

**CORONARY
ARTERY
BYPASS
SURGERY**

**in
New York State**

1992-1994

New York State Department of Health

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INTRODUCTION

Coronary artery bypass graft (CABG) surgery is one of the most common surgical procedures performed in the United States. In 1994, a total of 18,051 CABG operations were performed in New York State.

New York has taken a leadership role in setting standards for cardiac surgery, and in monitoring outcomes and sharing performance data with patients, hospitals and physicians. Using a risk adjustment formula crafted with the Cardiac Advisory Committee, the Department of Health is able to compile and compare the performance of New York's surgeons and cardiac surgery centers. This process consists of a thorough quality check of all data submitted through verification with other Department of Health databases and reviews of hospital medical records. The data are then analyzed using traditional statistical methods. Data analyses and quality audits are reviewed and approved by the Cardiac Advisory Committee before the statistics are published.

This process allows for comparison and, more importantly, has identified opportunities for quality improvement which have been effectively utilized by hospitals. The data have prompted some hospitals to re-evaluate their processes of care and to make changes that have significantly improved their patient outcomes. Results have been dramatic since the inception of the program, and mortality rates continued to decline in 1994. During the three-year period covered by this report, the number of bypass surgeries performed each year has increased by 12.6 percent. This increase in volume was accompanied by a decrease in actual mortality from 2.78 percent in 1992 to 2.49 percent in 1994. When changes in expected mortality (a measure of the severity of illness) are taken into account, this represents a 7.5 percent decrease in risk-adjusted mortality in the three-year period.

While the Department of Health recognizes that new, improved methods and training have been important in effecting this change, it is our opinion that the data reporting and analysis described in this booklet have played an important role in achieving this outcome.

I encourage doctors to discuss this information with their patients and colleagues as they develop treatment plans. While these statistics are an important tool in making informed health care choices, individual treatment decisions 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 coronary artery bypass surgery. These include the patient's health before this procedure, the skill of the operating team and the recovery room staff. In addition, keep in mind that the information in this booklet does not include data from 1995 or 1996. Important changes may have taken place in some hospitals during that time period.

I commend the providers of this state and the Cardiac Advisory Committee 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 that the quality of cardiac surgery available to New York residents remains the highest in the nation.



Barbara A. DeBuono, M.D., M.P.H., Commissioner
New York State Department of Health

CORONARY ARTERY BYPASS GRAFT SURGERY

Coronary artery bypass graft surgery (CABG) is 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, bypassing the arterial blockage. A section of one of the large (saphenous) veins in the leg or of the mammary artery in the chest is used to construct the bypass. CABG surgery is one of the most common, successful major operations currently performed in the United States.

As is true of all major surgery, there are risks that must be considered. The patient is totally anesthetized, and there is a recovery period in the hospital followed by several weeks at home. While the mortality rate from CABG surgery continues to improve, it is about 1 to 2 percent among relatively healthy patients. An additional 5 to 10 percent nationally have heart attacks during or right after the surgery has been performed.

Even in successful cases, there is a risk of relapse causing the need for another operation. Nearly half of coronary bypass patients nationwide relapse within five years, and most grafts using

veins do not stay open more than 10 years. Grafts using arteries generally stay open longer.

Often, both veins and arteries are grafted, 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.

About 70 percent of those who have had angina, the pain felt when blood and oxygen flow are obstructed, will no longer suffer from it after the surgery, while in 20 percent more the pain will be less severe. For those patients who have found no other relief from angina, and who have blockage in the left main coronary artery or in all three coronary arteries, CABG is generally the treatment of choice.

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

THE HEALTH DEPARTMENT PROGRAM

The New York State 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 New York State 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 individual patients' preoperative conditions.

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

- understanding the health risks of patients which adversely affect how they will fare in coronary artery bypass surgery;
- improving the results of different treatments of heart disease;
- improving cardiac care;
- providing information to help patients make better decisions about their own care.

PATIENT POPULATION

All patients undergoing isolated coronary artery bypass graft surgery (CABG surgery with no other major heart surgery during the same admission) in New York State hospitals, who were discharged in 1994, are included in the one-year results for coronary artery bypass surgery. Similarly, all patients undergoing isolated CABG surgery who were discharged between January 1, 1992, and December 31, 1994, are included in the three-year results.

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 New York State Department of Health adjusts for patient risk in assessing provider outcomes.

Data Collection

As part of the risk-adjustment process, New York State hospitals where coronary artery bypass surgery is performed provide information to the Department of Health for each patient undergoing that procedure. Cardiac surgery departments in hospitals 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 hospital, physician and the patient's status at discharge, these data are entered into a computer, and sent to the Department of Health for analysis.

Assessing Patient Risk

Each person who develops coronary artery 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 facts 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.

An 80-year-old patient with a history of two heart attacks, for example, has a very different risk profile from a 40-year-old with no previous heart problems.

The statistical analyses conducted by the Department of Health consist of determining which of the risk factors collected are significantly related to in-hospital death for CABG surgery, and determining how to weight the significant risk factors to predict the chance each patient will have of dying in the hospital, given his/her specific characteristics.

Doctors and patients should review individual risk profiles together. Treatment decisions must be made by doctors and patients together after careful 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 if 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 coronary bypass surgery.

The mortality rate for each hospital and surgeon is also predicted using the statistical model. 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**.

