

**Technical Note**

**For**

**The California Report on  
Coronary Artery  
Bypass Graft Surgery 2013:  
Hospital Data**

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# Introduction

This technical note describes the research methods used to develop the California CABG Outcomes Reporting Program's (CCORP) eleventh report: *The California Report on Coronary Artery Bypass Graft (CABG) Surgery in California, 2013: Hospital Data*. This report is produced by the Office of Statewide Health Planning and Development (OSHPD) in compliance with California Health and Safety Code Sections 128745-128750 and can be found at: [OSHPD CABG Reports](#). See Appendix A for definitions of some of the technical terms used in this document.

## Hospital Performance Measures Reported

This report provides hospital performance data on five key measures of CABG surgery:  
*Outcome measures*

- Isolated CABG operative mortality
- CABG + valve operative mortality
- Post-operative stroke (isolated CABG)
- 30-day hospital readmission (isolated CABG)

*Process measure*

- Use of the internal mammary artery (isolated CABG)

The four outcome measures are risk-adjusted to account for variation in the health status of patients prior to CABG surgery.

## Measure Definitions:

**Operative mortality** is defined as a patient death occurring in the hospital after CABG surgery (regardless of the length of stay) or death occurring anywhere after hospital discharge but within 30 days of the CABG surgery. Use of operative mortality instead of in-hospital mortality avoids potential manipulation of outcomes through discharge practices and holds hospitals accountable for patients who died at home or in other facilities shortly after discharge. The National Quality Forum (NQF), which serves as the national body for vetting quality measures, has endorsed the national Society of Thoracic Surgeons (STS) operative mortality measure for CABG surgery.<sup>1</sup> CCORP uses the STS definition of operative mortality, and also verifies deaths following patient discharge using death records from the California Department of Public Health.

- *Isolated CABG surgery* is defined as CABG surgery performed on patients 18 years or older without other major procedures, such as valve repair or carotid endarterectomy, during the same surgery. A detailed definition of isolated CABG surgery can be found on pages 53-54 of the training manual: [http://oshpd.ca.gov/HID/SubmitData/CCORP\\_CABG/Training-Manual-2nd-half-2014.pdf](http://oshpd.ca.gov/HID/SubmitData/CCORP_CABG/Training-Manual-2nd-half-2014.pdf).
- *CABG + valve surgery* is defined as CABG surgery performed on patients 18 years or older that includes aortic valve replacement, mitral valve replacement or repair, or a combination thereof.

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<sup>1</sup> National Quality Forum (NQF). National voluntary consensus standards for quality measurement, Washington, DC: National Quality Forum. NQF updated in 2015 its endorsement of the risk-adjusted operative mortality for isolated CABG measure by STS (#0119), Details can be found at [NQF QPS](#).

**Post-operative stroke** is defined as a post-operative, central neurologic deficit that did not resolve within 24 hours after surgery.

**Hospital readmission** includes only those patients readmitted to any hospital within 30 days of being discharged after CABG surgery, who had a principal diagnosis indicating a heart-related condition or an infection or a complication that was likely related to the CABG surgery. Readmissions for other reasons are excluded in this analysis. California adopted the diagnosis categories and associated ICD-9-CM codes used by the Pennsylvania Healthcare Cost Containment Council for readmissions. OSHPD extends its thanks to the Council for making these available (Appendix B).

**Use of the internal mammary artery (IMA)** is the preferred method for CABG surgery of the left anterior descending artery. Research shows that high rates of IMA use result in long-term graft patency and improved patient survival.

## Data Quality Review and Verification

### Study Population

Under state law, California-licensed hospitals are required to report all isolated and non-isolated CABG surgeries to OSHPD. The study populations for the measures vary by data year and exclusion criteria (Table A).

**Table A. Study Populations Used in Measures (by Year, Exclusion Criteria, and Denominator)**

Measure	Study population	Data Year(s)
CABG Operative Mortality	Total number of isolated CABG cases without salvage operative status	2013
CABG + Valve Operative Mortality	Total number of aortic valve replacement, mitral valve repair or mitral valve replacement (or a combination) plus CABG cases without salvage operative status	2012-2013
Post-Operative Stroke	Total number of isolated CABG cases without salvage operative status	2012-2013
30-Day Hospital Readmission	Total number of isolated CABG cases, where the patient was discharged alive from the CABG-performing hospital and could be followed-up via hospital patient discharge data (PDD) 2013-2014. Patients in salvage operative status, patients who were transferred to acute care or patients who left against medical advice were excluded.	2013
Internal Mammary Artery Usage	First-time, non-cardiogenic shock, isolated CABG surgeries discharged in 2013 where the operative status was elective or urgent and the Left Anterior Descending (LAD) artery was bypassed	2013

Table B shows the distribution of CABG cases in 2012 and 2013. For 2012 and 2013, there were 30,739 adult CABG surgeries performed in California. Of these, 23,660 (77%) were isolated CABG surgeries and 7,079 (23%) were non-isolated CABG surgeries. The study population for most

outcomes in this report consists of all adult patients who underwent isolated CABG surgery and were discharged in 2013. However, to improve statistical power for CABG + valve cases and post-operative stroke results, the study population includes those patients who were discharged in 2012 or 2013.

**Table B. California CABG Surgery Volume, 2012-2013**

CABG Type	2012		2013		2012-2013 Combined	
	Cases	%	Cases	%	Cases	%
Isolated CABGs	11,720	77.1%	11,940	76.8%	23,660	77.0%
CABG + Valve	2,508	16.5%	2,642	17.0%	5,150	16.7%
Other Non-isolated CABGs	965	6.4 %	964	6.2%	1,929	6.3%
All CABGs	15,193	100%	15,546	100%	30,739	100%

\*Table excludes all CABG salvage cases.

**Data Sources**

The primary data source for this report is the 2012 and 2013 clinical data registry collected by CCORP from 125 hospitals. These data were linked to death records from the California Department of Public Health to identify patients who died at home or at facilities other than the operating hospital within 30 days following CABG surgery. These data were also linked to OSHPD’s Patient Discharge Data (PDD) to identify patients who were discharged alive, and were readmitted to a hospital within 30 days of CABG surgery.

