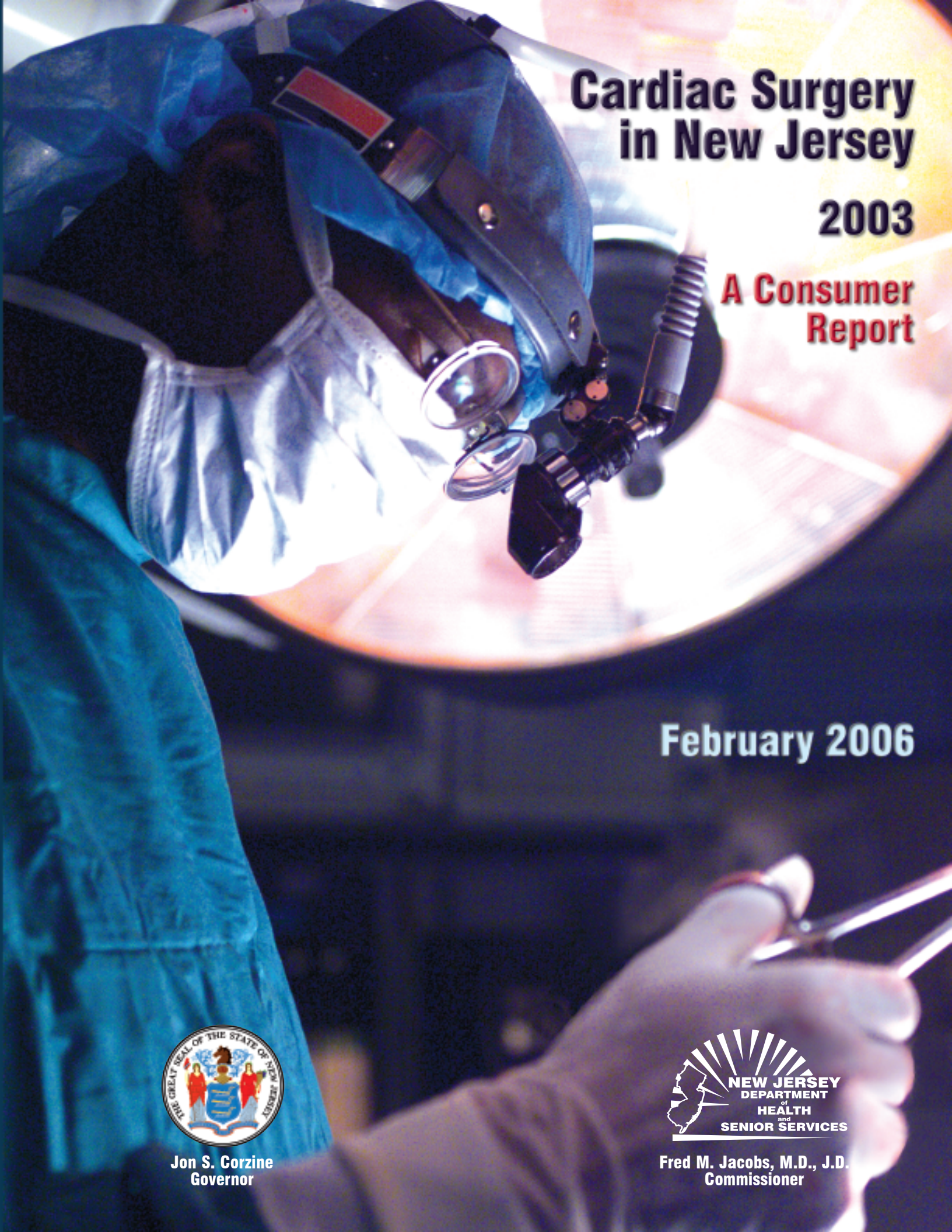

Cardiac Surgery in New Jersey

2003

A Consumer Report

February 2006

Jon S. Corzine
Governor

NEW JERSEY DEPARTMENT of HEALTH and SENIOR SERVICES

Fred M. Jacobs, M.D., J.D.
Commissioner

Message From The Commissioner

I am pleased to present Cardiac Surgery in New Jersey 2003, the State's eighth consumer report on coronary artery bypass graft surgery. This report summarizes the results of an analysis of mortality for patients of the New Jersey hospitals performing bypass surgery in 2003.

Although mortality rates in 2003 were higher than in 2002, the difference is not statistically significant. Overall, New Jersey's heart centers have achieved a 50 percent reduction in operative mortality between 1994 and 2003. This is a remarkable tribute to the hospitals' and surgeons' commitment to making cardiac surgery safer.

In facing bypass surgery, patients and their families have questions and concerns. We hope this guide answers many of those questions and helps patients discuss concerns and treatment options with their physicians.

The Department has worked closely with the Cardiovascular Health Advisory Panel (CHAP) to bring consumers and providers the best possible data on cardiac bypass surgery outcomes. This report also provides information on the total number of cardiac surgeries physicians perform, including but not limited to bypass surgeries. I would like to thank the CHAP members for their important efforts to support quality improvement in cardiac services in New Jersey.

Fred M. Jacobs, M.D., J.D.
Commissioner

NEW JERSEY DEPARTMENT of HEALTH and SENIOR SERVICES

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Executive Summary

The Department of Health and Senior Services collected data in 2003 from the 17 hospitals covered in this report on 10,468 open-heart surgery patients. Of these patients, 6,817 had coronary artery bypass graft (CABG) surgery with no other major surgery during the same admission.

The primary goal of this report is to provide New Jersey hospitals and surgeons with data they can use in assessing quality of care related to bypass surgery. More importantly, this report presents patients and families of patients with important information they can use in discussing questions and issues related to bypass surgery with their physicians.

After subjecting the CABG surgery data to extensive error checks and consulting with an expert clinical panel, the isolated CABG surgery data were analyzed using a statistical procedure to assess hospital and surgeon performance. The statistical analysis took into account the patient's health status before surgery as well as demographic factors. This process is commonly known as "risk-adjustment" and allows for fair comparisons among hospitals and surgeons treating diverse patient populations. Some key findings of the 2003 data analysis are as follows:

- In 2003, there were 10,468 total open heart surgeries performed in New Jersey by hospitals covered in this report, of which 6,817 were isolated CABG surgeries.
- Of the 6,817 isolated CABG surgery patients, 159 died while in the hospital or within 30 days after surgery.
- The statewide observed operative mortality rate for isolated CABG surgery patients in 2003 was 2.33 percent and represents an 8.4 percent increase over 2002. When comparing 2002 and 2003 mortality rates on a risk-adjusted basis, the change was only a 7.1 percent increase. This increase was not statistically significant.
- Review of ten years pooled data suggest that the risk-adjusted patient mortality in New Jersey has declined by 50 percent between 1994 and 2003.
- In 2003, Hackensack University Medical Center had a significantly lower risk-adjusted mortality rate than the state average, while Cooper Hospital/University Medical Center had a significantly higher risk-adjusted mortality rate. Notably, Englewood Hospital and Medical Center's observed mortality rate in 2003 was zero, but this rate was not statistically significantly lower than the statewide average, when compared on a risk-adjusted basis.
- One surgeon still practicing in New Jersey, Dr. Amrit Nayar of Our Lady of Lourdes Medical Center, had a significantly higher risk-adjusted mortality rate. Although no surgeon had a statistically significantly lower risk-adjusted mortality rate than the statewide average in the 2002-2003 period, it is nevertheless notable that Dr. Arisan Ergin of Englewood Hospital and Medical Center had no deaths during this two-year period.
- As expected, the risk of death from isolated CABG surgery increases with age.
- Not surprisingly, sicker patients were at greater risk:
  - An isolated CABG surgery patient who had myocardial infarction (MI) less than 24 hours prior to the surgery was 3.28 times as likely to die after an isolated CABG surgery compared with a patient who had no previous MI or had MI longer than 24 hours prior to surgery.
  - An isolated CABG surgery patient with lung disease was about two times (odds ratio = 1.87) as likely to die after CABG surgery compared to a patient who had no lung disease.
  - Previous heart surgery, congestive heart failure, and renal failure are also significantly associated with higher CABG surgery mortality among New Jersey patients*.

* *Information on methods used in this report is presented in Appendix D.*

Introduction

This report is for patients and families of patients facing the possibility of coronary artery bypass graft (CABG) surgery. It provides mortality rates for the 17 hospitals that performed cardiac surgery in 2003 and the physicians performing this common cardiac surgical procedure in 2002-2003.

For this study, the Department of Health and Senior Services collected data on the 6,817 patients who had bypass surgery with no other major surgery during the same admission in 2003. This is the most recent year for which a complete, audited data set is available. All data have been "risk-adjusted," which means that data were adjusted to take into account the patient's health condition before surgery. This risk-adjustment allows for fair comparisons among hospitals and surgeons treating diverse patient populations.

An important goal of this analysis is to give hospitals data they can use in assessing quality of care related to bypass surgery. There is strong evidence, from the handful of states with similar reports, that this information encourages hospitals to examine their procedures and make changes that can improve quality of care and, ultimately, save lives.

New Jersey's mortality rate for bypass surgery has shown a significant decline since public reporting began with 1994 data. For 2003, the observed mortality rate of 2.33 percent is higher than the 2.15 percent mortality rate for 2002, suggesting a small reversal of the trend. However, when data from all years are pooled together and analyzed, the resulting 7.1 percent increase in the risk-adjusted mortality rate from 2002 to 2003 is not statistically significant.

Another goal of the report is to give patients and physicians information to use in discussing questions and issues related to bypass surgery. Please remember that the numbers in this guide are just one factor to consider in deciding where to have cardiac surgery. You and your physician together can make the best choice after full consideration of your medical needs. Also note that hospital data in this guide are from 2003, while surgeon data refer to 2002 and 2003 combined. These data may not reflect the current performance of specific hospitals, which may have revamped their programs since then.

Readers who have followed the Department's CABG surgery reports for years prior to 2000 will observe that the mortality rates presented in this report appear to be higher than previously released. This is not really the case. Instead, starting with the 2000 CABG surgery report, the Department, in consultation with the Cardiovascular Health Advisory Panel (CHAP), changed its definition of mortality to reduce the possibility that hospital discharge policies could artificially lower CABG surgery mortality rates. The current definition is discussed in greater detail later in this report.

