

**ADULT
CARDIAC
SURGERY**

**in
New York State**

2009 – 2011

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INTRODUCTION

The information contained in this booklet is intended for health care providers, patients and families of patients who are considering cardiac surgery. It provides data on risk factors associated with death following coronary artery bypass graft surgery (CABG) and heart valve surgery, and lists hospital and physician-specific mortality rates which have been risk-adjusted to account for differences in patient severity of illness.

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.

We are pleased to be able to continue to provide information in this year's report that encompasses outcomes for isolated CABG, valve surgery and the two procedures done in combination. Isolated CABG, CABG without any other major cardiac procedure done at the same time, is the most common of the many types of cardiac surgery performed on adults. We have reported risk-adjusted outcomes for isolated CABG surgery for over twenty years. However, many additional patients undergo procedures each year to repair or replace heart valves or undergo valve surgery done in combination with CABG. This report provides important information on the risk factors and outcomes for both CABG and valve surgery. In addition, this report includes information on mortality outside the hospital but within 30 days following surgery. We believe this to be an important quality indicator that will provide useful information to patients and providers.

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 2011. Important changes may have taken place in some hospitals during that time period.

In developing treatment plans, 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 lack of exercise. Limiting these risk factors after surgery will continue to be important in minimizing the occurrence of new blockages.

Providers of this state and the Cardiac Advisory Committee are to be commended for the excellent results that have been achieved through this cooperative quality improvement system. The Department of Health will continue to work in partnership with hospitals and physicians to ensure 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. Triple and quadruple bypasses are often done for this reason, not necessarily because the patient's condition is more severe. 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, pulmonic 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. 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, sometimes also called Transcatheter Aortic Valve Implantation), 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. TAVR procedures are not included among valve repairs or replacement operations in this report. This report contains

outcomes for the following valve procedures when done alone or in combination with CABG: Aortic Valve Replacement, Mitral Valve Repair, Mitral Valve Replacement and Multiple Valve Surgery.

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, 2008, and November 30, 2011, provided by all non-federal hospitals in NYS where cardiac surgery is performed. The analysis period for this report includes patients discharged in December 2008 but not those discharged in December 2011. 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 2011 cases includes patients discharged from December 1, 2010 through November 30, 2011. In total there were 58,760 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.

When St. Vincent's Hospital in Manhattan closed in April of 2010, the cardiac data validation process for 2009 cases was incomplete. Because the accuracy of risk factors, procedural information and outcomes for these cases cannot be verified, the 129 cases reported by this hospital in the analysis period are not included in this report.

In addition, 103 records were excluded because they belong to patients residing outside the United States,

and these patients could not be followed after hospital discharge. There were 14 cases excluded from analysis because each 30-day mortality can only be associated with a single cardiac surgery. An additional 20 records belonging to patients enrolled in a clinical trial (PARTNER) comparing outcomes for two kinds of valve replacement procedures were excluded as well.

Beginning with patients discharged in 2006, the Department of Health, with the advice of the Cardiac Advisory Committee, began a trial period of excluding from publicly released reports any patients meeting the Cardiac Data System definition of pre-operative cardiogenic shock. Cardiogenic shock is a condition associated with severe hypotension (very low blood pressure). [The technical definition used in this report can be found on page 42.] 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, 462 cases with cardiogenic shock were removed from the data. This accounts for 0.79 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 58,032 cardiac surgeries analyzed in this report. Isolated CABG surgery represented 48.80 percent of all adult cardiac surgery included in this report. Valve or combined valve/CABG surgery represented 38.33 percent of all adult cardiac surgery for the same period. Total cardiac surgery, isolated CABG, valve or valve/

CABG surgery and other cardiac surgery volumes are tabulated in Table 7 by hospital and surgeon for the period 2009 through 2011.

Note on Hospitals Not Performing Cardiac Surgery During Entire 2009 – 2011 Period

Southside hospital began performing cardiac surgery in February 2011.

RISK ADJUSTMENT FOR ASSESSING PROVIDER PERFORMANCE

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

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

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

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

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

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

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

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

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 and/or valve surgery and determining how to weigh the significant risk factors

to predict the chance each patient will have of dying, given his or her specific characteristics.

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

Predicting Patient Mortality Rates for Providers

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

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

Computing the Risk-Adjusted Mortality Rate

The risk-adjusted mortality rate (RAMR) represents the best estimate, based on the associated statistical model, of what the provider's mortality rate would have been if the provider had a mix of patients identical to the statewide mix. Thus, the RAMR has, to the extent possible, ironed out differences among providers in patient severity of illness, since it arrives at a mortality rate for each provider for an identical group of patients.

To calculate the RAMR, the OMR is first divided by the provider's EMR. If the resulting ratio is larger than one, the provider has a higher mortality rate than expected on the basis of its patient mix; if it is smaller than one, the provider has a lower mortality rate than expected from its patient mix. For isolated CABG patients the ratio is then multiplied by the overall statewide mortality rate of 1.24 percent (in-hospital/30-day mortality in 2011) to obtain the provider's RAMR. For the three-year period

2009-2011, the ratio is multiplied by 1.56 percent (in-hospital/30-day mortality rate) for isolated CABG patients or 4.22 percent (in-hospital/30-day mortality rate) for valve or valve/CABG patients.

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

Interpreting the Risk-Adjusted Mortality Rate

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

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

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

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

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 process problems that have led to less than optimal outcomes, and have altered those processes to achieve improved results.

RESULTS

2011 Risk Factors for CABG Surgery

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 2011 are presented in Table 1.

Roughly speaking, the odds ratio for a risk factor represents the number of times a patient with that risk factor is more likely to die in the hospital during or after CABG or after discharge but within 30 days of the surgery than a patient without the risk factor, all other risk factors being the same. For example, the odds ratio for the risk factor Peripheral Vascular Disease is 1.771. This means that a patient who has Peripheral Vascular Disease prior to surgery is approximately 1.771 times as likely to die in the hospital or after discharge within 30 days of surgery as a patient who does not have Peripheral Vascular Disease but who has the same other significant risk factors.

For some of the risk factors in the table, there are only two possibilities: having the risk factor and not having it. For example, a patient either has Peripheral Vascular Disease or does not have Peripheral Vascular Disease. Cerebrovascular Disease and Emergency transfer to OR after diagnostic cath or PCI are interpreted in this way as well.

For age, the odds ratio roughly represents the number of times a patient who is older than 50 is more likely to die in the hospital or after discharge but within 30 days than a patient who is one year younger. Thus, the chance of in-hospital/30-day mortality for a patient undergoing CABG who is 51 years old is approximately 1.053 times that of a patient 50 years old undergoing CABG, if all other risk factors are the same. All patients age 50 and younger have

roughly the same odds of dying in the hospital or after discharge but within 30 days if their other risk factors are identical.

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 and 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

Ejection Fraction is the percentage of blood in the heart's left ventricle that is expelled when it contracts. Higher ejection fraction denotes a healthier heart. In this model, patients with an ejection fraction less than 30 percent have odds of in-hospital/30-day mortality that are 2.329 times the odds of death for a person with an ejection fraction greater than 30 percent but all of the other significant risk factors the same.

Previous MI is subdivided into three groups: occurring less than seven days prior to surgery, seven or more days prior and no MI prior to surgery. The last group is referred to as the reference category. The odds ratios for the Previous MI categories are relative to patients who have not had an MI prior to the procedure.

Since Renal Failure is expressed in terms of renal failure with dialysis and elevated creatinine without dialysis, the odds ratios for all Renal Failure categories are relative to patients with no dialysis and no creatinine greater than 1.3 mg/dL prior to surgery.

Table 1: Multivariable Risk Factor Equation for CABG In-Hospital / 30-Day Deaths in New York State in 2011

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Demographic				
Age: Number of years greater than 50	—	0.0520	<.0001	1.053
Body Surface Area (0.1 m ²)	—	-0.9203	0.0007	—
Body Surface Area – squared (0.01 m ⁴)	—	0.0231	0.0003	—
Ventricular Function				
Ejection Fraction < 30%	7.16	0.8456	0.0014	2.329
Previous MI				
No Previous MI	52.42	— Reference —		1.000
Previous MI less than 7 days	21.50	0.8533	0.0009	2.347
Previous MI 7 days or more	26.08	0.7488	0.0031	2.114
Comorbidities				
Cerebrovascular Disease	18.87	0.6585	0.0025	1.932
Peripheral Vascular Disease	11.41	0.5717	0.0154	1.771
Renal Failure				
No Renal Failure	74.74	— Reference —		1.000
Renal Failure, Creatinine ≥ 1.3 mg/dl	22.60	0.4419	0.0457	1.556
Renal Failure, Requiring Dialysis	2.65	1.4971	<.0001	4.469
Emergency Transfer to OR after Diagnostic Cath or PCI	2.10	1.5803	<.0001	4.856
Intercept = 2.4717				
C Statistic = 0.781				

2011 HOSPITAL OUTCOMES FOR CABG SURGERY

Table 2 and Figure 1 present the CABG surgery results for the 40 hospitals performing this operation in NYS in 2011. 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 2011, the number of in-hospital/30-day deaths, the OMR, the EMR based on the statistical model presented in Table 1, the RAMR and a 95 percent confidence interval for the RAMR.

As indicated in Table 2, the overall in-hospital/30-day mortality rate for the 8,627 CABG surgeries was 1.24 percent. In-hospital/30-day OMRs ranged from 0.00 percent to 3.08 percent. The range of EMRs, which measure patient severity of illness, was 0.79 percent to 1.80 percent.

The RAMRs, which are used to measure performance, ranged from 0.00 percent to 4.58 percent. No hospitals had RAMRs that were significantly higher or lower than the statewide rate.

The 2011 in-hospital/30-day mortality rate of 1.24 percent for Isolated CABG is lower than the 1.58 percent observed in 2010.

The in-hospital OMR for 2011 Isolated CABG discharges (not shown in Table 2) was 0.90 percent for all 8,627 patients included in the analysis.

Figures 1 and 2 provide a visual representation of the data displayed in Tables 2 and 3. 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. 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.

2009-2011 HOSPITAL OUTCOMES FOR VALVE SURGERY

Table 3 and Figure 2 present the combined Valve Only and Valve/CABG surgery results for the 40 hospitals performing these operations in NYS during the years 2009-2011. The table contains, for each hospital, the combined number of Valve Only and Valve/CABG operations resulting in 2009-2011 discharges, the number of in-hospital/30-day deaths, the OMR, the EMR based on the statistical models presented in Appendices 2-3, 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 22,246 combined Valve Only and Valve/CABG procedures performed at the 40 hospitals was 4.22 percent. The OMRs ranged from 0.95 percent to 7.32 percent. The range of EMRs, which measure patient severity of illness, was 2.21 percent to 5.32 percent.

The RAMRs, which are used to measure performance, ranged from 0.86 percent to 11.56 percent. Three hospitals (Arnot Ogden Medical Center in Elmira, Beth Israel Medical Center in Manhattan, and Staten Island University Hospital) had RAMRs that were significantly higher than the statewide rate. Two hospitals (Long Island Jewish Medical Center in New Hyde Park and NY Presbyterian – Weil Cornell

Medical Center in Manhattan) had RAMRs that were significantly lower than the statewide rate.

Table 4 presents valve procedures performed at the 40 cardiac surgery hospitals in NYS during 2009-2011. The table contains, for each hospital, the number of valve operations (as defined by eight separate groups: Aortic Valve Replacements, Aortic Valve Repair or Replacements plus CABG, Mitral Valve Replacement, Mitral Valve Replacement plus CABG, Mitral Valve Repair, Mitral Valve Repair plus CABG, Multiple Valve Surgery and Multiple Valve Surgery plus CABG) resulting in 2009-2011 discharges. In addition to the hospital volumes, the rate of in-hospital/30-day death for the state (Statewide Mortality Rate) is given for each group. Unless otherwise specified, when the report refers to Valve or Valve/CABG procedures it is referring to the last column of Table 4.

The 2009-2011 in-hospital/30-day OMR of 4.22 percent for Valve and Valve/CABG surgeries is lower than the 4.59 percent observed for 2008-2010. The in-hospital OMR for 2009-2011 valve surgeries (not shown in Table 3) is 3.54 percent for the 22,246 patients included in this analysis.

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, 1.24 percent for Isolated CABG patients in 2011 or 4.22 percent for Valve or Valve/CABG patients in 2009-2011).

