# Cardiac Surgery in New Jersey 2002

## Technical Report

June 2005


Richard J. Codey
Acting Governor

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

**Message From The Commissioner**

I am pleased to present Cardiac Surgery in New Jersey 2002, the state's seventh consumer report on coronary artery bypass graft surgery. This technical report is a supplement to the 2002 consumer report and contains additional statistics and methodological details that may be used for reference.

The data for 2002 continues the trend of steady reduction in cardiac surgery mortality in New Jersey. I congratulate New Jersey's heart centers on achieving a 53 percent reduction in operative mortality between 1994 and 2002. This is a remarkable tribute to the hospitals' and surgeons' commitment to making cardiac surgery safer.

The Department of Health and Senior Services (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

# The New Jersey's Cardiovascular Health Advisory Panel (CHAP)



---

## Department of Health & Senior Services - Cardiac Surgery Report Team

Marilyn Dahl, Deputy Commissioner, Health Care Quality & Oversight

Emmanuel Noggoh, MS
Director, Health Care Quality Assessment

Abate Mammo, PhD
Jianping Huang, PhD
Claffertene Cheeks, PhD

# Table of Contents



## List of Tables and Figures



## Appendices

# Introduction

This is a report on the quality of care provided by hospitals and surgeons performing bypass surgery in New Jersey. It is the seventh in a series of reports providing useful information on quality of cardiac surgical care. The mortality rates (or death rates) of bypass surgery patients provide one measure of the quality of surgical care provided by surgeons and hospitals. The rates are adjusted statistically by the health condition of patients before the surgery.

In this report, we provide information on hospitals and surgeons that perform isolated coronary artery bypass graft (CABG) surgery (simply called bypass surgery). This information encourages these providers to examine their surgical procedures and make changes to improve the quality of bypass surgery in New Jersey. The report also is for patients and their families facing the possibility of coronary artery bypass graft surgery.

# Background

### Coronary artery disease and bypass surgery

According to the American Heart Association, nearly 2,600 Americans die of cardiovascular disease (CVD) each day, an average of one death every 33 seconds. CVD is the single most important killer of Americans, and the most common form of CVD is coronary artery disease. The Department's Center for Health Statistics reports that 22,519 New Jerseyans (or approximately 62 people a day) died from heart disease in 2002, and that heart disease also remains the number one cause of death in the State.

Coronary artery disease is a chronic disease brought about when fat and cholesterol gradually deposit in the lining of blood vessels that supply the heart. The heart muscle works continuously and needs an adequate flow of blood to supply it with nutrients. Over time, the fat deposits may harden and partially block the blood vessels, causing a reduction in blood flow to the heart. This can lead to chest pains called angina, which are warning signs for heart attacks (myocardial infarction). A heart attack occurs when one or more vessels carrying blood to the heart muscle are totally blocked.

The two most common procedures for the treatment of coronary artery disease are Coronary Artery Bypass Graft (CABG) surgery and percutaneous transluminal coronary angioplasty (PTCA). Despite recent large increases in the number of PTCA procedures performed, for many coronary artery disease patients, bypass surgery remains the treatment of choice.

In bypass surgery, the surgeon uses a healthy blood vessel from another part of the patient's body to create an alternate path or graft for blood to flow to the heart, bypassing the blockage caused by the disease. That allows oxygen-rich blood to flow freely to nourish the heart muscle. Surgeons often create one, two, three, or sometimes more grafts for patients, depending on how many blood vessels (and their main branches) are blocked.

### Public disclosure and quality improvement

Four 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, and currently also publishes a report on angioplasty. Pennsylvania has published several cardiac report cards starting with 1990 data, with its current report using 2003 data. California has published several report cards, with the most recent

using 1999 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. In New Jersey, mortality declined substantially between 1994 and 2002. Later in this report, we present the results from a statistical analysis that shows the trend in CABG surgery mortality.

### Definition of CABG Surgery operative mortality

Beginning with the 2000 report, the Department, after consulting with its Cardiovascular Health Advisory Panel (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 hospital after isolated coronary artery bypass graft (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 the potential for "gaming" 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 and deaths occurring during the hospitalization in which the surgery was performed, even when more than 30 days after the procedure.

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 (See Appendices A and B).

## The bypass surgery data used for this report

This report uses data on all adult patients in New Jersey who underwent bypass surgery with no other major surgery during the same admission. These cases are often called isolated bypass surgery. As in previous years, data include bypass surgery cases that use minimally invasive methods first performed in New Jersey in 1996.

All licensed cardiac surgery centers in New Jersey submit data on adult bypass patients to the Department on a quarterly basis. The data include patient demographics, patient health history before bypass surgery, and whether the patient died in the hospital. The 2002 data include submissions from seventeen licensed cardiac surgery centers. Jersey City Medical Center, first licensed for cardiac surgery in November 2004, is not included in this report. This facility will be included in future reports when data for a full calendar year becomes available.