Heart disease and cardiac surgery in New Jersey

Heart disease is the single largest killer of Americans. About every 30 seconds, a person somewhere in this country will suffer a heart attack, and about once every minute, someone will die from one. In New Jersey, cardiovascular disease, including heart disease, is the leading cause of death, with heart disease alone accounting for 21,801 deaths in 2003 for an age-standardized death rate of 2.32 per 1,000. The age-standardized death rate was higher among males (death rates = 2.84 per 1,000) compared with females (death rates = 1.94 per 1,000). The New Jersey data also show variations in heart disease mortality by race where blacks died at the rate of 2.63 per 1,000 compared with 2.31 for whites (see http://njshad.doh.state.nj.us/).

The most common form of heart disease is coronary artery disease. It occurs when the coronary arteries, which carry blood to the heart muscle, become clogged or partially blocked by fatty deposits on the artery walls. This can lead to chest pain, or

angina, which is a warning sign for a heart attack. A heart attack occurs when a coronary artery is totally blocked.

Treatment options

Treatment for coronary artery disease will vary for different patients. The choice of treatment depends on the nature and severity of the disease and other factors unique to each patient.

For some patients, lifestyle changes such as quitting smoking, eating a low-fat diet, and getting more exercise may be enough. Some patients require special medications. Others may need medical procedures such as angioplasty or coronary artery bypass graft surgery. Angioplasty reduces obstructions of fatty deposits in coronary arteries and has become an increasingly common treatment method. Bypass surgery uses an artery or vein taken from another part of the body to divert blood around the clogged part of a patient's artery or arteries.

This report is about coronary artery bypass graft surgery. It describes the performance records of 17 hospitals in New Jersey that offered this type of surgery in 2003 and the surgeons who performed this operation at least 100 times between January 2002 and December 2003. The information in this report can help you in discussions with your doctor about bypass surgery.

Performance data

In 2003, there were 6,817 isolated bypass surgeries performed in New Jersey. In an isolated bypass surgery, no other major heart procedure is performed at the same time. The number of people who died during the hospitalization in which the operation was performed, or after discharge but within 30 days of the surgery, was 159, or 2.33 percent of those who underwent the surgery. This number (i.e. the number of isolated bypass surgery deaths) is used to calculate a mortality rate that is used as a performance measure.

Definition of operative mortality

Beginning with the 2000 report, the Department, after consulting with the CHAP, changed the way mortality is defined for the purposes of the Department's cardiac surgery performance report. Previously, the Department defined patient death for this report as in-hospital death before discharge from the hospital after isolated CABG surgery. As a result, patients who died after being discharged home or to post-acute care facilities were not counted for purposes of calculating CABG surgery mortality rates. This caused concerns about "gaming" of outcomes through discharge practices.

Therefore, beginning with the 2000 report, the Department includes in its definition of "operative mortality" deaths up to thirty days post surgery or deaths occurring during the hospital stay in which the surgery was performed, no matter how many days after the procedure. Deaths occurring within thirty days after surgery, but post-discharge, have been identified by matching patient records in the Department's open heart data base against the state's official death records.

Applying the revised definition of mortality, the Department also recalculated the statewide CABG surgery mortality rates for the prior years, in order to analyze the trend over time. Operative mortality rate estimates by year are presented in Figure 4 (see Appendix C for the statewide operative mortality rate estimates for years 1994-2003.)

Risk-adjusted mortality

In evaluating the performance of hospitals and individual surgeons, it would be unfair to make comparisons only on the basis of how many patients died. The mortality risk for patients undergoing

bypass surgery varies significantly with how healthy patients are prior to surgery. For instance, an 85-year-old woman who has arrhythmia and renal failure with dialysis would be at higher risk during this surgery than a 60-year-old non-smoking man who had no history of chronic disease.

In order to produce fair comparisons, the New Jersey Department of Health and Senior Services applied a methodology that estimates risk-adjusted mortality rates. The risk-adjusted mortality rate gives "extra credit" to hospitals and surgeons with sicker patient populations, in order not to disadvantage them in the performance comparisons.

Each hospital was required to submit data which contain a risk profile for each patient undergoing bypass surgery.

Key factors that are associated with a patient's chance of surviving the operation include:

- the patient's age and sex;
- whether the patient has various preoperative risk factors, such as renal failure, cerebrovascular accidents, low ejection fraction, chronic lung disease, peripheral vascular diseases, or immuno-suppressive therapy;
- whether the patient has preoperative cardiac status, like:
  - myocardial infarction within 24 hours prior to surgery;
  - arrhythmia;
  - cardiogenic shock;
- whether the patient had any previous open heart surgery.

Weights derived from the statistical model were assigned for each key risk factor and calculations were performed for each hospital to produce risk-adjusted mortality rates as a fairer basis of comparison (see Appendix D for more details).

Performance reports lead to improvement

This performance report is for use not only by you and your doctors, but also by hospitals to improve the quality of their care and their patients' outcomes. On a risk-adjusted basis, the New Jersey statewide risk-adjusted mortality rate for bypass surgery increased by 7.1 percent from 2002 to 2003. However, this increase was not statistically significant. Moreover, despite this one-year change in the trend, mortality in 2003 still remained about 50 percent lower than it was in 1994, on a risk-adjusted basis. Evidence both from New Jersey and other states that have published similar performance reports suggests these reports contribute to the decline in mortality rates and overall improvement in the quality of bypass surgery.

Hospitals

In 2003, seventeen hospitals in New Jersey were licensed to perform coronary artery bypass graft surgery. Jersey City Medical Center, which was licensed in November 2004, will be included in future reports, when a full calendar year of data is available.

This report provides risk-adjusted mortality rates for each of the seventeen hospitals. You will see that there are variations among the hospitals. Through statistical analysis, the Department is able to determine in which cases the variations reflect real differences in performance, and not different levels of risk among patients or random variation.

Nevertheless, these data should not be used as the sole factor in making choices about hospitals, but should be part of the discussion between you and your doctor.

Surgeons

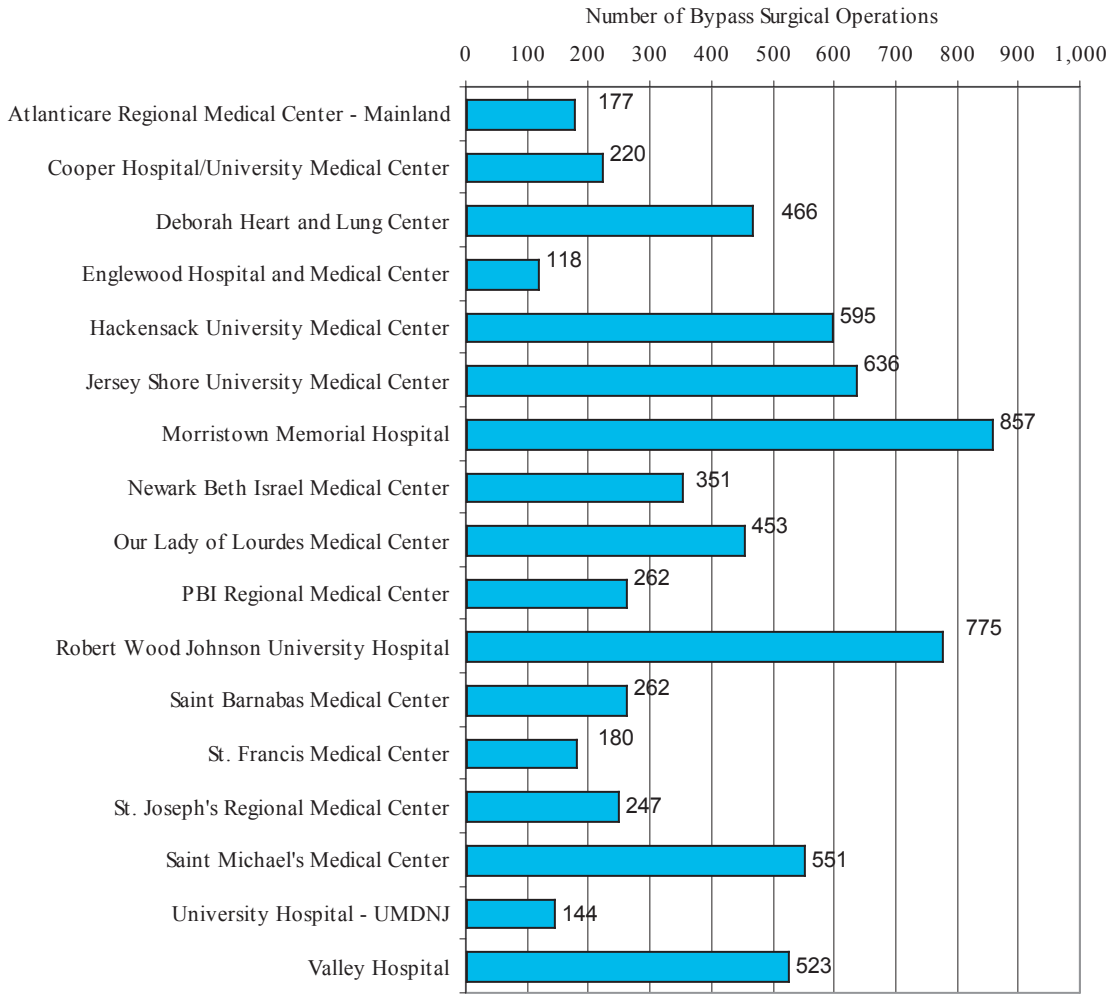
A risk-adjusted mortality rate was also calculated for each of the 52 surgeons who performed at least

100 bypass operations in one hospital in the years 2002 and 2003 combined. Even after combining two years' worth of data, some surgeons' volume still falls short of the 100 cases considered the minimum required for the Department to have confidence in the results of the analysis. Statistics for these low-volume surgeons are grouped under the hospital where the operations took place, in a category called "All Others." These surgeons are listed by name but with no risk-adjusted mortality rates, since their small numbers do not permit an accurate indication of their performance. Please note that this report does indicate the total number of open heart and CABG-only surgeries the low volume surgeons performed, as well as their number of CABG-only surgery operative deaths.

Volume affects quality

Many studies nationally and in other states have shown that, in general, hospitals and surgeons that perform bypass surgery more frequently have lower patient mortality rates. New Jersey's data also confirm this general trend. However, there are exceptions, and a number of hospitals with low volumes have results that are in line with the statewide average.

