Maimonides Medical Ctr	195	8	4.10	2.46	4.62	(1.99, 9.11)
Mercy Hospital-Buffalo	102	3	2.94	2.59	3.15	(0.63, 9.20)
Montefiore - Moses	103	4	3.88	3.43	3.14	(0.84, 8.04)
Montefiore - Weiler	152	4	2.63	2.42	3.02	(0.81, 7.73)
Mount Sinai Hospital	769	23	2.99	2.89	2.88	(1.82, 4.32)
NYP-Brooklyn Methodist	72	2	2.78	2.77	2.78	(0.31,10.05)
NYP-Columbia Presby.	1110	14	1.26	2.70	1.30**	(0.71, 2.17)
NYP-Weill Cornell	494	10	2.02	2.68	2.10	(1.00, 3.86)
NYU Hospitals Center	876	15	1.71	2.19	2.17	(1.21, 3.57)
NYU Winthrop Hospital	764	20	2.62	3.02	2.40	(1.47, 3.71)
North Shore Univ Hosp	670	17	2.54	2.88	2.45	(1.43, 3.92)
Rochester General Hosp	259	13	5.02	2.61	5.33*	(2.83, 9.11)
Southside Hospital	216	6	2.78	2.79	2.76	(1.01, 6.01)
St. Elizabeth Med Ctr	81	2	2.47	2.63	2.61	(0.29, 9.42)
St. Francis Hospital	1075	38	3.53	3.21	3.06	(2.16, 4.20)
St. Josephs Hospital	452	17	3.76	3.17	3.30	(1.92, 5.28)
St. Peters Hospital	174	3	1.72	2.85	1.68	(0.34, 4.90)
Staten Island Univ Hosp	47	0	0.00	1.68	0.00	(0.00,12.86)
Strong Memorial Hosp	297	18	6.06	2.89	5.83*	(3.45, 9.21)
UHS-Wilson Med Ctr	162	3	1.85	2.45	2.10	(0.42, 6.13)
Univ. Hosp-Stony Brook	250	10	4.00	2.55	4.36	(2.09, 8.01)
Vassar Bros. Med Ctr	103	5	4.85	2.57	5.23	(1.69,12.21)
Westchester Med Ctr	312	12	3.85	2.88	3.70	(1.91, 6.47)
STATEWIDE TOTAL	**10163**	**282**	**2.77**			

*Risk-adjusted mortality rate significantly higher than statewide rate based on 95 percent confidence interval.
**Risk-adjusted mortality rate significantly lower than statewide rate based on 95 percent confidence interval.

2015-2017 HOSPITAL AND SURGEON OUTCOMES

Table 6 provides the number of Isolated CABG operations, number of CABG patients who died in the hospital or after discharge but within 30 days of surgery, OMR, EMR, RAMR and the 95 percent confidence interval for the RAMR for Isolated CABG patients in 2015-2017. In addition, the final two columns provide the number of Isolated CABG, Valve and Valve/CABG procedures and the RAMR for these patients in 2015-2017 for each of the 38 hospitals performing these operations during the time period. Surgeons and hospitals with RAMRs that are significantly lower or higher than the statewide mortality rate (as judged by the 95 percent confidence interval) are also noted.

The hospital information is presented for each surgeon who met at least one of the following criteria: (a) performed 200 or more cardiac operations during 2015-2017, (b) performed at least one cardiac operation in each of the years, 2015-2017. A cardiac operation is defined as any reportable adult cardiac operation and may include cases not listed in Tables 6 or 7.

The results for surgeons not meeting either of the above criteria are grouped together and reported as "All Others" in the hospital in which the operations were performed. Surgeons who met the above criteria and who performed operations in more than one hospital during 2015-2017 are noted in Table 6 and listed under all hospitals in which they performed these operations; their results are also listed separately in Table 7. This table contains the same information as Table 6 across all hospitals in which the surgeon performed operations.

Table 6

In-Hospital / 30-Day Observed, Expected and Risk-Adjusted Mortality Rates by Surgeon for Isolated CABG and Valve Surgery (done in combination with or without CABG) in New York State, 2015-2017 Discharges

			Isolated CABG				Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
STATEWIDE TOTAL	**25831**	**414**	**1.60**				**46198**	**2.22**
Albany Med. Ctr								
Akujuo A C	172	3	1.74	1.81	1.55	(0.31, 4.53)	277	4.90 *
Bennett E	19	0	0.00	1.38	0.00	(0.00,22.39)	189	3.04
Britton L	127	2	1.57	1.02	2.48	(0.28, 8.94)	246	1.84
#Singh C	23	0	0.00	3.33	0.00	(0.00, 7.67)	27	0.00
Zhang L	148	5	3.38	1.73	3.13	(1.01, 7.30)	176	2.64
All Others	215	4	1.86	1.99	1.50	(0.40, 3.84)	341	2.92
Total	**704**	**14**	**1.99**	**1.74**	**1.83**	**(1.00, 3.07)**	**1256**	**3.10**
Arnot Ogden Med Ctr								
#Hoffman D	168	2	1.19	1.30	1.46	(0.16, 5.29)	216	3.36
All Others	20	0	0.00	1.22	0.00	(0.00,24.11)	27	0.00
Total	**188**	**2**	**1.06**	**1.29**	**1.32**	**(0.15, 4.76)**	**243**	**2.98**
Bassett Medical Center								
Daniel S R	104	4	3.85	2.39	2.58	(0.69, 6.61)	153	4.03
Kelley J	135	2	1.48	1.68	1.41	(0.16, 5.11)	220	2.31
Total	**239**	**6**	**2.51**	**1.99**	**2.02**	**(0.74, 4.41)**	**373**	**3.01**

Table 6 continued

	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
			Isolated CABG				Isolated CABG, or Valve or Valve/CABG	
Bellevue Hospital Ctr								
#Balsam L B	104	1	0.96	0.85	1.82	(0.02,10.14)	221	1.20
#Culliford A	148	4	2.70	1.18	3.66	(0.99, 9.38)	230	3.39
Malhotra S P	.	.	.	.	.	(. , .)	1	0.00
#Smith D E	174	3	1.72	1.00	2.77	(0.56, 8.10)	237	2.83
##Swistel D	1	0	0.00	0.98	0.00	(0.00,100.0)	1	0.00
All Others	.	.	.	.	.	(. , .)	1	0.00
Total	**427**	**8**	**1.87**	**1.02**	**2.93**	**(1.26, 5.78)**	**691**	**2.47**
Buffalo General Med Ctr								
#Aldridge J	201	6	2.99	1.42	3.38	(1.23, 7.35)	241	5.85 *
Ashraf M	559	11	1.97	1.31	2.40	(1.20, 4.30)	689	3.36
Grosner G	569	7	1.23	1.58	1.25	(0.50, 2.57)	1134	1.80
Total	**1329**	**24**	**1.81**	**1.44**	**2.01**	**(1.28, 2.98)**	**2064**	**2.60**
Ellis Hospital								
Choumarov K	247	5	2.02	1.34	2.42	(0.78, 5.64)	311	2.91
Reich H	166	4	2.41	1.80	2.15	(0.58, 5.50)	291	3.39
#Singh C	167	7	4.19	1.68	4.00	(1.60, 8.24)	246	3.03
Total	**580**	**16**	**2.76**	**1.57**	**2.82 ***	**(1.61, 4.57)**	**848**	**3.11**
Good Sam - Suffern								
All Others	284	7	2.46	1.33	2.97	(1.19, 6.13)	371	4.03
Total	**284**	**7**	**2.46**	**1.33**	**2.97**	**(1.19, 6.13)**	**371**	**4.03**
Good Sam-West Islip								
#Dimeo A C	5	0	0.00	3.84	0.00	(0.00,30.61)	5	0.00
#Henry M J	1	0	0.00	8.95	0.00	(0.00,65.66)	1	0.00
Lamendola C	231	7	3.03	1.90	2.56	(1.02, 5.26)	420	2.77
Rovensky M	367	2	0.54	2.25	0.39 **	(0.04, 1.40)	458	0.71 **
All Others	34	0	0.00	1.91	0.00	(0.00, 9.07)	38	5.54
Total	**638**	**9**	**1.41**	**2.13**	**1.06**	**(0.48, 2.02)**	**922**	**1.76**
Lenox Hill Hospital								
#Brinster D R	34	0	0.00	1.26	0.00	(0.00,13.72)	123	1.69
Hemli J M	30	0	0.00	1.66	0.00	(0.00,11.83)	35	0.00
Patel N C	655	7	1.07	1.29	1.32	(0.53, 2.73)	906	1.29
Pirelli L	34	0	0.00	1.51	0.00	(0.00,11.47)	60	2.19
#Scheinerman S J	151	2	1.32	1.19	1.78	(0.20, 6.43)	225	1.21
Total	**904**	**9**	**1.00**	**1.30**	**1.23**	**(0.56, 2.34)**	**1349**	**1.33**
Long Island Jewish MC								
#Graver L	34	0	0.00	1.70	0.00	(0.00,10.17)	98	0.79
##Hartman A	3	0	0.00	0.88	0.00	(0.00,100.0)	7	0.00
#Meyer D B	.	.	.	.	.	(. , .)	4	0.00
#Palazzo R	58	0	0.00	1.47	0.00	(0.00, 6.90)	66	0.00
#Scheinerman S J	2	0	0.00	1.65	0.00	(0.00,100.0)	6	0.00
Total	**97**	**0**	**0.00**	**1.53**	**0.00**	**(0.00, 3.95)**	**181**	**0.50**