The CCORP clinical data registry primarily consists of data elements from STS’s Adult Cardiac Surgery Database. However, it also includes a few data elements exclusive to CCORP. Although STS and CCORP data definitions are generally identical, CCORP provides additional clarifications to assist hospitals with coding. All data elements and their definitions can be found in the training manual at:

[http://oshpd.ca.gov/HID/SubmitData/CCORP\\_CABG/Training-Manual-2nd-half-2014.pdf](http://oshpd.ca.gov/HID/SubmitData/CCORP_CABG/Training-Manual-2nd-half-2014.pdf).

CCORP reviews the data submitted by each hospital for completeness and errors. Using a three-step data quality review and verification process, CCORP asks hospitals to check data quality, data discrepancies, and potential risk-factor coding problems.

**Step 1: Data Collection and Acceptance**

Hospitals report their data using CCORP’s online clinical data collection system, Cardiac Online Reporting for California (CORC). Automated data acceptance reports notify hospitals of invalid, missing and abnormally high or low data values. Data quality reports are also generated each time a hospital submits data. Hospitals review these summary reports before they adjust, finalize and certify their data submission.

**Step 2: Data Discrepancy Reports**

Data discrepancy reports compare the CCORP clinical registry data to OSHPD’s PDD file (the hospital administrative data record). Hospitals are asked to review and account for discrepancies between the two data sources via patient medical chart review to verify that 1) all

CABG surgeries discharged in 2013 were reported; 2) each CABG was accurately coded as isolated or non-isolated CABG surgery; 3) coding of *Discharge Status* was consistent; 4) *Resuscitation* occurred prior to CABG surgery; and 5) coding of post-operative complications (including strokes) was consistent.

### ***Step 3: Risk-Factor Coding Reports***

Risk-factor coding reports identify values that may be extreme by comparing the hospital reported prevalence rates in the current year to prior years and to administrative data from the PDD. CCORP requests hospitals to review and, when necessary, correct miscoded data elements.

### ***Hospital Medical Chart Audit***

After completing the data quality review and verification process, CCORP develops a preliminary risk model for operative mortality and post-operative stroke to help identify candidate hospitals for an on-site medical chart audit. Candidate selection for the 2013 audit was based on results of the preliminary model which identified “**Better**” or “**Worse**” hospital performers and on data quality reports that identified problems in over- and under-reporting of patient-risk factors. Additionally, a small number of hospitals were randomly selected for audit.

The 2013 audit included 18 hospitals and a total of 1,250 patient records (14.4% of 125 hospitals and approximately 8% of all CABG surgery cases in 2013). On-site medical chart reviews were conducted by trained, independent auditors under contract with OSHPD. All hospital deaths and post-operative strokes at selected hospitals were audited and high-risk patients, based on predicted mortality, were sampled at a higher rate. The number of patient records selected within a hospital was proportional to the isolated CABG volume of the hospital, but generally ranged from 40 to 160 cases. If a selected hospital performed fewer than 40 isolated CABG surgeries per year, all surgeries were audited. Individual audit summary reports were sent to each hospital for review and comment.

## Risk Model for Adjusting Hospital CABG Operative Mortality Rates, 2013

This section explains the development and validation of CCORP's risk model that accounts for the variation in patient severity of illness for hospital operative mortality. CCORP used a multivariable logistic regression model to estimate the relationship between each of the demographic and pre-operative risk factors and the probability of operative mortality.

To develop the risk model for hospital mortality rates, the 11,940 isolated (non-salvage) CABG surgery cases in 2013 were evaluated for missing data; 11,865 cases had no missing data in any field and were used for risk model parameter estimation. The 75 (0.6%) isolated CABG cases with missing data fields were removed to ensure that the effects of risk factors were estimated based on the most complete data available.

To generate the hospital specific results shown in this report, missing values for these 75 records were imputed (after risk model parameter estimation) by replacing them with the lowest risk category of the same variable (e.g., *Chronic Lung Disease = none*). CCORP assigned the lowest risk value for the following reasons: 1) some hospitals leave data fields blank by design when the risk factor is absent or the value is normal; 2) this approach maintains consistency with other major cardiac reporting programs that replace missing data with the lowest-risk or normal value; and 3) this approach creates an incentive for more complete reporting by hospitals. After imputing the missing values, the parameters of the risk model were applied to all cases to estimate each patient's probability of death. CCORP summed these probabilities to estimate the expected mortality for each hospital. The risk model, based on the 2013 data, is presented in Table C-1 with statistically significant risk factors identified in bolded text.

**Table C-1: Logistic Regression Risk Model for CABG Operative Mortality, 2013**

Risk Factor		Coefficient	Standard Error	P-value	Odds Ratio
Intercept		-8.272	0.653	<.0001	
<b>Age (Years)</b>		<b>0.033</b>	<b>0.007</b>	<b>&lt;.0001</b>	<b>1.034</b>
Gender	Male	Reference			
	<b>Female</b>	<b>0.667</b>	<b>0.135</b>	<b>&lt;.0001</b>	<b>1.949</b>
Race	White	Reference			
	Non-White	0.000	0.137	0.999	1.000
Body Mass Index	18.5-39.9	Reference			
	<18.5	-0.156	0.601	0.796	0.856
	>=40.0	0.468	0.283	0.098	1.596
Status of the Procedure	Elective	Reference			
	Urgent	0.233	0.177	0.189	1.262
	<b>Emergent</b>	<b>0.967</b>	<b>0.317</b>	<b>0.002</b>	<b>2.631</b>
<b>Last Creatinine Level (mg/dl)</b>		<b>1.176</b>	<b>0.178</b>	<b>&lt;.0001</b>	<b>3.240</b>
Hypertension		0.483	0.270	0.074	1.620
<b>Peripheral Arterial Disease</b>		<b>0.347</b>	<b>0.159</b>	<b>0.029</b>	<b>1.415</b>
Cerebrovascular Disease		0.176	0.246	0.473	1.193