Figure 1
Number of Isolated Coronary Artery Bypass Graft Surgeries (2003)



SOURCE: New Jersey Department of Health and Senior Services

Bypass surgery volume at New Jersey hospitals in 2003

Figure 1 shows the number of bypass operations performed in 2003 in each of the seventeen hospitals. You can see that some hospitals do more of these procedures than others, with totals ranging from a low of 118 to a high of 857 with the median being 351. Bypass surgery volume has been declining in New Jersey as angioplasty increasingly is substituted. Since bypass is the most common type of cardiac surgery, between 2000 and 2004 the overall volume of cardiac surgery has declined by 15.4 percent.

Statewide performance

In 2003, the observed operative isolated CABG surgery mortality rate for the state was 2.33 percent, based on data on the 6,817 patients who underwent this surgery.

Hospital risk-adjusted mortality: 2003

Figure 2 shows the risk-adjusted mortality rate for each New Jersey hospital performing bypass surgery in 2003. The risk-adjusted mortality rate takes into account the patients' risk factors going into surgery as well as the actual mortality rate after the surgery, in order to make a fair assessment of hospital performance.

The vertical line on Figure 2 represents New Jersey's statewide isolated CABG surgery operative mortality rate per 100 cases for 2003, i.e. 2.33. Each hospital's performance is displayed graphically in relation to this statewide average.

Figure 2 shows one hospital - Hackensack University Medical Center - has its bar completely to the left of the statewide average line. This means that this hospital had a risk-adjusted mortality rate significantly below the statewide average. Another hospital - Cooper Hospital/University Medical Center – has its bar completely to the right of the statewide average line. This means that the hospital had a risk-adjusted mortality rate significantly above the statewide average.

The remaining fifteen hospitals have bars that cross the statewide 2.33 percent average line. That means that their risk-adjusted mortality rates were not statistically different from the statewide average. Although it seems counterintuitive, Englewood Hospital and Medical Center's observed zero mortality rate in 2003 was not statistically significantly lower than the statewide average when compared on a risk-adjusted basis.

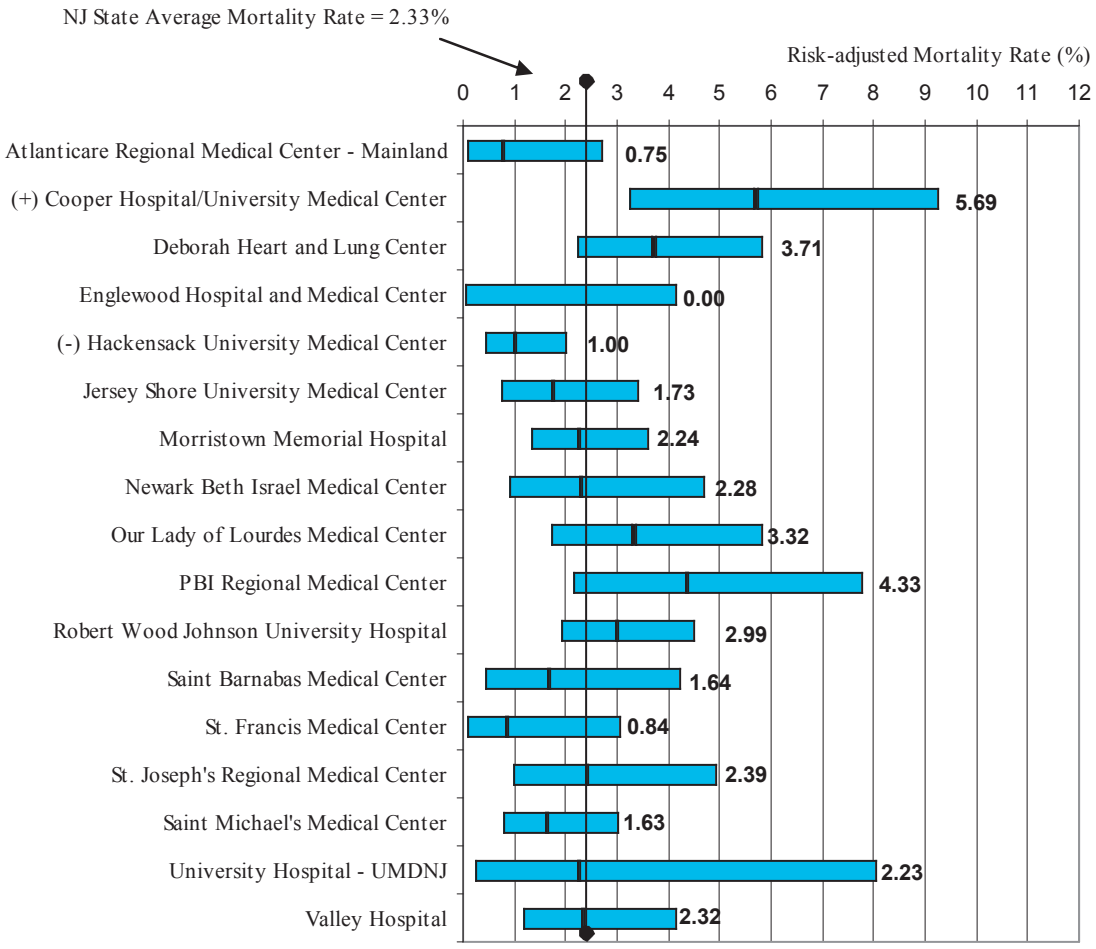
Statistical significance

In trying to determine a hospital's or surgeon's performance, it is important to account for the fact that some differences occur simply due to chance or random variation. Statistical tests are conducted on the data so that we can be as certain as possible that the differences are due to actual differences in performance. A difference is called "statistically significant" when it is too large to be due to chance or random variation.

The dark line in the middle of each hospital's bar represents its risk-adjusted mortality rate. However, we cannot really be certain that this number is the precise rate. We can only be relatively sure that the true rate falls somewhere on the bar. In analyzing data, we use what is called a "95 percent confidence interval," and the bar represents the lower and upper limits of this confidence interval. We are 95 percent confident that the hospital's actual risk-adjusted mortality rate falls within the range shown by the bar. Another way of saying it is that the bar represents the statistical margin of error for the calculation of that rate.

When using this report, it is important to remember that the charts are designed to show whether a hospital's or surgeon's risk-adjusted mortality rate is significantly above or below the

Figure 2
Hospital Risk-Adjusted Operative Mortality Rate* (2003)



SOURCE: New Jersey Department of Health and Senior Services

* = Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

\+ = Risk-adjusted mortality rate significantly higher than the New Jersey mortality rate based on 95 percent confidence interval.

\- = Risk-adjusted mortality rate significantly lower than the New Jersey mortality rate based on 95 percent confidence interval.

statewide rate, or whether a rate is statistically the same as the statewide rate. Thus, it is more important to view the bars in relation to the average line than it is to examine the individual calculated rates on the bars. The chart should not be used to make hospital-to-hospital or surgeon-to-surgeon comparisons, only to compare hospitals and surgeons to the statewide rate.

In examining the charts, you will see that some bars are shorter than others. The bar is shorter for hospitals or surgeons performing more surgeries, and longer for those with lower volumes. This reflects the fact that larger numbers -- in this case, more surgeries -- increase the precision of a statistic.

Individual surgeon performance

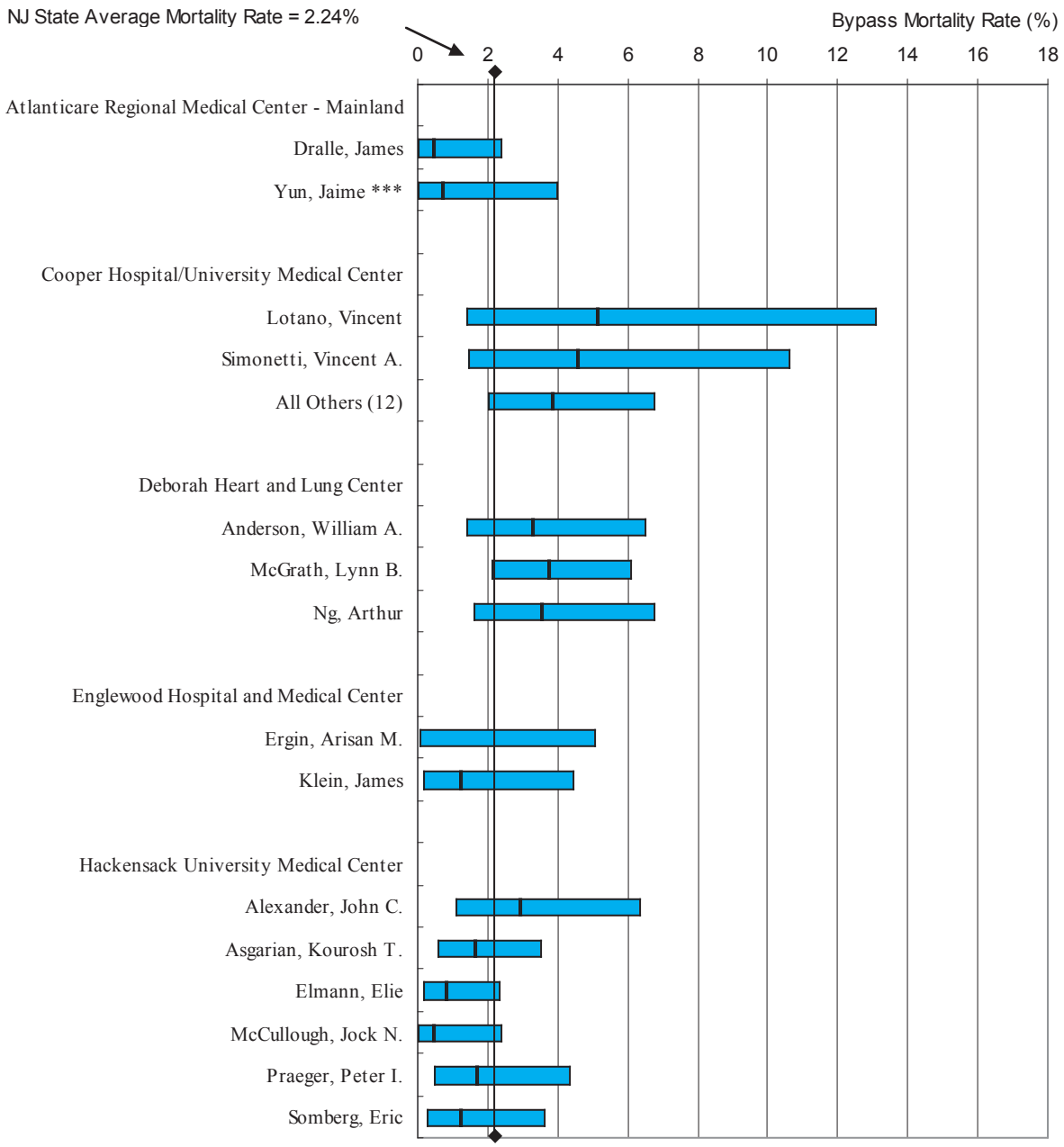
Figure 3 and Table 1 show the risk-adjusted mortality rate for each of the 52 surgeons who performed at least 100 isolated bypass surgery operations in one hospital in New Jersey in the years 2002 and 2003 combined.

