

ADULT CARDIAC SURGERY

in New York State

2017-2019



Department
of Health

January 2023

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
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

Barry Kaplan, M.D.

Assistant Professor of Medicine
Northwell Hofstra School of Medicine
Manhasset, NY

Stephen Lahey, M.D.

Professor Emeritus, School of Medicine
University of Connecticut Health Center
Farmington, CT

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
Chief, Division of Pediatric and Adult Congenital 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.

Cardiology Consultant

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 Morningside
Mount Sinai West
New York, NY

Ferdinand Venditti, Jr., M.D.

Professor of Medicine Emeritus
Albany Medical College
Albany, NY

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

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
Mount Sinai 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

Stephen Lahey, M.D.

Professor Emeritus, School of Medicine
University of Connecticut Health Center

Ralph Mosca, M.D.

Vice Chairman, Department of Cardiac Surgery
Chief, Division of Pediatric and Adult Congenital 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.

Cardiology Consultant

Thoralf Sundt, III, M.D.

Chief, Cardiac Surgical Division
Co-Director, Heart Center
Massachusetts General Hospital

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

Office of Quality and Patient Safety

Alda Osinaga, M.D., M.P.H.

Director, Clinical Center
Chief Medical Officer

Linda Efferen, M.D., M.B.A., M.A.C.P.

Medical Director

Cardiac Services Program

Kimberly S. Cozzens, M.A.

Program Director

Diane Fanuele, M.S.

Clinical Data Coordinator

Lori Frazier

Project Assistant

Cynthia Johnson

Cardiac Data Systems Coordinator

Feng (Johnson) Qian, M.D., PhD, M.B.A.

Associate Professor of Health Policy and Management

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

Research Scientist

Olivia Vasto, M.P.H.

Clinical Data Coordinator

TABLE OF CONTENTS

- INTRODUCTION 7
- CORONARY ARTERY BYPASS GRAFT SURGERY (CABG) 8
- CARDIAC VALVE PROCEDURES 8
- THE DEPARTMENT OF HEALTH PROGRAM 9
- PATIENT POPULATION 9
- RISK ADJUSTMENT FOR ASSESSING PROVIDER PERFORMANCE 11
 - Data Collection, Data Validation and Identifying Deaths and Readmissions. 11
 - Assessing Patient Risk. 11
 - Predicting Patient Mortality Rates for Hospitals and Surgeons 12
 - Computing the Risk-Adjusted Mortality Rate 12
 - Interpreting the Risk-Adjusted Mortality Rate 12
 - Predicting Patient Readmission and Computing and Interpreting Risk-Adjusted Readmission Rates. . 13
 - How This Initiative Contributes to Quality Improvement. 13
- DEFINITIONS OF KEY TERMS 14
- 2019 HOSPITAL OUTCOMES FOR CABG SURGERY 15
 - Table 1 In-Hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for Isolated CABG Surgery in New York State, 2019 Discharges 16
 - Figure 1 In-Hospital / 30-Day Risk-Adjusted Mortality Rates for Isolated CABG in New York State, 2019 Discharges. 17
 - Table 2 30-Day Observed, Expected and Risk-Adjusted Readmission Rates for Isolated CABG in New York State, 2019 Discharges. 18
 - Figure 2 30-Day Risk-Adjusted Readmission Rates for Isolated CABG in New York State, 2019 Discharges. 19
- 2017-2019 HOSPITAL OUTCOMES FOR VALVE SURGERY 20
 - Table 3 In-Hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for Valve or Valve/CABG Surgery in New York State, 2017-2019 Discharges 21
 - Figure 3 In-Hospital/30-Day Risk-Adjusted Mortality Rates for Valve or Valve/CABG Surgery in New York State, 2017-2019 Discharges 22
 - Table 4a Hospital Volume for Valve Surgery in New York State, 2017-2019 Discharges 23
 - Table 4b Hospital Volume for Valve with CABG Surgery in New York State, 2017-2019 Discharges .. 24
 - Table 5 In-Hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for Transcatheter Aortic Valve Replacement in New York State, 2017-2019 Discharges 25
- 2017-2019 HOSPITAL AND SURGEON OUTCOMES 26
 - 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, 2017-2019 Discharges 26
 - Table 7 Summary Information for Surgeons Practicing at More Than One Hospital, 2017-2019 . . . 34

SURGEON AND HOSPITAL VOLUMES FOR TOTAL ADULT CARDIAC SURGERY, 2017-2019. 37

 Table 8 Surgeon and Hospital Volume for Isolated CABG, Valve or Valve/CABG,
 Other Cardiac Surgery and Total Adult Cardiac Surgery, 2017-2019. 37

CRITERIA USED IN REPORTING SIGNIFICANT RISK FACTORS (2019) 45

MEDICAL TERMINOLOGY 48

APPENDIX 1 Risk Factors for CABG In-Hospital / 30-Day Deaths
 in New York State in 2019 50

APPENDIX 2 Risk Factors for CABG 30-Day Readmissions
 in New York State in 2019 52

APPENDIX 3 Risk Factors for Valve Surgery In-Hospital/30-Day Mortality
 in New York State in 2017-2019 54

APPENDIX 4 Risk Factors for Valve and CABG Surgery In-Hospital/30-Day Mortality
 in New York State in 2017-2019 56

APPENDIX 5 Risk Factors for TAVR In-Hospital/30-Day Mortality in New York State 2017-2019 58

APPENDIX 6 Risk Factors for Isolated CABG In-Hospital/30-Day Mortality
 in New York State 2017-2019 59

NEW YORK STATE CARDIAC SURGERY CENTERS 61

INTRODUCTION

For over thirty 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 this 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 2019. 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, 2016, and November 30, 2019, provided by all non-federal hospitals in NYS where cardiac surgery is performed. The analysis period for this report includes patients discharged in December 2016 but not those discharged in December 2019. 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 2019 cases includes patients discharged from December 1, 2018 through November 30, 2019. In total there were 69,881 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 195 patients residing outside the United States were excluded because these patients could not be followed after hospital discharge. There were 4 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, 617 cases with refractory cardiogenic shock were removed from the data. This accounts for 0.88 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 69,065 cardiac surgeries analyzed in this report. Isolated CABG surgery represented 38.00 percent of all adult cardiac surgery included in this report. Valve or combined valve/CABG surgery represented 25.83 percent of all adult cardiac surgery for the same period. TAVR represented 21.64 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 2017 through 2019.

While there were 8,938 CABG cases included in the mortality analysis for 2019 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 384 cases. Another 104 patients were excluded because they died in the same admission as their index CABG, so readmission was impossible. Forty 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 538, leaving 8,400 cases to be examined for 30-day readmission rates.

Note on Hospitals Not Performing Cardiac Surgery During Entire 2017-2019 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 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 same is true when comparing the performance of individual surgeons. The following describes how the Department of Health adjusts for patient risk in assessing provider outcomes.

Data Collection, Data Validation and Identifying Deaths and Readmissions

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 reported to the Cardiac Surgery Reporting System (CSRS).

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 during the same acute care admission as CABG, valve surgery, or TAVR, even if they lived for more than thirty days after the procedure. Patients discharged to hospice care who expire within thirty days of going to hospice are also analyzed as an in-hospital mortality.

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 following CABG, valve surgery or TAVR (and readmission after CABG) 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.

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.

Predicting Patient Mortality Rates for Hospitals and Surgeons

The mortality rate for each hospital is also predicted using the relevant statistical models. This is accomplished by summing the predicted probabilities of death for each of the hospital's patients and dividing by the number of patients at that hospital. The resulting rate is an estimate of what the hospital's mortality rate would have been if the hospital'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 at that hospital. The process of predicting a surgeon's predicted mortality rate is exactly the same as described above for hospitals.

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 (hospital's or surgeon'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 1.62 percent (in-hospital/30-day mortality in 2019) to obtain the provider's RAMR. For the three-year period 2017-2019, the ratio is multiplied by 1.56 percent (in-hospital/30-day mortality rate) for isolated CABG patients or 2.57 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 provider'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 verify 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 (11.61 percent in 2019).

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 hospital'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, 1.62 percent for Isolated CABG patients in 2019 or 2.57 percent for Valve or Valve/CABG patients in 2017-2019).

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 (11.61 percent 30-day readmission rate for all CABG patients discharged in 2019).

Confidence Intervals are used to identify which providers 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. Providers with significantly higher rates than expected after adjusting for risk are those where the confidence interval range falls entirely above the statewide mortality rate. Providers 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.

2019 HOSPITAL OUTCOMES FOR CABG SURGERY

Table 1 and Figure 1 present the CABG surgery results for the 36 hospitals performing this operation in NYS in 2019. 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 2019, 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 8,938 CABG surgeries was 1.62 percent. In-hospital/30-day OMRs ranged from 0.00 percent to 6.17 percent. The range of EMRs, which measure patient severity of illness, was 0.93 percent to 2.67 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 5.68 percent. Two hospitals (Albany Medical Center and Good Samaritan University Hospital in West Islip) had RAMRs that were significantly higher than the statewide rate. No hospitals had RAMRs that were significantly lower than the statewide rate.

The 2019 in-hospital/30-day mortality rate of 1.62 percent for Isolated CABG is slightly higher than the 1.48 percent observed in 2018.

The in-hospital OMR for 2019 Isolated CABG discharges (not shown in Table 1) was 1.20 percent for all 8,938 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 36 Non-Federal hospitals performing CABG in NYS in 2019. The table contains, for each hospital, the number of CABGs resulting in 2019 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 8,400 CABGs included in this 2019 analysis was 11.61 percent. Observed readmission rates ranged from 4.98 percent to 18.94 percent. The range in ERRs, which measure patient severity of illness, was between 9.95 percent and 13.70 percent. The RARRs, which measure hospital performance, range from 5.07 percent to 22.09 percent.

Based on confidence intervals for RARRs, four hospitals (Montefiore Weiler in the Bronx, North Shore University Hospital in Manhasset, Rochester General Hospital, and South Shore University Hospital in Bayshore) had RARRs that were significantly higher than the statewide average. Five hospitals (Buffalo General Medical Center, Ellis Hospital in Schenectady, Mercy Hospital in Buffalo, Mount Sinai Morningside in Manhattan, and Staten Island University Hospital) 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, 2019 Discharges**

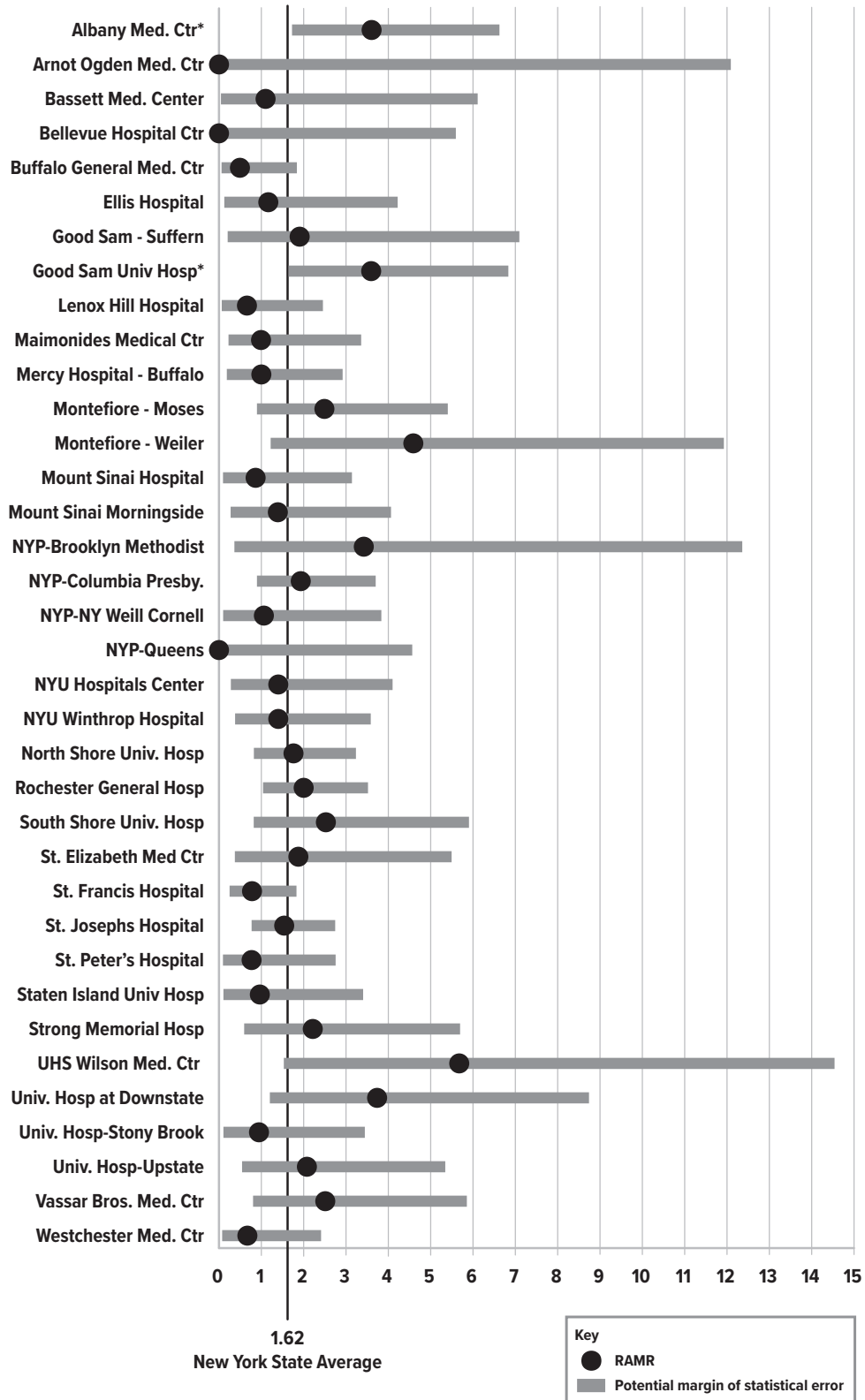
(Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	259	10	3.86	1.74	3.61*	(1.73, 6.63)
Arnot Ogden Med Ctr	53	0	0.00	0.93	0.00	(0.00, 12.09)
Bassett Medical Center	87	1	1.15	1.70	1.10	(0.01, 6.11)
Bellevue Hospital Ctr	106	0	0.00	1.09	0.00	(0.00, 5.16)
Buffalo General Med Ctr	475	2	0.42	1.34	0.51	(0.06, 1.84)
Ellis Hospital	195	2	1.03	1.42	1.17	(0.13, 4.22)
Good Sam - Suffern	114	2	1.75	1.49	1.91	(0.21, 6.89)
Good Sam Univ Hosp	208	9	4.33	1.95	3.61*	(1.65, 6.84)
Lenox Hill Hospital	349	2	0.57	1.40	0.66	(0.07, 2.39)
Maimonides Medical Ctr	232	3	1.29	1.81	1.16	(0.23, 3.38)
Mercy Hospital-Buffalo	331	3	0.91	1.47	1.00	(0.20, 2.92)
Montefiore - Moses	243	6	2.47	1.61	2.48	(0.91, 5.41)
Montefiore - Weiler	135	4	2.96	1.05	4.59	(1.24,11.76)
Mount Sinai Hospital	285	2	0.70	1.31	0.87	(0.10, 3.14)
Mount Sinai Morningside	323	3	0.93	1.08	1.39	(0.28, 4.07)
NYP Brooklyn Methodist	89	2	2.25	1.06	3.42	(0.38,12.36)
NYP Columbia Presby.	468	9	1.92	1.59	1.96	(0.89, 3.71)
NYP NY Weill Cornell	176	2	1.14	1.73	1.06	(0.12, 3.84)
NYP Queens	98	0	0.00	1.33	0.00	(0.00, 4.57)
NYU Hospitals Center	234	3	1.28	1.48	1.40	(0.28, 4.10)
NYU Winthrop Hospital	243	4	1.65	1.91	1.40	(0.38, 3.59)
North Shore Univ Hosp	524	10	1.91	1.76	1.76	(0.84, 3.24)
Rochester General Hosp	453	12	2.65	2.14	2.01	(1.04, 3.52)
South Shore Univ. Hosp	192	5	2.60	1.67	2.53	(0.82, 5.91)
St. Elizabeth Med Ctr	147	3	2.04	1.76	1.88	(0.38, 5.50)
St. Francis Hospital	538	5	0.93	1.92	0.78	(0.25, 1.83)
St. Josephs Hospital	534	11	2.06	2.18	1.54	(0.77, 2.75)
St. Peter's Hospital	327	2	0.61	1.30	0.77	(0.09, 2.76)
Staten Island Univ Hosp	214	2	0.93	1.61	0.94	(0.11, 3.41)
Strong Memorial Hosp	245	4	1.63	1.19	2.22	(0.60, 5.70)
UHS Wilson Med Ctr	95	4	4.21	1.20	5.68	(1.53,14.54)
Univ Hosp at Downstate	81	5	6.17	2.67	3.75	(1.21, 8.75)
Univ. Hosp-Stony Brook	202	2	0.99	1.68	0.95	(0.11, 3.45)
Univ. Hosp-Upstate	191	4	2.09	1.63	2.09	(0.56, 5.35)
Vassar Bros. Med Ctr	210	5	2.38	1.54	2.51	(0.81, 5.86)
Westchester Med Ctr	282	2	0.71	1.72	0.67	(0.08, 2.42)
STATEWIDE TOTAL	8938	145	1.62			

