ADULT CARDIAC SURGERY

in New York State

2014-2016

Department of Health

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TABLE OF CONTENTS

INTRODUCTION

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

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

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

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

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

As they develop treatment plans, we encourage doctors to discuss this information with their patients and colleagues. While these statistics are an important tool in making informed health care choices, individual treatment plans must be made by doctors and patients together after careful consideration of all pertinent factors. It is important to recognize that many factors can influence the outcome of cardiac surgery. These include the patient's health before the procedure, the skill of the operating team and general after-care. In addition, keep in mind that the information in this booklet does not include data after 2016. 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, 2013, and November 30, 2016, provided by all non-federal hospitals in NYS where cardiac surgery is performed. The analysis period for this report includes patients discharged in December 2013 but not those discharged in December 2016. 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 2016 cases includes patients discharged from December 1, 2015 through November 30, 2016. In total there were 63,516 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 166 patients residing outside the United States were excluded because these patients could not be followed after hospital discharge. There were 5 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. 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, 601 cases with cardiogenic shock were removed from the data. This accounts for 0.95 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 62,744 cardiac surgeries analyzed in this report. Isolated CABG surgery represented 39.83 percent of all adult cardiac surgery included in this report. Valve or combined valve/CABG surgery represented 34.32 percent of all adult cardiac surgery for the same period. TAVR represented 12.23 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 2014 through 2016.

While there were 8,693 CABG cases included in the mortality analysis for 2016 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 333 cases. Another 105 patients were excluded because they died in the same admission as their index CABG, so readmission was impossible. Forty-one cases were transfered to another acute care facility after CABG and so were excluded from readmission analysis. Finally, 11 cases with a discharge status of 'left against medical advice' were excluded from the readmission analysis.

In total, the number of excluded cases was 490 (some patients had more than one reason for exclusion), leaving 8,203 cases to be examined for 30-day readmission rates.

Note on Hospitals Not Performing Cardiac Surgery During Entire 2014 – 2016 Period

Good Samaritan in West Islip began performing cardiac surgery in January 2014.

RISK ADJUSTMENT FOR ASSESSING PROVIDER PERFORMANCE

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

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

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

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

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

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

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

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

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

Thirty-day readmission is defined as admission to a NYS non-Federal hospital within 30 days of discharge from the index hospitalization.

Assessing Patient Risk

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

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

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

Predicting Patient Mortality Rates for Providers

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

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

Computing the Risk-Adjusted Mortality Rate

The risk-adjusted mortality rate (RAMR) represents the best estimate, based on the associated statistical model, of what the provider's mortality rate would have been if the provider had a mix of patients identical to the statewide mix. Thus, the RAMR has, to the extent possible, ironed out differences among providers in patient severity of illness, since it arrives at a mortality rate for each provider for an identical group of patients. To calculate the RAMR, the OMR is first divided by the provider's EMR. If the resulting ratio is larger than one, the provider has a higher mortality rate than expected on the basis of its patient mix; if it is smaller than one, the provider has a lower mortality rate than expected from its patient mix. For isolated CABG patients the ratio is then multiplied by the overall statewide mortality rate of 1.67 percent (in-hospital/30-day mortality in 2016) to obtain the provider's RAMR. For the three-year period 2014-2016, the ratio is multiplied by 1.49 percent (in-hospital/30-day mortality rate) for isolated CABG patients or 3.12 percent (in-hospital/30-day mortality rate) for valve or valve/CABG patients.

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

Interpreting the Risk-Adjusted Mortality Rate

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

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

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

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

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

Patient risk of 30-day readmission is assessed using the same methods used for assessing mortality risk as described above. All potential risk factors are considered and those that are independently related to readmission are identified and given weights so as to best predict the risk of 30-day readmission for each patient. Observed readmission rates (ORR), expected readmission rates (ERR) and risk-adjusted readmission rates (RARR) are calculated in the same way that OMR, EMR and RAMR are calculated. ERR and RARR are compared to the statewide observed readmission rate (12.82 percent in 2016).

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

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

How This Initiative Contributes to Quality Improvement

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

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

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

DEFINITIONS OF KEY TERMS

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

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

The **risk-adjusted mortality rate (RAMR)** is the best estimate, based on the statistical model, of what the provider's mortality rate would have been if the provider had a mix of patients identical to the statewide mix. It is obtained by first dividing the OMR by the EMR, and then multiplying by the relevant statewide mortality rate (for example, 1.67 percent for Isolated CABG patients in 2016 or 3.12 percent for Valve or Valve/CABG patients in 2014-2016).

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 (12.82 percent 30-day readmission rate for all CABG patients discharged in 2016).

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

2016 HOSPITAL OUTCOMES FOR CABG SURGERY

Table 1 and Figure 1 present the CABG surgery results for the 37 hospitals performing this operation in NYS in 2016. 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 2016, 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 8,693 CABG surgeries was 1.67 percent. In-hospital/30-day OMRs ranged from 0.00 percent to 3.57 percent. The range of EMRs, which measure patient severity of illness, was 1.10 percent to 2.61 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 4.57 percent. No hospitals had RAMRs that were significantly higher than the statewide rate. One hospital (Lenox Hill Hospital in Manhattan) had a RAMR that was significantly lower than the statewide rate.

The 2016 in-hospital/30-day mortality rate of 1.67 percent for Isolated CABG is higher than the 1.56 percent observed in 2015.

The in-hospital OMR for 2016 Isolated CABG discharges (not shown in Table 1) was 1.23 percent for all 8,693 patients included in the analysis.

Figure 1 provides a visual representation of the data displayed in Table 1. For each hospital, the black dot represents the RAMR and the gray bar represents the confidence interval, or potential statistical error, for the RAMR. The black vertical line is the NYS in-hospital/30-day mortality rate. A gray bar that extends far above and/or below the statewide average indicates that a hospital has a wide confidence interval. This is common when the hospital has a very small number of cases. It does not necessarily mean that the risk-adjusted mortality rate is very high or very low. For any hospital where the gray bar crosses the state average line, the RAMR is not statistically different from the state as a whole. Hospitals that are statistical outliers will have gray bars (confidence intervals) that are either entirely above or entirely below the line for the statewide rate.

Table 2 presents the 30-day readmission results for the 37 Non-Federal hospitals performing CABG in NYS in 2016. The table contains, for each hospital, the number of CABGs resulting in 2016 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 8,203 CABGs included in this 2016 analysis was 12.82 percent. Observed readmission rates ranged from 5.45 percent to 28.57 percent. The range in ERRs, which measure patient severity of illness, was between 10.99 percent and 14.27 percent. The RARRs, which measure hospital performance, range from 5.48 percent to 25.85 percent.

Based on confidence intervals for RARRs, three hospitals (Bellevue Hospital in Manhattan, University Hospital in Brooklyn, and Westchester Medical Center) had RARRs that were significantly higher than the statewide average. Three hospitals (NYU Hospitals Center in Manhattan, St. Joseph's Hospital in Syracuse, and Vassar Brothers Medical Center in Poughkeepsie) 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, 2016 Discharges

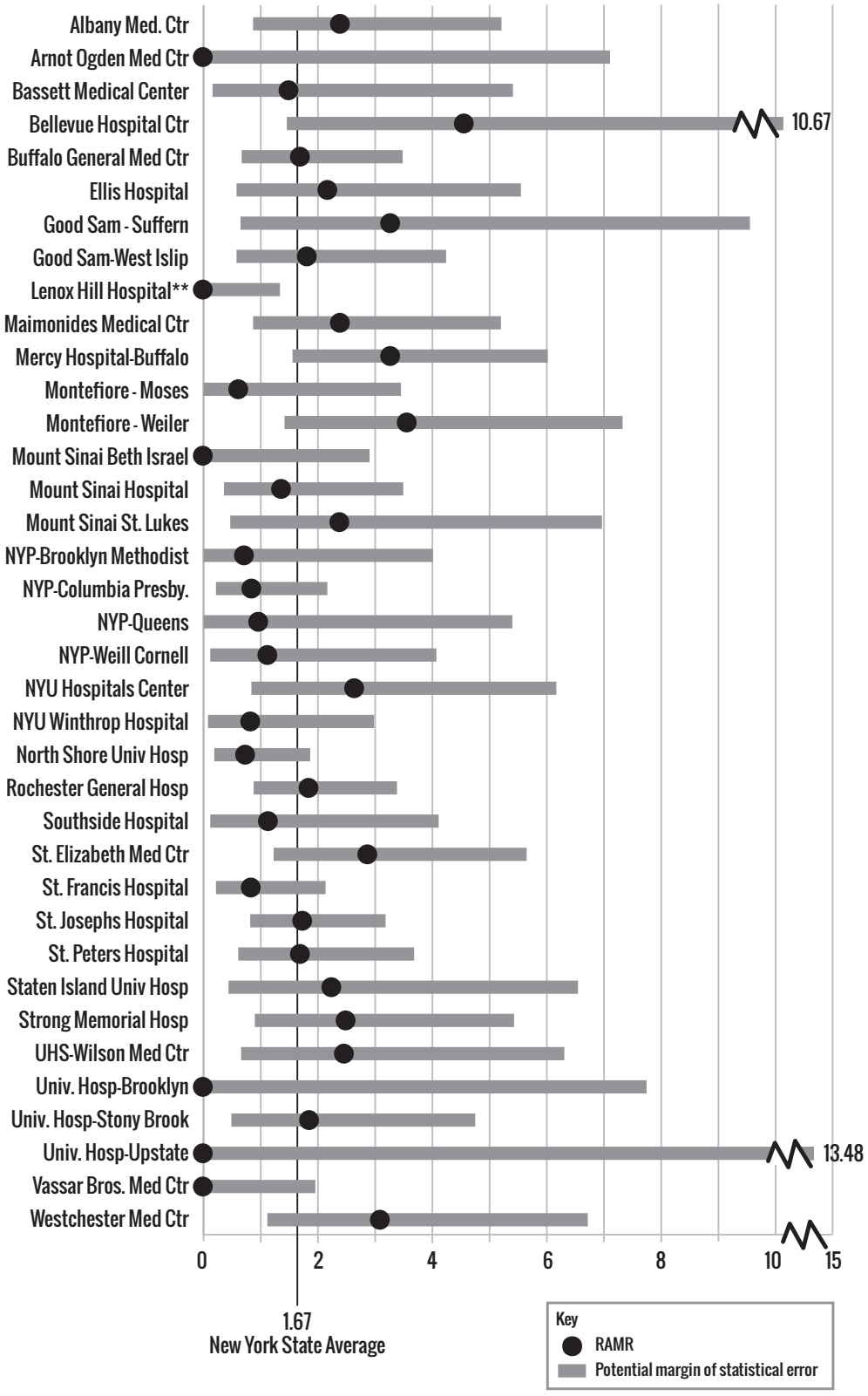
(Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	224	6	2.68	1.86	2.40	(0.88, 5.23)
Arnot Ogden Med Ctr	53	0	0.00	1.62	0.00	(0.00, 7.13)
Bassett Medical Center	85	2	2.35	2.61	1.50	(0.17, 5.43)
Bellevue Hospital Ctr	144	5	3.47	1.27	4.57	(1.47,10.67)
Buffalo General Med Ctr	414	7	1.69	1.66	1.70	(0.68, 3.50)
Ellis Hospital	200	4	2.00	1.53	2.18	(0.59, 5.57)
Good Sam - Suffern	100	3	3.00	1.53	3.28	(0.66, 9.58)
Good Sam-West Islip	211	5	2.37	2.17	1.82	(0.59, 4.26)
Lenox Hill Hospital	306	0	0.00	1.48	0.00 **	(0.00, 1.35)
Maimonides Medical Ctr	222	6	2.70	1.88	2.40	(0.88, 5.22)
Mercy Hospital-Buffalo	346	10	2.89	1.47	3.28	(1.57, 6.04)
Montefiore - Moses	182	1	0.55	1.47	0.62	(0.01, 3.47)
Montefiore - Weiler	201	7	3.48	1.63	3.57	(1.43, 7.35)
Mount Sinai Beth Israel	183	0	0.00	1.14	0.00	(0.00, 2.92)
Mount Sinai Hospital	347	4	1.15	1.40	1.37	(0.37, 3.51)
Mount Sinai St. Lukes	130	3	2.31	1.61	2.39	(0.48, 6.99)
NYP-Brooklyn Methodist	138	1	0.72	1.67	0.72	(0.01, 4.03)
NYP-Columbia Presby.	467	4	0.86	1.68	0.85	(0.23, 2.18)
NYP-Queens	156	1	0.64	1.10	0.97	(0.01, 5.42)
NYP-Weill Cornell	182	2	1.10	1.62	1.13	(0.13, 4.09)
NYU Hospitals Center	246	5	2.03	1.28	2.65	(0.85, 6.19)
NYU Winthrop Hospital	216	2	0.93	1.86	0.83	(0.09, 3.00)
North Shore Univ Hosp	575	4	0.70	1.58	0.74	(0.20, 1.88)
Rochester General Hosp	452	10	2.21	1.99	1.85	(0.89, 3.40)
Southside Hospital	202	2	0.99	1.44	1.14	(0.13, 4.13)
St. Elizabeth Med Ctr	229	8	3.49	2.02	2.88	(1.24, 5.67)
St. Francis Hospital	530	4	0.75	1.50	0.84	(0.23, 2.15)
St. Josephs Hospital	446	10	2.24	2.15	1.74	(0.83, 3.20)
St. Peters Hospital	369	6	1.63	1.60	1.70	(0.62, 3.70)
Staten Island Univ Hosp	163	3	1.84	1.37	2.25	(0.45, 6.57)
Strong Memorial Hosp	225	6	2.67	1.78	2.50	(0.91, 5.45)
UHS-Wilson Med Ctr	112	4	3.57	2.41	2.47	(0.67, 6.33)
Univ. Hosp-Brooklyn	57	0	0.00	1.38	0.00	(0.00, 7.77)
Univ. Hosp-Stony Brook	180	4	2.22	1.99	1.86	(0.50, 4.77)
Univ. Hosp-Upstate	36	0	0.00	1.26	0.00	(0.00,13.48)
Vassar Bros. Med Ctr	167	0	0.00	1.86	0.00	(0.00, 1.97)
Westchester Med Ctr	197	6	3.05	1.64	3.10	(1.13, 6.74)
STATEWIDE TOTAL	**8693**	**145**	**1.67**			

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

Figure 1

In-Hospital/30-Day Risk-Adjusted Mortality Rates for Isolated CABG in New York State, 2016 Discharges



