Executive Summary

The California Coronary Artery Bypass Graft (CABG) Outcomes Reporting Program (CCORP), established in 2001, is the largest public reporting program on CABG surgery outcomes in the United States.

The *California Report on Coronary Artery Bypass Graft Surgery, 2011 Hospital Data* presents findings from analyses of data collected from 122 California-licensed hospitals that performed adult isolated CABG[1] surgery during 2011. The hospital results for risk-adjusted mortality, risk-adjusted readmissions and internal mammary artery utilization are based on 2011 data. The hospital results for risk-adjusted post-operative stroke are based on combined 2010 and 2011 data.

The three outcome measures (operative mortality, post-operative stroke, and hospital readmission) help patients, hospitals, physicians, and payers evaluate hospital performance. These measures are risk-adjusted, which is a statistical technique that enables fair comparison of hospital outcomes even though some hospitals treat sicker patients. In this report, operative mortality includes all deaths that occurred during the hospitalization in which the CABG surgery was performed (regardless of length of stay) and any deaths within 30 days after the surgery (no matter where the deaths occurred). Post-operative stroke is defined as a post-operative, central neurologic deficit that did not resolve within 24 hours. A readmission was counted only if the patient, within 30 days of being discharged from the hospital where the CABG was performed, was readmitted with a condition that was likely related to the CABG surgery. Readmissions for other reasons were excluded.

Additionally, this report provides 2011 hospital-level data on internal mammary artery (IMA)[2] usage, which is an important process measure of surgical quality. This report also compares statewide volume and mortality outcomes for two types of cardiac revascularization procedures: percutaneous coronary interventions (PCI) and CABG surgery. PCI is also known as angioplasty or balloon catheterization.

Key Findings

2011 Hospital Operative Mortality Findings:

- There were 249 operative deaths among 12,399 isolated CABG surgeries performed in 2011.
- The operative mortality rate for isolated CABG surgery in California was 2.01% in 2011 (compared to 2.00% in 2010). This represents a 31% reduction in the operative mortality rate since 2003 (2.91%), the first year of mandated public reporting.

[1] Isolated CABG surgery refers to heart bypass surgery without other major surgery, such as heart or lung transplantation, valve repair, etc., that was performed concurrently with the bypass procedure.

[2] The internal mammary artery (IMA) supplies blood to the front chest wall and the breasts. It is a paired artery, with one running on each side of the inner chest. Evidence shows that the IMA, when grafted to a coronary artery, is less susceptible to obstruction over time and remains fully open longer than vein grafts.

- There was significant[3] variation, from 0% to 8.18%, in hospital operative mortality rates after adjusting for patient pre-operative health. Despite such variation, 121 of 122 hospitals (99%) performed at a rate that did not differ significantly from the statewide average.

- No hospital performed significantly **"Better"** than the state average in terms of risk-adjusted operative mortality (Table 1), and one hospital performed **"Worse"** than the state average (Table 2).

2010-2011 Hospital Post-Operative Stroke Findings:

- 329 of the 24,947 patients (1.32%) who underwent isolated CABG surgery in 2010-2011 experienced a post-operative stroke; this is a slight increase since 2009-2010 (1.31%), and just below the national rate of 1.4% reported by the Society of Thoracic Surgeons.[4]

- There was wide variation in post-operative stroke rates among hospitals after adjusting for patient pre-operative health. Hospital risk-adjusted post-operative stroke rates ranged from 0% to 5.10% and 118 of 123 hospitals (96%) performed at a rate that did not differ significantly from the statewide average.

- One hospital performed **"Better"** than the state average (Table 1), and four hospitals performed **"Worse"** than the state average (Table 2).

2011 Hospital Readmission Findings:

- 1,438 of the 11,085 patients (12.97%) who underwent isolated CABG surgery in 2011 and were discharged alive experienced a hospital readmission within 30 days of the surgery. This represents a 1.4% reduction from the 2010 rate of 13.15%.

- There was wide variation in the readmission rates among hospitals performing CABG surgery after adjusting for patient pre-operative conditions. Hospital risk-adjusted readmission rates ranged from 0% to 33.05% and 116 of 122 hospitals (95%) performed at a rate that did not differ significantly from the statewide average.

- Two hospitals performed **"Better"** than the state average on hospital readmissions (Table 1), and four hospitals performed **"Worse"** than the state average (Table 2).