Confidence Intervals are used to identify which hospitals had significantly more or fewer deaths than expected given the risk factors of their patients. The confidence interval identifies the range in which the RAMR may fall. Hospitals with significantly higher rates than expected after adjusting for risk are those where the confidence interval range falls entirely above the statewide mortality rate. Hospitals with significantly lower rates than expected, given the severity of illness of their patients before surgery, have confidence intervals entirely below the statewide mortality rate.

The more cases a provider performs, the narrower their confidence interval will be. This is because as a provider performs more cases, the likelihood of chance variation in the RAMR decreases.

Table 2: In-hospital/30-Day Observed, Expected and Risk-Adjusted Mortality Rates for Isolated CABG Surgery in New York State, 2011 Discharges (Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Medical Center	241	0	0.00	1.47	0.00	(0.00, 1.28)
Arnot Ogden Med Ctr	81	0	0.00	0.99	0.00	(0.00, 5.68)
Bellevue Hospital Ctr	93	1	1.08	1.12	1.19	(0.02, 6.62)
Beth Israel Med Ctr	164	1	0.61	0.79	0.95	(0.01, 5.30)
Buffalo General Hosp	288	4	1.39	1.18	1.46	(0.39, 3.73)
Champ. Valley Phys Hosp	80	2	2.50	0.88	3.53	(0.40,12.75)
Ellis Hospital	180	1	0.56	1.24	0.56	(0.01, 3.10)
Erie County Med Ctr	81	0	0.00	0.81	0.00	(0.00, 6.92)
Good Sam - Suffern	119	0	0.00	0.93	0.00	(0.00, 4.12)
Lenox Hill Hospital	272	1	0.37	1.36	0.33	(0.00, 1.86)
Long Island Jewish	133	2	1.50	1.30	1.44	(0.16, 5.18)
M I Bassett Hospital	63	1	1.59	1.12	1.76	(0.02, 9.78)
Maimonides Medical Ctr	272	2	0.74	1.78	0.51	(0.06, 1.85)
Mercy Hospital	361	3	0.83	1.21	0.85	(0.17, 2.48)
Millard Fillmore Hosp	211	2	0.95	1.19	0.99	(0.11, 3.57)
Montefiore - Moses	178	2	1.12	1.26	1.10	(0.12, 3.98)
Montefiore - Weiler	207	0	0.00	1.08	0.00	(0.00, 2.04)
Mount Sinai Hospital	304	6	1.97	0.89	2.74	(1.00, 5.97)
NY Hospital - Queens	98	1	1.02	0.84	1.51	(0.02, 8.39)
NY Methodist Hospital	91	1	1.10	1.19	1.15	(0.02, 6.39)
NYP- Columbia Presby.	368	7	1.90	1.21	1.96	(0.78, 4.03)
NYP- Weill Cornell	183	2	1.09	0.97	1.39	(0.16, 5.03)
NYU Hospitals Center	132	4	3.03	0.82	4.58	(1.23,11.72)
North Shore Univ Hosp	364	3	0.82	1.13	0.90	(0.18, 2.63)
Rochester General Hosp	316	6	1.90	1.42	1.65	(0.60, 3.60)
Southside Hospital	112	2	1.79	1.63	1.36	(0.15, 4.92)
St. Elizabeth Med Ctr	209	2	0.96	1.25	0.95	(0.11, 3.43)
St. Francis Hospital	723	8	1.11	1.27	1.08	(0.47, 2.13)
St. Josephs Hospital	395	8	2.03	1.63	1.54	(0.66, 3.04)
St. Lukes at St. Lukes	102	2	1.96	1.76	1.38	(0.16, 5.00)
St. Peters Hospital	284	3	1.06	1.07	1.23	(0.25, 3.58)
Staten Island Univ Hosp	303	2	0.66	1.03	0.79	(0.09, 2.86)
Strong Memorial Hosp	249	6	2.41	1.22	2.45	(0.89, 5.33)
United Hlth Svcs-Wilson	163	3	1.84	1.56	1.47	(0.29, 4.28)
Univ. Hosp-Brooklyn	65	2	3.08	1.80	2.12	(0.24, 7.66)
Univ. Hosp-Stony Brook	237	5	2.11	1.35	1.94	(0.63, 4.53)
Univ. Hosp-Upstate	158	3	1.90	1.19	1.99	(0.40, 5.80)
Vassar Bros. Med Ctr	206	4	1.94	1.28	1.88	(0.51, 4.82)
Westchester Med Ctr	256	1	0.39	1.58	0.31	(0.00, 1.70)
Winthrop Univ. Hosp	285	4	1.40	0.99	1.76	(0.47, 4.50)
Statewide Total	8627	107	1.24			

Figure 1: In-Hospital/30-Day Risk-Adjusted Mortality Rates for Isolated CABG in New York State, 2011 Discharges

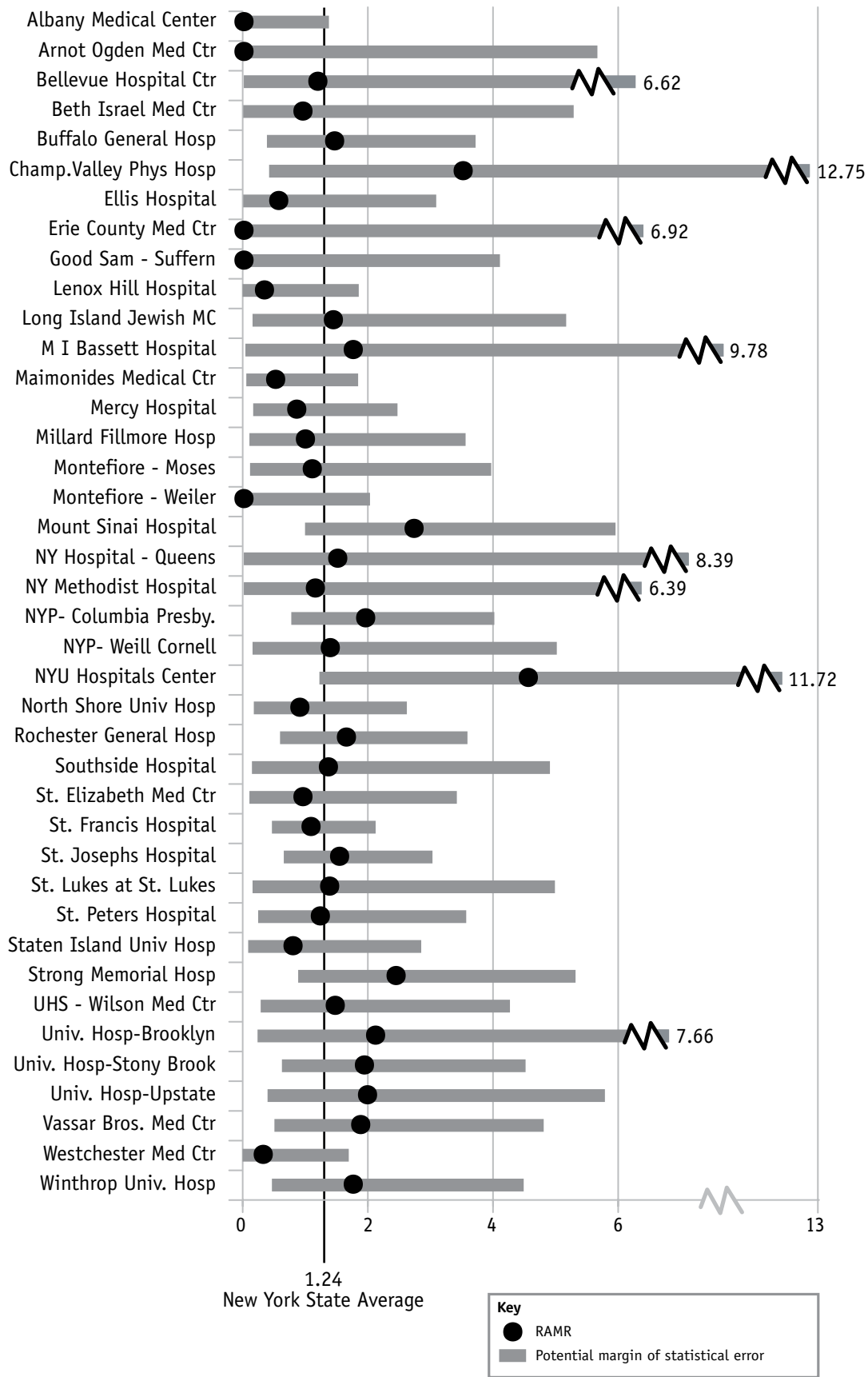


Table 3: In-hospital/30-Day Observed, Expected, and Risk-Adjusted Mortality Rates for Valve or Valve/CABG Surgery in New York State, 2009-2011 Discharges.

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Medical Center	532	18	3.38	3.97	3.59	(2.13, 5.68)
Arnot Ogden Med Ctr	123	9	7.32	2.67	11.56 *	(5.28,21.95)
Bellevue Hospital Ctr	272	12	4.41	3.27	5.69	(2.94, 9.95)
Beth Israel Med Ctr	291	19	6.53	3.90	7.07 *	(4.26,11.05)
Buffalo General Hosp	493	13	2.64	3.18	3.50	(1.86, 5.99)
Champ.Valley Phys Hosp	75	4	5.33	2.21	10.19	(2.74,26.10)
Ellis Hospital	299	12	4.01	3.90	4.34	(2.24, 7.59)
Erie County Med Ctr	54	3	5.56	4.30	5.46	(1.10,15.95)
Good Sam - Suffern	171	6	3.51	3.10	4.78	(1.74,10.40)
Lenox Hill Hospital	544	34	6.25	4.88	5.40	(3.74, 7.55)
Long Island Jewish MC	618	15	2.43	4.88	2.10 **	(1.17, 3.46)
M I Bassett Hospital	105	1	0.95	3.28	1.23	(0.02, 6.82)
Maimonides Medical Ctr	428	17	3.97	4.87	3.44	(2.00, 5.51)
Mercy Hospital	417	17	4.08	3.22	5.34	(3.11, 8.55)
Millard Fillmore Hosp	259	8	3.09	2.51	5.20	(2.24,10.24)
Montefiore - Moses	418	22	5.26	4.84	4.59	(2.88, 6.95)
Montefiore - Weiler	363	25	6.89	4.70	6.19	(4.00, 9.14)
Mount Sinai Hospital	1597	67	4.20	3.58	4.94	(3.83, 6.28)
NY Hospital - Queens	93	1	1.08	2.59	1.75	(0.02, 9.76)
NY Methodist Hospital	181	7	3.87	4.04	4.05	(1.62, 8.34)
NYP- Columbia Presby.	1876	78	4.16	4.27	4.11	(3.25, 5.12)
NYP- Weill Cornell	1296	31	2.39	3.71	2.72 **	(1.85, 3.86)
NYU Hospitals Center	1265	44	3.48	3.22	4.56	(3.31, 6.12)
North Shore Univ Hosp	1326	54	4.07	5.04	3.41	(2.56, 4.45)
Rochester General Hosp	974	56	5.75	4.55	5.34	(4.03, 6.93)
Southside Hospital	104	1	0.96	4.73	0.86	(0.01, 4.77)
St. Elizabeth Med Ctr	386	25	6.48	4.37	6.26	(4.05, 9.24)
St. Francis Hospital	1953	97	4.97	5.16	4.06	(3.29, 4.96)
St. Josephs Hospital	1043	51	4.89	5.16	4.00	(2.98, 5.26)
St. Lukes at St. Lukes	266	17	6.39	3.97	6.79	(3.95,10.87)
St. Peters Hospital	787	29	3.68	4.20	3.70	(2.48, 5.32)
Staten Island Univ Hosp	338	20	5.92	3.46	7.22 *	(4.41,11.15)
Strong Memorial Hosp	620	26	4.19	3.51	5.05	(3.30, 7.40)
UHS - Wilson Med Ctr	238	6	2.52	3.44	3.10	(1.13, 6.74)
Univ. Hosp-Brooklyn	121	4	3.31	4.91	2.84	(0.76, 7.27)
Univ. Hosp-Stony Brook	496	34	6.85	5.32	5.44	(3.76, 7.60)
Univ. Hosp-Upstate	250	7	2.80	3.48	3.40	(1.36, 7.01)
Vassar Bros. Med Ctr	499	11	2.20	3.79	2.46	(1.23, 4.40)
Westchester Med Ctr	470	16	3.40	5.08	2.83	(1.62, 4.59)
Winthrop Univ. Hosp	605	22	3.64	4.47	3.43	(2.15, 5.20)
Statewide Total	22246	939	4.22			