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

Table 2

30-Day Observed, Expected and Risk-Adjusted Readmission Rates for Isolated CABG Surgery in New York State, 2016 Discharges

(Listed Alphabetically by Hospital)

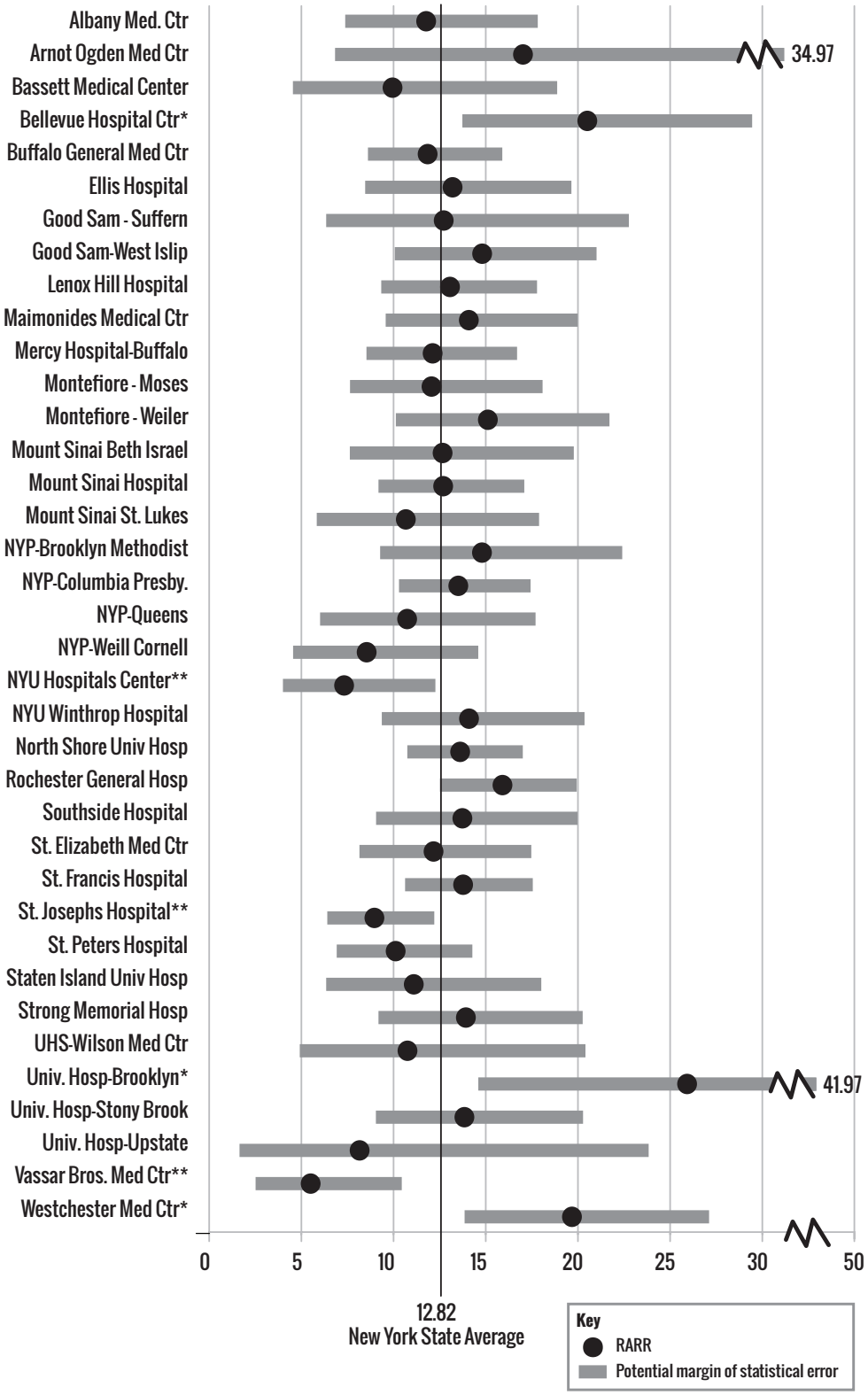
Hospital	Cases	Readmits	ORR	ERR	RARR	95% CI for RARR
Albany Med. Ctr	204	22	10.78	11.79	11.73	(7.35,17.77)
Arnot Ogden Med Ctr	42	7	16.67	12.59	16.97	(6.80,34.97)
Bassett Medical Center	82	9	10.98	14.20	9.91	(4.52,18.82)
Bellevue Hospital Ctr	140	29	20.71	12.99	20.45*	(13.69,29.37)
Buffalo General Med Ctr	389	44	11.31	12.29	11.81	(8.58,15.85)
Ellis Hospital	184	24	13.04	12.71	13.16	(8.43,19.59)
Good Sam - Suffern	91	11	12.09	12.22	12.68	(6.32,22.70)
Good Sam-West Islip	207	31	14.98	13.01	14.76	(10.03,20.95)
Lenox Hill Hospital	295	40	13.56	13.36	13.02	(9.30,17.73)
Maimonides Medical Ctr	212	31	14.62	13.36	14.04	(9.54,19.93)
Mercy Hospital-Buffalo	332	37	11.14	11.83	12.08	(8.50,16.65)
Montefiore - Moses	179	23	12.85	13.71	12.02	(7.61,18.03)
Montefiore - Weiler	188	29	15.43	13.13	15.07	(10.09,21.65)
Mount Sinai Beth Israel	164	19	11.59	11.77	12.62	(7.60,19.72)
Mount Sinai Hospital	324	43	13.27	13.45	12.65	(9.15,17.04)
Mount Sinai St. Lukes	122	14	11.48	13.84	10.63	(5.81,17.84)
NYP-Brooklyn Methodist	134	22	16.42	14.27	14.75	(9.24,22.34)
NYP-Columbia Presby.	397	59	14.86	14.15	13.47	(10.26,17.38)
NYP-Queens	154	15	9.74	11.67	10.70	(5.99,17.65)
NYP-Weill Cornell	147	13	8.84	13.33	8.51	(4.53,14.55)
NYU Hospitals Center	220	14	6.36	11.20	7.29**	(3.98,12.23)
NYU Winthrop Hospital	211	28	13.27	12.12	14.05	(9.33,20.30)
North Shore Univ Hosp	562	77	13.70	12.95	13.57	(10.71,16.96)
Rochester General Hosp	441	75	17.01	13.75	15.86	(12.48,19.88)
Southside Hospital	197	27	13.71	12.84	13.69	(9.02,19.92)
St. Elizabeth Med Ctr	217	29	13.36	14.13	12.13	(8.12,17.42)
St. Francis Hospital	505	65	12.87	12.02	13.73	(10.59,17.50)
St. Josephs Hospital	429	40	9.32	13.38	8.93**	(6.38,12.17)
St. Peters Hospital	345	32	9.28	11.80	10.08	(6.89,14.23)
Staten Island Univ Hosp	158	16	10.13	11.74	11.06	(6.32,17.96)
Strong Memorial Hosp	216	27	12.50	11.55	13.88	(9.15,20.20)
UHS-Wilson Med Ctr	98	9	9.18	10.99	10.72	(4.89,20.35)
Univ. Hosp-Brooklyn	56	16	28.57	14.18	25.85*	(14.76,41.97)
Univ. Hosp-Stony Brook	173	26	15.03	13.96	13.80	(9.01,20.22)
Univ. Hosp-Upstate	35	3	8.57	13.51	8.13	(1.63,23.77)
Vassar Bros. Med Ctr	165	9	5.45	12.76	5.48**	(2.50,10.41)
Westchester Med Ctr	188	37	19.68	12.86	19.62*	(13.81,27.04)
STATEWIDE TOTAL	**8203**	**1052**	**12.82**			

* 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, 2016 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.

2014-2016 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 2014-2016. The table contains, for each hospital, the combined number of Valve Only and Valve/CABG operations resulting in 2014-2016 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 21,532 combined Valve Only and Valve/CABG procedures performed at the 38 hospitals was 3.12 percent. The OMRs ranged from 0.43 percent to 7.35 percent. The range of EMRs, which measure patient severity of illness, was 1.60 percent to 4.43 percent.

The RAMRs, which are used to measure performance, ranged from 0.46 percent to 9.77 percent. Four hospitals (Mercy Hospital in Buffalo, Montefiore Medical Center - Moses Division in the Bronx, St. Elizabeth Medical Center in Utica, Strong Memorial Hospital in Rochester, and United Health Services - Wilson in Johnson City) had RAMRs that were significantly higher than the statewide rate. Three hospitals (Mount Sinai Hospital in Manhattan, St. Joseph's Hospital in Syracuse, and Vassar Brothers Medical Center in Poughkeepsie) had RAMRs that were significantly lower than the statewide rate.

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

Table 4 presents valve procedures performed at the 38 cardiac surgery hospitals in NYS during 2014-2016. The table contains, for each hospital, the number of valve operations (as defined by eight separate groups: Aortic Valve Replacements, Aortic Valve Repair or Replacements plus CABG, Mitral Valve Replacement, Mitral Valve Replacement plus CABG, Mitral Valve Repair, Mitral Valve Repair plus CABG, Multiple Valve Surgery and Multiple Valve Surgery plus CABG) resulting in 2014-2016 discharges. In addition to the hospital volumes, the rate of in-hospital/30-day death for the state (Statewide Mortality Rate) is given for each group. Unless otherwise specified, when the report refers to Valve or Valve/CABG procedures it is referring to the last column of Table 4.

The 2014-2016 in-hospital/30-day OMR of 3.12 percent for Valve and Valve/CABG surgeries is higher than the 3.03 percent observed for 2013-2015. The in-hospital OMR for 2014-2016 valve surgeries (not shown in Table 3) is 2.59 percent for the 21,532 patients included in this analysis.

Table 5 presents the results for transcatheter aortic valve replacement (TAVR) procedures performed at the 26 hospitals performing TAVR during the 2014-2016 discharge period. The table contains, for each hospital, the number of TAVR procedures resulting in 2014-2016 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 2014-2016 reporting period and the number of cases listed does not represent a full three year's program activity. Other hospitals have begun performing the procedure more recently.

As indicated in Table 5, the overall in-hospital/30-day mortality rate for the 7,674 TAVR procedures performed at the 26 hospitals was 3.60 percent. The OMRs ranged from 1.82 percent to 7.41 percent. The range of EMRs, which measure patient severity of illness, was 2.24 percent to 4.64 percent.

The RAMRs, which are used to measure performance, ranged from 1.78 percent to 7.94 percent. Two hospitals (Strong Memorial Hospital in Rochester and University Hospital - Stony Brook) had RAMRs that were statistically higher than the statewide rate. One hospital (NY Presbyterian at Columbia in Manhattan) had a RAMR that was statistically lower than the statewide rate.

Table 3

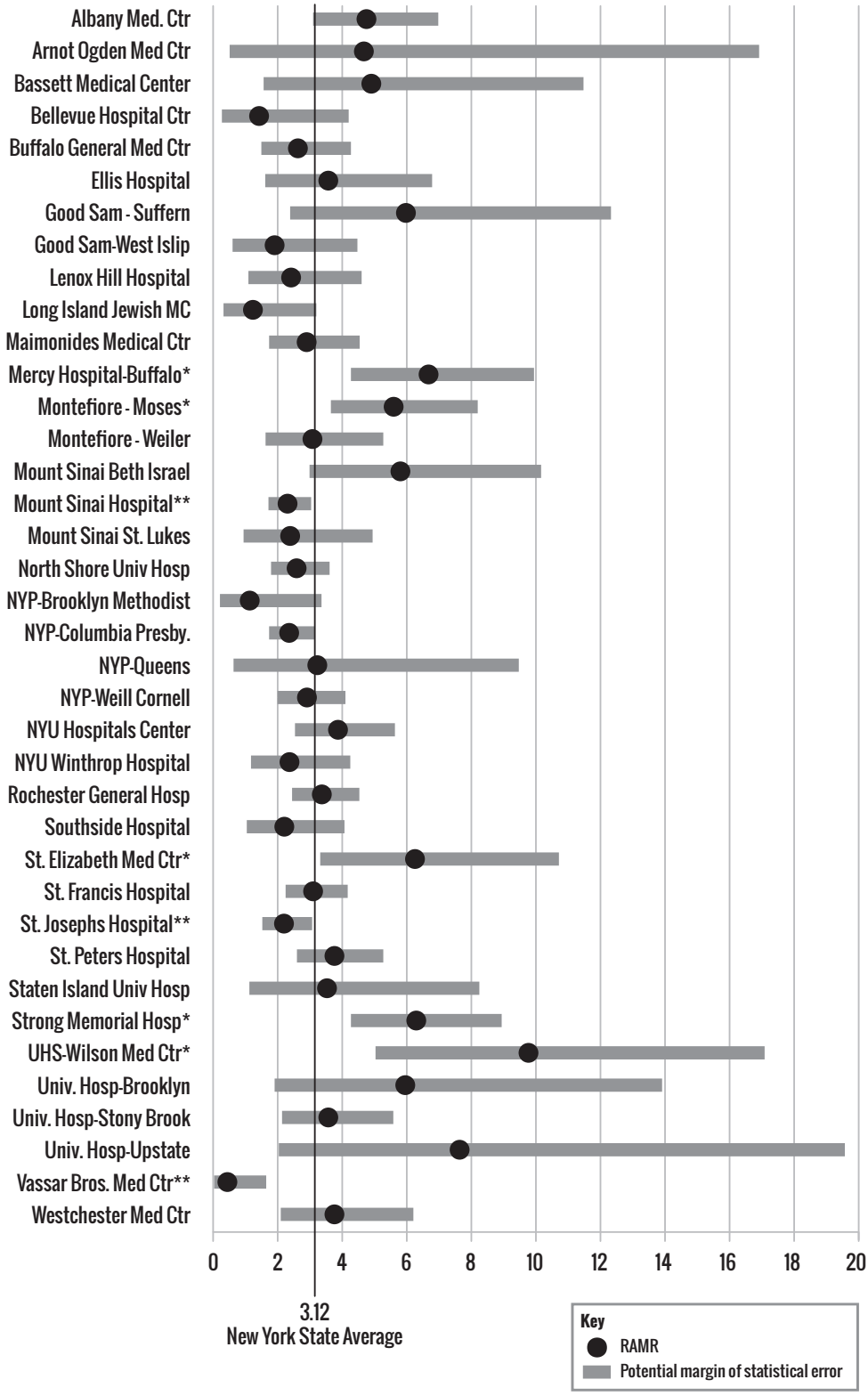
In-hospital/30-Day Observed, Expected, and Risk-Adjusted Mortality Rates for Valve or Valve/CABG Surgery in New York State, 2014 - 2016 Discharges