Figure 3 expands on Figure 2, listing surgeons by name under the hospital at which they practice. Following the named surgeons, some hospitals have an "All Others" category which consists of all surgeons not performing enough procedures for an individual risk-adjusted mortality rate to be developed. The category "All Others" is not displayed on Figure 3 unless there are two or more surgeons listed under it.

Once again, the vertical line on Figure 3 represents the statewide operative mortality rate for 2002-2003 combined. Note that, because two years' data is combined, the statewide operative mortality rate for surgeons is 2.24 percent, in contrast to the 2.33 percent mortality rate for 2003 used to assess hospitals. If a surgeon has a bar completely to the left of the statewide average line, it means that the surgeon's mortality rate was significantly lower than the statewide average. In 2002-2003, no surgeon had a bar completely to the left of the line. As is the case for some in this report, it is possible for a surgeon to have no mortality and still have his/her bar cross the statewide average line.

If a surgeon has a bar completely to the right of the statewide average line, it means that the surgeon's mortality rate was significantly higher than the statewide average for this two-year period. One surgeon currently practicing cardiac surgery in New Jersey, Dr. Amrit Nayar of Our Lady of Lourdes Medical Center, had a bar completely to the right of the line, indicating a statistically significantly higher mortality rate. It is notable that one surgeon, Dr. Arisan Ergin of Englewood Hospital and Medical Center, had no deaths during this two-year period. However, although it seems counterintuitive, his corresponding risk-adjusted mortality rate was not statistically significantly lower than the statewide average.

Figure 3
Surgeon Risk-Adjusted Operative Mortality* Rate (2002-2003)



SOURCE: New Jersey Department of Health and Senior Services.

* = Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

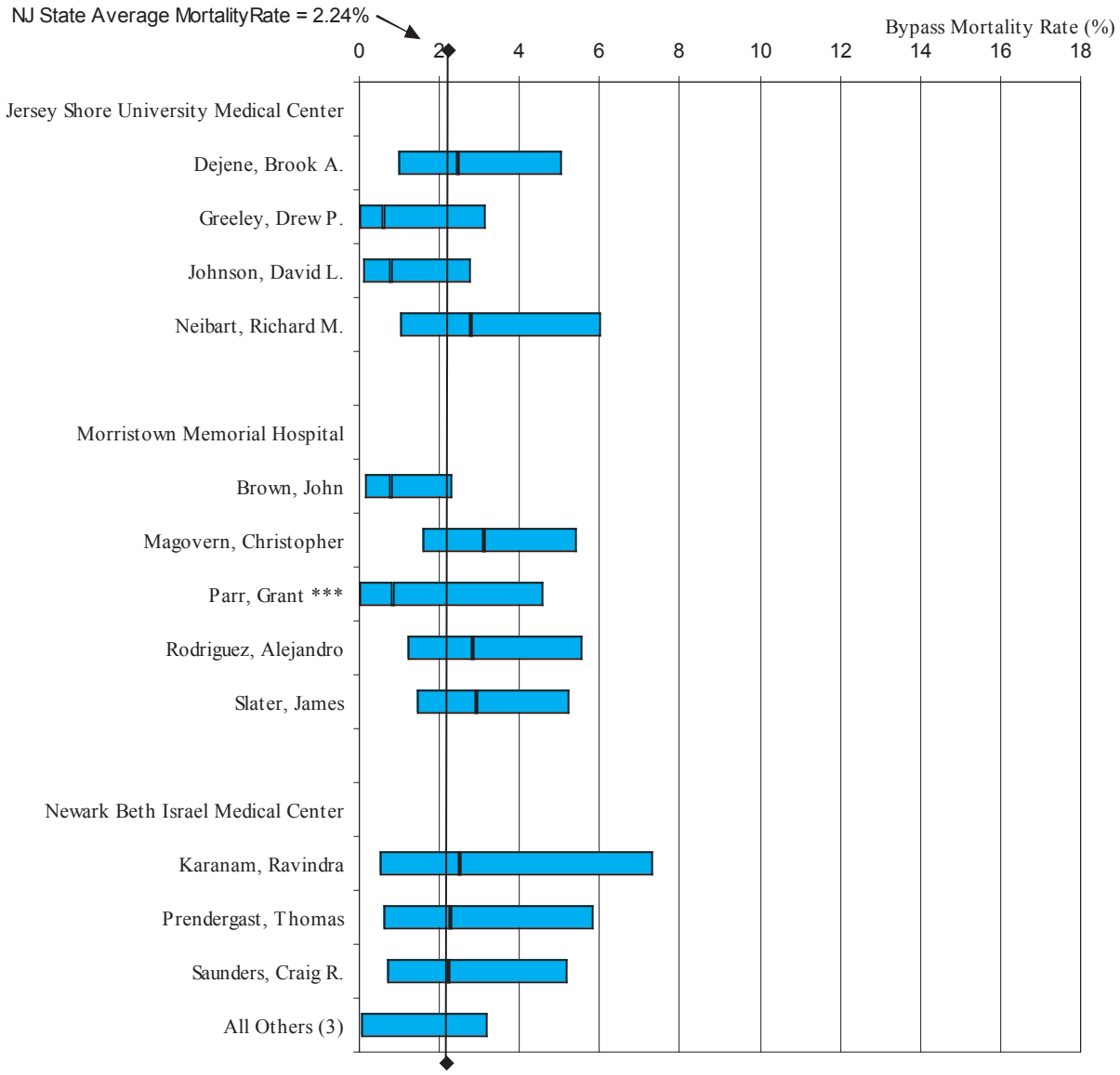
(-) = Risk-adjusted mortality rate significantly lower than the New Jersey mortality rate, based on 95 percent confidence interval.

(+) = Risk-adjusted mortality rate significantly higher than the New Jersey mortality rate, based on 95 percent confidence interval.

** = Surgeon not currently performing CABG surgery in this hospital.

*** = Surgeon not currently performing CABG surgery in New Jersey.

Figure 3 (continued)
Surgeon Risk-Adjusted Operative Mortality* Rate (2002-2003)



SOURCE: New Jersey Department of Health and Senior Services.

* = Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

(-) = Risk-adjusted mortality rate significantly lower than the New Jersey mortality rate, based on 95 percent confidence interval.

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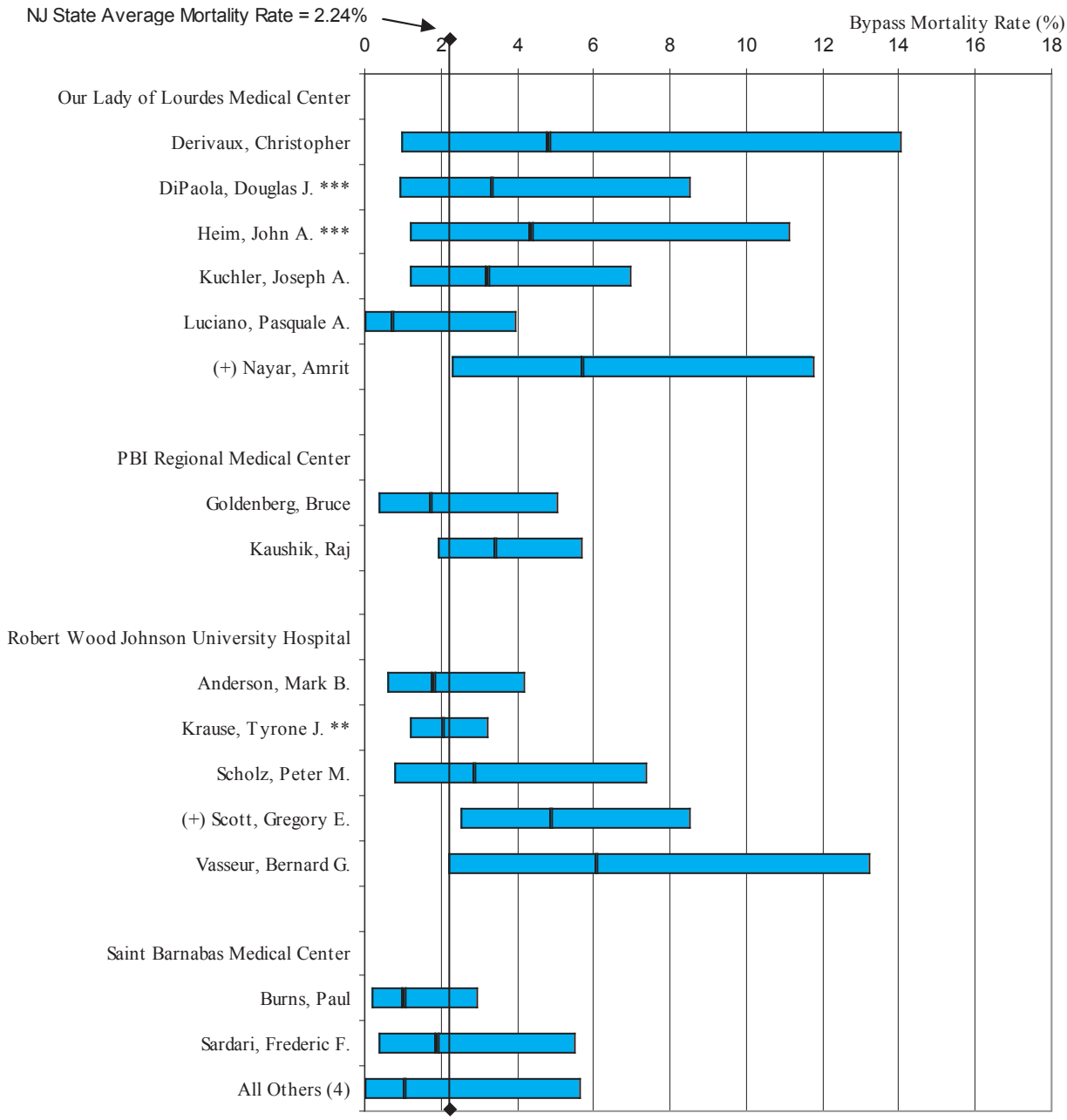
Figure 3 (continued)
Surgeon Risk-Adjusted Operative Mortality* Rate (2002-2003)



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(+) = Risk-adjusted mortality rate significantly higher than the New Jersey mortality rate, based on 95 percent confidence interval.