Computing the Risk-Adjusted Rate

The **risk-adjusted mortality rate** 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 risk-adjusted mortality rate 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 get the risk-adjusted mortality rate, the observed mortality rate is first divided by the provider's expected mortality rate. 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. The ratio is then multiplied by the overall statewide mortality rate (2.49% in 1994) to obtain the provider's risk-adjusted rate.

Interpreting the Risk-Adjusted Mortality Rate

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

The risk-adjusted mortality rate 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 risk-adjusted mortality rate 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. In order to minimize misinterpretation due to chance variation, physician-specific coronary bypass data have been reported only for surgeons who have performed at least 200 operations over a three-year period. Another attempt to prevent misinterpretation of differences caused by chance variation is the use of expected ranges (confidence intervals) in the reported 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 risk-adjusted rate may not be reflective of quality of care. The Department of Health monitors the quality of coded data by reviewing patients' medical records to ascertain the presence of key risk factors. When significant coding problems have been discovered, hospitals have been required to recode these data and have been subjected to subsequent monitoring.

A final reason that risk-adjusted rates may be misleading is that overall preprocedural severity of illness may not be accurately estimated because important risk factors are missing. This is not considered to be an important factor, however, because the New York State data system contains virtually every risk factor that has ever been demonstrated to be related to patient mortality in national and international studies.

Although there are reasons that risk-adjusted mortality rates 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 CABG surgery.

How This Contributes to Quality Improvement

The goal of the Department of Health and the Cardiac Advisory Committee is to improve the quality of care in relation to CABG surgery in New York State. Providing the hospitals and cardiac surgeons in New York State with data about their own outcomes for these procedures allows them to examine the quality of their own care, and to identify areas that need improvement.

The data collected and analyzed in this program are given to the Cardiac Advisory Committee. Committee members assist with interpretation and advise the Department of Health regarding which hospitals and surgeons 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 in CABG surgery show that significant progress is being made. In response to the program's results for CABG surgery, facilities have refined patient criteria, evaluated patients more closely for preoperative 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.

1994 Risk Factors for CABG Surgery

The significant preoperative risk factors for CABG surgery in 1994 are presented in Table 1.

Roughly speaking, the odds ratio for a risk factor represents the number of times more likely a patient with that risk factor is of dying in the hospital during or after CABG surgery than a patient without the risk factor, all other risk factors being the same. For example, the odds ratio for the risk factor "diabetes" is 1.726. This means that a patient who has diabetes is approximately 1.726 times as likely to die in the hospital as a patient who does not have diabetes but who has the same other significant risk factors.

For most of the risk factors in the table, there are only two possibilities: having the risk factor or not having it (for example, a patient either has diabetes or does not have it). Exceptions are age and body surface area (which is calculated using the patient's height and weight). For both of these risk factors, the odds ratio roughly represents the number of times more likely a patient is to die in the hospital than a patient with a value (age or body surface area) that is one unit smaller. Thus, a patient undergoing CABG who is 72 years old has a chance of dying in the hospital that is approximately 1.042 times the chance that a patient 71 years old undergoing CABG has of dying in the hospital.

Table 1: Multivariable Risk Factor Equation for CABG Hospital Deaths in New York State in 1994.

Patient Risk Factor	Logistic Regression		Odds Ratio
	Coefficient	P-Value	
Demographic			
Age	0.0411	<0.0001	1.042
Body Surface Area	- 0.7981	0.0007	0.450
Hemodynamic State			
Unstable	1.1348	<0.0001	3.111
Shock	2.0686	<0.0001	7.914
Comorbidities			
Chronic Obstructive Pulmonary Disease	0.3942	0.0009	1.483
Diabetes	0.5457	<0.0001	1.726
Renal Failure	1.4776	<0.0001	4.382
Extensively Calcified Ascending Aorta	0.5934	<0.0001	1.810
Ventricular Function			
Prev. MI < 6 Hrs.	0.8783	0.0009	2.407
Ejection Fraction Less Than 20%	1.1678	<0.0001	3.215
Ejection Fraction 20%-29%	0.6829	<0.0001	1.980
Congestive Heart Failure, This Admission	0.6322	<0.0001	1.882
Previous Open Heart Operations	0.7886	<0.0001	2.200

Intercept = - 5.8467

1994 HOSPITAL OUTCOMES FOR CABG SURGERY

Table 2 and Figure 1 present the 1994 CABG surgery results for the 31 hospitals performing this operation in New York. The table contains, for each hospital, the number of isolated CABG operations (CABG operations with no other major heart surgery) resulting in 1994 discharges, the number of in-hospital deaths, the observed mortality rate, the expected mortality rate based on the statistical model presented in Table 1, the risk-adjusted mortality rate, a 95 percent confidence interval for the risk-adjusted rate and upper and lower P-values for the risk-adjusted mortality rate.

Definitions of key terms are as follows:

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

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.

Confidence intervals for the risk-adjusted mortality rate indicate which hospitals had significantly more or fewer deaths than expected given the risk factors of their patients. Hospitals with significantly higher rates than expected after adjusting for risk are those with confidence intervals entirely above the statewide 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 rate.

As indicated in Table 2, the overall mortality rate for the 18,051 CABG operations performed at the 31 hospitals was 2.49 percent. Observed mortality rates ranged from 0.69 percent to 6.45 percent. The range in expected mortality rates, which measure patient severity of illness, was from 1.50 percent to 3.59 percent.

