ADULT CARDIAC SURGERY

in New York State

2016-2018

Department of Health

April 2022

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INTRODUCTION

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

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

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

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

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

As they develop treatment plans, we encourage doctors to discuss this information with their patients and colleagues. While these statistics are an important tool in making informed health care choices, individual treatment plans must be made by doctors and patients together after careful consideration of all pertinent factors. It is important to recognize that many factors can influence the outcome of cardiac surgery. These include the patient's health before the procedure, the skill of the operating team and general after-care. In addition, keep in mind that the information in this booklet does not include data after 2018. 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, 2015, and November 30, 2018, provided by all non-federal hospitals in NYS where cardiac surgery is performed. The analysis period for this report includes patients discharged in December 2015 but not those discharged in December 2018. 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 2018 cases includes patients discharged from December 1, 2017 through November 30, 2018. In total there were 68,260 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 183 patients residing outside the United States were excluded because these patients could not be followed after hospital discharge. There were 6 cases excluded from analysis because each 30-day mortality can only be associated with a single cardiac surgery.

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

refractory cardiogenic shock). Cardiogenic shock is a condition associated with severe hypotension (very low blood pressure). [The technical definition used in this report can be found on page 46.] 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, 568 cases with refractory cardiogenic shock were removed from the data. This accounts for 0.83 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 67,503 cardiac surgeries analyzed in this report. Isolated CABG surgery represented 38.51 percent of all adult cardiac surgery included in this report. Valve or combined valve/CABG surgery represented 28.36 percent of all adult cardiac surgery for the same period. TAVR represented 18.63 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 2016 through 2018.

While there were 8,522 CABG cases included in the mortality analysis for 2018 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 317 cases. Another 92 patients were excluded because they died in the same admission as their index CABG, so readmission was impossible. Forty-three cases were transferred to another acute care facility after CABG and so were excluded from readmission analysis. Finally, 17 cases with a discharge status of 'left against medical advice' were excluded from the readmission analysis.

In total, the number of excluded cases was 468 (one patient had more than one reason for exclusion), leaving 8,504 cases to be examined for 30-day readmission rates.

Note on Hospitals Not Performing Cardiac Surgery During Entire 2016-2018 Period

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

RISK ADJUSTMENT FOR ASSESSING PROVIDER PERFORMANCE

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

Data Collection, Data Validation and Identifying Deaths and Readmissions

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

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

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

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

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

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

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

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

Assessing Patient Risk

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

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

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

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

Predicting Patient Mortality Rates for Hospitals and Surgeons

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

Computing the Risk-Adjusted Mortality Rate

The risk-adjusted mortality rate (RAMR) represents the best estimate, based on the associated statistical model, of what the provider's (hospital's or surgeon's) mortality rate would have been if the provider had a mix of patients identical to the statewide mix. Thus, the RAMR has, to the extent possible, ironed out differences among providers in patient severity of illness, since it arrives at a mortality rate for each provider for an identical group of patients. To calculate the RAMR, the OMR is first divided by the provider's EMR. If the resulting ratio is larger than one, the provider has a higher mortality rate than expected on the basis of its patient mix; if it is smaller than one, the provider has a lower mortality rate than expected from its patient mix. For isolated CABG patients the ratio is then multiplied by the overall statewide mortality rate of 1.48 percent (in-hospital/30-day mortality in 2018) to obtain the provider's RAMR. For the three-year period 2016-2018, the ratio is multiplied by 1.58 percent (in-hospital/30-day mortality rate) for isolated CABG patients or 2.80 percent (in-hospital/30-day mortality rate) for valve or valve/CABG patients.

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

Interpreting the Risk-Adjusted Mortality Rate

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

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

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

Although there are reasons that RAMRs presented here may not be a perfect reflection

of quality of care, the Department of Health feels that this information is a valuable aid in choosing providers for cardiac surgery.

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

Patient risk of 30-day readmission is assessed using the same methods used for assessing mortality risk as described above. All potential risk factors are considered and those that are independently related to readmission are identified and given weights so as to best predict the risk of 30-day readmission for each patient. Observed readmission rates (ORR), expected readmission rates (ERR) and risk-adjusted readmission rates (RARR) are calculated in the same way that OMR, EMR and RAMR are calculated. ERR and RARR are compared to the statewide observed readmission rate (11.67 percent in 2018).

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

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

How This Initiative Contributes to Quality Improvement

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

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

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

DEFINITIONS OF KEY TERMS

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

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

The **risk-adjusted mortality rate (RAMR)** is the best estimate, based on the statistical model, of what the provider's mortality rate would have been if the provider had a mix of patients identical to the statewide mix. It is obtained by first dividing the OMR by the EMR, and then multiplying by the relevant statewide mortality rate (for example, 1.48 percent for Isolated CABG patients in 2018 or 2.80 percent for Valve or Valve/CABG patients in 2016-2018).

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

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

The **risk-adjusted readmission rate (RARR)** is the best estimate, based on the statistical model, of what the provider's readmission rate would have been if the provider had a mix of patients similar to the statewide mix. It is obtained by first dividing the ORR by the ERR, and then multiplying that quotient by the statewide readmission rate (11.67 percent 30-day readmission rate for all CABG patients discharged in 2018).

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

2018 HOSPITAL OUTCOMES FOR CABG SURGERY

Table 1 and Figure 1 present the CABG surgery results for the 36 hospitals performing this operation in NYS in 2018. 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 2018, 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 8,522 CABG surgeries was 1.48 percent. In-hospital/30-day OMRs ranged from 0.00 percent to 4.64 percent. The range of EMRs, which measure patient severity of illness, was 0.96 percent to 2.44 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 5.79 percent. One hospital (Montefiore Weiler in the Bronx) had a RAMR that was significantly higher than the statewide rate. No hospitals had RAMRs that were significantly lower than the statewide rate.

The 2018 in-hospital/30-day mortality rate of 1.48 percent for Isolated CABG is slightly lower than the 1.58 percent observed in 2017.

The in-hospital OMR for 2018 Isolated CABG discharges (not shown in Table 1) was 1.08 percent for all 8,522 patients included in the analysis.

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

Table 2 presents the 30-day readmission results for the 36 Non-Federal hospitals performing CABG in NYS in 2018. The table contains, for each hospital, the number of CABGs resulting in 2018 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 8,054 CABGs included in this 2018 analysis was 11.67 percent. Observed readmission rates ranged from 7.08 percent to 21.17 percent. The range in ERRs, which measure patient severity of illness, was between 10.08 percent and 13.71 percent. The RARRs, which measure hospital performance, range from 6.95 percent to 23.27 percent.

Based on confidence intervals for RARRs, one hospital (Montefiore- Weiler in the Bronx) had a RARR that was significantly higher than the statewide average. One hospital (Mercy Hospital in Buffalo) had a RARR that was 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, 2018 Discharges

(Listed Alphabetically by Hospital)

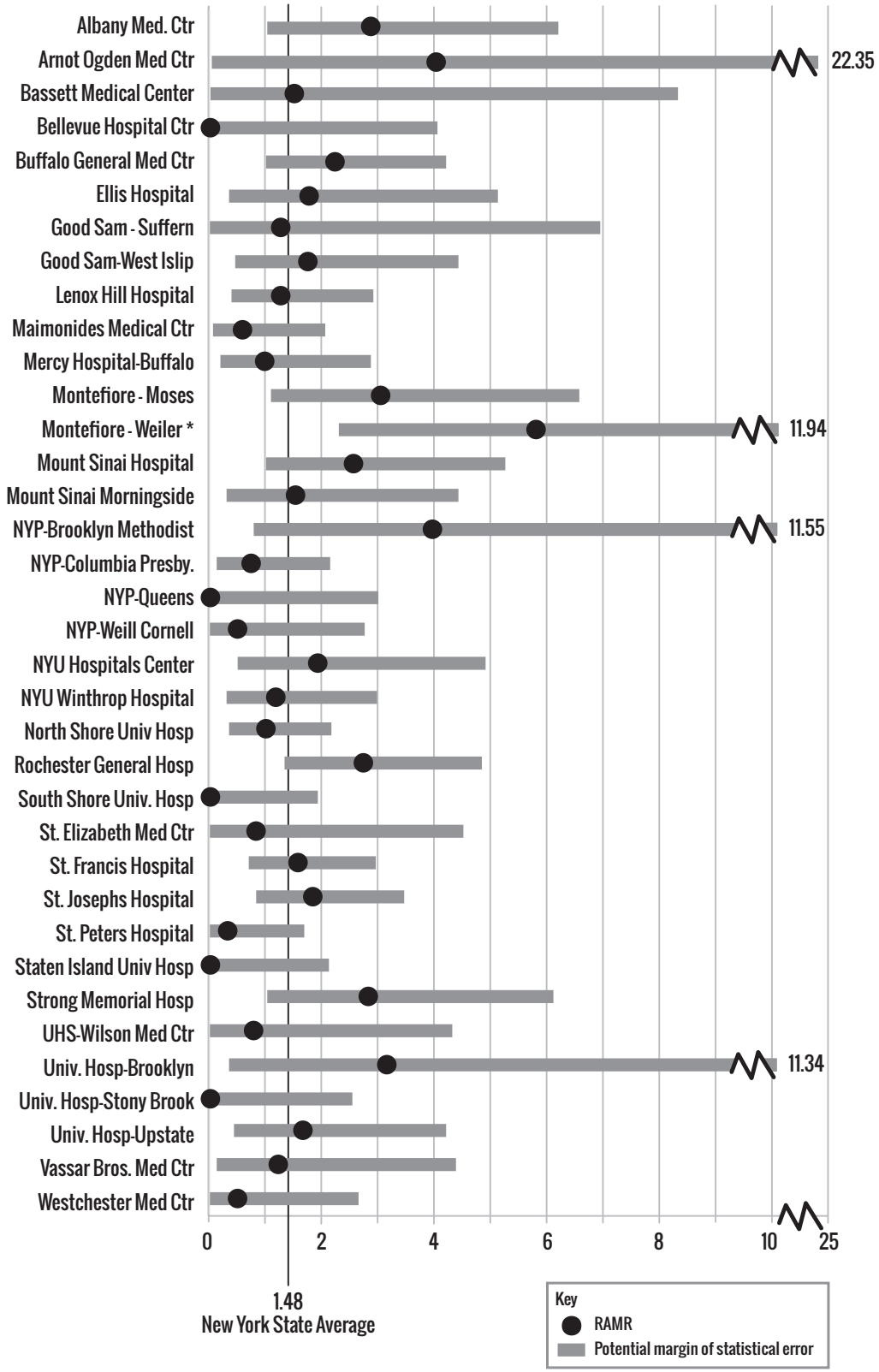
Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	261	6	2.30	1.19	2.85	(1.04, 6.21)
Arnot Ogden Med Ctr	38	1	2.63	0.97	4.02	(0.05,22.35)
Bassett Medical Center	68	1	1.47	1.45	1.50	(0.02, 8.35)
Bellevue Hospital Ctr	111	0	0.00	1.20	0.00	(0.00, 4.06)
Buffalo General Med Ctr	455	9	1.98	1.32	2.22	(1.01, 4.22)
Ellis Hospital	159	3	1.89	1.58	1.76	(0.35, 5.15)
Good Sam - Suffern	88	1	1.14	1.34	1.25	(0.02, 6.96)
Good Sam-West Islip	195	4	2.05	1.75	1.73	(0.47, 4.43)
Lenox Hill Hospital	366	5	1.37	1.61	1.26	(0.40, 2.93)
Maimonides Medical Ctr	261	2	0.77	1.98	0.57	(0.06, 2.06)
Mercy Hospital-Buffalo	340	3	0.88	1.33	0.98	(0.20, 2.87)
Montefiore - Moses	222	6	2.70	1.32	3.03	(1.11, 6.59)
Montefiore - Weiler	151	7	4.64	1.18	5.79 *	(2.32,11.94)
Mount Sinai Hospital	325	7	2.15	1.24	2.56	(1.03, 5.27)
Mount Sinai Morningside	305	3	0.98	0.96	1.52	(0.31, 4.44)
NYP-Brooklyn Methodist	98	3	3.06	1.14	3.95	(0.79,11.55)
NYP-Columbia Presby.	416	3	0.72	1.44	0.74	(0.15, 2.16)
NYP-Queens	128	0	0.00	1.41	0.00	(0.00, 3.00)
NYP-Weill Cornell	164	1	0.61	1.81	0.50	(0.01, 2.77)
NYU Hospitals Center	253	4	1.58	1.22	1.92	(0.52, 4.91)
NYU Winthrop Hospital	275	4	1.45	1.84	1.17	(0.31, 2.99)
North Shore Univ Hosp	532	6	1.13	1.67	1.00	(0.37, 2.18)
Rochester General Hosp	396	11	2.78	1.51	2.72	(1.36, 4.86)
South Shore Univ. Hosp	172	0	0.00	1.62	0.00	(0.00, 1.94)
St. Elizabeth Med Ctr	128	1	0.78	1.42	0.81	(0.01, 4.53)
St. Francis Hospital	525	9	1.71	1.62	1.56	(0.71, 2.97)
St. Josephs Hospital	456	9	1.97	1.60	1.83	(0.83, 3.47)
St. Peters Hospital	344	1	0.29	1.40	0.31	(0.00, 1.71)
Staten Island Univ Hosp	195	0	0.00	1.30	0.00	(0.00, 2.14)
Strong Memorial Hosp	208	6	2.88	1.51	2.82	(1.03, 6.13)
UHS-Wilson Med Ctr	137	1	0.73	1.39	0.78	(0.01, 4.33)
Univ. Hosp-Brooklyn	64	2	3.13	1.47	3.14	(0.35,11.34)
Univ. Hosp-Stony Brook	164	0	0.00	1.29	0.00	(0.00, 2.56)
Univ. Hosp-Upstate	147	4	2.72	2.44	1.65	(0.44, 4.22)
Vassar Bros. Med Ctr	172	2	1.16	1.41	1.22	(0.14, 4.40)
Westchester Med Ctr	203	1	0.49	1.52	0.48	(0.01, 2.67)
STATEWIDE TOTAL	**8522**	**126**	**1.48**			

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

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

Figure 1

In-Hospital/30-Day Risk-Adjusted Mortality Rates for Isolated CABG in New York State, 2018 Discharges



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

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

Table 2

In-hospital/30-Day Observed, Expected and Risk-Adjusted Readmission Rates for Isolated CABG Surgery in New York State, 2018 Discharges