* Risk-adjusted mortality rate significantly higher 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, 2019 Discharges



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

Table 2**In-hospital/30-Day Observed, Expected and Risk-Adjusted Readmission Rates for Isolated CABG Surgery in New York State, 2019 Discharges**

(Listed Alphabetically by Hospital)

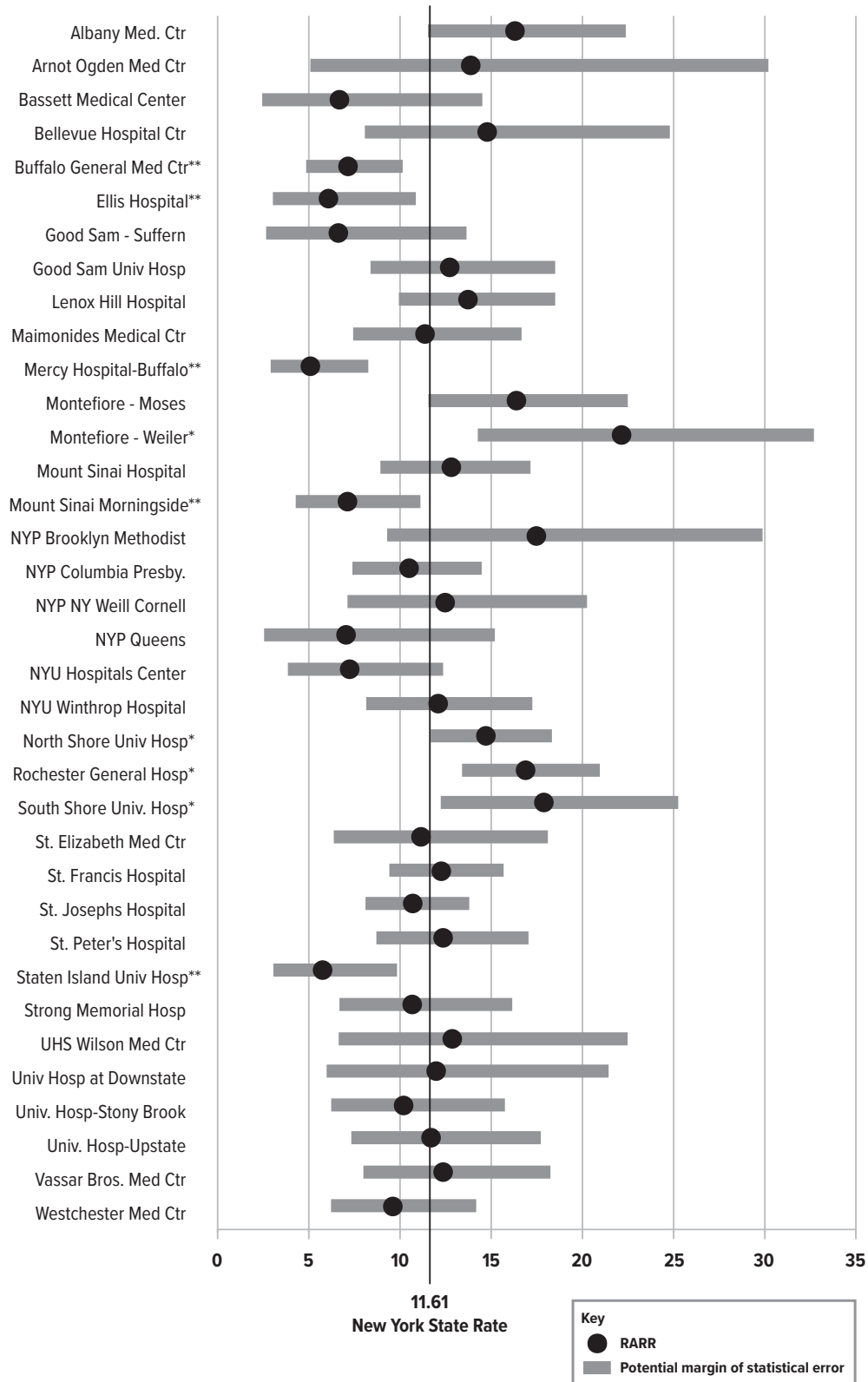
Hospital	Cases	Readmits	ORR	ERR	RARR	95% CI for RARR
Albany Med. Ctr	234	38	16.24	11.59	16.26	(11.50,22.32)
Arnot Ogden Med Ctr	48	6	12.50	10.49	13.84	(5.05,30.12)
Bassett Medical Center	86	6	6.98	12.15	6.66	(2.43,14.51)
Bellevue Hospital Ctr	105	14	13.33	10.50	14.74	(8.05,24.73)
Buffalo General Med Ctr	453	31	6.84	11.14	7.13**	(4.84,10.12)
Ellis Hospital	190	11	5.79	11.09	6.06**	(3.02,10.84)
Good Sam - Suffern	105	7	6.67	11.72	6.60	(2.65,13.61)
Good Sam Univ Hosp	200	27	13.50	12.35	12.69	(8.36,18.46)
Lenox Hill Hospital	326	43	13.19	11.18	13.69	(9.91,18.44)
Maimonides Medical Ctr	226	26	11.50	11.77	11.34	(7.41,16.62)
Mercy Hospital-Buffalo	321	16	4.98	11.41	5.07**	(2.90, 8.24)
Montefiore - Moses	230	38	16.52	11.74	16.34	(11.56,22.43)
Montefiore - Weiler	132	25	18.94	9.95	22.09*	(14.29,32.61)
Mount Sinai Hospital	270	35	12.96	11.78	12.78	(8.90,17.77)
Mount Sinai Morningside	284	19	6.69	10.93	7.10**	(4.27,11.09)
NYP Brooklyn Methodist	85	13	15.29	10.19	17.43	(9.27,29.80)
NYP Columbia Presby.	377	37	9.81	10.88	10.47	(7.37,14.44)
NYP NY Weill Cornell	121	16	13.22	12.34	12.44	(7.11,20.20)
NYP Queens	97	6	6.19	10.31	6.96	(2.54,15.16)
NYU Hospitals Center	202	13	6.44	10.35	7.22	(3.84,12.34)
NYU Winthrop Hospital	240	30	12.50	12.04	12.06	(8.13,17.21)
North Shore Univ Hosp	507	79	15.58	12.33	14.67*	(11.61,18.28)
Rochester General Hosp	438	82	18.72	12.91	16.84*	(13.39,20.90)
South Shore Univ. Hosp	187	32	17.11	11.13	17.84*	(12.20,25.19)
St. Elizabeth Med Ctr	142	16	11.27	11.76	11.12	(6.35,18.06)
St. Francis Hospital	523	63	12.05	11.44	12.23	(9.39,15.64)
St. Josephs Hospital	512	59	11.52	12.54	10.67	(8.12,13.76)
St. Peter's Hospital	306	37	12.09	11.38	12.33	(8.68,17.00)
Staten Island Univ Hosp	203	13	6.40	12.96	5.74**	(3.05, 9.81)
Strong Memorial Hosp	236	22	9.32	10.17	10.64	(6.66,16.11)
UHS Wilson Med Ctr	89	12	13.48	12.20	12.83	(6.62,22.42)
Univ Hosp at Downstate	78	11	14.10	13.70	11.95	(5.96,21.38)
Univ. Hosp-Stony Brook	199	20	10.05	11.47	10.17	(6.21,15.71)
Univ. Hosp-Upstate	181	22	12.15	12.09	11.67	(7.31,17.67)
Vassar Bros. Med Ctr	202	25	12.38	11.66	12.33	(7.97,18.20)
Westchester Med Ctr	265	25	9.43	11.43	9.58	(6.20,14.14)
STATEWIDE TOTAL	8400	975	11.61			

* 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, 2019 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.

2017-2019 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 2017-2019. The table contains, for each hospital, the combined number of Valve Only and Valve/CABG operations resulting in 2017-2019 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 17,840 combined Valve Only and Valve/CABG procedures performed at the 38 hospitals was 2.57 percent. The OMRs ranged from 0.00 percent to 10.17 percent. The range of EMRs, which measure patient severity of illness, was 0.77 percent to 4.05 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 13.24 percent. Six hospitals (Albany Medical Center, Arnot Ogden Medical Center in Elmira, Buffalo General Medical Center, Rochester General Hospital, Strong Memorial Hospital in Rochester, and University Hospital-Downstate in Brooklyn) had RAMRs that were significantly higher than the statewide rate. Six hospitals (Lenox Hill Hospital in Manhattan, Mount Sinai Hospital in Manhattan, NY-Presbyterian at Cornell in Manhattan, South Shore University Hospital in Bayshore, St. Joseph's Hospital in Syracuse, and St. Peter's Hospital in Albany) 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.

In this report, valve surgeries are separated into six separate groups and further classified by whether or not CABG was performed at the same time. The six groups are: Aortic Valve Replacement (AVR) or Repair, Mitral Valve Replacement (MVR), Mitral Valve Repair, Multiple Valve surgery where one of the valve procedures was MVR, Multiple Valve surgery with AVR but not MVR, and Multiple Valve surgery with repair of the Mitral and Tricuspid valves.

Table 4a presents valve surgery without CABG performed at the 38 cardiac surgery hospitals in NYS during 2017-2019. The table contains, for

each hospital, the number of valve operations resulting in 2017-2019 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. Table 4b includes the same information for each of the Valve surgery groups when performed at the same time as CABG. Unless otherwise specified, when the report refers to Valve or Valve/CABG procedures it is referring to the cases included in Tables 4a and 4b.

The 2017-2019 in-hospital/30-day OMR of 2.57 percent for Valve and Valve/CABG surgeries is lower than the 2.80 percent observed for 2016-2018. The in-hospital OMR for 2017-2019 valve surgeries (not shown in Table 3) is 2.15 percent for the 17,840 patients included in this analysis.