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	609	26	4.27	2.79	4.76	(3.11, 6.98)
Arnot Ogden Med Ctr	58	2	3.45	2.30	4.68	(0.53,16.90)
Bassett Medical Center	138	5	3.62	2.30	4.91	(1.58,11.47)
Bellevue Hospital Ctr	279	3	1.08	2.33	1.44	(0.29, 4.21)
Buffalo General Med Ctr	743	16	2.15	2.55	2.64	(1.51, 4.28)
Ellis Hospital	272	9	3.31	2.88	3.58	(1.63, 6.79)
Good Sam - Suffern	124	7	5.65	2.94	5.98	(2.40,12.32)
Good Sam-West Islip	252	5	1.98	3.22	1.92	(0.62, 4.48)
Lenox Hill Hospital	442	9	2.04	2.61	2.43	(1.11, 4.61)
Long Island Jewish MC	249	4	1.61	3.99	1.25	(0.34, 3.21)
Maimonides Medical Ctr	461	19	4.12	4.41	2.91	(1.75, 4.55)
Mercy Hospital-Buffalo	494	24	4.86	2.27	6.68 *	(4.28, 9.94)
Montefiore - Moses	409	26	6.36	3.54	5.60 *	(3.66, 8.20)
Montefiore - Weiler	316	13	4.11	4.15	3.09	(1.64, 5.28)
Mount Sinai Beth Israel	204	12	5.88	3.15	5.81	(3.00,10.16)
Mount Sinai Hospital	2271	51	2.25	3.01	2.32 **	(1.73, 3.05)
Mount Sinai St. Lukes	273	7	2.56	3.32	2.40	(0.96, 4.95)
NYP-Brooklyn Methodist	199	3	1.51	4.07	1.15	(0.23, 3.37)
NYP-Columbia Presby.	1938	48	2.48	3.25	2.37	(1.75, 3.15)
NYP-Queens	107	3	2.80	2.70	3.24	(0.65, 9.47)
NYP-Weill Cornell	1156	33	2.85	3.04	2.92	(2.01, 4.11)
NYU Hospitals Center	1355	27	1.99	1.60	3.88	(2.55, 5.64)
NYU Winthrop Hospital	440	11	2.50	3.28	2.38	(1.19, 4.26)
North Shore Univ Hosp	1083	35	3.23	3.87	2.60	(1.81, 3.62)
Rochester General Hosp	1070	44	4.11	3.79	3.38	(2.46, 4.54)
Southside Hospital	407	10	2.46	3.45	2.22	(1.06, 4.08)
St. Elizabeth Med Ctr	277	13	4.69	2.33	6.26 *	(3.33,10.71)
St. Francis Hospital	1257	44	3.50	3.50	3.11	(2.26, 4.18)
St. Josephs Hospital	1327	35	2.64	3.71	2.21 **	(1.54, 3.08)
St. Peters Hospital	933	34	3.64	3.01	3.77	(2.61, 5.28)
Staten Island Univ Hosp	143	5	3.50	3.08	3.54	(1.14, 8.25)
Strong Memorial Hosp	671	31	4.62	2.29	6.30 *	(4.28, 8.94)
UHS-Wilson Med Ctr	201	12	5.97	1.90	9.77 *	(5.04,17.07)
Univ. Hosp-Brooklyn	68	5	7.35	3.85	5.96	(1.92,13.90)
Univ. Hosp-Stony Brook	506	19	3.75	3.27	3.58	(2.15, 5.59)
Univ. Hosp-Upstate	60	4	6.67	2.72	7.64	(2.05,19.55)
Vassar Bros. Med Ctr	460	2	0.43	2.94	0.46 **	(0.05, 1.66)
Westchester Med Ctr	280	15	5.36	4.43	3.77	(2.11, 6.21)
STATEWIDE TOTAL	**21532**	**671**	**3.12**			

* 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, 2014-2016 Discharges



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

Table 4

Hospital Volume for Valve Surgery in New York State, 2014-2016 Discharges

Hospital	Aortic Valve Replace Surgery	Aortic Valve and CABG	Mitral Valve Replace Surgery	Mitral Replace and CABG	Mitral Valve Repair Surgery	Mitral Repair and CABG	Multiple Valve Surgery	Multiple Valve and CABG	Total Valve or Valve/ CABG
Albany Med. Ctr	227	148	41	11	72	26	66	18	609
Arnot Ogden Med Ctr	25	21	3	1	6	0	2	0	58
Bassett Medical Center	67	51	3	0	2	6	5	4	138
Bellevue Hospital Ctr	105	18	82	9	12	3	46	4	279
Buffalo General Med Ctr	283	219	71	27	74	21	25	23	743
Ellis Hospital	116	81	20	13	12	11	13	6	272
Good Sam - Suffern	39	35	13	2	14	6	6	9	124
Good Sam-West Islip	84	65	6	9	26	26	25	11	252
Lenox Hill Hospital	123	46	73	12	104	16	54	14	442
Long Island Jewish MC	62	40	22	13	41	14	41	16	249
Maimonides Medical Ctr	122	63	92	36	13	16	110	9	461
Mercy Hospital-Buffalo	192	148	42	25	51	4	27	5	494
Montefiore - Moses	114	62	80	24	39	13	63	14	409
Montefiore - Weiler	76	57	58	18	14	29	48	16	316
Mount Sinai Beth Israel	51	47	13	9	13	13	40	18	204
Mount Sinai Hospital	468	160	50	10	213	66	1143	161	2271
Mount Sinai St. Lukes	34	48	27	10	63	37	41	13	273
NYP-Brooklyn Methodist	77	27	34	10	8	1	33	9	199
NYP-Columbia Presby.	669	356	202	57	261	64	263	66	1938
NYP-Queens	41	20	24	7	5	1	8	1	107
NYP-Weill Cornell	443	171	113	31	163	26	165	44	1156
NYU Hospitals Center	466	97	106	18	473	30	150	15	1355
NYU Winthrop Hospital	136	74	71	34	39	27	38	21	440
North Shore Univ Hosp	339	227	122	64	89	43	154	45	1083
Rochester General Hosp	386	266	66	29	109	81	79	54	1070
Southside Hospital	117	83	51	23	53	16	46	18	407
St. Elizabeth Med Ctr	92	80	23	5	28	23	17	9	277
St. Francis Hospital	432	254	95	38	152	71	155	60	1257
St. Josephs Hospital	387	244	118	75	217	58	160	68	1327
St. Peters Hospital	309	275	45	23	54	65	104	58	933
Staten Island Univ Hosp	64	35	5	10	17	1	8	3	143
Strong Memorial Hosp	291	115	75	7	121	17	39	6	671
UHS-Wilson Med Ctr	104	66	16	2	4	1	5	3	201
Univ. Hosp-Brooklyn	12	13	16	3	4	5	14	1	68
Univ. Hosp-Stony Brook	173	144	36	20	43	30	47	13	506
Univ. Hosp-Upstate	30	6	14	2	4	1	3	0	60
Vassar Bros. Med Ctr	176	120	59	22	35	11	21	16	460
Westchester Med Ctr	66	63	34	24	23	19	39	12	280
Statewide Total	**6998**	**4045**	**2021**	**733**	**2671**	**898**	**3303**	**863**	**21532**
STATEWIDE MORTALITY RATE (%)	**1.77**	**3.16**	**3.71**	**10.64**	**0.67**	**3.34**	**4.78**	**6.95**	**3.12**

Table 5

In-hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for TAVR in New York State, 2014-2016 Discharges (Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	467	18	3.85	3.12	4.45	(2.63, 7.03)
Buffalo General Med Ctr	407	11	2.70	3.17	3.06	(1.53, 5.48)
Lenox Hill Hospital	182	5	2.75	3.39	2.91	(0.94, 6.80)
Long Island Jewish MC	55	1	1.82	3.66	1.79	(0.02, 9.95)
Maimonides Medical Ctr	182	8	4.40	3.00	5.27	(2.27,10.38)
Mercy Hospital-Buffalo	42	1	2.38	3.38	2.53	(0.03,14.10)
Montefiore - Moses	123	6	4.88	3.98	4.41	(1.61, 9.60)
Montefiore - Weiler	75	2	2.67	2.24	4.28	(0.48,15.46)
Mount Sinai Hospital	608	30	4.93	4.02	4.41	(2.97, 6.30)
NYP-Brooklyn Methodist	63	3	4.76	3.12	5.49	(1.10,16.05)
NYP-Columbia Presby.	1043	24	2.30	4.64	1.78**	(1.14, 2.65)
NYP-Weill Cornell	384	13	3.39	3.41	3.57	(1.90, 6.11)
NYU Hospitals Center	607	16	2.64	2.43	3.91	(2.23, 6.35)
NYU Winthrop Hospital	655	22	3.36	3.51	3.45	(2.16, 5.22)
North Shore Univ Hosp	496	17	3.43	3.56	3.46	(2.01, 5.54)
Rochester General Hosp	101	5	4.95	4.55	3.92	(1.26, 9.14)
Southside Hospital	135	4	2.96	2.97	3.59	(0.96, 9.18)
St. Elizabeth Med Ctr	34	1	2.94	3.50	3.02	(0.04,16.80)
St. Francis Hospital	805	26	3.23	3.62	3.21	(2.10, 4.70)
St. Josephs Hospital	354	17	4.80	3.67	4.71	(2.74, 7.54)
St. Peters Hospital	125	5	4.00	2.98	4.83	(1.56,11.28)
Strong Memorial Hosp	216	16	7.41	4.04	6.60*	(3.77,10.72)
UHS-Wilson Med Ctr	104	3	2.88	3.17	3.27	(0.66, 9.55)
Univ. Hosp-Stony Brook	126	11	8.73	3.96	7.94*	(3.96,14.20)
Vassar Bros. Med Ctr	39	2	5.13	3.16	5.84	(0.66,21.08)
Westchester Med Ctr	246	9	3.66	3.97	3.32	(1.51, 6.30)
STATEWIDE TOTAL	**7674**	**276**	**3.60**			

*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.

2014-2016 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 2014-2016. In addition, the final two columns provide the number of Isolated CABG, Valve and Valve/CABG procedures and the RAMR for these patients in 2014-2016 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 2014-2016, (b) performed at least one cardiac operation in each of the years, 2014-2016. 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 2014-2016 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, 2014-2016 Discharges

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
STATEWIDE TOTAL	**24991**	**372**	**1.49**				**46523**	**2.24**
Albany Med. Ctr								
Akujuo A C	176	4	2.27	1.39	2.44	(0.66, 6.25)	273	5.90 *
Bennett E	34	1	2.94	1.62	2.69	(0.04,14.99)	217	2.48
Britton L	128	1	0.78	1.20	0.97	(0.01, 5.39)	252	1.95
Depan H	115	1	0.87	2.23	0.58	(0.01, 3.23)	233	2.57
Zhang L	121	3	2.48	1.30	2.85	(0.57, 8.32)	142	2.41
All Others	161	2	1.24	1.68	1.10	(0.12, 3.97)	227	1.93
Total	**735**	**12**	**1.63**	**1.55**	**1.57**	**(0.81, 2.75)**	**1344**	**3.00**
Arnot Ogden Med Ctr								
#Hoffman D	113	1	0.88	1.08	1.22	(0.02, 6.77)	148	3.14
All Others	100	2	2.00	0.95	3.13	(0.35,11.31)	123	3.29
Total	**213**	**3**	**1.41**	**1.02**	**2.06**	**(0.41, 6.01)**	**271**	**3.20**
Bassett Medical Center								
#Choumarov K	1	0	0.00	0.88	0.00	(0.00,100.0)	1	0.00
Daniel S R	109	2	1.83	1.41	1.94	(0.22, 7.01)	158	3.70
Kelley J	157	3	1.91	1.39	2.04	(0.41, 5.97)	246	3.01
Total	**267**	**5**	**1.87**	**1.40**	**2.00**	**(0.64, 4.66)**	**405**	**3.25**

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								
#Balsam L B	100	1	1.00	1.07	1.39	(0.02, 7.74)	238	1.07
#Culliford A	114	5	4.39	1.19	5.47 *	(1.76,12.77)	177	4.02
#Malhotra S P	.	.	.	.	.	(. , .)	1	0.00
#Smith D E	121	2	1.65	1.17	2.09	(0.24, 7.56)	176	2.87
All Others	33	0	0.00	1.14	0.00	(0.00,14.55)	55	0.00
Total	**368**	**8**	**2.17**	**1.15**	**2.82**	**(1.21, 5.55)**	**647**	**2.30**
Buffalo General Med Ctr								
#Aldridge J	191	5	2.62	1.29	3.02	(0.97, 7.05)	221	4.52
#Ashraf M	587	8	1.36	1.29	1.58	(0.68, 3.11)	706	2.57
Grosner G	559	6	1.07	1.23	1.30	(0.48, 2.84)	1153	1.74
Total	**1337**	**19**	**1.42**	**1.26**	**1.68**	**(1.01, 2.62)**	**2080**	**2.19**
Ellis Hospital								
#Choumarov K	229	3	1.31	1.55	1.25	(0.25, 3.67)	281	2.46
Reich H	142	2	1.41	1.51	1.39	(0.16, 5.02)	270	2.10
Singh C	220	4	1.82	1.62	1.67	(0.45, 4.27)	312	2.49
Total	**591**	**9**	**1.52**	**1.57**	**1.44**	**(0.66, 2.74)**	**863**	**2.36**
Good Sam - Suffern								
Elmann E M	30	0	0.00	1.83	0.00	(0.00, 9.97)	66	2.66
Ng A F	85	3	3.53	1.43	3.66	(0.74,10.70)	127	3.27
Somberg E D	119	0	0.00	0.98	0.00	(0.00, 4.68)	151	3.55
All Others	71	2	2.82	1.25	3.35	(0.38,12.09)	85	5.83
Total	**305**	**5**	**1.64**	**1.25**	**1.95**	**(0.63, 4.54)**	**429**	**3.60**
Good Sam-West Islip								
#Henry M J	1	0	0.00	0.45	0.00	(0.00,100.0)	1	0.00
#Lamendola C	235	8	3.40	1.50	3.38	(1.46, 6.66)	406	3.23
#Rovensky M	322	1	0.31	1.54	0.30	(0.00, 1.67)	403	0.30 **
All Others	3	0	0.00	2.48	0.00	(0.00,73.44)	3	0.00
Total	**561**	**9**	**1.60**	**1.53**	**1.56**	**(0.71, 2.97)**	**813**	**1.88**
Lenox Hill Hospital								
#Brinster D R	24	0	0.00	1.36	0.00	(0.00,16.72)	88	1.98
Hemli J M	33	1	3.03	1.52	2.96	(0.04,16.47)	39	3.84
Patel N C	631	8	1.27	1.35	1.40	(0.60, 2.76)	892	1.89
Pirelli L	19	0	0.00	2.24	0.00	(0.00,12.82)	38	2.46
#Scheinerman S J	91	2	2.20	1.30	2.51	(0.28, 9.07)	145	1.81
All Others	10	0	0.00	1.21	0.00	(0.00,44.94)	48	2.28
Total	**808**	**11**	**1.36**	**1.37**	**1.48**	**(0.74, 2.65)**	**1250**	**1.98**
Long Island Jewish MC								
#Graver L	105	0	0.00	2.25	0.00	(0.00, 2.31)	266	0.72 **
##Hartman A	3	0	0.00	0.53	0.00	(0.00,100.0)	7	0.00
Meyer D B	.	.	.	.	.	(. , .)	4	0.00
#Palazzo R	129	0	0.00	1.51	0.00	(0.00, 2.80)	162	0.00
#Scheinerman S J	62	2	3.23	1.83	2.63	(0.30, 9.49)	109	2.18
Total	**299**	**2**	**0.67**	**1.83**	**0.55**	**(0.06, 1.97)**	**548**	**0.87 ** **