(Listed Alphabetically by Hospital)

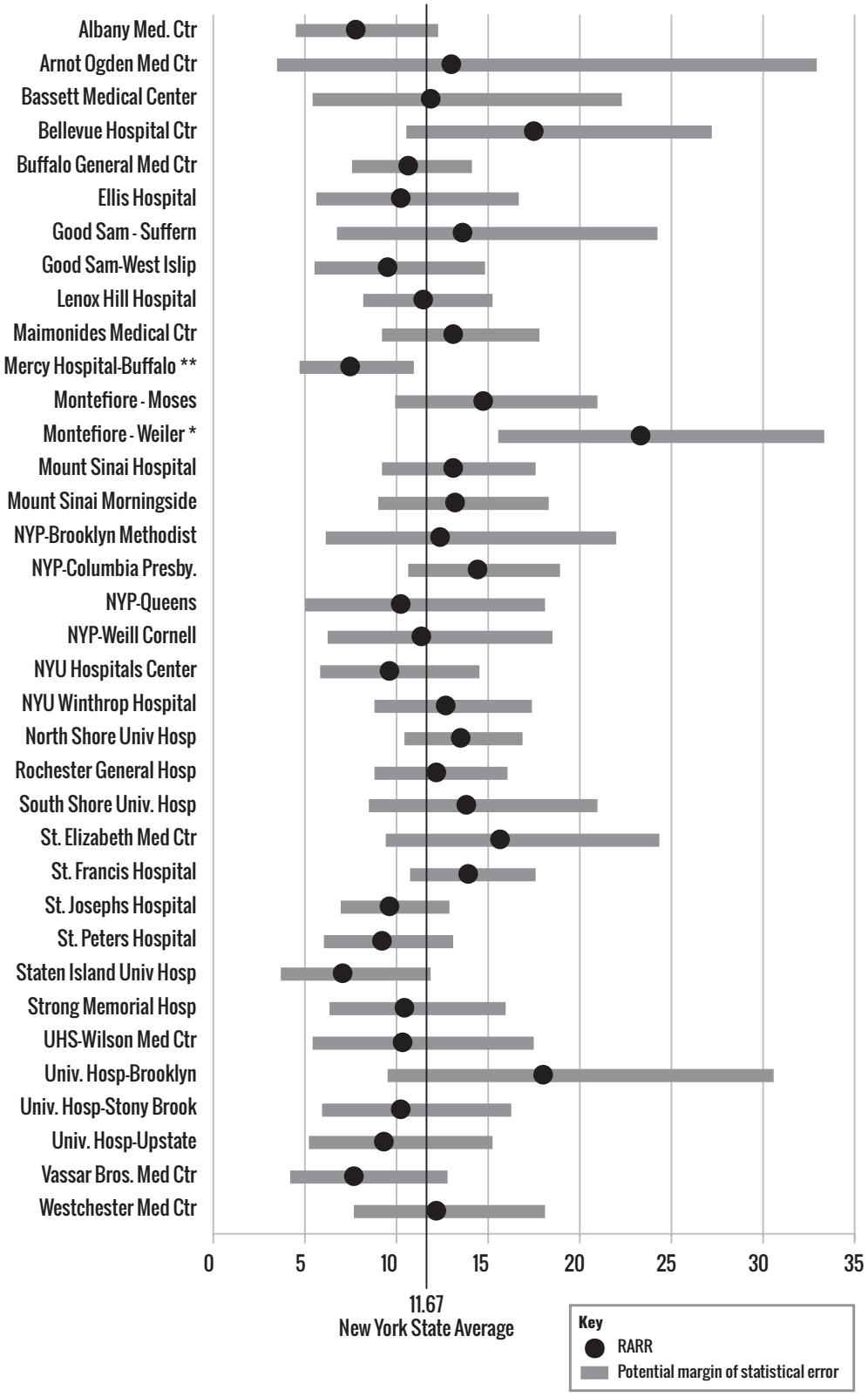
Hospital	Cases	Readmits	ORR	ERR	RARR	95% CI for RARR
Albany Med. Ctr	240	17	7.08	10.78	7.67	(4.47,12.28)
Arnot Ogden Med Ctr	35	4	11.43	10.36	12.87	(3.46,32.96)
Bassett Medical Center	65	9	13.85	13.71	11.78	(5.38,22.37)
Bellevue Hospital Ctr	111	19	17.12	11.45	17.45	(10.50,27.26)
Buffalo General Med Ctr	430	43	10.00	11.09	10.53	(7.62,14.18)
Ellis Hospital	153	15	9.80	11.32	10.11	(5.65,16.67)
Good Sam - Suffern	79	11	13.92	11.99	13.55	(6.75,24.24)
Good Sam-West Islip	190	18	9.47	11.75	9.41	(5.57,14.87)
Lenox Hill Hospital	332	42	12.65	13.03	11.33	(8.16,15.31)
Maimonides Medical Ctr	257	38	14.79	13.30	12.98	(9.18,17.82)
Mercy Hospital-Buffalo	336	24	7.14	11.37	7.33**	(4.70,10.91)
Montefiore - Moses	213	30	14.08	11.18	14.70	(9.91,20.98)
Montefiore - Weiler	137	29	21.17	10.62	23.27*	(15.58,33.41)
Mount Sinai Hospital	296	40	13.51	12.17	12.96	(9.26,17.64)
Mount Sinai Morningside	267	33	12.36	11.02	13.08	(9.00,18.38)
NYP-Brooklyn Methodist	94	11	11.70	11.07	12.33	(6.15,22.07)
NYP-Columbia Presby.	357	50	14.01	11.39	14.35	(10.65,18.92)
NYP-Queens	126	11	8.73	10.08	10.11	(5.04,18.09)
NYP-Weill Cornell	124	15	12.10	12.55	11.25	(6.29,18.56)
NYU Hospitals Center	232	21	9.05	11.11	9.51	(5.88,14.53)
NYU Winthrop Hospital	269	36	13.38	12.40	12.59	(8.82,17.43)
North Shore Univ Hosp	517	72	13.93	12.13	13.39	(10.48,16.87)
Rochester General Hosp	383	46	12.01	11.63	12.05	(8.82,16.08)
South Shore Univ. Hosp	169	21	12.43	10.57	13.73	(8.49,20.98)
St. Elizabeth Med Ctr	127	19	14.96	11.19	15.60	(9.39,24.36)
St. Francis Hospital	507	67	13.21	11.15	13.84	(10.72,17.57)
St. Josephs Hospital	442	43	9.73	11.86	9.57	(6.92,12.89)
St. Peters Hospital	333	28	8.41	10.80	9.09	(6.04,13.13)
Staten Island Univ Hosp	179	13	7.26	12.19	6.95	(3.70,11.89)
Strong Memorial Hosp	200	20	10.00	11.29	10.34	(6.31,15.97)
UHS-Wilson Med Ctr	123	13	10.57	12.05	10.24	(5.45,17.51)
Univ. Hosp-Brooklyn	62	13	20.97	13.67	17.90	(9.52,30.61)
Univ. Hosp-Stony Brook	163	17	10.43	11.99	10.15	(5.91,16.25)
Univ. Hosp-Upstate	141	15	10.64	13.43	9.25	(5.17,15.25)
Vassar Bros. Med Ctr	169	14	8.28	12.70	7.61	(4.16,12.77)
Westchester Med Ctr	196	23	11.73	11.34	12.08	(7.66,18.13)
STATEWIDE TOTAL	**8054**	**940**	**11.67**			

* 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, 2018 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.

2016-2018 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 2016-2018. The table contains, for each hospital, the combined number of Valve Only and Valve/CABG operations resulting in 2016-2018 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 19,143 combined Valve Only and Valve/CABG procedures performed at the 38 hospitals was 2.80 percent. The OMRs ranged from 0.00 percent to 8.89 percent. The range of EMRs, which measure patient severity of illness, was 1.53 percent to 4.69 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 11.43 percent. Four hospitals (Arnot Ogden Medical Center in Elmira, NYU Hospitals Center in Manhattan, Strong Memorial Hospital in Rochester, and United Health Services - Wilson in Johnson City) had RAMRs that were significantly higher than the statewide rate. Four hospitals (Lenox Hill Hospital in Manhattan, South Shore University Hospital in Bayshore, St. Joseph's Hospital in Syracuse, and Vassar Brothers Medical Center in Poughkeepsie) had RAMRs that were significantly lower than the statewide rate.

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

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

Table 4a presents valve surgery without CABG performed at the 38 cardiac surgery hospitals in NYS during 2016-2018. The table contains, for each hospital, the number of valve operations resulting in 2016-2018 discharges. In addition to the hospital volumes, the rate of in-hospital/30-day death for the state (Statewide Mortality Rate) is given for each group. Table 4b includes the same information for each of the Valve surgery groups when performed at the same time as CABG. Unless otherwise specified, when the report refers to Valve or Valve/CABG procedures it is referring to the cases included in Tables 4a and 4b.

The 2016-2018 in-hospital/30-day OMR of 2.80 percent for Valve and Valve/CABG surgeries is lower than the 3.00 percent observed for 2015-2017. The in-hospital OMR for 2016-2018 valve surgeries (not shown in Table 3) is 2.29 percent for the 19,143 patients included in this analysis.

Table 5 presents the results for transcatheter aortic valve replacement (TAVR) procedures performed at the 28 hospitals performing TAVR during the 2016-2018 discharge period. The table contains, for each hospital, the number of TAVR procedures resulting in 2016-2018 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 2016-2018 reporting period and the number of cases listed does not represent a full three year's program activity. Other hospitals may have begun performing the procedure more recently than the timeframe covered by this report.

As indicated in Table 5, the overall in-hospital/30-day mortality rate for the 12,579 TAVR procedures performed at the 28 hospitals was 2.42 percent. The OMRs ranged from 0.00 percent to 4.76 percent. The range of EMRs, which measure patient severity of illness, was 1.38 percent to 3.07 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 4.47 percent. One hospital (Albany Medical Center) had a RAMR that was statistically higher than the statewide rate. Two hospitals (Lenox Hill Hospital in Manhattan and NY Presbyterian at Columbia in Manhattan) had RAMRs that were 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, 2016-2018 Discharges

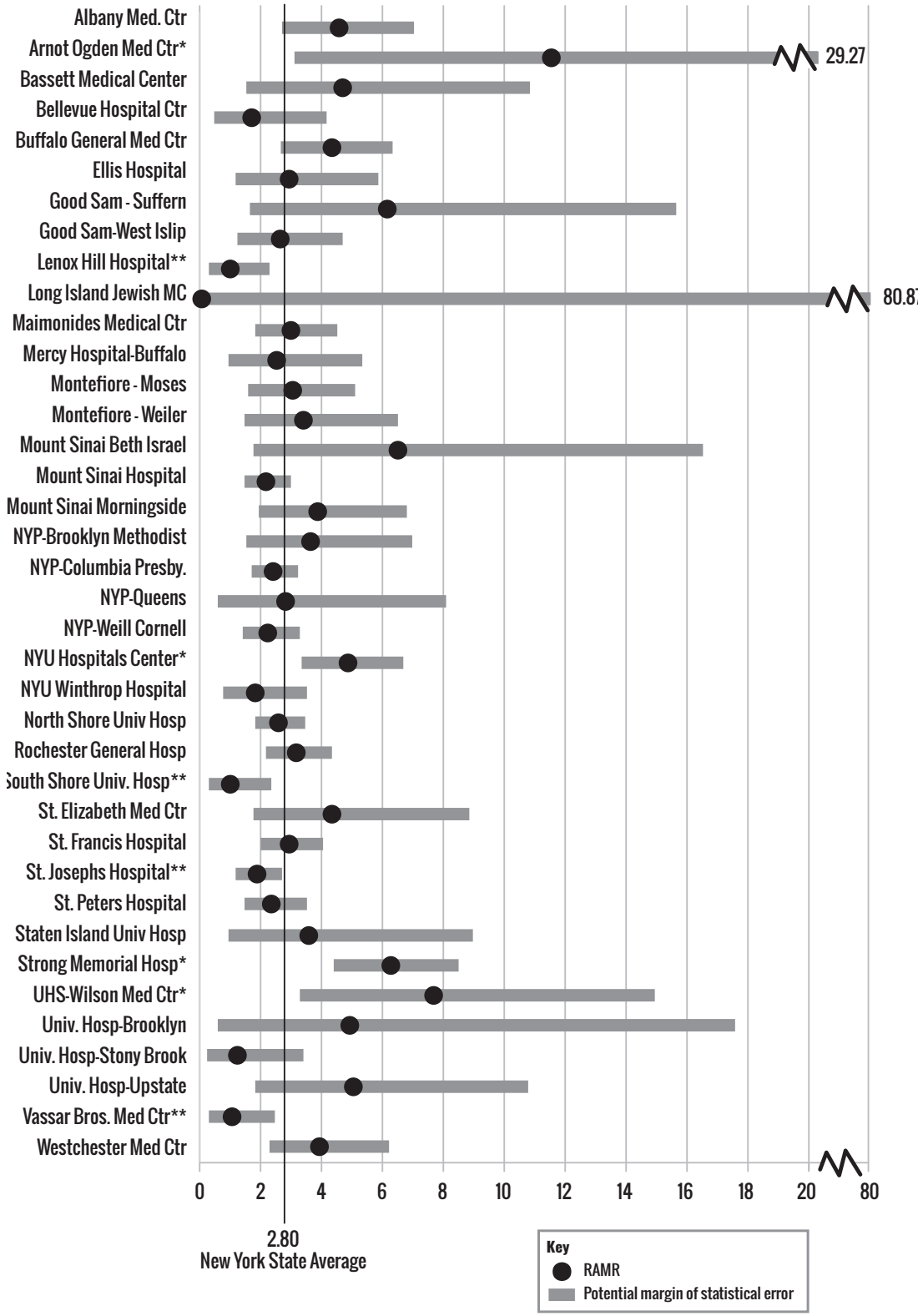
Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	505	19	3.76	2.36	4.47	(2.69, 6.98)
Arnot Ogden Med Ctr	45	4	8.89	2.18	11.43 *	(3.08,29.27)
Bassett Medical Center	111	5	4.50	2.73	4.63	(1.49,10.80)
Bellevue Hospital Ctr	270	4	1.48	2.58	1.61	(0.43, 4.12)
Buffalo General Med Ctr	726	24	3.31	2.19	4.22	(2.70, 6.28)
Ellis Hospital	254	7	2.76	2.72	2.84	(1.14, 5.85)
Good Sam - Suffern	64	4	6.25	2.88	6.09	(1.64,15.58)
Good Sam-West Islip	322	10	3.11	3.42	2.55	(1.22, 4.68)
Lenox Hill Hospital	415	4	0.96	3.02	0.89 **	(0.24, 2.29)
Long Island Jewish MC	4	0	0.00	3.18	0.00	(0.00,80.87)
Maimonides Medical Ctr	409	20	4.89	4.69	2.92	(1.78, 4.51)
Mercy Hospital-Buffalo	302	6	1.99	2.29	2.43	(0.89, 5.30)
Montefiore - Moses	396	13	3.28	3.09	2.98	(1.58, 5.09)
Montefiore - Weiler	276	8	2.90	2.47	3.28	(1.41, 6.47)
Mount Sinai Beth Israel	61	4	6.56	2.85	6.44	(1.73,16.50)
Mount Sinai Hospital	2075	33	1.59	2.13	2.09	(1.44, 2.94)
Mount Sinai Morningside	276	11	3.99	2.96	3.77	(1.88, 6.75)
NYP-Brooklyn Methodist	193	8	4.15	3.29	3.53	(1.52, 6.95)
NYP-Columbia Presby.	1515	39	2.57	3.09	2.33	(1.66, 3.19)
NYP-Queens	124	3	2.42	2.46	2.76	(0.55, 8.06)
NYP-Weill Cornell	1113	23	2.07	2.69	2.15	(1.36, 3.23)
NYU Hospitals Center	1347	35	2.60	1.53	4.77 *	(3.32, 6.63)
NYU Winthrop Hospital	336	8	2.38	3.79	1.76	(0.76, 3.47)
North Shore Univ Hosp	1223	40	3.27	3.65	2.51	(1.79, 3.41)
Rochester General Hosp	910	34	3.74	3.39	3.09	(2.14, 4.32)
South Shore Univ. Hosp	428	4	0.93	2.90	0.90 **	(0.24, 2.31)
St. Elizabeth Med Ctr	196	7	3.57	2.34	4.27	(1.71, 8.79)
St. Francis Hospital	1009	32	3.17	3.11	2.85	(1.95, 4.03)
St. Josephs Hospital	1219	24	1.97	3.06	1.80 **	(1.15, 2.68)
St. Peters Hospital	869	21	2.42	2.96	2.28	(1.41, 3.49)
Staten Island Univ Hosp	155	4	2.58	2.07	3.48	(0.94, 8.92)
Strong Memorial Hosp	783	38	4.85	2.21	6.15 *	(4.35, 8.45)
UHS-Wilson Med Ctr	166	8	4.82	1.79	7.56 *	(3.25,14.90)
Univ. Hosp-Brooklyn	54	2	3.70	2.13	4.86	(0.55,17.55)
Univ. Hosp-Stony Brook	234	3	1.28	3.10	1.16	(0.23, 3.38)
Univ. Hosp-Upstate	105	6	5.71	3.24	4.94	(1.80,10.75)
Vassar Bros. Med Ctr	360	4	1.11	3.24	0.96 **	(0.26, 2.46)
Westchester Med Ctr	293	17	5.80	4.22	3.85	(2.24, 6.16)
STATEWIDE TOTAL	**19143**	**536**	**2.80**			