*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 2: In-Hospital/30-Day Risk-Adjusted Mortality Rates for Valve or Valve/CABG Surgery in New York State, 2009-2011 Discharges

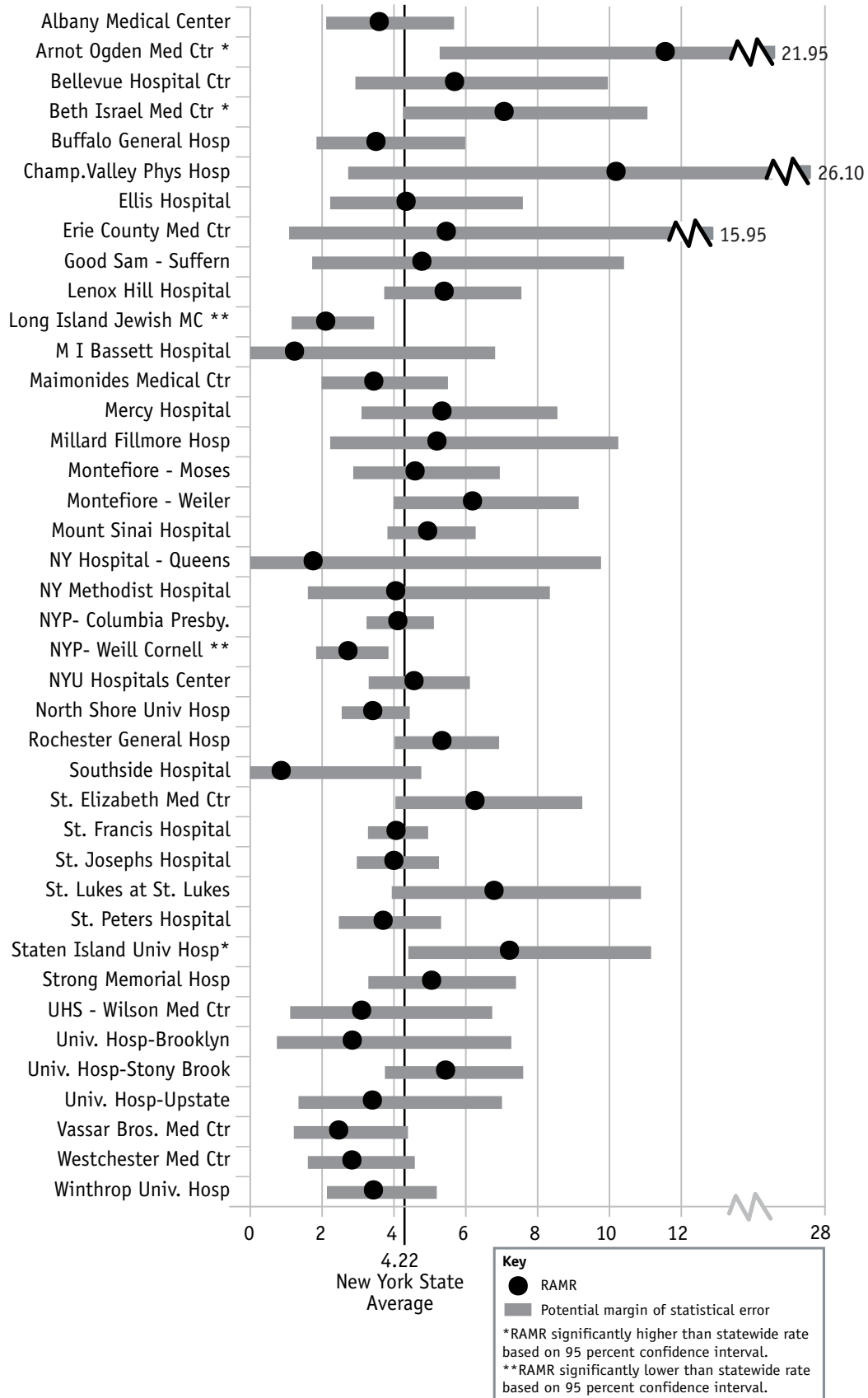


Table 4: Hospital Volume for Valve Procedures in New York State, 2009-2011 Discharges

Hospital	Aortic Valve Replace Surgery	Aortic Valve and CABG	Mitral Valve Replace Surgery	Mitral Replace and CABG	Mitral Valve Repair Surgery	Mitral Repair and CABG	Multiple Valve Surgery	Multiple Valve and CABG	Total Valve or Valve/ CABG
Albany Medical Center	172	180	25	20	56	18	46	15	532
Arnot Ogden Med Ctr	58	41	11	3	3	2	5	0	123
Bellevue Hospital Ctr	70	19	57	12	16	14	78	6	272
Beth Israel Med Ctr	68	74	38	11	24	25	37	14	291
Buffalo General Hosp	166	162	36	18	53	38	16	4	493
Champ.Valley Phys Hosp	30	28	1	0	3	10	3	0	75
Ellis Hospital	114	86	17	10	23	30	10	9	299
Erie County Med Ctr	17	14	10	7	1	0	3	2	54
Good Sam - Suffern	69	41	12	14	12	11	7	5	171
Lenox Hill Hospital	159	105	40	10	66	54	80	30	544
Long Island Jewish	166	120	94	45	58	38	65	32	618
M I Bassett Hospital	35	40	13	5	5	4	1	2	105
Maimonides Medical Ctr	137	69	83	22	25	28	58	6	428
Mercy Hospital	123	117	32	24	55	28	23	15	417
Millard Fillmore Hosp	90	83	14	6	33	13	13	7	259
Montefiore - Moses	103	74	52	35	30	55	55	14	418
Montefiore - Weiler	93	57	62	20	37	36	42	16	363
Mount Sinai Hospital	256	169	30	8	214	63	714	143	1597
NY Hospital - Queens	37	14	9	7	6	1	16	3	93
NY Methodist Hospital	70	38	18	6	12	8	26	3	181
NYP- Columbia Presby.	695	376	171	58	223	93	200	60	1876
NYP- Weill Cornell	506	227	121	36	153	43	168	42	1296
NYU Hospitals Center	477	115	104	25	296	50	175	23	1265
North Shore Univ Hosp	460	336	145	71	91	50	126	47	1326
Rochester General Hosp	370	244	82	22	102	64	54	36	974
Southside Hospital	29	27	5	6	10	10	13	4	104
St. Elizabeth Med Ctr	117	106	22	15	26	50	26	24	386
St. Francis Hospital	659	492	106	39	206	130	220	101	1953
St. Josephs Hospital	278	263	87	56	96	80	118	65	1043
St. Lukes at St. Lukes	53	51	31	15	56	27	24	9	266
St. Peters Hospital	262	246	32	27	59	43	73	45	787
Staten Island Univ Hosp	103	73	42	22	43	35	13	7	338
Strong Memorial Hosp	252	164	36	11	78	28	36	15	620
Unitd Hlth Svcs-Wilson	88	88	19	14	10	4	10	5	238
Univ.Hosp-Brooklyn	23	17	18	3	15	15	21	9	121
Univ.Hosp-Stony Brook	129	107	43	21	41	35	71	49	496
Univ.Hosp-Upstate	81	47	15	7	54	9	34	3	250
Vassar Bros. Med Ctr	167	149	46	30	27	32	24	24	499
Westchester Med Ctr	164	151	36	1	50	29	25	14	470
Winthrop Univ. Hosp	202	147	50	28	49	74	38	17	605
Total	7148	4957	1865	790	2417	1377	2767	925	22246
Statewide Mortality Rate (%)	2.85	4.46	5.04	6.20	1.28	4.28	5.75	13.19	4.22

2009-2011 HOSPITAL AND SURGEON OUTCOMES

Table 5 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 2009-2011. In addition, the final two columns provide the number of Isolated CABG, Valve and Valve/CABG procedures and the RAMR for these patients in 2009-2011 for each of the 40 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 2009-2011, (b) performed at least one cardiac operation in each of the years, 2009-2011. A cardiac

operation is defined as any reportable adult cardiac operation and may include cases not listed in Tables 5 or 6.

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 2009-2011 are noted in Table 5 and listed under all hospitals in which they performed these operations.

Also, surgeons who met either criterion (a) or (b) above and have performed Isolated CABG, Valve or Valve/CABG operations in two or more NYS hospitals are listed separately in Table 6. This table contains the same information as Table 5 across all hospitals in which the surgeon performed operations.

Table 5: 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, 2009-2011 Discharges

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Statewide Total	28322	441	1.56				50568	2.73
Albany Medical Center								
#Bennett E	24	0	0.00	1.07	0.00	(0.00,22.29)	83	2.56
Britton L	264	1	0.38	1.44	0.41	(0.01, 2.28)	433	2.78
##Depan H	204	2	0.98	1.55	0.98	(0.11, 3.55)	343	1.51
Miller S	250	5	2.00	1.46	2.13	(0.69, 4.96)	397	2.43
All Others	74	1	1.35	1.66	1.27	(0.02, 7.04)	92	1.27
Total	816	9	1.10	1.49	1.16	(0.53, 2.19)	1348	2.22
Arnot Ogden Med Ctr								
Nast E	155	1	0.65	1.38	0.73	(0.01, 4.05)	218	4.39
Raudat C W	146	1	0.68	1.34	0.80	(0.01, 4.42)	206	3.74
Total	301	2	0.66	1.36	0.76	(0.09, 2.74)	424	4.07
Bellevue Hospital Ctr								
#Balsam L B	138	0	0.00	1.12	0.00	(0.00, 3.71)	255	1.11
##Crooke G	69	0	0.00	0.80	0.00	(0.00,10.33)	103	2.72
#Culliford A	1	0	0.00	2.62	0.00	(0.00,100.0)	1	0.00
##Deanda A	83	2	2.41	1.17	3.22	(0.36,11.61)	136	4.74
##Loulmet D F	16	1	6.25	1.57	6.21	(0.08,34.54)	39	8.31
##Ribakove G	29	1	3.45	1.55	3.47	(0.05,19.29)	67	6.40
#Schwartz C F	20	0	0.00	0.70	0.00	(0.00,40.56)	27	0.00
Total	356	4	1.12	1.10	1.59	(0.43, 4.06)	628	3.40

Table 5 continued

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Beth Israel Med Ctr								
Geller C M	82	0	0.00	1.07	0.00	(0.00, 6.52)	116	2.23
Hoffman D	185	2	1.08	0.99	1.70	(0.19, 6.13)	235	4.39
#Ko W	19	0	0.00	1.33	0.00	(0.00,22.66)	49	0.00
Tranbaugh R	276	2	0.72	1.10	1.02	(0.11, 3.69)	452	4.02
All Others	4	0	0.00	0.42	0.00	(0.00,100.0)	5	0.00
Total	566	4	0.71	1.06	1.03	(0.28, 2.65)	857	3.62
Buffalo General Hosp								
##Aldridge J	4	0	0.00	1.12	0.00	(0.00,100.0)	4	0.00
#Ashraf M	11	0	0.00	1.10	0.00	(0.00,47.30)	11	0.00
Grosner G	736	12	1.63	1.40	1.81	(0.93, 3.16)	1160	2.65
##Picone A	177	7	3.95	1.51	4.08 *	(1.64, 8.41)	243	5.04
All Others	108	5	4.63	1.50	4.82	(1.55,11.25)	111	8.14
Total	1036	24	2.32	1.43	2.53 *	(1.62, 3.76)	1529	3.32
Champ.Valley Phys Hosp								
Abbott A E	121	2	1.65	1.24	2.07	(0.23, 7.48)	164	4.21
#Canavan T	1	0	0.00	1.85	0.00	(0.00,100.0)	1	0.00
#El Amir N	8	0	0.00	0.74	0.00	(0.00,95.88)	9	0.00
#Singh C	44	1	2.27	1.38	2.57	(0.03,14.28)	50	3.50
All Others	102	3	2.94	1.06	4.32	(0.87,12.61)	127	9.33 *
Total	276	6	2.17	1.18	2.86	(1.04, 6.22)	351	5.54
Ellis Hospital								
##Depan H	98	3	3.06	1.99	2.40	(0.48, 7.01)	150	3.52
#Reich H	204	4	1.96	1.21	2.53	(0.68, 6.48)	358	2.88
#Singh C	149	0	0.00	1.36	0.00	(0.00, 2.82)	216	0.68
All Others	120	2	1.67	1.27	2.05	(0.23, 7.39)	146	5.09
Total	571	9	1.58	1.39	1.76	(0.80, 3.34)	870	2.92
Erie County Med Ctr								
#Bell-Thomson J	1	0	0.00	0.50	0.00	(0.00,100.0)	1	0.00
#Downing S W	268	3	1.12	1.44	1.21	(0.24, 3.55)	308	2.50
##Picone A	22	0	0.00	0.81	0.00	(0.00,32.23)	33	0.00
All Others	21	0	0.00	1.07	0.00	(0.00,25.48)	24	7.48
Total	312	3	0.96	1.36	1.10	(0.22, 3.21)	366	2.49
Good Sam - Suffern								
Lundy E F	201	1	0.50	1.50	0.52	(0.01, 2.87)	330	1.79
Salenger R	237	1	0.42	1.20	0.55	(0.01, 3.04)	279	2.30
Total	438	2	0.46	1.34	0.53	(0.06, 1.91)	609	1.95
Lenox Hill Hospital								
#Ciuffo G B	10	0	0.00	2.30	0.00	(0.00,24.78)	14	0.00
Gorki H	18	0	0.00	1.67	0.00	(0.00,19.04)	21	6.47
##Loulmet D F	3	0	0.00	0.36	0.00	(0.00,100.0)	22	7.50
Patel N C	536	6	1.12	1.50	1.17	(0.43, 2.54)	747	2.16
Plestis K A	83	1	1.20	1.50	1.25	(0.02, 6.97)	218	0.85
Subramanian V	320	3	0.94	1.70	0.86	(0.17, 2.51)	492	4.05
Total	970	10	1.03	1.57	1.02	(0.49, 1.88)	1514	2.87