The risk-adjusted mortality rates, which are used to measure performance, ranged from 0.79 percent to 7.05 percent. Two hospitals, St. Francis Hospital and St. Joseph's Hospital, had risk-adjusted mortality rates that were significantly lower than the statewide rate. One hospital, Bellevue, had a significantly higher risk-adjusted rate than the statewide average.

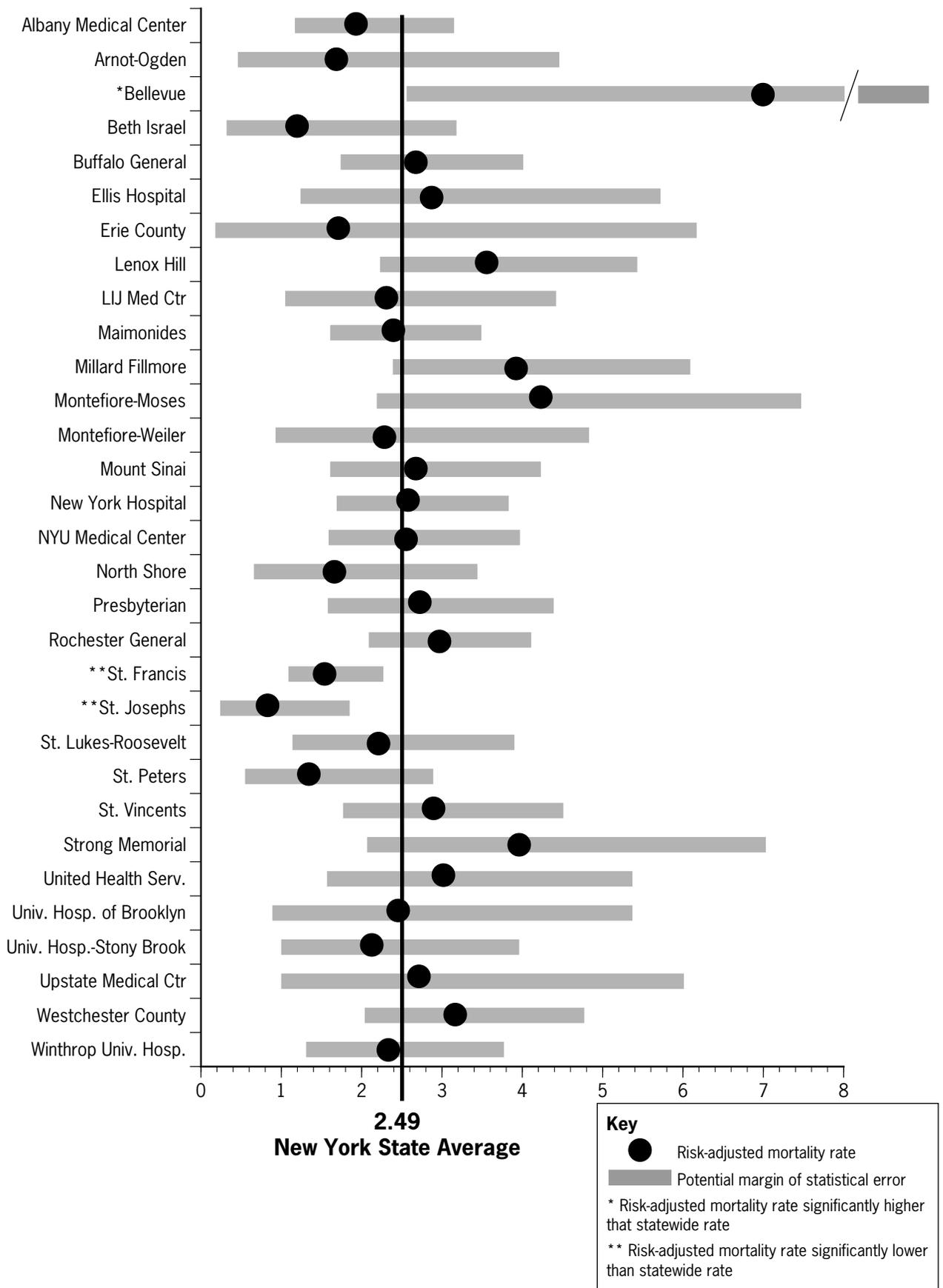
Table 2: Hospital Observed, Expected and Risk-Adjusted Mortality Rates for Coronary Artery Bypass Grafts in New York State, 1994 Discharges (Listed Alphabetically by Hospital)