* 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, 2016-2018 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 4a

Hospital Volume for Valve Surgeries in New York State, 2016-2018 Discharges

Hospital	Aortic Valve Replace (AVR)	Mitral Valve Replace (MVR)	Mitral Valve Repair	Multiple Valve			Total
				Includes MVR	Includes AVR w/o MVR	Mitral & Tricuspid Repair	
Albany Med. Ctr	182	43	63	17	13	16	334
Arnot Ogden Med Ctr	22	2	3	1	0	0	28
Bassett Medical Center	50	7	4	1	2	0	64
Bellevue Hospital Ctr	101	70	10	42	3	0	226
Buffalo General Med Ctr	271	70	92	26	19	1	479
Ellis Hospital	119	20	11	8	0	2	160
Good Sam - Suffern	23	4	8	0	0	0	35
Good Sam-West Islip	117	10	29	20	4	2	182
Lenox Hill Hospital	114	74	94	28	12	8	330
Long Island Jewish MC	3	0	1	0	0	0	4
Maimonides Medical Ctr	102	62	16	94	5	2	281
Mercy Hospital-Buffalo	117	16	13	16	3	0	165
Montefiore - Moses	110	69	44	27	7	5	262
Montefiore - Weiler	78	47	23	24	11	1	184
Mount Sinai Beth Israel	15	1	4	6	2	4	32
Mount Sinai Hospital	369	53	289	207	124	722	1764
Mount Sinai Morningside	64	21	34	23	14	14	170
NYP-Brooklyn Methodist	63	29	12	36	4	3	147
NYP-Columbia Presby.	519	156	207	170	33	28	1113
NYP-Queens	43	23	11	18	0	0	95
NYP-Weill Cornell	363	99	237	114	35	18	866
NYU Hospitals Center	323	138	554	98	42	41	1196
NYU Winthrop Hospital	76	65	27	34	8	2	212
North Shore Univ Hosp	341	151	113	133	39	24	801
Rochester General Hosp	313	59	100	35	25	11	543
South Shore Univ. Hosp	116	45	72	20	10	13	276
St. Elizabeth Med Ctr	65	15	18	10	0	0	108
St. Francis Hospital	337	86	114	80	38	14	669
St. Josephs Hospital	384	113	218	70	32	21	838
St. Peters Hospital	278	51	47	47	28	4	455
Staten Island Univ Hosp	57	8	27	5	1	7	105
Strong Memorial Hosp	392	72	156	25	8	8	661
UHS-Wilson Med Ctr	91	14	1	2	1	1	110
Univ. Hosp-Brooklyn	20	15	4	3	0	0	42
Univ. Hosp-Stony Brook	52	9	31	17	17	19	145
Univ. Hosp-Upstate	39	26	8	5	3	1	82
Vassar Bros. Med Ctr	128	46	39	15	2	2	232
Westchester Med Ctr	57	32	32	24	8	6	159
Statewide Total	**5914**	**1821**	**2766**	**1501**	**553**	**1000**	**13555**
STATEWIDE MORTALITY RATE (%)	**1.54**	**3.29**	**0.80**	**6.46**	**2.53**	**0.70**	**2.15**

Table 4b

Hospital Volume for Valve with CABG Surgeries in New York State, 2016-2018 Discharges

Hospital	Aortic Valve Replace (AVR) w/ CABG	Mitral Valve Replace (MVR) w/ CABG	Mitral Valve Repair w/ CABG	Multiple Valve w/ CABG			Total
				Includes MVR	Includes AVR w/o MVR	Mitral & Tricuspid Repair	
Albany Med. Ctr	123	13	26	4	3	2	171
Arnot Ogden Med Ctr	16	0	1	0	0	0	17
Bassett Medical Center	42	1	3	0	1	0	47
Bellevue Hospital Ctr	26	14	1	3	0	0	44
Buffalo General Med Ctr	182	27	27	3	8	0	247
Ellis Hospital	67	12	7	5	3	0	94
Good Sam - Suffern	11	2	11	2	3	0	29
Good Sam-West Islip	85	11	27	6	9	2	140
Lenox Hill Hospital	43	13	19	6	1	3	85
Long Island Jewish MC	0	0	0	0	0	0	0
Maimonides Medical Ctr	61	33	18	14	0	2	128
Mercy Hospital-Buffalo	109	12	4	11	1	0	137
Montefiore - Moses	67	37	17	10	3	0	134
Montefiore - Weiler	52	8	24	3	3	2	92
Mount Sinai Beth Israel	19	1	3	2	0	4	29
Mount Sinai Hospital	134	6	45	21	24	81	311
Mount Sinai Morningside	51	20	31	1	2	1	106
NYP-Brooklyn Methodist	18	17	3	6	1	1	46
NYP-Columbia Presby.	254	40	42	41	14	11	402
NYP-Queens	18	9	1	1	0	0	29
NYP-Weill Cornell	149	30	33	21	11	3	247
NYU Hospitals Center	85	18	36	5	5	2	151
NYU Winthrop Hospital	63	36	20	3	2	0	124
North Shore Univ Hosp	223	68	76	34	16	5	422
Rochester General Hosp	210	30	84	11	24	8	367
South Shore Univ. Hosp	85	23	29	9	2	4	152
St. Elizabeth Med Ctr	66	1	13	5	3	0	88
St. Francis Hospital	201	50	54	20	11	4	340
St. Josephs Hospital	212	58	76	20	11	4	381
St. Peters Hospital	277	17	73	19	20	8	414
Staten Island Univ Hosp	30	5	12	0	1	2	50
Strong Memorial Hosp	102	6	12	1	0	1	122
UHS-Wilson Med Ctr	55	0	0	1	0	0	56
Univ. Hosp-Brooklyn	9	1	2	0	0	0	12
Univ. Hosp-Stony Brook	51	5	19	0	9	5	89
Univ. Hosp-Upstate	14	3	4	1	1	0	23
Vassar Bros. Med Ctr	80	23	14	8	2	1	128
Westchester Med Ctr	74	26	15	11	6	2	134
Statewide Total	**3364**	**676**	**882**	**308**	**200**	**158**	**5588**
STATEWIDE MORTALITY RATE (%)	**2.85**	**8.73**	**2.95**	**12.34**	**7.50**	**6.96**	**4.38**

Table 5

In-hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for TAVR in New York State, 2016-2018 Discharges (Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Med. Ctr	735	35	4.76	3.07	3.76 *	(2.62, 5.24)
Buffalo General Med Ctr	808	19	2.35	2.25	2.54	(1.53, 3.96)
Good Sam-West Islip	40	0	0.00	2.09	0.00	(0.00,10.63)
Lenox Hill Hospital	338	0	0.00	2.03	0.00 **	(0.00, 1.30)
Maimonides Medical Ctr	228	7	3.07	2.43	3.06	(1.23, 6.31)
Mercy Hospital-Buffalo	194	4	2.06	1.99	2.52	(0.68, 6.44)
Montefiore - Moses	58	2	3.45	2.69	3.11	(0.35,11.22)
Montefiore - Weiler	257	5	1.95	2.12	2.23	(0.72, 5.20)
Mount Sinai Hospital	862	17	1.97	2.61	1.84	(1.07, 2.94)
Mount Sinai Morningside	9	0	0.00	1.38	0.00	(0.00,71.52)
NYP-Brooklyn Methodist	86	2	2.33	2.28	2.47	(0.28, 8.92)
NYP-Columbia Presby.	1237	20	1.62	2.71	1.45 **	(0.88, 2.24)
NYP-Weill Cornell	569	11	1.93	1.89	2.47	(1.23, 4.43)
NYU Hospitals Center	1031	13	1.26	1.73	1.77	(0.94, 3.02)
NYU Winthrop Hospital	840	29	3.45	2.90	2.89	(1.93, 4.15)
North Shore Univ Hosp	800	17	2.13	2.54	2.03	(1.18, 3.24)
Rochester General Hosp	456	17	3.73	2.54	3.56	(2.07, 5.70)
South Shore Univ. Hosp	279	7	2.51	2.65	2.29	(0.92, 4.73)
St. Elizabeth Med Ctr	142	4	2.82	2.42	2.82	(0.76, 7.22)
St. Francis Hospital	1260	37	2.94	2.47	2.88	(2.03, 3.97)
St. Josephs Hospital	497	10	2.01	2.71	1.80	(0.86, 3.31)
St. Peters Hospital	218	2	0.92	2.15	1.03	(0.12, 3.74)
Staten Island Univ Hosp	90	0	0.00	1.85	0.00	(0.00, 5.34)
Strong Memorial Hosp	384	15	3.91	2.35	4.02	(2.25, 6.63)
UHS-Wilson Med Ctr	221	3	1.36	1.98	1.67	(0.33, 4.87)
Univ. Hosp-Stony Brook	369	6	1.63	2.40	1.64	(0.60, 3.57)
Vassar Bros. Med Ctr	214	9	4.21	2.28	4.47	(2.04, 8.49)
Westchester Med Ctr	357	14	3.92	2.34	4.07	(2.22, 6.82)
STATEWIDE TOTAL	**12579**	**305**	**2.42**			

*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.