Table 5 presents the results for transcatheter aortic valve replacement (TAVR) procedures performed at the 30 hospitals performing TAVR during the 2017-2019 discharge period. The table contains, for each hospital, the number of TAVR procedures resulting in 2017-2019 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 2017-2019 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 14,945 TAVR procedures performed at the 30 hospitals was 2.22 percent. The OMRs ranged from 0.00 percent to 4.76 percent. The range of EMRs, which measure patient severity of illness, was 1.41 percent to 2.80 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 4.76 percent. Two hospitals (Albany Medical Center, and Vassar Brothers Medical Center in Poughkeepsie) had RAMRs that were statistically higher than the statewide rate. One hospital (Lenox Hill Hospital 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, 2017-2019 Discharges**

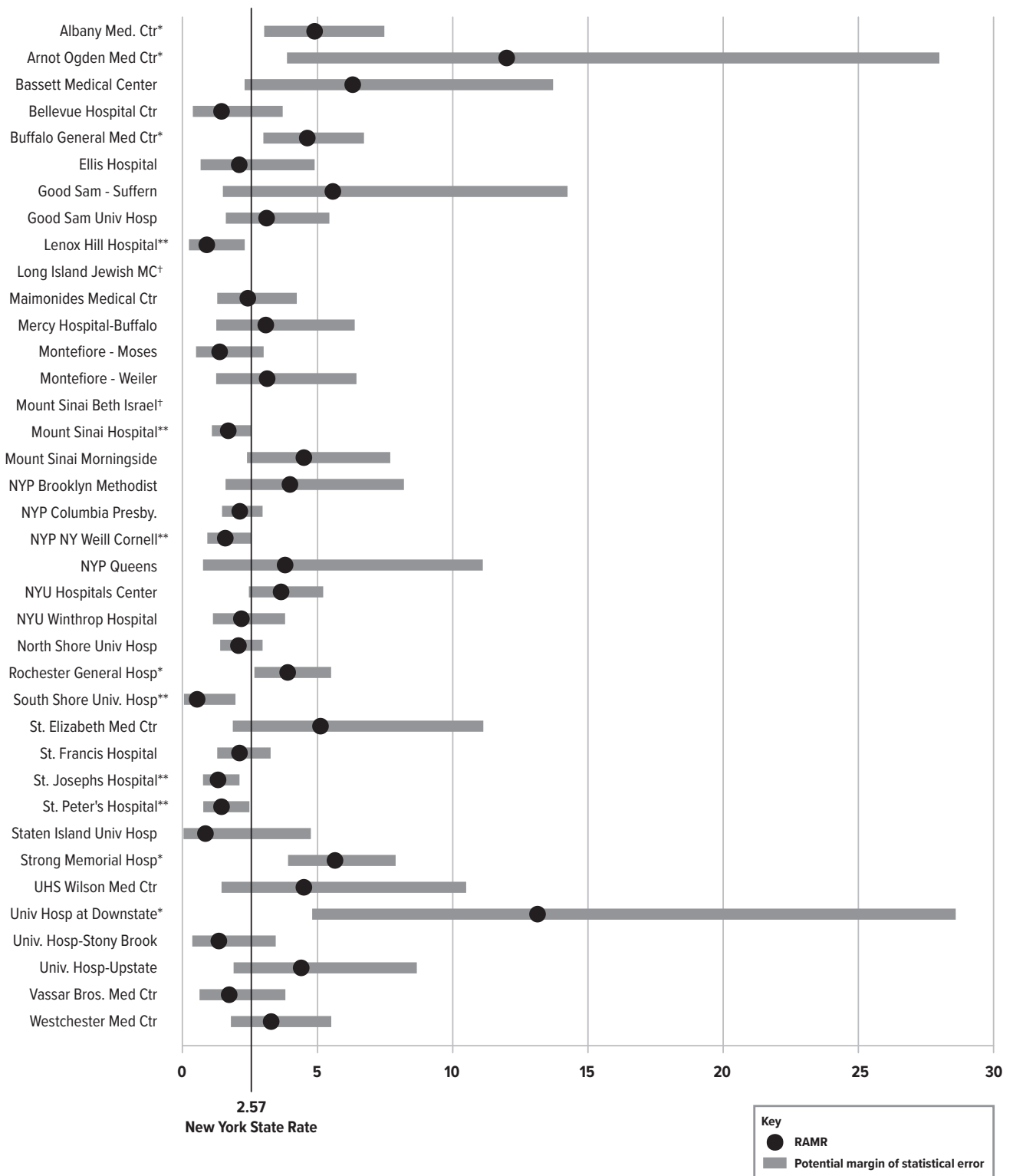
Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	504	21	4.17	2.17	4.93*	(3.05, 7.53)
Arnot Ogden Med Ctr	56	5	8.93	1.90	12.09*	(3.90,28.22)
Bassett Medical Center	99	6	6.06	2.45	6.35	(2.32,13.82)
Bellevue Hospital Ctr	252	4	1.59	2.79	1.46	(0.39, 3.74)
Buffalo General Med Ctr	715	26	3.64	2.02	4.62*	(3.02, 6.77)
Ellis Hospital	229	5	2.18	2.64	2.12	(0.68, 4.95)
Good Sam - Suffern	66	4	6.06	2.77	5.61	(1.51,14.36)
Good Sam Univ Hosp	343	12	3.50	2.86	3.14	(1.62, 5.49)
Lenox Hill Hospital	398	4	1.01	2.84	0.91**	(0.24, 2.32)
Long Island Jewish MC	1	0	0.00	0.77	0.00	(0.00,100.0)
Maimonides Medical Ctr	340	13	3.82	4.02	2.44	(1.30, 4.17)
Mercy Hospital-Buffalo	256	7	2.73	2.25	3.11	(1.25, 6.41)
Montefiore - Moses	381	6	1.57	2.91	1.39	(0.51, 3.03)
Montefiore - Weiler	272	7	2.57	2.10	3.15	(1.26, 6.48)
Mount Sinai Beth Israel	3	0	0.00	1.54	0.00	(0.00,100.0)
Mount Sinai Hospital	1863	24	1.29	1.93	1.71**	(1.10, 2.55)
Mount Sinai Morningside	316	13	4.11	2.33	4.53	(2.41, 7.75)
NYP Brooklyn Methodist	160	7	4.38	2.80	4.01	(1.61, 8.26)
NYP Columbia Presby.	1442	34	2.36	2.83	2.14	(1.48, 2.99)
NYP NY Weill Cornell	1035	17	1.64	2.64	1.60**	(0.93, 2.56)
NYP Queens	101	3	2.97	1.99	3.83	(0.77,11.20)
NYU Hospitals Center	1337	30	2.24	1.57	3.68	(2.48, 5.25)
NYU Winthrop Hospital	345	12	3.48	4.05	2.20	(1.14, 3.85)
North Shore Univ Hosp	1043	30	2.88	3.53	2.09	(1.41, 2.99)
Rochester General Hosp	757	32	4.23	2.76	3.93*	(2.69, 5.55)
South Shore Univ. Hosp	395	2	0.51	2.37	0.55**	(0.06, 1.98)
St. Elizabeth Med Ctr	133	6	4.51	2.25	5.16	(1.88,11.23)
St. Francis Hospital	908	20	2.20	2.66	2.12	(1.30, 3.28)
St. Josephs Hospital	1171	17	1.45	2.80	1.33**	(0.77, 2.13)
St. Peter's Hospital	799	13	1.63	2.86	1.46**	(0.78, 2.50)
Staten Island Univ Hosp	161	1	0.62	1.85	0.86	(0.01, 4.79)
Strong Memorial Hosp	740	34	4.59	2.07	5.69*	(3.94, 7.95)
UHS Wilson Med Ctr	140	5	3.57	2.02	4.53	(1.46,10.58)
Univ Hosp at Downstate	59	6	10.17	1.97	13.24*	(4.84,28.83)
Univ. Hosp-Stony Brook	256	4	1.56	2.95	1.36	(0.37, 3.48)
Univ. Hosp-Upstate	152	8	5.26	3.05	4.43	(1.91, 8.74)
Vassar Bros. Med Ctr	307	6	1.95	2.84	1.77	(0.64, 3.84)
Westchester Med Ctr	305	14	4.59	3.56	3.31	(1.81, 5.55)
STATEWIDE TOTAL	17,840	458	2.57			

* 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, 2017-2019 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.
 † Too few cases for graphical representation.

Table 4a**Hospital Volume for Valve Surgery in New York State, 2017-2019 Discharges**

Hospital	Aortic Valve Replace (AVR)	Mitral Valve Replace (MVR)	Mitral Valve Repair	Multiple Valve			Total
				Includes MVR	Includes AVR w/o MVR	Mitral & Tricuspid Repair	
Albany Med. Ctr	172	47	75	16	9	15	334
Arnot Ogden Med Ctr	30	3	1	0	0	0	34
Bassett Medical Center	39	7	7	1	3	0	57
Bellevue Hospital Ctr	86	53	18	46	5	0	208
Buffalo General Med Ctr	275	67	98	25	16	3	484
Ellis Hospital	98	21	11	7	1	2	140
Good Sam - Suffern	19	4	7	2	0	0	32
Good Sam Univ Hosp	115	21	27	21	8	4	196
Lenox Hill Hospital	104	65	93	29	14	15	320
Long Island Jewish MC	1	0	0	0	0	0	1
Maimonides Medical Ctr	71	53	11	73	5	5	218
Mercy Hospital-Buffalo	85	21	13	12	3	1	135
Montefiore - Moses	105	67	38	32	7	4	253
Montefiore - Weiler	85	44	24	19	13	5	190
Mount Sinai Beth Israel	0	0	0	1	0	0	1
Mount Sinai Hospital	291	50	279	182	90	693	1585
Mount Sinai Morningside	93	29	34	25	13	13	207
NYP Brooklyn Methodist	51	25	10	32	2	3	123
NYP Columbia Presby.	496	140	203	169	43	33	1084
NYP NY Weill Cornell	319	91	208	112	42	20	792
NYP Queens	39	17	9	17	0	0	82
NYU Hospitals Center	274	150	574	99	55	45	1197
NYU Winthrop Hospital	75	77	29	32	9	4	226
North Shore Univ Hosp	266	166	102	117	32	28	711
Rochester General Hosp	238	64	87	29	22	11	451
South Shore Univ. Hosp	113	38	73	16	10	12	262
St. Elizabeth Med Ctr	43	7	11	10	0	0	71
St. Francis Hospital	284	80	107	78	44	19	612
St. Josephs Hospital	352	99	236	61	25	25	798
St. Peter's Hospital	250	48	58	36	32	10	434
Staten Island Univ Hosp	51	12	35	4	1	5	108
Strong Memorial Hosp	385	63	137	29	10	6	630
UHS Wilson Med Ctr	70	14	7	2	1	0	94
Univ Hosp at Downstate	22	13	11	1	0	0	47
Univ. Hosp-Stony Brook	45	10	39	12	18	21	145
Univ. Hosp-Upstate	50	33	15	9	5	2	114
Vassar Bros. Med Ctr	89	34	50	23	2	2	200
Westchester Med Ctr	59	32	37	20	8	4	160
Statewide Total	5240	1765	2774	1399	548	1010	12736
STATEWIDE MORTALITY RATE (%)	1.39	3.29	0.72	5.72	2.92	0.59	1.99

Table 4b**Hospital Volume for Valve with CABG Surgery in New York State,
2017-2019 Discharges**

Hospital	Aortic Valve Replace (AVR) w/ CABG	Mitral Valve Replace (MVR) w/ CABG	Mitral Valve Repair w/ CABG	Multiple Valve w/ CABG			Total
				Includes MVR	Includes AVR w/o MVR	Mitral & Tricuspid Repair	
Albany Med. Ctr	122	16	25	3	3	1	170
Arnot Ogden Med Ctr	16	3	2	1	0	0	22
Bassett Medical Center	36	2	4	0	0	0	42
Bellevue Hospital Ctr	26	12	2	3	1	0	44
Buffalo General Med Ctr	170	24	28	1	8	0	231
Ellis Hospital	67	8	7	5	2	0	89
Good Sam - Suffern	17	3	11	1	2	0	34
Good Sam Univ Hosp	94	12	27	4	8	2	147
Lenox Hill Hospital	43	9	19	2	2	3	78
Long Island Jewish MC	0	0	0	0	0	0	0
Maimonides Medical Ctr	54	37	16	13	1	1	122
Mercy Hospital-Buffalo	92	11	8	9	1	0	121
Montefiore - Moses	68	39	11	9	1	0	128
Montefiore - Weiler	48	7	20	3	2	2	82
Mount Sinai Beth Israel	1	0	1	0	0	0	2
Mount Sinai Hospital	116	5	44	21	17	75	278
Mount Sinai Morningside	56	14	28	3	5	3	109
NYP Brooklyn Methodist	13	15	5	3	0	1	37
NYP Columbia Presby.	219	42	43	34	11	9	358
NYP NY Weill Cornell	142	24	40	21	10	6	243
NYP Queens	13	4	1	1	0	0	19
NYU Hospitals Center	77	18	30	8	5	2	140
NYU Winthrop Hospital	57	34	21	4	3	0	119
North Shore Univ Hosp	151	64	73	29	10	5	332
Rochester General Hosp	171	27	76	10	13	9	306
South Shore Univ. Hosp	79	15	28	6	3	2	133
St. Elizabeth Med Ctr	48	2	9	2	1	0	62
St. Francis Hospital	179	42	45	16	11	3	296
St. Josephs Hospital	198	51	87	16	15	6	373
St. Peter's Hospital	238	14	66	21	20	6	365
Staten Island Univ Hosp	33	5	14	0	1	0	53
Strong Memorial Hosp	98	6	4	1	0	1	110
UHS Wilson Med Ctr	45	1	0	0	0	0	46
Univ Hosp at Downstate	6	1	5	0	0	0	12
Univ. Hosp-Stony Brook	63	4	26	0	13	5	111
Univ. Hosp-Upstate	21	8	7	1	1	0	38
Vassar Bros. Med Ctr	67	14	18	6	1	1	107
Westchester Med Ctr	95	21	12	11	4	2	145
Statewide Total	3039	614	863	268	175	145	5104
STATEWIDE MORTALITY RATE (%)	2.63	6.51	3.13	13.81	5.71	7.59	4.02