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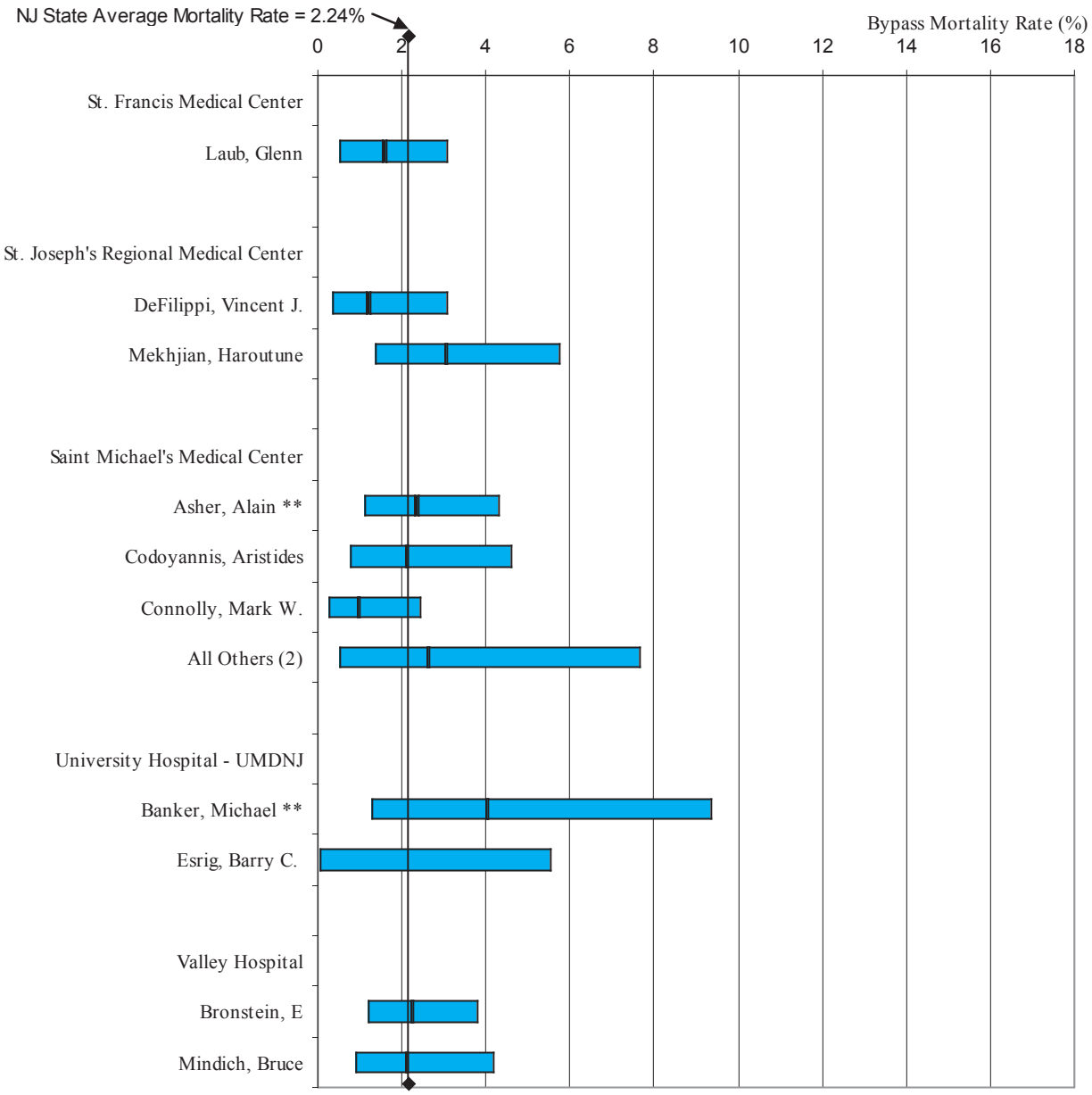
*** = Surgeon not currently performing CABG surgery in New Jersey.

Figure 3 (continued)
Surgeon Risk-Adjusted Operative Mortality* Rate (2002-2003)



SOURCE: New Jersey Department of Health and Senior Services.

* = Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

(-) = Risk-adjusted mortality rate significantly lower than the New Jersey mortality rate, based on 95 percent confidence interval.

(+) = Risk-adjusted mortality rate significantly higher than the New Jersey mortality rate, based on 95 percent confidence interval.

** = Surgeon not currently performing CABG surgery in this hospital.

*** = Surgeon not currently performing CABG surgery in New Jersey.

Table 1

Patient Risk-Adjusted Operative Mortality* Rate for Surgeons (2002-2003)

Hospital and Surgeon	Total Open Heart Procedures	Number of Isolated CABG Operations	Patient Operative Deaths*	Observed Patient Mortality(%)	Expected Patient Mortality(%)	Risk-Adjusted Patient Mortality (%)	95% Confidence Interval
Atlanticare City Medical Center - Mainland							
Dralle, James	264	188	1	0.53	2.81	0.42	(0.01, 2.36)
Yun, Jaime ++	133	113	1	0.88	2.77	0.72	(0.01, 3.98)
All Others (1)							
Eugene Grossi ++	9	7	1				
Cooper Hospital/University Medical Center							
Lotano, Vincent	121	101	4	3.96	1.74	5.10	(1.37, 13.05)
Simonetti, Vincent A.	169	101	5	4.95	2.44	4.54	(1.46, 10.59)
All Others (12)	396	226	12	5.31	3.08	3.85	(1.99, 6.73)
Antinori, Charles H. ++	62	43	3				
Cilley, Jonathan H.	160	89	4				
DelRossi, Anthony J.	91	37	3				
Derivaux, Christopher +	1	1	0				
Heim, John A. ++	2	2	0				
Karam, Joseph A. ++	1	0	0				
Luciano, Pasquale A. ++	1	1	0				
Marra, Steven W. ++	70	51	2				
Monk, Scott ++	2	0	0				
Ross, Steven E.	1	0	0				
Sariol, Hector ++	3	0	0				
Villanueva, Dioscoro S. ++	2	2	0				
Deborah Heart and Lung Center							
Anderson, William A.	398	255	8	3.14	2.14	3.28	(1.41, 6.46)
McGrath, Lynn B.	753	427	16	3.75	2.25	3.72	(2.13, 6.05)
Ng, Arthur	434	235	9	3.83	2.42	3.54	(1.62, 6.72)
All Others (1)							
Grosso, Michael ++	75	34	4				
Englewood Hospital and Medical Center							
Ergin, Arisan M.	211	108	0	0.00	1.52	0.00	(0, 5.01)
Klein, James	281	159	2	1.26	2.29	1.23	(0.14, 4.44)
All Others (1)							
McMurtry, Kirk	15	11	0				
Hackensack University Medical Center							
Alexander, John C.	323	167	6	3.59	2.77	2.90	(1.06, 6.31)
Asgarian, Kourosh T.	425	254	6	2.36	3.29	1.60	(0.59, 3.49)
Elmann, Elie	318	194	3	1.55	4.38	0.79	(0.16, 2.31)
McCullough, Jock N.	305	182	1	0.55	2.86	0.43	(0.01, 2.39)
Praeger, Peter I.	283	211	4	1.90	2.52	1.68	(0.45, 4.31)
Somberg, Eric	335	238	3	1.26	2.31	1.22	(0.25, 3.58)
All Others (1)							
Brenner, William ++	41	21	1				

*Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

LO = The risk-adjusted patient mortality is significantly lower than the state average mortality rate, based on 95 percent confidence interval.
HI = The risk-adjusted patient mortality is significantly higher than the state average mortality rate, based on 95 percent confidence interval.

\+ = Surgeon not currently performing CABG surgery in this hospital.
++ = Surgeon not currently performing CABG surgery in New Jersey.

Table 1 (continued)

Patient Risk-Adjusted Operative Mortality* Rate for Surgeons (2002-2003)

Hospital and Surgeon	Total Open Heart Procedures	Number of Isolated CABG Operations	Patient Operative Deaths*	Observed Patient Mortality(%)	Expected Patient Mortality(%)	Risk-Adjusted Patient Mortality (%)	95% Confidence Interval
Jersey Shore University Medical Center							
Dejene, Brook A.	408	319	7	2.19	2.02	2.43	(0.97, 5.01)
Greeley, Drew P.	431	278	1	0.36	1.44	0.56	(0.01, 3.11)
Johnson, David L.	447	326	2	0.61	1.80	0.76	(0.09, 2.75)
Neibart, Richard M.	430	304	6	1.97	1.61	2.74	(1, 5.97)
Morristown Memorial Hospital							
Brown, John	779	422	3	0.71	2.03	0.78	(0.16, 2.28)
Magovern, Christopher	601	454	12	2.64	1.92	3.08	(1.59, 5.38)
Parr, Grant ++	354	134	1	0.75	2.04	0.82	(0.01, 4.55)
Rodriguez, Alejandro	547	405	8	1.98	1.58	2.80	(1.2, 5.51)
Slater, James	563	436	11	2.52	1.94	2.91	(1.45, 5.2)
Newark Beth Israel Medical Center							
Karanam, Ravindra	345	174	3	1.72	1.55	2.49	(0.5, 7.28)
Prendergast, Thomas	376	230	4	1.74	1.72	2.26	(0.61, 5.8)
Saunders, Craig R.	375	196	5	2.55	2.58	2.21	(0.71, 5.16)
All Others (3)	296	158	0	0.00	1.66	0.00	(0, 3.14)
Burns, Paul	4	3	0				
Goldstein, Daniel J.	198	95	0				
Sardari, Frederic F.	94	60	0				
Our Lady of Lourdes Medical Center							
Derivaux, Christopher	119	102	3	2.94	1.37	4.80	(0.96, 14.02)
DiPaola, Douglas J. ++	200	149	4	2.68	1.81	3.32	(0.89, 8.5)
Heim, John A. ++	141	106	4	3.77	1.95	4.34	(1.17, 11.11)
Kuchler, Joseph A.	361	228	6	2.63	1.84	3.20	(1.17, 6.96)
Luciano, Pasquale A.	241	201	1	0.50	1.58	0.70	(0.01, 3.92)
Nayar, Amrit	217	151	7	4.64	1.82	5.70 **HI**	(2.29, 11.75)
All Others (1)							
Eisen, Morris M. ++	97	79	3				
PBI Regional Medical Center							
Goldenberg, Bruce	244	168	3	1.79	2.31	1.73	(0.35, 5.05)
Kaushik, Raj	459	314	15	4.78	3.12	3.42	(1.91, 5.64)
All Others (1)							
Chuback, John	93	76	0				
Robert Wood Johnson University Hospital							
Anderson, Mark B.	429	278	5	1.80	2.26	1.78	(0.57, 4.15)
Krause, Tyrone J. +	1,246	888	18	2.03	2.25	2.02	(1.2, 3.19)
Scholz, Peter M.	330	142	4	2.82	2.19	2.88	(0.77, 7.36)
Scott, Gregory E.	300	229	12	5.24	2.41	4.86 **HI**	(2.51, 8.5)
Vasseur, Bernard G.	181	107	6	5.61	2.07	6.07	(2.21, 13.2)

*Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

LO = The risk-adjusted patient mortality is significantly lower than the state average mortality rate, based on 95 percent confidence interval.
HI = The risk-adjusted patient mortality is significantly higher than the state average mortality rate, based on 95 percent confidence interval.

\+ = Surgeon not currently performing CABG surgery in this hospital.
++ = Surgeon not currently performing CABG surgery in New Jersey.

Table 1 (continued)

Patient Risk-Adjusted Operative Mortality* Rate for Surgeons (2002-2003)

Hospital and Surgeon	Total Open Heart Procedures	Number of Isolated CABG Operations	Patient Operative Deaths*	Observed Patient Mortality(%)	Expected Patient Mortality(%)	Risk-Adjusted Patient Mortality (%)	95% Confidence Interval
Saint Barnabas Medical Center							
Burns, Paul	411	293	3	1.02	2.28	1.00	(0.2, 2.94)
Sardari, Frederic F.	221	150	3	2.00	2.39	1.87	(0.38, 5.47)
All Others (4)	203	109	1	0.92	2.04	1.01	(0.01, 5.61)
Goldstein, Daniel J.	75	46	1				
Karanam, Ravindra	2	1	0				
Prendergast, Thomas	11	8	0				
Saunders, Craig R.	115	54	0				
St. Francis Medical Center							
Laub, Glenn	391	298	5	1.68	2.39	1.57	(0.51, 3.67)
All Others (2)	128	83	1				
Costic, Joseph	115	83	1				
Seinfeld, Fredric ++	13	0	0				
St. Joseph's Regional Medical Center							
DeFilippi, Vincent J.	449	252	4	1.59	2.99	1.19	(0.32, 3.04)
Mekhjian, Haroutune	419	297	9	3.03	2.25	3.02	(1.38, 5.73)
All Others (1)							
Nguyen ++	5	0	0				
Saint Michael's Medical Center							
Asher, Alain +	462	328	10	3.05	2.92	2.34	(1.12, 4.3)
Codoyannis, Aristides	278	224	6	2.68	2.85	2.10	(0.77, 4.58)
Connolly, Mark W.	576	432	4	0.93	2.20	0.94	(0.25, 2.41)
All Others (2)	151	110	3	2.73	2.34	2.61	(0.52, 7.63)
Esrig, Barry C. +	36	22	1				
Jihayel, Ayad K. ++	115	88	2				
University Hospital - UMDNJ							
Banker, Michael +	167	129	5	3.88	2.16	4.01	(1.29, 9.36)
Esrig, Barry C.	148	103	0	0.00	1.45	0.00	(0, 5.5)
All Others (1)							
Rajaii Khorasani, Ahmad ·	30	24	0				
Valley Hospital							
Bronstein, E	659	544	13	2.39	2.41	2.22	(1.18, 3.8)
Mindich, Bruce	851	471	8	1.70	1.80	2.11	(0.91, 4.16)
All Others (1)							
Rubinstein, M.++	78	75	2				
State Total (2002 - 2003)	21,526	14,208	318	2.24	2.24	2.24	(2, 2.5)

SOURCE: New Jersey Department of Health and Senior Services.

*Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

LO = The risk-adjusted patient mortality is significantly lower than the state average mortality rtae, based on 95 percent confidence interval.
HI = The risk-adjusted patient mortality is significantly higher than the state average mortality rate, based on 95 percent confidence interval.

\+ = Surgeon not currently performing CABG surgery in this hospital.
++ = Surgeon not currently performing CABG surgery in New Jersey.

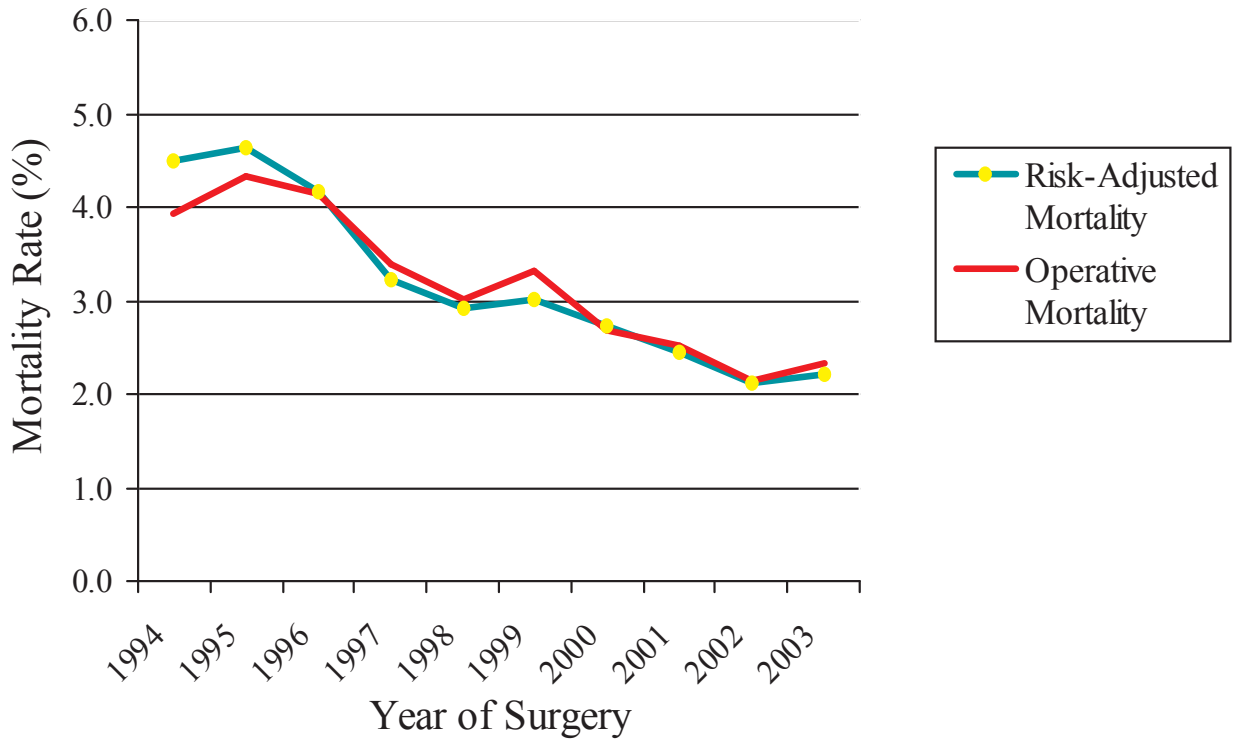
Statewide trends in risk-adjusted CABG Surgery mortality rates: Pooled estimates

Figure 4 presents the statewide risk-adjusted mortality rates for years 1994 to 2003 derived by pooling data from all years.

Figure 4 also presents the trend in statewide observed isolated CABG operative mortality rates for years 1994-2003. The observed operative mortality rate estimates exhibit a declining trend that is similar to the risk-adjusted mortality estimates. (See also Appendix C for trends in statewide in-hospital mortality rate estimates). When compared to 1994, the risk-adjusted patient mortality in 2003 dropped by about 50 percent.

When a linear regression line is fitted to the pooled annual estimates, mortality rate has been declining, in absolute terms, at the rate of 0.29 percent per year (See Appendix D, Figure D1).

Figure 4
Trends in Statewide CABG Surgery Mortality Rates



Appendix A

Questions and answers

These are answers to some commonly asked questions that may be of interest to you as you read this report.

Q: Should I go only to the hospitals with below-average risk-adjusted mortality rates?
A: Not necessarily. There are many factors to consider in determining the best hospital for you. Among these are your own personal risk factors and the experience certain hospitals have treating patients with those risk factors. Before making up your mind, you should discuss this report with the physician, usually a cardiologist, who refers you for cardiac surgery. The cardiologist's knowledge and expertise will be a valuable guide in making your decision. You should also keep in mind that the data in this guide is from 2003 and that a hospital's performance may have changed since then.

Q: Should I avoid any surgeon whose volume is low in this report?
A: No, not necessarily. First, there are lower volume surgeons with good patient outcomes. Second, there may be a good explanation for why a surgeon had a low volume that is unrelated to his/her experience. For example, the surgeon may have recently moved from another state, where he/she performed a high volume of these procedures. It is best to discuss your concerns with your referring doctor.

Q: Should I refuse to go to a hospital for heart surgery if that hospital has a worse than average mortality record?
A: Important decisions in areas such as cardiac surgery should be made after considering all available information. The statistics in this report are a starting point for discussions with your doctor. But they do not tell the complete story. That is why it is critical to bring your concerns and questions to your doctor.

Q: Is it better to go to a hospital with a high volume of cases?
A: National studies have demonstrated that, in general, hospitals with higher volumes have better results. However, some hospitals with high volumes have relatively high mortality rates, while others with low volumes have lower mortality rates.