2016-2018 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 2016-2018. In addition, the final two columns provide the number of Isolated CABG, Valve and Valve/CABG procedures and the RAMR for these patients in 2016-2018 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 2016-2018, (b) performed at least one cardiac operation in each of the years, 2016-2018. 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 2016-2018 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, 2016-2018 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	**25997**	**410**	**1.58**				**45140**	**2.10**
Albany Med. Ctr								
Akujuo A C	188	5	2.66	1.35	3.11	(1.00, 7.25)	293	5.28 *
Bennett E	14	0	0.00	1.33	0.00	(0.00,31.14)	136	3.88
Britton L	129	2	1.55	1.14	2.14	(0.24, 7.73)	252	2.12
Devejian N	.	.	.	.	.	(. , .)	1	0.00
#Ferdinand F D	23	1	4.35	2.76	2.48	(0.03,13.80)	26	3.13
Samy S A	147	4	2.72	1.19	3.60	(0.97, 9.22)	227	4.26
#Singh C	73	2	2.74	2.10	2.05	(0.23, 7.42)	107	1.79
All Others	131	3	2.29	1.81	2.00	(0.40, 5.85)	168	1.73
Total	**705**	**17**	**2.41**	**1.49**	**2.56**	**(1.49, 4.09)**	**1210**	**3.37 ***
Arnot Ogden Med Ctr								
Hoffman D	111	1	0.90	1.46	0.97	(0.01, 5.42)	143	4.42
All Others	35	1	2.86	0.91	4.95	(0.06,27.52)	48	3.85
Total	**146**	**2**	**1.37**	**1.33**	**1.63**	**(0.18, 5.88)**	**191**	**4.31**

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
Bassett Medical Center								
Daniel S R	99	4	4.04	2.24	2.84	(0.77, 7.28)	135	3.90
Kelley J	131	1	0.76	1.68	0.72	(0.01, 3.99)	206	1.99
#Neragi-Miandoab S	3	0	0.00	1.27	0.00	(0.00,100.0)	3	0.00
Total	**233**	**5**	**2.15**	**1.91**	**1.77**	**(0.57, 4.13)**	**344**	**2.80**
Bellevue Hospital Ctr								
#Balsam L B	77	0	0.00	0.88	0.00	(0.00, 8.52)	157	0.71
#Culliford A	144	3	2.08	1.23	2.68	(0.54, 7.82)	225	2.95
#Hisamoto K	35	0	0.00	0.86	0.00	(0.00,19.31)	60	0.00
#Malhotra S P	.	.	.	.	.	(. , .)	1	0.00
#Smith D E	162	3	1.85	0.97	3.01	(0.61, 8.80)	235	2.39
#Swistel D	5	0	0.00	1.80	0.00	(0.00,64.26)	9	0.00
All Others	2	0	0.00	1.43	0.00	(0.00,100.0)	8	0.00
Total	**425**	**6**	**1.41**	**1.04**	**2.13**	**(0.78, 4.64)**	**695**	**1.84**
Buffalo General Med Ctr								
#Aldridge J	178	6	3.37	1.53	3.48	(1.27, 7.57)	223	5.31 *
Ashraf M	521	9	1.73	1.35	2.02	(0.92, 3.84)	659	2.88
Grosner G	611	8	1.31	1.65	1.25	(0.54, 2.46)	1154	2.25
Total	**1310**	**23**	**1.76**	**1.51**	**1.83**	**(1.16, 2.74)**	**2036**	**2.76**
Ellis Hospital								
Choumarov K	262	7	2.67	1.50	2.82	(1.13, 5.80)	346	2.56
Reich H	197	3	1.52	1.61	1.49	(0.30, 4.35)	321	2.85
#Singh C	95	5	5.26	1.42	5.85 *	(1.88,13.65)	141	4.30
Total	**554**	**15**	**2.71**	**1.52**	**2.80**	**(1.57, 4.62)**	**808**	**3.00**
Good Sam - Suffern								
Badami C D	130	2	1.54	1.33	1.82	(0.20, 6.59)	165	4.08
All Others	134	4	2.99	1.38	3.41	(0.92, 8.72)	163	3.67
Total	**264**	**6**	**2.27**	**1.36**	**2.64**	**(0.97, 5.75)**	**328**	**3.87**
Good Sam-West Islip								
#Dimeo A C	5	0	0.00	3.64	0.00	(0.00,31.77)	5	0.00
#Henry M J	1	0	0.00	10.54	0.00	(0.00,54.88)	1	0.00
Lamendola C	172	6	3.49	1.67	3.30	(1.20, 7.18)	354	2.24
Rovensky M	360	5	1.39	2.54	0.86	(0.28, 2.02)	454	1.29
All Others	96	0	0.00	1.51	0.00	(0.00, 4.00)	142	2.74
Total	**634**	**11**	**1.74**	**2.17**	**1.26**	**(0.63, 2.26)**	**956**	**1.78**
Lenox Hill Hospital								
#Brinster D R	35	0	0.00	1.41	0.00	(0.00,11.72)	130	0.80
Hemli J M	35	0	0.00	2.05	0.00	(0.00, 8.08)	42	0.00
Patel N C	718	4	0.56	1.35	0.65	(0.18, 1.67)	941	0.86 **
Pirelli L	42	0	0.00	1.25	0.00	(0.00,11.00)	67	0.00
Scheinerman S J	181	2	1.10	1.33	1.31	(0.15, 4.74)	246	0.94
Total	**1011**	**6**	**0.59**	**1.37**	**0.69 ** **	**(0.25, 1.49)**	**1426**	**0.80 ** **
Long Island Jewish MC								
#Meyer D B	.	.	.	.	.	(. , .)	4	0.00
Total	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**4**	**0.00**

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Maimonides Medical Ctr								
#Abrol S	61	4	6.56	2.85	3.62	(0.97, 9.28)	128	3.25
Crooke G	69	0	0.00	1.74	0.00	(0.00, 4.82)	133	1.82
Jacobowitz I	333	4	1.20	1.81	1.05	(0.28, 2.68)	491	1.90
Ribakove G	66	1	1.52	1.72	1.39	(0.02, 7.75)	140	2.31
Saunders P	66	1	1.52	1.85	1.29	(0.02, 7.18)	75	1.56
Stephens G A	52	1	1.92	1.59	1.90	(0.02,10.60)	71	1.58
#Tak V M	1	0	0.00	8.90	0.00	(0.00,64.99)	3	0.00
#Vaynblat M	2	0	0.00	4.27	0.00	(0.00,67.74)	4	0.00
All Others	34	0	0.00	2.18	0.00	(0.00, 7.82)	48	0.00
Total	**684**	**11**	**1.61**	**1.91**	**1.33**	**(0.66, 2.37)**	**1093**	**2.01**
Mercy Hospital-Buffalo								
Adkins M	153	7	4.58	1.70	4.25 *	(1.70, 8.75)	202	5.64 *
#Aldridge J	1	0	0.00	3.56	0.00	(0.00,100.0)	2	0.00
Downing S W	359	6	1.67	1.48	1.78	(0.65, 3.87)	543	1.32
Jain H B	316	4	1.27	1.51	1.33	(0.36, 3.40)	361	1.85
#Joyce F	9	1	11.11	4.36	4.02	(0.05,22.37)	10	10.06
All Others	193	1	0.52	1.34	0.61	(0.01, 3.39)	215	1.30
Total	**1031**	**19**	**1.84**	**1.52**	**1.91**	**(1.15, 2.98)**	**1333**	**2.32**
Montefiore - Moses								
#Chau M L	3	0	0.00	1.27	0.00	(0.00,100.0)	3	0.00
#Derose J J	5	0	0.00	0.92	0.00	(0.00,100.0)	8	0.00
#Goldstein D J	176	3	1.70	1.50	1.80	(0.36, 5.25)	299	2.68
#Jakobleff W A	211	3	1.42	1.50	1.50	(0.30, 4.38)	275	1.64
#Michler R E	126	2	1.59	1.23	2.04	(0.23, 7.35)	291	2.79
Peek G J	.	.	.	.	.	(. , .)	4	0.00
All Others	74	1	1.35	1.38	1.54	(0.02, 8.56)	111	0.92
Total	**595**	**9**	**1.51**	**1.42**	**1.68**	**(0.77, 3.19)**	**991**	**2.23**
Montefiore - Weiler								
#Chau M L	90	5	5.56	1.10	7.96 *	(2.56,18.57)	112	7.67 *
#Derose J J	359	11	3.06	1.24	3.88 *	(1.94, 6.95)	573	3.86 *
#Goldstein D J	9	0	0.00	1.86	0.00	(0.00,34.62)	14	0.00
#Jakobleff W A	6	0	0.00	0.72	0.00	(0.00,100.0)	9	0.00
#Michler R E	.	.	.	.	.	(. , .)	4	0.00
All Others	69	4	5.80	1.70	5.38	(1.45,13.78)	97	5.57
Total	**533**	**20**	**3.75**	**1.28**	**4.61** *	**(2.81, 7.12)**	**809**	**4.30** *
Mount Sinai Beth Israel								
#DiLuozzo G	13	0	0.00	1.18	0.00	(0.00,37.84)	18	0.00
#Puskas J D	180	0	0.00	1.08	0.00	(0.00, 2.98)	236	2.34
Total	**193**	**0**	**0.00**	**1.08**	**0.00**	**(0.00, 2.77)**	**254**	**2.19**

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Mount Sinai Hospital								
Adams D H	1	0	0.00	1.69	0.00	(0.00,100.0)	1001	0.18 **
Anyanwu A	56	0	0.00	1.85	0.00	(0.00, 5.57)	154	2.17
Boateng P	43	0	0.00	1.30	0.00	(0.00,10.38)	119	0.00
El-Eshmawi A M	15	0	0.00	0.57	0.00	(0.00,68.13)	80	0.00
Filsoufi F	296	2	0.68	1.15	0.93	(0.10, 3.36)	381	1.12
Nguyen K	1	0	0.00	0.38	0.00	(0.00,100.0)	2	0.00
Pawale A A	26	3	11.54	0.99	18.45 *	(3.71,53.90)	51	5.19
Reddy R C	336	6	1.79	1.52	1.85	(0.68, 4.03)	464	2.87
Stelzer P	19	0	0.00	0.98	0.00	(0.00,31.09)	234	3.02
Stewart A S	79	1	1.27	0.94	2.11	(0.03,11.76)	330	1.98
#Tannous H J	20	0	0.00	1.48	0.00	(0.00,19.54)	28	0.00
Varghese R	137	2	1.46	1.11	2.07	(0.23, 7.47)	241	2.55
All Others	4	0	0.00	1.17	0.00	(0.00,100.0)	23	0.00
Total	**1033**	**14**	**1.36**	**1.28**	**1.67**	**(0.91, 2.80)**	**3108**	**1.72**
Mount Sinai Morningside								
Balaram S K	187	2	1.07	1.66	1.01	(0.11, 3.66)	299	1.65
#Chikwe J Y	37	1	2.70	1.43	2.99	(0.04,16.63)	75	2.51
#DiLuozzo G	25	0	0.00	1.01	0.00	(0.00,22.80)	54	5.89
#Puskas J D	426	7	1.64	1.07	2.43	(0.97, 5.00)	513	3.35
All Others	22	0	0.00	1.26	0.00	(0.00,20.94)	32	0.00
Total	**697**	**10**	**1.43**	**1.25**	**1.81**	**(0.87, 3.33)**	**973**	**2.61**
NYP-Brooklyn Methodist								
##Gulkarov I M	71	1	1.41	1.63	1.36	(0.02, 7.58)	138	1.79
#Tranbaugh R	233	4	1.72	1.68	1.61	(0.43, 4.11)	322	3.10
Worku B M	69	0	0.00	1.22	0.00	(0.00, 6.88)	106	0.00
All Others	2	0	0.00	1.09	0.00	(0.00,100.0)	2	0.00
Total	**375**	**5**	**1.33**	**1.59**	**1.33**	**(0.43, 3.09)**	**568**	**2.22**
NYP-Columbia Presby.								
Argenziano M	282	2	0.71	1.42	0.79	(0.09, 2.84)	496	1.30
#Bacha E	.	.	.	.	.	(. , .)	3	0.00
Bapat V N	20	0	0.00	1.62	0.00	(0.00,17.84)	100	0.50
Borger M A	18	0	0.00	2.16	0.00	(0.00,14.86)	168	1.82
#Chai P J	.	.	.	.	.	(. , .)	2	0.00
George I	147	1	0.68	1.24	0.86	(0.01, 4.80)	382	1.52
Kalfa D M	.	.	.	.	.	(. , .)	1	0.00
Naka Y	227	1	0.44	1.47	0.47	(0.01, 2.64)	320	0.97
Smith C	219	3	1.37	1.11	1.95	(0.39, 5.70)	624	1.77
Takayama H	314	5	1.59	1.77	1.42	(0.46, 3.32)	583	2.19
Takeda K	110	3	2.73	2.27	1.90	(0.38, 5.54)	172	2.57
All Others	1	0	0.00	0.43	0.00	(0.00,100.0)	2	0.00
Total	**1338**	**15**	**1.12**	**1.52**	**1.16**	**(0.65, 1.92)**	**2853**	**1.69**
NYP-Queens								
#Avgerinos D V	129	0	0.00	0.76	0.00	(0.00, 5.90)	165	1.32
#Lang S	329	3	0.91	0.97	1.49	(0.30, 4.34)	417	1.86
All Others	1	0	0.00	0.70	0.00	(0.00,100.0)	1	0.00
Total	**459**	**3**	**0.65**	**0.91**	**1.13**	**(0.23, 3.31)**	**583**	**1.74**

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								
#Avgerinos D V	.	.	.	.	.	(. , .)	1	0.00
#Bacha E	.	.	.	.	.	(. , .)	2	0.00
#Chai P J	.	.	.	.	.	(. , .)	1	0.00
Girardi L	174	0	0.00	1.26	0.00	(0.00, 2.64)	722	1.33
##Gulkarov I M	.	.	.	.	.	(. , .)	2	0.00
Guy T S	53	0	0.00	1.19	0.00	(0.00, 9.21)	292	0.43
Krieger K	65	1	1.54	1.26	1.92	(0.03,10.70)	181	2.99
#Lang S	4	0	0.00	4.70	0.00	(0.00,30.80)	10	0.00
Lau C	163	2	1.23	1.98	0.98	(0.11, 3.53)	242	1.43
Salemi A	53	2	3.77	1.60	3.72	(0.42,13.42)	151	1.57
#Tranbaugh R	3	0	0.00	8.03	0.00	(0.00,24.00)	4	0.00
All Others	22	0	0.00	1.31	0.00	(0.00,20.07)	42	5.37
Total	**537**	**5**	**0.93**	**1.57**	**0.93**	**(0.30, 2.18)**	**1650**	**1.53**
NYU Hospitals Center								
#Balsam L B	.	.	.	.	.	(. , .)	3	0.00
#Culliford A	6	0	0.00	1.05	0.00	(0.00,92.15)	16	0.00
Galloway A	45	1	2.22	1.30	2.70	(0.04,15.02)	329	4.63 *
Grossi E	1	0	0.00	0.49	0.00	(0.00,100.0)	4	0.00
#Hisamoto K	5	1	20.00	0.77	40.81	(0.53,100.0)	7	31.88
Loulmet D F	41	0	0.00	0.84	0.00	(0.00,16.81)	516	4.70 *
#Malhotra S P	.	.	.	.	.	(. , .)	1	0.00
Mosca R S	.	.	.	.	.	(. , .)	6	0.00
#Smith D E	55	0	0.00	1.34	0.00	(0.00, 7.87)	80	2.62
#Swistel D	139	2	1.44	0.89	2.56	(0.29, 9.24)	291	5.90 *
#Vaynblat M	107	3	2.80	1.11	3.98	(0.80,11.62)	189	3.82
Williams M R	5	0	0.00	0.68	0.00	(0.00,100.0)	157	1.82
Zias E	350	6	1.71	1.13	2.39	(0.87, 5.20)	502	1.61
Total	**754**	**13**	**1.72**	**1.09**	**2.50**	**(1.33, 4.28)**	**2101**	**3.50** *
NYU Winthrop Hospital								
#Abrol S	172	2	1.16	2.21	0.83	(0.09, 3.00)	235	0.60
Goncalves J A	17	0	0.00	2.42	0.00	(0.00,14.06)	37	1.80
Kokotos W J	143	2	1.40	1.85	1.19	(0.13, 4.30)	265	1.87
##Pogo G	63	0	0.00	2.44	0.00	(0.00, 3.76)	76	0.00
Salhab K F	159	2	1.26	1.99	1.00	(0.11, 3.60)	209	1.62
Schubach S	183	0	0.00	1.73	0.00	(0.00, 1.83)	251	0.00 **
Total	**737**	**6**	**0.81**	**2.00**	**0.64** **	**(0.23, 1.40)**	**1073**	**1.07** **