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	133	6	4.51	2.52	2.66	(0.97, 5.80)	251	2.22
Crooke G	87	1	1.15	1.74	0.99	(0.01, 5.48)	147	1.04
Jacobowitz I	254	2	0.79	1.90	0.62	(0.07, 2.22)	381	1.87
Ribakove G	83	1	1.20	1.35	1.33	(0.02, 7.41)	162	3.51
Saunders P	53	1	1.89	1.79	1.57	(0.02, 8.75)	60	3.81
Stephens G A	7	1	14.29	3.40	6.25	(0.08,34.79)	29	4.87
##Tak V M	3	1	33.33	5.33	9.31	(0.12,51.78)	9	6.72
#Vaynblat M	81	3	3.70	2.02	2.72	(0.55, 7.96)	123	2.47
Total	**701**	**16**	**2.28**	**1.97**	**1.73**	**(0.99, 2.80)**	**1162**	**2.30**
Mercy Hospital-Buffalo								
Adkins M	369	10	2.71	1.40	2.87	(1.38, 5.29)	471	4.77 *
#Aldridge J	1	0	0.00	2.25	0.00	(0.00,100.0)	2	0.00
#Ashraf M	1	0	0.00	0.53	0.00	(0.00,100.0)	1	0.00
Bell-Thomson J	230	5	2.17	1.51	2.14	(0.69, 5.00)	444	4.84 *
Downing S W	431	7	1.62	1.47	1.64	(0.66, 3.38)	606	2.62
#Joyce F	2	0	0.00	0.63	0.00	(0.00,100.0)	2	0.00
All Others	35	0	0.00	0.95	0.00	(0.00,16.41)	37	0.00
Total	**1069**	**22**	**2.06**	**1.44**	**2.13**	**(1.34, 3.23)**	**1563**	**3.88** *
Montefiore - Moses								
#Bello R A	4	1	25.00	0.67	55.30	(0.72,100.0)	5	27.94
#Chau M L	3	0	0.00	1.37	0.00	(0.00,100.0)	4	0.00
#D Alessandro D A	123	1	0.81	1.52	0.80	(0.01, 4.44)	213	1.49
#Derose J J	7	0	0.00	0.89	0.00	(0.00,87.33)	10	14.17
#Goldstein D J	143	0	0.00	1.18	0.00	(0.00, 3.23)	260	4.56 *
#Jakobleff W A	200	1	0.50	1.61	0.46	(0.01, 2.57)	243	2.45
#Michler R E	83	1	1.20	1.21	1.48	(0.02, 8.23)	231	2.96
All Others	.	.	.	.	.	(. , .)	6	0.00
Total	**563**	**4**	**0.71**	**1.41**	**0.75**	**(0.20, 1.93)**	**972**	**3.00**
Montefiore - Weiler								
#Bello R A	187	5	2.67	1.30	3.07	(0.99, 7.15)	273	3.42
#Chau M L	40	2	5.00	1.20	6.21	(0.70,22.43)	44	7.49
#D Alessandro D A	1	0	0.00	0.37	0.00	(0.00,100.0)	1	0.00
#Derose J J	323	4	1.24	1.21	1.52	(0.41, 3.89)	520	2.19
#Goldstein D J	42	2	4.76	1.03	6.91	(0.78,24.93)	62	4.77
#Jakobleff W A	2	0	0.00	0.54	0.00	(0.00,100.0)	3	0.00
#Michler R E	1	0	0.00	0.50	0.00	(0.00,100.0)	9	0.00
Total	**596**	**13**	**2.18**	**1.22**	**2.66**	**(1.42, 4.55)**	**912**	**2.86**
Mount Sinai Beth Israel								
#Hoffman D	28	0	0.00	2.45	0.00	(0.00, 7.96)	34	2.16
##Puskas J D	359	4	1.11	1.14	1.46	(0.39, 3.73)	500	3.13
##Tranbaugh R	158	0	0.00	1.63	0.00	(0.00, 2.12)	205	1.49
All Others	21	1	4.76	2.32	3.06	(0.04,17.02)	31	5.18
Total	**566**	**5**	**0.88**	**1.39**	**0.95**	**(0.31, 2.21)**	**770**	**2.67**

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	4	0	0.00	1.54	0.00	(0.00,88.68)	1055	0.33 **
Anyanwu A C	56	0	0.00	1.53	0.00	(0.00, 6.38)	160	2.19
Boateng P	32	0	0.00	1.10	0.00	(0.00,15.49)	97	1.97
##Chikwe J Y	77	3	3.90	1.02	5.66	(1.14,16.54)	119	5.03
El-Eshmawi A M	14	0	0.00	0.44	0.00	(0.00,89.30)	55	4.93
Filsoufi F	272	1	0.37	1.19	0.46	(0.01, 2.55)	379	1.94
##Puskas J D	42	0	0.00	1.02	0.00	(0.00,12.77)	47	0.00
Reddy R C	277	3	1.08	1.62	0.99	(0.20, 2.90)	419	2.11
Stelzer P	29	0	0.00	0.91	0.00	(0.00,20.58)	301	1.88
Stewart A S	116	3	2.59	1.34	2.88	(0.58, 8.40)	426	3.22
#Tannous H J	61	0	0.00	1.29	0.00	(0.00, 6.96)	87	0.00
Varghese R	100	4	4.00	1.03	5.76 *	(1.55,14.75)	202	3.10
All Others	2	0	0.00	0.49	0.00	(0.00,100.0)	6	8.10
Total	**1082**	**14**	**1.29**	**1.29**	**1.50**	**(0.82, 2.51)**	**3353**	**1.77**
Mount Sinai St. Lukes								
Balaram S K	181	3	1.66	2.04	1.21	(0.24, 3.54)	269	1.59
##Chikwe J Y	86	1	1.16	1.24	1.40	(0.02, 7.79)	166	1.98
##Puskas J D	7	0	0.00	0.89	0.00	(0.00,87.94)	8	0.00
#Swistel D	93	2	2.15	2.06	1.56	(0.17, 5.62)	196	2.17
All Others	.	.	.	.	.	(. , .)	1	0.00
Total	**367**	**6**	**1.63**	**1.83**	**1.33**	**(0.48, 2.89)**	**640**	**1.84**
NYP-Brooklyn Methodist								
#Gulkarov I M	159	1	0.63	1.54	0.61	(0.01, 3.39)	260	0.62 **
##Tranbaugh R	97	1	1.03	1.99	0.77	(0.01, 4.29)	133	2.42
#Worku B M	41	0	0.00	2.70	0.00	(0.00, 4.93)	60	0.00
All Others	51	0	0.00	1.13	0.00	(0.00, 9.47)	94	0.00
Total	**348**	**2**	**0.57**	**1.74**	**0.49**	**(0.06, 1.77)**	**547**	**0.79 ****
NYP-Columbia Presby.								
Argenziano M	244	1	0.41	1.26	0.48	(0.01, 2.68)	548	0.63 **
Bacchetta M D	.	.	.	.	.	(. , .)	1	0.00
#Bacha E	.	.	.	.	.	(. , .)	1	0.00
Borger M A	34	0	0.00	2.28	0.00	(0.00, 7.04)	268	1.74
#Chai P J	.	.	.	.	.	(. , .)	5	0.00
George I	142	3	2.11	1.71	1.84	(0.37, 5.36)	340	2.85
Naka Y	265	3	1.13	1.45	1.17	(0.23, 3.41)	427	1.29
Quaegebeur J	.	.	.	.	.	(. , .)	1	0.00
Smith C	194	0	0.00	1.05	0.00	(0.00, 2.67)	775	2.26
Takayama H	319	5	1.57	1.98	1.18	(0.38, 2.75)	608	1.60
Takeda K	43	1	2.33	2.77	1.25	(0.02, 6.96)	78	1.48
#Williams M R	7	0	0.00	0.85	0.00	(0.00,91.86)	133	0.00 **
All Others	1	0	0.00	2.36	0.00	(0.00,100.0)	2	0.00
Total	**1249**	**13**	**1.04**	**1.58**	**0.98**	**(0.52, 1.67)**	**3187**	**1.65 ****
NYP-Queens								
#Lang S	284	2	0.70	0.90	1.17	(0.13, 4.21)	382	2.13
All Others	50	0	0.00	0.68	0.00	(0.00,16.00)	59	0.00
Total	**334**	**2**	**0.60**	**0.87**	**1.03**	**(0.12, 3.71)**	**441**	**1.94**

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-Weill Cornell								
#Bacha E	.	.	.	.	.	(. , .)	5	0.00
#Chai P J	.	.	.	.	.	(. , .)	3	0.00
Girardi L	246	1	0.41	1.36	0.44	(0.01, 2.47)	903	1.64
#Gulkarov I M	2	0	0.00	2.79	0.00	(0.00,97.72)	5	0.00
Krieger K	159	1	0.63	1.56	0.60	(0.01, 3.33)	423	2.35
#Lang S	8	0	0.00	1.07	0.00	(0.00,63.60)	17	0.00
Salemi A	65	2	3.08	1.23	3.73	(0.42,13.47)	167	2.93
##Tranbaugh R	2	0	0.00	0.86	0.00	(0.00,100.0)	4	0.00
#Worku B M	.	.	.	.	.	(. , .)	1	0.00
All Others	88	1	1.14	1.86	0.91	(0.01, 5.06)	198	1.91
Total	**570**	**5**	**0.88**	**1.48**	**0.88**	**(0.28, 2.06)**	**1726**	**1.95**
NYU Hospitals Center								
#Balsam L B	2	0	0.00	0.75	0.00	(0.00,100.0)	4	0.00
#Culliford A	37	0	0.00	0.69	0.00	(0.00,21.44)	80	1.68
Galloway A	60	1	1.67	0.77	3.21	(0.04,17.84)	471	3.23
Grossi E	7	0	0.00	0.81	0.00	(0.00,96.49)	14	0.00
Loulmet D F	47	0	0.00	0.68	0.00	(0.00,17.06)	453	2.32
#Malhotra S P	.	.	.	.	.	(. , .)	2	0.00
Mosca R S	.	.	.	.	.	(. , .)	9	0.00
#Smith D E	26	0	0.00	1.05	0.00	(0.00,20.09)	43	5.39
#Swistel D	48	0	0.00	0.92	0.00	(0.00,12.41)	121	6.20
#Vaynblat M	33	0	0.00	0.76	0.00	(0.00,21.71)	58	6.76
#Williams M R	8	0	0.00	1.14	0.00	(0.00,59.70)	125	3.56
Zias E	326	6	1.84	1.11	2.48	(0.90, 5.39)	560	1.80
All Others	4	0	0.00	0.42	0.00	(0.00,100.0)	13	0.00
Total	**598**	**7**	**1.17**	**0.97**	**1.80**	**(0.72, 3.71)**	**1953**	**2.77**
NYU Winthrop Hospital								
Goncalves J A	97	2	2.06	1.61	1.91	(0.21, 6.90)	231	2.44
Kokotos W J	156	1	0.64	1.32	0.72	(0.01, 4.01)	306	1.35
Salhab K F	179	3	1.68	1.63	1.53	(0.31, 4.47)	231	2.19
Schubach S	178	0	0.00	1.22	0.00	(0.00, 2.52)	282	0.54
Total	**610**	**6**	**0.98**	**1.43**	**1.03**	**(0.37, 2.23)**	**1050**	**1.65**
North Shore Univ Hosp								
#Brinster D R	11	0	0.00	0.89	0.00	(0.00,55.66)	17	0.00
Esposito R	234	1	0.43	1.06	0.60	(0.01, 3.34)	402	1.46
##Fernandez H A	5	0	0.00	1.46	0.00	(0.00,74.57)	10	0.00
#Graver L	170	2	1.18	1.97	0.89	(0.10, 3.21)	344	1.04
Hall M	95	0	0.00	2.70	0.00	(0.00, 2.13)	153	1.35
##Hartman A	119	0	0.00	1.35	0.00	(0.00, 3.41)	369	2.34
#Kalimi R	51	0	0.00	1.45	0.00	(0.00, 7.38)	114	0.00
#Palazzo R	109	1	0.92	1.32	1.03	(0.01, 5.75)	156	1.61
#Pogo G	45	2	4.44	1.85	3.57	(0.40,12.91)	77	4.42
##Taylor J	132	1	0.76	1.44	0.78	(0.01, 4.34)	251	1.44
Vatsia S	190	3	1.58	1.37	1.72	(0.35, 5.03)	315	1.87
Yu P J	86	1	1.16	1.52	1.14	(0.01, 6.32)	122	3.42
Total	**1247**	**11**	**0.88**	**1.52**	**0.86**	**(0.43, 1.54)**	**2330**	**1.69**