The Department sets the criteria for collecting the data and checks the quality of data reporting using traditional data management procedures. In addition, independent external teams of medical chart reviewers audit and verify the accuracy of a sample of the data against the actual clinical records at each hospital. If discrepancies are found between the data submitted and the clinical records, hospitals are required to provide corroborating documentation or their data set is revised. The Department also verifies the data submitted using other data sources, to assess whether all bypass surgical operations as well as all deaths from bypass surgery were reported. Deaths occurring within thirty days after surgery, but post-discharge, have been identified by matching patients in the Department's open heart data base with the state's official death records.

This report presents risk-adjusted mortality for hospitals using 2002 data and for

surgeons using 2001 and 2002 data combined, the most recent audited data available for analysis.

### Hospitals and surgeons are not penalized for operating on very high risk patients

Great care is taken to ensure that this report does not discourage surgeons from operating on patients who are extremely ill. Cardiac surgeons and hospitals in New Jersey have been advised that treating extremely ill patients will not be counted in the calculation of their mortality rates. Hospitals are encouraged to submit the clinical data on such patients after their surgery for review and possible exclusion from the analysis. Members of a Department expert clinical panel review the clinical data on such patients (with all identifying information removed) and recommend which patients should be excluded from the report. Additionally, the analysis adjusts for the before-surgery health condition of patients. Hospitals and surgeons should, therefore, not have any disincentives to treat extremely ill patients.

## 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 85 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 history 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 $Y_i$, 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,
$\beta_k$= Logistic regression coefficient for risk factor $X_k$,
K = Number of risk factors in the model,
n = Number of patients,
$\varepsilon_i$ = 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 in that age group 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 = 1.672) 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 and a half times (odds ratio= 2.579) 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 more than two and half times greater (odds ratio= 2.662). The reference group in this case is patients either with no renal failure or with renal failure but without need for dialysis.

In another example, a patient who experienced congestive heart failure in the two weeks before bypass surgery is over twice (odds ratio =2.164) as likely to die during or after surgery compared to a patient who had no congestive heart failure.

## Estimation of risk-adjusted mortality rates

The risk factors presented in Table 1 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

## Table 1

### Risk Factors Identified for Isolated Bypass Surgery Operative Mortality* (2002)

| Patient Risk Factors Identified | Proportion of Patients(%) | Logistic Regression Results | | |
|---|---|---|---|---|
| | | Coefficient | P-Value | Odds Ratio |
| **Demographic Factors** | | | | |
| Age (in years) | -- | 0.0550 | <.0001 | 1.056 |
| **Health Factors** | | | | |
| Cerebrovascular Accidents | 7.50 | 0.5840 | 0.0087 | 1.793 |
| Congestive Heart Failure in the 2 Weeks Before Surgery | 17.41 | 0.7721 | <.0001 | 2.164 |
| Immunosuppressive Therapy | 2.33 | 1.0045 | 0.0023 | 2.731 |
| Lung Disease | 12.98 | 0.5142 | 0.0095 | 1.672 |
| Previous MI < 24 hours | 2.07 | 1.2686 | 0.0007 | 3.556 |
| Renal Failure Without Dialysis | 3.68 | 0.9791 | 0.0001 | 2.662 |
| Renal Failure Requiring Dialysis | 1.53 | 1.3157 | 0.0003 | 3.727 |
| **Previous Open Heart Surgery** | 4.05 | 0.9473 | 0.0005 | 2.579 |
| Intercept | | -8.2639 | | |
| C-Statistic | | 0.765 | | |
| N | | 7391 | | |

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.

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 2002 model C-statistic is 76.5% and is considered fairly high.

## Risk-adjusted patient mortality rate estimates

This section presents the results of our analysis including:

(1) comparisons of risk-adjusted patient mortality for hospitals to the state average in 2002;

(2) comparisons of the risk-adjusted patient mortality for surgeons in 2001 and 2002 combined to the statewide average for 2001 and 2002 combined;

(3) comparisons of the statewide risk-adjusted patient mortality rate for each year in 1994-2002 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.

### Patient CABG surgery mortality by hospital compared to the state average in 2002

The risk-adjusted patient mortality estimates from bypass surgery for each hospital in 2002 are presented in Table 2. The results compare each hospital's risk-adjusted patient mortality rate with the statewide mortality rate.

The observed operative mortality rate statewide in 2002 for bypass patients was 2.15 percent, based on 159 deaths out of 7,391 bypass operations performed. Table 2 (Col. 4) presents the observed CABG surgery mortality rate for each of the seventeen hospitals.