Hospital	Cases	Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Medical Center	1167	18	1.54	1.93	1.98	(1.18, 3.14)
Arnot-Ogden	236	4	1.69	2.42	1.74	(0.47, 4.45)
Bellevue	93	6	6.45	2.28	7.05 *	(2.57, 15.34)
Beth Israel	270	4	1.48	2.98	1.24	(0.33, 3.17)
Buffalo General	1173	25	2.13	1.95	2.71	(1.75, 4.00)
Ellis Hospital	422	8	1.90	1.63	2.90	(1.25, 5.71)
Erie County	183	2	1.09	1.59	1.71	(0.19, 6.16)
Lenox Hill	634	22	3.47	2.41	3.58	(2.24, 5.42)
LIJ Med Ctr	415	9	2.17	2.32	2.32	(1.06, 4.41)
Maimonides	833	29	3.48	3.58	2.42	(1.62, 3.48)
Millard Fillmore	659	20	3.03	1.92	3.94	(2.40, 6.08)
Montefiore-Moses	416	12	2.88	1.68	4.27	(2.20, 7.46)
Montefiore-Weiler	293	7	2.39	2.54	2.34	(0.94, 4.82)
Mount Sinai	487	19	3.90	3.59	2.70	(1.62, 4.22)
New York Hospital	942	26	2.76	2.63	2.61	(1.70, 3.82)
NYU Medical Center	629	21	3.34	3.21	2.59	(1.60, 3.96)
North Shore	600	7	1.17	1.74	1.67	(0.67, 3.43)
Presbyterian	549	17	3.10	2.82	2.73	(1.59, 4.38)
Rochester General	1006	37	3.68	3.07	2.98	(2.10, 4.10)
St. Francis	1618	26	1.61	2.60	1.54 **	(1.01, 2.26)
St. Josephs	723	5	0.69	2.19	0.79 **	(0.25, 1.84)
St. Lukes-Roosevelt	500	12	2.40	2.68	2.23	(1.15, 3.89)
St. Peters	558	7	1.25	2.23	1.40	(0.56, 2.88)
St. Vincents	580	20	3.45	2.94	2.91	(1.78, 4.50)
Strong Memorial	377	12	3.18	1.97	4.02	(2.08, 7.02)
United Health Serv.	391	12	3.07	2.49	3.07	(1.58, 5.36)
Univ. Hosp. of Brooklyn	223	6	2.69	2.72	2.46	(0.90, 5.36)
Univ.Hosp.-Stony Brook	443	10	2.26	2.62	2.15	(1.03, 3.95)
Upstate Medical Ctr	360	6	1.67	1.50	2.76	(1.01, 6.00)
Westchester County	714	24	3.36	2.62	3.20	(2.05, 4.76)
Winthrop Univ.Hosp.	557	16	2.87	3.08	2.32	(1.32, 3.76)
Total	18051	449	2.49			

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

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

Figure 1: Hospital Observed, Expected and Risk-Adjusted Mortality Rates for Coronary Artery Bypass Grafts in New York State, 1994 Discharges (Listed Alphabetically by Hospital)



1992-1994 STATEWIDE DATA FOR CABG SURGERY

Table 3, which is based on statistical analyses of the last three years of CABG data taken together, presents annual statewide information regarding the volume, observed mortality rate, expected mortality rate and risk-adjusted mortality rate for isolated CABG surgery in New York from 1992 to 1994.

As indicated in Table 3, the volume of isolated CABG operations in New York rose 4.1 percent to 16,690 in 1993, and rose 8.2 percent to 18,051 in 1994. This was accompanied by a drop in actual mortality rate from 2.78 percent in 1992 to 2.71 percent in 1993 to 2.49 percent in 1994. As a

result of these changes in observed and expected mortality rates, the risk-adjusted mortality rate dropped from 2.79 percent in 1992 to 2.58 percent in 1994, a decrease of 7.5 percent. Since the risk-adjusted mortality rate is a measure of outcome after having adjusted for severity of illness, these data are evidence of continued improvement in CABG surgery results during the three-year period.

The expected and risk-adjusted mortality rates for 1992 and 1993 do not match the results reported in last year's version of this report because expected and risk-adjusted rates are relative, and a different time period was used in each report.

Table 3: Observed, Expected and Risk-adjusted Hospital Mortality (%) after Coronary Artery Bypass Surgery, 1992-1994

Hospital Mortality	1992 (n=16,028)	1993 (n=16,690)	1994 (n=18,051)
Observed	2.78	2.71	2.49
Expected	2.65	2.76	2.56
Risk-Adjusted	2.79	2.61	2.58

1992-1994 HOSPITAL AND SURGEON DATA FOR CABG SURGERY

Table 4 provides the number of isolated CABG operations, number of CABG patients who died in the hospital, observed mortality rate, expected mortality rate, risk-adjusted mortality rate and the 95 percent confidence interval for the risk-adjusted mortality rate for 1992-94 for each of the 31 hospitals performing CABG surgery during the time period. This hospital information is presented for each surgeon who performed 200 or more isolated CABG operations in that hospital during 1992-1994. The results for surgeons who performed fewer than 200 isolated CABG operations are grouped together and reported as "other cases" in the hospital in which the operations were performed. Surgeons who performed operations in more than one hospital are noted in the table and are listed in all hospitals in which they performed 200 or more operations.

Surgeons who have performed a total of 200 or more isolated CABG operations between 1992 and 1994 and performed CABG surgery in two or more New York State hospitals are listed separately in Table 5. For these surgeons, the table presents the number of isolated CABG operations and number of deaths in each hospital, as well as the aggregate (across all hospitals in which the surgeon performed operations) number of isolated CABG operations, number of deaths, observed mortality rate, expected mortality rate and risk-adjusted mortality rate.

In addition, surgeons and hospitals with risk-adjusted mortality rates that are significantly lower or higher than the statewide mortality rate (as judged by a 95% confidence interval) are noted in tables 4 and 5.