Table 6 continued

	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
			Isolated CABG				**Isolated CABG, or Valve or Valve/CABG**	
Maimonides Medical Ctr								
#Abrol S	106	6	5.66	2.43	3.74	(1.36, 8.13)	205	2.79
Crooke G	79	1	1.27	1.45	1.40	(0.02, 7.78)	146	2.01
Jacobowitz I	287	5	1.74	2.03	1.37	(0.44, 3.20)	433	2.40
Ribakove G	83	1	1.20	1.35	1.43	(0.02, 7.95)	153	3.42
Saunders P	61	1	1.64	1.77	1.48	(0.02, 8.24)	68	3.67
Stephens G A	13	1	7.69	2.11	5.86	(0.08,32.58)	22	4.36
##Tak V M	3	1	33.33	12.33	4.33	(0.06,24.11)	9	4.00
#Vaynblat M	37	1	2.70	1.85	2.34	(0.03,13.03)	60	2.79
All Others	9	0	0.00	2.50	0.00	(0.00,26.08)	13	0.00
Total	**678**	**17**	**2.51**	**1.96**	**2.05**	**(1.19, 3.28)**	**1109**	**2.66**
Mercy Hospital-Buffalo								
Adkins M	315	9	2.86	1.68	2.72	(1.24, 5.16)	413	4.40 *
#Aldridge J	1	0	0.00	3.18	0.00	(0.00,100.0)	2	0.00
Bell-Thomson J	107	1	0.93	1.36	1.10	(0.01, 6.11)	220	3.45
Downing S W	409	8	1.96	1.66	1.89	(0.81, 3.72)	579	2.51
Jain H B	194	2	1.03	1.54	1.07	(0.12, 3.86)	221	1.25
#Joyce F	9	1	11.11	3.66	4.86	(0.06,27.06)	10	12.86
All Others	47	0	0.00	1.23	0.00	(0.00,10.17)	50	0.00
Total	**1082**	**21**	**1.94**	**1.62**	**1.93**	**(1.19, 2.94)**	**1495**	**3.11**
Montefiore - Moses								
#Bello R A	2	0	0.00	0.89	0.00	(0.00,100.0)	3	0.00
#Chau M L	4	0	0.00	1.02	0.00	(0.00,100.0)	5	0.00
#Derose J J	4	0	0.00	0.96	0.00	(0.00,100.0)	9	0.00
#Goldstein D J	166	2	1.20	1.33	1.45	(0.16, 5.24)	293	3.56
#Jakobleff W A	211	1	0.47	1.49	0.51	(0.01, 2.84)	264	2.26
#Michler R E	106	0	0.00	1.17	0.00	(0.00, 4.73)	283	1.70
Peek G J	.	.	.	.	.	(. , .)	5	0.00
All Others	56	0	0.00	1.34	0.00	(0.00, 7.85)	102	0.00
Total	**549**	**3**	**0.55**	**1.35**	**0.65**	**(0.13, 1.89)**	**964**	**2.22**
Montefiore - Weiler								
#Bello R A	126	5	3.97	1.36	4.69	(1.51,10.94)	185	4.62
#Chau M L	75	3	4.00	1.24	5.17	(1.04,15.10)	88	5.84
#Derose J J	340	8	2.35	1.50	2.52	(1.08, 4.96)	553	2.57
#Goldstein D J	15	0	0.00	0.85	0.00	(0.00,46.20)	23	0.00
#Jakobleff W A	3	0	0.00	0.48	0.00	(0.00,100.0)	5	0.00
#Michler R E	1	0	0.00	0.39	0.00	(0.00,100.0)	9	0.00
All Others	16	1	6.25	1.42	7.06	(0.09,39.30)	16	9.78
Total	**576**	**17**	**2.95**	**1.41**	**3.36 ***	**(1.96, 5.38)**	**879**	**3.10**
Mount Sinai Beth Israel								
#Hoffman D	2	0	0.00	0.28	0.00	(0.00,100.0)	4	0.00
##Puskas J D	323	1	0.31	1.10	0.45	(0.01, 2.51)	443	2.27
##Tranbaugh R	65	0	0.00	1.42	0.00	(0.00, 6.35)	79	1.62
All Others	13	0	0.00	1.25	0.00	(0.00,36.07)	18	0.00
Total	**403**	**1**	**0.25**	**1.15**	**0.35**	**(0.00, 1.92)**	**544**	**2.06**

Table 6 continued

	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Isolated CABG, or Valve or Valve/CABG Cases	RAMR
				Isolated CABG				
Mount Sinai Hospital								
Adams D H	4	0	0.00	1.46	0.00	(0.00,100.0)	1069	0.26 **
Anyanwu A C	62	0	0.00	1.74	0.00	(0.00, 5.44)	166	2.44
Boateng P	43	0	0.00	1.32	0.00	(0.00,10.35)	109	0.74
##Chikwe J Y	34	1	2.94	1.59	2.97	(0.04,16.51)	48	2.64
El-Eshmawi A M	12	0	0.00	0.56	0.00	(0.00,88.20)	48	2.58
Filsoufi F	287	2	0.70	1.27	0.88	(0.10, 3.17)	379	1.74
Nguyen K	1	0	0.00	0.43	0.00	(0.00,100.0)	2	0.00
Pawale A A	9	1	11.11	1.07	16.69	(0.22,92.85)	18	6.50
##Puskas J D	5	0	0.00	1.29	0.00	(0.00,90.89)	6	0.00
Reddy R C	342	3	0.88	1.55	0.91	(0.18, 2.65)	478	1.94
Stelzer P	27	0	0.00	0.80	0.00	(0.00,27.28)	277	2.21
Stewart A S	128	2	1.56	1.16	2.16	(0.24, 7.81)	450	2.67
#Tannous H J	39	0	0.00	1.39	0.00	(0.00,10.83)	56	0.00
Varghese R	113	3	2.65	1.14	3.74	(0.75,10.94)	214	3.04
All Others	.	.	.	.	.	(. , .)	5	0.00
Total	**1106**	**12**	**1.08**	**1.35**	**1.29**	**(0.66, 2.25)**	**3325**	**1.59 **
Mount Sinai St. Lukes								
Balaram S K	210	3	1.43	1.70	1.35	(0.27, 3.94)	319	2.14
##Chikwe J Y	86	1	1.16	1.22	1.53	(0.02, 8.52)	166	2.09
##Puskas J D	196	4	2.04	1.21	2.70	(0.73, 6.92)	237	4.67
##Swistel D	31	0	0.00	2.06	0.00	(0.00, 9.19)	66	1.42
All Others	15	0	0.00	1.18	0.00	(0.00,33.19)	32	4.60
Total	**538**	**8**	**1.49**	**1.45**	**1.64**	**(0.71, 3.24)**	**820**	**2.68**
NYP-Brooklyn Methodist								
##Gulkarov I M	135	2	1.48	1.77	1.34	(0.15, 4.85)	240	1.73
##Tranbaugh R	185	1	0.54	1.66	0.52	(0.01, 2.90)	252	1.35
#Worku B M	48	0	0.00	1.65	0.00	(0.00, 7.41)	70	0.00
All Others	19	0	0.00	1.31	0.00	(0.00,23.69)	34	0.00
Total	**387**	**3**	**0.78**	**1.68**	**0.74**	**(0.15, 2.16)**	**596**	**1.23**
NYP-Columbia Presby.								
Argenziano M	260	2	0.77	1.29	0.95	(0.11, 3.44)	512	1.05
#Bacha E	.	.	.	.	.	(. , .)	3	0.00
Borger M A	32	0	0.00	2.28	0.00	(0.00, 8.06)	284	1.47
#Chai P J	.	.	.	.	.	(. , .)	2	0.00
George I	137	3	2.19	1.50	2.34	(0.47, 6.84)	370	2.96
Naka Y	259	3	1.16	1.47	1.26	(0.25, 3.68)	382	1.43
Smith C	215	3	1.40	1.22	1.84	(0.37, 5.37)	698	2.75
Takayama H	318	5	1.57	1.92	1.31	(0.42, 3.06)	588	2.24
Takeda K	82	4	4.88	2.41	3.24	(0.87, 8.30)	138	3.34
All Others	6	0	0.00	0.94	0.00	(0.00,100.0)	20	0.00
Total	**1309**	**20**	**1.53**	**1.58**	**1.55**	**(0.94, 2.39)**	**2997**	**2.16**
NYP-Queens								
#Avgerinos D V	96	0	0.00	0.70	0.00	(0.00, 8.76)	122	0.00
#Lang S	351	3	0.85	0.89	1.54	(0.31, 4.50)	441	3.04
All Others	1	0	0.00	0.74	0.00	(0.00,100.0)	1	0.00
Total	**448**	**3**	**0.67**	**0.85**	**1.26**	**(0.25, 3.69)**	**564**	**2.50**

Table 6 continued

	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
			Isolated CABG				Isolated CABG, or Valve or Valve/CABG	
NYP-Weill Cornell								
#Avgerinos D V	.	.	.	.	.	(. , .)	1	0.00
#Bacha E	.	.	.	.	.	(. , .)	2	0.00
#Chai P J	.	.	.	.	.	(. , .)	3	0.00
Girardi L	219	0	0.00	1.55	0.00	(0.00, 1.73)	829	1.37
##Gulkarov I M	1	0	0.00	1.30	0.00	(0.00,100.0)	4	0.00
Guy T S	44	0	0.00	0.99	0.00	(0.00,13.52)	195	0.79
Krieger K	104	2	1.92	1.54	2.00	(0.22, 7.21)	284	3.14
#Lang S	4	0	0.00	5.73	0.00	(0.00,25.65)	12	0.00
Lau C	128	2	1.56	2.09	1.20	(0.13, 4.33)	190	1.88
Salemi A	62	2	3.23	1.34	3.85	(0.43,13.89)	153	2.90
##Tranbaugh R	2	0	0.00	1.53	0.00	(0.00,100.0)	4	0.00
#Worku B M	.	.	.	.	.	(. , .)	1	0.00
All Others	5	0	0.00	1.34	0.00	(0.00,88.04)	17	5.50
Total	**569**	**6**	**1.05**	**1.63**	**1.04**	**(0.38, 2.26)**	**1695**	**1.90**
NYU Hospitals Center								
#Balsam L B	1	0	0.00	0.71	0.00	(0.00,100.0)	5	0.00
#Culliford A	14	0	0.00	0.73	0.00	(0.00,57.58)	37	2.50
Galloway A	53	1	1.89	0.93	3.27	(0.04,18.17)	384	4.38
Grossi E	5	0	0.00	0.98	0.00	(0.00,100.0)	8	0.00
Loulmet D F	37	0	0.00	0.72	0.00	(0.00,22.13)	487	4.06
Mosca R S	.	.	.	.	.	(. , .)	5	0.00
#Smith D E	52	0	0.00	1.37	0.00	(0.00, 8.23)	76	2.98
##Swistel D	101	1	0.99	0.97	1.64	(0.02, 9.14)	224	4.84
#Vaynblat M	65	2	3.08	1.09	4.52	(0.51,16.31)	118	4.90
Williams M R	6	0	0.00	0.91	0.00	(0.00,100.0)	154	1.55
Zias E	349	7	2.01	1.26	2.56	(1.02, 5.26)	535	1.77
All Others	1	0	0.00	0.41	0.00	(0.00,100.0)	3	0.00
Total	**684**	**11**	**1.61**	**1.13**	**2.27**	**(1.13, 4.06)**	**2036**	**3.16 ***
NYU Winthrop Hospital								
#Abrol S	68	0	0.00	1.38	0.00	(0.00, 6.24)	92	0.00
Goncalves J A	57	0	0.00	2.20	0.00	(0.00, 4.68)	124	2.55
Kokotos W J	155	1	0.65	1.62	0.64	(0.01, 3.56)	285	1.86
##Pogo G	44	0	0.00	2.44	0.00	(0.00, 5.47)	55	0.00
Salhab K F	163	2	1.23	1.81	1.09	(0.12, 3.92)	220	2.16
Schubach S	183	0	0.00	1.48	0.00	(0.00, 2.17)	269	0.00 **
Total	**670**	**3**	**0.45**	**1.71**	**0.42 ****	**(0.08, 1.23)**	**1045**	**1.46**
North Shore Univ Hosp								
#Brinster D R	13	0	0.00	1.34	0.00	(0.00,33.77)	21	0.00
Esposito R	226	0	0.00	1.21	0.00	(0.00, 2.16)	380	1.54
##Fernandez H A	11	0	0.00	2.13	0.00	(0.00,25.04)	19	0.00
#Graver L	274	3	1.09	1.83	0.96	(0.19, 2.80)	574	1.16 **
Hall M	71	1	1.41	2.44	0.92	(0.01, 5.14)	122	1.93
##Hartman A	150	0	0.00	1.49	0.00	(0.00, 2.63)	412	2.15
#Kalimi R	28	0	0.00	1.20	0.00	(0.00,17.53)	52	0.00
#Meyer D B	.	.	.	.	.	(. , .)	1	0.00
#Palazzo R	169	1	0.59	1.34	0.71	(0.01, 3.93)	230	1.01
##Pogo G	7	0	0.00	1.43	0.00	(0.00,58.65)	15	0.00
##Taylor J	243	1	0.41	1.77	0.37	(0.00, 2.07)	443	1.54
Vatsia S	209	4	1.91	1.34	2.29	(0.62, 5.86)	323	2.32
Yu P J	101	2	1.98	1.53	2.07	(0.23, 7.48)	138	3.60
All Others	1	0	0.00	0.28	0.00	(0.00,100.0)	1	0.00
Total	**1503**	**12**	**0.80**	**1.56**	**0.82 ****	**(0.42, 1.43)**	**2731**	**1.66 ****