**Table C-1: Logistic Regression Risk Model for CABG Operative Mortality, 2013**

Risk Factor		Coefficient	Standard Error	P-value	Odds Ratio
Cerebrovascular Accident (CVA)Timing	No CVA	Reference			
	> 2 weeks	0.260	0.284	0.359	1.297
	<= 2 weeks	1.308	0.709	0.065	3.700
Chronic Lung Disease	None/Mild/Moderate	Reference			
	<b>Severe</b>	<b>0.557</b>	<b>0.232</b>	<b>0.016</b>	<b>1.745</b>
Immunocompromise		0.419	0.299	0.161	1.520
<b>Atrial Fibrillation/Flutter</b>		<b>0.478</b>	<b>0.171</b>	<b>0.005</b>	<b>1.612</b>
Third Degree Heart Block		0.373	0.521	0.474	1.452
Sustained VT/VF		0.261	0.267	0.328	1.298
Timing of Myocardial Infarction (MI)	No MI	Reference			
	<b>21 or more days</b>	<b>0.403</b>	<b>0.202</b>	<b>0.046</b>	<b>1.497</b>
	<b>8-20 days ago</b>	<b>0.636</b>	<b>0.244</b>	<b>0.009</b>	<b>1.889</b>
	1-7 days ago	0.352	0.182	0.053	1.422
	<b>Within 24 Hours</b>	<b>0.676</b>	<b>0.293</b>	<b>0.021</b>	<b>1.965</b>
<b>Cardiogenic Shock</b>		<b>1.050</b>	<b>0.331</b>	<b>0.002</b>	<b>2.856</b>
Heart Failure		-0.029	0.178	0.872	0.972
NYHA Classification	I,II, or III	Reference			
	IV	0.069	0.220	0.753	1.072
Prior Cardiac Surgery	None	Reference			
	<b>One or more</b>	<b>0.940</b>	<b>0.270</b>	<b>0.001</b>	<b>2.560</b>
Interval from Prior PCI to Surgery	No Prior PCI	Reference			
	Prior PCI > 6 HRS	0.102	0.151	0.499	1.107
	<b>Prior PCI &lt;= 6 HRS</b>	<b>0.809</b>	<b>0.346</b>	<b>0.019</b>	<b>2.246</b>
<b>Ejection Fraction (%)</b>		<b>-0.018</b>	<b>0.005</b>	<b>0.001</b>	<b>0.983</b>
Left Main Disease ( $\geq 50\%$ )		0.257	0.132	0.052	1.293
Number of Diseased Vessels	None, One, or Two	Reference			
	Three or more	-0.257	0.149	0.084	0.773
Mitral Insufficiency	None/Trivial/Mild	Reference			
	Moderate/Severe	0.297	0.194	0.125	1.346

**Bolded text** indicates statistical significance.

Note: "Last Creatinine Level" and "Ejection Fraction" were modeled using piecewise linear transformations.

### Discrimination of Risk Model for CABG Operative Mortality

A commonly used measure of discrimination is the C-statistic, also known as the area under the Receiver Operating Characteristic (ROC) curve. For all possible pairs of patients, where one dies

and the other survives surgery, the C-statistic describes the proportion of pairs where the patient who died had a higher predicted risk of death than the patient who lived.

C-statistics range from 0.5 to 1, with higher values indicating better discrimination. For the 2013 risk model, the C-statistic was 0.796. In recently published CABG surgery mortality reports by other states (New Jersey, New York, and Pennsylvania), the C-statistics ranged from 0.791 to 0.836.

### Calibration of Risk Model for CABG Operative Mortality

A common measure of calibration is the Hosmer-Lemeshow  $\chi^2$  test, which compares observed and predicted outcomes over deciles of risk. The p-value of the Hosmer-Lemeshow test statistic for this 2013 risk model is 0.483, indicating there were no significant differences between observed and predicted outcomes over deciles of risk.

A second calibration test sorts the data into 10 risk groups and compares the observed deaths with the predicted deaths. As presented in Table C-2, Risk Group 10 shows the patients in the highest risk group. Among the 1,179 patients in Group 10, 121 patients died, and the model predicted 121.9 patient deaths. Assuming a Poisson distribution for a binary outcome, the predicted range of deaths for Risk Group 10 is 100.3 to 143.6. The observed number of 121 deaths falls within the range of predicted deaths. In fact, none of the ten risk groups had significantly fewer or significantly more deaths than were predicted by the model.

**Table C-2: Calibration of Risk Model for CABG Operative Mortality, 2013**

Risk Group	Isolated CABG Cases	Observed Deaths	Predicted Deaths	Difference	95%CI of Predicted Deaths
1	1,187	2	3.9	1.9	(0.0, 7.8)
2	1,188	6	6.1	0.1	(1.3, 10.9)
3	1,187	9	8.0	-1.0	(2.4, 13.5)
4	1,188	6	10.1	4.1	(3.9, 16.3)
5	1,188	13	12.6	-0.4	(5.7, 19.6)
6	1,187	20	16.0	-4.0	(8.2, 23.8)
7	1,187	15	20.9	5.9	(11.9, 29.9)
8	1,187	27	28.6	1.6	(18.1, 39.0)
9	1,187	53	43.9	-9.1	(30.9, 56.9)
10	1,179	121	121.9	0.9	(100.3, 143.6)
<b>Total</b>	<b>11,865</b>	<b>272</b>	<b>272.0</b>	<b>0</b>	

Note: Risk Group 1 is at lowest risk for mortality and Risk Group 10 is at highest risk.

### Process for Calculating Hospital Risk-Adjusted CABG Mortality Rates and Performance Ratings

The risk-adjusted mortality rate (RAMR) is computed by dividing the provider’s observed mortality by the provider’s expected mortality (based on the risk model) to get the observed/expected (O/E) ratio. The O/E ratio is then multiplied by the statewide average mortality rate (2.29% in 2013) to obtain the provider’s RAMR.