Table 5**In-hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for TAVR in New York State, 2017-2019 Discharges** (Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	943	38	4.03	2.53	3.54*	(2.51, 4.86)
Bassett Medical Center	21	0	0.00	1.41	0.00	(0.00,27.50)
Buffalo General Med Ctr	1037	32	3.09	2.15	3.19	(2.18, 4.51)
Ellis Hospital	107	3	2.80	2.80	2.23	(0.45, 6.50)
Good Sam Univ Hosp	118	1	0.85	2.24	0.84	(0.01, 4.68)
Lenox Hill Hospital	363	2	0.55	2.10	0.58**	(0.07, 2.10)
Maimonides Medical Ctr	244	6	2.46	2.23	2.45	(0.89, 5.33)
Mercy Hospital-Buffalo	255	5	1.96	1.88	2.32	(0.75, 5.41)
Montefiore - Moses	21	1	4.76	2.66	3.98	(0.05,22.12)
Montefiore - Weiler	328	6	1.83	2.38	1.71	(0.62, 3.71)
Mount Sinai Hospital	972	23	2.37	2.36	2.23	(1.41, 3.35)
Mount Sinai Morningside	75	1	1.33	2.10	1.41	(0.02, 7.87)
NYP Brooklyn Methodist	106	2	1.89	2.44	1.72	(0.19, 6.21)
NYP Columbia Presby.	1350	23	1.70	2.47	1.53	(0.97, 2.30)
NYP NY Weill Cornell	669	10	1.49	2.10	1.58	(0.76, 2.91)
NYU Hospitals Center	1176	15	1.28	1.82	1.56	(0.87, 2.57)
NYU Winthrop Hospital	834	27	3.24	2.33	3.09	(2.04, 4.50)
North Shore Univ Hosp	833	16	1.92	2.30	1.86	(1.06, 3.02)
Rochester General Hosp	604	16	2.65	2.13	2.76	(1.58, 4.49)
South Shore Univ. Hosp	340	10	2.94	2.21	2.95	(1.41, 5.43)
St. Elizabeth Med Ctr	168	3	1.79	1.98	2.00	(0.40, 5.86)
St. Francis Hospital	1424	35	2.46	2.28	2.39	(1.67, 3.33)
St. Josephs Hospital	587	11	1.87	2.32	1.79	(0.89, 3.21)
St. Peter's Hospital	270	2	0.74	2.20	0.75	(0.08, 2.70)
Staten Island Univ Hosp	146	0	0.00	1.98	0.00	(0.00, 2.82)
Strong Memorial Hosp	467	16	3.43	2.24	3.39	(1.94, 5.51)
UHS Wilson Med Ctr	276	1	0.36	1.93	0.42	(0.01, 2.32)
Univ. Hosp-Stony Brook	513	5	0.97	2.14	1.01	(0.33, 2.37)
Vassar Bros. Med Ctr	306	12	3.92	1.83	4.76*	(2.45, 8.31)
Westchester Med Ctr	392	10	2.55	2.14	2.65	(1.27, 4.88)
STATEWIDE TOTAL	14,945	332	2.22			

*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.

2017-2019 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 2017-2019. In addition, the final two columns provide the number of Isolated CABG, Valve and Valve/CABG procedures and the RAMR for these patients in 2017-2019 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 2017-2019, (b) performed at least one cardiac operation in each of the years, 2017-2019. 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 2017-2019 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, 2017-2019 Discharges

	No of Cases	Deaths	Isolated CABG			95% CI for RAMR	Isolated CABG, or Valve or Valve/CABG	
			OMR	EMR	RAMR		Cases	RAMR
STATEWIDE TOTAL	26,242	410	1.56				44,082	1.97
Albany Med. Ctr								
Akujuo A C	213	3	1.41	1.24	1.77	(0.36, 5.18)	328	3.09
Bennett E	4	0	0.00	0.52	0.00	(0.00, 100.0)	71	4.36
Britton L	116	3	2.59	1.19	3.40	(0.68, 9.94)	235	3.17
Samy S A	172	5	2.91	1.30	3.48	(1.12, 8.13)	282	4.77*
#Singh C	141	6	4.26	2.20	3.02	(1.10, 6.57)	201	3.62
#Stein L H	23	2	8.70	1.60	8.49	(0.95, 30.66)	32	7.43
All Others	71	2	2.82	1.53	2.87	(0.32, 10.36)	95	2.59
Total	740	21	2.84	1.47	3.02*	(1.87, 4.62)	1244	3.80*
Arnot Ogden Med Ctr								
All Others	146	2	1.37	1.20	1.78	(0.20, 6.43)	202	4.89
Total	146	2	1.37	1.20	1.78	(0.20, 6.43)	202	4.89
Bassett Medical Center								
Daniel S R	96	4	4.17	1.70	3.83	(1.03, 9.81)	123	5.39*
Kelley J	136	0	0.00	1.62	0.00	(0.00, 2.60)	208	1.59
##Neragi-Miandoab	3	0	0.00	1.14	0.00	(0.00, 100.0)	3	0.00
Total	235	4	1.70	1.65	1.61	(0.43, 4.13)	334	3.13

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Bellevue Hospital Ctr								
#Culliford A	119	0	0.00	1.22	0.00	(0.00, 3.94)	194	1.48
#Hisamoto K	68	0	0.00	0.82	0.00	(0.00, 10.25)	131	0.00
#Loulmet D F	.	.	.	.	.	(. . , . .)	1	37.85
#Smith D E	117	1	0.85	1.06	1.26	(0.02, 7.02)	175	0.64
#Swistel D	9	0	0.00	1.36	0.00	(0.00, 46.82)	15	0.00
All Others	74	0	0.00	1.02	0.00	(0.00, 7.62)	123	0.00
Total	387	1	0.26	1.07	0.38	(0.00, 2.11)	639	0.88
Buffalo General Med Ctr								
Aldridge J	153	4	2.61	1.31	3.13	(0.84, 8.01)	198	6.36*
Ashraf M	553	8	1.45	1.41	1.60	(0.69, 3.15)	682	2.14
Grosner G	665	6	0.90	1.43	0.99	(0.36, 2.15)	1206	2.14
Total	1371	18	1.31	1.41	1.46	(0.86, 2.30)	2086	2.57
Ellis Hospital								
Choumarov K	269	7	2.60	1.53	2.65	(1.06, 5.47)	374	2.26
Reich H	228	3	1.32	1.55	1.32	(0.27, 3.87)	336	2.26
##Sarabu M	4	0	0.00	1.24	0.00	(0.00, 100.0)	4	0.00
#Singh C	30	3	10.00	1.16	13.48*	(2.71, 39.37)	46	5.93
All Others	18	0	0.00	1.15	0.00	(0.00, 27.74)	18	0.00
Total	549	13	2.37	1.51	2.46	(1.31, 4.20)	778	2.48
Good Sam - Suffern								
Badami C D	159	3	1.89	1.22	2.42	(0.49, 7.08)	199	3.77
All Others	119	2	1.68	1.54	1.70	(0.19, 6.15)	145	2.39
Total	278	5	1.80	1.35	2.07	(0.67, 4.84)	344	3.17
Good Sam Univ Hosp								
Carter T I	165	2	1.21	1.74	1.09	(0.12, 3.93)	253	2.55
#Dimeo A C	2	0	0.00	2.97	0.00	(0.00, 96.60)	2	0.00
#Henry M J	1	0	0.00	4.50	0.00	(0.00, 100.0)	1	0.00
Lamendola C	98	2	2.04	1.53	2.08	(0.23, 7.50)	253	2.23
Rovensky M	365	11	3.01	2.13	2.22	(1.10, 3.96)	465	2.45
Total	631	15	2.38	1.94	1.92	(1.07, 3.16)	974	2.41
Lenox Hill Hospital								
#Brinster D R	34	1	2.94	1.35	3.39	(0.04, 18.88)	122	1.78
Hemli J M	29	0	0.00	1.92	0.00	(0.00, 10.29)	34	0.00
Patel N C	742	4	0.54	1.50	0.56**	(0.15, 1.44)	968	0.76**
Pirelli L	43	0	0.00	1.51	0.00	(0.00, 8.83)	68	0.00
Scheinerman S J	206	3	1.46	1.29	1.77	(0.35, 5.16)	260	1.36
Total	1054	8	0.76	1.46	0.81	(0.35, 1.60)	1452	0.88**
Long Island Jewish MC								
#Meyer D B	.	.	.	.	.	(. . , . .)	1	0.00
Total	.	.	.	.	.	(. . , . .)	1	0.00

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Maimonides Medical Ctr								
#Abrol S	12	0	0.00	2.18	0.00	(0.00, 21.87)	23	0.00
Crooke G	72	1	1.39	2.38	0.91	(0.01, 5.07)	131	2.29
Jacobowitz I	330	3	0.91	1.87	0.76	(0.15, 2.22)	471	1.27
Ribakove G	69	2	2.90	1.80	2.51	(0.28, 9.06)	124	2.43
Saunders P	75	0	0.00	1.83	0.00	(0.00, 4.17)	86	0.00
Stephens G A	85	2	2.35	2.03	1.81	(0.20, 6.55)	125	1.83
Youdelman B A	51	0	0.00	1.86	0.00	(0.00, 6.04)	74	1.08
Total	694	8	1.15	1.94	0.93	(0.40, 1.83)	1034	1.53
Mercy Hospital-Buffalo								
Downing S W	310	4	1.29	1.49	1.35	(0.36, 3.46)	471	1.22
Forman J M	157	1	0.64	1.52	0.65	(0.01, 3.64)	170	0.70
Jain H B	443	6	1.35	1.41	1.50	(0.55, 3.26)	520	2.73
##Joyce F	7	1	14.29	4.07	5.48	(0.07, 30.49)	8	12.72
#Karavas A N	70	0	0.00	1.43	0.00	(0.00, 5.71)	74	0.00
All Others	29	0	0.00	0.97	0.00	(0.00, 20.46)	29	0.00
Total	1016	12	1.18	1.46	1.26	(0.65, 2.21)	1272	1.82
Montefiore - Moses								
#Chau M L	1	0	0.00	0.32	0.00	(0.00, 100.0)	1	0.00
#Derose J J	2	0	0.00	1.62	0.00	(0.00, 100.0)	6	0.00
#Forest S J	97	1	1.03	1.73	0.93	(0.01, 5.19)	131	1.45
#Goldstein D J	192	5	2.60	1.41	2.88	(0.93, 6.72)	292	2.21
#Jakobleff W A	197	4	2.03	1.49	2.13	(0.57, 5.45)	262	1.65
#Michler R E	107	2	1.87	0.99	2.94	(0.33, 10.60)	265	2.07
Scheinin S A	60	2	3.33	1.48	3.52	(0.40, 12.70)	80	2.33
Total	656	14	2.13	1.42	2.35	(1.28, 3.94)	1037	1.93
Montefiore - Weiler								
#Chau M L	67	6	8.96	1.27	11.04*	(4.03, 24.03)	94	9.46*
#Derose J J	365	10	2.74	1.05	4.08*	(1.95, 7.50)	603	3.75*
#Forest S J	3	0	0.00	1.05	0.00	(0.00, 100.0)	3	0.00
#Goldstein D J	8	0	0.00	1.84	0.00	(0.00, 38.93)	11	0.00
#Jakobleff W A	7	0	0.00	0.63	0.00	(0.00, 100.0)	9	0.00
#Michler R E	.	.	.	.	.	(. , .)	2	0.00
All Others	17	1	5.88	1.63	5.62	(0.07, 31.28)	17	7.09
Total	467	17	3.64	1.11	5.13*	(2.98, 8.21)	739	4.34*
Mount Sinai Beth Israel								
#DiLuozzo G	1	0	0.00	2.99	0.00	(0.00, 100.0)	1	0.00
#Puskas J D	9	0	0.00	2.38	0.00	(0.00, 26.79)	12	0.00
Total	10	0	0.00	2.44	0.00	(0.00, 23.51)	13	0.00

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Mount Sinai Hospital								
Adams D H	1	0	0.00	1.57	0.00	(0.00, 100.0)	959	0.19**
Anyanwu A	55	0	0.00	1.60	0.00	(0.00, 6.51)	154	1.61
Boateng P	47	0	0.00	1.27	0.00	(0.00, 9.61)	130	0.00
Castillo-Granero J	19	0	0.00	1.04	0.00	(0.00, 29.07)	51	2.88
El-Eshmawi A M	16	0	0.00	1.05	0.00	(0.00, 34.21)	89	0.00
Filsoufi F	289	3	1.04	1.06	1.53	(0.31, 4.46)	379	1.70
Nguyen K	1	0	0.00	0.36	0.00	(0.00, 100.0)	2	0.00
Pawale A A	30	3	10.00	1.15	13.60*	(2.73, 39.74)	54	6.75
Reddy R C	283	4	1.41	1.45	1.52	(0.41, 3.89)	378	2.23
Stelzer P	15	0	0.00	0.78	0.00	(0.00, 48.89)	183	3.00
Stewart A S	50	1	2.00	0.93	3.35	(0.04, 18.63)	184	1.55
Varghese R	161	1	0.62	1.11	0.87	(0.01, 4.86)	267	1.72
All Others	4	0	0.00	0.98	0.00	(0.00, 100.0)	4	0.00
Total	971	12	1.24	1.22	1.59	(0.82, 2.78)	2834	1.48
Mount Sinai Morningside								
Balaram S K	152	0	0.00	1.28	0.00	(0.00, 2.95)	266	1.20
#DiLuozzo G	35	0	0.00	1.07	0.00	(0.00, 15.33)	73	8.09*
#Puskas J D	662	9	1.36	1.05	2.01	(0.92, 3.82)	806	2.84
Torregrossa G	41	1	2.44	1.53	2.50	(0.03, 13.89)	61	2.04
Total	890	10	1.12	1.12	1.57	(0.75, 2.89)	1206	2.62
NYP Brooklyn Methodist								
##Gulkarov I M	28	1	3.57	1.44	3.88	(0.05, 21.61)	62	4.02
#Tranbaugh R	202	5	2.48	1.51	2.56	(0.83, 5.98)	276	3.97
Worku B M	92	0	0.00	1.20	0.00	(0.00, 5.17)	143	0.00
All Others	4	0	0.00	1.21	0.00	(0.00, 100.0)	5	0.00
Total	326	6	1.84	1.41	2.03	(0.74, 4.43)	486	2.81
NYP Columbia Presby.								
Argenziano M	286	1	0.35	1.47	0.37	(0.00, 2.07)	480	1.26
#Bacha E	.	.	.	.	.	(. . .)	6	0.00
Bapat V N	31	0	0.00	1.74	0.00	(0.00, 10.61)	190	1.16
George I	141	0	0.00	1.17	0.00	(0.00, 3.47)	400	0.88
Naka Y	219	2	0.91	1.40	1.02	(0.11, 3.68)	321	1.24
Smith C	222	6	2.70	1.20	3.51	(1.28, 7.64)	585	1.94
Takayama H	299	6	2.01	1.52	2.07	(0.75, 4.49)	552	2.58
Takeda K	137	5	3.65	2.24	2.54	(0.82, 5.94)	208	2.89
All Others	4	0	0.00	0.69	0.00	(0.00, 100.0)	39	2.06
Total	1339	20	1.49	1.48	1.58	(0.97, 2.44)	2781	1.76