Table 6 continued

	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
			Isolated CABG				**Isolated CABG, or Valve or Valve/CABG**	
Rochester General Hosp								
Cheeran D	526	14	2.66	1.97	2.16	(1.18, 3.63)	910	2.22
Kirshner R	498	9	1.81	1.52	1.91	(0.87, 3.63)	1056	2.94
Yankey G K N	232	13	5.60	2.15	4.17 *	(2.22, 7.13)	295	5.03 *
Total	1256	36	2.87	1.82	2.52 *	(1.76, 3.49)	2261	2.87 *
Southside Hospital								
##Fernandez H A	135	0	0.00	1.20	0.00	(0.00, 3.64)	219	0.44
##Hartman A	3	0	0.00	0.50	0.00	(0.00,100.0)	21	3.76
#Kalimi R	195	0	0.00	1.45	0.00	(0.00, 2.08)	421	0.00 **
Manetta F	169	1	0.59	1.32	0.72	(0.01, 4.01)	233	1.07
##Pogo G	45	2	4.44	1.81	3.93	(0.44,14.19)	65	4.53
##Taylor J	1	0	0.00	0.64	0.00	(0.00,100.0)	3	0.00
Total	548	3	0.55	1.37	0.64	(0.13, 1.87)	962	0.79 **
St. Elizabeth Med Ctr								
Cahill A T	116	4	3.45	2.03	2.72	(0.73, 6.96)	144	3.54
Fuzesi L	190	9	4.74	2.25	3.37	(1.54, 6.40)	257	3.98
#Joyce F	227	5	2.20	1.72	2.05	(0.66, 4.78)	341	3.64
All Others	51	2	3.92	1.53	4.11	(0.46,14.83)	86	3.85
Total	584	20	3.42	1.94	2.83 *	(1.73, 4.37)	828	3.76 *
St. Francis Hospital								
Bercow N	329	1	0.30	2.16	0.23 **	(0.00, 1.25)	572	2.00
Colangelo R	548	6	1.09	1.39	1.27	(0.46, 2.76)	921	1.93
#Dimeo A C	207	4	1.93	1.42	2.18	(0.59, 5.58)	272	2.32
#Henry M J	127	3	2.36	2.51	1.51	(0.30, 4.41)	147	2.30
Lundy E F	305	4	1.31	1.82	1.15	(0.31, 2.96)	415	1.53
Robinson N	79	2	2.53	2.08	1.95	(0.22, 7.05)	370	1.86
Total	1595	20	1.25	1.76	1.14	(0.70, 1.77)	2697	1.94
St. Josephs Hospital								
#Green G R	226	5	2.21	2.13	1.67	(0.54, 3.89)	495	1.44
Lutz C J	276	4	1.45	2.33	1.00	(0.27, 2.56)	637	1.35
Marvasti M	176	0	0.00	1.72	0.00	(0.00, 1.94)	305	0.27 **
Nazem A	298	5	1.68	1.93	1.39	(0.45, 3.25)	499	2.25
Zhou Z	329	5	1.52	1.91	1.28	(0.41, 2.98)	668	1.28
Total	1305	19	1.46	2.01	1.16	(0.70, 1.81)	2604	1.43 **
St. Peters Hospital								
Edwards N	228	2	0.88	1.30	1.08	(0.12, 3.91)	438	2.19
Karavas A N	341	3	0.88	1.31	1.08	(0.22, 3.14)	502	1.44
Saifi J	202	4	1.98	1.94	1.63	(0.44, 4.18)	516	2.07
Terrien C M	320	5	1.56	1.63	1.54	(0.50, 3.59)	523	1.71
Total	1091	14	1.28	1.52	1.35	(0.74, 2.27)	1979	1.86
Staten Island Univ Hosp								
##Gulkarov I M	9	1	11.11	0.55	32.42	(0.42,100.0)	10	37.68
Imam M N	96	0	0.00	0.99	0.00	(0.00, 6.19)	141	1.12
Rosell F M	281	2	0.71	1.64	0.70	(0.08, 2.52)	315	1.99
Wohler A M	50	3	6.00	1.89	5.10	(1.02,14.90)	69	5.19
All Others	104	3	2.88	1.47	3.14	(0.63, 9.16)	151	2.40
Total	540	9	1.67	1.50	1.79	(0.81, 3.39)	686	2.47

Table 6 continued

	No of Cases	Deaths	**Isolated CABG** OMR	EMR	RAMR	95% CI for RAMR	**Isolated CABG, or Valve or Valve/CABG** Cases	RAMR
Strong Memorial Hosp								
Gensini P F	.	.	.	.	.	(. , .)	9	0.00
Knight P	293	7	2.39	1.93	1.99	(0.80, 4.09)	891	3.72 *
Lehoux J M	157	1	0.64	1.19	0.86	(0.01, 4.78)	202	4.25
Prasad S M	95	4	4.21	2.17	3.11	(0.84, 7.97)	134	5.94 *
All Others	106	1	0.94	1.31	1.16	(0.02, 6.43)	133	1.11
Total	**651**	**13**	**2.00**	**1.68**	**1.90**	**(1.01, 3.25)**	**1369**	**3.88 ***
UHS-Wilson Med Ctr								
Rahman A	.	.	.	.	.	(. , .)	1	0.00
Wong K	166	1	0.60	1.51	0.64	(0.01, 3.56)	244	1.71
Yousuf M	166	7	4.22	2.42	2.79	(1.12, 5.75)	251	5.48 *
All Others	58	2	3.45	1.46	3.79	(0.43,13.70)	81	3.66
Total	**390**	**10**	**2.56**	**1.89**	**2.17**	**(1.04, 4.00)**	**577**	**3.91 ***
Univ. Hosp-Brooklyn								
Beckles D L	105	4	3.81	1.89	3.22	(0.87, 8.26)	136	4.79
Neragi-Miandoab S	40	2	5.00	2.47	3.24	(0.36,11.69)	51	3.32
##Tak V M	7	2	28.57	1.27	36.19 *	(4.06,100.0)	15	10.89
All Others	3	0	0.00	1.08	0.00	(0.00,100.0)	3	0.00
Total	**155**	**8**	**5.16**	**2.00**	**4.14 ***	**(1.78, 8.15)**	**205**	**5.13 ***
Univ. Hosp-Stony Brook								
Bilfinger T	76	2	2.63	2.13	1.98	(0.22, 7.14)	94	3.32
##Chikwe J Y	114	1	0.88	1.58	0.89	(0.01, 4.94)	202	0.39 **
##Fernandez H A	96	0	0.00	1.75	0.00	(0.00, 3.50)	159	1.13
McLarty A	48	1	2.08	3.37	0.99	(0.01, 5.52)	62	1.18
##Tak V M	78	1	1.28	2.70	0.76	(0.01, 4.23)	109	2.32
#Tannous H J	63	1	1.59	1.42	1.79	(0.02, 9.97)	73	2.08
##Taylor J	106	1	0.94	2.01	0.75	(0.01, 4.19)	201	0.98
All Others	89	2	2.25	1.43	2.52	(0.28, 9.11)	162	3.76
Total	**670**	**9**	**1.34**	**1.96**	**1.10**	**(0.50, 2.09)**	**1062**	**1.70**
Univ. Hosp-Upstate								
Dunton R F	74	1	1.35	1.41	1.54	(0.02, 8.58)	101	3.90
Esrig B	24	1	4.17	1.64	4.07	(0.05,22.64)	37	11.89 *
#Green G R	24	0	0.00	2.27	0.00	(0.00,10.78)	37	0.00
All Others	14	0	0.00	0.88	0.00	(0.00,47.73)	26	4.35
Total	**136**	**2**	**1.47**	**1.55**	**1.52**	**(0.17, 5.51)**	**201**	**4.09**
Vassar Bros. Med Ctr								
Sarabu M	99	4	4.04	2.12	3.06	(0.82, 7.82)	279	1.69
Shahani R B	173	1	0.58	1.74	0.53	(0.01, 2.96)	263	0.40 **
Zakow P	204	1	0.49	1.68	0.47	(0.01, 2.61)	326	0.59 **
Total	**476**	**6**	**1.26**	**1.79**	**1.13**	**(0.41, 2.45)**	**868**	**0.95 *** *

Table 6 continued

	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
			Isolated CABG				Isolated CABG, or Valve or Valve/CABG	
Westchester Med Ctr								
Kai M	107	2	1.87	1.62	1.85	(0.21, 6.69)	149	3.68
Lansman S	4	0	0.00	1.14	0.00	(0.00,100.0)	6	0.00
Malekan R	117	0	0.00	1.77	0.00	(0.00, 2.84)	173	2.12
Spielvogel D	272	7	2.57	1.65	2.50	(1.00, 5.16)	401	2.47
Tang G H L	.	.	.	.	.	(. , .)	4	38.01
All Others	42	4	9.52	1.01	15.14 *	(4.07,38.77)	68	11.14 *
Total	**542**	**13**	**2.40**	**1.61**	**2.38**	**(1.27, 4.07)**	**801**	**3.10**
STATEWIDE TOTAL	**25831**	**414**	**1.60**				**46198**	**2.22**

* RAMR significantly higher than statewide rate based on 95 percent confidence interval.
** RAMR significantly lower than statewide rate based on 95 percent confidence interval.
# Performed operations in another NYS hospital.
Performed operations in two or more other NYS hospitals.

Table 7

Summary Information for Surgeons Practicing at More Than One Hospital, 2015-2017.