Table 4: Observed, Expected and Risk-Adjusted Hospital and Surgeon Mortality Data for Coronary Artery Bypass Graft Surgery, 1992-1994

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Medical Center Hospital						
##Bennett E	491	6	1.22	2.41	1.35	(0.49, 2.93)
##Britton L	427	8	1.87	2.11	2.36	(1.02, 4.65)
#Canavan T	550	12	2.18	2.07	2.80	(1.44, 4.88)
Ferraris V	346	11	3.18	2.51	3.36	(1.67, 6.01)
Foster E	244	6	2.46	2.91	2.24	(0.82, 4.89)
Luber J	263	9	3.42	2.20	4.13	(1.89, 7.85)
All Others	706	14	1.98	1.91	2.75	(1.50, 4.62)
TOTAL	3027	66	2.18	2.22	2.60	(2.01, 3.31)
Arnot-Ogden Memorial Hospital						
Borja A	380	13	3.42	2.36	3.86	(2.05, 6.59)
Vaughan J	297	5	1.68	2.35	1.90	(0.61, 4.43)
All Others	313	5	1.60	2.52	1.68	(0.54, 3.92)
TOTAL	990	23	2.32	2.41	2.56	(1.62, 3.84)
Bellevue Hospital Center						
TOTAL	235	10	4.26	2.76	4.10	(1.96, 7.54)

Table 4 continued

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
Beth Israel Medical Center						
Tranbaugh R	563	10	1.78	3.31	1.42 **	(0.68, 2.62)
All Others	151	4	2.65	2.16	3.25	(0.88, 8.33)
TOTAL	714	14	1.96	3.07	1.70	(0.93, 2.85)
Buffalo General Hospital						
Bergsland J	566	7	1.24	2.11	1.55	(0.62, 3.20)
#Bhayana J	497	15	3.02	2.03	3.96	(2.21, 6.53)
Grosner G	471	10	2.12	2.16	2.62	(1.25, 4.81)
Lajos T	561	27	4.81	2.71	4.72 *	(3.11, 6.87)
Levinsky L	213	6	2.82	2.42	3.09	(1.13, 6.72)
Lewin A	672	21	3.13	1.91	4.35 *	(2.69, 6.66)
Raza S	577	20	3.47	2.22	4.14	(2.53, 6.39)
TOTAL	3557	106	2.98	2.20	3.60 *	(2.95, 4.35)
Ellis Hospital						
Depan H	473	10	2.11	1.85	3.04	(1.46, 5.59)
#Older T	297	7	2.36	1.48	4.23	(1.70, 8.73)
All Others	326	6	1.84	1.86	2.62	(0.96, 5.71)
TOTAL	1096	23	2.10	1.75	3.18	(2.02, 4.77)
Erie County Medical Center						
Bell-Thomson J	346	5	1.45	1.37	2.81	(0.90, 6.55)
All Others	67	3	4.48	1.42	8.39	(1.69, 24.51)
TOTAL	413	8	1.94	1.37	3.74	(1.61, 7.37)
Lenox Hill Hospital						
Stelzer P	389	7	1.80	2.18	2.19	(0.88, 4.51)
Subramanian V	1307	43	3.29	2.79	3.14	(2.27, 4.22)
All Others	180	9	5.00	1.76	7.54 *	(3.44, 14.31)
TOTAL	1876	59	3.14	2.56	3.26	(2.48, 4.20)
Long Island Jewish Medical Center						
Graver L	560	11	1.96	2.42	2.15	(1.07, 3.85)
Palazzo R	291	4	1.37	2.65	1.38	(0.37, 3.53)
All Others	269	15	5.58	2.77	5.34 *	(2.98, 8.80)
TOTAL	1120	30	2.68	2.57	2.77	(1.87, 3.96)
Maimonides Medical Center						
#Cunningham J N	412	19	4.61	3.77	3.25	(1.96, 5.08)
Jacobowitz I	1272	44	3.46	3.96	2.32	(1.69, 3.11)
Sabado M	368	20	5.43	4.56	3.17	(1.93, 4.89)
All Others	299	7	2.34	3.13	1.98	(0.80, 4.09)
TOTAL	2351	90	3.83	3.91	2.60	(2.09, 3.19)
Millard Fillmore Hospital						
Aldridge J	522	14	2.68	2.11	3.38	(1.85, 5.68)
Guarino R	459	11	2.40	1.51	4.21	(2.10, 7.54)
Jennings L	292	6	2.05	2.39	2.28	(0.83, 4.97)
Major W	306	5	1.63	2.09	2.07	(0.67, 4.84)
All Others	211	7	3.32	2.10	4.19	(1.68, 8.62)
TOTAL	1790	43	2.40	2.00	3.19	(2.31, 4.30)