Table 6 continued

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
NYP NY Weill Cornell								
#Bacha E	.	.	.	.	.	( . , . )	1	0.00
Chai P J	.	.	.	.	.	( . , . )	1	0.00
Girardi L	182	1	0.55	1.18	0.73	(0.01, 4.05)	686	1.48
##Gulkarov I M	.	.	.	.	.	( . , . )	1	0.00
Guy T S	30	0	0.00	1.03	0.00	(0.00, 18.48)	227	0.00
#Iannacone E M	37	0	0.00	1.80	0.00	(0.00, 8.60)	64	2.87
Krieger K	37	1	2.70	1.17	3.60	(0.05, 20.03)	115	1.39
#Lang S	3	0	0.00	8.54	0.00	(0.00, 22.37)	8	0.00
Lau C	188	3	1.60	2.02	1.24	(0.25, 3.61)	296	1.59
Salemi A	36	0	0.00	1.85	0.00	(0.00, 8.59)	117	0.00
#Tranbaugh R	1	0	0.00	31.38	0.00	(0.00, 18.26)	2	0.00
All Others	17	0	0.00	0.65	0.00	(0.00, 51.59)	48	0.00
Total	531	5	0.94	1.64	0.90	(0.29, 2.10)	1566	1.20**
NYP Queens								
Avgerinos D V	107	0	0.00	0.86	0.00	(0.00, 6.24)	152	1.26
#Iannacone E M	1	0	0.00	1.04	0.00	(0.00, 100.0)	1	0.00
#Lang S	293	2	0.68	1.14	0.94	(0.11, 3.39)	349	1.68
Total	401	2	0.50	1.06	0.73	(0.08, 2.65)	502	1.57
NYU Hospitals Center								
#Culliford A	1	0	0.00	0.52	0.00	(0.00, 100.0)	7	0.00
Galloway A	30	0	0.00	1.42	0.00	(0.00, 13.47)	276	3.22
Grossi E	.	.	.	.	.	( . , . )	2	0.00
#Hisamoto K	8	1	12.50	0.70	27.72	(0.36, 100.0)	17	11.59
#Loulmet D F	36	0	0.00	0.79	0.00	(0.00, 20.15)	531	4.63*
Mosca R S	.	.	.	.	.	( . , . )	2	0.00
#Smith D E	61	0	0.00	1.49	0.00	(0.00, 6.32)	90	2.14
#Swistel D	138	3	2.17	1.05	3.24	(0.65, 9.48)	298	3.45
Vaynblat M	103	3	2.91	1.39	3.27	(0.66, 9.55)	183	2.25
Williams M R	5	0	0.00	0.73	0.00	(0.00, 100.0)	182	1.38
Zias E	359	4	1.11	1.12	1.55	(0.42, 3.96)	485	1.14
All Others	1	0	0.00	1.24	0.00	(0.00, 100.0)	6	0.00
Total	742	11	1.48	1.16	1.99	(0.99, 3.56)	2079	2.73
NYU Winthrop Hospital								
#Abrol S	268	4	1.49	1.93	1.21	(0.33, 3.10)	377	1.47
Kokotos W J	137	4	2.92	2.14	2.13	(0.57, 5.45)	235	2.08
Salhab K F	132	0	0.00	1.55	0.00	(0.00, 2.81)	193	1.50
Schubach S	161	0	0.00	1.57	0.00	(0.00, 2.26)	224	0.00**
All Others	66	0	0.00	2.02	0.00	(0.00, 4.30)	80	1.19
Total	764	8	1.05	1.83	0.89	(0.38, 1.76)	1109	1.41

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
North Shore Univ Hosp								
#Brinster D R	5	0	0.00	2.05	0.00	(0.00, 56.03)	10	0.00
Esposito R	146	3	2.05	1.54	2.08	(0.42, 6.08)	229	2.23
#Fernandez H A	20	0	0.00	1.85	0.00	(0.00, 15.45)	28	0.00
Graver L	193	2	1.04	1.26	1.29	(0.14, 4.65)	402	0.57
Hartman A	169	2	1.18	1.57	1.18	(0.13, 4.25)	425	1.91
#Kalimi R	8	0	0.00	0.71	0.00	(0.00, 100.0)	9	0.00
Lima B	14	0	0.00	0.93	0.00	(0.00, 43.94)	16	0.00
#Manetta F	108	0	0.00	1.76	0.00	(0.00, 3.01)	142	0.00
#Meyer D B	.	.	.	.	.	(. , .)	1	0.00
Palazzo R	211	1	0.47	1.49	0.50	(0.01, 2.76)	262	0.40
#Taylor J	389	3	0.77	1.73	0.70	(0.14, 2.04)	636	1.46
Vatsia S	191	4	2.09	1.79	1.83	(0.49, 4.68)	284	1.97
Yu P J	95	4	4.21	1.66	3.96	(1.06, 10.13)	132	3.22
All Others	14	1	7.14	2.34	4.78	(0.06, 26.58)	30	2.66
Total	1563	20	1.28	1.61	1.25	(0.76, 1.92)	2606	1.59
Rochester General Hosp								
Cheeran D	481	11	2.29	2.07	1.73	(0.86, 3.09)	752	2.31
Kirshner R	552	16	2.90	1.88	2.41	(1.37, 3.91)	950	3.39*
Prastein D J	91	3	3.30	2.05	2.51	(0.50, 7.33)	113	2.58
Yankey G K N	96	10	10.42	2.12	7.69*	(3.68, 14.14)	125	7.99*
All Others	78	1	1.28	1.79	1.12	(0.01, 6.22)	115	1.45
Total	1298	41	3.16	1.97	2.50*	(1.79, 3.39)	2055	3.09*
South Shore Univ. Hosp								
#Fernandez H A	174	3	1.72	1.34	2.01	(0.40, 5.88)	289	1.02
#Kalimi R	204	1	0.49	1.55	0.49	(0.01, 2.74)	444	0.24**
#Manetta F	87	0	0.00	1.41	0.00	(0.00, 4.68)	113	1.09
#Taylor J	.	.	.	.	.	(. , .)	1	0.00
All Others	75	1	1.33	1.81	1.15	(0.02, 6.42)	88	2.25
Total	540	5	0.93	1.50	0.97	(0.31, 2.26)	935	0.79**
St. Elizabeth Med Ctr								
Cahill A T	152	2	1.32	1.93	1.07	(0.12, 3.85)	177	1.14
Fuzesi L	167	4	2.40	1.85	2.02	(0.54, 5.17)	221	3.67
##Joyce F	139	4	2.88	1.46	3.09	(0.83, 7.91)	192	3.63
All Others	6	1	16.67	2.27	11.48	(0.15, 63.88)	7	11.32
Total	464	11	2.37	1.76	2.10	(1.05, 3.76)	597	3.00
St. Francis Hospital								
Bercow N	308	3	0.97	1.51	1.01	(0.20, 2.95)	488	2.51
Colangelo R	481	6	1.25	1.36	1.43	(0.52, 3.12)	714	1.40
#Dimeo A C	488	7	1.43	1.61	1.39	(0.56, 2.87)	630	1.27
#Henry M J	62	1	1.61	2.29	1.10	(0.01, 6.12)	80	2.24
Lundy E F	290	4	1.38	2.07	1.04	(0.28, 2.67)	364	1.34
Robinson N	18	0	0.00	2.12	0.00	(0.00, 15.00)	279	1.01
Total	1647	21	1.28	1.63	1.22	(0.76, 1.87)	2555	1.58

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
St. Josephs Hospital								
#Green G R	68	1	1.47	1.57	1.46	(0.02, 8.13)	142	0.62
Lutz C J	343	5	1.46	2.13	1.07	(0.34, 2.50)	717	0.97
Marvasti M	221	4	1.81	1.68	1.68	(0.45, 4.30)	343	1.01
Nazem A	353	6	1.70	1.98	1.34	(0.49, 2.92)	524	2.34
Zhou Z	446	7	1.57	2.07	1.19	(0.48, 2.44)	869	1.06**
All Others	36	0	0.00	2.06	0.00	(0.00, 7.73)	43	0.00
Total	1467	23	1.57	1.98	1.24	(0.78, 1.86)	2638	1.27**
St. Peter's Hospital								
Edwards N	222	1	0.45	1.18	0.60	(0.01, 3.32)	418	0.82
#Karavas A N	165	3	1.82	1.26	2.25	(0.45, 6.56)	247	2.09
Polomsky M	141	2	1.42	1.48	1.50	(0.17, 5.41)	203	1.74
Saifi J	259	1	0.39	1.47	0.41	(0.01, 2.29)	528	0.81**
##Sarabu M	13	0	0.00	1.43	0.00	(0.00, 30.85)	13	0.00
Terrien C M	249	3	1.20	1.84	1.02	(0.21, 2.99)	439	1.25
Total	1049	10	0.95	1.46	1.02	(0.49, 1.87)	1848	1.19**
Staten Island Univ Hosp								
##Gulkarov I M	139	2	1.44	1.61	1.39	(0.16, 5.03)	160	1.44
Imam M N	194	0	0.00	1.22	0.00	(0.00, 2.42)	327	0.00**
Rosell F M	261	2	0.77	1.94	0.62	(0.07, 2.23)	265	1.14
All Others	7	0	0.00	1.14	0.00	(0.00, 71.78)	10	0.00
Total	601	4	0.67	1.62	0.64	(0.17, 1.64)	762	0.77**
Strong Memorial Hosp								
Alfieris G	1	0	0.00	0.72	0.00	(0.00, 100.0)	8	0.00
Barrus B B	202	4	1.98	1.21	2.56	(0.69, 6.55)	225	4.00
Gosev I	186	3	1.61	1.17	2.16	(0.43, 6.32)	234	1.89
Knight P	110	2	1.82	1.86	1.53	(0.17, 5.52)	710	3.48*
Prasad S M	144	6	4.17	1.83	3.56	(1.30, 7.74)	198	6.16*
All Others	33	0	0.00	1.34	0.00	(0.00, 12.94)	41	3.51
Total	676	15	2.22	1.44	2.41	(1.35, 3.97)	1416	3.85*
UHS Wilson Med Ctr								
#Beckles D L	50	2	4.00	1.61	3.88	(0.44, 14.03)	71	5.70
Khan A M	117	2	1.71	2.26	1.18	(0.13, 4.26)	161	2.14
#Shahani R B	10	0	0.00	0.92	0.00	(0.00, 62.35)	14	0.00
Wong K	147	2	1.36	1.59	1.33	(0.15, 4.82)	196	1.17
All Others	44	3	6.82	1.49	7.16	(1.44, 20.91)	66	8.96*
Total	368	9	2.45	1.78	2.15	(0.98, 4.08)	508	2.94
Univ Hosp at Downstate								
#Beckles D L	58	1	1.72	1.94	1.39	(0.02, 7.74)	79	3.92
##Joyce F	9	1	11.11	0.84	20.74	(0.27, 100.0)	10	26.10*
##Neragi-Miandoab	25	2	8.00	2.92	4.28	(0.48, 15.46)	29	5.00
#Stein L H	10	0	0.00	0.94	0.00	(0.00, 60.89)	12	0.00
All Others	105	5	4.76	2.00	3.73	(1.20, 8.69)	136	5.80*
Total	207	9	4.35	1.99	3.41	(1.56, 6.48)	266	5.59*

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Univ. Hosp-Stony Brook								
Bilfinger T	29	0	0.00	1.74	0.00	(0.00, 11.37)	37	0.00
Chikwe J Y	248	1	0.40	1.59	0.40	(0.01, 2.21)	423	0.44**
McLarty A	40	1	2.50	2.42	1.61	(0.02, 8.98)	57	2.66
Tannous H J	147	1	0.68	1.35	0.79	(0.01, 4.38)	180	1.31
All Others	95	1	1.05	2.21	0.74	(0.01, 4.14)	118	1.39
Total	559	4	0.72	1.70	0.66	(0.18, 1.69)	815	0.92**
Univ. Hosp-Upstate								
Esrig B	52	3	5.77	3.55	2.54	(0.51, 7.42)	73	5.72*
#Green G R	213	1	0.47	1.91	0.38	(0.01, 2.14)	312	0.81
All Others	142	5	3.52	1.96	2.80	(0.90, 6.54)	174	3.84
Total	407	9	2.21	2.14	1.62	(0.74, 3.07)	559	2.51
Vassar Bros. Med Ctr								
##Neragi-Miandoab	42	2	4.76	1.65	4.52	(0.51, 16.32)	49	4.50
##Sarabu M	34	3	8.82	2.29	6.02	(1.21, 17.59)	91	2.89
#Shahani R B	110	0	0.00	1.34	0.00	(0.00, 3.88)	172	0.00
Sperling J S	171	4	2.34	2.28	1.60	0.43, 4.11)	308	2.26
All Others	160	2	1.25	1.38	1.41	(0.16, 5.10)	204	1.11
Total	517	11	2.13	1.75	1.90	(0.95, 3.40)	824	1.88
Westchester Med Ctr								
Goldberg J B	37	0	0.00	1.15	0.00	(0.00, 13.43)	73	1.49
Kai M	102	2	1.96	1.77	1.73	(0.19, 6.25)	123	2.82
Lansman S	1	0	0.00	2.99	0.00	(0.00, 100.0)	1	0.00
Malekan R	188	1	0.53	1.30	0.64	(0.01, 3.55)	259	2.18
Spielvogel D	346	3	0.87	1.53	0.88	(0.18, 2.58)	522	1.58
All Others	7	0	0.00	1.11	0.00	(0.00, 73.63)	8	0.00
Total	681	6	0.88	1.48	0.93	(0.34, 2.02)	986	1.88
STATEWIDE TOTAL	26,242	410	1.56				44,082	1.97