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Abrol S	**174**	**6**	**3.45**	**2.02**	**2.74**	**(1.00, 5.95)**	**297**	**2.26**
Maimonides Medical Ctr	106	6	5.66	2.43	3.74	(1.36, 8.13)	205	2.79
NYU Winthrop Hospital	68	0	0.00	1.38	0.00	(0.00, 6.24)	92	0.00
Aldridge J	**202**	**6**	**2.97**	**1.42**	**3.34**	**(1.22, 7.27)**	**243**	**5.78** *
Buffalo General Med Ctr	201	6	2.99	1.42	3.38	(1.23, 7.35)	241	5.85 *
Mercy Hospital-Buffalo	1	0	0.00	3.18	0.00	(0.00,100.0)	2	0.00
Avgerinos D V	**96**	**0**	**0.00**	**0.70**	**0.00**	**(0.00, 8.76)**	**123**	**0.00**
NYP-Queens	96	0	0.00	0.70	0.00	(0.00, 8.76)	122	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	1	0.00
Bacha E	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**5**	**0.00**
NYP-Columbia Presby.	.	.	.	.	.	(. , .)	3	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	2	0.00
Balsam L B	**105**	**1**	**0.95**	**0.84**	**1.81**	**(0.02,10.06)**	**226**	**1.16**
Bellevue Hospital Ctr	104	1	0.96	0.85	1.82	(0.02,10.14)	221	1.20
NYU Hospitals Center	1	0	0.00	0.71	0.00	(0.00,100.0)	5	0.00
Bello R A	**128**	**5**	**3.91**	**1.35**	**4.64**	**(1.50,10.83)**	**188**	**4.50**
Montefiore - Moses	2	0	0.00	0.89	0.00	(0.00,100.0)	3	0.00
Montefiore - Weiler	126	5	3.97	1.36	4.69	(1.51,10.94)	185	4.62
Brinster D R	**47**	**0**	**0.00**	**1.28**	**0.00**	**(0.00, 9.76)**	**144**	**1.52**
Lenox Hill Hospital	34	0	0.00	1.26	0.00	(0.00,13.72)	123	1.69
North Shore Univ Hosp	13	0	0.00	1.34	0.00	(0.00,33.77)	21	0.00
Chai P J	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**5**	**0.00**
NYP-Columbia Presby.	.	.	.	.	.	(. , .)	2	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	3	0.00
Chau M L	**79**	**3**	**3.80**	**1.23**	**4.95**	**(1.00,14.47)**	**93**	**5.63**
Montefiore - Moses	4	0	0.00	1.02	0.00	(0.00,100.0)	5	0.00
Montefiore - Weiler	75	3	4.00	1.24	5.17	(1.04,15.10)	88	5.84
Chikwe J Y	**234**	**3**	**1.28**	**1.45**	**1.42**	**(0.28, 4.14)**	**416**	**1.24**
Mount Sinai Hospital	34	1	2.94	1.59	2.97	(0.04,16.51)	48	2.64
Mount Sinai St. Lukes	86	1	1.16	1.22	1.53	(0.02, 8.52)	166	2.09
Univ. Hosp-Stony Brook	114	1	0.88	1.58	0.89	(0.01, 4.94)	202	0.39 **
Culliford A	**162**	**4**	**2.47**	**1.14**	**3.46**	**(0.93, 8.86)**	**267**	**3.22**
Bellevue Hospital Ctr	148	4	2.70	1.18	3.66	(0.99, 9.38)	230	3.39
NYU Hospitals Center	14	0	0.00	0.73	0.00	(0.00,57.58)	37	2.50

Table 7 continued

	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
			Isolated CABG				**Isolated CABG, or Valve or Valve/CABG**	
Derose J J	**344**	**8**	**2.33**	**1.49**	**2.50**	**(1.08, 4.92)**	**562**	**2.50**
Montefiore - Moses	4	0	0.00	0.96	0.00	(0.00,100.0)	9	0.00
Montefiore - Weiler	340	8	2.35	1.50	2.52	(1.08, 4.96)	553	2.57
Dimeo A C	**212**	**4**	**1.89**	**1.48**	**2.04**	**(0.55, 5.23)**	**277**	**2.24**
Good Sam-West Islip	5	0	0.00	3.84	0.00	(0.00,30.61)	5	0.00
St. Francis Hospital	207	4	1.93	1.42	2.18	(0.59, 5.58)	272	2.32
Fernandez H A	**242**	**0**	**0.00**	**1.46**	**0.00**	**(0.00, 1.67)**	**397**	**0.71** **
North Shore Univ Hosp	11	0	0.00	2.13	0.00	(0.00,25.04)	19	0.00
Southside Hospital	135	0	0.00	1.20	0.00	(0.00, 3.64)	219	0.44
Univ. Hosp-Stony Brook	96	0	0.00	1.75	0.00	(0.00, 3.50)	159	1.13
Goldstein D J	**181**	**2**	**1.10**	**1.29**	**1.37**	**(0.15, 4.95)**	**316**	**3.39**
Montefiore - Moses	166	2	1.20	1.33	1.45	(0.16, 5.24)	293	3.56
Montefiore - Weiler	15	0	0.00	0.85	0.00	(0.00,46.20)	23	0.00
Graver L	**308**	**3**	**0.97**	**1.82**	**0.86**	**(0.17, 2.51)**	**672**	**1.11** **
Long Island Jewish MC	34	0	0.00	1.70	0.00	(0.00,10.17)	98	0.79
North Shore Univ Hosp	274	3	1.09	1.83	0.96	(0.19, 2.80)	574	1.16 **
Green G R	**250**	**5**	**2.00**	**2.14**	**1.50**	**(0.48, 3.50)**	**532**	**1.31**
St. Josephs Hospital	226	5	2.21	2.13	1.67	(0.54, 3.89)	495	1.44
Univ. Hosp-Upstate	24	0	0.00	2.27	0.00	(0.00,10.78)	37	0.00
Gulkarov I M	**145**	**3**	**2.07**	**1.69**	**1.96**	**(0.39, 5.73)**	**254**	**2.04**
NYP-Brooklyn Methodist	135	2	1.48	1.77	1.34	(0.15, 4.85)	240	1.73
NYP-Weill Cornell	1	0	0.00	1.30	0.00	(0.00,100.0)	4	0.00
Staten Island Univ Hosp	9	1	11.11	0.55	32.42	(0.42,100.0)	10	37.68
Hartman A	**156**	**0**	**0.00**	**1.46**	**0.00**	**(0.00, 2.58)**	**440**	**2.22**
Long Island Jewish MC	3	0	0.00	0.88	0.00	(0.00,100.0)	7	0.00
North Shore Univ Hosp	150	0	0.00	1.49	0.00	(0.00, 2.63)	412	2.15
Southside Hospital	3	0	0.00	0.50	0.00	(0.00,100.0)	21	3.76
Henry M J	**128**	**3**	**2.34**	**2.56**	**1.47**	**(0.30, 4.29)**	**148**	**2.25**
Good Sam-West Islip	1	0	0.00	8.95	0.00	(0.00,65.66)	1	0.00
St. Francis Hospital	127	3	2.36	2.51	1.51	(0.30, 4.41)	147	2.30
Hoffman D	**170**	**2**	**1.18**	**1.29**	**1.46**	**(0.16, 5.27)**	**220**	**3.22**
Arnot Ogden Med Ctr	168	2	1.19	1.30	1.46	(0.16, 5.29)	216	3.36
Mount Sinai Beth Israel	2	0	0.00	0.28	0.00	(0.00,100.0)	4	0.00
Jakobleff W A	**214**	**1**	**0.47**	**1.47**	**0.51**	**(0.01, 2.83)**	**269**	**2.19**
Montefiore - Moses	211	1	0.47	1.49	0.51	(0.01, 2.84)	264	2.26
Montefiore - Weiler	3	0	0.00	0.48	0.00	(0.00,100.0)	5	0.00
Joyce F	**236**	**6**	**2.54**	**1.80**	**2.27**	**(0.83, 4.94)**	**351**	**4.13**
Mercy Hospital-Buffalo	9	1	11.11	3.66	4.86	(0.06,27.06)	10	12.86
St. Elizabeth Med Ctr	227	5	2.20	1.72	2.05	(0.66, 4.78)	341	3.64

Table 7 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Kalimi R	**223**	**0**	**0.00**	**1.42**	**0.00**	**(0.00, 1.86)**	**473**	**0.00 **
North Shore Univ Hosp	28	0	0.00	1.20	0.00	(0.00,17.53)	52	0.00
Southside Hospital	195	0	0.00	1.45	0.00	(0.00, 2.08)	421	0.00 **
Lang S	**355**	**3**	**0.85**	**0.94**	**1.43**	**(0.29, 4.19)**	**453**	**2.76**
NYP-Queens	351	3	0.85	0.89	1.54	(0.31, 4.50)	441	3.04
NYP-Weill Cornell	4	0	0.00	5.73	0.00	(0.00,25.65)	12	0.00
Meyer D B	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**5**	**0.00**
Long Island Jewish MC	.	.	.	.	.	(. , .)	4	0.00
North Shore Univ Hosp	.	.	.	.	.	(. , .)	1	0.00
Michler R E	**107**	**0**	**0.00**	**1.17**	**0.00**	**(0.00, 4.71)**	**292**	**1.57**
Montefiore - Moses	106	0	0.00	1.17	0.00	(0.00, 4.73)	283	1.70
Montefiore - Weiler	1	0	0.00	0.39	0.00	(0.00,100.0)	9	0.00
Palazzo R	**227**	**1**	**0.44**	**1.37**	**0.51**	**(0.01, 2.86)**	**296**	**0.79**
Long Island Jewish MC	58	0	0.00	1.47	0.00	(0.00, 6.90)	66	0.00
North Shore Univ Hosp	169	1	0.59	1.34	0.71	(0.01, 3.93)	230	1.01
Pogo G	**96**	**2**	**2.08**	**2.07**	**1.61**	**(0.18, 5.82)**	**135**	**2.25**
NYU Winthrop Hospital	44	0	0.00	2.44	0.00	(0.00, 5.47)	55	0.00
North Shore Univ Hosp	7	0	0.00	1.43	0.00	(0.00,58.65)	15	0.00
Southside Hospital	45	2	4.44	1.81	3.93	(0.44,14.19)	65	4.53
Puskas J D	**524**	**5**	**0.95**	**1.14**	**1.34**	**(0.43, 3.13)**	**686**	**3.10**
Mount Sinai Beth Israel	323	1	0.31	1.10	0.45	(0.01, 2.51)	443	2.27
Mount Sinai Hospital	5	0	0.00	1.29	0.00	(0.00,90.89)	6	0.00
Mount Sinai St. Lukes	196	4	2.04	1.21	2.70	(0.73, 6.92)	237	4.67
Scheinerman S J	**153**	**2**	**1.31**	**1.20**	**1.75**	**(0.20, 6.31)**	**231**	**1.12**
Lenox Hill Hospital	151	2	1.32	1.19	1.78	(0.20, 6.43)	225	1.21
Long Island Jewish MC	2	0	0.00	1.65	0.00	(0.00,100.0)	6	0.00
Singh C	**190**	**7**	**3.68**	**1.88**	**3.14**	**(1.26, 6.47)**	**273**	**2.66**
Albany Med. Ctr	23	0	0.00	3.33	0.00	(0.00, 7.67)	27	0.00
Ellis Hospital	167	7	4.19	1.68	4.00	(1.60, 8.24)	246	3.03
Smith D E	**226**	**3**	**1.33**	**1.08**	**1.96**	**(0.39, 5.74)**	**313**	**2.88**
Bellevue Hospital Ctr	174	3	1.72	1.00	2.77	(0.56, 8.10)	237	2.83
NYU Hospitals Center	52	0	0.00	1.37	0.00	(0.00, 8.23)	76	2.98
Swistel D	**133**	**1**	**0.75**	**1.22**	**0.99**	**(0.01, 5.49)**	**291**	**3.44**
Bellevue Hospital Ctr	1	0	0.00	0.98	0.00	(0.00,100.0)	1	0.00
Mount Sinai St. Lukes	31	0	0.00	2.06	0.00	(0.00, 9.19)	66	1.42
NYU Hospitals Center	101	1	0.99	0.97	1.64	(0.02, 9.14)	224	4.84
Tak V M	**88**	**4**	**4.55**	**2.92**	**2.50**	**(0.67, 6.39)**	**133**	**3.84**
Maimonides Medical Ctr	3	1	33.33	12.33	4.33	(0.06,24.11)	9	4.00
Univ. Hosp-Brooklyn	7	2	28.57	1.27	36.19 *	(4.06,100.0)	15	10.89
Univ. Hosp-Stony Brook	78	1	1.28	2.70	0.76	(0.01, 4.23)	109	2.32