However, because a provider's point estimate of the RAMR can be attributed to chance, the performance rating is not based on a point estimate of the RAMR, but a comparison of the 95% confidence interval (CI) of each provider's RAMR to the statewide mortality rate.<sup>2</sup> CCORP treated the 2013 data as a sample, and inferred a range within which each provider's true performance was likely to fall. As shown in Table C-3, a provider's performance rating is "**Better**" if the upper 95% CI of a provider's risk-adjusted mortality is below the state average mortality rate (indicating the provider's RAMR is significantly lower than the state average.) A provider's performance rating is "**Worse**" if the lower 95% CI of a provider's RAMR is above the state average mortality rate (indicating the provider's risk-adjusted mortality is significantly higher than the state average.) If the state average mortality rate is within the 95% CI of a provider's RAMR, then the performance rating is "**Average.**"

### **Hospital Operative Mortality Results, 2013**

Among the 11,940 isolated (non-salvage) CABG surgeries performed at 125 hospitals in 2013, 273 patients died either in-hospital or within 30 days of the surgery date, reflecting a statewide operative mortality rate of 2.29%. The *observed* mortality rates among hospitals ranged from 0% to 14.00%. The *expected* mortality rates, which are generated by the risk model and account for patient severity-of-illness, were between 1.03% and 5.24%. The RAMR ranged from 0% to 10.42%.

Based on the 95% confidence intervals for RAMR, all of the eligible hospitals performed within the expected range when compared to the statewide mortality rate (Table C-3)<sup>3</sup>.

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<sup>2</sup> CCORP uses the Poisson Exact Probability method to compute the 95% confidence interval for the risk-adjusted mortality rate. (Buchan, Iain, *Calculating Poisson Confidence Interval in Excel*, January 2004).

<sup>3</sup> One hospital, John Muir Medical Center – Walnut Creek Campus, performed only one non-isolated CABG surgery in 2013 and, therefore, was ineligible to receive a performance rating.

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>Sacramento Valley &amp; Northern California Region</b>	Enloe Medical Center – Esplanade Campus	140	121	4	3.31	2.05	3.68	(1.00, 9.44)	Average
	Mercy General Hospital	690	436	6	1.38	2.27	1.39	(0.51, 3.03)	Average
	Mercy Medical Center – Redding	121	100	2	2.00	3.07	1.49	(0.18, 5.39)	Average
	Mercy San Juan Hospital	125	80	2	2.50	2.38	2.41	(0.29, 8.70)	Average
	Rideout Memorial Hospital	89	74	5	6.76	2.81	5.50	(1.79, 12.85)	Average
	Saint Joseph Hospital – Eureka	30	20	0	0.00	1.51	0.00	(0.00, 27.96)	Average
	Shasta Regional Medical Center †	89	81	4	4.94	2.37	4.77	(1.30, 12.22)	Average
	Sutter Memorial Hospital	481	331	4	1.21	2.17	1.28	(0.35, 3.27)	Average
	UC Davis Medical Center	171	116	4	3.45	2.02	3.90	(1.06, 10.01)	Average
<b>San Francisco Bay Area &amp; San Jose</b>	Alta Bates Summit Medical Center – Summit Campus – Hawthorne	156	121	2	1.65	2.15	1.76	(0.21, 6.37)	Average
	California Pacific Medical Center – Pacific Campus	87	68	2	2.94	1.70	3.97	(0.48, 14.35)	Average
	Community Hospital of the Monterey Peninsula	103	72	0	0.00	1.46	0.00	(0.00, 8.05)	Average
	Dominican Hospital – Santa Cruz/Soquel	75	64	0	0.00	2.74	0.00	(0.00, 4.82)	Average
	El Camino Hospital	96	66	2	3.03	2.85	2.43	(0.29, 8.79)	Average
	Good Samaritan Hospital – San Jose	87	67	3	4.48	3.01	3.41	(0.70, 9.97)	Average
	John Muir Medical Center – Concord Campus	245	207	1	0.48	2.06	0.54	(0.01, 2.99)	Average
	John Muir Medical Center – Walnut Creek Campus	1	0	.	.	.	.	.	Not Available**

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	Kaiser Foundation Hospital – San Francisco	440	338	9	2.66	1.51	4.02	(1.84, 7.64)	Average
	Kaiser Foundation Hospital – Santa Clara	337	249	2	0.80	2.29	0.80	(0.10, 2.90)	Average
	Marin General Hospital	34	32	0	0.00	1.03	0.00	(0.00, 25.52)	Average
	North Bay Medical Center	56	49	1	2.04	2.58	1.81	(0.05, 10.07)	Average
	O'Connor Hospital – San Jose	39	30	3	10.00	4.43	5.17	(1.07, 15.12)	Average
	Peninsula Medical Center	48	38	1	2.63	1.70	3.55	(0.09, 19.79)	Average
	Queen of the Valley Hospital – Napa	64	51	4	7.84	2.69	6.66	(1.82, 17.09)	Average
	Regional Medical of San Jose	85	71	2	2.82	5.24	1.23	(0.15, 4.45)	Average
	Saint Helena Hospital	90	69	4	5.80	2.74	4.84	(1.32, 12.40)	Average
	Saint Mary's Medical Center, San Francisco	23	17	0	0.00	2.02	0.00	(0.00, 24.55)	Average
	Salinas Valley Memorial Hospital	97	85	4	4.71	2.45	4.39	(1.20, 11.26)	Average
	San Ramon Regional Medical Center	25	19	0	0.00	1.21	0.00	(0.00, 36.80)	Average
	Santa Clara Valley Medical Center	88	68	0	0.00	1.19	0.00	(0.00, 10.45)	Average
	Santa Rosa Memorial Hospital – Montgomery	89	73	2	2.74	3.02	2.07	(0.25, 7.49)	Average
	Sequoia Hospital	79	45	2	4.44	3.52	2.89	(0.35, 10.44)	Average
	Seton Medical Center	66	57	2	3.51	3.18	2.52	(0.31, 9.12)	Average
Stanford Hospital	122	87	1	1.15	1.51	1.74	(0.04, 9.68)	Average	
Sutter Medical Center of Santa Rosa	65	54	2	3.70	1.35	6.25	(0.76, 22.61)	Average	