Table 5 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
LIJ Medical Center								
Graver L	154	2	1.30	1.58	1.28	(0.14, 4.63)	453	2.13
#Manetta F	72	1	1.39	1.55	1.40	(0.02, 7.78)	105	2.93
Meyer D B	1	0	0.00	1.07	0.00	(0.00,100.0)	1	0.00
Palazzo R	154	0	0.00	1.35	0.00	(0.00, 2.74)	259	0.37 **
Parnell V	.	.	.	.	.	(. . .)	2	0.00
Scheinerman S J	168	2	1.19	1.72	1.08	(0.12, 3.90)	347	0.52 **
Total	549	5	0.91	1.55	0.91	(0.29, 2.13)	1167	1.41 **
M I Bassett Hospital								
#Kelley J	79	1	1.27	1.28	1.54	(0.02, 8.54)	121	1.23
Lancey R A	104	4	3.85	1.66	3.60	(0.97, 9.21)	149	4.05
All Others	26	0	0.00	1.39	0.00	(0.00,15.82)	44	0.00
Total	209	5	2.39	1.49	2.51	(0.81, 5.85)	314	2.50
Maimonides Medical Ctr								
Abrol S	192	3	1.56	1.79	1.36	(0.27, 3.97)	287	2.59
##Crooke G	35	0	0.00	1.76	0.00	(0.00, 9.28)	58	0.00
Jacobowitz I	302	3	0.99	2.04	0.76	(0.15, 2.22)	427	0.84 **
Lahey S J	13	1	7.69	3.45	3.47	(0.05,19.30)	17	8.11
##Ribakove G	40	1	2.50	2.80	1.39	(0.02, 7.73)	102	3.18
#Saunders P	4	0	0.00	1.06	0.00	(0.00,100.0)	4	0.00
Stephens G A	65	2	3.08	0.94	5.10	(0.57,18.41)	90	9.41 *
Vaynblat M	154	6	3.90	1.73	3.50	(1.28, 7.63)	241	3.86
All Others	18	1	5.56	1.12	7.71	(0.10,42.91)	25	7.92
Total	823	17	2.07	1.86	1.73	(1.01, 2.77)	1251	2.57
Mercy Hospital								
##Aldridge J	66	2	3.03	1.88	2.51	(0.28, 9.07)	86	4.64
#Bell-Thomson J	447	8	1.79	1.40	1.99	(0.86, 3.93)	748	3.61
#Downing S W	158	0	0.00	1.29	0.00	(0.00, 2.81)	183	0.00
Lico S	349	3	0.86	1.40	0.96	(0.19, 2.80)	420	2.37
All Others	1	0	0.00	0.30	0.00	(0.00,100.0)	1	0.00
Total	1021	13	1.27	1.41	1.41	(0.75, 2.40)	1438	2.94
Millard Fillmore Hosp								
##Aldridge J	128	1	0.78	1.57	0.78	(0.01, 4.32)	170	2.50
#Ashraf M	588	8	1.36	1.41	1.50	(0.65, 2.95)	777	2.76
##Picone A	10	0	0.00	1.79	0.00	(0.00,31.85)	38	3.11
All Others	3	0	0.00	2.07	0.00	(0.00,91.95)	3	0.00
Total	729	9	1.23	1.45	1.33	(0.61, 2.52)	988	2.72

Table 5 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Montefiore - Moses								
#Bello R A	14	0	0.00	2.74	0.00	(0.00,14.87)	17	0.00
#D Alessandro D A	255	5	1.96	1.50	2.04	(0.66, 4.76)	397	3.08
##Deanda A	17	0	0.00	1.25	0.00	(0.00,26.84)	26	0.00
#Derose J J	54	1	1.85	2.07	1.40	(0.02, 7.77)	59	2.04
#Goldstein D J	171	1	0.58	1.86	0.49	(0.01, 2.72)	299	2.10
#Michler R E	68	1	1.47	1.15	1.99	(0.03,11.07)	191	4.22
Weinstein S	.	.	.	.	.	(. . .)	1	0.00
All Others	49	1	2.04	1.35	2.35	(0.03,13.09)	56	2.68
Total	628	9	1.43	1.62	1.38	(0.63, 2.62)	1046	2.79
Montefiore - Weiler								
#Bello R A	224	5	2.23	1.38	2.51	(0.81, 5.87)	325	5.05 *
#D Alessandro D A	3	0	0.00	1.68	0.00	(0.00,100.0)	4	0.00
#Derose J J	266	1	0.38	1.24	0.47	(0.01, 2.62)	468	3.39
#Goldstein D J	43	0	0.00	1.37	0.00	(0.00, 9.71)	80	0.00
#Michler R E	9	1	11.11	6.07	2.85	(0.04,15.85)	31	1.98
All Others	1	0	0.00	16.15	0.00	(0.00,35.36)	1	0.00
Total	546	7	1.28	1.42	1.41	(0.56, 2.90)	909	3.52
Mount Sinai Hospital								
Adams D H	17	0	0.00	0.78	0.00	(0.00,43.34)	886	2.13
Anyanwu A C	43	1	2.33	1.48	2.45	(0.03,13.60)	107	5.04
Chikwe J Y	82	1	1.22	1.58	1.20	(0.02, 6.68)	134	1.92
#Ciuffo G B	94	6	6.38	1.55	6.39 *	(2.34,13.92)	174	7.33 *
DiLuozzo G	4	0	0.00	0.95	0.00	(0.00,100.0)	18	6.23
Filsoufi F	278	5	1.80	1.14	2.46	(0.79, 5.75)	405	3.42
Griep R	1	0	0.00	0.48	0.00	(0.00,100.0)	6	0.00
Nguyen K	1	0	0.00	0.26	0.00	(0.00,100.0)	2	0.00
Reddy R C	262	8	3.05	1.07	4.44 *	(1.91, 8.76)	362	6.24 *
Stelzer P	43	2	4.65	0.94	7.73	(0.87,27.89)	256	3.03
Tannous H J	58	0	0.00	1.00	0.00	(0.00, 9.82)	82	0.00
#Zias E	47	1	2.13	1.29	2.57	(0.03,14.30)	72	7.94
All Others	21	0	0.00	0.68	0.00	(0.00,40.14)	44	3.31
Total	951	24	2.52	1.18	3.32 *	(2.12, 4.93)	2548	3.63 *
NY Hospital - Queens								
#Lang S	294	2	0.68	1.27	0.83	(0.09, 3.01)	384	0.90
All Others	6	1	16.67	0.53	49.25	(0.64,100.0)	9	54.02 *
Total	300	3	1.00	1.26	1.24	(0.25, 3.62)	393	1.77
NY Methodist Hospital								
##Ciaburri D	65	0	0.00	2.22	0.00	(0.00, 3.95)	117	0.00 **
#Tortolani A	138	3	2.17	1.27	2.66	(0.53, 7.77)	221	4.66
All Others	93	0	0.00	1.18	0.00	(0.00, 5.19)	139	1.87
Total	296	3	1.01	1.45	1.09	(0.22, 3.17)	477	2.35

Table 5 continued

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
NYP- Columbia Presby.								
Argenziano M	150	6	4.00	1.25	4.97 *	(1.81,10.81)	388	4.86 *
#Chen J M	.	.	.	.	.	(. . .)	1	0.00
#Naka Y	298	9	3.02	1.50	3.14	(1.43, 5.96)	580	3.76
Quaegebeur J	.	.	.	.	.	(. . .)	2	0.00
Smith C	114	3	2.63	1.03	3.96	(0.80,11.58)	674	1.87
Stewart A S	178	6	3.37	1.51	3.47	(1.27, 7.56)	558	3.42
Takayama H	75	1	1.33	1.75	1.19	(0.02, 6.61)	126	2.11
Williams M R	150	1	0.67	1.45	0.71	(0.01, 3.98)	445	2.34
All Others	31	0	0.00	0.83	0.00	(0.00,22.29)	98	2.67
Total	996	26	2.61	1.40	2.90 *	(1.89, 4.25)	2872	3.01
NYP- Weill Cornell								
#Chen J M	.	.	.	.	.	(. . .)	6	0.00
##Ciaburri D	1	0	0.00	1.00	0.00	(0.00,100.0)	2	0.00
Girardi L	238	0	0.00	1.35	0.00	(0.00, 1.77)	927	1.44 **
Isom O	31	0	0.00	1.05	0.00	(0.00,17.58)	100	1.24
Krieger K	190	1	0.53	1.46	0.56	(0.01, 3.12)	584	1.85
#Lang S	6	0	0.00	4.19	0.00	(0.00,22.74)	15	0.00
#Naka Y	2	0	0.00	0.41	0.00	(0.00,100.0)	2	0.00
Salemi A	135	2	1.48	1.58	1.46	(0.16, 5.27)	259	2.19
#Tortolani A	4	1	25.00	0.57	67.99	(0.89,100.0)	5	73.22
All Others	12	1	8.33	3.10	4.19	(0.05,23.31)	15	5.48
Total	619	5	0.81	1.47	0.85	(0.27, 1.99)	1915	1.72 **
NYU Hospitals Center								
#Balsam L B	3	0	0.00	0.54	0.00	(0.00,100.0)	6	0.00
##Crooke G	5	0	0.00	1.35	0.00	(0.00,84.82)	12	0.00
#Culliford A	83	1	1.20	0.90	2.09	(0.03,11.65)	184	2.87
##Deanda A	2	0	0.00	0.92	0.00	(0.00,100.0)	5	0.00
Galloway A	42	0	0.00	1.23	0.00	(0.00,11.03)	574	2.66
Grossi E	9	0	0.00	0.89	0.00	(0.00,71.66)	24	3.88
##Loulmet D F	39	0	0.00	0.85	0.00	(0.00,17.30)	245	3.01
Mosca R S	1	0	0.00	0.38	0.00	(0.00,100.0)	6	0.00
##Ribakove G	21	0	0.00	1.10	0.00	(0.00,24.67)	67	3.78
#Schwartz C F	120	1	0.83	1.27	1.02	(0.01, 5.66)	237	3.64
#Zias E	95	2	2.11	0.96	3.43	(0.38,12.37)	323	2.66
All Others	.	.	.	.	.	(. . .)	2	0.00
Total	420	4	0.95	1.06	1.40	(0.38, 3.59)	1685	2.90
North Shore Univ Hosp								
Esposito R	312	5	1.60	1.87	1.34	(0.43, 3.12)	552	3.36
Hall M	213	2	0.94	2.45	0.60	(0.07, 2.15)	400	2.03
#Hartman A	73	1	1.37	1.68	1.27	(0.02, 7.08)	426	2.11
#Kalimi R	259	5	1.93	2.40	1.25	(0.40, 2.92)	477	1.25 **
Pogo G	191	5	2.62	1.61	2.52	(0.81, 5.89)	344	3.15
Vatsia S	224	2	0.89	1.54	0.90	(0.10, 3.27)	388	1.02 **
All Others	20	0	0.00	1.19	0.00	(0.00,24.02)	31	0.00
Total	1292	20	1.55	1.96	1.23	(0.75, 1.90)	2618	2.19