Notes on data:

The data used in this study were reported by hospitals according to criteria established by the Department, with assistance from the clinical experts. The data were audited by an independent reviewer under contract to the Department.

Throughout the process of developing this report, the Department has taken steps to make sure that all hospitals were informed about data reporting and auditing requirements, as well as the statistical methods being used to risk-adjust the reported mortality rate.

The Department considers it a vital function of hospitals to be able to collect and report complete, accurate medical information on patients. This function is critical not only to the success of the cardiac surgery report, but to the hospitals' own ongoing efforts to improve the quality of care for all patients. The Department and hospitals will continue working to improve data collection procedures so that this report contains the best possible information.

Appendix B

New Jersey's Cardiovascular Health Advisory Panel (CHAP) members

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Appendix C

Statewide observed in-hospital and operative mortality rates:

Year of Operation	Mortality Rate	
	In-hospital	Operative Mortality*
1994-1995	3.75	4.14
1996-1997	3.37	3.75
1998	2.60	3.01
1999	2.89	3.31
2000	2.22	2.68
2001	2.01	2.51
2002	1.80	2.15
2003	1.91	2.33

* Operative mortality includes the following:

- all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and
- deaths occurring after discharge from hospital, but within 30 days of the procedure.

Appendix D

Summary of Methods Used in this Report

Background

Five states, including New Jersey, have issued reports on bypass surgery outcomes for hospitals, and sometimes surgeons. New York first published a bypass surgery report card in 1990, presenting 1989 data with the latest being in October 2005 using 2001-2003 data. New York State also publishes a performance report on angioplasty programs and physicians. Starting with its 1990 data, Pennsylvania has published several cardiac surgery reports, with its latest report released in 2005 on 2003 data. California has also published several cardiac surgery reports, with the most recent released in February 2005 using 2000-2002 data. Massachusetts published its first report on CABG surgery in October 2004 using 2002 data followed by a 2003 report using 2005 data. In 1997, New Jersey began reporting on patient mortality for bypass surgery hospitals and surgeons, using 1994 and 1995 data combined.

The experience from these states is that these disclosures have contributed to hospital quality improvement initiatives and significant reductions in bypass surgery mortality.

Identifying factors that affect a patient's risk of CABG surgery mortality

The observed patient CABG surgery mortality rate for a hospital or surgeon is estimated as the number of CABG surgery patients who died in the hospital during or after surgery, or patients who died after discharge but within 30 days post surgery, divided by the total number of CABG surgery patients who underwent the surgery.

Unfortunately, this observed patient mortality rate is not a complete measure of the quality of care provided by a hospital or a surgeon, because it does not account for how sick the patients were before surgery. If one hospital had considerably sicker patients than another hospital, it would be expected that its observed mortality rate would be somewhat higher. So it would not be fair to evaluate surgeons and hospitals performing bypass surgery solely on the basis of the percentage of their patients that died. For instance, an 80 year-old woman who has diabetes and lung disease is at a higher risk of dying, when undergoing this surgery, than a 50 year-old woman with no history of chronic disease or previous cardiac surgery.

To undertake an even-handed analysis of the quality of surgical care provided by surgeons and hospitals performing bypass surgery, the Department adjusts the patient mortality rates for each surgeon and each hospital by the pre-surgery risk factors of each patient. This method gives hospitals and surgeons who operate on less healthy patients "extra credit." Such hospitals and surgeons are not at a disadvantage when the outcome of the surgical care they provide is presented next to that of other hospitals and surgeons. Additionally, as stated earlier, extremely high risk patients, where the probability of death is very high, may, with the concurrence of the expert clinical panel, be excluded from the calculation.

The risk adjustment method is a statistical approach which uses results of a logistic regression analysis to assess the average risk of a bypass surgery for a patient. Key elements of the health histories of patients who have undergone bypass surgery in the same period, as well as their socio-demographic characteristics, are taken into account to estimate the expected outcome of a bypass surgery.

Assessing patient risk factors

A logistic regression model which included all the before-surgery health and demographic factors was fitted to the data for the period covered by this report to identify those risk factors that were important in predicting whether a patient would die

after a bypass surgery. The general form of a logistic regression model for estimating the "logit" of the probability of dying (p), denoted by Yi, is presented below.

$$Y_i = \sum_k^K \beta_k X_{ki} + \varepsilon_i \text{ , } Where X_{0i} = 1;$$

$$Y_i = \log_e\left(\frac{p_i}{1-p_i}\right) = \text{ the "logit" of p}_i$$

i = 1,2,…,n; k = 0,1,2,...,K,
β_k= Logistic regression coefficient for risk factor X_k,
K = Number of risk factors in the model,
n = Number of patients,
ε_i = Random error term i.

The statistically significant risk factors for this report (X_k) identified by the stepwise logistic regression analysis method are presented in Table 1. Table 1 also includes estimates of coefficients for the statistically significant risk factors, an indication of the level of statistical significance (p-values), and odds ratios. The list of risk factors includes only those that were statistically significant in predicting CABG surgery mortality with p-values of 0.05 or smaller.

The odds ratios are derived from the coefficients, and are used to compare the relative importance of the risk factors in predicting mortality from bypass surgery. For each of the risk factors identified in Table 1, the odds ratio represents how much more likely a patient is to die when compared to a patient who is in the reference group. So, for example, Table 1 shows that a patient who had lung disease is more than one and a half times (odds ratio = 1.869) as likely to die during or after bypass surgery compared to a patient who did not have lung disease. This is based on the assumption that both patients have the same set of other risk factors presented in the table.

Similarly, the odds of dying during or after bypass surgery for a patient with a previous open heart surgery are over two times (odds ratio= 2.054) compared with the odds of a patient who had no previous open heart surgery. Also, the odds of dying for a patient with renal failure requiring dialysis are four and half times as likely (odds ratio= 4.472) while a renal failure patient without dialysis was two and half times (odds ratio = 2.553) as likely to die compared with a patient who had no renal failure.

In another example, a patient who experienced myocardial infarction 24 hours before bypass surgery is over three times (odds ratio =3.277) as likely to die during or after surgery compared to a patient who had no prior myocardial infarction.

Estimation of risk-adjusted mortality rates

The risk factors presented in Table D1 were used in the fitted logistic regression model to predict the probability of death from bypass surgery for each patient. The sum of predicted probabilities of dying for patients operated on in each hospital divided by the number of patients operated on in that hospital provides the predicted (or expected) death rate associated with the hospital. A similar analysis for a surgeon results in the expected death rate associated with that surgeon. Terms such as "expected" and "predicted" are used interchangeably in this report to signify that the estimates are derived from predicted probabilities after accounting for similar risk factors.

The predicted probability of dying for patient i ($\hat{p}_i$) is given as follows:

$$\hat{p}_i = \frac{e^{(\hat{Y}_i)}}{1+e^{(\hat{Y}_i)}}, \text{ Where } i = 1,2,3,..., n \text{ ; and}$$

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i} + \hat{\beta}_3 X_{3i} + ... + \hat{\beta}_k X_{ki}$$

To assess the performance of each hospital or surgeon, we compared the observed patient mortality with what was expected or predicted patient mortality, based on the risk factors existing for the hospital's or surgeon's patients. First, the observed patient mortality is divided by the expected mortality. If the resulting ratio is larger than one, the hospital or surgeon has a higher patient mortality than expected on the basis of their patient mix. If the ratio is smaller than one, the hospital or surgeon has

a lower mortality than expected, based on their patient mix. The ratio is then multiplied by the statewide average patient mortality rate to produce the risk-adjusted patient mortality rate for the hospital or the surgeon.

The risk-adjusted mortality rate represents the best estimate the fitted model provides using the statistically significant health risk factors. The risk-adjusted patient mortality rate represents what the associated hospital's or surgeon's patient mortality would have been if they had a mix of patients identical to the statewide mix. Thus, the risk-adjusted patient mortality has, to the extent possible, ironed out differences among hospitals and surgeons in patient mortality arising from the severity of illness of their patients.

The statistical methods described above are tested to determine if they are sufficiently accurate in predicting the risk of death for all patients – for those who are severely ill prior to undergoing bypass surgery as well as those who are relatively healthy. In the analysis of data for this report, the tests confirmed that the model is reasonably accurate in predicting how patients of different risk levels will fare when undergoing bypass surgery. The area under the Receiver Operating Characteristic (ROC) curve, denoted by C-statistic in Table 1, was used to evaluate model performance. The C-statistic may be interpreted as the degree to which the risk factors in the model predicted the probability of death for CABG surgery patients. Specifically, the C-statistic measures the tendency of the predicted mortality for patients in the sample that died to be higher than those for patients who were discharged alive and were also alive 30 days after CABG surgery. The 2003 model C-statistic is 82.5% and is considered fairly high.

Table D1

Risk Factors Identified for Isolated Bypass Surgery Operative Mortality* (2003)

Patient Risk Factors identified	Proportion of patients(%)	Logistic Regression Results		
		Coefficient	P-Value	Odds Ratio
Demographic factors				
Age (in years)	--	0.0677	<.0001	1.107
Female	26.32	0.3919	0.0250	1.480
Health factors				
Cerebrovascular Accidents	7.39	0.4793	0.0409	1.615
Immunosuppressive Therapy	2.33	0.7301	0.0298	2.075
Lung Disease	13.70	0.6252	0.0013	1.869
Peripheral Vascular Disease	16.93	0.4307	0.0209	1.538
Previous MI < 24 hours	1.89	1.1869	0.0013	3.277
Renal Failure without Dialysis	3.04	0.9372	0.0012	2.553
Renal Failure Requiring Dialysis	2.04	1.4979	<.0001	4.472
Factors related to functioning of the heart				
Arrhythmia	8.65	0.5742	0.0065	1.776
Cardiogenic Shock - Hemodynamic Instability	2.86	0.7365	0.0311	2.089
Ejection Fraction less than 30%	7.51	0.7053	0.0042	2.025
Ejection Fraction 30% - 39%	11.81	0.8438	<.0001	2.325
Previous Open Heart Surgery	3.93	0.7199	0.0133	2.054
Intercept		-9.4833		
C-Statistic		0.825		
N		6,817		

SOURCE: New Jersey Department of Health and Senior Services.

* Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure.