Table 7 continued

	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
			Isolated CABG				**Isolated CABG, or Valve or Valve/CABG**	
Tannous H J	**102**	**1**	**0.98**	**1.41**	**1.12**	**(0.01, 6.20)**	**129**	**1.12**
Mount Sinai Hospital	39	0	0.00	1.39	0.00	(0.00,10.83)	56	0.00
Univ. Hosp-Stony Brook	63	1	1.59	1.42	1.79	(0.02, 9.97)	73	2.08
Taylor J	**350**	**2**	**0.57**	**1.84**	**0.50**	**(0.06, 1.80)**	**647**	**1.38**
North Shore Univ Hosp	243	1	0.41	1.77	0.37	(0.00, 2.07)	443	1.54
Southside Hospital	1	0	0.00	0.64	0.00	(0.00,100.0)	3	0.00
Univ. Hosp-Stony Brook	106	1	0.94	2.01	0.75	(0.01, 4.19)	201	0.98
Tranbaugh R	**252**	**1**	**0.40**	**1.60**	**0.40**	**(0.01, 2.21)**	**335**	**1.39**
Mount Sinai Beth Israel	65	0	0.00	1.42	0.00	(0.00, 6.35)	79	1.62
NYP-Brooklyn Methodist	185	1	0.54	1.66	0.52	(0.01, 2.90)	252	1.35
NYP-Weill Cornell	2	0	0.00	1.53	0.00	(0.00,100.0)	4	0.00
Vaynblat M	**102**	**3**	**2.94**	**1.37**	**3.45**	**(0.69,10.08)**	**178**	**3.92**
Maimonides Medical Ctr	37	1	2.70	1.85	2.34	(0.03,13.03)	60	2.79
NYU Hospitals Center	65	2	3.08	1.09	4.52	(0.51,16.31)	118	4.90
Worku B M	**48**	**0**	**0.00**	**1.65**	**0.00**	**(0.00, 7.41)**	**71**	**0.00**
NYP-Brooklyn Methodist	48	0	0.00	1.65	0.00	(0.00, 7.41)	70	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	1	0.00

  * RAMR significantly higher than statewide rate based on 95 percent confidence interval.
** RAMR significantly lower than statewide rate based on 95 percent confidence interval.

SURGEON AND HOSPITAL VOLUMES
FOR TOTAL ADULT CARDIAC SURGERY, 2015-2017

Table 8 presents, for each hospital and for each surgeon performing at least 200 cardiac operations in any hospital in 2015-2017 and/or performing one or more cardiac operations in each of the years 2015-2017, the total number of Isolated CABG operations, the total number of Valve or Valve/CABG operations, the total number of Other Cardiac operations and Total Cardiac operations. As in Table 6, results for surgeons not meeting the above criteria are grouped together in an "All Others" category.

The Isolated CABG column includes patients who undergo bypass of one or more of the coronary arteries with no other major heart

surgery earlier in the same admission. Valve or Valve/CABG volumes include the total number of cases for the eight Valve and Valve/CABG groups that were identified in Table 4. Other Cardiac Surgery refers to cardiac procedures not represented by Isolated CABG, and Valve or Valve/CABG operations and includes, but is not limited to: TAVR, repairs of congenital conditions, heart transplants, aneurysm repairs, ventricular reconstruction and ventricular assist device insertions. Total Cardiac Surgery is the sum of the previous three columns and includes any surgery on the heart or great vessels.

Table 8

Surgeon and Hospital Volume for Isolated CABG, Valve or Valve/CABG, Other Cardiac Surgery, and Total Adult Cardiac Surgery, 2015-2017.

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Albany Med. Ctr				
Akujuo A C	172	105	93	370
Bennett E	19	170	414	603
Britton L	127	119	80	326
Singh C	23	4	8	35
Zhang L	148	28	21	197
All Others	215	126	179	520
Total	**704**	**552**	**795**	**2051**
Arnot Ogden Med Ctr				
Hoffman D	168	48	6	222
All Others	20	7	0	27
Total	**188**	**55**	**6**	**249**
Bassett Medical Center				
Daniel S R	104	49	13	166
Kelley J	135	85	26	246
Total	**239**	**134**	**39**	**412**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Bellevue Hospital Ctr				
Balsam L B	104	117	47	268
Culliford A	148	82	31	261
Malhotra S P	0	1	26	27
Smith D E	174	63	18	255
Swistel D	1	0	0	1
All Others	0	1	11	12
Total	**427**	**264**	**133**	**824**
Buffalo General Med Ctr				
Aldridge J	201	40	212	453
Ashraf M	559	130	332	1021
Grosner G	569	565	225	1359
Total	**1329**	**735**	**769**	**2833**
Ellis Hospital				
Choumarov K	247	64	14	325
Reich H	166	125	24	315
Singh C	167	79	11	257
Total	**580**	**268**	**49**	**897**
Good Sam - Suffern				
All Others	284	87	11	382
Total	**284**	**87**	**11**	**382**
Good Sam-West Islip				
Dimeo A C	5	0	0	5
Henry M J	1	0	0	1
Lamendola C	231	189	32	452
Rovensky M	367	91	15	473
All Others	34	4	2	40
Total	**638**	**284**	**49**	**971**
Lenox Hill Hospital				
Brinster D R	34	89	337	460
Hemli J M	30	5	14	49
Patel N C	655	251	26	932
Pirelli L	34	26	137	197
Scheinerman S J	151	74	74	299
All Others	0	0	9	9
Total	**904**	**445**	**597**	**1946**
Long Island Jewish MC				
Graver L	34	64	9	107
Hartman A	3	4	1	8
Meyer D B	0	4	10	14
Palazzo R	58	8	12	78
Scheinerman S J	2	4	5	11
All Others	0	0	9	9
Total	**97**	**84**	**46**	**227**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Maimonides Medical Ctr				
Abrol S	106	99	92	297
Crooke G	79	67	180	326
Jacobowitz I	287	146	120	553
Ribakove G	83	70	37	190
Saunders P	61	7	69	137
Stephens G A	13	9	6	28
Tak V M	3	6	2	11
Vaynblat M	37	23	11	71
All Others	9	4	11	24
Total	**678**	**431**	**528**	**1637**
Mercy Hospital-Buffalo				
Adkins M	315	98	15	428
Aldridge J	1	1	0	2
Bell-Thomson J	107	113	19	239
Downing S W	409	170	148	727
Jain H B	194	27	7	228
Joyce F	9	1	0	10
All Others	47	3	2	52
Total	**1082**	**413**	**191**	**1686**
Montefiore - Moses				
Bello R A	2	1	19	22
Chau M L	4	1	54	59
Derose J J	4	5	78	87
Goldstein D J	166	127	137	430
Jakobleff W A	211	53	38	302
Michler R E	106	177	38	321
Peek G J	0	5	32	37
All Others	56	46	36	138
Total	**549**	**415**	**432**	**1396**
Montefiore - Weiler				
Bello R A	126	59	26	211
Chau M L	75	13	115	203
Derose J J	340	213	113	666
Goldstein D J	15	8	3	26
Jakobleff W A	3	2	1	6
Michler R E	1	8	0	9
All Others	16	0	8	24
Total	**576**	**303**	**266**	**1145**
Mount Sinai Beth Israel				
Hoffman D	2	2	2	6
Puskas J D	323	120	35	478
Tranbaugh R	65	14	8	87
All Others	13	5	34	52
Total	**403**	**141**	**79**	**623**

Table 8 continued	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Mount Sinai Hospital				
Adams D H	4	1065	68	1137
Anyanwu A C	62	104	333	499
Boateng P	43	66	29	138
Chikwe J Y	34	14	5	53
El-Eshmawi A M	12	36	9	57
Filsoufi F	287	92	28	407
Nguyen K	1	1	26	28
Pawale A A	9	9	10	28
Puskas J D	5	1	0	6
Reddy R C	342	136	86	564
Stelzer P	27	250	347	624
Stewart A S	128	322	619	1069
Tannous H J	39	17	3	59
Varghese R	113	101	23	237
All Others	0	5	169	174
Total	**1106**	**2219**	**1755**	**5080**
Mount Sinai St. Lukes				
Balaram S K	210	109	39	358
Chikwe J Y	86	80	22	188
Puskas J D	196	41	11	248
Swistel D	31	35	2	68
All Others	15	17	35	67
Total	**538**	**282**	**109**	**929**
NYP-Brooklyn Methodist				
Gulkarov I M	135	105	56	296
Tranbaugh R	185	67	18	270
Worku B M	48	22	33	103
All Others	19	15	40	74
Total	**387**	**209**	**147**	**743**
NYP-Columbia Presby.				
Argenziano M	260	252	44	556
Bacha E	0	3	122	125
Borger M A	32	252	234	518
Chai P J	0	2	83	85
George I	137	233	1130	1500
Naka Y	259	123	212	594
Smith C	215	483	83	781
Takayama H	318	270	207	795
Takeda K	82	56	152	290
All Others	6	14	408	428
Total	**1309**	**1688**	**2675**	**5672**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
NYP-Queens				
Avgerinos D V	96	26	15	137
Lang S	351	90	22	463
All Others	1	0	1	2
Total	**448**	**116**	**38**	**602**
NYP-Weill Cornell				
Avgerinos D V	0	1	1	2
Bacha E	0	2	18	20
Chai P J	0	3	15	18
Girardi L	219	610	648	1477
Gulkarov I M	1	3	0	4
Guy T S	44	151	32	227
Krieger K	104	180	20	304
Lang S	4	8	3	15
Lau C	128	62	66	256
Salemi A	62	91	550	703
Tranbaugh R	2	2	2	6
Worku B M	0	1	1	2
All Others	5	12	4	21
Total	**569**	**1126**	**1360**	**3055**
NYU Hospitals Center				
Balsam L B	1	4	39	44
Culliford A	14	23	5	42
Galloway A	53	331	66	450
Grossi E	5	3	9	17
Loulmet D F	37	450	58	545
Mosca R S	0	5	21	26
Smith D E	52	24	32	108
Swistel D	101	123	19	243
Vaynblat M	65	53	16	134
Williams M R	6	148	949	1103
Zias E	349	186	36	571
All Others	1	2	40	43
Total	**684**	**1352**	**1290**	**3326**
NYU Winthrop Hospital				
Abrol S	68	24	20	112
Goncalves J A	57	67	414	538
Kokotos W J	155	130	88	373
Pogo G	44	11	29	84
Salhab K F	163	57	310	530
Schubach S	183	86	92	361
All Others	0	0	1	1
Total	**670**	**375**	**954**	**1999**