* 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, 2017-2019**

	Isolated CABG					95% CI for RAMR	Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR		Cases	RAMR
Abrol S	280	4	1.43	1.94	1.15	(0.31, 2.95)	400	1.39
Maimonides Medical Ctr	12	0	0.00	2.18	0.00	(0.00, 21.87)	23	0.00
NYU Winthrop Hospital	268	4	1.49	1.93	1.21	(0.33, 3.10)	377	1.47
Bacha E	.	.	.	.	.	(. , .)	7	0.00
NYP Columbia Presby.	.	.	.	.	.	(. , .)	6	0.00
NYP NY Weill Cornell	.	.	.	.	.	(. , .)	1	0.00
Beckles D L	108	3	2.78	1.79	2.43	(0.49, 7.10)	150	4.65
UHS Wilson Med Ctr	50	2	4.00	1.61	3.88	(0.44, 14.03)	71	5.70
Univ Hosp at Downstate	58	1	1.72	1.94	1.39	(0.02, 7.74)	79	3.92
Brinster D R	39	1	2.56	1.44	2.78	(0.04, 15.45)	132	1.67
Lenox Hill Hospital	34	1	2.94	1.35	3.39	(0.04, 18.88)	122	1.78
North Shore Univ Hosp	5	0	0.00	2.05	0.00	(0.00, 56.03)	10	0.00
Chau M L	68	6	8.82	1.25	11.00 *	(4.02, 23.94)	95	9.44 *
Montefiore - Moses	1	0	0.00	0.32	0.00	(0.00, 100.0)	1	0.00
Montefiore - Weiler	67	6	8.96	1.27	11.04 *	(4.03, 24.03)	94	9.46 *
Culliford A	120	0	0.00	1.22	0.00	(0.00, 3.93)	201	1.45
Bellevue Hospital Ctr	119	0	0.00	1.22	0.00	(0.00, 3.94)	194	1.48
NYU Hospitals Center	1	0	0.00	0.52	0.00	(0.00, 100.0)	7	0.00
Derose J J	367	10	2.72	1.05	4.04 *	(1.94, 7.43)	609	3.66 *
Montefiore - Moses	2	0	0.00	1.62	0.00	(0.00,100.0)	6	0.00
Montefiore - Weiler	365	10	2.74	1.05	4.08 *	(1.95, 7.50)	603	3.75 *
DiLuozzo G	36	0	0.00	1.12	0.00	(0.00, 14.19)	74	7.85 *
Mount Sinai Beth Israel	1	0	0.00	2.99	0.00	(0.00, 100.0)	1	0.00
Mount Sinai Morningside	35	0	0.00	1.07	0.00	(0.00, 15.33)	73	8.09 *
Dimeo A C	490	7	1.43	1.61	1.38	(0.55, 2.85)	632	1.26
Good Sam Univ Hosp	2	0	0.00	2.97	0.00	(0.00, 96.60)	2	0.00
St. Francis Hospital	488	7	1.43	1.61	1.39	(0.56, 2.87)	630	1.27
Fernandez H A	194	3	1.55	1.39	1.74	(0.35, 5.07)	317	0.86
North Shore Univ Hosp	20	0	0.00	1.85	0.00	(0.00, 15.45)	28	0.00
South Shore Univ. Hosp	174	3	1.72	1.34	2.01	(0.40, 5.88)	289	1.02
Forest S J	100	1	1.00	1.71	0.92	(0.01, 5.10)	134	1.43
Montefiore - Moses	97	1	1.03	1.73	0.93	(0.01, 5.19)	131	1.45
Montefiore - Weiler	3	0	0.00	1.05	0.00	(0.00, 100.0)	3	0.00

Table 7 continued

	Isolated CABG					95% CI for RAMR	Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR		Cases	RAMR
Goldstein D J	200	5	2.50	1.43	2.73	(0.88, 6.38)	303	2.15
Montefiore - Moses	192	5	2.60	1.41	2.88	(0.93, 6.72)	292	2.21
Montefiore - Weiler	8	0	0.00	1.84	0.00	(0.00, 38.93)	11	0.00
Green G R	281	2	0.71	1.83	0.61	(0.07, 2.20)	454	0.75 **
St. Josephs Hospital	68	1	1.47	1.57	1.46	(0.02, 8.13)	142	0.62
Univ. Hosp-Upstate	213	1	0.47	1.91	0.38	(0.01, 2.14)	312	0.81
Gulkarov I M	167	3	1.80	1.58	1.77	(0.36, 5.18)	223	2.33
NYP Brooklyn Methodist	28	1	3.57	1.44	3.88	(0.05, 21.61)	62	4.02
NYP NY Weill Cornell	.	.	.	.	.	(. . , . .)	1	0.00
Staten Island Univ Hosp	139	2	1.44	1.61	1.39	(0.16, 5.03)	160	1.44
Henry M J	63	1	1.59	2.32	1.07	(0.01, 5.94)	81	2.18
Good Sam Univ Hosp	1	0	0.00	4.50	0.00	(0.00, 100.0)	1	0.00
St. Francis Hospital	62	1	1.61	2.29	1.10	(0.01, 6.12)	80	2.24
Hisamoto K	76	1	1.32	0.81	2.54	(0.03, 14.13)	148	1.66
Bellevue Hospital Ctr	68	0	0.00	0.82	0.00	(0.00, 10.25)	131	0.00
NYU Hospitals Center	8	1	12.50	0.70	27.72	(0.36, 100.0)	17	11.59
Iannacone E M	38	0	0.00	1.78	0.00	(0.00, 8.47)	65	2.85
NYP NY Weill Cornell	37	0	0.00	1.80	0.00	(0.00, 8.60)	64	2.87
NYP Queens	1	0	0.00	1.04	0.00	(0.00, 100.0)	1	0.00
Jakobleff W A	204	4	1.96	1.46	2.10	(0.56, 5.37)	271	1.62
Montefiore - Moses	197	4	2.03	1.49	2.13	(0.57, 5.45)	262	1.65
Montefiore - Weiler	7	0	0.00	0.63	0.00	(0.00, 100.0)	9	0.00
Joyce F	155	6	3.87	1.54	3.93	(1.44, 8.56)	210	5.29 *
Mercy Hospital-Buffalo	7	1	14.29	4.07	5.48	(0.07, 30.49)	8	12.72
St. Elizabeth Med Ctr	139	4	2.88	1.46	3.09	(0.83, 7.91)	192	3.63
Univ Hosp at Downstate	9	1	11.11	0.84	20.74	(0.27, 100.0)	10	26.10 *
Kalimi R	212	1	0.47	1.52	0.48	(0.01, 2.70)	453	0.24 **
North Shore Univ Hosp	8	0	0.00	0.71	0.00	(0.00, 100.0)	9	0.00
South Shore Univ. Hosp	204	1	0.49	1.55	0.49	(0.01, 2.74)	444	0.24 **
Karavas A N	235	3	1.28	1.32	1.52	(0.30, 4.43)	321	1.67
Mercy Hospital-Buffalo	70	0	0.00	1.43	0.00	(0.00, 5.71)	74	0.00
St. Peter's Hospital	165	3	1.82	1.26	2.25	(0.45, 6.56)	247	2.09
Lang S	296	2	0.68	1.21	0.87	(0.10, 3.15)	357	1.55
NYP NY Weill Cornell	3	0	0.00	8.54	0.00	(0.00, 22.37)	8	0.00
NYP Queens	293	2	0.68	1.14	0.94	(0.11, 3.39)	349	1.68
Loulmet D F	36	0	0.00	0.79	0.00	(0.00, 20.15)	532	4.94 *
Bellevue Hospital Ctr	.	.	.	.	.	(. . , . .)	1	37.85
NYU Hospitals Center	36	0	0.00	0.79	0.00	(0.00, 20.15)	531	4.63 *
Manetta F	195	0	0.00	1.60	0.00	(0.00, 1.83)	255	0.43
North Shore Univ Hosp	108	0	0.00	1.76	0.00	(0.00, 3.01)	142	0.00
South Shore Univ. Hosp	87	0	0.00	1.41	0.00	(0.00, 4.68)	113	1.09

Table 7 continued

	Isolated CABG					95% CI for RAMR	Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR		Cases	RAMR
Meyer D B	.	.	.	.	.	( . , . )	2	0.00
Long Island Jewish MC	.	.	.	.	.	( . , . )	1	0.00
North Shore Univ Hosp	.	.	.	.	.	( . , . )	1	0.00
Michler R E	107	2	1.87	0.99	2.94	(0.33, 10.60)	267	2.01
Montefiore - Moses	107	2	1.87	0.99	2.94	(0.33, 10.60)	265	2.07
Montefiore - Weiler	.	.	.	.	.	( . , . )	2	0.00
Neragi-Miandoab S	70	4	5.71	2.08	4.30	(1.16, 11.00)	81	4.64
Bassett Medical Center	3	0	0.00	1.14	0.00	(0.00, 100.0)	3	0.00
Univ Hosp at Downstate	25	2	8.00	2.92	4.28	(0.48, 15.46)	29	5.00
Vassar Bros. Med Ctr	42	2	4.76	1.65	4.52	(0.51, 16.32)	49	4.50
Puskas J D	671	9	1.34	1.07	1.95	(0.89, 3.71)	818	2.77
Mount Sinai Beth Israel	9	0	0.00	2.38	0.00	(0.00, 26.79)	12	0.00
Mount Sinai Morningside	662	9	1.36	1.05	2.01	(0.92, 3.82)	806	2.84
Sarabu M	51	3	5.88	1.99	4.62	(0.93, 13.51)	108	2.66
Ellis Hospital	4	0	0.00	1.24	0.00	(0.00, 100.0)	4	0.00
St. Peter's Hospital	13	0	0.00	1.43	0.00	(0.00, 30.85)	13	0.00
Vassar Bros. Med Ctr	34	3	8.82	2.29	6.02	(1.21, 17.59)	91	2.89
Shahani R B	120	0	0.00	1.31	0.00	(0.00, 3.65)	186	0.00
UHS Wilson Med Ctr	10	0	0.00	0.92	0.00	(0.00, 62.35)	14	0.00
Vassar Bros. Med Ctr	110	0	0.00	1.34	0.00	(0.00, 3.88)	172	0.00
Singh C	171	9	5.26	2.02	4.07 *	(1.86, 7.73)	247	4.05 *
Albany Med. Ctr	141	6	4.26	2.20	3.02	(1.10, 6.57)	201	3.62
Ellis Hospital	30	3	10.00	1.16	13.48 *	(2.71, 39.37)	46	5.93
Smith D E	178	1	0.56	1.20	0.73	(0.01, 4.05)	265	1.20
Bellevue Hospital Ctr	117	1	0.85	1.06	1.26	(0.02, 7.02)	175	0.64
NYU Hospitals Center	61	0	0.00	1.49	0.00	(0.00, 6.32)	90	2.14
Stein L H	33	2	6.06	1.40	6.76	(0.76, 24.42)	44	6.04
Albany Med. Ctr	23	2	8.70	1.60	8.49	(0.95, 30.66)	32	7.43
Univ Hosp at Downstate	10	0	0.00	0.94	0.00	(0.00, 60.89)	12	0.00
Swistel D	147	3	2.04	1.07	2.99	(0.60, 8.74)	313	3.29
Bellevue Hospital Ctr	9	0	0.00	1.36	0.00	(0.00, 46.82)	15	0.00
NYU Hospitals Center	138	3	2.17	1.05	3.24	(0.65, 9.48)	298	3.45
Taylor J	389	3	0.77	1.73	0.70	(0.14, 2.04)	637	1.45
North Shore Univ Hosp	389	3	0.77	1.73	0.70	(0.14, 2.04)	636	1.46
South Shore Univ. Hosp	.	.	.	.	.	( . , . )	1	0.00
Tranbaugh R	203	5	2.46	1.66	2.32	(0.75, 5.42)	278	3.64
NYP Brooklyn Methodist	202	5	2.48	1.51	2.56	(0.83, 5.98)	276	3.97
NYP NY Weill Cornell	1	0	0.00	31.38	0.00	(0.00, 18.26)	2	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, 2017-2019

Table 8 presents, for each hospital and for each surgeon performing at least 200 cardiac operations in any hospital in 2017-2019 and/or performing one or more cardiac operations in each of the years 2017-2019, 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 twelve Valve and Valve/CABG groups that were identified in Tables 4a and 4b. 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 and some rare multiple valve surgeries that were not accounted for by one of the 12 valve groups. 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, 2017-2019

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Albany Med. Ctr				
Akujuo A C	213	115	255	583
Bennett E	4	67	220	291
Britton L	116	119	44	279
Samy S A	172	110	113	395
Singh C	141	60	444	645
Stein L H	23	9	36	68
All Others	71	24	58	153
Total	740	504	1170	2414
Arnot Ogden Med Ctr				
All Others	146	56	16	218
Total	146	56	16	218
Bassett Medical Center				
Daniel S R	96	27	9	132
Kelley J	136	72	52	260
Neragi-Miandoab S	3	0	0	3
Total	235	99	61	395

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Bellevue Hospital Ctr				
Culliford A	119	75	28	222
Hisamoto K	68	63	35	166
Loulmet D F	0	1	0	1
Smith D E	117	58	22	197
Swistel D	9	6	3	18
All Others	74	49	37	160
Total	387	252	125	764
Buffalo General Med Ctr				
Aldridge J	153	45	568	766
Ashraf M	553	129	467	1149
Grosner G	665	541	172	1378
Total	1371	715	1207	3293
Ellis Hospital				
Choumarov K	269	105	54	428
Reich H	228	108	66	402
Sarabu M	4	0	5	9
Singh C	30	16	4	50
All Others	18	0	24	42
Total	549	229	153	931
Good Sam - Suffern				
Badami C D	159	40	8	207
All Others	119	26	6	151
Total	278	66	14	358
Good Sam Univ Hosp				
Carter T I	165	88	50	303
Dimeo A C	2	0	0	2
Henry M J	1	0	0	1
Lamendola C	98	155	134	387
Rovensky M	365	100	15	480
All Others	0	0	2	2
Total	631	343	201	1175
Lenox Hill Hospital				
Brinster D R	34	88	331	453
Hemli J M	29	5	34	68
Patel N C	742	226	37	1005
Pirelli L	43	25	310	378
Scheinerman S J	206	54	37	297
All Others	0	0	5	5
Total	1054	398	754	2206
Long Island Jewish MC				
Meyer D B	0	1	12	13
All Others	0	0	15	15
Total	0	1	27	28