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
Rochester General Hosp								
Cheeran D	501	9	1.80	1.95	1.37	(0.63, 2.61)	936	2.18
Kirshner R	454	5	1.10	1.41	1.16	(0.37, 2.70)	1047	2.43
Yankey G K N	168	6	3.57	2.00	2.66	(0.97, 5.79)	210	3.41
Total	**1123**	**20**	**1.78**	**1.74**	**1.52**	**(0.93, 2.35)**	**2193**	**2.39**
Southside Hospital								
##Fernandez H A	81	0	0.00	1.05	0.00	(0.00, 6.44)	138	0.69
##Hartman A	25	1	4.00	1.03	5.77	(0.08,32.09)	92	4.97
#Kalimi R	206	1	0.49	1.54	0.47	(0.01, 2.61)	397	0.50 **
Manetta F	173	1	0.58	1.45	0.59	(0.01, 3.31)	244	0.97
#Pogo G	45	2	4.44	1.84	3.59	(0.40,12.95)	65	4.00
##Taylor J	1	0	0.00	0.50	0.00	(0.00,100.0)	2	0.00
All Others	1	0	0.00	4.93	0.00	(0.00,100.0)	1	0.00
Total	**532**	**5**	**0.94**	**1.44**	**0.97**	**(0.31, 2.27)**	**939**	**1.55**
St. Elizabeth Med Ctr								
Cahill A T	74	2	2.70	1.66	2.42	(0.27, 8.74)	92	4.34
El Amir N	114	2	1.75	1.11	2.36	(0.27, 8.53)	183	3.40
#Joyce F	273	4	1.47	1.29	1.69	(0.45, 4.32)	422	4.40 *
All Others	114	6	5.26	2.09	3.75	(1.37, 8.17)	155	3.95
Total	**575**	**14**	**2.43**	**1.46**	**2.48**	**(1.36, 4.16)**	**852**	**4.07** *
St. Francis Hospital								
Bercow N	389	8	2.06	2.02	1.52	(0.65, 2.99)	673	2.65
Colangelo R	548	6	1.09	1.18	1.38	(0.50, 3.01)	1022	2.07
#Henry M J	116	3	2.59	2.26	1.70	(0.34, 4.98)	131	2.23
#Lamendola C	5	0	0.00	0.87	0.00	(0.00,100.0)	10	0.00
Lundy E F	283	4	1.41	1.85	1.14	(0.31, 2.91)	408	1.62
Robinson N	97	4	4.12	1.47	4.18	(1.12,10.70)	435	2.55
#Rovensky M	13	0	0.00	0.97	0.00	(0.00,43.49)	17	0.00
All Others	43	0	0.00	1.31	0.00	(0.00, 9.67)	55	2.93
Total	**1494**	**25**	**1.67**	**1.63**	**1.53**	**(0.99, 2.26)**	**2751**	**2.26**
St. Josephs Hospital								
Green G R	242	4	1.65	1.88	1.31	(0.35, 3.34)	537	1.19
Lutz C J	253	5	1.98	1.75	1.68	(0.54, 3.93)	600	2.09
Marvasti M	157	1	0.64	1.96	0.48	(0.01, 2.70)	318	0.82
Nazem A	283	6	2.12	1.46	2.17	(0.79, 4.72)	499	2.33
Zhou Z	289	5	1.73	1.53	1.69	(0.54, 3.94)	597	2.09
Total	**1224**	**21**	**1.72**	**1.68**	**1.52**	**(0.94, 2.32)**	**2551**	**1.80**
St. Peters Hospital								
Edwards N	182	3	1.65	0.97	2.53	(0.51, 7.40)	434	3.54
Karavas A N	388	1	0.26	1.21	0.32	(0.00, 1.76)	522	1.25
Saifi J	173	5	2.89	1.68	2.56	(0.83, 5.98)	514	3.06
Terrien C M	311	2	0.64	1.23	0.78	(0.09, 2.82)	517	1.78
Total	**1054**	**11**	**1.04**	**1.25**	**1.24**	**(0.62, 2.22)**	**1987**	**2.45**

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
Staten Island Univ Hosp								
McGinn J	200	4	2.00	1.29	2.31	(0.62, 5.91)	276	1.95
Rosell F M	259	1	0.39	1.35	0.43	(0.01, 2.37)	298	2.16
Wohler A M	69	4	5.80	1.22	7.07 *	(1.90,18.10)	92	6.49
All Others	16	0	0.00	1.40	0.00	(0.00,24.42)	21	5.88
Total	**544**	**9**	**1.65**	**1.31**	**1.88**	**(0.86, 3.56)**	**687**	**2.72**
Strong Memorial Hosp								
Alfieris G	.	.	.	.	.	(. , .)	1	0.00
Gensini P F	.	.	.	.	.	(. , .)	10	0.00
Knight P	417	7	1.68	1.70	1.47	(0.59, 3.03)	975	3.33
Lehoux J M	124	1	0.81	1.08	1.11	(0.01, 6.18)	163	4.65
Massey H	50	2	4.00	1.44	4.15	(0.47,14.97)	88	5.01
All Others	66	2	3.03	2.35	1.92	(0.22, 6.94)	91	5.04
Total	**657**	**12**	**1.83**	**1.63**	**1.67**	**(0.86, 2.92)**	**1328**	**3.70 ***
UHS-Wilson Med Ctr								
Wong K	181	4	2.21	1.13	2.92	(0.78, 7.47)	281	5.14 *
Yousuf M	216	6	2.78	1.87	2.22	(0.81, 4.82)	314	4.91 *
All Others	2	1	50.00	0.87	85.31	(1.11,100.0)	5	45.63
Total	**399**	**11**	**2.76**	**1.53**	**2.69**	**(1.34, 4.81)**	**600**	**5.20 ***
Univ. Hosp-Brooklyn								
##Tak V M	35	3	8.57	1.69	7.56 *	(1.52,22.08)	74	6.32 *
All Others	87	4	4.60	1.93	3.55	(0.96, 9.09)	116	4.67
Total	**122**	**7**	**5.74**	**1.86**	**4.59 ***	**(1.84, 9.47)**	**190**	**5.51 ***
Univ. Hosp-Stony Brook								
Bilfinger T	69	2	2.90	2.01	2.15	(0.24, 7.76)	89	3.39
##Chikwe J Y	18	0	0.00	1.48	0.00	(0.00,20.52)	29	0.00
##Fernandez H A	189	1	0.53	1.71	0.46	(0.01, 2.56)	307	0.96
Gupta S	131	2	1.53	1.31	1.74	(0.20, 6.27)	260	2.93
McLarty A	38	1	2.63	2.71	1.44	(0.02, 8.03)	47	1.84
##Tak V M	54	1	1.85	2.97	0.93	(0.01, 5.17)	73	2.14
#Tannous H J	13	0	0.00	1.64	0.00	(0.00,25.56)	14	0.00
##Taylor J	203	1	0.49	1.69	0.43	(0.01, 2.41)	392	1.80
All Others	42	0	0.00	1.00	0.00	(0.00,12.96)	52	4.43
Total	**757**	**8**	**1.06**	**1.76**	**0.90**	**(0.39, 1.77)**	**1263**	**2.03**
Univ. Hosp-Upstate								
Dunton R F	62	1	1.61	1.42	1.69	(0.02, 9.42)	94	4.19
All Others	29	0	0.00	0.96	0.00	(0.00,19.59)	57	3.78
Total	**91**	**1**	**1.10**	**1.27**	**1.29**	**(0.02, 7.15)**	**151**	**4.02**
Vassar Bros. Med Ctr								
Sarabu M	106	2	1.89	1.46	1.92	(0.22, 6.93)	323	0.83
Shahani R B	170	2	1.18	1.75	1.00	(0.11, 3.60)	270	0.76
Zakow P	220	0	0.00	1.53	0.00	(0.00, 1.63)	363	0.30 **
All Others	2	0	0.00	0.26	0.00	(0.00,100.0)	2	0.00
Total	**498**	**4**	**0.80**	**1.59**	**0.75**	**(0.20, 1.93)**	**958**	**0.63 ** **

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
Westchester Med Ctr								
Kai M	125	3	2.40	1.86	1.92	(0.39, 5.61)	181	3.56
Lafaro R	42	4	9.52	0.96	14.83 *	(3.99,37.96)	69	8.26 *
Lansman S	11	0	0.00	1.00	0.00	(0.00,49.42)	14	0.00
Malekan R	150	1	0.67	1.95	0.51	(0.01, 2.84)	222	1.50
Spielvogel D	204	7	3.43	1.95	2.62	(1.05, 5.40)	304	3.32
Tang G H L	.	.	.	.	.	(. , .)	18	5.55
All Others	5	0	0.00	0.86	0.00	(0.00,100.0)	9	0.00
Total	537	15	2.79	1.82	2.28	(1.28, 3.77)	817	3.03
STATEWIDE TOTAL	**24991**	**372**	**1.49**				**46523**	**2.24**

* 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, 2014-2016.

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Aldridge J	**192**	**5**	**2.60**	**1.29**	**2.99**	**(0.97, 6.99)**	**223**	**4.47**
Buffalo General Med Ctr	191	5	2.62	1.29	3.02	(0.97, 7.05)	221	4.52
Mercy Hospital-Buffalo	1	0	0.00	2.25	0.00	(0.00,100.0)	2	0.00
Ashraf M	**588**	**8**	**1.36**	**1.28**	**1.58**	**(0.68, 3.11)**	**707**	**2.57**
Buffalo General Med Ctr	587	8	1.36	1.29	1.58	(0.68, 3.11)	706	2.57
Mercy Hospital-Buffalo	1	0	0.00	0.53	0.00	(0.00,100.0)	1	0.00
Bacha E	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**6**	**0.00**
NYP-Columbia Presby.	.	.	.	.	.	(. , .)	1	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	5	0.00
Balsam L B	**102**	**1**	**0.98**	**1.06**	**1.37**	**(0.02, 7.64)**	**242**	**1.05**
Bellevue Hospital Ctr	100	1	1.00	1.07	1.39	(0.02, 7.74)	238	1.07
NYU Hospitals Center	2	0	0.00	0.75	0.00	(0.00,100.0)	4	0.00
Bello R A	**191**	**6**	**3.14**	**1.29**	**3.64**	**(1.33, 7.92)**	**278**	**3.71**
Montefiore - Moses	4	1	25.00	0.67	55.30	(0.72,100.0)	5	27.94
Montefiore - Weiler	187	5	2.67	1.30	3.07	(0.99, 7.15)	273	3.42
Brinster D R	**35**	**0**	**0.00**	**1.21**	**0.00**	**(0.00,12.86)**	**105**	**1.80**
Lenox Hill Hospital	24	0	0.00	1.36	0.00	(0.00,16.72)	88	1.98
North Shore Univ Hosp	11	0	0.00	0.89	0.00	(0.00,55.66)	17	0.00
Chai P J	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**8**	**0.00**
NYP-Columbia Presby.	.	.	.	.	.	(. , .)	5	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	3	0.00
Chau M L	**43**	**2**	**4.65**	**1.21**	**5.72**	**(0.64,20.65)**	**48**	**6.99**
Montefiore - Moses	3	0	0.00	1.37	0.00	(0.00,100.0)	4	0.00
Montefiore - Weiler	40	2	5.00	1.20	6.21	(0.70,22.43)	44	7.49
Chikwe J Y	**181**	**4**	**2.21**	**1.17**	**2.81**	**(0.76, 7.20)**	**314**	**2.56**
Mount Sinai Hospital	77	3	3.90	1.02	5.66	(1.14,16.54)	119	5.03
Mount Sinai St. Lukes	86	1	1.16	1.24	1.40	(0.02, 7.79)	166	1.98
Univ. Hosp-Stony Brook	18	0	0.00	1.48	0.00	(0.00,20.52)	29	0.00
Choumarov K	**230**	**3**	**1.30**	**1.55**	**1.25**	**(0.25, 3.66)**	**282**	**2.46**
Bassett Medical Center	1	0	0.00	0.88	0.00	(0.00,100.0)	1	0.00
Ellis Hospital	229	3	1.31	1.55	1.25	(0.25, 3.67)	281	2.46
Culliford A	**151**	**5**	**3.31**	**1.07**	**4.61**	**(1.49,10.76)**	**257**	**3.35**
Bellevue Hospital Ctr	114	5	4.39	1.19	5.47 *	(1.76,12.77)	177	4.02
NYU Hospitals Center	37	0	0.00	0.69	0.00	(0.00,21.44)	80	1.68

Table 7 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
D Alessandro D A	**124**	**1**	**0.81**	**1.51**	**0.80**	**(0.01, 4.43)**	**214**	**1.49**
Montefiore - Moses	123	1	0.81	1.52	0.80	(0.01, 4.44)	213	1.49
Montefiore - Weiler	1	0	0.00	0.37	0.00	(0.00,100.0)	1	0.00
Derose J J	**330**	**4**	**1.21**	**1.21**	**1.50**	**(0.40, 3.83)**	**530**	**2.35**
Montefiore - Moses	7	0	0.00	0.89	0.00	(0.00,87.33)	10	14.17
Montefiore - Weiler	323	4	1.24	1.21	1.52	(0.41, 3.89)	520	2.19
Fernandez H A	**275**	**1**	**0.36**	**1.51**	**0.36**	**(0.00, 2.00)**	**455**	**0.86** **
North Shore Univ Hosp	5	0	0.00	1.46	0.00	(0.00,74.57)	10	0.00
Southside Hospital	81	0	0.00	1.05	0.00	(0.00, 6.44)	138	0.69
Univ. Hosp-Stony Brook	189	1	0.53	1.71	0.46	(0.01, 2.56)	307	0.96
Goldstein D J	**185**	**2**	**1.08**	**1.15**	**1.40**	**(0.16, 5.06)**	**322**	**4.60** *
Montefiore - Moses	143	0	0.00	1.18	0.00	(0.00, 3.23)	260	4.56 *
Montefiore - Weiler	42	2	4.76	1.03	6.91	(0.78,24.93)	62	4.77
Graver L	**275**	**2**	**0.73**	**2.08**	**0.52**	**(0.06, 1.88)**	**610**	**0.89** **
Long Island Jewish MC	105	0	0.00	2.25	0.00	(0.00, 2.31)	266	0.72 **
North Shore Univ Hosp	170	2	1.18	1.97	0.89	(0.10, 3.21)	344	1.04
Gulkarov I M	**161**	**1**	**0.62**	**1.55**	**0.60**	**(0.01, 3.32)**	**265**	**0.60** **
NYP-Brooklyn Methodist	159	1	0.63	1.54	0.61	(0.01, 3.39)	260	0.62 **
NYP-Weill Cornell	2	0	0.00	2.79	0.00	(0.00,97.72)	5	0.00
Hartman A	**147**	**1**	**0.68**	**1.28**	**0.79**	**(0.01, 4.41)**	**468**	**2.93**
Long Island Jewish MC	3	0	0.00	0.53	0.00	(0.00,100.0)	7	0.00
North Shore Univ Hosp	119	0	0.00	1.35	0.00	(0.00, 3.41)	369	2.34
Southside Hospital	25	1	4.00	1.03	5.77	(0.08,32.09)	92	4.97
Henry M J	**117**	**3**	**2.56**	**2.24**	**1.70**	**(0.34, 4.97)**	**132**	**2.22**
Good Sam-West Islip	1	0	0.00	0.45	0.00	(0.00,100.0)	1	0.00
St. Francis Hospital	116	3	2.59	2.26	1.70	(0.34, 4.98)	131	2.23
Hoffman D	**141**	**1**	**0.71**	**1.35**	**0.78**	**(0.01, 4.34)**	**182**	**2.82**
Arnot Ogden Med Ctr	113	1	0.88	1.08	1.22	(0.02, 6.77)	148	3.14
Mount Sinai Beth Israel	28	0	0.00	2.45	0.00	(0.00, 7.96)	34	2.16
Jakobleff W A	**202**	**1**	**0.50**	**1.60**	**0.46**	**(0.01, 2.56)**	**246**	**2.43**
Montefiore - Moses	200	1	0.50	1.61	0.46	(0.01, 2.57)	243	2.45
Montefiore - Weiler	2	0	0.00	0.54	0.00	(0.00,100.0)	3	0.00
Joyce F	**275**	**4**	**1.45**	**1.29**	**1.68**	**(0.45, 4.31)**	**424**	**4.39** *
Mercy Hospital-Buffalo	2	0	0.00	0.63	0.00	(0.00,100.0)	2	0.00
St. Elizabeth Med Ctr	273	4	1.47	1.29	1.69	(0.45, 4.32)	422	4.40 *
Kalimi R	**257**	**1**	**0.39**	**1.52**	**0.38**	**(0.00, 2.12)**	**511**	**0.38** **
North Shore Univ Hosp	51	0	0.00	1.45	0.00	(0.00, 7.38)	114	0.00
Southside Hospital	206	1	0.49	1.54	0.47	(0.01, 2.61)	397	0.50 **
Lamendola C	**240**	**8**	**3.33**	**1.49**	**3.34**	**(1.44, 6.58)**	**416**	**3.14**
Good Sam-West Islip	235	8	3.40	1.50	3.38	(1.46, 6.66)	406	3.23
St. Francis Hospital	5	0	0.00	0.87	0.00	(0.00,100.0)	10	0.00