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	UC San Francisco Medical Center	94	76	1	1.32	1.56	1.92	(0.05, 10.74)	Average
	Valleycare Medical Center	35	23	0	0.00	3.47	0.00	(0.00, 10.58)	Average
	Washington Hospital – Fremont	118	112	3	2.68	2.67	2.30	(0.47, 6.72)	Average
<b>Central California</b>	Bakersfield Heart Hospital	90	79	3	3.80	2.11	4.11	(0.85, 12.04)	Average
	Bakersfield Memorial Hospital	160	128	2	1.56	2.88	1.24	(0.15, 4.48)	Average
	Community Regional Medical Center – Fresno	264	213	4	1.88	2.45	1.75	(0.48, 4.49)	Average
	Dameron Hospital	48	44	2	4.55	2.41	4.30	(0.52, 15.57)	Average
	Doctors Medical Center	246	190	7	3.68	3.10	2.72	(1.09, 5.61)	Average
	Emanuel Medical Center, Inc.	50	47	0	0.00	3.27	0.00	(0.00, 5.49)	Average
	Fresno Heart and Surgical Hospital	160	135	5	3.70	2.84	2.99	(0.97, 6.98)	Average
	Kaweah Delta Medical Center	185	162	3	1.85	1.99	2.13	(0.44, 6.22)	Average
	Marian Regional Medical Center	65	52	0	0.00	2.33	0.00	(0.00, 6.99)	Average
	Memorial Hospital Medical Center – Modesto	184	156	4	2.56	2.57	2.28	(0.62, 5.84)	Average
	Saint Agnes Medical Center	275	217	2	0.92	1.94	1.08	(0.13, 3.92)	Average
	Saint Joseph's Medical Center of Stockton	229	190	7	3.68	2.72	3.10	(1.25, 6.40)	Average
San Joaquin Community Hospital	79	69	1	1.45	2.31	1.43	(0.04, 8.00)	Average	

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara</b>	Antelope Valley Hospital	20	20	2	10.00	3.85	5.93	(0.72, 21.47)	Average
	Community Memorial Hospital – San Buenaventura	88	70	1	1.43	3.02	1.08	(0.03, 6.04)	Average
	French Hospital Medical Center	123	88	1	1.14	1.95	1.33	(0.03, 7.44)	Average
	Glendale Adventist Medical Center – Wilson Terrace	149	127	5	3.94	1.77	5.09	(1.66, 11.90)	Average
	Glendale Memorial Hospital and Medical Center	128	108	3	2.78	2.41	2.64	(0.54, 7.72)	Average
	Los Robles Hospital and Medical Center	101	74	0	0.00	3.08	0.00	(0.00, 3.71)	Average
	Northridge Hospital Medical Center	71	63	2	3.17	2.51	2.89	(0.35, 10.45)	Average
	Palmdale Regional Medical Center	10	10	0	0.00	1.95	0.00	(0.00, 43.24)	Average
	Providence Holy Cross Medical Center	50	40	1	2.50	2.56	2.23	(0.06, 12.44)	Average
	Providence Saint Joseph Medical Center	63	48	0	0.00	1.44	0.00	(0.00, 12.24)	Average
	Providence Tarzana Medical Center	68	52	1	1.92	2.74	1.61	(0.04, 8.97)	Average
	Saint John’s Regional Medical Center	77	56	1	1.79	2.61	1.56	(0.04, 8.73)	Average
	Santa Barbara Cottage Hospital	101	77	0	0.00	1.90	0.00	(0.00, 5.77)	Average
	Valley Presbyterian Hospital	44	41	2	4.88	1.76	6.35	(0.77, 22.96)	Average
West Hills Hospital and Medical Center	51	44	0	0.00	2.90	0.00	(0.00, 6.62)	Average	

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>Greater Los Angeles</b>	Beverly Hospital	30	28	1	3.57	2.38	3.43	(0.09, 19.12)	Average
	California Hospital Medical Center – Los Angeles	33	32	0	0.00	2.52	0.00	(0.00, 10.48)	Average
	Cedars Sinai Medical Center	220	130	1	0.77	1.70	1.03	(0.03, 5.76)	Average
	Centinela Hospital Medical Center	31	25	3	12.00	2.63	10.42	(2.15, 30.50)	Average
	Citrus Valley Medical Center – Inter Community Campus	107	89	2	2.25	2.59	1.99	(0.24, 7.19)	Average
	Downey Regional Medical Center	66	63	1	1.59	1.83	1.99	(0.05, 11.09)	Average
	Garfield Medical Center	132	107	1	0.93	1.61	1.33	(0.03, 7.40)	Average
	Good Samaritan Hospital – Los Angeles	111	88	2	2.27	2.29	2.27	(0.28, 8.20)	Average
	Henry Mayo Newhall Memorial Hospital	19	13	0	0.00	3.14	0.00	(0.00, 20.66)	Average
	Hollywood Presbyterian Medical Center	50	47	2	4.26	2.47	3.93	(0.48, 14.23)	Average
	Huntington Memorial Hospital	97	66	0	0.00	1.89	0.00	(0.00, 6.77)	Average
	Kaiser Foundation Hospital – Sunset	657	502	9	1.79	1.76	2.33	(1.07, 4.43)	Average
	Keck Hospital of University of Southern California	136	62	3	4.84	1.94	5.70	(1.18, 16.69)	Average
	Lakewood Regional Medical Center	89	79	4	5.06	2.95	3.93	(1.07, 10.07)	Average
	Long Beach Memorial Medical Center	187	157	7	4.46	2.63	3.88	(1.56, 8.00)	Average
Los Angeles County/Harbor – UCLA Medical Center	95	82	4	4.88	1.43	7.80	(2.13, 20.00)	Average	