## Table 2

### Comparing Hospitals' Patient Operative Mortality* from Bypass Surgery to the State Average (2002)

| Hospital | Number of Isolated CABG Operations | Patient Operative Deaths* | Observed Patient Mortality (%) | Expected Patient Mortality (%) | Risk-Adjusted Patient Mortality (%) | | 95% Confidence Interval |
|---|---|---|---|---|---|---|---|
| Atlantic City Medical Center | 131 | 1 | 0.76 | 2.34 | 0.70 | | (0.01, 3.90) |
| Cooper Hospital/University Medical Center | 208 | 5 | 2.40 | 2.18 | 2.37 | | (0.76, 5.52) |
| Deborah Heart and Lung Center | 485 | 18 | 3.71 | 2.29 | 3.49 | | (2.07, 5.51) |
| Englewood Hospital | 160 | 2 | 1.25 | 1.97 | 1.36 | | (0.15, 4.93) |
| Hackensack University Medical Center | 672 | 16 | 2.38 | 2.49 | 2.06 | | (1.18, 3.35) |
| Jersey Shore Medical Center | 591 | 8 | 1.35 | 1.80 | 1.62 | | (0.70, 3.19) |
| Morristown Memorial Hospital | 994 | 18 | 1.81 | 1.88 | 2.07 | | (1.23, 3.28) |
| Newark Beth Israel Medical Center | 407 | 5 | 1.23 | 1.88 | 1.41 | | (0.45, 3.28) |
| Our Lady of Lourdes Medical Center | 563 | 16 | 2.84 | 1.59 | 3.85 | **HI** | (2.20, 6.25) |
| PBI Regional Medical Center | 296 | 7 | 2.36 | 2.92 | 1.74 | | (0.70, 3.59) |
| Robert Wood Johnson University Hospital | 869 | 22 | 2.53 | 2.14 | 2.54 | | (1.59, 3.85) |
| St Barnabas Medical Center | 290 | 3 | 1.03 | 2.28 | 0.98 | | (0.20, 2.85) |
| St Francis Medical Center | 201 | 4 | 1.99 | 2.17 | 1.98 | | (0.53, 5.06) |
| St Joseph's Hospital and Medical Center | 302 | 6 | 1.99 | 2.28 | 1.88 | | (0.69, 4.08) |
| St Michael's Medical Center | 543 | 13 | 2.39 | 2.88 | 1.79 | | (0.95, 3.05) |
| UMDNJ - University Hospital | 112 | 3 | 2.68 | 2.50 | 2.30 | | (0.46, 6.73) |
| Valley Hospital | 567 | 12 | 2.12 | 1.93 | 2.36 | | (1.22, 4.11) |
| State Total (2002) | 7,391 | 159 | 2.15 | 2.15 | 2.15 | | |

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.

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

After adjusting for how sick the patients were before surgery at each hospital, we present the estimates of risk-adjusted patient mortality for each hospital in the sixth column of Table 2 and graphically in Figure 1.

In Figure 1, the risk-adjusted mortality rate estimate associated with each hospital is presented as a dark narrow bar in the middle of a broader shaded bar that represents the confidence interval around the estimate. The graph also presents a vertical line drawn to represent the state average patient mortality rate at 2.15 percent. This line is important because, as stated earlier, all risk-adjusted patient mortality estimates are meaningful only when compared to the statewide average mortality rate.

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

In 2002, the risk-adjusted mortality rates for most hospitals were not different from the state average. However, Our Lady of Lourdes Medical Center had an estimate significantly higher than the state average.

**Patient mortality for surgeons in 2001 and 2002 combined**

This report presents risk-adjusted patient mortality rates for surgeons in 2001 and 2002 combined. Risk-adjusted mortality rates for surgeons were calculated for only those surgeons who performed a minimum of 100 bypass surgeries in 2001 and 2002 combined. Surgeons in each hospital who performed less than 100 operations in the 2001-2002 reporting period were placed in one group called **"All Others."** Risk-adjusted patient mortality rate was then estimated for the group instead of the surgeons individually, unless there was only one surgeon in the group. No rate was calculated in this case.

Table 3 presents the total number of open heart and CABG surgeries as well as the number of isolated CABG operative deaths for each surgeon. For surgeons with a minimum of 100 isolated CABG surgeries, mortality rates for 2001 and 2002 combined are also presented, along with the 95% confidence interval.

The state average mortality rate for bypass surgery patients in 2001-2002 combined was 2.34 percent, based on 361 deaths out of 15,436 bypass operations performed. The table shows two surgeons who performed at least 100 bypass operations with the risk-adjusted patient mortality rate estimates significantly above the average state patient mortality rate. Similar to previous reports, the patient mortality rate estimates of the remaining individual surgeons were not statistically different from the state average.