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
North Shore Univ Hosp								
#Brinster D R	8	0	0.00	1.51	0.00	(0.00,47.79)	18	0.00
Esposito R	167	1	0.60	1.34	0.70	(0.01, 3.92)	272	1.99
#Fernandez H A	14	0	0.00	1.88	0.00	(0.00,21.93)	24	0.00
Graver L	310	3	0.97	1.37	1.11	(0.22, 3.25)	634	1.38
Hall M	42	1	2.38	3.09	1.22	(0.02, 6.77)	74	1.03
#Hartman A	174	0	0.00	1.53	0.00	(0.00, 2.18)	432	2.10
#Kalimi R	15	0	0.00	0.99	0.00	(0.00,38.76)	19	0.00
#Manetta F	28	0	0.00	1.63	0.00	(0.00,12.64)	37	0.00
#Meyer D B	.	.	.	.	.	(. , .)	1	0.00
Palazzo R	191	1	0.52	1.37	0.60	(0.01, 3.35)	251	0.44
##Pogo G	1	0	0.00	1.84	0.00	(0.00,100.0)	1	0.00
#Taylor J	372	1	0.27	1.78	0.24 **	(0.00, 1.33)	645	1.45
Vatsia S	193	3	1.55	1.38	1.78	(0.36, 5.20)	294	1.88
Yu P J	90	4	4.44	1.50	4.68	(1.26,11.99)	124	4.94
All Others	9	0	0.00	1.15	0.00	(0.00,56.05)	11	0.00
Total	**1614**	**14**	**0.87**	**1.54**	**0.89 ** **	**(0.49, 1.49)**	**2837**	**1.63**
Rochester General Hosp								
Cheeran D	530	13	2.45	1.94	1.99	(1.06, 3.40)	898	2.11
Kirshner R	540	12	2.22	1.69	2.08	(1.07, 3.63)	1029	2.77
Yankey G K N	197	14	7.11	2.38	4.71 *	(2.57, 7.91)	247	5.53 *
All Others	30	0	0.00	1.21	0.00	(0.00,15.90)	33	0.00
Total	**1297**	**39**	**3.01**	**1.89**	**2.51 ***	**(1.79, 3.44)**	**2207**	**2.77 ***
South Shore Univ. Hosp								
#Fernandez H A	175	0	0.00	1.32	0.00	(0.00, 2.51)	297	0.31 **
#Hartman A	1	0	0.00	0.37	0.00	(0.00,100.0)	3	0.00
#Kalimi R	209	0	0.00	1.59	0.00	(0.00, 1.74)	452	0.00 **
#Manetta F	133	1	0.75	1.39	0.85	(0.01, 4.74)	181	1.95
##Pogo G	13	1	7.69	3.36	3.62	(0.05,20.12)	19	2.53
#Taylor J	.	.	.	.	.	(. , .)	2	0.00
All Others	19	0	0.00	1.16	0.00	(0.00,26.16)	24	6.09
Total	**550**	**2**	**0.36**	**1.48**	**0.39 ** **	**(0.04, 1.40)**	**978**	**0.61 ** **
St. Elizabeth Med Ctr								
Cahill A T	138	4	2.90	1.97	2.32	(0.62, 5.95)	170	3.09
Fuzesi L	217	7	3.23	2.27	2.24	(0.90, 4.61)	297	3.29
#Joyce F	191	5	2.62	1.52	2.71	(0.87, 6.33)	275	3.09
Total	**546**	**16**	**2.93**	**1.93**	**2.39**	**(1.37, 3.88)**	**742**	**3.18**
St. Francis Hospital								
Bercow N	308	1	0.32	1.69	0.30	(0.00, 1.68)	505	2.46
Colangelo R	500	5	1.00	1.38	1.14	(0.37, 2.66)	805	1.51
#Dimeo A C	365	7	1.92	1.58	1.92	(0.77, 3.96)	479	2.04
#Henry M J	94	1	1.06	1.87	0.90	(0.01, 4.98)	116	1.84
Lundy E F	325	5	1.54	1.77	1.37	(0.44, 3.19)	419	1.77
Robinson N	47	1	2.13	2.65	1.27	(0.02, 7.06)	324	1.61
Total	**1639**	**20**	**1.22**	**1.63**	**1.18**	**(0.72, 1.83)**	**2648**	**1.88**

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
St. Josephs Hospital								
#Green G R	148	3	2.03	2.03	1.57	(0.32, 4.60)	307	1.34
Lutz C J	321	6	1.87	2.11	1.40	(0.51, 3.04)	697	1.49
Marvasti M	193	0	0.00	1.52	0.00	(0.00, 1.97)	310	0.30 **
Nazem A	329	8	2.43	1.69	2.27	(0.98, 4.47)	515	3.03
Zhou Z	388	5	1.29	1.90	1.07	(0.35, 2.50)	769	1.08 **
Total	**1379**	**22**	**1.60**	**1.86**	**1.35**	**(0.85, 2.05)**	**2598**	**1.53 ** **
St. Peters Hospital								
Edwards N	239	3	1.26	1.35	1.47	(0.29, 4.28)	443	1.98
Karavas A N	281	3	1.07	1.36	1.24	(0.25, 3.63)	428	1.93
Saifi J	244	4	1.64	1.87	1.38	(0.37, 3.54)	539	1.65
Terrien C M	296	4	1.35	1.85	1.15	(0.31, 2.94)	509	1.46
All Others	31	0	0.00	1.67	0.00	(0.00,11.18)	41	0.00
Total	**1091**	**14**	**1.28**	**1.61**	**1.25**	**(0.69, 2.10)**	**1960**	**1.69**
Staten Island Univ Hosp								
##Gulkarov I M	68	1	1.47	1.71	1.35	(0.02, 7.54)	77	1.43
Imam M N	153	0	0.00	1.10	0.00	(0.00, 3.44)	249	0.61
Rosell F M	285	2	0.70	1.62	0.68	(0.08, 2.47)	313	1.95
All Others	44	2	4.55	1.43	5.02	(0.56,18.14)	66	4.06
Total	**550**	**5**	**0.91**	**1.47**	**0.97**	**(0.31, 2.27)**	**705**	**1.67**
Strong Memorial Hosp								
Alfieris G	.	.	.	.	.	(. , .)	3	0.00
Gosev I	122	2	1.64	1.22	2.13	(0.24, 7.68)	147	2.13
Knight P	171	6	3.51	2.00	2.77	(1.01, 6.02)	816	3.99 *
Lehoux J M	121	0	0.00	1.12	0.00	(0.00, 4.29)	159	3.80
Prasad S M	147	7	4.76	2.06	3.64	(1.46, 7.50)	206	5.93 *
All Others	95	2	2.11	1.21	2.74	(0.31, 9.90)	108	3.05
Total	**656**	**17**	**2.59**	**1.59**	**2.57**	**(1.50, 4.11)**	**1439**	**4.16 ***
UHS-Wilson Med Ctr								
#Beckles D L	12	0	0.00	1.45	0.00	(0.00,33.25)	12	0.00
#Ferdinand F D	8	0	0.00	1.73	0.00	(0.00,41.77)	9	0.00
Khan A M	118	3	2.54	2.20	1.82	(0.37, 5.33)	164	3.04
Wong K	152	1	0.66	1.40	0.74	(0.01, 4.12)	218	1.24
Yousuf M	95	5	5.26	2.13	3.90	(1.26, 9.09)	147	7.30 *
All Others	.	.	.	.	.	(. , .)	1	0.00
Total	**385**	**9**	**2.34**	**1.83**	**2.01**	**(0.92, 3.82)**	**551**	**3.56**
Univ. Hosp-Brooklyn								
#Beckles D L	101	1	0.99	1.59	0.98	(0.01, 5.45)	134	2.71
#Neragi-Miandoab S	39	2	5.13	2.39	3.39	(0.38,12.24)	49	3.40
All Others	43	1	2.33	1.07	3.44	(0.04,19.15)	54	3.52
Total	**183**	**4**	**2.19**	**1.64**	**2.10**	**(0.57, 5.39)**	**237**	**3.03**

Table 6 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	No of Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Univ. Hosp-Stony Brook								
Bilfinger T	68	1	1.47	2.11	1.10	(0.01, 6.12)	85	1.16
#Chikwe J Y	218	1	0.46	1.52	0.48	(0.01, 2.66)	364	0.26 **
McLarty A	50	1	2.00	2.43	1.30	(0.02, 7.23)	67	1.38
#Tak V M	87	1	1.15	2.13	0.85	(0.01, 4.73)	119	2.22
#Tannous H J	99	1	1.01	1.31	1.22	(0.02, 6.79)	114	2.30
All Others	15	1	6.67	0.91	11.61	(0.15,64.60)	22	6.30
Total	**537**	**6**	**1.12**	**1.72**	**1.02**	**(0.37, 2.23)**	**771**	**1.14**
Univ. Hosp-Upstate								
Esrig B	53	3	5.66	2.03	4.39	(0.88,12.83)	77	7.72 *
#Green G R	117	0	0.00	2.48	0.00	(0.00, 1.99)	171	0.00 **
All Others	82	2	2.44	2.30	1.67	(0.19, 6.03)	109	3.30
Total	**252**	**5**	**1.98**	**2.33**	**1.34**	**(0.43, 3.14)**	**357**	**2.49**
Vassar Bros. Med Ctr								
Sarabu M	66	3	4.55	2.22	3.23	(0.65, 9.44)	197	1.26
Shahani R B	154	0	0.00	1.68	0.00	(0.00, 2.23)	247	0.00 **
Zakow P	126	1	0.79	1.52	0.83	(0.01, 4.60)	204	0.44
All Others	128	2	1.56	1.87	1.32	(0.15, 4.77)	186	2.70
Total	**474**	**6**	**1.27**	**1.76**	**1.13**	**(0.41, 2.47)**	**834**	**1.05 ** **
Westchester Med Ctr								
Goldberg J B	27	0	0.00	0.99	0.00	(0.00,21.57)	54	2.28
Kai M	90	2	2.22	1.61	2.18	(0.24, 7.86)	116	4.61
Lansman S	2	0	0.00	3.20	0.00	(0.00,90.36)	2	0.00
Malekan R	130	1	0.77	1.48	0.82	(0.01, 4.55)	196	2.53
Spielvogel D	338	4	1.18	1.65	1.13	(0.30, 2.89)	503	1.68
Tang G	.	.	.	.	.	(. , .)	1	0.00
All Others	9	3	33.33	1.28	41.16 *	(8.27,100.0)	17	32.42 *
Total	**596**	**10**	**1.68**	**1.58**	**1.67**	**(0.80, 3.08)**	**889**	**2.60**
STATEWIDE TOTAL	**25997**	**410**	**1.58**				**45140**	**2.10**

* 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, 2016-2018.