Table 4 continued

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
Montefiore Medical Center - Moses Division						
Attai L	480	17	3.54	1.96	4.79 *	(2.79, 7.67)
Brodman R	287	4	1.39	1.84	2.01	(0.54, 5.15)
Merav A	299	7	2.34	2.03	3.06	(1.23, 6.31)
All Others	78	4	5.13	1.48	9.19	(2.47, 23.52)
TOTAL	1144	32	2.80	1.92	3.88	(2.65, 5.47)
Montefiore Medical Center - Weiler Division						
Frymus M	293	13	4.44	2.82	4.17	(2.22, 7.14)
Sisto D	336	9	2.68	4.77	1.49	(0.68, 2.83)
All Others	147	7	4.76	2.29	5.51	(2.21, 11.35)
TOTAL	776	29	3.74	3.56	2.78	(1.86, 4.00)
Mount Sinai Hospital						
Ergin M	539	10	1.86	2.56	1.93	(0.92, 3.54)
Lansman S	407	17	4.18	3.60	3.08	(1.79, 4.93)
All Others	447	17	3.80	2.67	3.79	(2.20, 6.06)
TOTAL	1393	44	3.16	2.90	2.89	(2.10, 3.88)
New York Hospital						
Gold J	238	2	0.84	3.75	0.60 **	(0.07, 2.15)
Isom O	264	4	1.52	2.50	1.61	(0.43, 4.11)
Krieger K	872	22	2.52	2.66	2.52	(1.58, 3.81)
Lang S	828	26	3.14	3.59	2.32	(1.51, 3.40)
Rosengart T	405	14	3.46	3.98	2.31	(1.26, 3.87)
All Others	159	5	3.14	2.71	3.08	(0.99, 7.18)
TOTAL	2766	73	2.64	3.22	2.18	(1.71, 2.74)
New York University Medical Center						
#Colvin S	262	9	3.44	4.52	2.02	(0.92, 3.83)
#Culliford A	385	6	1.56	3.72	1.11 **	(0.41, 2.42)
Esposito R	301	6	1.99	4.02	1.32	(0.48, 2.87)
#Galloway A	247	7	2.83	2.91	2.59	(1.04, 5.34)
Spencer F	236	10	4.24	2.86	3.94	(1.88, 7.24)
All Others	435	16	3.68	4.71	2.07	(1.18, 3.37)
TOTAL	1866	54	2.89	3.89	1.97 **	(1.48, 2.57)
North Shore University Hospital						
Hall M	582	12	2.06	2.21	2.48	(1.28, 4.33)
Nelson R	261	6	2.30	2.29	2.66	(0.97, 5.79)
Pogo G	362	3	0.83	1.93	1.14	(0.23, 3.32)
Tortolani A	374	10	2.67	1.60	4.44	(2.12, 8.16)
All Others	55	1	1.82	1.71	2.83	(0.04, 15.73)
TOTAL	1634	32	1.96	2.01	2.59	(1.77, 3.66)
Presbyterian Hospital-City of New York						
Rose E	529	13	2.46	2.02	3.23	(1.72, 5.52)
Smith C	588	18	3.06	3.21	2.53	(1.50, 4.00)
All Others	548	20	3.65	2.57	3.77	(2.30, 5.82)
TOTAL	1665	51	3.06	2.62	3.10	(2.31, 4.08)
Rochester General Hospital						
Cheeran D	783	22	2.81	2.43	3.06	(1.92, 4.64)
Kirshner R	850	27	3.18	3.41	2.47	(1.63, 3.60)
Knight P	925	33	3.57	2.50	3.78	(2.60, 5.31)
All Others	320	10	3.13	3.52	2.35	(1.13, 4.33)
TOTAL	2878	92	3.20	2.87	2.96	(2.39, 3.63)

Table 4 continued

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
St. Francis Hospital						
Bercow N	234	3	1.28	2.25	1.51	(0.30, 4.42)
Damus P	506	3	0.59	2.22	0.71 **	(0.14, 2.07)
Durban L	687	10	1.46	3.20	1.21 **	(0.58, 2.22)
Hartstein M	338	4	1.18	1.93	1.63	(0.44, 4.17)
Robinson N	950	17	1.79	2.16	2.20	(1.28, 3.52)
Taylor J	819	12	1.47	2.76	1.41 **	(0.73, 2.46)
Weisz D	498	16	3.21	2.76	3.09	(1.76, 5.01)
Wisoff B	237	6	2.53	2.99	2.25	(0.82, 4.89)
All Others	82	1	1.22	2.59	1.25	(0.02, 6.95)
TOTAL	4351	72	1.65	2.55	1.72 **	(1.35, 2.17)
St. Josephs Hospital Health Center						
Marvasti M	530	1	0.19	1.71	0.29 **	(0.00, 1.63)
Nast E	247	4	1.62	2.61	1.65	(0.44, 4.21)
Nazem A	611	9	1.47	3.00	1.30 **	(0.60, 2.48)
Rosenberg J	573	9	1.57	1.88	2.22	(1.01, 4.21)
TOTAL	1961	23	1.17	2.28	1.37 **	(0.87, 2.05)
St. Lukes Roosevelt Hospital-St. Lukes Div.						
Aronis M	246	2	0.81	1.71	1.26	(0.14, 4.56)
Mindich B	352	5	1.42	1.92	1.96	(0.63, 4.58)
Swistel D	332	7	2.11	4.07	1.38	(0.55, 2.83)
Zadeh B	298	8	2.68	2.88	2.47	(1.06, 4.87)
All Others	204	11	5.39	2.60	5.51 *	(2.74, 9.85)
TOTAL	1432	33	2.30	2.68	2.28	(1.57, 3.21)
St. Peters Hospital						
##Dal Col R	476	12	2.52	2.24	2.98	(1.54, 5.21)
#McIlduff J	328	11	3.35	3.11	2.86	(1.43, 5.12)
##Miller S	342	9	2.63	2.93	2.39	(1.09, 4.53)
All Others	426	11	2.58	2.76	2.48	(1.24, 4.44)
TOTAL	1572	43	2.74	2.71	2.68	(1.94, 3.60)
St. Vincents Hospital and Medical Center						
Galdieri R	444	17	3.83	3.10	3.28	(1.91, 5.25)
McGinn J	497	9	1.81	3.87	1.24 **	(0.57, 2.36)
Tyras D	561	12	2.14	2.26	2.51	(1.29, 4.38)
All Others	195	9	4.62	1.14	10.78 *	(4.92, 20.46)
TOTAL	1697	47	2.77	2.82	2.60	(1.91, 3.46)
State University Hospital Upstate Medical Center						
Brandt B	209	6	2.87	1.91	3.99	(1.46, 8.68)
Parker F	322	5	1.55	1.93	2.14	(0.69, 4.99)
All Others	427	20	4.68	1.83	6.78 *	(4.14, 10.48)
TOTAL	958	31	3.24	1.88	4.56 *	(3.10, 6.48)
Strong Memorial Hospital						
Hicks G	596	24	4.03	3.02	3.54	(2.27, 5.27)
Risher W	376	13	3.46	1.81	5.07 *	(2.70, 8.67)
All Others	140	8	5.71	2.17	7.00 *	(3.01, 13.79)
TOTAL	1112	45	4.05	2.50	4.30 *	(3.13, 5.75)