**Table 3**

**Patient Risk-Adjusted Operative Mortality* Rate for Surgeons (2001 - 2002)**

| 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 |
|---|---|---|---|---|---|---|---|
| ***Atlantic City Medical Center*** | | | | | | | |
| **All Others (2)** | 171 | 131 | 1 | 0.76 | 2.61 | 0.68 | (0.01, 3.81) |
| Dralle, James | 108 | 80 | 1 | | | | |
| Yun, Jaime | 63 | 51 | 0 | | | | |
| ***Cooper Hospital/University Medical Center*** | | | | | | | |
| Simonetti, Vincent A. | 173 | 128 | 4 | 3.13 | 2.26 | 3.23 | (0.87, 8.27) |
| **All Others (10)** | 428 | 304 | 9 | 2.96 | 2.66 | 2.60 | (1.19, 4.93) |
| Antinori, Charles H. | 85 | 59 | 2 | | | | |
| Cilley, Jonathan H. | 124 | 78 | 2 | | | | |
| DelRossi, Anthony J. | 59 | 25 | 0 | | | | |
| Derivaux, Christopher+ | 1 | 1 | 0 | | | | |
| DiPaola, Douglas J.++ | 1 | 1 | 0 | | | | |
| Heim, John A.++ | 4 | 3 | 0 | | | | |
| Lotano, Vincent | 71 | 60 | 1 | | | | |
| Luciano, Pasquale A.+ | 1 | 1 | 0 | | | | |
| Marra, Steven W. | 79 | 73 | 4 | | | | |
| Villanueva, Dioscoro S.++ | 3 | 3 | 0 | | | | |
| ***Deborah Heart and Lung Center*** | | | | | | | |
| Anderson, William A. | 385 | 237 | 11 | 4.64 | 2.63 | 4.13 | (2.06, 7.40) |
| Grosso, Michael++ | 249 | 131 | 10 | 7.63 | 3.28 | 5.44 **HI** | (2.60, 10.00) |
| McGrath, Lynn B. | 806 | 460 | 12 | 2.61 | 2.10 | 2.91 | (1.50, 5.08) |
| Ng, Arthur | 466 | 245 | 4 | 1.63 | 2.26 | 1.69 | (0.45, 4.32) |
| ***Englewood Hospital & Medical Center*** | | | | | | | |
| Ergin, Arisan M. | 227 | 114 | 1 | 0.88 | 2.49 | 0.82 | (0.01, 4.58) |
| Klein, James | 287 | 174 | 3 | 1.72 | 2.55 | 1.58 | (0.32, 4.62) |
| **All Others (1)** | | | | | | | |
| Merav, Avraham++ | 2 | 1 | 0 | | | | |
| ***Hackensack University Medical Center*** | | | | | | | |
| Alexander, John C. | 378 | 220 | 9 | 4.09 | 2.93 | 3.26 | (1.49, 6.19) |
| Asgarian, Kourosh T. | 359 | 225 | 5 | 2.22 | 3.27 | 1.59 | (0.51, 3.70) |
| Elmann, Elie | 334 | 210 | 10 | 4.76 | 4.08 | 2.73 | (1.31, 5.01) |
| McCullough, Jock N. | 307 | 217 | 2 | 0.92 | 2.32 | 0.93 | (0.10, 3.35) |
| Praeger, Peter I. | 365 | 275 | 5 | 1.82 | 2.45 | 1.73 | (0.56, 4.04) |
| Somberg, Eric | 398 | 289 | 3 | 1.04 | 2.06 | 1.18 | (0.24, 3.45) |
| **All Others (1)** | | | | | | | |
| Brenner, William++ | 105 | 60 | 3 | | | | |
| ***Jersey Shore University Medical Center*** | | | | | | | |
| Dejene, Brook A. | 381 | 295 | 6 | 2.03 | 2.03 | 2.34 | (0.85, 5.09) |
| Greeley, Drew P. | 440 | 293 | 8 | 2.73 | 1.72 | 3.71 | (1.60, 7.31) |
| Johnson, David L. | 458 | 343 | 2 | 0.58 | 1.93 | 0.71 | (0.08, 2.55) |
| Neibart, Richard M. | 449 | 303 | 6 | 1.98 | 1.74 | 2.67 | (0.97, 5.81) |

*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 based on 95 percent confidence interval.
**HI =** The risk-adjusted patient mortality is significantly higher than the state average mortality 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 3 (Continued)**