Table 7 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Lang S	**292**	**2**	**0.68**	**0.90**	**1.13**	**(0.13, 4.07)**	**399**	**1.97**
NYP-Queens	284	2	0.70	0.90	1.17	(0.13, 4.21)	382	2.13
NYP-Weill Cornell	8	0	0.00	1.07	0.00	(0.00,63.60)	17	0.00
Malhotra S P	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**3**	**0.00**
Bellevue Hospital Ctr	.	.	.	.	.	(. , .)	1	0.00
NYU Hospitals Center	.	.	.	.	.	(. , .)	2	0.00
Michler R E	**84**	**1**	**1.19**	**1.20**	**1.47**	**(0.02, 8.19)**	**240**	**2.73**
Montefiore - Moses	83	1	1.20	1.21	1.48	(0.02, 8.23)	231	2.96
Montefiore - Weiler	1	0	0.00	0.50	0.00	(0.00,100.0)	9	0.00
Palazzo R	**238**	**1**	**0.42**	**1.42**	**0.44**	**(0.01, 2.44)**	**318**	**0.79**
Long Island Jewish MC	129	0	0.00	1.51	0.00	(0.00, 2.80)	162	0.00
North Shore Univ Hosp	109	1	0.92	1.32	1.03	(0.01, 5.75)	156	1.61
Pogo G	**90**	**4**	**4.44**	**1.85**	**3.58**	**(0.96, 9.17)**	**142**	**4.20**
North Shore Univ Hosp	45	2	4.44	1.85	3.57	(0.40,12.91)	77	4.42
Southside Hospital	45	2	4.44	1.84	3.59	(0.40,12.95)	65	4.00
Puskas J D	**408**	**4**	**0.98**	**1.12**	**1.30**	**(0.35, 3.33)**	**555**	**2.86**
Mount Sinai Beth Israel	359	4	1.11	1.14	1.46	(0.39, 3.73)	500	3.13
Mount Sinai Hospital	42	0	0.00	1.02	0.00	(0.00,12.77)	47	0.00
Mount Sinai St. Lukes	7	0	0.00	0.89	0.00	(0.00,87.94)	8	0.00
Rovensky M	**335**	**1**	**0.30**	**1.52**	**0.29**	**(0.00, 1.63)**	**420**	**0.29** **
Good Sam-West Islip	322	1	0.31	1.54	0.30	(0.00, 1.67)	403	0.30 **
St. Francis Hospital	13	0	0.00	0.97	0.00	(0.00,43.49)	17	0.00
Scheinerman S J	**153**	**4**	**2.61**	**1.52**	**2.57**	**(0.69, 6.58)**	**254**	**2.01**
Lenox Hill Hospital	91	2	2.20	1.30	2.51	(0.28, 9.07)	145	1.81
Long Island Jewish MC	62	2	3.23	1.83	2.63	(0.30, 9.49)	109	2.18
Smith D E	**147**	**2**	**1.36**	**1.15**	**1.76**	**(0.20, 6.35)**	**219**	**3.53**
Bellevue Hospital Ctr	121	2	1.65	1.17	2.09	(0.24, 7.56)	176	2.87
NYU Hospitals Center	26	0	0.00	1.05	0.00	(0.00,20.09)	43	5.39
Swistel D	**141**	**2**	**1.42**	**1.67**	**1.27**	**(0.14, 4.57)**	**317**	**3.01**
Mount Sinai St. Lukes	93	2	2.15	2.06	1.56	(0.17, 5.62)	196	2.17
NYU Hospitals Center	48	0	0.00	0.92	0.00	(0.00,12.41)	121	6.20
Tak V M	**92**	**5**	**5.43**	**2.56**	**3.16**	**(1.02, 7.38)**	**156**	**4.56**
Maimonides Medical Ctr	3	1	33.33	5.33	9.31	(0.12,51.78)	9	6.72
Univ. Hosp-Brooklyn	35	3	8.57	1.69	7.56 *	(1.52,22.08)	74	6.32 *
Univ. Hosp-Stony Brook	54	1	1.85	2.97	0.93	(0.01, 5.17)	73	2.14
Tannous H J	**74**	**0**	**0.00**	**1.35**	**0.00**	**(0.00, 5.47)**	**101**	**0.00**
Mount Sinai Hospital	61	0	0.00	1.29	0.00	(0.00, 6.96)	87	0.00
Univ. Hosp-Stony Brook	13	0	0.00	1.64	0.00	(0.00,25.56)	14	0.00

Table 7 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Taylor J	**336**	**2**	**0.60**	**1.59**	**0.56**	**(0.06, 2.01)**	**645**	**1.65**
North Shore Univ Hosp	132	1	0.76	1.44	0.78	(0.01, 4.34)	251	1.44
Southside Hospital	1	0	0.00	0.50	0.00	(0.00,100.0)	2	0.00
Univ. Hosp-Stony Brook	203	1	0.49	1.69	0.43	(0.01, 2.41)	392	1.80
Tranbaugh R	**257**	**1**	**0.39**	**1.76**	**0.33**	**(0.00, 1.83)**	**342**	**1.83**
Mount Sinai Beth Israel	158	0	0.00	1.63	0.00	(0.00, 2.12)	205	1.49
NYP-Brooklyn Methodist	97	1	1.03	1.99	0.77	(0.01, 4.29)	133	2.42
NYP-Weill Cornell	2	0	0.00	0.86	0.00	(0.00,100.0)	4	0.00
Vaynblat M	**114**	**3**	**2.63**	**1.66**	**2.36**	**(0.47, 6.90)**	**181**	**3.13**
Maimonides Medical Ctr	81	3	3.70	2.02	2.72	(0.55, 7.96)	123	2.47
NYU Hospitals Center	33	0	0.00	0.76	0.00	(0.00,21.71)	58	6.76
Williams M R	**15**	**0**	**0.00**	**1.01**	**0.00**	**(0.00,36.18)**	**258**	**1.21**
NYP-Columbia Presby.	7	0	0.00	0.85	0.00	(0.00,91.86)	133	0.00 **
NYU Hospitals Center	8	0	0.00	1.14	0.00	(0.00,59.70)	125	3.56
Worku B M	**41**	**0**	**0.00**	**2.70**	**0.00**	**(0.00, 4.93)**	**61**	**0.00**
NYP-Brooklyn Methodist	41	0	0.00	2.70	0.00	(0.00, 4.93)	60	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	1	0.00

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

SURGEON AND HOSPITAL VOLUMES FOR TOTAL ADULT CARDIAC SURGERY, 2014-2016

Table 8 presents, for each hospital and for each surgeon performing at least 200 cardiac operations in any hospital in 2014-2016 and/or performing one or more cardiac operations in each of the years 2014-2016, the total number of Isolated CABG operations, the total number of Valve or Valve/CABG operations, the total number of Other Cardiac operations and Total Cardiac operations. As in Table 6, results for surgeons not meeting the above criteria are grouped together in an "All Others" category.

The Isolated CABG column includes patients who undergo bypass of one or more of the coronary arteries with no other major heart surgery earlier in the same admission. Valve or Valve/CABG volumes include the total number of cases for the eight Valve and Valve/CABG groups that were identified in Table 4. Other Cardiac Surgery refers to cardiac procedures not represented by Isolated CABG, and Valve or Valve/CABG operations and includes, but is not limited to: TAVR, repairs of congenital conditions, heart transplants, aneurysm repairs, ventricular reconstruction and ventricular assist device insertions. Total Cardiac Surgery is the sum of the previous three columns and includes any surgery on the heart or great vessels.

Table 8

Surgeon and Hospital Volume for Isolated CABG, Valve or Valve/CABG, Other Cardiac Surgery, and Total Adult Cardiac Surgery, 2014-2016.