Table 8 continued	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
North Shore Univ Hosp				
Brinster D R	13	8	57	78
Esposito R	226	154	341	721
Fernandez H A	11	8	20	39
Graver L	274	300	49	623
Hall M	71	51	17	139
Hartman A	150	262	128	540
Kalimi R	28	24	9	61
Meyer D B	0	1	1	2
Palazzo R	169	61	137	367
Pogo G	7	8	1	16
Taylor J	243	200	72	515
Vatsia S	209	114	119	442
Yu P J	101	37	101	239
All Others	1	0	11	12
Total	**1503**	**1228**	**1063**	**3794**
Rochester General Hosp				
Cheeran D	526	384	221	1131
Kirshner R	498	558	96	1152
Yankey G K N	232	63	154	449
Total	**1256**	**1005**	**471**	**2732**
Southside Hospital				
Fernandez H A	135	84	58	277
Hartman A	3	18	10	31
Kalimi R	195	226	169	590
Manetta F	169	64	101	334
Pogo G	45	20	20	85
Taylor J	1	2	0	3
All Others	0	0	1	1
Total	**548**	**414**	**359**	**1321**
St. Elizabeth Med Ctr				
Cahill A T	116	28	20	164
Fuzesi L	190	67	24	281
Joyce F	227	114	65	406
All Others	51	35	14	100
Total	**584**	**244**	**123**	**951**
St. Francis Hospital				
Bercow N	329	243	194	766
Colangelo R	548	373	31	952
Dimeo A C	207	65	34	306
Henry M J	127	20	257	404
Lundy E F	305	110	24	439
Robinson N	79	291	683	1053
All Others	0	0	1	1
Total	**1595**	**1102**	**1224**	**3921**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
St. Josephs Hospital				
Green G R	226	269	166	661
Lutz C J	276	361	163	800
Marvasti M	176	129	117	422
Nazem A	298	201	134	633
Zhou Z	329	339	218	886
Total	**1305**	**1299**	**798**	**3402**
St. Peters Hospital				
Edwards N	228	210	50	488
Karavas A N	341	161	58	560
Saifi J	202	314	141	657
Terrien C M	320	203	136	659
Total	**1091**	**888**	**385**	**2364**
Staten Island Univ Hosp				
Gulkarov I M	9	1	1	11
Imam M N	96	45	64	205
Rosell F M	281	34	26	341
Wohler A M	50	19	24	93
All Others	104	47	8	159
Total	**540**	**146**	**123**	**809**
Strong Memorial Hosp				
Gensini P F	0	9	42	51
Knight P	293	598	384	1275
Lehoux J M	157	45	103	305
Prasad S M	95	39	127	261
All Others	106	27	128	261
Total	**651**	**718**	**784**	**2153**
UHS-Wilson Med Ctr				
Rahman A	0	1	1	2
Wong K	166	78	69	313
Yousuf M	166	85	85	336
All Others	58	23	31	112
Total	**390**	**187**	**186**	**763**
Univ. Hosp-Brooklyn				
Beckles D L	105	31	15	151
Neragi-Miandoab S	40	11	2	53
Tak V M	7	8	0	15
All Others	3	0	0	3
Total	**155**	**50**	**17**	**222**

Table 8 continued	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Univ. Hosp-Stony Brook				
Bilfinger T	76	18	138	232
Chikwe J Y	114	88	16	218
Fernandez H A	96	63	33	192
McLarty A	48	14	54	116
Tak V M	78	31	2	111
Tannous H J	63	10	83	156
Taylor J	106	95	41	242
All Others	89	73	53	215
Total	**670**	**392**	**420**	**1482**
Univ. Hosp-Upstate				
Dunton R F	74	27	9	110
Esrig B	24	13	5	42
Green G R	24	13	6	43
All Others	14	12	10	36
Total	**136**	**65**	**30**	**231**
Vassar Bros. Med Ctr				
Sarabu M	99	180	132	411
Shahani R B	173	90	30	293
Zakow P	204	122	33	359
Total	**476**	**392**	**195**	**1063**
Westchester Med Ctr				
Kai M	107	42	90	239
Lansman S	4	2	1	7
Malekan R	117	56	116	289
Spielvogel D	272	129	200	601
Tang G H L	0	4	235	239
All Others	42	26	124	192
Total	**542**	**259**	**766**	**1567**
TOTAL	**25831**	**20367**	**19262**	**65460**

Criteria Used in Reporting Significant Risk Factors (2017)

Based on Documentation in Medical Records

Patient Risk Factor	Definitions
Demographic	
Body Surface Area	Body surface area (BSA) is a function of height and weight and increases for larger heights and weights. The statistical formula used to calculate BSA in this report is: $BSA\ (m^2) = 0.0003207 \times H^{0.3} \times W^{(0.7285 - (0.0188 \times LOG))}$ Where H is Height in centimeters and W is Weight in grams.
Body Mass Index	Body Mass Index (BMI) is a measure of body size that is the ratio of the weight of the body in kilograms to the square of its height in meters and is considered an indication of nutritional status of the body. The formula for BMI is: $BMI = Weight/Height^2$ where Height is height in meters (m) and Weight is weight in kilograms (kg).
Hemodynamic State	**Determined in the immediate pre-operative period, defined as the period prior to anesthesia taking responsibility for the patient.**
Non-Refractory Cardiogenic Shock	Non-Refractory Cardiogenic Shock is defined as an episode of systolic blood pressure <90 mmHg and/or cardiac index < 2.2 L/min/m^2 determined to be secondary to cardiac dysfunction and the requirement for parenteral inotropic or vasopressor agents or mechanical support (e.g., IABP, extracorporeal circulation, VAD) to maintain blood pressure and cardiac index above those specified levels. (Definition adopted in 2015).
Refractory Cardiogenic Shock	Refractory Cardiogenic Shock is defined as an episode of systolic blood pressure <80 mm Hg and/or cardiac index < 2.0 L/min/m^2 determined to be secondary to cardiac dysfunction despite the use of parenteral inotropic or vasopressor agents or mechanical support (e.g., IABP, extracorporeal circulation, VADs). (Definition adopted in 2015.) Records with this risk factor were excluded from all analyses in this report.

Patient Risk Factor	Definitions
Comorbidities	
Chronic Lung Disease	The patient has chronic lung disease with pre-operative findings of one of the following: • Mild - FEV_1 60% to 75% of predicted, and/or on chronic inhaled or oral bronchodilator therapy. • Moderate - FEV_1 50% to 59% of predicted, and/or on chronic steroid therapy aimed at lung disease. • Severe - FEV_1 <50% predicted, and/or Room Air pO_2 < 60 or Room Air pCO_2 > 50.
Congestive Heart Failure (CHF), Current	Within 2 weeks prior to the procedure, the patient has a clinical diagnosis of CHF and symptoms requiring treatment for CHF. Note: Physician diagnosis of CHF may be based on one of the following: • Paroxysmal nocturnal dyspnea (PND) • Dyspnea on exertion (DOE) due to heart failure • Chest X-Ray showing pulmonary congestion Documentation must include the presence of a diagnosis of CHF, evidence of symptoms, and treatment for CHF.
Diabetes with Insulin Treatment	The patient has a history of diabetes diagnosed and/or treated by a physician. Diabetes control method as presented on admission was Insulin.
Extensive Aortic Atherosclerosis	Ascending, transverse, and/or descending aortic atherosclerosis marked by either extensive calcification or luminal atheroma such that the intended surgical procedure is altered.
Neurological Event: Stroke	The patient has a history of a neurological event: stroke. Stroke is an acute episode of focal or global neurological dysfunction caused by brain, spinal cord, or retinal vascular injury as a result of hemorrhage or infarction, where the neurological dysfunction lasts for greater than 24 hours.
Peripheral Vascular Disease	Angiographic demonstration of at least 50% narrowing in a major aortoiliac or femoral/popliteal vessel, previous surgery for such disease, absent femoral or pedal pulses, or the inability to insert a catheter or intra-aortic balloon due to iliac aneurysm or obstruction of the aortoiliac or femoral arteries Ankle-Brachial Index < 0.9 is also acceptable documentation.
Renal Failure, Creatinine	Last pre-operative serum creatinine was in the indicated range.
Renal Failure Requiring Dialysis	The patient is currently (prior to surgery) undergoing dialysis.

Patient Risk Factor	Definitions
Ventricular Function	
Ejection Fraction	Value of the ejection fraction taken closest to but before the start of the procedure. Intraoperative direct observation of the heart is not an adequate basis for a visual estimate of the ejection fraction. Intra-operative TEE is acceptable, if no pre-operative Ejection Fraction is available. If no ejection fraction is reported, the ejection fraction is considered "normal" for purposes of analysis and is classified with the reference category.
Previous MI	One or more myocardial infarctions (MI) in the specified time period prior to surgery.
STEMI	The patient presented with a ST-segment elevation myocardial infarction (STEMI) or its equivalent as documented in the medical record. STEMIs are characterized by the presence of both criteria: a. ECG evidence of STEMI b. Cardiac biomarkers (creatinine kinase-myocardial band, Troponin T or I) exceed the upper limit of normal according to the individual hospital's laboratory parameters with a clinical presentation which is consistent or suggestive of ischemia.
Previous Procedures	
Current Surgery for PCI Complication	The patient required immediate surgery as a complication of PCI. Immediate surgery is defined as surgery as soon as the surgeon and/or operating room could accommodate the patient.
Previous CABG Surgery	Prior to this cardiac surgery, the patient has undergone CABG surgery.
Previous Other Cardiac Surgery	Prior to this cardiac surgery, the patient has undergone cardiac surgery other than CABG or Valve surgery or intervention.
Previous Valve Surgery or Intervention	Prior to this cardiac surgery, the patient has previously undergone surgery or catheter based intervention for valve repair or replacement.
Valve Disease	
Mitral Valve Incompetence, Severe	The patient has severe mitral valve incompetence (also called regurgitation) as demonstrated by left ventriculography or by pre-op or intraoperative echocardiography.
Vessels Diseased	
Left Main Disease	The patient has at least a 50 percent blockage in the Left Main Coronary Artery.
Two or More Vessels Diseased	The patient has at least a 70 percent blockage in two or more of the native coronary arteries including the Left Anterior Descending (LAD), the Right Coronary Artery (RCA), and the Left Circumflex (LCX) or their major branches.

MEDICAL TERMINOLOGY

angina pectoris – The pain or discomfort felt when blood and oxygen flow to the heart are impeded by blockages in the coronary arteries. Can also be caused by an arterial spasm.

angioplasty – Also known as percutaneous transluminal coronary angioplasty (PTCA) or percutaneous coronary intervention (PCI). In this procedure, a balloon catheter is threaded up to the site of blockage in an artery in the heart, and is then inflated to push arterial plaque against the wall of the artery to create a wider channel in the artery. Other procedures or devices are frequently used in conjunction with, or in place of, the balloon catheter. In particular, stents are used for most patients and devices such as rotoblaters and ultrasound are sometimes used.

arteriosclerosis – Also called atherosclerotic coronary artery disease or coronary artery disease, the group of diseases characterized by thickening and loss of elasticity of the arterial walls, popularly called "hardening of the arteries."

atherosclerosis – One form of arteriosclerosis in which plaques or fatty deposits form in the inner layer of the arteries.

coronary artery bypass graft surgery (CABG) – A procedure in which a vein or artery from another part of the body is used to create an alternate path for blood to flow to the heart muscle, bypassing the arterial blockage. Typically, a section of one of the large saphenous veins in the leg, the radial artery in the arm or the mammary artery in the chest is used to construct the bypass. One or more bypasses may be performed during a single operation. When no other major heart surgery (such as valve replacement) is included, the operation is referred to as an isolated CABG. The average number of bypass grafts created during CABG is three or four. Generally, all significantly blocked arteries are bypassed unless they enter areas of the heart that are permanently damaged by previous heart attacks. Five or more bypasses are occasionally created. Multiple bypasses are often performed to provide several alternate routes for the blood flow and to improve the long-term success of the procedure, not necessarily because the patient's condition is more severe.

cardiac catheterization – Also known as coronary angiography, a procedure for diagnosing the condition of the heart and the arteries connecting to it. A thin tube threaded through an artery to the heart releases a dye, which allows doctors to observe blockages with an X-ray camera. This procedure is generally required before coronary bypass surgery.

cardiovascular disease – Disease of the heart and blood vessels, the most common form is coronary artery disease.