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>Greater Los Angeles (continued)</b>	Los Angeles County/University of Southern California Medical Center	123	97	0	0.00	1.09	0.00	(0.00, 7.99)	Average
	Methodist Hospital of Southern California	56	45	0	0.00	2.38	0.00	(0.00, 7.87)	Average
	Presbyterian Intercommunity Hospital	150	67	0	0.00	2.85	0.00	(0.00, 4.43)	Average
	Providence Little Company of Mary Medical Center – Torrance	117	79	2	2.53	2.42	2.39	(0.29, 8.65)	Average
	Ronald Reagan UCLA Medical Center	211	109	1	0.92	2.23	0.94	(0.02, 5.26)	Average
	Saint Francis Medical Center	28	25	1	4.00	1.59	5.75	(0.15, 32.10)	Average
	Saint John's Health Center	60	41	3	7.32	2.94	5.69	(1.17, 16.65)	Average
	Saint Mary Medical Center	60	52	1	1.92	3.58	1.23	(0.03, 6.86)	Average
	Saint Vincent Medical Center	74	65	4	6.15	2.51	5.60	(1.53, 14.37)	Average
	Torrance Memorial Medical Center	58	38	1	2.63	2.03	2.97	(0.08, 16.57)	Average
White Memorial Medical Center	51	47	0	0.00	2.14	0.00	(0.00, 8.41)	Average	
<b>Inland Empire, Riverside &amp; San Bernardino</b>	Desert Regional Medical Center	127	103	2	1.94	2.07	2.15	(0.26, 7.76)	Average
	Desert Valley Hospital	38	31	1	3.23	3.00	2.46	(0.06, 13.71)	Average
	Eisenhower Medical Center	167	132	3	2.27	3.23	1.61	(0.33, 4.71)	Average
	Loma Linda University Medical Center	244	179	4	2.23	2.71	1.88	(0.51, 4.83)	Average
	Loma Linda University Medical Center – Murrieta	110	95	1	1.05	3.17	0.76	(0.02, 4.23)	Average

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>Inland Empire, Riverside &amp; San Bernardino (continued)</b>	Pomona Valley Hospital Medical Center	118	103	2	1.94	2.69	1.65	(0.20, 5.98)	Average
	Riverside Community Hospital	213	160	7	4.38	2.48	4.03	(1.62, 8.31)	Average
	Saint Bernardine Medical Center	546	457	14	3.06	1.90	3.69	(2.02, 6.21)	Average
	Saint Mary Regional Medical Center	131	114	4	3.51	2.25	3.57	(0.97, 9.14)	Average
	San Antonio Community Hospital	184	139	1	0.72	2.24	0.73	(0.02, 4.10)	Average
<b>Orange County</b>	AHMC Anaheim Regional Medical Center	144	116	2	1.72	2.76	1.43	(0.17, 5.16)	Average
	Fountain Valley Regional Hospital and Medical Center – Euclid	109	97	2	2.06	2.66	1.77	(0.22, 6.42)	Average
	Hoag Memorial Hospital Presbyterian	236	152	3	1.97	2.56	1.76	(0.36, 5.16)	Average
	Mission Hospital Regional Medical Center	137	108	1	0.93	2.43	0.87	(0.02, 4.87)	Average
	Orange Coast Memorial Medical Center	89	74	0	0.00	1.51	0.00	(0.00, 7.54)	Average
	Saddleback Memorial Medical Center	102	82	0	0.00	2.07	0.00	(0.00, 4.98)	Average
	Saint Joseph Hospital – Orange	121	86	3	3.49	2.02	3.94	(0.81, 11.53)	Average
	Saint Jude Medical Center	91	77	0	0.00	3.42	0.00	(0.00, 3.21)	Average
	UC Irvine Medical Center	56	46	1	2.17	2.00	2.48	(0.06, 13.84)	Average
	West Anaheim Medical Center	26	26	2	7.69	2.10	8.38	(1.02, 30.31)	Average
	Western Medical Center – Anaheim	62	56	1	1.79	1.94	2.10	(0.05, 11.71)	Average

**Table C-3: Hospital Risk-Adjusted CABG Operative Mortality Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Mortality	Observed Mortality Rate (%)	Expected Mortality Rate (%)	Risk-Adjusted Mortality Rate (%RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>11,940</b>	<b>273</b>	<b>2.29</b>				
<b>Orange County (continued)</b>	Western Medical Center – Santa Ana	86	75	1	1.33	2.18	1.40	(0.04, 7.80)	Average
<b>Greater San Diego</b>	Alvarado Hospital	46	37	2	5.41	2.25	5.50	(0.67, 19.89)	Average
	Grossmont Hospital	151	123	6	4.88	2.72	4.11	(1.51, 8.95)	Average
	Palomar Health Downtown Campus	50	44	1	2.27	2.44	2.13	(0.05, 11.87)	Average
	Scripps Green Hospital	55	31	0	0.00	1.35	0.00	(0.00, 20.17)	Average
	Scripps Memorial Hospital – La Jolla	330	233	1	0.43	2.19	0.45	(0.01, 2.50)	Average
	Scripps Mercy Hospital	150	124	1	0.81	1.74	1.06	(0.03, 5.92)	Average
	Sharp Chula Vista Medical Center	115	78	4	5.13	1.80	6.53	(1.78, 16.74)	Average
	Sharp Memorial Hospital	183	119	2	1.68	1.57	2.45	(0.30, 8.86)	Average
	Tri-City Medical Center – Oceanside	80	60	3	5.00	1.74	6.55	(1.35, 19.18)	Average
	UC San Diego Health – Sulpizio Cardiovascular Center	142	81	2	2.47	1.70	3.33	(0.40, 12.03)	Average

\*A hospital is classified as **“Better”** if the upper 95% CI of the RAMR falls below the California observed mortality rate (2.11%). A hospital is classified as **“Worse”** if the lower 95% CI of the RAMR is higher than the California observed mortality rate. A hospital’s performance is considered **“Average”** if the statewide average mortality rate falls within the 95% CI of a hospital’s RAMR.

\*\*Not Available: Hospital results are not shown because data necessary to confirm deaths and readmissions were not available.

† Hospitals submitted statements regarding this report. See Appendix C for their statements.