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Abrol S	**233**	**6**	**2.58**	**2.38**	**1.71**	**(0.62, 3.72)**	**363**	**1.65**
Maimonides Medical Ctr	61	4	6.56	2.85	3.62	(0.97, 9.28)	128	3.25
NYU Winthrop Hospital	172	2	1.16	2.21	0.83	(0.09, 3.00)	235	0.60
Aldridge J	**179**	**6**	**3.35**	**1.54**	**3.43**	**(1.25, 7.48)**	**225**	**5.24** *
Buffalo General Med Ctr	178	6	3.37	1.53	3.48	(1.27, 7.57)	223	5.31 *
Mercy Hospital-Buffalo	1	0	0.00	3.56	0.00	(0.00,100.0)	2	0.00
Avgerinos D V	**129**	**0**	**0.00**	**0.76**	**0.00**	**(0.00, 5.90)**	**166**	**1.29**
NYP-Queens	129	0	0.00	0.76	0.00	(0.00, 5.90)	165	1.32
NYP-Weill Cornell	.	.	.	.	.	(. , .)	1	0.00
Bacha E	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**5**	**0.00**
NYP-Columbia Presby.	.	.	.	.	.	(. , .)	3	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	2	0.00
Balsam L B	**77**	**0**	**0.00**	**0.88**	**0.00**	**(0.00, 8.52)**	**160**	**0.70**
Bellevue Hospital Ctr	77	0	0.00	0.88	0.00	(0.00, 8.52)	157	0.71
NYU Hospitals Center	.	.	.	.	.	(. , .)	3	0.00
Beckles D L	**113**	**1**	**0.88**	**1.58**	**0.88**	**(0.01, 4.92)**	**146**	**2.52**
UHS-Wilson Med Ctr	12	0	0.00	1.45	0.00	(0.00,33.25)	12	0.00
Univ. Hosp-Brooklyn	101	1	0.99	1.59	0.98	(0.01, 5.45)	134	2.71
Brinster D R	**43**	**0**	**0.00**	**1.43**	**0.00**	**(0.00, 9.41)**	**148**	**0.73**
Lenox Hill Hospital	35	0	0.00	1.41	0.00	(0.00,11.72)	130	0.80
North Shore Univ Hosp	8	0	0.00	1.51	0.00	(0.00,47.79)	18	0.00
Chai P J	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**3**	**0.00**
NYP-Columbia Presby.	.	.	.	.	.	(. , .)	2	0.00
NYP-Weill Cornell	.	.	.	.	.	(. , .)	1	0.00
Chau M L	**93**	**5**	**5.38**	**1.11**	**7.66** *	**(2.47,17.88)**	**115**	**7.46** *
Montefiore - Moses	3	0	0.00	1.27	0.00	(0.00,100.0)	3	0.00
Montefiore - Weiler	90	5	5.56	1.10	7.96 *	(2.56,18.57)	112	7.67 *
Chikwe J Y	**255**	**2**	**0.78**	**1.50**	**0.82**	**(0.09, 2.97)**	**439**	**0.79** **
Mount Sinai Morningside	37	1	2.70	1.43	2.99	(0.04,16.63)	75	2.51
Univ. Hosp-Stony Brook	218	1	0.46	1.52	0.48	(0.01, 2.66)	364	0.26 **
Culliford A	**150**	**3**	**2.00**	**1.22**	**2.59**	**(0.52, 7.56)**	**241**	**2.74**
Bellevue Hospital Ctr	144	3	2.08	1.23	2.68	(0.54, 7.82)	225	2.95
NYU Hospitals Center	6	0	0.00	1.05	0.00	(0.00,92.15)	16	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
Derose J J	**364**	**11**	**3.02**	**1.24**	**3.84** *	**(1.92, 6.88)**	**581**	**3.80** *
Montefiore - Moses	5	0	0.00	0.92	0.00	(0.00,100.0)	8	0.00
Montefiore - Weiler	359	11	3.06	1.24	3.88 *	(1.94, 6.95)	573	3.86 *
DiLuozzo G	**38**	**0**	**0.00**	**1.07**	**0.00**	**(0.00,14.23)**	**72**	**4.38**
Mount Sinai Beth Israel	13	0	0.00	1.18	0.00	(0.00,37.84)	18	0.00
Mount Sinai Morningside	25	0	0.00	1.01	0.00	(0.00,22.80)	54	5.89
Dimeo A C	**370**	**7**	**1.89**	**1.60**	**1.86**	**(0.75, 3.83)**	**484**	**2.01**
Good Sam-West Islip	5	0	0.00	3.64	0.00	(0.00,31.77)	5	0.00
St. Francis Hospital	365	7	1.92	1.58	1.92	(0.77, 3.96)	479	2.04
Ferdinand F D	**31**	**1**	**3.23**	**2.50**	**2.04**	**(0.03,11.33)**	**35**	**2.57**
Albany Med. Ctr	23	1	4.35	2.76	2.48	(0.03,13.80)	26	3.13
UHS-Wilson Med Ctr	8	0	0.00	1.73	0.00	(0.00,41.77)	9	0.00
Fernandez H A	**189**	**0**	**0.00**	**1.36**	**0.00**	**(0.00, 2.25)**	**321**	**0.29** **
North Shore Univ Hosp	14	0	0.00	1.88	0.00	(0.00,21.93)	24	0.00
South Shore Univ. Hosp	175	0	0.00	1.32	0.00	(0.00, 2.51)	297	0.31 **
Goldstein D J	**185**	**3**	**1.62**	**1.51**	**1.69**	**(0.34, 4.93)**	**313**	**2.57**
Montefiore - Moses	176	3	1.70	1.50	1.80	(0.36, 5.25)	299	2.68
Montefiore - Weiler	9	0	0.00	1.86	0.00	(0.00,34.62)	14	0.00
Green G R	**265**	**3**	**1.13**	**2.23**	**0.80**	**(0.16, 2.34)**	**478**	**0.83** **
St. Josephs Hospital	148	3	2.03	2.03	1.57	(0.32, 4.60)	307	1.34
Univ. Hosp-Upstate	117	0	0.00	2.48	0.00	(0.00, 1.99)	171	0.00 **
Gulkarov I M	**139**	**2**	**1.44**	**1.67**	**1.36**	**(0.15, 4.90)**	**217**	**1.68**
NYP-Brooklyn Methodist	71	1	1.41	1.63	1.36	(0.02, 7.58)	138	1.79
NYP-Weill Cornell	.	.	.	.	.	(. , .)	2	0.00
Staten Island Univ Hosp	68	1	1.47	1.71	1.35	(0.02, 7.54)	77	1.43
Hartman A	**175**	**0**	**0.00**	**1.52**	**0.00**	**(0.00, 2.18)**	**435**	**2.10**
North Shore Univ Hosp	174	0	0.00	1.53	0.00	(0.00, 2.18)	432	2.10
South Shore Univ. Hosp	1	0	0.00	0.37	0.00	(0.00,100.0)	3	0.00
Henry M J	**95**	**1**	**1.05**	**1.97**	**0.84**	**(0.01, 4.70)**	**117**	**1.76**
Good Sam-West Islip	1	0	0.00	10.54	0.00	(0.00,54.88)	1	0.00
St. Francis Hospital	94	1	1.06	1.87	0.90	(0.01, 4.98)	116	1.84
Hisamoto K	**40**	**1**	**2.50**	**0.85**	**4.66**	**(0.06,25.94)**	**67**	**1.73**
Bellevue Hospital Ctr	35	0	0.00	0.86	0.00	(0.00,19.31)	60	0.00
NYU Hospitals Center	5	1	20.00	0.77	40.81	(0.53,100.0)	7	31.88
Jakobleff W A	**217**	**3**	**1.38**	**1.48**	**1.48**	**(0.30, 4.32)**	**284**	**1.58**
Montefiore - Moses	211	3	1.42	1.50	1.50	(0.30, 4.38)	275	1.64
Montefiore - Weiler	6	0	0.00	0.72	0.00	(0.00,100.0)	9	0.00
Joyce F	**200**	**6**	**3.00**	**1.65**	**2.87**	**(1.05, 6.24)**	**285**	**3.66**
Mercy Hospital-Buffalo	9	1	11.11	4.36	4.02	(0.05,22.37)	10	10.06
St. Elizabeth Med Ctr	191	5	2.62	1.52	2.71	(0.87, 6.33)	275	3.09

Table 7 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Kalimi R	**224**	**0**	**0.00**	**1.55**	**0.00**	**(0.00, 1.66)**	**471**	**0.00** **
North Shore Univ Hosp	15	0	0.00	0.99	0.00	(0.00,38.76)	19	0.00
South Shore Univ. Hosp	209	0	0.00	1.59	0.00	(0.00, 1.74)	452	0.00 **
Lang S	**333**	**3**	**0.90**	**1.01**	**1.40**	**(0.28, 4.10)**	**427**	**1.76**
NYP-Queens	329	3	0.91	0.97	1.49	(0.30, 4.34)	417	1.86
NYP-Weill Cornell	4	0	0.00	4.70	0.00	(0.00,30.80)	10	0.00
Malhotra S P	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**2**	**0.00**
Bellevue Hospital Ctr	.	.	.	.	.	(. , .)	1	0.00
NYU Hospitals Center	.	.	.	.	.	(. , .)	1	0.00
Manetta F	**161**	**1**	**0.62**	**1.43**	**0.68**	**(0.01, 3.80)**	**218**	**1.62**
North Shore Univ Hosp	28	0	0.00	1.63	0.00	(0.00,12.64)	37	0.00
South Shore Univ. Hosp	133	1	0.75	1.39	0.85	(0.01, 4.74)	181	1.95
Meyer D B	**.**	**.**	**.**	**.**	**.**	**(. , .)**	**5**	**0.00**
Long Island Jewish MC	.	.	.	.	.	(. , .)	4	0.00
North Shore Univ Hosp	.	.	.	.	.	(. , .)	1	0.00
Michler R E	**126**	**2**	**1.59**	**1.23**	**2.04**	**(0.23, 7.35)**	**295**	**2.72**
Montefiore - Moses	126	2	1.59	1.23	2.04	(0.23, 7.35)	291	2.79
Montefiore - Weiler	.	.	.	.	.	(. , .)	4	0.00
Neragi-Miandoab S	**42**	**2**	**4.76**	**2.31**	**3.26**	**(0.37,11.76)**	**52**	**3.30**
Bassett Medical Center	3	0	0.00	1.27	0.00	(0.00,100.0)	3	0.00
Univ. Hosp-Brooklyn	39	2	5.13	2.39	3.39	(0.38,12.24)	49	3.40
Pogo G	**77**	**1**	**1.30**	**2.59**	**0.79**	**(0.01, 4.40)**	**96**	**0.80**
NYU Winthrop Hospital	63	0	0.00	2.44	0.00	(0.00, 3.76)	76	0.00
North Shore Univ Hosp	1	0	0.00	1.84	0.00	(0.00,100.0)	1	0.00
South Shore Univ. Hosp	13	1	7.69	3.36	3.62	(0.05,20.12)	19	2.53
Puskas J D	**606**	**7**	**1.16**	**1.07**	**1.70**	**(0.68, 3.50)**	**749**	**3.00**
Mount Sinai Beth Israel	180	0	0.00	1.08	0.00	(0.00, 2.98)	236	2.34
Mount Sinai Morningside	426	7	1.64	1.07	2.43	(0.97, 5.00)	513	3.35
Singh C	**168**	**7**	**4.17**	**1.72**	**3.83**	**(1.53, 7.89)**	**248**	**3.18**
Albany Med. Ctr	73	2	2.74	2.10	2.05	(0.23, 7.42)	107	1.79
Ellis Hospital	95	5	5.26	1.42	5.85 *	(1.88,13.65)	141	4.30
Smith D E	**217**	**3**	**1.38**	**1.06**	**2.05**	**(0.41, 6.00)**	**315**	**2.47**
Bellevue Hospital Ctr	162	3	1.85	0.97	3.01	(0.61, 8.80)	235	2.39
NYU Hospitals Center	55	0	0.00	1.34	0.00	(0.00, 7.87)	80	2.62
Swistel D	**144**	**2**	**1.39**	**0.92**	**2.39**	**(0.27, 8.61)**	**300**	**5.66** *
Bellevue Hospital Ctr	5	0	0.00	1.80	0.00	(0.00,64.26)	9	0.00
NYU Hospitals Center	139	2	1.44	0.89	2.56	(0.29, 9.24)	291	5.90 *
Tak V M	**88**	**1**	**1.14**	**2.21**	**0.81**	**(0.01, 4.51)**	**122**	**2.12**
Maimonides Medical Ctr	1	0	0.00	8.90	0.00	(0.00,64.99)	3	0.00
Univ. Hosp-Stony Brook	87	1	1.15	2.13	0.85	(0.01, 4.73)	119	2.22

Table 7 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Tannous H J	**119**	**1**	**0.84**	**1.34**	**0.99**	**(0.01, 5.52)**	**142**	**1.82**
Mount Sinai Hospital	20	0	0.00	1.48	0.00	(0.00,19.54)	28	0.00
Univ. Hosp-Stony Brook	99	1	1.01	1.31	1.22	(0.02, 6.79)	114	2.30
Taylor J	**372**	**1**	**0.27**	**1.78**	**0.24 ****	**(0.00, 1.33)**	**647**	**1.45**
North Shore Univ Hosp	372	1	0.27	1.78	0.24 **	(0.00, 1.33)	645	1.45
South Shore Univ. Hosp	.	.	.	.	.	(. , .)	2	0.00
Tranbaugh R	**236**	**4**	**1.69**	**1.77**	**1.51**	**(0.41, 3.88)**	**326**	**2.99**
NYP-Brooklyn Methodist	233	4	1.72	1.68	1.61	(0.43, 4.11)	322	3.10
NYP-Weill Cornell	3	0	0.00	8.03	0.00	(0.00,24.00)	4	0.00
Vaynblat M	**109**	**3**	**2.75**	**1.17**	**3.71**	**(0.75,10.84)**	**193**	**3.56**
Maimonides Medical Ctr	2	0	0.00	4.27	0.00	(0.00,67.74)	4	0.00
NYU Hospitals Center	107	3	2.80	1.11	3.98	(0.80,11.62)	189	3.82

* 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, 2016-2018

Table 8 presents, for each hospital and for each surgeon performing at least 200 cardiac operations in any hospital in 2016-2018 and/or performing one or more cardiac operations in each of the years 2016-2018, the total number of Isolated CABG operations, the total number of Valve or Valve/CABG operations, the total number of Other Cardiac operations and Total Cardiac operations. As in Table 6, results for surgeons not meeting the above criteria are grouped together in an "All Others" category.

The Isolated CABG column includes patients who undergo bypass of one or more of the coronary arteries with no other major heart surgery earlier in the same admission. Valve or Valve/CABG volumes include the total number of cases for the twelve Valve and Valve/CABG groups that were identified in Tables 4a and 4b. Other Cardiac Surgery refers to cardiac procedures not represented by Isolated CABG, and Valve or Valve/CABG operations and includes, but is not limited to: TAVR, repairs of congenital conditions, heart transplants, aneurysm repairs, ventricular reconstruction and ventricular assist device insertions and some rare multiple valve surgeries that were not accounted for by one of the 12 valve groups. Total Cardiac Surgery is the sum of the previous three columns and includes any surgery on the heart or great vessels.

Table 8

Surgeon and Hospital Volume for Isolated CABG, Valve or Valve/CABG, Other Cardiac Surgery, and Total Adult Cardiac Surgery, 2016-2018.