Table 4 continued

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
United Health Services - Wilson Division						
Cunningham J R	403	11	2.73	2.39	3.03	(1.51, 5.42)
Wong K	354	6	1.69	1.98	2.28	(0.83, 4.96)
Yousuf M	389	13	3.34	3.27	2.72	(1.44, 4.64)
TOTAL	1146	30	2.62	2.56	2.71	(1.83, 3.87)
University Hospital (Stony Brook)						
Bilfinger T	242	12	4.96	4.58	2.88	(1.48, 5.03)
Hartman A	522	7	1.34	2.39	1.49	(0.60, 3.06)
Seifert F	235	12	5.11	3.31	4.09	(2.11, 7.15)
All Others	44	1	2.27	4.44	1.36	(0.02, 7.57)
TOTAL	1043	32	3.07	3.19	2.55	(1.74, 3.60)
University Hospital of Brooklyn						
Zisbrod Z	436	9	2.06	3.15	1.74	(0.79, 3.31)
All Others	310	12	3.87	2.62	3.93	(2.03, 6.86)
TOTAL	746	21	2.82	2.93	2.55	(1.58, 3.90)
Westchester County Medical Center						
Axelrod H	289	6	2.08	3.07	1.79	(0.65, 3.90)
Fleisher A	355	9	2.54	2.15	3.13	(1.43, 5.94)
Lafaro R	357	14	3.92	1.91	5.46 *	(2.98, 9.16)
Moggio R	323	7	2.17	2.50	2.31	(0.92, 4.75)
Pooley R	241	15	6.22	1.78	9.27 *	(5.19, 15.29)
Sarabu M	319	3	0.94	2.82	0.89 **	(0.18, 2.59)
All Others	44	1	2.27	1.59	3.79	(0.05, 21.07)
TOTAL	1928	55	2.85	2.35	3.22	(2.42, 4.19)
Winthrop - University Hospital						
Mohtashemi M	219	3	1.37	2.88	1.26	(0.25, 3.69)
Schubach S	449	9	2.00	3.13	1.70	(0.78, 3.23)
Scott W	328	4	1.22	3.34	0.97 **	(0.26, 2.48)
All Others	536	21	3.92	3.47	2.99	(1.85, 4.58)
TOTAL	1532	37	2.42	3.26	1.97	(1.38, 2.71)
Statewide Totals	50769	1348	2.66			

* Risk-adjusted rate is significantly higher than statewide rate

** Risk-adjusted rate is significantly lower than statewide rate

Performed operations in another New York State hospital

Performed operations in two other New York State hospitals

OMR - the observed mortality rate is the number of observed deaths divided by the number of patients.

EMR - the expected mortality rate is the sum of the predicted probability of death for each patient divided by the total number of patients.

RAMR - the risk-adjusted mortality rate 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.

Note: Only surgeons performing 200 or more CABG operations in 1992-1994 at the hospital identified are listed by name in Table 4.

Table 5: Summary Information for Surgeons Practicing at More Than One Hospital and Performing at Least 200 CABG Operations, 1992-1994