Table 5 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Rochester General Hosp								
Becker E J	151	5	3.31	1.95	2.65	(0.85, 6.18)	194	4.18
Cheeran D	518	7	1.35	1.81	1.16	(0.47, 2.40)	852	3.07
Kirshner R	473	13	2.75	1.85	2.31	(1.23, 3.95)	1070	3.47
Total	1142	25	2.19	1.85	1.85	(1.20, 2.73)	2116	3.38
Southside Hospital								
#Hartman A	22	0	0.00	1.35	0.00	(0.00,19.27)	75	1.10
#Kalimi R	57	1	1.75	2.14	1.28	(0.02, 7.11)	100	0.75
#Manetta F	33	1	3.03	1.95	2.42	(0.03,13.48)	41	2.78
Total	112	2	1.79	1.93	1.44	(0.16, 5.21)	216	1.16
St. Elizabeth Med Ctr								
#El Amir N	233	3	1.29	1.68	1.20	(0.24, 3.50)	346	2.56
Joyce F	324	8	2.47	1.58	2.43	(1.05, 4.79)	508	4.28
#Kelley J	87	3	3.45	1.35	3.98	(0.80,11.64)	138	4.57
All Others	68	1	1.47	1.32	1.73	(0.02, 9.62)	106	5.44
Total	712	15	2.11	1.56	2.10	(1.18, 3.47)	1098	3.90 *
St. Francis Hospital								
Bercow N	316	3	0.95	2.09	0.71	(0.14, 2.07)	536	2.84
Colangelo R	667	11	1.65	1.63	1.57	(0.78, 2.82)	1075	2.05
Fernandez H A	360	3	0.83	2.15	0.60	(0.12, 1.76)	512	1.97
Lamendola C	342	10	2.92	1.89	2.41	(1.16, 4.44)	570	4.20 *
Robinson N	373	10	2.68	1.62	2.57	(1.23, 4.74)	781	3.67
Taylor J	339	3	0.88	1.72	0.80	(0.16, 2.35)	876	1.69 **
Total	2397	40	1.67	1.82	1.43	(1.02, 1.95)	4350	2.59
St. Josephs Hospital								
Green G R	277	4	1.44	1.72	1.31	(0.35, 3.35)	494	2.20
Marvasti M	204	3	1.47	1.55	1.48	(0.30, 4.32)	479	1.71
Nazem A	368	4	1.09	1.96	0.86	(0.23, 2.21)	538	1.77
Rosenberg J	205	7	3.41	2.30	2.31	(0.93, 4.76)	352	5.31 *
Zhou Z	357	7	1.96	1.95	1.57	(0.63, 3.23)	591	2.39
Total	1411	25	1.77	1.90	1.45	(0.94, 2.14)	2454	2.57
St. Lukes at St. Lukes								
Balaram S K	80	2	2.50	1.86	2.09	(0.23, 7.54)	141	3.10
Swistel D	268	9	3.36	2.15	2.44	(1.11, 4.63)	473	4.68 *
Total	348	11	3.16	2.08	2.37	(1.18, 4.23)	614	4.29 *
St. Peters Hospital								
#Bennett E	145	0	0.00	1.18	0.00	(0.00, 3.35)	442	1.55
#Canavan T	447	4	0.89	1.44	0.97	(0.26, 2.48)	549	1.56
##Depan H	.	.	.	.	.	(. . .)	1	0.00
#Reich H	5	0	0.00	1.27	0.00	(0.00,89.66)	5	0.00
Saifi J	288	6	2.08	1.60	2.03	(0.74, 4.41)	613	2.90
All Others	121	1	0.83	1.44	0.89	(0.01, 4.96)	183	3.30
Total	1006	11	1.09	1.45	1.18	(0.59, 2.11)	1793	2.29

Table 5 continued

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Staten Island Univ Hosp								
Asgarian K T	320	5	1.56	1.33	1.83	(0.59, 4.26)	531	4.55 *
McGinn J	348	5	1.44	1.29	1.74	(0.56, 4.05)	442	3.27
Nabagiez J P	8	0	0.00	1.73	0.00	(0.00,41.34)	8	0.00
Rosell F M	280	3	1.07	1.52	1.10	(0.22, 3.21)	313	2.36
All Others	8	0	0.00	1.09	0.00	(0.00,65.29)	8	0.00
Total	964	13	1.35	1.37	1.53	(0.81, 2.62)	1302	3.61
Strong Memorial Hosp								
Alfieris G	.	.	.	.	.	(. , .)	1	0.00
Hicks G	287	5	1.74	1.36	2.00	(0.64, 4.66)	396	3.37
Knight P	529	14	2.65	1.20	3.44 *	(1.88, 5.77)	1000	4.12 *
Massey H	149	2	1.34	1.24	1.68	(0.19, 6.06)	187	2.95
All Others	.	.	.	.	.	(. , .)	1	0.00
Total	965	21	2.18	1.25	2.70 *	(1.67, 4.13)	1585	3.79 *
Unitd Hlth Svcs-Wilson								
Wong K	285	4	1.40	1.82	1.20	(0.32, 3.07)	417	1.64
Yousuf M	282	5	1.77	1.60	1.73	(0.56, 4.03)	388	3.12
Total	567	9	1.59	1.71	1.45	(0.66, 2.75)	805	2.29
Univ.Hosp-Brooklyn								
Burack J H	15	0	0.00	1.69	0.00	(0.00,22.52)	21	0.00
#Ko W	24	1	4.17	1.69	3.84	(0.05,21.34)	45	1.94
Lee D C	34	1	2.94	2.75	1.66	(0.02, 9.26)	52	1.95
Tak V M	104	2	1.92	1.54	1.94	(0.22, 7.00)	180	2.75
Total	177	4	2.26	1.81	1.95	(0.52, 4.98)	298	2.39
Univ.Hosp-Stony Brook								
Bilfinger T	98	3	3.06	1.99	2.40	(0.48, 7.01)	145	4.36
Gupta S	116	2	1.72	1.50	1.79	(0.20, 6.47)	223	1.59
McLarty A	102	3	2.94	1.32	3.47	(0.70,10.13)	144	7.93 *
Rosengart T	168	1	0.60	1.78	0.52	(0.01, 2.89)	363	2.59
Seifert F	234	2	0.85	1.48	0.90	(0.10, 3.25)	339	2.79
Total	718	11	1.53	1.60	1.49	(0.74, 2.67)	1214	3.24
Univ.Hosp-Upstate								
Fink G W	165	1	0.61	1.58	0.60	(0.01, 3.32)	245	0.48 **
Lutz C J	281	5	1.78	1.82	1.52	(0.49, 3.55)	451	3.05
Total	446	6	1.35	1.73	1.21	(0.44, 2.63)	696	2.16
Vassar Bros. Med Ctr								
Bhutani A K	94	1	1.06	1.18	1.41	(0.02, 7.83)	103	4.32
##Ciaburri D	1	0	0.00	0.60	0.00	(0.00,100.0)	1	0.00
Sarabu M	152	1	0.66	1.59	0.65	(0.01, 3.60)	424	1.04 **
Shahani R	165	2	1.21	1.26	1.50	(0.17, 5.43)	255	2.10
Zakow P	224	3	1.34	1.21	1.73	(0.35, 5.06)	352	2.52
Total	636	7	1.10	1.30	1.31	(0.53, 2.71)	1135	1.81

Table 5 continued

	Isolated CABG						Isolated CABG, or Valve or Valve/CABG	
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Westchester Med Ctr								
Lafaro R	228	3	1.32	1.58	1.30	(0.26, 3.79)	301	2.50
Lansman S	207	1	0.48	1.99	0.38	(0.00, 2.10)	301	1.85
Malekan R	115	2	1.74	2.51	1.08	(0.12, 3.90)	167	1.31
#Saunders P	2	0	0.00	1.18	0.00	(0.00,100.0)	3	0.00
Spielvogel D	335	2	0.60	1.83	0.51	(0.06, 1.83)	576	1.17 **
All Others	24	0	0.00	1.72	0.00	(0.00,13.82)	33	3.52
Total	911	8	0.88	1.89	0.72 **	(0.31, 1.43)	1381	1.59 **
Winthrop Univ. Hosp								
Goncalves J A	324	6	1.85	1.66	1.74	(0.64, 3.79)	553	2.72
Kokotos W J	219	3	1.37	1.72	1.24	(0.25, 3.63)	389	2.26
Schubach S	184	1	0.54	1.09	0.77	(0.01, 4.30)	378	1.56
All Others	62	0	0.00	1.58	0.00	(0.00, 5.84)	74	0.00
Total	789	10	1.27	1.54	1.28	(0.62, 2.36)	1394	2.23
STATEWIDE TOTAL	28322	441	1.56				50568	2.73

* 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 6: Summary Information for Surgeons Practicing at More Than One Hospital, 2009-2011.

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Aldridge J	198	3	1.52	1.66	1.42	(0.29, 4.15)	260	3.37
Buffalo General Hosp	4	0	0.00	1.12	0.00	(0.00,100.0)	4	0.00
Mercy Hospital	66	2	3.03	1.88	2.51	(0.28, 9.07)	86	4.64
Millard Fillmore Hosp	128	1	0.78	1.57	0.78	(0.01, 4.32)	170	2.50
Ashraf M	599	8	1.34	1.41	1.48	(0.64, 2.91)	788	2.74
Buffalo General Hosp	11	0	0.00	1.10	0.00	(0.00,47.30)	11	0.00
Millard Fillmore Hosp	588	8	1.36	1.41	1.50	(0.65, 2.95)	777	2.76
Balsam L B	141	0	0.00	1.10	0.00	(0.00, 3.67)	261	1.08
Bellevue Hospital Ctr	138	0	0.00	1.12	0.00	(0.00, 3.71)	255	1.11
NYU Hospitals Center	3	0	0.00	0.54	0.00	(0.00,100.0)	6	0.00
Bell-Thomson J	448	8	1.79	1.40	1.99	(0.86, 3.92)	749	3.61
Erie County Med Ctr	1	0	0.00	0.50	0.00	(0.00,100.0)	1	0.00
Mercy Hospital	447	8	1.79	1.40	1.99	(0.86, 3.93)	748	3.61
Bello R A	238	5	2.10	1.46	2.24	(0.72, 5.22)	342	4.75
Montefiore - Moses	14	0	0.00	2.74	0.00	(0.00,14.87)	17	0.00
Montefiore - Weiler	224	5	2.23	1.38	2.51	(0.81, 5.87)	325	5.05 *
Bennett E	169	0	0.00	1.16	0.00	(0.00, 2.91)	525	1.70
Albany Medical Center	24	0	0.00	1.07	0.00	(0.00,22.29)	83	2.56
St. Peters Hospital	145	0	0.00	1.18	0.00	(0.00, 3.35)	442	1.55
Canavan T	448	4	0.89	1.44	0.96	(0.26, 2.47)	550	1.56
Champ.Valley Phys Hosp	1	0	0.00	1.85	0.00	(0.00,100.0)	1	0.00
St. Peters Hospital	447	4	0.89	1.44	0.97	(0.26, 2.48)	549	1.56
Chen J M	.	.	.	.	.	(. . .)	7	0.00
NYP- Columbia Presby.	.	.	.	.	.	(. . .)	1	0.00
NYP- Weill Cornell	.	.	.	.	.	(. . .)	6	0.00
Ciaburri D	67	0	0.00	2.18	0.00	(0.00, 3.91)	120	0.00 **
NY Methodist Hospital	65	0	0.00	2.22	0.00	(0.00, 3.95)	117	0.00 **
NYP- Weill Cornell	1	0	0.00	1.00	0.00	(0.00,100.0)	2	0.00
Vassar Bros. Med Ctr	1	0	0.00	0.60	0.00	(0.00,100.0)	1	0.00
Ciuffo G B	104	6	5.77	1.63	5.52 *	(2.02,12.02)	188	6.86 *
Lenox Hill Hospital	10	0	0.00	2.30	0.00	(0.00,24.78)	14	0.00
Mount Sinai Hospital	94	6	6.38	1.55	6.39 *	(2.34,13.92)	174	7.33 *
Crooke G	109	0	0.00	1.13	0.00	(0.00, 4.62)	173	1.38
Bellevue Hospital Ctr	69	0	0.00	0.80	0.00	(0.00,10.33)	103	2.72
Maimonides Medical Ctr	35	0	0.00	1.76	0.00	(0.00, 9.28)	58	0.00
NYU Hospitals Center	5	0	0.00	1.35	0.00	(0.00,84.82)	12	0.00