2011 Hospital Internal Mammary Artery (IMA) Usage Findings:

- The IMA is the preferred conduit for CABG surgery of the left anterior descending (LAD) artery. Hospitals with high rates of IMA use are providing high quality care to their patients. California hospitals had a 96.65% IMA usage rate in 2011 compared to 89.6% in 2003.[5]

---

[3] Significant refers to statistically significant with a less than 5% probability that the result is due to chance alone ($p<0.05$).

[4] Shahian DM, O'Brien SM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1—coronary artery bypass grafting surgery. *Ann Thorac Surg* 2009; 88:S2-22.

[5] The increase in the statewide IMA usage rate from 93.7% in 2007 to 95.9% in 2008, 96.2% in 2009, 96.0% in 2010, and 96.7% in 2011 is partly due to a change in the IMA measure. Beginning in 2008, patients who did not have the LAD bypassed were excluded from the denominator. If this exclusion were not used, the statewide IMA usage rate would be 94.4% for 2008, 94.8% for 2009, 94.7% for 2010, and 95.2% for 2011.

Five California hospitals had IMA usage rates that were significantly lower than the state average and were given **"Low"** performance ratings (Table 2). There is no consensus on what an optimal usage rate should be, so **"Better"** performance ratings were not given for very high rates of IMA usage. Those hospitals with **"Low"** performance ratings are listed in Table 2.

Table 1: Hospitals with **"Better"** Performance Ratings

HOSPITAL	REGION
Hospitals with "Better" Risk-Adjusted Post-Operative Stroke Rates, 2010-2011	
Sutter Memorial Hospital	Sacramento Valley & Northern California Region
Hospitals with "Better" Risk-Adjusted 30-Day Readmission Rates, 2011	
Regional Medical of San Jose	San Francisco Bay Area & San Jose
Santa Rosa Memorial Hospital	San Francisco Bay Area & San Jose

Table 2: Hospitals with **"Worse"** or **"Low"** Performance Ratings

HOSPITAL	REGION
Hospitals with "Worse" Risk-Adjusted Operative Mortality Rates, 2011	
AHMC Anaheim Regional Medical Center	Orange County
Hospitals with "Worse" Risk-Adjusted Post-Operative Stroke Rates, 2010-2011	
Seton Medical Center	San Francisco Bay Area & San Jose
Providence Tarzana Medical Center	San Fernando Valley, Antelope Valley, Ventura & Santa Barbara
Hoag Memorial Hospital Presbyterian	Orange County
Sharp Memorial Hospital	Greater San Diego
Hospitals with "Worse" Risk-Adjusted 30-Day Readmission Rates, 2011	
West Hills Hospital and Medical Center	San Fernando Valley, Antelope Valley, Ventura & Santa Barbara
Ronald Reagan UCLA Medical Center	Greater Los Angeles
White Memorial Medical Center	Greater Los Angeles
Saddleback Memorial Medical Center	Orange County
Hospitals with "Low" Internal Mammary Artery (IMA) Use Rates, 2011	
Marin General Hospital	San Francisco Bay Area & San Jose
Santa Rosa Memorial Hospital - Montgomery	San Francisco Bay Area & San Jose
Sutter Medical Center of Santa Rosa	San Francisco Bay Area & San Jose
Memorial Hospital Medical Center - Modesto	Central California
Palmdale Regional Medical Center	San Fernando Valley, Antelope Valley, Ventura & Santa Barbara

Percutaneous Coronary Intervention (PCI) vs. CABG Utilization and Outcomes Findings:

- **Volume**: Between 1997 and 2012, PCI (angioplasty/balloon catheterization) volume *decreased* by 3% (from 44,350 to 42,941) while isolated CABG surgeries decreased by 58% (from 28,178 to 11,725) and non-isolated CABG surgeries decreased by 20% (from 4,276 to 3,400). For the same time period, valve-only procedures increased by 68% (from 4,473 to 7,519).

- **Mortality**: Between 1997 and 2012, observed in-hospital mortality rates for isolated and non-isolated CABG surgeries decreased from 3.08% to 1.63% and from 9.66% to 6.06%, respectively. The observed in-hospital mortality for valve-only procedures decreased from 5.28% to 3.11%. However, the observed in-hospital mortality rate for PCIs increased from 1.70% to 2.41%, surpassing the in-hospital mortality rate for isolated CABG surgeries.