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Albany Med. Ctr				
Akujuo A C	188	105	180	473
Bennett E	14	122	336	472
Britton L	129	123	58	310
Devejian N	0	1	12	13
Ferdinand F D	23	3	118	144
Samy S A	147	80	75	302
Singh C	73	34	143	250
All Others	131	37	20	188
Total	**705**	**505**	**942**	**2152**
Arnot Ogden Med Ctr				
Hoffman D	111	32	4	147
All Others	35	13	2	50
Total	**146**	**45**	**6**	**197**
Bassett Medical Center				
Daniel S R	99	36	9	144
Kelley J	131	75	26	232
Neragi-Miandoab S	3	0	0	3
Total	**233**	**111**	**35**	**379**

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Bellevue Hospital Ctr				
Balsam L B	77	80	30	187
Culliford A	144	81	30	255
Hisamoto K	35	25	16	76
Malhotra S P	0	1	22	23
Smith D E	162	73	25	260
Swistel D	5	4	1	10
All Others	2	6	14	22
Total	**425**	**270**	**138**	**833**
Buffalo General Med Ctr				
Aldridge J	178	45	376	599
Ashraf M	521	138	416	1075
Grosner G	611	543	204	1358
Total	**1310**	**726**	**996**	**3032**
Ellis Hospital				
Choumarov K	262	84	13	359
Reich H	197	124	21	342
Singh C	95	46	9	150
Total	**554**	**254**	**43**	**851**
Good Sam - Suffern				
Badami C D	130	35	7	172
All Others	134	29	5	168
Total	**264**	**64**	**12**	**340**
Good Sam-West Islip				
Dimeo A C	5	0	0	5
Henry M J	1	0	0	1
Lamendola C	172	182	74	428
Rovensky M	360	94	10	464
All Others	96	46	12	154
Total	**634**	**322**	**96**	**1052**
Lenox Hill Hospital				
Brinster D R	35	95	353	483
Hemli J M	35	7	22	64
Patel N C	718	223	31	972
Pirelli L	42	25	249	316
Scheinerman S J	181	65	68	314
All Others	0	0	6	6
Total	**1011**	**415**	**729**	**2155**
Long Island Jewish MC				
Meyer D B	0	4	10	14
All Others	0	0	6	6
Total	**0**	**4**	**16**	**20**

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Maimonides Medical Ctr				
Abrol S	61	67	61	189
Crooke G	69	64	216	349
Jacobowitz I	333	158	132	623
Ribakove G	66	74	24	164
Saunders P	66	9	79	154
Stephens G A	52	19	12	83
Tak V M	1	2	1	4
Vaynblat M	2	2	0	4
All Others	34	14	45	93
Total	**684**	**409**	**570**	**1663**
Mercy Hospital-Buffalo				
Adkins M	153	49	7	209
Aldridge J	1	1	0	2
Downing S W	359	184	202	745
Jain H B	316	45	49	410
Joyce F	9	1	0	10
All Others	193	22	6	221
Total	**1031**	**302**	**264**	**1597**
Montefiore - Moses				
Chau M L	3	0	42	45
Derose J J	5	3	39	47
Goldstein D J	176	123	114	413
Jakobleff W A	211	64	38	313
Michler R E	126	165	31	322
Peek G J	0	4	36	40
All Others	74	37	68	179
Total	**595**	**396**	**368**	**1359**
Montefiore - Weiler				
Chau M L	90	22	200	312
Derose J J	359	214	141	714
Goldstein D J	9	5	2	16
Jakobleff W A	6	3	1	10
Michler R E	0	4	0	4
All Others	69	28	29	126
Total	**533**	**276**	**373**	**1182**
Mount Sinai Beth Israel				
DiLuozzo G	13	5	33	51
Puskas J D	180	56	19	255
All Others	0	0	1	1
Total	**193**	**61**	**53**	**307**

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Mount Sinai Hospital				
Adams D H	1	1000	70	1071
Anyanwu A	56	98	285	439
Boateng P	43	76	49	168
El-Eshmawi A M	15	65	15	95
Filsoufi F	296	85	58	439
Nguyen K	1	1	18	20
Pawale A A	26	25	13	64
Reddy R C	336	128	97	561
Stelzer P	19	215	323	557
Stewart A S	79	251	459	789
Tannous H J	20	8	2	30
Varghese R	137	104	27	268
All Others	4	19	431	454
Total	**1033**	**2075**	**1847**	**4955**
Mount Sinai Morningside				
Balaram S K	187	112	56	355
Chikwe J Y	37	38	10	85
DiLuozzo G	25	29	55	109
Puskas J D	426	87	41	554
All Others	22	10	3	35
Total	**697**	**276**	**165**	**1138**
NYP-Brooklyn Methodist				
Gulkarov I M	71	67	40	178
Tranbaugh R	233	89	28	350
Worku B M	69	37	69	175
All Others	2	0	25	27
Total	**375**	**193**	**162**	**730**
NYP-Columbia Presby.				
Argenziano M	282	214	48	544
Bacha E	0	3	123	126
Bapat V N	20	80	201	301
Borger M A	18	150	138	306
Chai P J	0	2	68	70
George I	147	235	1135	1517
Kalfa D M	0	1	23	24
Naka Y	227	93	212	532
Smith C	219	405	85	709
Takayama H	314	269	271	854
Takeda K	110	62	189	361
All Others	1	1	379	381
Total	**1338**	**1515**	**2872**	**5725**
NYP-Queens				
Avgerinos D V	129	36	22	187
Lang S	329	88	16	433
All Others	1	0	1	2
Total	**459**	**124**	**39**	**622**

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
NYP-Weill Cornell				
Avgerinos D V	0	1	1	2
Bacha E	0	2	28	30
Chai P J	0	1	14	15
Girardi L	174	548	680	1402
Gulkarov I M	0	2	0	2
Guy T S	53	239	45	337
Krieger K	65	116	31	212
Lang S	4	6	2	12
Lau C	163	79	92	334
Salemi A	53	98	634	785
Tranbaugh R	3	1	2	6
All Others	22	20	34	76
Total	**537**	**1113**	**1563**	**3213**
NYU Hospitals Center				
Balsam L B	0	3	26	29
Culliford A	6	10	4	20
Galloway A	45	284	78	407
Grossi E	1	3	9	13
Hisamoto K	5	2	22	29
Loulmet D F	41	475	59	575
Malhotra S P	0	1	18	19
Mosca R S	0	6	32	38
Smith D E	55	25	43	123
Swistel D	139	152	21	312
Vaynblat M	107	82	21	210
Williams M R	5	152	1121	1278
Zias E	350	152	43	545
All Others	0	0	70	70
Total	**754**	**1347**	**1567**	**3668**
NYU Winthrop Hospital				
Abrol S	172	63	49	284
Goncalves J A	17	20	170	207
Kokotos W J	143	122	91	356
Pogo G	63	13	31	107
Salhab K F	159	50	601	810
Schubach S	183	68	100	351
All Others	0	0	1	1
Total	**737**	**336**	**1043**	**2116**

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
North Shore Univ Hosp				
Brinster D R	8	10	62	80
Esposito R	167	105	361	633
Fernandez H A	14	10	34	58
Graver L	310	324	63	697
Hall M	42	32	12	86
Hartman A	174	258	131	563
Kalimi R	15	4	8	27
Manetta F	28	9	30	67
Meyer D B	0	1	0	1
Palazzo R	191	60	189	440
Pogo G	1	0	0	1
Taylor J	372	273	105	750
Vatsia S	193	101	139	433
Yu P J	90	34	119	243
All Others	9	2	30	41
Total	**1614**	**1223**	**1283**	**4120**
Rochester General Hosp				
Cheeran D	530	368	294	1192
Kirshner R	540	489	100	1129
Yankey G K N	197	50	235	482
All Others	30	3	49	82
Total	**1297**	**910**	**678**	**2885**
South Shore Univ. Hosp				
Fernandez H A	175	122	87	384
Hartman A	1	2	1	4
Kalimi R	209	243	219	671
Manetta F	133	48	101	282
Pogo G	13	6	13	32
Taylor J	0	2	0	2
All Others	19	5	16	40
Total	**550**	**428**	**437**	**1415**
St. Elizabeth Med Ctr				
Cahill A T	138	32	39	209
Fuzesi L	217	80	28	325
Joyce F	191	84	121	396
Total	**546**	**196**	**188**	**930**
St. Francis Hospital				
Bercow N	308	197	177	682
Colangelo R	500	305	25	830
Dimeo A C	365	114	56	535
Henry M J	94	22	406	522
Lundy E F	325	94	46	465
Robinson N	47	277	758	1082
All Others	0	0	1	1
Total	**1639**	**1009**	**1469**	**4117**

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
St. Josephs Hospital				
Green G R	148	159	101	408
Lutz C J	321	376	144	841
Marvasti M	193	117	193	503
Nazem A	329	186	182	697
Zhou Z	388	381	190	959
Total	**1379**	**1219**	**810**	**3408**
St. Peters Hospital				
Edwards N	239	204	52	495
Karavas A N	281	147	48	476
Saifi J	244	295	166	705
Terrien C M	296	213	159	668
All Others	31	10	2	43
Total	**1091**	**869**	**427**	**2387**
Staten Island Univ Hosp				
Gulkarov I M	68	9	19	96
Imam M N	153	96	107	356
Rosell F M	285	28	27	340
All Others	44	22	20	86
Total	**550**	**155**	**173**	**878**
Strong Memorial Hosp				
Alfieris G	0	3	21	24
Gosev I	122	25	124	271
Knight P	171	645	405	1221
Lehoux J M	121	38	72	231
Prasad S M	147	59	231	437
All Others	95	13	107	215
Total	**656**	**783**	**960**	**2399**
UHS-Wilson Med Ctr				
Beckles D L	12	0	16	28
Ferdinand F D	8	1	24	33
Khan A M	118	46	61	225
Wong K	152	66	85	303
Yousuf M	95	52	63	210
All Others	0	1	1	2
Total	**385**	**166**	**250**	**801**
Univ. Hosp-Brooklyn				
Beckles D L	101	33	11	145
Neragi-Miandoab S	39	10	2	51
All Others	43	11	1	55
Total	**183**	**54**	**14**	**251**

Table 8, continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Univ. Hosp-Stony Brook				
Bilfinger T	68	17	221	306
Chikwe J Y	218	146	37	401
McLarty A	50	17	59	126
Tak V M	87	32	6	125
Tannous H J	99	15	171	285
All Others	15	7	6	28
Total	**537**	**234**	**500**	**1271**
Univ. Hosp-Upstate				
Esrig B	53	24	13	90
Green G R	117	54	50	221
All Others	82	27	20	129
Total	**252**	**105**	**83**	**440**
Vassar Bros. Med Ctr				
Sarabu M	66	131	120	317
Shahani R B	154	93	124	371
Zakow P	126	78	20	224
All Others	128	58	58	244
Total	**474**	**360**	**322**	**1156**
Westchester Med Ctr				
Goldberg J B	27	27	234	288
Kai M	90	26	74	190
Lansman S	2	0	9	11
Malekan R	130	66	117	313
Spielvogel D	338	165	263	766
Tang G	0	1	150	151
All Others	9	8	23	40
Total	**596**	**293**	**870**	**1759**
TOTAL	**25997**	**19143**	**22363**	**67503**

Criteria Used in Reporting Significant Risk Factors (2018)

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).
Refractory Cardiogenic Shock	Refractory Cardiogenic Shock is defined as an episode of systolic blood pressure <80 mm Hg and/or cardiac index < 2.0 L/min/m^2 determined to be secondary to cardiac dysfunction despite the use of parenteral inotropic or vasopressor agents or mechanical support (e.g., IABP, extracorporeal circulation, VADs). (Definition adopted in 2015.) Records with this risk factor were excluded from all analyses in this report.
Comorbidities	
Cerebrovascular Disease	The patient has cerebrovascular disease, documented by any one of the following: • Stroke - an acute episode of focal or global neurological dysfunction caused by brain, spinal cord, or retinal vascular injury as a result of hemorrhage or infarction, where the neurological dysfunction lasts for greater than 24 hours. • Transient Ischemic Attack (TIA) without history of stroke - transient episode of focal neurological dysfunction caused by brain, spinal cord, or retinal ischemia, without acute infarction, where the neurological dysfunction resolves within 24 hours. • Non-invasive or invasive arterial imaging test demonstrating >=80% stenosis of any of the major extracranial or intracranial vessels to the brain. • Previous cervical or cerebral artery surgery or percutaneous intervention.

Patient Risk Factor	Definitions
Comorbidities, *continued*	
Chronic Lung Disease	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.
Congestive Heart Failure (CHF), Past	Between 2 weeks and 6 months prior to the procedure, the patient has a clinical diagnosis/past medical history of CHF and ongoing 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 a diagnosis of CHF and evidence of treatment for CHF. Patient's clinical status may be compensated.
Diabetes with Insulin Treatment	The patient has a history of diabetes diagnosed and/or treated by a physician. Diabetes control method as presented on admission was Insulin.
Extensive Aortic Atherosclerosis	Ascending, transverse, and/or descending aortic atherosclerosis marked by either extensive calcification or luminal atheroma such that the intended surgical procedure is altered.
Malignant Ventricular Arrhythmia	Recent (within the past 14 days) sustained ventricular tachycardia requiring electrical defibrillation or conversion with intravenous anti-arrhythmic agents or ventricular fibrillation requiring electrical defibrillation. Excludes V-Tach or V-Fib occurring within 6 hours of the diagnosis of a myocardial infarction and responding well to treatment.
Peripheral Vascular Disease	Angiographic demonstration of at least 50% narrowing in a major aortoiliac or femoral/popliteal vessel, previous surgery for such disease, absent femoral or pedal pulses, or the inability to insert a catheter or intra-aortic balloon due to iliac aneurysm or obstruction of the aortoiliac or femoral arteries Ankle-Brachial Index < 0.9 is also acceptable documentation.
Renal Failure, Creatinine	Last pre-operative serum creatinine was in the indicated range.
Renal Failure Requiring Dialysis	The patient is currently (prior to surgery) undergoing dialysis.

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

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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 2018

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 2018 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 Malignant Ventricular Arrhythmia is 5.119. This means that a patient who has Malignant Ventricular Arrhythmia prior to surgery is approximately 5.119 times as likely to die in the hospital or after discharge within 30 days of surgery as a patient who does not have Malignant Ventricular Arrhythmia but who has the same other significant risk factors.

STEMI within 7 Days, Cerebrovascular Disease (other than TIA only), and Immediate Surgery after Diagnostic Cath or PCI 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 60 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 61 years old is approximately 1.074 times that of a patient 60 years old undergoing CABG, if all other risk factors are the same. All patients age 60 and younger have roughly the same odds of in-hospital / 30-day mortality if their other risk factors are identical.

Ejection Fraction, which is the percentage of blood in the heart's left ventricle that is expelled when it contracts (with more denoting a healthier heart), is subdivided into 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 3.752 times as likely to die in the hospital or within 30 days of surgery as a patient with an ejection fraction of 40 percent or higher, all other significant risk factors being the same.

Renal Failure is subdivided into four groups. The first group represents patients with serum creatinine from 1.3 mg/dl to 1.5 mg/dl who are not on dialysis. The second group is patients with serum creatinine greater than 1.5 mg/dL 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 2018.

		Logistic Regression		
Patient Risk Factor	**Prevalence %**	**Coefficient**	**P-value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 60	—	0.0710	<0.0001	1.074
Ventricular Function				
Ejection Fraction				
Ejection Fraction 40% or greater	83.74	— Reference —		1.000
Ejection Fraction less than 30%	6.24	1.3222	<0.0001	3.752
Ejection Fraction 30-39%	10.02	0.7592	0.0018	2.136
Pre-Procedural MI				
STEMI within 7 Days	4.14	0.9035	0.0028	2.468
Comorbidities				
Cerebrovascular Disease Other Than TIA Only	11.15	0.5410	0.0171	1.718
Malignant Ventricular Arrythmia	0.54	1.6330	0.0033	5.119
Renal Failure				
No Renal Failure	78.39	– Reference –		1.000
Creatinine, 1.3-1.5 mg/dl	10.76	0.7083	0.0041	2.030
Creatinine, >1.5 mg/dl	6.92	1.0018	<0.0001	2.723
Requiring Dialysis	3.93	1.5505	<0.0001	4.714
Previous Cardiac Procedures				
Immediate Surgery After Catheter Procedure	1.11	1.2334	0.0076	3.433

Intercept = -5.7210

C-Statistic = 0.778

Appendix 2
Risk Factors for CABG 30-Day Readmissions in New York State in 2018

The significant pre-procedural risk factors for 30-day readmissions following CABG in 2018 are presented in the table that follows. Pre-Procedural MI, Cerebrovascular Disease, Chronic Lung Disease, and Diabetes with Insulin Treatment are interpreted in the same way as Malignant Ventricular Arrhythmia in Appendix 1. The patient either has the risk factor or does not.