Risk-adjusted patient mortality rate estimates

This section presents the results of our analysis including:

(1) comparisons of risk-adjusted patient mortality rates for hospitals to the state average in 2003;

(2) comparisons of the risk-adjusted patient mortality rates for surgeons in 2002 and 2003 combined to the statewide average for 2002 and 2003 combined;

(3) comparisons of the statewide risk-adjusted patient mortality rate for each year in 1994-2003 to the average for the whole period.

The risk-adjusted mortality rate estimates are presented in percentage points. The results also include the lowest and the highest risk-adjusted mortality rate estimates one would expect, using a 95 percent confidence level*.

* *95% confidence limits are calculated as follows:*

$$\text{LCL} \equiv \left[D \left(\left(1 - \frac{1}{9D} \right) - \frac{1.96}{3\sqrt{D}} \right)^3 \div E \right] S$$

$$\text{UCL} \equiv \left[(D+1) \left(\left(1 - \frac{1}{9(D+1)} \right) + \frac{1.96}{3\sqrt{(D+1)}} \right)^3 \div E \right] S$$

Where D = Observed mortality, and E = Predicted or Expected mortality, S = Statewide average.

(Source: Breslow, NE & Day NE, Statistical Methods in Cancer Research: Vol II,The design and analysis of cohort studies, International Agency for Research on Cancer, Lyon, 1988.)

Patient CABG surgery mortality rate by hospital compared to the state average in 2003

The risk-adjusted patient mortality estimates from bypass surgery for each hospital in 2003 are presented in Table D2. The results compare each hospital's risk-adjusted patient mortality rate with the statewide mortality rate.

After adjusting for how sick the patients were before surgery at each hospital, we present the estimates of risk-adjusted patient mortality rate for each hospital in the sixth column of Table D2.

If a hospital's 95 % confidence interval contains the state average, it means that the difference between the hospital's risk-adjusted mortality rate and the state average was not statistically significant. If the whole of a hospital's 95 % confidence interval clearly falls to the left of the state average vertical line, it means that the hospital's risk-adjusted patient mortality rate was statistically significantly lower than the state average. If the whole of the 95 % confidence interval falls to the right of the state average, it means that the hospital's risk-adjusted mortality rate was statistically significantly higher than the state average.

The observed operative mortality rate statewide in 2003 for bypass patients was 2.33 percent, based on 159 deaths out of 6,817 bypass operations performed. Table 2 (Col. 4) presents the observed CABG surgery mortality rate for each of the seventeen hospitals.

Table D2

Comparing Hospitals' Patient Operative Mortality* from Bypass Surgery to the State Average (2003)

Hospital	Number of Isolated CABG Operations	Patient Operative Deaths*	Observed Patient Mortality (%)	Expected Patient Mortality (%)	Risk Adjusted Patient Mortality (%)	95% Confidence Interval
Atlanticare Regional Medical Center - Mainland	177	2	1.13	3.52	0.75	(0.08, 2.70)
(+) Cooper Hospital/University Medical Center	220	16	7.27	2.98	5.69	(3.25, 9.24)
Deborah Heart and Lung Center	466	19	4.08	2.57	3.71	(2.23, 5.79)
Englewood Hospital and Medical Center	118	0	0.00	1.77	0.00	(0.00, 4.09)
(-) Hackensack University Medical Center	595	8	1.34	3.13	1.00	(0.43, 1.97)
Jersey Shore University Medical Center	636	8	1.26	1.70	1.73	(0.74, 3.40)
Morristown Memorial Hospital	857	17	1.98	2.06	2.24	(1.31, 3.59)
Newark Beth Israel Medical Center	351	7	1.99	2.04	2.28	(0.91, 4.69)
Our Lady of Lourdes Medical Center	453	12	2.65	1.86	3.32	(1.71, 5.79)
PBI Regional Medical Center	262	11	4.20	2.26	4.33	(2.16, 7.75)
Robert Wood Johnson University Hospital	775	23	2.97	2.32	2.99	(1.89, 4.48)
Saint Barnabas Medical Center	262	4	1.53	2.17	1.64	(0.44, 4.21)
St. Francis Medical Center	180	2	1.11	3.09	0.84	(0.09, 3.03)
St. Joseph's Regional Medical Center	247	7	2.83	2.77	2.39	(0.96, 4.92)
Saint Michael's Medical Center	551	10	1.81	2.60	1.63	(0.78, 2.99)
University Hospital - UMDNJ	144	2	1.39	1.45	2.23	(0.25, 8.05)
Valley Hospital	523	11	2.10	2.12	2.32	(1.15, 4.14)
State Total (2003)	6,817	159	2.33	2.33	2.33	

SOURCE: New Jersey Department of Health and Senior Services.

* Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

+ = The risk-adjusted patient mortality is significantly higher than the state average mortality based on 95 percent confidence interval.

- The risk-adjusted patient mortality is significantly lower than the state average mortality based on 95 percent confidence interval.

Annual risk-adjusted mortality compared to the combined 1994-2003 risk-adjusted mortality

Table D3 presents the results of an analysis to identify the trend in the statewide mortality rate of patients who underwent bypass surgery using a statistical model based on the pooled data collected over the period 1994–2003. For each of the eight years, the table presents the observed patient mortality rate, the expected patient mortality rate, and the statewide risk-adjusted patient mortality rate estimate. Note that the numbers differ from those shown in reports produced before, due to the revised definition of mortality and the use of pooled data for the analysis. The table further exhibits whether the risk-adjusted mortality rate for the year is statistically different from the average mortality rate over the eight-year period.

Table D3 also shows that between 2002 and 2003, the number of bypass surgeries performed in New Jersey declined precipitously from 7,391 to 6,817 or by about 7.8 percent. Over the same time period, the number of deaths stayed the same at 159. On risk-adjusted basis, mortality rate increased by 7.1% between 2002 and 2003 even though it has declined by about50% since 1994.

The trend in operative CABG mortality between 1994 and 2003 was estimated by fitting a regression line to pooled annual risk-adjusted CABG mortality rates to calendar year (Figure D1). According to the fitted regression line operative mortality from CABG surgery has been declining, in absolute terms, at the rate of 0.29 percent per year between 1994 and 2003 (R2 = .91).

Table D3

Annual Risk-Adjusted Patient Operative Mortality Rate* Derived from the Pooled Data for the Period (1994-2003)

Calendar Year	Number of Isolated CABG Operations	Operative Patient Mortality*	Observed Patient Mortality Rate (%)	Predicted Patient Mortality Rate (%)	Risk-Adjusted Patient Mortality Rate (%)		Annual Change in Risk-Adjusted Mortality Rate (%)	Percent Change from 1994 Risk-adjusted Mortality Rate (%)
1994	6,957	274	3.94	2.79	4.50	**HI**	----	----
1995	7,553	327	4.33	2.97	4.64	**HI**	3.1	3.1
1996	8,262	341	4.13	3.14	4.18	**HI**	-9.9	-7.1
1997	8,286	280	3.38	3.33	3.23	**SA**	-22.7	-28.2
1998	8,377	252	3.01	3.26	2.94	**SA**	-9.0	-34.7
1999	8,108	268	3.31	3.46	3.04	**SA**	3.4	-32.4
2000	8,220	220	2.68	3.10	2.75	**LO**	-9.5	-38.9
2001	8,045	202	2.51	3.23	2.47	**LO**	-10.2	-45.1
2002	7,391	159	2.15	3.22	2.12	**LO**	-14.2	-52.9
2003	6,817	159	2.33	3.26	2.27	**LO**	7.1	-49.6
1994 - 2003	78,016	2,482	3.18	3.18	3.18			

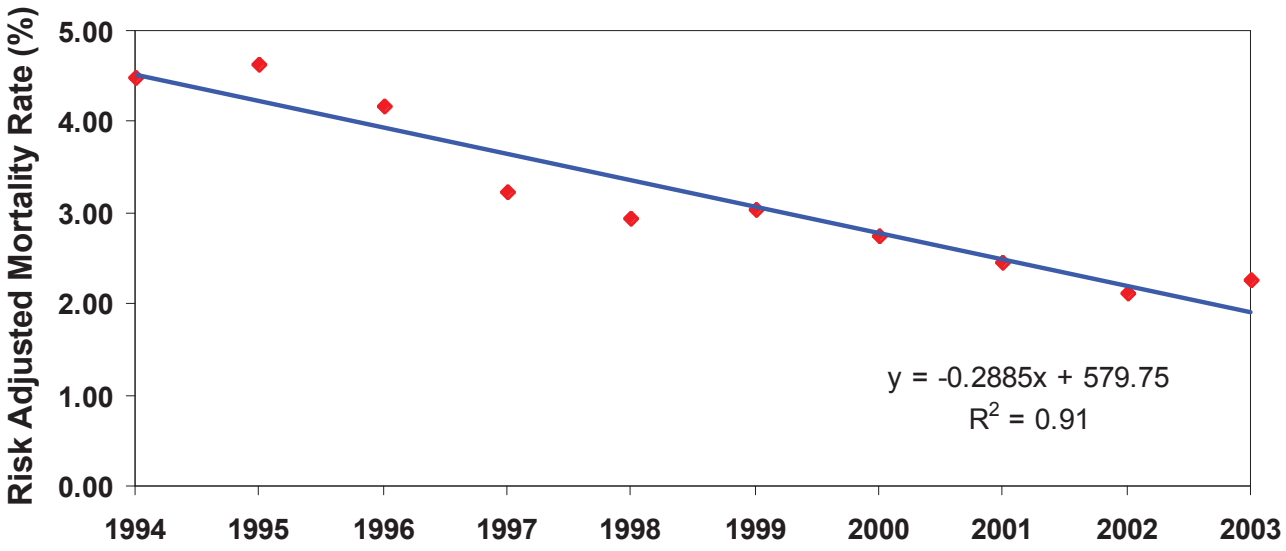
SOURCE: New Jersey Department of Health and Senior Services.

*Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

LO - The risk-adjusted patient mortality is significantly lower than the state average mortality for the 1994-2003 period when evaluated with a 95 percent confidence interval.
SA - The risk-adjusted patient mortality is same as the state average mortality for the 1994-2003 period when evaluated with a 95 percent confidence interval.
HI - The risk-adjusted patient mortality is significantly higher than the state average mortality for the 1994-2003 period when evaluated with a 95 percent confidence interval.

Figure D1

Trend in Risk-Adjusted Operative Mortality* Rate (1994-2003)



SOURCE: New Jersey Department of Health and Senior Services.

* Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

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