Table 6 continued

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Culliford A	84	1	1.19	0.92	2.02	(0.03,11.25)	185	2.85
Bellevue Hospital Ctr	1	0	0.00	2.62	0.00	(0.00,100.0)	1	0.00
NYU Hospitals Center	83	1	1.20	0.90	2.09	(0.03,11.65)	184	2.87
D Alessandro D A	258	5	1.94	1.50	2.01	(0.65, 4.70)	401	3.06
Montefiore - Moses	255	5	1.96	1.50	2.04	(0.66, 4.76)	397	3.08
Montefiore - Weiler	3	0	0.00	1.68	0.00	(0.00,100.0)	4	0.00
Deanda A	102	2	1.96	1.18	2.60	(0.29, 9.37)	167	3.86
Bellevue Hospital Ctr	83	2	2.41	1.17	3.22	(0.36,11.61)	136	4.74
Montefiore - Moses	17	0	0.00	1.25	0.00	(0.00,26.84)	26	0.00
NYU Hospitals Center	2	0	0.00	0.92	0.00	(0.00,100.0)	5	0.00
Depan H	302	5	1.66	1.69	1.52	(0.49, 3.55)	494	2.11
Albany Medical Center	204	2	0.98	1.55	0.98	(0.11, 3.55)	343	1.51
Ellis Hospital	98	3	3.06	1.99	2.40	(0.48, 7.01)	150	3.52
St. Peters Hospital	.	.	.	.	.	(. . .)	1	0.00
Derose J J	320	2	0.63	1.38	0.70	(0.08, 2.54)	527	3.26
Montefiore - Moses	54	1	1.85	2.07	1.40	(0.02, 7.77)	59	2.04
Montefiore - Weiler	266	1	0.38	1.24	0.47	(0.01, 2.62)	468	3.39
Downing S W	426	3	0.70	1.38	0.79	(0.16, 2.32)	491	1.60
Erie County Med Ctr	268	3	1.12	1.44	1.21	(0.24, 3.55)	308	2.50
Mercy Hospital	158	0	0.00	1.29	0.00	(0.00, 2.81)	183	0.00
El Amir N	241	3	1.24	1.64	1.18	(0.24, 3.44)	355	2.54
Champ.Valley Phys Hosp	8	0	0.00	0.74	0.00	(0.00,95.88)	9	0.00
St. Elizabeth Med Ctr	233	3	1.29	1.68	1.20	(0.24, 3.50)	346	2.56
Goldstein D J	214	1	0.47	1.76	0.41	(0.01, 2.30)	379	1.70
Montefiore - Moses	171	1	0.58	1.86	0.49	(0.01, 2.72)	299	2.10
Montefiore - Weiler	43	0	0.00	1.37	0.00	(0.00, 9.71)	80	0.00
Hartman A	95	1	1.05	1.60	1.02	(0.01, 5.70)	501	1.99
North Shore Univ Hosp	73	1	1.37	1.68	1.27	(0.02, 7.08)	426	2.11
Southside Hospital	22	0	0.00	1.35	0.00	(0.00,19.27)	75	1.10
Kalimi R	316	6	1.90	2.35	1.26	(0.46, 2.73)	577	1.16 **
North Shore Univ Hosp	259	5	1.93	2.40	1.25	(0.40, 2.92)	477	1.25 **
Southside Hospital	57	1	1.75	2.14	1.28	(0.02, 7.11)	100	0.75
Kelley J	166	4	2.41	1.32	2.85	(0.77, 7.29)	259	3.41
M I Bassett Hospital	79	1	1.27	1.28	1.54	(0.02, 8.54)	121	1.23
St. Elizabeth Med Ctr	87	3	3.45	1.35	3.98	(0.80,11.64)	138	4.57

Table 6 continued

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Ko W	43	1	2.33	1.53	2.37	(0.03,13.17)	94	1.15
Beth Israel Med Ctr	19	0	0.00	1.33	0.00	(0.00,22.66)	49	0.00
Univ.Hosp-Brooklyn	24	1	4.17	1.69	3.84	(0.05,21.34)	45	1.94
Lang S	300	2	0.67	1.33	0.78	(0.09, 2.82)	399	0.84
NY Hospital - Queens	294	2	0.68	1.27	0.83	(0.09, 3.01)	384	0.90
NYP- Weill Cornell	6	0	0.00	4.19	0.00	(0.00,22.74)	15	0.00
Loulmet D F	58	1	1.72	1.02	2.63	(0.03,14.64)	306	4.20
Bellevue Hospital Ctr	16	1	6.25	1.57	6.21	(0.08,34.54)	39	8.31
Lenox Hill Hospital	3	0	0.00	0.36	0.00	(0.00,100.0)	22	7.50
NYU Hospitals Center	39	0	0.00	0.85	0.00	(0.00,17.30)	245	3.01
Manetta F	105	2	1.90	1.67	1.77	(0.20, 6.40)	146	2.89
LIJ Medical Center	72	1	1.39	1.55	1.40	(0.02, 7.78)	105	2.93
Southside Hospital	33	1	3.03	1.95	2.42	(0.03,13.48)	41	2.78
Michler R E	77	2	2.60	1.73	2.34	(0.26, 8.46)	222	3.79
Montefiore - Moses	68	1	1.47	1.15	1.99	(0.03,11.07)	191	4.22
Montefiore - Weiler	9	1	11.11	6.07	2.85	(0.04,15.85)	31	1.98
Naka Y	300	9	3.00	1.49	3.13	(1.43, 5.94)	582	3.75
NYP- Columbia Presby.	298	9	3.02	1.50	3.14	(1.43, 5.96)	580	3.76
NYP- Weill Cornell	2	0	0.00	0.41	0.00	(0.00,100.0)	2	0.00
Picone A	209	7	3.35	1.45	3.60	(1.44, 7.42)	314	4.21
Buffalo General Hosp	177	7	3.95	1.51	4.08 *	(1.64, 8.41)	243	5.04
Erie County Med Ctr	22	0	0.00	0.81	0.00	(0.00,32.23)	33	0.00
Millard Fillmore Hosp	10	0	0.00	1.79	0.00	(0.00,31.85)	38	3.11
Reich H	209	4	1.91	1.21	2.47	(0.66, 6.32)	363	2.86
Ellis Hospital	204	4	1.96	1.21	2.53	(0.68, 6.48)	358	2.88
St. Peters Hospital	5	0	0.00	1.27	0.00	(0.00,89.66)	5	0.00
Ribakove G	90	2	2.22	2.00	1.73	(0.19, 6.24)	236	4.11
Bellevue Hospital Ctr	29	1	3.45	1.55	3.47	(0.05,19.29)	67	6.40
Maimonides Medical Ctr	40	1	2.50	2.80	1.39	(0.02, 7.73)	102	3.18
NYU Hospitals Center	21	0	0.00	1.10	0.00	(0.00,24.67)	67	3.78
Saunders P	6	0	0.00	1.10	0.00	(0.00,86.55)	7	0.00
Maimonides Medical Ctr	4	0	0.00	1.06	0.00	(0.00,100.0)	4	0.00
Westchester Med Ctr	2	0	0.00	1.18	0.00	(0.00,100.0)	3	0.00
Schwartz C F	140	1	0.71	1.19	0.93	(0.01, 5.19)	264	3.47
Bellevue Hospital Ctr	20	0	0.00	0.70	0.00	(0.00,40.56)	27	0.00
NYU Hospitals Center	120	1	0.83	1.27	1.02	(0.01, 5.66)	237	3.64

Table 6 continued

	Isolated CABG					Isolated CABG, or Valve or Valve/CABG		
	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR	Cases	RAMR
Singh C	193	1	0.52	1.36	0.59	(0.01, 3.29)	266	1.14
Champ.Valley Phys Hosp	44	1	2.27	1.38	2.57	(0.03,14.28)	50	3.50
Ellis Hospital	149	0	0.00	1.36	0.00	(0.00, 2.82)	216	0.68
Tortolani A	142	4	2.82	1.25	3.50	(0.94, 8.96)	226	5.20
NY Methodist Hospital	138	3	2.17	1.27	2.66	(0.53, 7.77)	221	4.66
NYP- Weill Cornell	4	1	25.00	0.57	67.99	(0.89,100.0)	5	73.22
Zias E	142	3	2.11	1.07	3.08	(0.62, 9.01)	395	3.51
Mount Sinai Hospital	47	1	2.13	1.29	2.57	(0.03,14.30)	72	7.94
NYU Hospitals Center	95	2	2.11	0.96	3.43	(0.38,12.37)	323	2.66

* 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, 2009-2011

Table 7 presents, for each hospital and for each surgeon performing at least 200 cardiac operations in any hospital in 2009-2011 and/or performing one or more cardiac operations in each of the years 2009-2011, 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 5, results for surgeons not meeting the above criteria are grouped together in an “All Others” category.

The Isolated CABG column includes patients who undergo bypass of one or more of the coronary arteries

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

Table 7: Surgeon and Hospital Volume for Isolated CABG, Valve or Valve/CABG, Other Cardiac Surgery, and Total Adult Cardiac Surgery, 2009-2011.

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Albany Medical Center				
Bennett E	24	59	8	91
Britton L	264	169	46	479
Depan H	204	139	39	382
Miller S	250	147	17	414
All Others	74	18	23	115
Total	816	532	133	1481
Arnot Ogden Med Ctr				
Nast E	155	63	16	234
Raudat C W	146	60	11	217
Total	301	123	27	451
Bellevue Hospital Ctr				
Balsam L B	138	117	67	322
Crooke G	69	34	28	131
Culliford A	1	0	1	2
Deanda A	83	53	64	200
Loulmet D F	16	23	2	41
Ribakove G	29	38	8	75
Schwartz C F	20	7	6	33
All Others	0	0	1	1
Total	356	272	177	805

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Beth Israel Med Ctr				
Geller C M	82	34	11	127
Hoffman D	185	50	10	245
Ko W	19	30	12	61
Tranbaugh R	276	176	52	504
All Others	4	1	1	6
Total	566	291	86	943
Buffalo General Hosp				
Aldridge J	4	0	0	4
Ashraf M	11	0	0	11
Grosner G	736	424	45	1205
Picone A	177	66	12	255
All Others	108	3	8	119
Total	1036	493	65	1594
Champ.Valley Phys Hosp				
Abbott A E	121	43	18	182
Canavan T	1	0	0	1
EL Amir N	8	1	1	10
Singh C	44	6	2	52
All Others	102	25	3	130
Total	276	75	24	375
Ellis Hospital				
Depan H	98	52	7	157
Reich H	204	154	17	375
Singh C	149	67	11	227
All Others	120	26	1	147
Total	571	299	36	906
Erie County Med Ctr				
Bell-Thomson J	1	0	1	2
Downing S W	268	40	27	335
Picone A	22	11	3	36
All Others	21	3	3	27
Total	312	54	34	400
Good Sam - Suffern				
Lundy E F	201	129	14	344
Salenger R	237	42	7	286
Total	438	171	21	630

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Lenox Hill Hospital				
Ciuffo G B	10	4	0	14
Gorki H	18	3	2	23
Loulmet D F	3	19	6	28
Patel N C	536	211	21	768
Plestis K A	83	135	250	468
Subramanian V	320	172	44	536
All Others	0	0	1	1
Total	970	544	324	1838
Long Island Jewish MC				
Graver L	154	299	48	501
Manetta F	72	33	14	119
Meyer D B	1	0	6	7
Palazzo R	154	105	25	284
Parnell V	0	2	19	21
Scheinerman S J	168	179	19	366
Total	549	618	131	1298
M I Bassett Hospital				
Kelley J	79	42	12	133
Lancey R A	104	45	9	158
All Others	26	18	1	45
Total	209	105	22	336
Maimonides Medical Ctr				
Abrol S	192	95	67	354
Crooke G	35	23	16	74
Jacobowitz I	302	125	25	452
Lahey S J	13	4	4	21
Ribakove G	40	62	7	109
Saunders P	4	0	2	6
Stephens G A	65	25	9	99
Vaynblat M	154	87	17	258
All Others	18	7	4	29
Total	823	428	151	1402
Mercy Hospital				
Aldridge J	66	20	1	87
Bell-Thomson J	447	301	67	815
Downing S W	158	25	9	192
Lico S	349	71	30	450
All Others	1	0	0	1
Total	1021	417	107	1545