coronary arteries – The arteries that supply the heart muscle with blood. When they are narrowed or blocked, oxygen-rich blood cannot flow freely to the heart muscle or myocardium.

heart valve – Gates that connect the different chambers of the heart so that there is a one-way flow of blood between the chambers. The heart has four valves: the tricuspid, mitral, pulmonic and aortic valves.

incompetent valves – A valve that does not close tightly.

ischemic heart disease (ischemia) – Heart disease that occurs as a result of inadequate blood supply to the heart muscle or myocardium.

myocardial infarction (MI) – Also called a heart attack, partial destruction of the heart muscle due to interrupted blood supply.

plaque – Also called atheroma, this is the fatty deposit in the coronary artery that can block blood flow.

risk factors for heart disease – Certain risk factors have been found to increase the likelihood of developing heart disease. Some are controllable or avoidable and some cannot be controlled. The biggest heart disease risk factors are heredity, gender and age, none of which can be controlled. Men are much more likely to develop heart disease than women before the age of 55, although it is the number one killer of both men and women. Some controllable risk factors that contribute to a higher likelihood of developing coronary artery disease are high cholesterol levels, cigarette smoking, high blood pressure (hypertension), obesity, a sedentary lifestyle or lack of exercise, diabetes and poor stress management.

stenosis - The narrowing of an artery due to blockage. Restenosis is when the narrowing recurs after surgery.

stenotic valve – A valve that does not open fully.

valve disease – Occurs when a valve cannot open all of the way (reducing flow to the next heart chamber) or cannot close all of the way (causing blood to leak backwards into the previous heart chamber).

valve repair – Widening valve openings for stenotic valves or narrowing or tightening valve openings for incompetent valves without having to replace the valves.

valve replacement – Replacement of a diseased valve. New valves are either mechanical (durable materials such as Dacron or titanium) or biological (tissues taken from pigs, cows or human donors).

Appendix 1
Risk Factors for CABG In-Hospital / 30-Day Deaths in New York State in 2017

The significant pre-operative risk factors for death in the hospital during the same admission as the surgery or after hospital discharge but within 30 days of surgery (in-hospital/30-day mortality) for CABG in 2017 are presented in Appendix Table 1.

Roughly speaking, the odds ratio for a risk factor represents the number of times more likely to die in the hospital during or after CABG or after discharge but within 30 days of the surgery a patient with that risk factor is than a patient without the risk factor, all other risk factors being the same. For example, the odds ratio for the risk factor Non-Refractory Shock is 4.614. This means that a patient who has Non-Refractory Shock prior to surgery is approximately 4.614 times as likely to die in the hospital or after discharge within 30 days of surgery as a patient who does not have Non-Refractory Shock but who has the same other significant risk factors.

STEMI within 7 Days, Neurological Event: Stroke, Peripheral Vascular Disease, and Previous CABG are also interpreted in this way. The patient either has the risk factor or does not have the risk factor.

For age, the odds ratio roughly represents the number of times more likely to die a patient who is older than 55 is compared to a patient who is one year younger but otherwise has the same significant risk factors. Thus, the chance of in-hospital / 30-day death for a patient undergoing CABG who is 56 years old is approximately 1.065 times that of a patient 55 years old undergoing CABG, if all other risk factors are the same. All patients age 55 and younger have roughly the same odds of in-hospital / 30-day mortality if their other risk factors are identical.

Body Mass Index (BMI) is a relationship of weight to height. It is a measure of body size that is the ratio of the weight of the body in kilograms to the square of its height in meters and is considered an indication of nutritional status of the body. This model includes terms for both BMI and BMI-squared, reflecting the complex relationship between BMI and 30-day mortality. The quadratic function of BMI (BMI-squared) used in the statistical model reflects the fact that patients with very high and very low BMIs tend to have higher risks of death than patients with intermediate levels of BMI. This functional form is used to improve the model's ability to predict mortality, but it means that the odds ratios for these terms do not have a straightforward interpretation.

Ejection Fraction, which is the percentage of blood in the heart's left ventricle that is expelled when it contracts (with more denoting a healthier heart), is subdivided into three ranges (less than 30 percent, 30 percent to 39 percent, and 40 percent or more). The last range is referred to as the reference category. This means that the odds ratio that appears for the other Ejection Fraction categories in the table is relative to patients with an ejection fraction of 40 percent or more. Thus, a patient with an ejection fraction of less than 30 percent is about 3.120 times as likely to die in the hospital or within 30 days of surgery as a patient with an ejection fraction of 40 percent or higher, all other significant risk factors being the same.

Chronic Lung Disease is divided into three categories: patients with Mild or Moderate disease; patients with Severe disease; and patients with no chronic lung disease. The last group is the reference category.

Renal Failure is subdivided into three groups. The first group represents patients with serum creatinine greater than 1.5 mg/dL who are not on dialysis. The second group includes patients with renal failure on dialysis. These groups are relative to patients who are not on dialysis and whose last pre-operative serum creatinine values were less than 1.5 mg/dL.

Appendix Table 1

Multivariable Risk Factor Equation for CABG In-Hospital/30-Day Deaths in New York State in 2017.

Patient Risk Factor	Prevalence %	Logistic Regression Coefficient	P-value	Odds Ratio
Demographic				
Age: Number of years greater than 55	—	0.0632	<.0001	1.065
Body Mass Index (kg/m^2)	—	-0.1117	0.1846	—
Body Mass Index Squared (kg^2/m^4)	—	0.0025	0.0407	—
Hemodynamic Status				
Non-Refractory Shock	0.63	1.5292	0.0006	4.614
Ventricular Function				
Ejection Fraction				
Ejection Fraction 40% or greater	83.80	— Reference —		1.000
Ejection Fraction less than 30%	6.32	1.1379	<.0001	3.120
Ejection Fraction 30-39%	9.88	0.6598	0.0057	1.934
Pre-Procedural MI				
STEMI within 7 Days	3.66	1.6586	<.0001	5.252
Comorbidities				
Chronic Lung Disease				
None	88.98	— Reference —		1.000
Mild or Moderate	8.54	0.6775	0.0049	1.969
Severe	2.48	0.9198	0.0072	2.509
Neurological Event: Stroke	7.71	0.6677	0.0063	1.950
Peripheral Vascular Disease	11.30	0.7958	<.0001	2.216
Renal Failure				
No Renal Failure	89.18	— Reference —		1.000
Creatinine >1.5 mg/dL	7.31	0.6465	0.0081	1.909
Requiring Dialysis	3.51	1.2089	<.0001	3.350
Previous Cardiac Procedures				
Previous CABG	1.31	1.2698	0.0044	3.560

Intercept = - 4.9693

C-Statistic = 0.798

Appendix 2
Risk Factors for CABG 30-Day Readmissions in New York State in 2017

The significant pre-procedural risk factors for 30-day readmissions following CABG in 2017 are presented in the table that follows. Female, CHF-Current, Peripheral Vascular Disease, and Diabetes with Insulin Treatment are interpreted in the same way as Non-Refractory Shock in Appendix 1. The patient either has the risk factor or does not.

The interpretation of Body Mass Index and Chronic Lung Disease is the same as presented in Appendix 1.

The interpretation of Age in this model is similar to that in Appendix 1 except in this case the increase risk is associated with increasing age above 70 years.

The interpretation of Renal Failure is similar to that in Appendix 1 except in this model there are two categories of patients with elevated creatinine who are not on dialysis.

Appendix Table 2

Multivariable Risk Factor Equation for CABG / 30-Day Readmission in New York State in 2017.

Patient Risk Factor	Prevalence %	Logistic Regression		
		Coefficient	**P-value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 70	—	0.0375	<0.0001	1.038
Body Mass Index (kg/m^2)	—	-0.0942	0.0168	—
Body Mass Index Term (kg^2/m^4)	—	0.0016	0.0076	—
Female	24.54	0.2718	0.0004	1.312
Comorbidities				
Congestive Heart Failure (CHF), Current (within 2 weeks)	15.04	0.3240	0.0002	1.383
Chronic Lung Disease				
None	89.09	— Reference —		1.000
Mild or Moderate	8.47	0.3641	0.0009	1.439
Severe	2.44	0.4860	0.0080	1.626
Diabetes with Insulin Treatment	19.45	0.4207	<0.0001	1.523
Peripheral Vascular Disease	11.12	0.3161	0.0012	1.372
Renal Failure				
No Renal Failure	70.33	— Reference —		1.000
Creatinine 1.2-1.5 mg/dL	19.13	0.2885	0.0009	1.334
Creatinine ≥1.6 mg/dL	7.12	0.4257	0.0005	1.531
Requiring Dialysis	3.42	0.8755	<0.0001	2.400

Intercept = -1.2407

C-Statistic = 0.640

Appendix 3
Risk Factors For Valve Surgery In-Hospital / 30-Day Mortality in 2015-2017

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve surgery in the 2015-2017 time period are presented in the table that follows.

For Age in years, the odds ratio represents the increased likelihood for in-hospital/30-day mortality for each one year increase in age. If two patients have all of the same significant risk factors but one patient is one year older, the older patient will be 1.036 times as likely die in the hospital or within 30 days.

Body surface area (BSA) is a function of height and weight and increases for larger heights and weights. This model includes terms for both BSA and BSA-squared, reflecting the complex relationship between BSA and in-hospital/ 30-day mortality. The quadratic function of BSA (BSA-squared) used in this statistical model reflects the fact that patients with very high or very low BSAs tend to have higher risks of in-hospital/30-day mortality than patients with intermediate levels of BSA. This functional form is used to improve the model's ability to predict mortality, but it means that the odds ratios for these terms do not have a straightforward interpretation.

The odds ratio for type of valve surgery roughly represents the number of times more likely to die in the hospital during or after surgery or after discharge but within 30 days a patient with a specific valve surgery is than a patient who has had aortic valve replacement surgery, all other risk factors being the same. For example, a patient who has a mitral valve replacement surgery is roughly 1.582 times as likely to die in the hospital during or after surgery or after discharge but within 30 days of surgery as a patient with aortic valve replacement surgery, all other significant risk factors being the same.

Chronic Lung Disease is interpreted in the same was as described in Appendix 1.

The interpretation of renal failure in this model is similar to that provided in Appendix 1 except in this case there are two levels of elevated serum creatinine.

All other variables can be interpreted in the same way as previously described for risk factors with only two options; the patient either has the risk factor or does not.

Appendix Table 3

Multivariable Risk Factor Equation for Valve Surgery In-Hospital / 30-Day Deaths In NYS, 2015-2017.

Risk Factor	Prevalence %	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Demographic				
Age: Number of years	---	0.0356	<.0001	1.036
Body Surface Area (m^2)	---	-6.6835	<.0001	--
Body Surface Area Squared (m^4)	---	1.5462	<.0001	--
Type of Valve Surgery				
Aortic Valve Replacement	44.92	---Reference--		1.000
Mitral Valve Replacement	13.74	0.4584	0.0056	1.582
Mitral Valve Repair	19.10	-0.5972	0.0215	0.550
Multiple Valve Surgery	22.24	0.7267	<.0001	2.068
Hemodynamic Status				
Non-Refractory Shock	0.57	1.1835	0.0023	3.266
Comorbidities				
Chronic Lung Disease				
None	86.87	---Reference--		1.000
Mild or Moderate	9.91	0.6437	<.0001	1.904
Severe	3.22	1.1388	<.0001	3.123
Diabetes with Insulin Therapy	5.79	0.5391	0.0024	1.714
Renal Failure				
No Renal Failure	93.68	---Reference--		1.000
Creatinine 1.6-2.0 mg/dL	4.29	0.7894	<.0001	2.202
Creatinine ≥2.1 mg/dL	2.03	1.1569	<.0001	3.180
Requiring Dialysis	2.75	1.8703	<.0001	6.490
Vessels Diseased				
Two or More Vessels Diseased	1.97	0.7437	0.0027	2.104
Previous Cardiac Procedures				
Previous Valve Surgery or Intervention	12.71	0.5282	0.0001	1.696

Intercept = 0.0683
C Statistic = 0.780

Appendix 4
Risk Factors for Valve and CABG Surgery In-Hospital / 30-Day Mortality in New York State in 2015-2017

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve and CABG surgery in the 2015-2017 time period are presented in the table that follows.