## Risk Model for Adjusting Hospital CABG + Valve Operative Mortality Rates, 2012-2013

Performance ratings for hospitals executing CABG + valve surgery are based on surgeries performed in 2012 or 2013 that combined CABG and aortic valve replacement, mitral valve repair or mitral valve replacement procedures. These surgeries excluded those patients in salvage operative status.

To develop the risk model for hospital CABG + valve operative mortality, the 5,150 CABG + valve cases in 2012-2013 were evaluated for missing data; 5,111 cases had no missing data in any field and were used for the risk model parameter estimation. The 39 (0.8%) CABG + valve cases with missing data fields were removed to ensure that the effects of risk factors were estimated based on the most complete data available.

To generate the hospital specific results shown in this report, missing values for these 39 records were imputed (after risk model parameter estimation) by replacing them with the lowest risk category of the same variable (e.g., *Chronic Lung Disease = none*). The risk model, based on the 2012-2013 data, is presented in Table D-1 with statistically significant risk factors identified in bolded text.

**Table D-1: Logistic Regression Risk Model for CABG + Valve Operative Mortality, 2012-2013**

Risk Factor		Coefficient	Standard Error	P-value	Odds Ratio
Intercept		-6.952	0.742	<.0001	
Surgery Type	AVR+CABG	Reference			
	MV Repair+CABG	-0.303	0.221	0.171	0.739
	MV Replacement+CABG	0.070	0.236	0.765	1.073
	<b>AVR+MVR+CABG</b>	<b>0.751</b>	<b>0.227</b>	<b>0.001</b>	<b>2.119</b>
<b>Age (Years)</b>		<b>0.028</b>	<b>0.007</b>	<b>0.000</b>	<b>1.028</b>
Gender	Male	Reference			
	<b>Female</b>	<b>0.392</b>	<b>0.135</b>	<b>0.004</b>	<b>1.480</b>
Race	White	Reference			
	Non-White	0.173	0.138	0.210	1.189
Body Mass Index	18.5-39.9	Reference			
	<18.5	0.080	0.453	0.860	1.083
	>=40.0	0.379	0.318	0.234	1.460
Status of the Procedure	Elective	Reference			
	<b>Urgent</b>	<b>0.329</b>	<b>0.149</b>	<b>0.027</b>	<b>1.389</b>
	<b>Emergent</b>	<b>1.071</b>	<b>0.377</b>	<b>0.005</b>	<b>2.918</b>
<b>Last Creatinine Level (mg/dl)</b>		<b>0.662</b>	<b>0.303</b>	<b>0.029</b>	<b>1.938</b>
Hypertension		0.160	0.215	0.456	1.173
Peripheral Arterial Disease		0.077	0.156	0.623	1.080
Cerebrovascular Disease		0.139	0.191	0.467	1.149

**Table D-1: Logistic Regression Risk Model for CABG + Valve Operative Mortality, 2012-2013**

Risk Factor		Coefficient	Standard Error	P-value	Odds Ratio	
Diabetes Control	No Diabetes	Reference				
	Non-Insulin	0.075	0.142	0.598	1.078	
	Insulin	0.170	0.186	0.360	1.186	
Chronic Lung Disease	None/Mild/Moderate	Reference				
	Severe	0.393	0.212	0.064	1.482	
<b>Immunocompromise</b>		<b>0.617</b>	<b>0.238</b>	<b>0.009</b>	<b>1.853</b>	
<b>Dialysis</b>		<b>0.666</b>	<b>0.278</b>	<b>0.017</b>	<b>1.946</b>	
Atrial Fibrillation/Flutter		0.258	0.145	0.075	1.295	
Third Degree Heart Block		0.306	0.583	0.600	1.358	
Timing of Myocardial Infarction (MI)	No MI	Reference				
	21 or more days	-0.036	0.179	0.842	0.965	
	8-20 days ago	-0.283	0.298	0.342	0.754	
	1-7 days ago	0.048	0.194	0.804	1.049	
	<b>Within 24 Hours</b>	<b>1.005</b>	<b>0.384</b>	<b>0.009</b>	<b>2.731</b>	
<b>Cardiogenic Shock</b>		<b>1.698</b>	<b>0.562</b>	<b>0.003</b>	<b>5.464</b>	
NYHA Classification	I,II, or III	Reference				
	<b>IV</b>	<b>0.604</b>	<b>0.155</b>	<b>&lt;.0001</b>	<b>1.830</b>	
Prior Cardiac Surgery	None	Reference				
	<b>One or more</b>	<b>0.523</b>	<b>0.233</b>	<b>0.025</b>	<b>1.687</b>	
Previous Valve Surgery		-0.473	0.387	0.221	0.623	
Ejection Fraction (%)		-0.003	0.005	0.576	0.997	
Left Main Disease ( $\geq 50\%$ )		0.106	0.152	0.486	1.112	
Number of Diseased Vessels	None, One, or Two	Reference				
	<b>Three or more</b>	<b>0.394</b>	<b>0.140</b>	<b>0.005</b>	<b>1.482</b>	
Mitral Insufficiency	None/Trivial/Mild	Reference				
	Moderate/Severe	0.023	0.171	0.894	1.023	
Infectious Endocarditis		0.293	0.338	0.385	1.341	
MELD Score		$\geq 10$ vs. $<10$	0.302	0.163	0.064	1.353
Interaction between Surgery Type and Cardiogenic Shock	AVR+CABG with Shock	Reference				
	MV Repair+CABG with Shock	<b>-1.718</b>	<b>0.802</b>	<b>0.032</b>	<b>0.179</b>	
	<b>MV Replacement+CABG with Shock</b>	<b>-2.261</b>	<b>0.804</b>	<b>0.005</b>	<b>0.104</b>	
	AVR and MVR+CABG with Shock	-1.315	1.376	0.339	0.268	

MELD: Model for End-Stage Liver Disease.

**Bolded text** indicates statistically significant.

Note: Last Creatinine level and Ejection Fraction were modeled using piecewise linear transformations.