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Millard Fillmore Hosp				
Aldridge J	128	42	34	204
Ashraf M	588	189	29	806
Picone A	10	28	3	41
All Others	3	0	1	4
Total	729	259	67	1055
Montefiore - Moses				
Bello R A	14	3	13	30
D Alessandro D A	255	142	84	481
Deanda A	17	9	26	52
Derose J J	54	5	9	68
Goldstein D J	171	128	58	357
Michler R E	68	123	43	234
Weinstein S	0	1	17	18
All Others	49	7	12	68
Total	628	418	262	1308
Montefiore - Weiler				
Bello R A	224	101	34	359
D Alessandro D A	3	1	2	6
Derose J J	266	202	74	542
Goldstein D J	43	37	6	86
Michler R E	9	22	2	33
All Others	1	0	3	4
Total	546	363	121	1030
Mount Sinai Hospital				
Adams D H	17	869	90	976
Anyanwu A C	43	64	134	241
Chikwe J Y	82	52	18	152
Ciuffo G B	94	80	6	180
DiLuzzo G	4	14	106	124
Filsoufi F	278	127	23	428
Griep R	1	5	29	35
Nguyen K	1	1	46	48
Reddy R C	262	100	46	408
Stelzer P	43	213	161	417
Tannous H J	58	24	4	86
Zias E	47	25	5	77
All Others	21	23	23	67
Total	951	1597	691	3239

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
NY Hospital - Queens				
Lang S	294	90	30	414
All Others	6	3	2	11
Total	300	93	32	425
NY Methodist Hospital				
Ciaburri D	65	52	8	125
Tortolani A	138	83	5	226
All Others	93	46	21	160
Total	296	181	34	511
NYP - Columbia Presby.				
Argenziano M	150	238	57	445
Chen J M	0	1	17	18
Naka Y	298	282	229	809
Quaegebeur J	0	2	68	70
Smith C	114	560	54	728
Stewart A S	178	380	407	965
Takayama H	75	51	55	181
Williams M R	150	295	217	662
All Others	31	67	338	436
Total	996	1876	1442	4314
NYP - Weill Cornell				
Chen J M	0	6	44	50
Ciaburri D	1	1	0	2
Girardi L	238	689	599	1526
Isom O	31	69	10	110
Krieger K	190	394	15	599
Lang S	6	9	3	18
Naka Y	2	0	0	2
Salemi A	135	124	81	340
Tortolani A	4	1	0	5
All Others	12	3	2	17
Total	619	1296	754	2669

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
NYU Hospitals Center				
Balsam L B	3	3	4	10
Crooke G	5	7	4	16
Culliford A	83	101	31	215
Deanda A	2	3	17	22
Galloway A	42	532	64	638
Grossi E	9	15	6	30
Loulmet D F	39	206	40	285
Mosca R S	1	5	31	37
Ribakove G	21	46	9	76
Schwartz C F	120	117	26	263
Zias E	95	228	47	370
All Others	0	2	4	6
Total	420	1265	283	1968
North Shore Univ Hosp				
Esposito R	312	240	45	597
Hall M	213	187	19	419
Hartman A	73	353	78	504
Kalimi R	259	218	36	513
Pogo G	191	153	38	382
Vatsia S	224	164	48	436
All Others	20	11	11	42
Total	1292	1326	275	2893
Rochester General Hosp				
Becker E J	151	43	11	205
Cheeran D	518	334	89	941
Kirshner R	473	597	70	1140
Total	1142	974	170	2286
Southside Hospital				
Hartman A	22	53	18	93
Kalimi R	57	43	9	109
Manetta F	33	8	9	50
Total	112	104	36	252
St. Elizabeth Med Ctr				
El Amir N	233	113	44	390
Joyce F	324	184	21	529
Kelley J	87	51	17	155
All Others	68	38	5	111
Total	712	386	87	1185

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
St. Francis Hospital				
Bercow N	316	220	18	554
Colangelo R	667	408	39	1114
Fernandez H A	360	152	20	532
Lamendola C	342	228	23	593
Robinson N	373	408	62	843
Taylor J	339	537	62	938
Total	2397	1953	224	4574
St. Josephs Hospital				
Green G R	277	217	46	540
Marvasti M	204	275	46	525
Nazem A	368	170	38	576
Rosenberg J	205	147	95	447
Zhou Z	357	234	39	630
Total	1411	1043	264	2718
St. Lukes at St. Lukes				
Balaram S K	80	61	27	168
Swistel D	268	205	44	517
Total	348	266	71	685
St. Peters Hospital				
Bennett E	145	297	28	470
Canavan T	447	102	6	555
Depan H	0	1	0	1
Reich H	5	0	0	5
Saifi J	288	325	54	667
All Others	121	62	9	192
Total	1006	787	97	1890
Staten Island Univ Hosp				
Asgarian K T	320	211	47	578
McGinn J	348	94	12	454
Nabagiez J P	8	0	2	10
Rosell F M	280	33	17	330
All Others	8	0	1	9
Total	964	338	79	1381

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Strong Memorial Hosp				
Alfieris G	0	1	30	31
Hicks G	287	109	60	456
Knight P	529	471	165	1165
Massey H	149	38	153	340
All Others	0	1	27	28
Total	965	620	435	2020
UHS - Wilson Med Ctr				
Wong K	285	132	16	433
Yousuf M	282	106	19	407
Total	567	238	35	840
Univ. Hosp-Brooklyn				
Burack J H	15	6	1	22
Ko W	24	21	7	52
Lee D C	34	18	6	58
Tak V M	104	76	25	205
Total	177	121	39	337
Univ. Hosp-Stony Brook				
Bilfinger T	98	47	19	164
Gupta S	116	107	24	247
McLarty A	102	42	37	181
Rosengart T	168	195	16	379
Seifert F	234	105	16	355
Total	718	496	112	1326
Univ. Hosp-Upstate				
Fink G W	165	80	38	283
Lutz C J	281	170	30	481
All Others	0	0	1	1
Total	446	250	69	765
Vassar Bros. Med Ctr				
Bhutani A K	94	9	1	104
Ciaburri D	1	0	0	1
Sarabu M	152	272	45	469
Shahani R	165	90	17	272
Zakow P	224	128	24	376
Total	636	499	87	1222

Table 7 continued

	Isolated CABG	Valve or Valve/CABG	Other Cardiac Surgery	Total Cardiac Surgery
Westchester Med Ctr				
Lafaro R	228	73	17	318
Lansman S	207	94	11	312
Malekan R	115	52	44	211
Saunders P	2	1	15	18
Spielvogel D	335	241	156	732
All Others	24	9	8	41
Total	911	470	251	1632
Winthrop Univ. Hosp				
Goncalves J A	324	229	75	628
Kokotos W J	219	170	19	408
Schubach S	184	194	14	392
All Others	62	12	1	75
Total	789	605	109	1503
Statewide Total	28322	22246	7464	58032

Criteria Used in Reporting Significant Risk Factors (2011)

Based on Documentation in Medical Records

Patient Risk Factor	Definitions
Demographic	
<ul style="list-style-type: none"> Body Surface Area 	<p>Body surface area (BSA) is a function of height and weight and increases for larger heights and weights. The statistical formula used to calculate BSA in this report is:</p> $BSA (m^2) = 0.0003207 \times \text{Height}(cm)^{0.3} \times \text{Weight}(grams)^{(0.7285 - (0.0188 \times \text{LOG}(grams))}$
Hemodynamic State	<p>Determined in the immediate pre-operative period, defined as the period prior to anesthesia taking responsibility for the patient.</p>
<ul style="list-style-type: none"> Unstable 	<p>Patient requires pharmacologic or mechanical support to maintain blood pressure or cardiac index.</p>
<ul style="list-style-type: none"> Shock 	<p>Acute hypotension (systolic blood pressure < 80 mmHg) or low cardiac index (< 2.0 liters/min/m²), despite pharmacologic or mechanical support. Records with this risk factor were excluded from all analyses in this report.</p>
Comorbidities	
<ul style="list-style-type: none"> Cerebrovascular Disease 	<p>A history of stroke, with or without residual deficit, angiographic or ultrasound demonstration of at least 50% narrowing in a major cerebral or carotid artery (common or internal), or previous surgery for such disease. A history of bruits or transient ischemic attacks (TIA) is not sufficient evidence of cerebrovascular disease.</p>
<ul style="list-style-type: none"> Peripheral Vascular Disease 	<p>Angiographic demonstration of at least 50% narrowing in a major aortoiliac or femoral/popliteal vessel, previous surgery for such disease, absent femoral or pedal pulses, or the inability to insert a catheter or intra-aortic balloon due to iliac aneurysm or obstruction of the aortoiliac or femoral arteries. Ankle-Brachial Index < 0.9 is also acceptable documentation.</p>
<ul style="list-style-type: none"> Renal Failure, Creatinine 	<p>Highest pre-operative creatinine during the hospital admission was in the indicated range.</p>
<ul style="list-style-type: none"> Renal Failure Requiring Dialysis 	<p>The patient is on chronic peritoneal or hemodialysis.</p>

Patient Risk Factor	Definitions
Ventricular Function	
<ul style="list-style-type: none"> • Ejection Fraction • Previous MI 	<p>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.</p> <p>One or more myocardial infarctions (MI) in the specified time period prior to surgery.</p>
Previous Cardiac Procedures	
<ul style="list-style-type: none"> • Emergency Transfer to OR after Diagnostic Cath or PCI 	<p>The patient requires immediate surgery following a diagnostic catheterization or PCI.</p>

MEDICAL TERMINOLOGY

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

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

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

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

coronary artery bypass graft surgery (CABG) - A procedure in which a vein or artery from another part of the body is used to create an alternate path for blood to flow to the heart muscle, bypassing the arterial blockage. Typically, a section of one of the large saphenous veins in the leg, the radial artery in the arm or the mammary artery in the chest is used to construct the bypass. One or more bypasses may be performed during a single operation. When no other major heart surgery (such as valve replacement) is included, the operation is referred to as an isolated CABG.

The average number of bypass grafts created during CABG is three or four. Generally, all significantly blocked arteries are bypassed unless they enter areas of the heart that are permanently damaged by previous heart attacks. Five or more bypasses are occasionally created. Multiple bypasses are often performed to provide several alternate routes for the blood flow and to improve the long-term success of the procedure, not necessarily because the patient's condition is more severe.

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

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

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

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

incompetent valves - A valve that does not close tightly.

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

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

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

risk factors for heart disease - Certain risk factors have been found to increase the likelihood of developing heart disease. Some are controllable or avoidable and some cannot be controlled. The biggest heart disease risk factors are heredity, gender and age, none of which can be controlled. Men are much more likely to develop heart disease than women before the age of 55, although it is the number one killer of both men and women.

Some controllable risk factors that contribute to a higher likelihood of developing coronary artery disease are high cholesterol levels, cigarette smoking, high blood pressure (hypertension), obesity, a sedentary lifestyle or lack of exercise, diabetes and poor stress management.

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

stenotic valve- A valve that does not open fully.

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

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

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

Appendix 1. 2009-2011 Risk Factors For Isolated CABG In-Hospital/30-Day Mortality

The significant pre-procedural risk factors for in-hospital/30-day mortality following isolated CABG in the 2009-2011 time period are presented in the table that follows.

Roughly speaking, the odds ratio for a risk factor represents the number of times a patient with that risk factor is more likely to die in the hospital during or after CABG or after discharge but within 30 days of the operation than a patient without the risk factor, all other risk factors being the same. For example, the odds ratio for the risk factor COPD is 1.509. This means that a patient with COPD is approximately 1.509 times as likely to die in the hospital during or after undergoing CABG or after discharge but within 30 days as a patient without COPD who has the same other significant risk factors.

For some risk factors in the table, there are only two possibilities – having the risk factor and not having it. For example, a patient either has COPD or does not have it. Unstable, Peripheral Vascular Disease and Emergency Transfer to OR after Diagnostic Cath or PCI are also interpreted in this way.