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Albany Med. Ctr				
Akujuo A C	176	97	46	319
Bennett E	34	183	359	576
Britton L	128	124	94	346
Depan H	115	118	22	255
Zhang L	121	21	15	157
All Others	161	66	119	346
Total	**735**	**609**	**655**	**1999**
Arnot Ogden Med Ctr				
Hoffman D	113	35	6	154
All Others	100	23	2	125
Total	**213**	**58**	**8**	**279**
Bassett Medical Center				
Choumarov K	1	0	0	1
Daniel S R	109	49	12	170
Kelley J	157	89	25	271
Total	**267**	**138**	**37**	**442**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Bellevue Hospital Ctr				
Balsam L B	100	138	52	290
Culliford A	114	63	20	197
Malhotra S P	0	1	22	23
Smith D E	121	55	16	192
All Others	33	22	24	79
Total	**368**	**279**	**134**	**781**
Buffalo General Med Ctr				
Aldridge J	191	30	133	354
Ashraf M	587	119	250	956
Grosner G	559	594	239	1392
Total	**1337**	**743**	**622**	**2702**
Ellis Hospital				
Choumarov K	229	52	18	299
Reich H	142	128	17	287
Singh C	220	92	11	323
Total	**591**	**272**	**46**	**909**
Good Sam - Suffern				
Elmann E M	30	36	2	68
Ng A F	85	42	2	129
Somberg E D	119	32	0	151
All Others	71	14	2	87
Total	**305**	**124**	**6**	**435**
Good Sam-West Islip				
Henry M J	1	0	0	1
Lamendola C	235	171	28	434
Rovensky M	322	81	12	415
All Others	3	0	0	3
Total	**561**	**252**	**40**	**853**
Lenox Hill Hospital				
Brinster D R	24	64	257	345
Hemli J M	33	6	9	48
Patel N C	631	261	37	929
Pirelli L	19	19	58	96
Scheinerman S J	91	54	58	203
All Others	10	38	67	115
Total	**808**	**442**	**486**	**1736**
Long Island Jewish MC				
Graver L	105	161	28	294
Hartman A	3	4	1	8
Meyer D B	0	4	12	16
Palazzo R	129	33	41	203
Scheinerman S J	62	47	29	138
All Others	0	0	13	13
Total	**299**	**249**	**124**	**672**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Maimonides Medical Ctr				
Abrol S	133	118	106	357
Crooke G	87	60	157	304
Jacobowitz I	254	127	113	494
Ribakove G	83	79	54	216
Saunders P	53	7	54	114
Stephens G A	7	22	4	33
Tak V M	3	6	2	11
Vaynblat M	81	42	24	147
Total	**701**	**461**	**514**	**1676**
Mercy Hospital-Buffalo				
Adkins M	369	102	17	488
Aldridge J	1	1	0	2
Ashraf M	1	0	0	1
Bell-Thomson J	230	214	45	489
Downing S W	431	175	97	703
Joyce F	2	0	0	2
All Others	35	2	1	38
Total	**1069**	**494**	**160**	**1723**
Montefiore - Moses				
Bello R A	4	1	21	26
Chau M L	3	1	40	44
D Alessandro D A	123	90	50	263
Derose J J	7	3	105	115
Goldstein D J	143	117	123	383
Jakobleff W A	200	43	18	261
Michler R E	83	148	41	272
All Others	0	6	34	40
Total	**563**	**409**	**432**	**1404**
Montefiore - Weiler				
Bello R A	187	86	41	314
Chau M L	40	4	54	98
D Alessandro D A	1	0	1	2
Derose J J	323	197	83	603
Goldstein D J	42	20	6	68
Jakobleff W A	2	1	2	5
Michler R E	1	8	0	9
All Others	0	0	1	1
Total	**596**	**316**	**188**	**1100**
Mount Sinai Beth Israel				
Hoffman D	28	6	7	41
Puskas J D	359	141	35	535
Tranbaugh R	158	47	12	217
All Others	21	10	31	62
Total	**566**	**204**	**85**	**855**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Mount Sinai Hospital				
Adams D H	4	1051	78	1133
Anyanwu A C	56	104	353	513
Boateng P	32	65	25	122
Chikwe J Y	77	42	25	144
El-Eshmawi A M	14	41	8	63
Filsoufi F	272	107	21	400
Puskas J D	42	5	4	51
Reddy R C	277	142	87	506
Stelzer P	29	272	380	681
Stewart A S	116	310	557	983
Tannous H J	61	26	5	92
Varghese R	100	102	21	223
All Others	2	4	50	56
Total	**1082**	**2271**	**1614**	**4967**
Mount Sinai St. Lukes				
Balaram S K	181	88	31	300
Chikwe J Y	86	80	22	188
Puskas J D	7	1	0	8
Swistel D	93	103	14	210
All Others	0	1	1	2
Total	**367**	**273**	**68**	**708**
NYP-Brooklyn Methodist				
Gulkarov I M	159	101	58	318
Tranbaugh R	97	36	13	146
Worku B M	41	19	14	74
All Others	51	43	58	152
Total	**348**	**199**	**143**	**690**
NYP-Columbia Presby.				
Argenziano M	244	304	40	588
Bacchetta M D	0	1	151	152
Bacha E	0	1	116	117
Borger M A	34	234	224	492
Chai P J	0	5	74	79
George I	142	198	836	1176
Naka Y	265	162	199	626
Quaegebeur J	0	1	54	55
Smith C	194	581	80	855
Takayama H	319	289	194	802
Takeda K	43	35	95	173
Williams M R	7	126	243	376
All Others	1	1	136	138
Total	**1249**	**1938**	**2442**	**5629**
NYP-Queens				
Lang S	284	98	23	405
All Others	50	9	10	69
Total	**334**	**107**	**33**	**474**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
NYP-Weill Cornell				
Bacha E	0	5	17	22
Chai P J	0	3	7	10
Girardi L	246	657	678	1581
Gulkarov I M	2	3	0	5
Krieger K	159	264	20	443
Lang S	8	9	2	19
Salemi A	65	102	425	592
Tranbaugh R	2	2	2	6
Worku B M	0	1	0	1
All Others	88	110	48	246
Total	**570**	**1156**	**1199**	**2925**
NYU Hospitals Center				
Balsam L B	2	2	38	42
Culliford A	37	43	14	94
Galloway A	60	411	57	528
Grossi E	7	7	38	52
Loulmet D F	47	406	74	527
Malhotra S P	0	2	15	17
Mosca R S	0	9	22	31
Smith D E	26	17	12	55
Swistel D	48	73	8	129
Vaynblat M	33	25	5	63
Williams M R	8	117	609	734
Zias E	326	234	37	597
All Others	4	9	21	34
Total	**598**	**1355**	**950**	**2903**
NYU Winthrop Hospital				
Goncalves J A	97	134	631	862
Kokotos W J	156	150	74	380
Salhab K F	179	52	62	293
Schubach S	178	104	68	350
All Others	0	0	1	1
Total	**610**	**440**	**836**	**1886**
North Shore Univ Hosp				
Brinster D R	11	6	33	50
Esposito R	234	168	289	691
Fernandez H A	5	5	6	16
Graver L	170	174	33	377
Hall M	95	58	17	170
Hartman A	119	250	103	472
Kalimi R	51	63	10	124
Palazzo R	109	47	71	227
Pogo G	45	32	13	90
Taylor J	132	119	41	292
Vatsia S	190	125	92	407
Yu P J	86	36	77	199
All Others	0	0	10	10
Total	**1247**	**1083**	**795**	**3125**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Rochester General Hosp				
Cheeran D	501	435	167	1103
Kirshner R	454	593	92	1139
Yankey G K N	168	42	54	264
Total	**1123**	**1070**	**313**	**2506**
Southside Hospital				
Fernandez H A	81	57	25	163
Hartman A	25	67	30	122
Kalimi R	206	191	99	496
Manetta F	173	71	71	315
Pogo G	45	20	20	85
Taylor J	1	1	0	2
All Others	1	0	0	1
Total	**532**	**407**	**245**	**1184**
St. Elizabeth Med Ctr				
Cahill A T	74	18	4	96
El Amir N	114	69	29	212
Joyce F	273	149	37	459
All Others	114	41	13	168
Total	**575**	**277**	**83**	**935**
St. Francis Hospital				
Bercow N	389	284	194	867
Colangelo R	548	474	37	1059
Henry M J	116	15	84	215
Lamendola C	5	5	3	13
Lundy E F	283	125	15	423
Robinson N	97	338	599	1034
Rovensky M	13	4	0	17
All Others	43	12	2	57
Total	**1494**	**1257**	**934**	**3685**
St. Josephs Hospital				
Green G R	242	295	183	720
Lutz C J	253	347	167	767
Marvasti M	157	161	67	385
Nazem A	283	216	80	579
Zhou Z	289	308	201	798
Total	**1224**	**1327**	**698**	**3249**
St. Peters Hospital				
Edwards N	182	252	64	498
Karavas A N	388	134	43	565
Saifi J	173	341	117	631
Terrien C M	311	206	107	624
Total	**1054**	**933**	**331**	**2318**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Staten Island Univ Hosp				
McGinn J	200	76	1	277
Rosell F M	259	39	31	329
Wohler A M	69	23	26	118
All Others	16	5	6	27
Total	**544**	**143**	**64**	**751**
Strong Memorial Hosp				
Alfieris G	0	1	18	19
Gensini P F	0	10	46	56
Knight P	417	558	343	1318
Lehoux J M	124	39	79	242
Massey H	50	38	96	184
All Others	66	25	59	150
Total	**657**	**671**	**641**	**1969**
UHS-Wilson Med Ctr				
Wong K	181	100	52	333
Yousuf M	216	98	69	383
All Others	2	3	4	9
Total	**399**	**201**	**125**	**725**
UVM Health Network CVP				
All Others	0	0	1	1
Total	**0**	**0**	**1**	**1**
Univ. Hosp-Brooklyn				
Tak V M	35	39	5	79
All Others	87	29	10	126
Total	**122**	**68**	**15**	**205**
Univ. Hosp-Stony Brook				
Bilfinger T	69	20	57	146
Chikwe J Y	18	11	1	30
Fernandez H A	189	118	74	381
Gupta S	131	129	84	344
McLarty A	38	9	48	95
Tak V M	54	19	1	74
Tannous H J	13	1	4	18
Taylor J	203	189	68	460
All Others	42	10	2	54
Total	**757**	**506**	**339**	**1602**
Univ. Hosp-Upstate				
Dunton R F	62	32	10	104
All Others	29	28	19	76
Total	**91**	**60**	**29**	**180**
Vassar Bros. Med Ctr				
Sarabu M	106	217	90	413
Shahani R B	170	100	19	289
Zakow P	220	143	34	397
All Others	2	0	0	2
Total	**498**	**460**	**143**	**1101**

Table 8 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Westchester Med Ctr				
Kai M	125	56	102	283
Lafaro R	42	27	12	81
Lansman S	11	3	5	19
Malekan R	150	72	116	338
Spielvogel D	204	100	128	432
Tang G H L	0	18	261	279
All Others	5	4	19	28
Total	**537**	**280**	**643**	**1460**
TOTAL	**24991**	**21532**	**16221**	**62744**

Criteria Used in Reporting Significant Risk Factors (2016)

Based on Documentation in Medical Records

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

Patient Risk Factor	Definitions
Comorbidities	
Cerebrovascular Disease	Cerebrovascular disease prior to surgery documented by any one of the following: • CVA (symptoms > 24 hrs after onset, presumed to be from vascular etiology); • TIA (recovery within 24 hrs); • Non-invasive carotid test with > 79% diameter occlusion.; or • Prior carotid surgery or stenting or prior cerebral aneurysm clipping or coil. Does not include neurological disease processes such as metabolic and/or anoxic ischemic encephalopathy.
Chronic Lung Disease	The patient has chronic lung disease with pre-operative findings of one of the following: • Mild - FEV_1 60% to 75% of predicted, and/or on chronic inhaled or oral bronchodilator therapy. • Moderate - FEV_1 50% to 59% of predicted, and/or on chronic steroid therapy aimed at lung disease. • Severe - FEV_1 <50% predicted, and/or Room Air pO_2 < 60 or Room Air pCO_2 > 50.
Congestive Heart Failure (CHF), Current	Within 2 weeks prior to the procedure, the patient has a clinical diagnosis of CHF and symptoms requiring treatment for CHF. Note: Physician diagnosis of CHF may be based on one of the following: • Paroxysmal nocturnal dyspnea (PND) • Dyspnea on exertion (DOE) due to heart failure • Chest X-Ray showing pulmonary congestion Documentation must include the presence of a diagnosis of CHF, evidence of symptoms, and treatment for CHF.
Diabetes	The patient has a history of diabetes diagnosed and/or treated by a physician. For patients with Diabetes, indicate the patient's diabetes control method as presented on admission. Patients placed on a pre-procedure diabetic pathway of insulin drip at admission but whose diabetes was controlled by diet or oral methods are not coded as being treated with insulin. Choose the most aggressive therapy from the order below • Insulin: insulin treatment (includes any combination with insulin) • Other subcutaneous medications (e.g., GLP-1 agonist) • Oral: treatment with oral agent (includes oral agent with or without diet treatment) • Diet only: Treatment with diet only • None: no treatment for diabetes • Other: other adjunctive treatment, non-oral/insulin/diet • Unknown.
Endocarditis	Patients with two or more positive blood cultures without other obvious source with demonstrated valvular vegetations or acute valvular dysfunction caused by infection. Includes patients who are on antibiotics at the time of surgery. Excludes patients who have completed antibiotic therapy and have no evidence of residual infection.

Patient Risk Factor	Definitions
Comorbidities, *continued*	
Extensive Aortic Atherosclerosis	Ascending, transverse, and/or descending aortic atherosclerosis marked by either extensive calcification or luminal atheroma such that the intended surgical procedure is altered.
Hepatic Failure	The patient has cirrhosis or other liver disease and has a bilirubin > 2 mg/dL and a serum albumin < 3.5 g/dL.
Peripheral Vascular Disease	Angiographic demonstration of at least 50% narrowing in a major aortoiliac or femoral/popliteal vessel, previous surgery for such disease, absent femoral or pedal pulses, or the inability to insert a catheter or intra-aortic balloon due to iliac aneurysm or obstruction of the aortoiliac or femoral arteries Ankle-Brachial Index < 0.9 is also acceptable documentation.
Renal Failure, Creatinine	Last pre-operative serum creatinine was in the indicated range.
Renal Failure Requiring Dialysis	The patient is currently (prior to surgery) undergoing dialysis.
Ventricular Function	
Ejection Fraction	Value of the ejection fraction taken closest to but before the start of the procedure. Intraoperative direct observation of the heart is not an adequate basis for a visual estimate of the ejection fraction. Intra-operative TEE is acceptable, if no pre-operative Ejection Fraction is available. If no ejection fraction is reported, the ejection fraction is considered "normal" for purposes of analysis and is classified with the reference category.
Previous MI	One or more myocardial infarctions (MI) in the specified time period prior to surgery.
STEMI	The patient presented with a ST-elevation myocardial infarction (STEMI) or its equivalent as documented in the medical record. STEMIs are characterized by the presence of both criteria: a. ECG evidence of STEMI b. Cardiac biomarkers (creatinine kinase-myocardial band, Troponin T or I) exceed the upper limit of normal according to the individual hospital's laboratory parameters with a clinical presentation which is consistent or suggestive of ischemia.
Previous Procedures	
Previous PCI This Episode of Care	The patient has had a Percutaneous Coronary Intervention prior to the current cardiac surgery but during this episode of care.
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.
Previous CABG Surgery	Prior to this cardiac surgery, the patient has previously undergone CABG surgery.
Vessels Diseased	
Left Main Disease	The patient has at least a 50 percent blockage in the Left Main Coronary Artery.

MEDICAL TERMINOLOGY

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

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

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

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

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

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

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

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

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

incompetent valves – A valve that does not close tightly.

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

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

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

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

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

stenotic valve – A valve that does not open fully.

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

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

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

Appendix 1
Risk Factors for CABG In-Hospital / 30-Day Deaths in New York State in 2016

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 2016 are presented in Appendix Table 1.

Roughly speaking, the odds ratio for a risk factor represents the number of times more likely to die in the hospital during or after CABG or after discharge but within 30 days of the surgery a patient with that risk factor is than a patient without the risk factor, all other risk factors being the same. For example, the odds ratio for the risk factor Non-Refractory Shock is 7.577. This means that a patient who has Non-Refractory Shock prior to surgery is approximately 7.577 times as likely to die in the hospital or after discharge within 30 days of surgery as a patient who does not have Non-Refractory Shock but who has the same other significant risk factors.

Female and Chronic Lung Disease (severe) are also interpreted in this way. The patient either has the risk factor or does not have the risk factor.

For age, the odds ratio roughly represents the number of times more likely to die a patient who is older than 55 is compared to a patient who is one year younger but otherwise has the same significant risk factors. Thus, the chance of in-hospital / 30-day death for a patient undergoing CABG who is 56 years old is approximately 1.049 times that of a patient 55 years old undergoing CABG, if all other risk factors are the same. All patients age 55 and younger have roughly the same odds of in-hospital / 30-day mortality if their other risk factors are identical.

Body Mass Index (BMI) is a relationship of weight to height. It is a measure of body size that is the ratio of the weight of the body in kilograms to the square of its height in meters and is considered an indication of nutritional status of the body. This model includes terms for both BMI and BMI-squared, reflecting the complex relationship between BMI and 30-day readmission. 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.

Previous MI is categorized in three groups. Two groups represent patients who have experienced a STEMI or NSTEMI within seven days before surgery. The odds ratios for both of these groups are relative to patients who have not experienced an MI within 7 days prior to surgery.

Ejection Fraction, which is the percentage of blood in the heart's left ventricle that is expelled when it contracts (with more denoting a healthier heart), is subdivided into three ranges (less than 30 percent, 30 percent to 39 percent, and 40 percent or more). The last range is referred to as the reference category. This means that the odds ratio that appears for the other Ejection Fraction categories in the table is relative to patients with an ejection fraction of 40 percent or more. Thus, a patient with an ejection fraction of less than 30 percent is about 3.890 times as likely to die in the hospital or within 30 days as a patient with an ejection fraction of 40 percent or higher, all other significant risk factors being the same.

Renal Failure is subdivided into four groups. The first group represents patients with serum creatinine between 1.3 and 2.0 mg/dL who are not on dialysis. The second group includes patients with creatinine of 2.1 mg/dL or greater who are not on dialysis. The third 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 1.3 mg/dL.

Appendix Table 1

Multivariable Risk Factor Equation for CABG In-Hospital / 30-Day Deaths in New York State in 2016.