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Maimonides Medical Ctr				
Abrol S	12	11	13	36
Crooke G	72	59	232	363
Jacobowitz I	330	141	117	588
Ribakove G	69	55	14	138
Saunders P	75	11	102	188
Stephens G A	85	40	16	141
Youdelman B A	51	23	86	160
Total	694	340	580	1614
Mercy Hospital-Buffalo				
Downing S W	310	161	211	682
Forman J M	157	13	4	174
Jain H B	443	77	110	630
Joyce F	7	1	2	10
Karavas A N	70	4	5	79
All Others	29	0	1	30
Total	1016	256	333	1605
Montefiore - Moses				
Chau M L	1	0	20	21
Derose J J	2	4	17	23
Forest S J	97	34	33	164
Goldstein D J	192	100	100	392
Jakobleff W A	197	65	38	300
Michler R E	107	158	16	281
Scheinin S A	60	20	75	155
All Others	0	0	23	23
Total	656	381	322	1359
Montefiore - Weiler				
Chau M L	67	27	290	384
Derose J J	365	238	127	730
Forest S J	3	0	2	5
Goldstein D J	8	3	1	12
Jakobleff W A	7	2	1	10
Michler R E	0	2	0	2
All Others	17	0	18	35
Total	467	272	439	1178
Mount Sinai Beth Israel				
DiLuozzo G	1	0	3	4
Puskas J D	9	3	0	12
All Others	0	0	1	1
Total	10	3	4	17

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Mount Sinai Hospital				
Adams D H	1	958	64	1023
Anyanwu A	55	99	233	387
Boateng P	47	83	51	181
Castillo-Granero J	19	32	107	158
El-Eshmawi A M	16	73	23	112
Filsoufi F	289	90	104	483
Nguyen K	1	1	9	11
Pawale A A	30	24	14	68
Reddy R C	283	95	89	467
Stelzer P	15	168	264	447
Stewart A S	50	134	231	415
Varghese R	161	106	33	300
All Others	4	0	651	655
Total	971	1863	1873	4707
Mount Sinai Morningside				
Balaram S K	152	114	59	325
DiLuozzo G	35	38	133	206
Puskas J D	662	144	58	864
Torregrossa G	41	20	14	75
Total	890	316	264	1470
NYP Brooklyn Methodist				
Gulkarov I M	28	34	22	84
Tranbaugh R	202	74	22	298
Worku B M	92	51	120	263
All Others	4	1	6	11
Total	326	160	170	656
NYP Columbia Presby.				
Argenziano M	286	194	47	527
Bacha E	0	6	119	125
Bapat V N	31	159	384	574
George I	141	259	1133	1533
Naka Y	219	102	198	519
Smith C	222	363	87	672
Takayama H	299	253	350	902
Takeda K	137	71	187	395
All Others	4	35	474	513
Total	1339	1442	2979	5760

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
NYP NY Weill Cornell				
Bacha E	0	1	32	33
Chai P J	0	1	12	13
Girardi L	182	504	702	1388
Gulkarov I M	0	1	0	1
Guy T S	30	197	35	262
Iannacone E M	37	27	61	125
Krieger K	37	78	38	153
Lang S	3	5	1	9
Lau C	188	108	104	400
Salemi A	36	81	609	726
Tranbaugh R	1	1	0	2
All Others	17	31	108	156
Total	531	1035	1702	3268
NYP Queens				
Avgerinos D V	107	45	21	173
Iannacone E M	1	0	0	1
Lang S	293	56	10	359
All Others	0	0	1	1
Total	401	101	32	534
NYU Hospitals Center				
Culliford A	1	6	1	8
Galloway A	30	246	81	357
Grossi E	0	2	7	9
Hisamoto K	8	9	38	55
Loulmet D F	36	495	57	588
Mosca R S	0	2	33	35
Smith D E	61	29	54	144
Swistel D	138	160	21	319
Vaynblat M	103	80	30	213
Williams M R	5	177	1253	1435
Zias E	359	126	48	533
All Others	1	5	194	200
Total	742	1337	1817	3896
NYU Winthrop Hospital				
Abrol S	268	109	76	453
Kokotos W J	137	98	84	319
Salhab K F	132	61	809	1002
Schubach S	161	63	40	264
All Others	66	14	31	111
Total	764	345	1040	2149

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
North Shore Univ Hosp				
Brinster D R	5	5	60	70
Esposito R	146	83	388	617
Fernandez H A	20	8	35	63
Graver L	193	209	37	439
Hartman A	169	256	116	541
Kalimi R	8	1	2	11
Lima B	14	2	42	58
Manetta F	108	34	73	215
Meyer D B	0	1	2	3
Palazzo R	211	51	196	458
Taylor J	389	247	93	729
Vatsia S	191	93	128	412
Yu P J	95	37	139	271
All Others	14	16	10	40
Total	1563	1043	1321	3927
Rochester General Hosp				
Cheeran D	481	271	333	1085
Kirshner R	552	398	107	1057
Prastein D J	91	22	226	339
Yankey G K N	96	29	183	308
All Others	78	37	50	165
Total	1298	757	899	2954
South Shore Univ. Hosp				
Fernandez H A	174	115	108	397
Kalimi R	204	240	265	709
Manetta F	87	26	73	186
Taylor J	0	1	0	1
All Others	75	13	41	129
Total	540	395	487	1422
St. Elizabeth Med Ctr				
Cahill A T	152	25	75	252
Fuzesi L	167	54	29	250
Joyce F	139	53	106	298
All Others	6	1	0	7
Total	464	133	210	807
St. Francis Hospital				
Bercow N	308	180	145	633
Colangelo R	481	233	25	739
Dimeo A C	488	142	81	711
Henry M J	62	18	519	599
Lundy E F	290	74	62	426
Robinson N	18	261	839	1118
All Others	0	0	1	1
Total	1647	908	1672	4227

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
St. Josephs Hospital				
Green G R	68	74	40	182
Lutz C J	343	374	164	881
Marvasti M	221	122	243	586
Nazem A	353	171	215	739
Zhou Z	446	423	191	1060
All Others	36	7	32	75
Total	1467	1171	885	3523
St. Peter's Hospital				
Edwards N	222	196	60	478
Karavas A N	165	82	31	278
Polomsky M	141	62	43	246
Saifi J	259	269	185	713
Sarabu M	13	0	3	16
Terrien C M	249	190	137	576
Total	1049	799	459	2307
Staten Island Univ Hosp				
Gulkarov I M	139	21	50	210
Imam M N	194	133	148	475
Rosell F M	261	4	25	290
All Others	7	3	10	20
Total	601	161	233	995
Strong Memorial Hosp				
Alfieris G	1	7	26	34
Barrus B B	202	23	81	306
Gosev I	186	48	179	413
Knight P	110	600	394	1104
Prasad S M	144	54	346	544
All Others	33	8	57	98
Total	676	740	1083	2499
UHS Wilson Med Ctr				
Beckles D L	50	21	49	120
Khan A M	117	44	57	218
Shahani R B	10	4	51	65
Wong K	147	49	106	302
All Others	44	22	48	114
Total	368	140	311	819
Univ Hosp at Downstate				
Beckles D L	58	21	8	87
Joyce F	9	1	1	11
Neragi-Miandoab S	25	4	1	30
Stein L H	10	2	1	13
All Others	105	31	6	142
Total	207	59	17	283

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Univ. Hosp-Stony Brook				
Bilfinger T	29	8	268	305
Chikwe J Y	248	175	46	469
McLarty A	40	17	57	114
Tannous H J	147	33	281	461
All Others	95	23	13	131
Total	559	256	665	1480
Univ. Hosp-Upstate				
Esrig B	52	21	14	87
Green G R	213	99	99	411
All Others	142	32	28	202
Total	407	152	141	700
Vassar Bros. Med Ctr				
Neragi-Miandoab S	42	7	28	77
Sarabu M	34	57	67	158
Shahani R B	110	62	155	327
Sperling J S	171	137	104	412
All Others	160	44	80	284
Total	517	307	434	1258
Westchester Med Ctr				
Goldberg J B	37	36	390	463
Kai M	102	21	61	184
Lansman S	1	0	17	18
Malekan R	188	71	121	380
Spielvogel D	346	176	256	778
All Others	7	1	38	46
Total	681	305	883	1869
STATEWIDE TOTAL	26242	17840	24983	69065

Criteria Used in Reporting Significant Risk Factors (2019)

Based on Documentation in Medical Records

Patient Risk Factor	Definitions
Demographic	
Body Surface Area	<p>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:</p> $BSA (m^2) = 0.0003207 \times H^{0.3} \times W^{(0.7285 - (0.0188 \times \text{LOG}))}$ <p>Where H is Height in centimeters and W is Weight in grams.</p>
Body Mass Index	<p>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.</p> <p>The formula for BMI is: $BMI = \text{Weight} / \text{Height}^2$ where Height is height in meters (m) and Weight is weight in kilograms (kg).</p>
Hemodynamic State	
Non-Refractory Cardiogenic Shock	<p>Determined in the immediate pre-operative period, defined as the period prior to anesthesia taking responsibility for the patient.</p> <p>Non-Refractory Cardiogenic Shock is defined as an episode of systolic blood pressure <90 mmHg and/or cardiac index < 2.2 L/min/m² 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.</p>
Refractory Cardiogenic Shock	<p>Refractory Cardiogenic Shock is defined as an episode of systolic blood pressure <80 mm Hg and/or cardiac index < 2.0 L/min/m² 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).</p> <p>Records with this risk factor were excluded from all analyses in this report.</p>
Comorbidities	
Cerebrovascular Disease	<p>The patient has cerebrovascular disease, documented by any one of the following:</p> <ul style="list-style-type: none"> • Stroke - 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. • Non-invasive or invasive arterial imaging test demonstrating $\geq 80\%$ stenosis of any of the major extracranial or intracranial vessels to the brain. • Previous cervical or cerebral artery surgery or percutaneous intervention.

Patient Risk Factor	Definitions
Comorbidities, continued	
Chronic Lung Disease	<p>The patient has chronic lung disease with pre-operative findings of one of the following:</p> <ul style="list-style-type: none"> • Mild - FEV₁ 60% to 75% of predicted, and/or on chronic inhaled or oral bronchodilator therapy. • Moderate - FEV₁ 50% to 59% of predicted, and/or on chronic steroid therapy aimed at lung disease. • Severe - FEV₁ <50% predicted, and/or Room Air pO₂ < 60 or Room Air pCO₂ > 50.
Heart Failure, Current	<p>Within 2 weeks prior to the procedure, the patient has a clinical diagnosis of Heart Failure and symptoms requiring treatment for Heart Failure. Note: Physician diagnosis of Heart Failure may be based on one of the following:</p> <ul style="list-style-type: none"> • Paroxysmal nocturnal dyspnea (PND) • Dyspnea on exertion (DOE) due to heart failure • Chest X-Ray showing pulmonary congestion
Diabetes with Insulin Treatment	<p>Documentation must include the presence of a diagnosis of Heart Failure, evidence of symptoms, and treatment for Heart Failure.</p> <p>The patient has a history of diabetes diagnosed and/or treated by a physician.</p> <p>Diabetes control method as presented on admission was Insulin.</p>
Extensive Aortic Atherosclerosis	<p>Ascending, transverse, and/or descending aortic atherosclerosis marked by either extensive calcification or luminal atheroma such that the intended surgical procedure is altered.</p>
Hepatic Failure	<p>The patient has cirrhosis or other liver disease and has a bilirubin > 2 mg/dL and a serum albumin < 3.5 g/dL.</p>
Malignant Ventricular Arrhythmia	<p>Recent (within the past 14 days) sustained ventricular tachycardia requiring electrical defibrillation or conversion with intravenous anti-arrhythmic agents or ventricular fibrillation requiring electrical defibrillation. Excludes V-Tach or V-Fib occurring within 6 hours of the diagnosis of a myocardial infarction and responding well to treatment.</p>
Peripheral Vascular Disease	<p>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</p> <p>Ankle-Brachial Index < 0.9 is also acceptable documentation.</p>
Renal Failure, Creatinine	<p>Last pre-operative serum creatinine was in the indicated range.</p>
Renal Failure Requiring Dialysis	<p>The patient is currently (prior to surgery) undergoing dialysis.</p>

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. Intraoperative 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.
Previous Procedures	
Previous CABG Surgery	Prior to this cardiac surgery, the patient has undergone CABG surgery.
Previous Cardiac Surgery or Valvular Intervention	Prior to this cardiac surgery, the patient has undergone CABG, valve surgery or intervention, or other cardiac surgery.
Previous PCI, This Episode of Care	Prior to this cardiac surgery, but during the same episode of care, the patient has undergone Percutaneous Coronary Intervention (PCI).
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.
Vessels Diseased	
One Vessel Diseased	The patient has at least a 70 percent blockage in one of the three native coronary arteries including the Left Anterior Descending (LAD), the Right Coronary Artery (RCA), and the Left Circumflex (LCX) or their major branches.
Two or More Vessels Diseased	The patient has at least a 70 percent blockage in two or three 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 rotoblators 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 2019

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 2019 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 Extensive Aortic Atherosclerosis is 2.590. This means that a patient who has Extensive Aortic Atherosclerosis prior to surgery is approximately 2.590 times as likely to die in the hospital or after discharge within 30 days of surgery as a patient who does not have Extensive Aortic Atherosclerosis but who has the same other significant risk factors.

Female Sex at Birth, MI within 20 days, Non-refractory Shock, Chronic Lung Disease (moderate or severe), Previous PCI this episode of care, 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 65 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 66 years old is approximately 1.074 times that of a patient 65 years old undergoing CABG, if all other risk factors are the same. All patients age 65 and younger have roughly the same odds of in-hospital / 30-day mortality if their other risk factors are identical.