The odds ratio for Type of Valve with CABG surgery roughly represents the number of times more likely to die in the hospital during or after that particular surgery or after discharge but within 30 days of surgery a patient with a specific Valve with CABG surgery is than a patient who had aortic valve repair or replacement and CABG surgery, all other risk factors being the same. For example, a patient who has a mitral valve replacement and CABG surgery is 2.367 times as likely to die in the hospital or after discharge but within 30 days of surgery as a patient with aortic valve repair or replacement and CABG surgery, all other significant risk factors being the same.

All other risk factors are interpreted as described in Appendix 1 - 3 or can be interpreted in the same way as Non-Refractory Shock in Appendix 1.

Appendix Table 4

Multivariable Risk Factor Equation for Valve and CABG Surgery In-Hospital / 30-Day Deaths in NYS, 2015-2017.

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Demographic				
Age: Number of years greater than 50	—	0.0472	<.0001	1.048
Body Surface Area (m^2)	—	-11.5099	<.0001	—
Body Surface Area Squared (m^4)	—	2.9346	<.0001	—
Female Gender	30.61	0.6633	.00001	1.941
Type of Valve Surgery (with CABG)				
Aortic Valve Repair or Replacement	60.57	— Reference —		1.000
Mitral Valve Replacement	11.95	0.8615	<.0001	2.367
Mitral Valve Repair	14.43	-0.1339	0.5592	0.875
Multiple Valve Surgery	13.05	0.9192	<.0001	2.507
Hemodynamic State				
Non-Refractory Shock	1.03	0.9913	0.0093	2.695
Ventricular Function				
Ejection Fraction <20%	1.84	1.1508	0.0007	3.161
Previous MI within 14 Days	14.82	0.5418	0.0007	1.719
Comorbidities				
Chronic Lung Disease, Severe	4.66	0.6216	0.0070	1.862
Neurological Event: Stroke	8.21	0.4317	0.0226	1.540
Peripheral Vascular Disease	12.30	0.4727	0.0043	1.604
Renal Failure				
No Renal Failure	86.32	— Reference —		1.000
Creatinine 1.6-3.0 mg/dL	8.94	0.5422	0.0047	1.720
Creatinine ≥3.1 mg/dL or Renal Dialysis	4.74	1.5709	<.0001	4.811
Previous Cardiac Procedures				
Previous CABG Surgery	3.53	0.9191	0.0004	2.507
Previous Non-CABG Cardiac Surgery or Valvular Intervention	3.64	0.7823	0.0026	2.187

Intercept = 5.7491

C Statistic = 0.769

Appendix 5
Multivariable Risk Factor Equation for TAVR In-Hospital / 30-Day Deaths in New York State in 2015-2017.

The significant pre-procedural risk factors for in-hospital/30-day mortality following TAVR in the 2015-2017 time period are presented in the table that follows. Most of the risk factors in this model are interpreted as described in Appendices 1 – 4. Extensive Aortic Atherosclerosis, Mitral Valve Incompetence (Severe), and Left Main Disease can be interpreted in the same way as previously described for risk factors with only two options; the patient either has the risk factor or does not.

Appendix Table 5

Multivariable Risk Factor Equation for TAVR In-Hospital / 30-Day Deaths in New York State in 2015-2017.

Patient Risk Factors	Prevalence (%)	Regression Coefficient	P value	Odds Ratio
Demographic				
Age: Number of years greater than 75	---	0.0322	0.0035	1.033
Body Surface Area (m^2)	---	-7.2868	<.0001	---
Body Surface Area Squared (m^4)	---	1.6108	0.0004	---
Ventricular Function				
Ejection Fraction < 30%	5.99	0.5396	0.0066	1.715
Comorbidities				
Chronic Lung Disease				
None or Mild	85.12	— Reference —		1.000
Moderate	6.33	0.5954	0.0042	1.814
Severe	8.55	0.8091	<.0001	2.246
Extensive Aortic Atherosclerosis	1.79	0.9636	0.0008	2.621
Renal Failure				
No Renal Failure	66.30	— Reference —		1.000
Creatinine 1.3-2.0 mg/dL	24.51	0.4253	0.0040	1.530
Creatinine ≥2.1 mg/dL or Renal Dialysis	9.19	1.1873	<.0001	3.278
Valve Disease				
Mitral Valve Incompetence, Severe	4.91	0.5536	0.0059	1.740
Vessels Diseased				
Left Main Disease	2.39	0.9359	0.0005	2.549

Intercept = 3.4134
C Statistic = 0.703

Appendix 6
Risk Factors for Isolated CABG In-Hospital / 30-Day Mortality in New York State 2015-2017

The significant pre-procedural risk factors for in-hospital/30-day mortality following isolated CABG in the 2015-2017 time period are presented in the table that follows. The risk factors in this model are interpreted as described in Appendices 1 – 5.

Appendix Table 6

Multivariable Risk Factor Equation for Isolated CABG In-Hospital / 30-Day Deaths in New York State in 2015-2017.

Patient Risk Factors	Prevalence (%)	Logistic Regression		
		Coefficient	P- value	Odds Ratio
Demographic				
Age: Number of years greater than 55	—	0.0553	<.0001	1.057
Body Mass Index (kg/m^2)	—	-0.1112	0.0025	—
Body Mass Index Squared (kg^2/m^4)	—	0.0021	<.0001	—
Female	24.29	0.4024	0.0003	1.495
Hemodynamic Status				
Non-Refractory Shock	0.56	1.5855	<.0001	4.882
Ventricular Function				
Ejection Fraction				
Ejection Fraction 50% or greater	67.93	— Reference —		1.000
Ejection Fraction less than 30%	6.59	1.3401	<.0001	3.820
Ejection Fraction 30-39%	9.94	0.6670	<.0001	1.948
Ejection Fraction 40-49%	15.54	0.3825	0.0081	1.466
Pre-Procedural MI				
No MI within 24 hours and No STEMI in 1 – 7 Days	95.19	— Reference —		1.000
STEMI, <24 Hours	1.21	1.2236	<.0001	3.399
STEMI, 1- 7 Days	2.47	0.9657	<.0001	2.626
Non-STEMI, <24 Hours	1.13	0.7175	0.0254	2.049
Comorbidities				
Chronic Lung Disease				
None	86.73	— Reference —		1.000
Mild or Moderate	10.10	0.4178	0.0041	1.519
Severe	3.17	0.9349	<.0001	2.547
Peripheral Vascular Disease	11.86	0.7798	<.0001	2.181
Renal Failure				
No Renal Failure	81.47	— Reference —		1.000
Creatinine 1.3-1.5 mg/dL	11.09	0.4891	0.0007	1.631
Creatinine >1.5 mg/dL	7.44	0.7671	<.0001	2.154
Requiring Dialysis	3.53	1.3244	<.0001	3.760
Cardiac Procedures				
Current Surgery is for PCI complication	0.38	1.2394	0.0014	3.454
Previous CABG Surgery	1.37	0.9204	0.0010	2.510

Intercept = -4.6680
C Statistic = 0.796

NEW YORK STATE CARDIAC SURGERY CENTERS

Albany Medical Center
43 New Scotland Avenue
Albany, New York 12208

Arnot Ogden Medical Center
600 Roe Avenue
Elmira, New York 14905

Bassett Medical Center
Atwell Road
Cooperstown, New York 13326

Bellevue Hospital Center
462 1st Avenue
New York, New York 10016

Buffalo General Medical Center
100 High Street
Buffalo, New York 14203

Ellis Hospital
1101 Nott Street
Schenectady, New York 12308

Good Samaritan Hospital Medical Center
1000 Montauk Highway
West Islip, New York 11795

Good Samaritan Hospital of Suffern
255 Lafayette Avenue
Suffern, New York 10901

Lenox Hill Hospital
100 East 77th Street
New York, New York 10021

Long Island Jewish Medical Center
270-05 76th Avenue
New Hyde Park, New York 11040

Maimonides Medical Center
4802 10th Avenue
Brooklyn, New York 11219

Mercy Hospital of Buffalo
565 Abbott Road
Buffalo, New York 14220

Montefiore Medical Center @ Henry & Lucy
Moses Division
111 East 210th Street
Bronx, New York 10467

Montefiore Medical Center @ Jack D. Weiler
Hospital of A. Einstein College
1825 Eastchester Road
Bronx, New York 10461

Mount Sinai Beth Israel*
281 1st Avenue
New York, New York 10003

Mount Sinai Hospital
1468 Madison Avenue
New York, New York 10029

Mount Sinai St. Luke's
1111 Amsterdam Avenue
New York, New York 10025

NY Presbyterian / Queens
56-45 Main Street
Flushing, New York 11355

NY Presbyterian Brooklyn Methodist Hospital
506 6th Street
Brooklyn, New York 11215

NY Presbyterian Hospital @ Columbia
Presbyterian Center
622 West 168th Street
New York, New York 10032

NY Presbyterian Hospital @ New York Weill –
Cornell College
525 East 68th Street
New York, New York 10065

NYU Hospitals Center
550 First Avenue
New York, New York 10016

NYU Winthrop University Hospital
259 First Street
Mineola, New York 11501

North Shore University Hospital
300 Community Drive
Manhasset, New York 11030

Rochester General Hospital
1425 Portland Avenue
Rochester, New York 14621

St. Elizabeth Medical Center
2209 Genesee Street
Utica, New York 13501

St. Francis Hospital
100 Port Washington Boulevard
Roslyn, New York 11576

St. Joseph's Hospital Health Center
301 Prospect Avenue
Syracuse, New York 13203

St. Peter's Hospital
315 South Manning Boulevard
Albany, New York 12208

Southside Hospital
301 East Main Street
Bayshore, New York 11706

Staten Island University Hospital – North
475 Seaview Avenue
Staten Island, New York 10305

Strong Memorial Hospital
601 Elmwood Avenue
Rochester, New York 14642

UHS Wilson Medical Center
33-57 Harrison Street
Johnson City, New York 13790

University Hospital at Stony Brook
Stony Brook, New York 11794-8410

University Hospital of Brooklyn
450 Clarkson Avenue
Brooklyn, New York 11203

Upstate University Hospital – SUNY Health
Sciences Center
750 East Adams Street
Syracuse, New York 13210

Vassar Brothers Medical Center
45 Reade Place
Poughkeepsie, New York 12601

Westchester Medical Center
100 Woods Road
Valhalla, New York 10595

*No longer performs cardiac surgery.

Additional copies of this report may be obtained through the Department of Health web site at
http://www.health.ny.gov

or by writing to:

Cardiac
Box 2006
New York State Department of Health
Albany, New York 12220