**Patient Risk-Adjusted Operative Mortality* Rate for Surgeons (2001 - 2002)**

| 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 |
|---|---|---|---|---|---|---|---|---|
| ***Morristown Memorial Hospital*** | | | | | | | | |
| Banker, Michael+ | 185 | 154 | 1 | 0.65 | 1.59 | 0.95 | | (0.01, 5.30) |
| Brown III, John M. | 776 | 398 | 3 | 0.75 | 2.02 | 0.87 | | (0.18, 2.54) |
| Magovern, Christopher J. | 567 | 447 | 10 | 2.24 | 1.88 | 2.78 | | (1.33, 5.11) |
| Parr, Grant Van++ | 334 | 148 | 1 | 0.68 | 1.87 | 0.85 | | (0.01, 4.71) |
| Rodriguez, Alejandro L. | 518 | 391 | 7 | 1.79 | 1.55 | 2.69 | | (1.08, 5.55) |
| Slater, James P. | 514 | 403 | 8 | 1.99 | 1.72 | 2.69 | | (1.16, 5.31) |
| ***Newark Beth Israel Medical Center*** | | | | | | | | |
| Goldstein, Daniel J. | 242 | 114 | 1 | 0.88 | 1.42 | 1.44 | | (0.02, 8.04) |
| Karanam, Ravindra | 362 | 203 | 3 | 1.48 | 1.68 | 2.05 | | (0.41, 5.99) |
| Prendergast, Thomas | 335 | 220 | 4 | 1.82 | 1.89 | 2.25 | | (0.61, 5.77) |
| Saunders, Craig R. | 391 | 228 | 6 | 2.63 | 2.17 | 2.83 | | (1.03, 6.17) |
| **All Others (2)** | 49 | 26 | 1 | 3.85 | 3.25 | 2.76 | | (0.04, 15.38) |
| Burns, Paul | 23 | 15 | 0 | | | | | |
| Sardari, Frederic F. | 26 | 11 | 1 | | | | | |
| ***Our Lady of Lourdes Medical Center*** | | | | | | | | |
| DiPaola, Douglas J.++ | 286 | 210 | 6 | 2.86 | 1.94 | 3.44 | | (1.25, 7.48) |
| Eisen, Morris M.++ | 141 | 117 | 7 | 5.98 | 1.78 | 7.88 | **HI** | (3.16, 16.23) |
| Heim, John A.++ | 223 | 187 | 8 | 4.28 | 1.88 | 5.33 | | (2.30, 10.51) |
| Kuchler, Joseph A. | 393 | 264 | 8 | 3.03 | 2.03 | 3.50 | | (1.51, 6.89) |
| Luciano, Pasquale A. | 292 | 254 | 6 | 2.36 | 1.82 | 3.04 | | (1.11, 6.62) |
| Nayar, Amrit | 242 | 185 | 8 | 4.32 | 1.97 | 5.12 | | (2.21, 10.09) |
| **All Others (2)** | 135 | 98 | 2 | 2.04 | 1.59 | 3.01 | | (0.34, 10.86) |
| Derivaux, Christopher | 32 | 30 | 2 | | | | | |
| Santaspirit, John S.++ | 103 | 68 | 0 | | | | | |
| ***PBI Regional Medical Center*** | | | | | | | | |
| Goldenberg, Bruce | 292 | 206 | 3 | 1.46 | 2.45 | 1.39 | | (0.28, 4.07) |
| Kaushik, Raj | 527 | 386 | 10 | 2.59 | 3.33 | 1.82 | | (0.87, 3.34) |
| **All Others (2)** | 31 | 27 | 2 | 7.41 | 3.05 | 5.68 | | (0.64, 20.51) |
| Chuback, John | 9 | 7 | 0 | | | | | |
| Schechter, Mark++ | 22 | 20 | 2 | | | | | |
| ***Robert Wood Johnson University Hospital*** | | | | | | | | |
| Anderson, Mark B. | 432 | 311 | 7 | 2.25 | 3.16 | 1.67 | | (0.67, 3.44) |
| Krause, Tyrone J. | 1,353 | 998 | 20 | 2.00 | 2.29 | 2.05 | | (1.25, 3.16) |
| Scholz, Peter M. | 320 | 123 | 4 | 3.25 | 2.44 | 3.11 | | (0.84, 7.97) |
| Scott, Gregory E. | 405 | 325 | 11 | 3.38 | 2.15 | 3.68 | | (1.84, 6.59) |
| Vasseur, Bernard G. | 201 | 119 | 3 | 2.52 | 2.40 | 2.46 | | (0.49, 7.17) |
| **All Others (1)** | | | | | | | | |
| Spotnitz, Alan J.+ | 40 | 25 | 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 based on 95 percent confidence interval.
**HI =** The risk-adjusted patient mortality is significantly higher than the state average mortality 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 3 (Continued)**