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 five ranges (less than 20 percent, 20 percent to 29 percent, 30 percent to 39 percent, 40 percent to 49 percent, and 50 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 50 percent or more. Thus, a patient with an ejection fraction of less than 20 percent is about 6.084 times as likely to die in the hospital or within 30 days of surgery as a patient with an ejection fraction of 50 percent or higher, all other significant risk factors being the same.

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 2019

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-value	Odds Ratio
Demographic				
Age: Number of years greater than 65	—	0.0714	<.0001	1.074
Female Sex at Birth	23.13	0.6804	.0001	1.975
Ventricular Function				
Ejection Fraction				
Ejection Fraction 50% or greater	69.65	— Reference —		1.000
Ejection Fraction less than 20%	1.26	1.8056	<.0001	6.084
Ejection Fraction 20-29%	5.47	1.2405	<.0001	3.457
Ejection Fraction 30-39%	8.94	0.7450	.0037	2.106
Ejection Fraction 40-49%	14.68	0.6070	.0099	1.835
Pre-Procedural MI				
MI within 20 days	31.14	0.3691	.0422	1.446
Hemodynamic State				
Non-refractory Shock	0.37	1.1683	.0357	3.216
Comorbidities				
Chronic Lung Disease, Moderate or Severe	5.00	0.5543	.0465	1.741
Extensive Aortic Atherosclerosis	2.15	0.9517	.0038	2.590
Renal Failure				
No Renal Failure	89.15	— Reference —		1.000
Creatinine >1.5 mg/dl	7.38	1.1368	<.0001	3.117
Renal Dialysis	3.47	1.5657	<.0001	4.786
Previous Cardiac Procedures				
Previous PCI, This Episode of Care	2.24	0.9531	.0120	2.594
Previous CABG	1.24	1.0666	.0283	2.906

Intercept = -5.6945

C-Statistic = 0.778

Appendix 2

Risk Factors for CABG 30-Day Readmissions in New York State in 2019

The significant pre-procedural risk factors for 30-day readmissions following CABG in 2019 are presented in the table that follows. Female Sex at Birth, Ejection Fraction less than 40%, Previous MI, Heart Failure within 2 weeks, Chronic Lung Disease (severe), and Diabetes with Insulin Treatment are interpreted in the same way as Extensive Aortic Atherosclerosis in Appendix 1. The patient either has the risk factor or does not.

In this model, age is represented by both a linear and a quadratic (squared) term. This represents the fact that as patients age, their risk of in-hospital / 30-day mortality increases at an increasing rate. 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. Therefore these odds ratios are not contained in the table.

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 interpretation of Renal Failure is similar to that in Appendix 1 except in this model patients with serum creatinine less than or equal to 2.0 mg/dl who are not on dialysis comprise the reference category.

Appendix Table 2

Multivariable Risk Factor Equation for CABG In-Hospital / 30-Day Readmission in New York State in 2019.

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-value	Odds Ratio
Demographic				
Age in Years	—	-0.0548	.0901	—
Age in Years, squared	—	0.0006	.0239	—
Female Sex at Birth	23.01	0.4437	<.0001	1.558
Body Surface Area	—	-0.3820	.0024	—
Body Surface Area, squared	—	0.0097	.0011	—
Ventricular Function				
Ejection Fraction, less than 40%	15.44	0.2680	.0048	1.307
Pre-Procedural MI (any)	49.24	0.1744	.0153	1.191
Comorbidities				
Heart Failure, within 2 weeks	14.36	0.2552	.0085	1.291
Chronic Lung Disease, Severe	2.60	0.5579	.0013	1.747
Diabetes with Insulin Treatment	19.42	0.4784	<.0001	1.613
Renal Failure				
No Renal Failure	94.24	— Reference —		1.000
Creatinine >2.0 mg/dl	2.36	0.7698	<.0001	2.159
Renal Dialysis	3.40	0.7838	<.0001	2.190

Intercept = 2.2732

C-Statistic = 0.652

Appendix 3

Risk Factors For Valve Surgery In-Hospital / 30-Day Mortality in 2017-2019

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve surgery in the 2017-2019 time period are presented in the table that follows.

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 1.48 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 repair or replacement surgery, all other significant risk factors being the same.

Previous MI is subdivided into three ranges: MI less than 24 hours before the surgery, MI 1 to 20 days before the surgery and no MI within 20 days before surgery. The last range is referred to as the reference category. The odds ratio for the Previous MI ranges are relative to patients who have not had an MI within twenty days prior to PCI.

The interpretation of renal failure in this model is similar to that provided in Appendix 1 except in this case there are two categories for patients with elevated serum creatinine who are not on dialysis.

Hepatic Failure and Previous Valve Surgery or Intervention are interpreted in the same manner as Extensive Aortic Atherosclerosis in Appendix 1. All other variables can be interpreted in the same way as previously described.

Appendix Table 3

Multivariable Risk Factor Equation for Valve Surgery In-Hospital / 30-Day Deaths in NYS, 2017-2019.

Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Type of Valve Surgery				
Aortic Valve Repair or Replacement	41.15	— Reference —		1.000
Mitral Valve Replacement	13.86	0.3917	.0416	1.480
Mitral Valve Repair	21.78	-0.4934	.0556	0.611
Multiple Valve Surgery				
with Mitral Valve Replacement (MVR)	10.98	0.9486	<.0001	2.582
with Aortic Valve Replacement but no MVR	4.30	0.4931	.0843	1.637
Mitral and Tricuspid Valve Repairs	7.93	-0.8944	.0375	0.409
Demographic				
Age: Number of years greater than 65	—	0.0580	<.0001	1.060
Body Surface Area	—	-0.5940	.0003	—
Body Surface Area, squared	—	0.0140	.0003	—
Ventricular Function				
Pre-Procedural MI				
No MI within 20 days	98.62	— Reference —		1.000
MI within 24 hours	0.05	2.0227	.0306	7.559
MI 1-20 days before surgery	1.33	0.8941	.0077	2.445
Hemodynamic Status				
Non-refractory Shock	0.68	1.4645	<.0001	4.326
Comorbidities				
Chronic Lung Disease, Severe	2.66	1.1799	<.0001	3.254
Hepatic Failure	0.10	2.8503	<.0001	17.292
Renal Failure				
No Renal Failure	91.76	— Reference —		1.000
Creatinine 1.6-2.0 mg/dl	4.01	0.8116	.0004	2.251
Creatinine >2.0 mg/dl	1.77	1.4448	<.0001	4.241
Renal Dialysis	2.46	1.8162	<.0001	6.148
Previous Cardiac Procedures				
Previous CABG	3.22	0.6402	.0061	1.897
Previous Valve Surgery or Intervention	13.36	0.3343	.0401	1.397

Intercept = 1.2655

C Statistic = 0.797

Appendix 4

Risk Factors for Valve and CABG Surgery In-Hospital / 30-Day Mortality in New York State in 2017-2019

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve and CABG surgery in the 2017-2019 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 1.726 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.

Appendix Table 4

Multivariable Risk Factor Equation for Valve and CABG Surgery In-Hospital / 30-Day Deaths in NYS, 2017-2019.

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Type of Valve Surgery w/ CABG				
Aortic Valve Repair or Replacement	59.54	— Reference —		1.000
Mitral Valve Replacement	12.03	0.5459	.0091	1.726
Mitral Valve Repair	16.91	-0.0352	.8809	0.965
Multiple Valve Surgery				
with Mitral Valve Replacement (MVR)	5.25	1.4157	<.0001	4.119
with Aortic Valve Replacement but no MVR	3.43	0.5063	.1570	1.659
Mitral and Tricuspid Valve Repairs	2.84	0.8416	.0194	2.320
Demographic				
Age: Number of years greater than 70	—	0.0446	.0022	1.046
Female Sex at Birth	27.92	0.5865	.0001	1.798
Ventricular Function				
Ejection Fraction less than 20%	1.57	1.1424	.0037	3.134
Pre-Procedural MI				
No MI within 14 days	84.31	— Reference —		1.000
MI within 24 hours	0.53	1.5694	.0134	4.804
MI 1-14 days before surgery	15.16	0.8343	<.0001	2.303
Comorbidities				
Cerebrovascular Disease	12.85	0.6183	.0005	1.856
Chronic Lung Disease, Moderate or Severe	7.13	0.6370	.0033	1.891
Malignant Ventricular Arrhythmia	0.51	1.3029	.0284	3.680
Renal Failure				
No Renal Failure	92.77	— Reference —		1.000
Creatinine >2.0 mg/dl	2.98	0.7150	.0287	2.044
Renal Dialysis	4.25	1.3663	<.0001	3.921
Previous Cardiac Procedures				
Previous Cardiac Surgery or Valvular Intervention	5.82	0.8631	.0002	2.370

Intercept = -4.4891

C-Statistic = 0.765

Appendix 5

Risk Factors for TAVR In-Hospital / 30-Day Deaths in New York State in 2017-2019

The significant pre-procedural risk factors for in-hospital/30-day mortality following TAVR in the 2017-2019 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. Coronary Artery Disease is comprised of three categories in this model (no vessels diseased, one vessel diseased and two or more vessels diseased). Number of vessels diseased refers to at least a 70 percent blockage in the native coronary arteries including the Left Anterior Descending (LAD), the Right Coronary Artery (RCA) and the Left Circumflex (LCX) or their major branches, respectively. The reference category for this group includes patients who have no vessels diseased.

Appendix Table 5

Multivariable Risk Factor Equation for TAVR In-Hospital / 30-Day Deaths in New York State in 2017-2019.

Patient Risk Factors	Prevalence (%)	Logistic Regression		
		Coefficient	P value	Odds Ratio
Demographic				
Age: Number of years greater than 70	—	0.0349	<.0001	1.035
Female Sex at Birth	47.87	0.4438	.0008	1.559
Body Surface Area	—	-0.4864	.0029	—
Body Surface Area, squared	—	0.0110	.0073	—
Ventricular Function				
Ejection Fraction less than 30%	4.77	0.5765	.0035	1.780
Hemodynamic State				
Non-refractory Shock	0.12	2.5004	<.0001	12.188
Comorbidities				
Cerebrovascular Disease	14.81	0.4297	.0016	1.537
Chronic Lung Disease, Moderate or Severe	11.04	0.5486	.0003	1.731
Extensive Aortic Atherosclerosis	2.12	0.6858	.0089	1.985
Renal Failure				
No Renal Failure	69.25	— Reference —	—	1.000
Creatinine 1.3 - 1.5 mg/dl	14.38	0.6106	.0001	1.842
Creatinine 1.6 - 2.0 mg/dl	8.32	0.8286	<.0001	2.290
Creatinine >2.0 mg/dl	3.83	1.3777	<.0001	3.966
Renal Dialysis	4.22	1.3866	<.0001	4.001
Vessels Diseased				
No Coronary Artery Disease	74.15	— Reference —	—	1.000
One Vessel Diseased	17.17	0.4328	.0017	1.542
Two or More Vessels Diseased	8.68	0.4482	.0098	1.565

Intercept = -0.0066

C-Statistic = 0.710

Appendix 6

Risk Factors for Isolated CABG In-Hospital / 30-Day Mortality in New York State 2017-2019

The significant pre-procedural risk factors for in-hospital/30-day mortality following isolated CABG in the 2017-2019 time period are presented in the table that follows. 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. The other risk factors in this model are interpreted as described in Appendices 1 – 5.

Appendix Table 6

Multivariable Risk Factor Equation for CABG In-Hospital / 30-Day Deaths in New York State in 2017-2019.

Patient Risk Factors	Prevalence (%)	Logistic Regression		
		Coefficient	P- value	Odds Ratio
Demographic				
Age: Number of years greater than 65	—	0.0764	<.0001	1.079
Body Mass Index (kg/m ²)	—	-0.0731	0.1350	—
Body Mass Index Squared (kg ² /m ⁴)	—	0.0016	0.0323	—
Female Sex at Birth	23.65	0.4535	<.0001	1.574
Ventricular Function				
Ejection Fraction				
Ejection Fraction 40% or greater	83.96	— Reference —		1.000
Ejection Fraction less than 20%	1.16	1.6540	<.0001	5.228
Ejection Fraction 20-29%	5.27	1.0812	<.0001	2.948
Ejection Fraction 30-39%	9.61	0.6255	<.0001	1.869
Pre-Procedural MI				
No MI within 20 days	68.82	— Reference —		1.000
MI within 24 hours	1.82	1.3235	<.0001	3.756
MI 1 - 20 days before surgery	29.37	0.4114	0.0001	1.509
Hemodynamic State				
Non-refractory Shock	0.48	1.1318	0.0002	3.101
Comorbidities				
Chronic Lung Disease				
None	88.62	— Reference —		1.000
Mild or Moderate	8.71	0.4095	0.0059	1.506
Severe	2.67	0.5950	0.0045	1.813
Extensive Aortic Atherosclerosis	2.27	0.6310	0.0027	1.879
Malignant Ventricular Arrhythmia	0.57	0.9215	0.0109	2.513
Peripheral Vascular Disease	11.82	0.4726	0.0001	1.604
Renal Failure				
No Renal Failure	78.24	— Reference —		1.000
Creatinine 1.3-1.5 mg/dL	10.91	0.3725	0.0140	1.451
Creatinine >1.5 mg/dL	7.21	0.9631	<.0001	2.620
Renal Dialysis	3.63	1.4188	<.0001	4.132
Previous Cardiac Procedures				
Previous CABG Surgery	1.22	1.2306	<.0001	3.423

Intercept = -4.9421

C Statistic = 0.783

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 of Suffern
255 Lafayette Avenue
Suffern, New York 10901

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

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
One Gustave L. Levy Place
New York, New York 10029

Mount Sinai Morningside
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
630 West 168th Street
New York, New York 10032

NY Presbyterian Hospital @ New York Weill –
Cornell College
525 East 68th Street
New York, New York 10021

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

NYU Winthrop 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

South Shore University 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

University Hospital at Downstate*
450 Clarkson Avenue
Brooklyn, New York 11203

Upstate University Hospital – State University
of New York
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

White Plains Hospital**
41 East Pond Road
White Plains, New York 10601

* No longer performs cardiac surgery.

** Hospital began performing cardiac surgery after November 30, 2019.

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