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
Acinapura A						
Maimonides	185	3	1.62	3.12	1.38	(0.28, 4.03)
St. Vincents	140	3	2.14	1.13	5.05	(1.01, 14.75)
Univ Hosp Brooklyn	3	0	0.00	3.16	0.00	(0.00, 100.0)
Total	328	6	1.83	2.27	2.14	(0.78, 4.66)
Bennett E						
Albany Med Ctr	491	6	1.22	2.41	1.35	(0.49, 2.93)
Ellis Hospital	2	0	0.00	3.12	0.00	(0.00, 100.0)
St. Peters	185	1	0.54	2.53	0.57	(0.01, 3.16)
Total	678	7	1.03	2.44	1.12 **	(0.45, 2.31)
Bhayana J						
Buffalo General	497	15	3.02	2.03	3.96	(2.21, 6.53)
Erie County	2	0	0.00	1.42	0.00	(0.00, 100.0)
Total	499	15	3.01	2.02	3.95	(2.21, 6.51)
Britton L						
Abany Med Ctr	427	8	1.87	2.11	2.36	(1.02, 4.65)
Ellis Hospital	19	0	0.00	0.99	0.00	(0.00, 51.86)
St. Peters	3	0	0.00	1.42	0.00	(0.00, 100.0)
Total	449	8	1.78	2.06	2.30	(0.99, 4.54)
Canavan T						
Albany Med Ctr	550	12	2.18	2.07	2.80	(1.44, 4.88)
Ellis Hospital	4	0	0.00	1.51	0.00	(0.00, 100.0)
Total	554	12	2.17	2.07	2.78	(1.44, 4.86)
Colvin S						
Bellevue	53	5	9.43	3.35	7.48	(2.41, 17.46)
NYU Med Ctr	262	9	3.44	4.52	2.02	(0.92, 3.83)
Total	315	14	4.44	4.33	2.73	(1.49, 4.58)
Culliford A						
Bellevue	1	0	0.00	0.22	0.00	(0.00, 100.0)
NYU Med Ctr	385	6	1.56	3.72	1.11 **	(0.41, 2.42)
Total	386	6	1.55	3.71	1.11 **	(0.41, 2.42)
Cunningham J N						
Maimonides	412	19	4.61	3.77	3.25	(1.96, 5.08)
Univ Hosp Brooklyn	76	2	2.63	3.54	1.98	(0.22, 7.14)
Total	488	21	4.30	3.73	3.06	(1.90, 4.68)
Dal Col R						
Albany Med Ctr	7	0	0.00	1.36	0.00	(0.00, 100.0)
Ellis Hospital	49	2	4.08	2.48	4.37	(0.49, 15.79)
St. Peters	476	12	2.52	2.24	2.98	(1.54, 5.21)
Total	532	14	2.63	2.25	3.10	(1.69, 5.20)
Galloway A						
Bellevue	48	1	2.08	1.95	2.84	(0.04, 15.81)
NYU Med Ctr	247	7	2.83	2.91	2.59	(1.04, 5.34)
Total	295	8	2.71	2.75	2.62	(1.13, 5.16)

Table 5 continued

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
Green G						
Presbyterian	157	5	3.18	1.58	5.35	(1.72, 12.48)
St. Lukes	44	0	0.00	1.28	0.00	(0.00, 17.32)
Total	201	5	2.49	1.51	4.36	(1.41, 10.18)
McIlduff J						
Ellis Hospital	95	0	0.00	2.40	0.00	(0.00, 4.26)
St. Peters	328	11	3.35	3.11	2.86	(1.43, 5.12)
Total	423	11	2.60	2.95	2.34	(1.17, 4.18)
Miller S						
Albany Med Ctr	116	1	0.86	2.62	0.87	(0.01, 4.86)
Ellis Hospital	1	0	0.00	1.21	0.00	(0.00, 100.0)
St. Peters	342	9	2.63	2.93	2.39	(1.09, 4.53)
Total	459	10	2.18	2.85	2.03	(0.97, 3.74)
Older T						
Ellis Hospital	297	7	2.36	1.48	4.23	(1.70, 8.73)
St. Peters	82	2	2.44	2.43	2.67	(0.30, 9.63)
Total	379	9	2.37	1.68	3.75	(1.71, 7.11)
Ribakove G						
Bellevue	83	3	3.61	2.98	3.22	(0.65, 9.42)
NYU Med Ctr	127	5	3.94	4.84	2.16	(0.70, 5.04)
Total	210	8	3.81	4.10	2.47	(1.06, 4.86)
Saifi J						
Albany Med Ctr	2	0	0.00	3.38	0.00	(0.00, 100.0)
Arnot-Ogden	172	2	1.16	2.18	1.42	(0.16, 5.11)
Ellis Hospital	156	4	2.56	1.44	4.72	(1.27, 12.09)
Total	330	6	1.82	1.84	2.63	(0.96, 5.71)
Walsh J						
Albany Med Ctr	1	0	0.00	2.53	0.00	(0.00, 100.0)
Millard Fillmore	183	5	2.73	2.09	3.47	(1.12, 8.10)
St. Peters	156	8	5.13	3.24	4.20	(1.81, 8.27)
Total	340	13	3.82	2.62	3.87	(2.06, 6.63)

* Risk-adjusted rate is significantly higher than statewide rate.

** Risk-adjusted rate is significantly lower than statewide rate.

OMR - the observed mortality rate is the number of observed deaths divided by the number of patients.

EMR - the expected mortality rate is the sum of the predicted probability of death for each patient divided by the total number of patients.

RAMR - the risk-adjusted mortality rate 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.

Note: Only surgeons practicing at more than one hospital and performing 200 or more CABG operations in New York State in 1992-1994 are listed in Table 5.

MEDICAL TERMINOLOGY

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

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

atherosclerosis — one form of arteriosclerosis in which plaques or fatty deposits form in the inner layer of the arteries.

double, triple, quadruple bypass — the average number of bypass grafts created during coronary artery bypass graft surgery 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 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, blood and oxygen cannot flow freely to the heart muscle or myocardium.

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

myocardial infarction — partial destruction of the heart muscle due to interrupted blood supply, also called a *heart attack* or *coronary thrombosis*.

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, all of which cannot 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. The risk increases with age, so that half of all cases are in those who are over 75 years old.

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 stress or type A personality characteristics.

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

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