**Patient Risk-Adjusted Operative Mortality* Rate for Surgeons (2001 - 2002)**

| 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 |
|---|---|---|---|---|---|---|---|
| ***St Barnabas Medical Center*** | | | | | | | |
| Burns, Paul | 223 | 165 | 3 | 1.82 | 2.57 | 1.65 | (0.33, 4.83) |
| Sardari, Frederic F. | 352 | 265 | 5 | 1.89 | 2.38 | 1.85 | (0.60, 4.33) |
| Saunders, Craig R. | 181 | 121 | 1 | 0.83 | 2.62 | 0.74 | (0.01, 4.11) |
| **All Others (3)** | 83 | 55 | 1 | 1.82 | 2.52 | 1.69 | (0.02, 9.40) |
| Goldstein, Daniel J. | 27 | 22 | 0 | | | | |
| Karanam, Ravindra | 8 | 4 | 0 | | | | |
| Prendergast, Thomas | 48 | 29 | 1 | | | | |
| ***St Francis Medical Center*** | | | | | | | |
| Laub, Glenn | 408 | 310 | 5 | 1.61 | 2.39 | 1.58 | (0.51, 3.68) |
| **All Others (1)** | | | | | | | |
| Costic, Joseph | 115 | 93 | 3 | | | | |
| ***St Joseph's Hospital and Medical Center*** | | | | | | | |
| DeFilippi, Vincent J. | 454 | 299 | 6 | 2.01 | 3.66 | 1.28 | (0.47, 2.79) |
| Mekhjian, Haroutune | 515 | 371 | 6 | 1.62 | 2.24 | 1.69 | (0.62, 3.68) |
| **All Others (2)** | 68 | 49 | 2 | 4.08 | 2.57 | 3.72 | (0.42, 13.42) |
| Kaushik, Raj+ | 46 | 33 | 0 | | | | |
| Schechter, Mark++ | 22 | 16 | 2 | | | | |
| ***St Michael's Medical Center*** | | | | | | | |
| Asher, Alain++ | 542 | 405 | 12 | 2.96 | 3.19 | 2.17 | (1.12, 3.79) |
| Codoyannis, Aristides | 311 | 255 | 7 | 2.75 | 2.87 | 2.24 | (0.90, 4.62) |
| Connolly, Mark W. | 135 | 108 | 2 | 1.85 | 3.21 | 1.35 | (0.15, 4.87) |
| Esrig, Barry C.+ | 200 | 152 | 3 | 1.97 | 2.68 | 1.72 | (0.35, 5.03) |
| Jihayel, Ayad K.+ | 222 | 183 | 4 | 2.19 | 3.21 | 1.59 | (0.43, 4.07) |
| **All Others (1)** | | | | | | | |
| Scott, Randolph P. | 17 | 11 | 0 | | | | |
| ***UMDNJ University Hospital*** | | | | | | | |
| Rajaii Khorasani, Ahmad++ | 148 | 110 | 4 | 3.64 | 2.39 | 3.56 | (0.96, 9.12) |
| **All Others (4)** | 170 | 116 | 3 | 2.59 | 2.44 | 2.47 | (0.50, 7.23) |
| Banker, Michael | 78 | 56 | 3 | | | | |
| Casale, Alfred++ | 44 | 26 | 0 | | | | |
| Esrig, Barry C. | 45 | 32 | 0 | | | | |
| Perera, S.++ | 3 | 2 | 0 | | | | |
| ***Valley Hospital*** | | | | | | | |
| Bronstein, E | 611 | 488 | 13 | 2.66 | 2.38 | 2.62 | (1.39, 4.47) |
| Mindich, Bruce | 781 | 391 | 8 | 2.05 | 2.00 | 2.39 | (1.03, 4.72) |
| Rubinstein, M.++ | 272 | 267 | 7 | 2.62 | 1.98 | 3.09 | (1.24, 6.37) |
| **State Total (2001 - 2002)** | 22,562 | 15,436 | 361 | 2.34 | 2.34 | 2.34 | |

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

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

**Annual risk-adjusted mortality compared to the combined 1994-2002 risk-adjusted mortality**

Table 4 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 1994–2002. 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 4 also shows that between 2001 and 2002, the number of bypass operations performed in New Jersey declined precipitously from 8,045 to 7,391 or by about 8.1 percent. Over the same time period, the number of deaths decreased substantially from 202 to 159 or by 21.3 percent.