		Logistic Regression		
Patient Risk Factor	**Prevalence (%)**	**Coefficient**	**P-Value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 55	—	0.0482	<.0001	1.049
Body Mass Index, kg/m^2	—	-0.1653	0.0142	—
Body Mass Index – squared, kg^2/m^4	—	0.0030	0.0019	—
Female	24.36	0.6585	0.0003	1.932
Ventricular Function				
Previous MI				
No MI within 7 Days	74.62	— Reference —		1.000
STEMI within 7 Days	3.95	0.8384	0.0106	2.313
NSTEMI within 7 Days	21.43	0.3950	0.0429	1.484
Ejection Fraction				
Ejection Fraction 40% or greater	83.84	— Reference —		1.000
Ejection Fraction < 30%	6.76	1.3584	<.0001	3.890
Ejection Fraction 30-39%	10.00	0.5640	0.0222	1.758
Hemodynamic State				
Non-refractory shock	0.47	2.0252	<.0001	7.577
Comorbidities				
Chronic Lung Disease, Severe	3.37	0.9558	0.0009	2.601
Renal Failure				
No Renal Failure	76.97	— Reference —		1.000
Creatinine 1.3-2.0 mg/dl	16.78	0.7802	0.0001	2.182
Creatinine ≥2.1 mg/dl	2.48	0.9613	0.0139	2.615
Requiring Dialysis	3.77	1.2958	<.0001	3.654

Intercept = -3.6094
C Statistic = 0.787

Appendix 2
Risk Factors for CABG 30-Day Readmissions in New York State in 2016

The significant pre-procedural risk factors for 30-day readmissions following CABG in 2016 are presented in the table that follows. Female, Previous MI within 20 days, Chronic Lung Disease (severe), CHF-Current, and Previous Valve Surgery or Intervention are interpreted in the same way as Non-Refractory Shock in Appendix 1. The patient either has the risk factor or does not.

Age appears in the model as a linear and quadratic term, reflecting the complex relationship between age and in-hospital/ 30-day mortality. The quadratic function of age used in this statistical model reflects the fact that mortality increases at an increasing rate as patients get older. 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

Diabetes and renal failure are interpreted the same as renal failure is interpreted in Appendix 1, whereby the odds of mortality for each category are relative to the reference category.

Appendix Table 2

Multivariable Risk Factor Equation for CABG / 30-Day Readmission in New York State in 2016.

		Logistic Regression		
Patient Risk Factor	**Prevalence (%)**	**Coefficient**	**P-Value**	**Odds Ratio**
Demographic				
Age: Number of years	—	-0.1288	<0.0001	—
Age Squared Term	—	0.0011	<0.0001	—
Female	24.43	0.3091	<0.0001	1.362
Ventricular Function				
Previous MI within 20 Days	31.49	0.2479	0.0006	1.281
Comorbidities				
Chronic Lung Disease, Severe	3.34	0.5637	0.0003	1.757
Congestive Heart Failure (CHF), Current (within 2 weeks)	17.18	0.2556	0.0024	1.291
Diabetes				
No Diabetes with Oral or Insulin Treatment	57.06	— Reference —		1.000
Oral Medication	24.15	0.2896	0.0006	1.336
Insulin Treatment	18.79	0.6607	<0.0001	1.936
Renal Failure				
No Renal Failure	88.60	— Reference —		1.000
Creatinine 1.6-2.0 mg/dl	5.25	0.3682	0.0057	1.445
Creatinine ≥2.1 mg/dl	2.44	0.5415	0.0026	1.719
Requiring Dialysis	3.71	1.2383	<0.0001	3.450
Previous Procedures				
Previous Valve Surgery or Intervention	0.32	1.0735	0.0166	2.926

Intercept = 1.1582

C-Statistic = 0.665

Appendix 3
Risk Factors For Valve Surgery In-Hospital / 30-Day Mortality in 2014-2016

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve surgery in the 2014-2016 time period are presented in the table that follows.

For Age in years, the odds ratio represents the increased likelihood for in-hospital/30-day mortality for each one year increase in age. If two patients have all of the same significant risk factors but one patient is one year older, the older patient will be 1.047 times as likely die in the hospital or within 30 days of discharge.

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

The odds ratio for type of valve surgery roughly represents the number of times more likely to die in the hospital during or after surgery or after discharge but within 30 days a patient with a specific valve surgery is than a patient who has had aortic valve replacement surgery, all other risk factors being the same. For example, a patient who has a mitral valve replacement surgery is roughly 1.728 times as likely to die in the hospital during or after surgery or after discharge but within 30 days of surgery as a patient with aortic valve replacement surgery, all other significant risk factors being the same.

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

The interpretation of renal failure in this model is similar to that provided in Appendix 2 except in this case there are only two levels of elevated serum creatinine.

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

Appendix Table 3

Multivariable Risk Factor Equation for Valve Surgery In-Hospital / 30-Day Deaths In NYS, 2014-2016.

		Logistic Regression		
Patient Risk Factor	**Prevalence %**	**Coefficient**	**P-Value**	**Odds Ratio**
Demographic				
Age: Number of years	—	0.0460	<.0001	1.047
Body Surface Area, $0.1m^2$	—	-0.5968	0.0001	—
Body Surface Area – squared, $0.01m^4$	—	0.0140	0.0002	—
Type of Valve Surgery				
Aortic Valve Replacement	46.67	— Reference —		1.000
Mitral Valve Replacement	13.48	0.5469	0.0006	1.728
Mitral Valve Repair	17.82	-0.5505	0.0327	0.577
Multiple Valve Repair/Replacement	22.03	0.8073	<.0001	2.242
Comorbidities				
Chronic Lung Disease				
None	84.60	— Reference —		1.000
Mild or Moderate	11.62	0.5008	0.0004	1.650
Severe	3.78	0.8956	<.0001	2.449
Diabetes with Insulin Treatment	6.10	0.6752	<.0001	1.964
Congestive Heart Failure (CHF), Current (within 2 weeks)	35.39	0.3570	0.0018	1.429
Endocarditis	5.80	0.5347	0.0040	1.707
Extensive Aortic Atherosclerosis	1.55	0.6156	0.0278	1.851
Renal Failure				
No Renal Failure				
Creatinine 1.6-2.0 mg/dl	4.67	0.4417	0.0180	1.555
Creatinine ≥2.1 mg/dl	2.07	0.7374	0.0033	2.091
Requiring Dialysis	2.63	1.5274	<.0001	4.606
Vessels Diseased				
Left Main Disease	0.61	1.0086	0.0119	2.742
Previous Cardiac Procedures				
Previous Valve Surgery or Intervention	12.33	0.3771	0.0064	1.458
Previous Cardiac Surgery, other than CABG or Valve	2.46	0.6496	0.0143	1.915

Intercept = -1.5722

C Statistic = 0.777

Appendix 4
Risk Factors for Valve and CABG Surgery In-Hospital / 30-Day Mortality in New York State in 2014-2016

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve and CABG surgery in the 2014-2016 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 a patient with a specific Valve with CABG surgery is than a patient who had aortic valve repair or replacement and CABG surgery, all other risk factors being the same. For example, a patient who has a mitral valve replacement and CABG surgery is 2.733 times as likely to die in the hospital or within 30 days after discharge as a patient with aortic valve repair or replacement and CABG surgery, all other significant risk factors being the same.

Ejection Fraction, which is the percentage of blood in the heart's left ventricle that is expelled when it contracts (with more denoting a healthier heart), is subdivided into three ranges (less than 20 percent, 20 percent to 29 percent, and 30 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 Valve with CABG patient with an ejection fraction of less than 20 percent is about 3.370 times as likely to die in the hospital or within 30 days as a patient with an ejection fraction of 20 percent or higher, all other significant risk factors being the same.

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

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, 2014-2016.

		Logistic Regression		
Patient Risk Factor	**Prevalence (%)**	**Coefficient**	**P-Value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 45	—	0.0563	<.0001	1.058
Female Gender	31.53	0.5219	0.0003	1.685
Body Surface Area ($0.1m^2$)	—	-1.0515	<.0001	—
Body Surface Area – squared ($0.01m^4$)	—	0.0260	<.0001	—
Type of Valve (with CABG)				
Aortic Valve Replacement	61.86	— Reference —		1.000
Mitral Valve Replacement	11.21	1.0054	<.0001	2.733
Mitral Valve Repair	13.73	-0.0649	0.7652	0.937
Multiple Valve Repair/Replacement	13.20	0.5084	0.0033	1.663
Ventricular Function				
Ejection Fraction				
Ejection Fraction 30% or greater	91.53	— Reference —		1.000
Ejection Fraction < 20 %	1.73	1.2148	0.0003	3.370
Ejection Fraction 20-29 %	6.74	0.5883	0.0037	1.801
Hemodynamic State				
Non-refractory shock	1.02	0.9243	0.0104	2.520
Comorbidities				
Chronic Lung Disease, Severe	5.52	0.5377	0.0111	1.712
Congestive Heart Failure (CHF), Current (within 2 weeks)	37.64	0.4040	0.0024	1.498
Endocarditis	1.33	1.1175	0.0010	3.057
Peripheral Vascular Disease	12.37	0.5422	0.0005	1.720
Renal Failure				
No Renal Failure	63.56	— Reference —		1.000
Creatinine 1.2-1.5 mg/dl	22.45	0.5157	0.0008	1.675
Creatinine ≥1.6 mg/dl	9.89	0.7639	<.0001	2.147
Requiring Dialysis	4.10	1.6415	<.0001	5.163
Previous Cardiac Procedures				
Previous CABG	3.75	1.2602	<.0001	3.526
Previous PCI, This Episode of Care	0.44	1.1560	0.0273	3.177

Intercept = 4.4025
C Statistic = 0.771

Appendix 5
Multivariable Risk Factor Equation for TAVR In-Hospital / 30-Day Deaths in New York State in 2014-2016.

The significant pre-procedural risk factors for in-hospital/30-day mortality following TAVR in the 2014-2016 time period are presented in the table that follows. The risk factors in this model are interpreted as described in Appendices 1 – 4.

Appendix Table 5

Multivariable Risk Factor Equation for TAVR In-Hospital / 30-Day Deaths in New York State in 2014-2016.

		Logistic Regression		
Risk Factor	**Prevalence (%)**	**Coefficient**	**P-value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 70	—	0.0373	.0003	1.038
Body Surface Area, 0.1 m^2	—	-0.8487	<.0001	—
Body Surface Area - squared, 0.01 m^4	—	0.0198	<.0001	—
Ventricular Function				
Ejection Fraction <20 %	1.24	0.8360	.0305	2.307
Comorbidities				
Chronic Lung Disease, Severe	10.72	0.7010	<.0001	2.016
Congestive Heart Failure (CHF), Current (within 2 weeks)	51.34	0.4723	.0003	1.604
Extensive Aortic Atherosclerosis	2.36	0.6352	.0290	1.887
Hepatic Failure	0.20	1.7841	.0236	5.954
Peripheral Vascular Disease	22.36	0.3558	.0094	1.427
Renal Failure				
No Dialysis and Creatinine < 1.6 mg/dl	80.04	— Reference —		1.000
Creatinine 1.6-2.0 mg/dl	10.26	0.4657	.0135	1.593
Creatinine ≥2.1 or Dialysis	9.70	0.9570	<.0001	2.604
Vessels Diseased				
Left Main Disease	2.27	0.9739	.0003	2.648

Intercept = 4.2058
C Statistic = 0.692

Appendix 6
Risk Factors for Isolated CABG In-Hospital / 30-Day Mortality in New York State 2014-2016

The significant pre-procedural risk factors for in-hospital/30-day mortality following isolated CABG in the 2014-2016 time period are presented in the table that follows. The risk factors in this model are interpreted as described in Appendices 1 – 5.

Appendix Table 6

Multivariable Risk Factor Equation for Isolated CABG In-Hospital / 30-Day Deaths in New York State in 2014-2016.

		Logistic Regression		
Patient Risk Factor	**Prevalence (%)**	**Coefficient**	**P-Value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 50	—	0.0462	<.0001	1.047
Body Surface Area ($0.1m^2$)	—	-0.6545	0.0001	---
Body Surface Area – squared ($0.01m^4$)	—	0.0162	<.0001	---
Female	24.17	0.3715	0.0034	1.450
Hemodynamic State				
Non-refractory Shock	0.61	1.5772	<.0001	4.842
Ventricular Function				
Ejection Fraction				
Ejection Fraction >40%	82.86	— Reference —		1.000
Ejection Fraction <30%	7.06	1.0090	<.0001	2.743
Ejection Fraction 30 – 39%	10.08	0.4246	0.0064	1.529
Previous MI				
No Previous MI within 7 days	75.64	— Reference —		1.000
STEMI, < 6 hours	0.53	1.5559	<.0001	4.739
STEMI, 6-23 hours	0.74	0.9318	0.0141	2.539
STEMI, 1 – 7 days	2.67	0.6665	0.0080	1.947
NSTEMI, < 7 days	20.42	0.4046	0.0010	1.499
Comorbidities				
Chronic Lung Disease, Severe	3.81	0.6440	0.0003	1.904
Congestive Heart Failure, Current (within 2 weeks)	16.18	0.4503	0.0004	1.569
Diabetes on Insulin Therapy	18.06	0.3410	0.0086	1.406
Peripheral Vascular Disease	12.05	0.7471	<.0001	2.111
Renal Failure				
No Renal Failure	77.83	— Reference —		1.000
Creatinine 1.3 – 1.5 mg/dl	11.02	0.5590	0.0002	1.749
Creatinine 1.6 – 2.5 mg/dl	6.46	0.7204	<.0001	2.055
Creatinine > 2.5 mg/dl	1.20	1.0195	0.0007	2.772
Requiring Dialysis	3.49	1.2908	<.0001	3.636
Previous Procedures				
Previous PCI this Episode of Care	2.48	0.8084	0.0008	2.244

Intercept = 0.2403
C Statistic = 0.804

NEW YORK STATE CARDIAC SURGERY CENTERS

Albany Medical Center
47 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 First Avenue and 27th Street
New York, New York 10016

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

Ellis Hospital
1101 Nott Street
Schenectady, New York 12308

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

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

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

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

Maimonides Medical Center
4802 Tenth 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*
10 Nathan D. Perlman Place
New York, New York 10003

Mount Sinai Hospital
One Gustave L. Levy Place
New York, New York 10029

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

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

NY Presbyterian Brooklyn Methodist Hospital
506 Sixth 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 University Hospital
259 First Street
Mineola, New York 11501

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

Rochester General Hospital
1425 Portland Avenue
Rochester, New York 14621

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

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

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

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

Southside Hospital
301 East Main Street
Bayshore, New York 11706

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

Strong Memorial Hospital
601 Elmwood Avenue
Rochester, New York 14642

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

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

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

Upstate University Hospital – 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

*No longer performs cardiac surgery.

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