With regard to age, the odds ratio roughly represents the number of times a patient who is over age 50 is more likely to die in the hospital than another patient who is one year younger, all other significant risk factors being the same. Thus, the chance of in-hospital/30-day mortality for a patient undergoing CABG surgery who is 51 years old is approximately 1.056 times that of a 50 year-old patient undergoing CABG, all other risk factors being the same. All patients age 50 or under have roughly the same odds of dying in the hospital or after discharge but within 30 days if their risk factors are identical.

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. This functional form is used to improve the model's ability to predict mortality, but it means that the odds ratios for these terms do not have a straightforward interpretation.

Ejection Fraction, which is the percentage of blood in the heart's left ventricle that is expelled when it contracts (with more denoting a healthier heart), is subdivided into four ranges: less than 20 percent; 20-29 percent; 30-39 percent; and 40 percent or more. The last range is referred to as the reference category. This means that the odds ratios that appear for the other Ejection Fraction categories in the table are relative to patients with an ejection fraction of 40 percent or more. Thus, a patient with an ejection fraction less than 20 percent is about 2.447 times as likely to die in the hospital or after discharge but within 30 days as a patient with an ejection fraction of 40 percent or higher, all other significant risk factors being the same.

Previous MI is subdivided into four groups: occurring less than 1 day prior to surgery; occurring 1 to 20 days prior to surgery; occurring 21 or more days prior to surgery; and no MI prior to the procedure. The last range is referred to as the reference category. The odds ratios for the Previous MI ranges listed above are relative to patients who have not had a previous MI prior to the procedure.

Since Renal Failure is expressed in terms of Renal Failure with dialysis and without dialysis, the odds ratios are relative to patients with no dialysis prior to surgery and no pre-operative creatinine greater than 1.5 mg/dL.

Appendix 1: Multivariable Risk Factor Equation for CABG In-Hospital/30-Day Deaths in New York State in 2009-2011

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Demographic				
Age: Number of years greater than 50	—	0.0542	<.0001	1.056
Body Surface Area (0.1 m ²)	—	-0.6606	<.0001	—
Body Surface Area – squared (0.01 m ⁴)	—	0.0157	<.0001	—
Hemodynamic State				
Unstable	0.72	1.2052	<.0001	3.338
Ventricular Function				
Ejection Fraction				
Ejection Fraction ≥ 40%	81.54	— Reference —		1.000
Ejection Fraction < 20%	1.65	0.8948	0.0003	2.447
Ejection Fraction 20-29%	6.02	0.6614	<.0001	1.938
Ejection Fraction 30-39%	10.80	0.3641	0.0075	1.439
Previous MI				
No Previous MI	52.26	— Reference —		1.000
Previous MI less than 1 day	2.51	0.7911	0.0019	2.206
Previous MI 1 - 20 days	23.57	0.5172	<.0001	1.677
Previous MI 21 days or more	21.66	0.4338	0.0010	1.543
Comorbidities				
COPD	24.41	0.4117	<.0001	1.509
Peripheral Vascular Disease	11.96	0.6939	<.0001	2.001
Renal Failure				
No Renal Failure	87.70	— Reference —		1.000
Renal Failure, Creatinine 1.6 - 2.0 mg/dl	6.41	0.5828	<.0001	1.791
Renal Failure, Creatinine > 2.0 mg/dl	3.21	0.5970	0.0026	1.817
Renal Failure, Requiring Dialysis	2.69	1.3760	<.0001	3.959
Emergency Transfer to OR after Diagnostic Cath or PCI				
	2.15	0.9300	0.0002	2.534

Intercept = 0.7546

C Statistic = 0.764

Appendix 2. 2009-2011 Risk Factors For Valve Surgery In-Hospital/30-Day Mortality

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve surgery in the 2009-2011 time period are presented in the table that follows.

Most of the risk factors in this model, including Age, BSA, Previous MI, Peripheral Vascular Disease, Renal Failure, and COPD are interpreted in the same way as described in Appendix 1. The interpretation of Endocarditis is like that provided for COPD in Appendix 1 - the patient either has the risk factor or does not have the risk factor.

Previous Cardiac Surgery is divided into three categories. Previous CABG with Patent Grafts refers to patients who have previously undergone CABG surgery and whose grafts remain patent (open for blood flow). Any Other Previous Cardiac Surgery

refers to patients who have had some other cardiac surgery but do not have patent grafts following CABG surgery. No Previous Cardiac Surgery is the reference category and refers to all other patients.

The odds ratio for type of valve surgery represents the number of times a patient with a specific valve surgery is more likely to die in the hospital during or after that particular surgery or after discharge but within 30 days 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 1.608 times as likely to die in the hospital during or after surgery or after discharge but within 30 days as a patient with aortic valve replacement surgery, all other significant risk factors being the same.

Appendix 2: Multivariable Risk Factor Equation for Valve Surgery In-Hospital/30-Day Deaths In NYS, 2009-2011.

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Demographic				
Age: number of years greater than 50	—	0.0503	<.0001	1.052
Body Surface Area (0.1 m ²)	—	-0.5916	<.0001	—
Body Surface Area – squared (0.01 m ⁴)	—	0.0142	<.0001	—
Type of Valve Surgery				
Aortic Valve Replacement	50.35	— Reference —		1.000
Mitral Valve Replacement	13.14	0.4748	0.0007	1.608
Mitral Valve Repair	17.02	-0.2282	0.1528	0.750
Multiple Valve Repair/Replacement	19.49	0.6770	<.0001	1.968
Hemodynamic State				
Unstable	0.54	1.1395	0.0003	3.125
Ventricular Function				
Ejection Fraction				
Ejection Fraction ≥ 30%	94.79	— Reference —		1.000
Ejection Fraction < 30%	5.21	0.4061	0.0182	1.501
Previous MI				
No Previous MI	98.13	— Reference —		1.000
Previous MI within 20 days	1.87	0.6601	0.0035	1.935
Comorbidities				
COPD	24.88	0.3375	0.0009	1.401
Endocarditis	4.79	0.7476	<.0001	2.112
Peripheral Vascular Disease	7.85	0.6068	<.0001	1.835
Renal Failure				
No Renal Failure	87.36	— Reference —		1.000
Renal Failure, Creatinine 1.6 -2.5 mg/dl	8.30	0.6958	<.0001	2.005
Renal Failure, Creatinine > 2.5 mg/dl	1.50	1.1534	<.0001	3.169
Renal Failure, Requiring Dialysis	2.84	2.0129	<.0001	7.485
Previous Open Heart Operations				
No Previous Cardiac Surgery	81.61	— Reference —		1.000
Previous CABG with Patent Grafts	9.26	0.6569	<.0001	1.929
Any Other Previous Cardiac Surgery	9.13	0.7624	<.0001	2.143

Intercept = 0.6393

C Statistic = 0.790

Appendix 3. 2009-2011 Risk Factors For Valve and CABG Surgery In-Hospital/30-Day Mortality

The significant pre-procedural risk factors for in-hospital/30-day mortality following valve and CABG surgery in the 2009-2011 time period are presented in the table that follows. Most of the risk factors in this model are interpreted in the same way as described previously.

Extensively Calcified Aorta is interpreted in the same way as COPD in Appendix 1.

The odds ratio for Type of Valve with CABG surgery represents the number of times a patient with a specific

Valve with CABG surgery is more likely to die in the hospital during or after that particular surgery or after discharge but within 30 days than a patient who has had aortic valve repair or replacement and CABG surgery, all other risk factors being the same. For example, a patient who has a mitral valve replacement and CABG surgery is 1.250 times as likely to die in the hospital during or after surgery as a patient with aortic valve repair or replacement and CABG surgery, all other significant risk factors being the same.

Appendix 3: Multivariable Risk Factor Equation for Valve and CABG Surgery In-Hospital/ 30-Day Deaths in NYS, 2009-2011.

Patient Risk Factor	Prevalence (%)	Logistic Regression		
		Coefficient	P-Value	Odds Ratio
Demographic				
Age: Number of years greater than 55	—	0.0484	<.0001	1.050
Female Gender	35.88	0.3872	0.0010	1.473
Body Surface Area (0.1 m ²)	—	-0.7340	<.0001	—
Body Surface Area – squared (0.01 m ⁴)	—	0.0180	<.0001	—
Type of Valve (with CABG)				
Aortic Valve Replacement	61.59	— Reference —		1.000
Mitral Valve Replacement	9.81	0.2234	0.1975	1.250
Mitral Valve Repair	17.11	-0.0182	0.9118	0.982
Multiple Valve Repair/Replacement	11.49	1.0865	<.0001	2.964
Hemodynamic State				
Unstable	0.99	1.4133	<.0001	4.110
Ventricular Function				
Ejection Fraction				
Ejection Fraction ≥ 30%	89.33	— Reference —		1.000
Ejection Fraction < 30 %	10.67	0.4010	0.0063	1.493
Previous MI				
No Previous MI	66.95	— Reference —		1.000
Any Previous MI	33.05	0.3239	0.0026	1.383
Comorbidities				
Extensively Calcified Aorta	9.23	0.3399	0.0251	1.405
Peripheral Vascular Disease	13.62	0.3375	0.0083	1.401
Renal Failure				
No Renal Failure	65.54	— Reference —		1.000
Renal Failure, Creatinine 1.3 – 1.5 mg/dl	16.04	0.5004	0.0004	1.649
Renal Failure, Creatinine 1.6 – 2.0 mg/dl	9.55	0.8187	<.0001	2.268
Renal Failure, Creatinine > 2.0 mg/dl	5.04	1.1543	<.0001	3.172
Renal Failure Requiring Dialysis	3.83	1.8519	<.0001	6.372
Previous Open Heart Operations				
No Previous Cardiac Surgery	92.07	— Reference —		1.000
Previous CABG with Patent Grafts	5.42	0.4989	0.0066	1.647
Any Other Previous Cardiac Surgery	2.51	0.5896	0.0250	1.803

Intercept = 2.4108

C Statistic = 0.759

NEW YORK STATE CARDIAC SURGERY CENTERS

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

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

Bellevue Hospital Center
First Avenue and 27th Street
New York, New York 10016

Beth Israel Medical Center
10 Nathan D. Perlman Place
New York, New York 10003

Buffalo General Hospital
100 High Street
Buffalo, New York 14203

Champlain Valley Physicians Hospital
Medical Center ***
75 Beekman Street
Plattsburgh, New York 12901

Columbia Presbyterian Medical Center
– NY Presbyterian
161 Fort Washington Avenue
New York, New York 10032

Ellis Hospital
1101 Nott Street
Schenectady, New York 12308

Erie County Medical Center ***
462 Grider Street
Buffalo, New York 14215

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

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

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

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

Maimonides Medical Center
4802 Tenth Avenue
Brooklyn, New York 11219

Mary Imogene Bassett Healthcare
Atwell Road
Cooperstown, New York 13326

Mercy Hospital
565 Abbott Road
Buffalo, New York 14220

Millard Fillmore Hospital ***
3 Gates Circle
Buffalo, New York 14209

Montefiore Medical Center
Henry & Lucy Moses Division
111 East 210th Street
Bronx, New York 11219

Montefiore Medical Center-
Weiler Hospital of
A. Einstein College of Medicine
1825 Eastchester Road
Bronx, New York 10461

Mount Sinai Medical Center
One Gustave L. Levy Place
New York, New York 10019

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

New York Hospital Medical
Center-Queens
56-45 Main Street
Flushing, New York 11355

New York Methodist Hospital
506 Sixth Street
Brooklyn, New York 11215

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 13413

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

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

St. Luke's Roosevelt
Hospital Center
11-11 Amsterdam Avenue
at 114th Street
New York, New York 10025

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

Southside Hospital
301 East Main Street
Bayshore, New York 11706

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

Strong Memorial Hospital
601 Elmwood Avenue
Rochester, New York 14642

United Health Services
Wilson Hospital Division
33-57 Harrison Street
Johnson City, New York 13790

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

University Hospital of Brooklyn
450 Lenox Road
Brooklyn, New York 11203

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

Vassar Brother's Medical Center
45 Reade Place
Poughkeepsie, New York 12601

Weill-Cornell Medical Center –
NY Presbyterian
525 East 68th Street
New York, New York 10021

Westchester Medical Center
Grasslands Road
Valhalla, New York 10595

Winthrop University Hospital
259 First Street
Mineola, New York 11501

** Began performing cardiac surgery after 2011

*** No longer performing cardiac surgery as of March 2014

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