## Table 4

### Annual Risk-Adjusted Patient Operative Mortality Rate* Derived from the Pooled Data for the Period 1994-2002

| Calendar Year | Number of Isolated CABG Operations | Operative Patient Mortality* | Observed Patient Mortality Rate (%) | Predicted Patient Mortality Rate (%) | Risk-Adjusted Patient Mortality Rate (%) | | Yearly Change in Risk-Adjusted Mortality Rate (%) | Percent Change from 1994 Risk-Adjusted Mortality Rate (%) |
|---|---|---|---|---|---|---|---|---|
| 1994 | 6,957 | 274 | 3.94 | 2.86 | 4.49 | **HI** | ---- | ---- |
| 1995 | 7,553 | 327 | 4.33 | 3.05 | 4.63 | **HI** | 0.14 | 3.2 |
| 1996 | 8,262 | 341 | 4.13 | 3.23 | 4.17 | **HI** | -0.46 | -7.1 |
| 1997 | 8,286 | 280 | 3.38 | 3.41 | 3.23 | **SA** | -0.94 | -28.0 |
| 1998 | 8,377 | 252 | 3.01 | 3.35 | 2.93 | **SA** | -0.30 | -34.7 |
| 1999 | 8,108 | 268 | 3.31 | 3.56 | 3.03 | **SA** | 0.10 | -32.5 |
| 2000 | 8,220 | 220 | 2.68 | 3.19 | 2.74 | **LO** | -0.30 | -39.1 |
| 2001 | 8,045 | 202 | 2.51 | 3.33 | 2.46 | **LO** | -0.27 | -45.2 |
| 2002 | 7,391 | 159 | 2.15 | 3.32 | 2.11 | **LO** | -0.35 | -52.9 |
| 1994 - 2002 | 71,199 | 2,323 | 3.26 | 3.26 | 3.26 | | | |

SOURCE: New Jersey Department of Health and Senior Services.

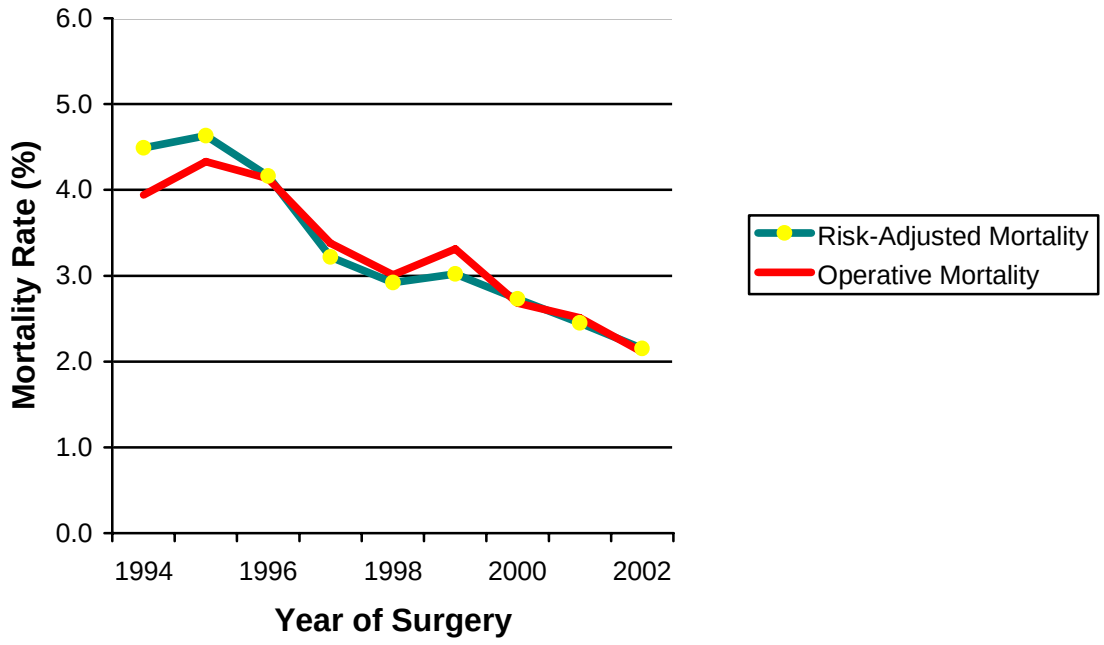
* = Operative Mortality includes: (1) all deaths occurring during the hospitalization in which the operation was performed, even after 30 days; and (2) those deaths occurring after discharge from the hospital, but within 30 days of the procedures.

**LO =** The risk-adjusted patient mortality is significantly lower than the state average mortality for the 1994-2001 period when evaluated with a 95 percent confidence interval.
**SA** = The risk-adjusted patient mortality is the same as the state average mortality for the 1994-2002 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 1994-2002 period when evaluated with a 95 percent confidence interval.

## Statewide trends in risk-adjusted CABG Surgery mortality rates

When compared to 1994, the risk-adjusted patient mortality rate in 2002 has dropped by 53 percent. Figure 2 illustrates the overall downward trend in mortality in New Jersey while Appendix B shows the trend in CABG mortality with a fitted regression line to the pooled annual estimates. According to the regression line fitted to the annual risk-adjusted mortality rate estimates derived from the pooled 1994-2002 data, mortality from CABG surgery has been declining, in absolute terms, at a rate of 0.32 percent per year (See Appendix B for more information).