The interpretation of Age in this model is similar to that in Appendix 1 except in this case the increase risk is associated with increasing age above 65 years.

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

The quadratic function of BMI (BMI-squared) used in the statistical model reflects the fact that patients with very high and very low BMIs tend to have higher risks of death than patients with intermediate levels of BMI. This functional form is used to improve the model's ability to predict mortality, but it means that the odds ratios for these terms do not have a straightforward interpretation.

Congestive Heart Failure (CHF) is divided into three groups (patients with CHF in the past two weeks, patients with CHF within six months but not within the past two weeks, and patients with no CHF within 6 months). The odds ratios for CHF-Current and CHF-Past are relative to patients with no CHF within the past 6 months.

The interpretation of Renal Failure is similar to that in Appendix 1 except in this model patients with serum creatinine less than 1.5 mg/dl who are not on dialysis comprise the reference category.

Appendix Table 2

Multivariable Risk Factor Equation for CABG 30-Day Readmission in New York State in 2018.

		Logistic Regression		
Patient Risk Factor	**Prevalence %**	**Coefficient**	**P-value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 65	—	0.0295	<.0001	1.030
Body Mass Index (kg/m^2)	—	-0.0734	0.0434	—
Body Mass Index Term (kg^2/m^4)	—	0.0012	0.0296	—
Ventricular Function				
Pre-Procedural MI within 20 Days	30.71	0.2000	0.0082	1.221
Comorbidities				
Cerebrovascular Disease	13.16	0.4158	<.0001	1.516
Chronic Lung Disease	11.81	0.2192	0.0292	1.245
Congestive Heart Failure (CHF)				
No CHF within 6 months	80.05	— Reference —		1.000
CHF, Current (within 2 weeks)	13.98	0.4246	<.0001	1.529
CHF, Past but not Current (2 wks – 6 months)	5.97	0.3675	0.0059	1.444
Diabetes with Insulin Treatment	19.88	0.3619	<.0001	1.436
Renal Failure				
No Renal Failure	89.37	— Reference —		1.0000
Creatinine, 1.5-2.5 mg/dl	5.77	0.3118	0.0187	1.366
Creatinine, >2.5 mg/dl	1.06	0.6896	0.0085	1.993
Renal Dialysis	3.80	0.8472	<.0001	2.333

Intercept = -1.5213

C-Statistic = 0.641

Appendix 3
Risk Factors For Valve Surgery In-Hospital / 30-Day Mortality in 2016-2018

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve surgery in the 2016-2018 time period are presented in the table that follows.

The odds ratio for type of valve surgery roughly represents the number of times more likely to die in the hospital during or after surgery or after discharge but within 30 days a patient with a specific valve surgery is than a patient who has had aortic valve replacement surgery, all other risk factors being the same. For example, a patient who has a mitral valve replacement surgery is roughly 1.39 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.

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.

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

The interpretation of renal failure in this model is similar to that provided in Appendix 1 except in this case the reference category includes patients with no dialysis and serum creatinine less than 1.6 mg/dl.

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

Appendix Table 3

Multivariable Risk Factor Equation for Valve Surgery In-Hospital / 30-Day Deaths In NYS, 2016-2018.

		Logistic Regression		
Risk Factor	**Prevalence %**	**Coefficient**	**P-Value**	**Odds Ratio**
Type of Valve Surgery				
Aortic Valve Replacement/Repair	43.63	— Reference —		1.000
Mitral Valve	13.43	0.3292	0.0687	1.390
Mitral Valve Repair	20.41	-0.3839	0.1146	0.681
Multiple Valve Surgery				
with Mitral Valve Replacement (MVR)	11.07	0.9837	<.0001	2.674
with Aortic Valve Replacement but no MVR	4.08	0.3618	0.2193	1.436
Mitral and Tricuspid Valve Repairs	7.38	-0.7745	0.0519	0.461
Demographic				
Age: Number of years greater than 65	—	0.0570	<.0001	1.059
Body Surface Area (m^2)	—	-0.5094	0.0022	—
Body Surface Area Square Term (m^4)	—	0.0120	0.0030	—
Ventricular Function				
Ejection Fraction less than 50%	16.64	0.3281	0.0205	1.388
Previous MI within 20 days	1.56	1.0125	0.0002	2.753
Hemodynamic Status				
Non-Refractory Shock	0.71	1.2384	0.0002	3.450
Comorbidities				
Chronic Lung Disease				
None	87.58	— Reference —		1.000
Mild or Moderate	9.30	0.6317	<.0001	1.881
Severe	3.12	0.9604	<.0001	2.613
Diabetes, Insulin Dependent	5.63	0.6084	0.0014	1.838
Hepatic Failure	0.10	1.9681	0.0091	7.157
Renal Failure				
No Renal Failure	91.06	— Reference —		1.000
Creatinine 1.6-2.0 mg/dL	4.15	0.6154	0.0045	1.850
Creatinine > 2.0 mg/dL	2.00	1.1266	<.0001	3.085
Requiring Dialysis	2.79	1.5226	<.0001	4.584
Previous Cardiac Procedures				
Previous CABG Surgery	3.76	0.6100	0.0030	1.840
Previous Valve Surgery or Intervention	12.95	0.3834	0.0114	1.467

Intercept = 0.3142

C Statistic = 0.790

Appendix 4
Risk Factors for Valve and CABG Surgery In-Hospital / 30-Day Mortality in New York State in 2016-2018

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve and CABG surgery in the 2016-2018 time period are presented in the table that follows.

The odds ratio for Type of Valve with CABG surgery roughly represents the number of times more likely to die in the hospital during or after that particular surgery or after discharge but within 30 days of surgery a patient with a specific Valve with CABG surgery is than a patient who had aortic valve repair or replacement and CABG surgery, all other risk factors being the same. For example, a patient who has a mitral valve replacement and CABG surgery is 2.260 times as likely to die in the hospital or after discharge but within 30 days of surgery as a patient with aortic valve repair or replacement and CABG surgery, all other significant risk factors being the same.

All other risk factors are interpreted as described in Appendix 1 - 3.

Appendix Table 4

Multivariable Risk Factor Equation for Valve and CABG Surgery In-Hospital / 30-Day Deaths in NYS, 2016-2018.

		Logistic Regression		
Patient Risk Factor	**Prevalence (%)**	**Coefficient**	**P-Value**	**Odds Ratio**
Type of Valve Surgery w/ CABG				
Aortic Valve Repair or Replacement	60.20	— Reference —		1.000
Mitral Valve Replacement	12.10	0.8152	<.0001	2.260
Mitral Valve Repair	15.78	-0.1561	0.5081	0.856
Multiple Valve				
With Mitral Valve Replacement (MVR)	5.51	1.2430	<.0001	3.466
With Aortic Valve Replacement but no MVR	3.58	0.7575	0.0122	2.133
Mitral and Tricuspid Valve Repairs	2.83	0.6977	0.0489	2.009
Demographic				
Age: Number of years greater than 50	—	0.0409	<0.0001	1.042
Body Surface Area (m^2)	—	-0.8840	<0.0001	—
Body Surface Area, Square Term (m^4)	—	0.0229	<0.0001	—
Female	28.92	0.8010	<0.0001	2.228
Ventricular Function				
Ejection Fraction <20%	1.88	1.4205	<0.0001	4.139
Previous MI within 14 Days	15.32	0.7434	<0.0001	2.103
Comorbidities				
Congestive Heart Failure, Current (within 2 weeks)	35.72	0.4042	0.0058	1.498
Extensive Aortic Atherosclerosis	3.33	0.6802	0.0134	1.974
Renal Failure				
No Renal Failure	86.54	– Reference –		1.000
Creatinine, 1.6-2.0 mg/dl	6.30	0.5553	0.0207	1.742
Creatinine, >2.0 mg/dl	3.04	0.7654	0.0099	2.150
Requiring Dialysis	4.12	1.2340	<0.0001	3.435
Previous Cardiac Procedures				
Previous PCI	22.53	0.3996	0.0087	1.491
Previous Cardiac Surgery or Valvular Intervention	6.12	0.7949	0.0002	2.214

Intercept = 2.9803

C Statistic = 0.775

Appendix 5
Risk Factors for TAVR In-Hospital / 30-Day Deaths in New York State in 2016-2018

The significant pre-procedural risk factors for in-hospital/30-day mortality following TAVR in the 2016-2018 time period are presented in the table that follows. Most of the risk factors in this model are interpreted as described in Appendices 1 – 4. Tricuspid Valve Incompetence is broken into three levels: None or Mild, Moderate, and Severe. Patients with no Tricuspid Valve Incompetence or only mild tricuspid valve incompetence are the reference category.

Appendix Table 5

Multivariable Risk Factor Equation for TAVR In-Hospital / 30-Day Deaths in New York State in 2016-2018.

Patient Risk Factors	Prevalence (%)	Regression Coefficient	P value	Odds Ratio
Demographic				
Age: Number of years greater than 75	—	0.0486	<.0001	1.050
Female	49.22	0.5280	<.0001	1.696
Ventricular Function				
Ejection Fraction less than 30%	5.38	0.4156	0.0455	1.515
Previous MI within 20 days	1.83	0.7244	0.0155	2.064
Comorbidities				
Chronic Lung Disease, Moderate or Severe	12.75	0.6155	<.0001	1.851
Extensive Aortic Atherosclerosis	1.98	0.8629	0.0016	2.370
Peripheral Vascular Disease	19.73	0.3326	0.0126	1.395
Renal Failure				
No Renal Failure	67.77	– Reference –		1.000
Creatinine 1.3 - 1.5 mg/dL	15.08	0.4500	0.0059	1.568
Creatinine 1.6 – 2.0 mg/dL	8.65	0.5854	0.0021	1.796
Creatinine >2.0 mg/dL or Renal Dialysis	8.50	1.1526	<.0001	3.167
Valve Disease				
Tricuspid Valve Incompetence				
None or Mild	78.20	– Reference –		1.000
Moderate	17.44	0.4019	0.0039	1.495
Severe	4.36	0.8746	<.0001	2.398
Coronary Artery Disease				
Three Vessels Diseased	2.19	0.7021	0.0135	2.018
Previous Cardiac Procedures				
Previous Valve Surgery or Intervention	13.65	0.3369	0.0241	1.401

Intercept = -5.1674
C Statistic = 0.702

Appendix 6
Risk Factors for Isolated CABG In-Hospital / 30-Day Mortality in New York State 2016-2018

The significant pre-procedural risk factors for in-hospital/30-day mortality following isolated CABG in the 2016-2018 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 2016-2018.

		Logistic Regression		
Patient Risk Factors	**Prevalence (%)**	**Coefficient**	**P- value**	**Odds Ratio**
Demographic				
Age: Number of years greater than 65	—	0.0744	<.0001	1.077
Body Mass Index (kg/m^2)	—	-0.1014	0.0195	0.904
Body Mass Index Squared (kg^2/m^4)	—	0.0021	0.0008	1.002
Female	24.07	0.4453	<.0001	1.561
Hemodynamic Status				
Non-Refractory Shock	0.52	1.4910	<.0001	4.441
Ventricular Function				
Ejection Fraction				
Ejection Fraction 40% or greater	83.59	— Reference —		1.000
Ejection Fraction less than 20%	1.14	1.5134	<.0001	4.542
Ejection Fraction 20-29%	5.30	1.2599	<.0001	3.525
Ejection Fraction 30-39%	9.97	0.6571	<.0001	1.929
Pre-Procedural MI				
No STEMI in 1 – 7 Days	96.08	— Reference —		1.000
STEMI, less than 24 Hours	1.07	1.3567	<.0001	3.883
STEMI, 1- 7 Days	2.85	0.9947	<.0001	2.704
Comorbidities				
Cerebrovascular Disease except TIA only	11.13	0.3278	0.0135	1.388
Chronic Lung Disease				
None	75.74	— Reference —		1.000
Mild or Moderate	9.73	0.4870	0.0007	1.628
Severe	2.92	0.8670	<.0001	2.380
Peripheral Vascular Disease	11.61	0.5412	<.0001	1.718
Renal Failure				
No Renal Failure	77.74	— Reference —		1.000
Creatinine 1.3-1.5 mg/dL	11.21	0.5800	<.0001	1.786
Creatinine >1.5 mg/dL	7.31	0.7176	<.0001	2.050
Requiring Dialysis	3.74	1.2893	<.0001	3.630
Previous Cardiac Procedures				
Previous CABG Surgery	1.29	0.9739	0.0005	2.648

Intercept = -4.5445
C Statistic = 0.786

NEW YORK STATE CARDIAC SURGERY CENTERS

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

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

Bassett Medical Center
Atwell Road
Cooperstown, New York 13326

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

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

Ellis Hospital
1101 Nott Street
Schenectady, New York 12308

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

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

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

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

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

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

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

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

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

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

Mount Sinai Morningside
1111 Amsterdam Avenue
New York, New York 10025

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

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

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

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

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

NYU Winthrop Hospital
259 First Street
Mineola, New York 11501

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

Rochester General Hospital
1425 Portland Avenue
Rochester, New York 14621

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

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

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

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

South Shore University Hospital
301 East Main Street
Bayshore, New York 11706

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

Strong Memorial Hospital
601 Elmwood Avenue
Rochester, New York 14642

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

University Hospital at Stony Brook
Stony Brook, New York 11794

SUNY Downstate Medical Center*
450 Clarkson Avenue
Brooklyn, New York 11203

Upstate University Hospital – State University of New York
750 East Adams Street
Syracuse, New York 13210

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

Westchester Medical Center
100 Woods Road
Valhalla, New York 10595

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

* No longer performs cardiac surgery.
** Hospital began performing cardiac surgery after November 30, 2018.

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

or by writing to:

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


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