**Figure 2. Trends in Statewide CABG Surgery Mortality in New Jersey**



# Conclusions

This is the seventh in a series of reports presenting information on the risk-adjusted patient mortality for surgeons and hospitals performing bypass surgery in New Jersey. In this release, we used 2002 data to report on patient mortality associated with hospitals and we used the combined 2001 and 2002 data to report on patient bypass mortality rate associated with surgeons. The summary of findings is as follows:

- In 2002, the risk-adjusted patient bypass mortality rate estimates associated with most hospitals were similar to the statewide average. However, one hospital had a risk-adjusted CABG surgery mortality rate that was significantly higher than the statewide average.

- In 2001 and 2002, risk-adjusted patient bypass mortality rate estimates associated with almost all surgeons performing bypass operations were not different from the statewide average. Two surgeons had risk-adjusted CABG surgery mortality rates that were significantly higher than the statewide average.

- Over most of the nine years (1994 through 2002) the risk-adjusted patient mortality rate has been dropping steadily at the rate of .32 percent per year. When compared to 1994, the patient mortality rate in 2002 has declined by 53 percent.

The information presented in this report should be used by hospitals and surgeons to continue to examine their surgical procedures and make changes to improve the quality of bypass surgery in the State.

# Appendix A

## Statewide Observed Mortality Rates

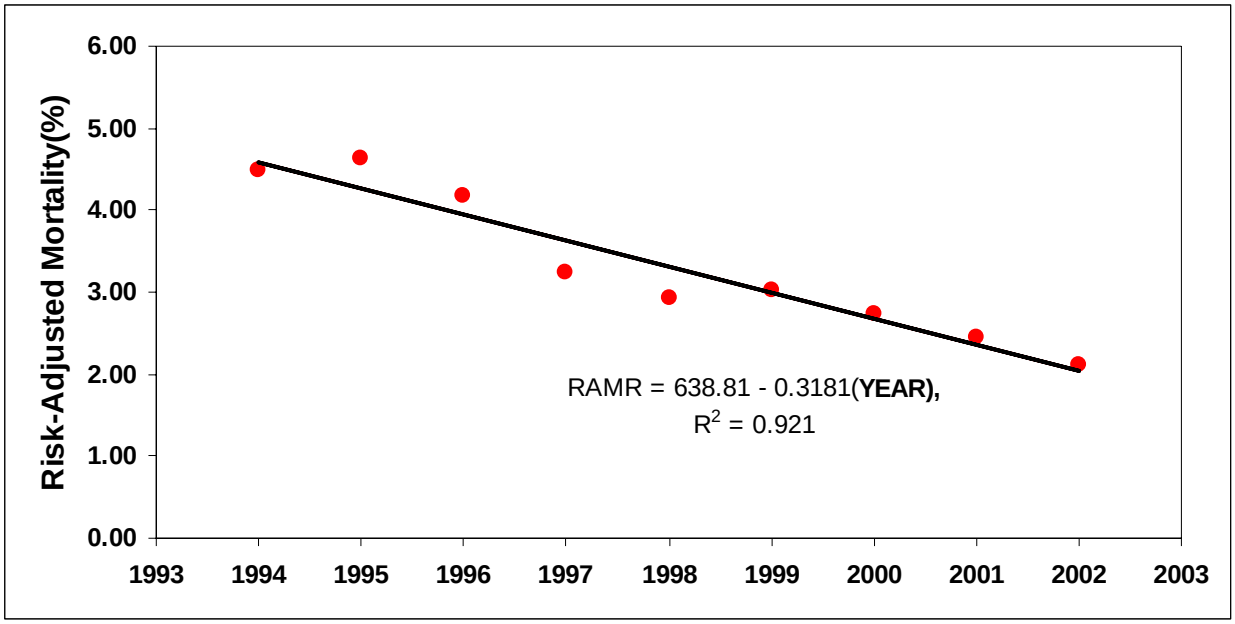
| Year of Operation | Type of Mortality Rate | |
|---|---|---|
| | In Hospital Mortality Rate | Operative Mortality Rate* |
| 1994-1995 | 3.75 | 4.14 |
| 1996-1997 | 3.37 | 3.75 |
| 1998 | 2.60 | 3.01 |
| 1999 | 2.89 | 3.31 |
| 2000 | 2.22 | 2.68 |
| 2001 | 2.01 | 2.51 |
| 2002 | 1.80 | 2.15 |

* 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 B

**Assessing the Trend in Risk-Adjusted Operative Mortality* Rates (1994-2002)**




SOURCE: NJ 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.

RAMR = Risk Adjusted Mortality Rate