### Discrimination of Risk Model for CABG + Valve Operative Mortality

Discrimination methods are explained in the section for isolated CABG operative mortality. For the 2012-2013 risk model, the C-statistic was 0.755. In recently published CABG + valve surgery mortality reports by the STS, the C-statistic was 0.75 (Ann Thorac Surg 2009;88:S43–62).

### Calibration of Risk Model for CABG + Valve Operative Mortality

Calibration methods are explained in the section for isolated CABG operative mortality. The p-value of the Hosmer-Lemeshow test statistic for this 2012-2013 risk model is 0.965, indicating there were no significant differences between observed and predicted outcomes over deciles of risk.

As presented in Table D-2, Risk Group 10 shows the patients in the highest risk group. Among the 512 patients in Group 10, 114 patients died, and the model predicted 114.3 patient deaths. Assuming a Poisson distribution for a binary outcome, the predicted range of deaths for Risk Group 10 is 93.3 to 135.2. The observed number of 114 deaths falls within the range of predicted deaths. In fact, none of the ten risk groups had significantly fewer or significantly more deaths than were predicted by the model.

**Table D-2: Calibration of Risk Model for CABG + Valve Operative Mortality, 2012-2013**

Risk Group	CABG Cases	Observed Deaths	Predicted Deaths	Difference	95%CI of Predicted Deaths
1	511	7	6.8	-0.2	(1.7, 11.9)
2	511	9	9.9	0.9	(3.7, 16.0)
3	511	9	12.3	3.3	(5.4, 19.1)
4	511	13	14.8	1.8	(7.3, 22.3)
5	511	20	17.5	-2.5	(9.3, 25.7)
6	511	21	21.1	0.1	(12.1, 30.1)
7	511	27	26.1	-0.9	(16.1, 36.1)
8	511	35	34.6	-0.4	(23.1, 46.1)
9	511	52	49.7	-2.3	(35.9, 63.6)
10	512	114	114.3	0.3	(93.3, 135.2)
<b>Total</b>	<b>5,111</b>	<b>307</b>	<b>307.0</b>	<b>0</b>	

Note: Risk Group 1 is at lowest risk for mortality and Risk Group 10 is at highest risk.

### Process for Calculating Hospital Risk-Adjusted CABG + Valve Mortality Rates and Performance Rating

The RAMR is computed by dividing the provider’s observed mortality by the provider’s expected mortality (based on the risk model) to get the observed/expected (O/E) ratio. The O/E ratio is then multiplied by the statewide average mortality rate (6.00% in 2012-2013) to obtain the provider’s RAMR.

However, because a provider’s point estimate of the RAMR can be attributed to chance, the performance rating is not based on the point estimate of the RAMR, but a comparison of the 95% CI of each provider’s RAMR to the statewide mortality rate.<sup>4</sup> CCORP treated the 2012-2013 data as a

<sup>4</sup> CCORP uses the Poisson Exact Probability method to compute the 95% confidence interval for the risk-adjusted mortality rate. (Buchan Iain, *Calculating Poisson Confidence Interval in Excel*, January 2004).

sample, and inferred a range within which each provider's true performance was likely to fall. As shown in Table D-3, a provider's performance rating is "**Better**" if the upper 95% CI of a provider's risk-adjusted mortality is below the state average mortality rate (indicating the provider's RAMR is significantly lower than the state average.) A provider's performance rating is "**Worse**" if the lower 95% CI of a provider's RAMR is above the state average mortality rate (indicating the provider's risk-adjusted mortality is significantly higher than the state average.) If the state average mortality rate is within the 95% CI of a provider's RAMR, then the performance rating is "**Average.**"

### **Hospital CABG + Valve Operative Mortality Results, 2012-2013**

Among the 5,150 CABG + valve and non-salvage surgeries performed at 121 hospitals in 2012-2013, 309 patients died either in-hospital or within 30 days of the surgery date, reflecting a statewide operative mortality rate of 6.00%. The *observed* mortality rates among hospitals ranged from 0% to 37.50%. The *expected* mortality rates, which are generated by the risk model and account for patient severity-of-illness, were between 2.67% and 16.34%. The RAMR, which measure hospital performance, ranged from 0% to 37.15%.

Based on the 95% confidence intervals for RAMR, one hospital performed "Better" (Scripps Memorial Hospital – La Jolla) and one hospital performed "Worse" (Saint Mary's Medical Center – San Francisco) than the state average. The remaining 119 hospitals performed within the expected range when compared to the statewide mortality rate (Table D-3).

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (%; RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Sacramento Valley &amp; Northern California Region</b>	Enloe Medical Center – Esplanade Campus	297	35	1	2.86	3.52	4.87	(0.12, 27.10)	Average
	Mercy General Hospital	1,382	333	14	4.20	6.36	3.97	(2.17, 6.65)	Average
	Mercy Medical Center – Redding	258	43	2	4.65	8.10	3.45	(0.42, 12.44)	Average
	Mercy San Juan Hospital	282	59	4	6.78	6.44	6.32	(1.72, 16.17)	Average
	Rideout Memorial Hospital	205	31	4	12.90	7.00	11.06	(3.01, 28.30)	Average
	Saint Joseph Hospital – Eureka	53	11	1	9.09	9.75	5.60	(0.14, 31.16)	Average
	Shasta Regional Medical Center †	167	17	0	0.00	2.91	0.00	(0.00, 44.70)	Average
	Sutter Memorial Hospital	918	188	12	6.38	6.47	5.92	(3.06, 10.34)	Average
	UC Davis Medical Center	313	61	4	6.56	5.78	6.80	(1.85, 17.41)	Average
<b>San Francisco Bay Area &amp; San Jose</b>	Alta Bates Summit Medical Center – Summit Campus – Hawthorne	302	65	4	6.15	7.09	5.21	(1.42, 13.33)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (%; RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	California Pacific Medical Center – Pacific Campus	172	33	2	6.06	4.40	8.27	(1.00, 29.88)	Average
	Community Hospital of the Monterey Peninsula	192	41	0	0.00	5.18	0.00	(0.00, 10.42)	Average
	Dominican Hospital – Santa Cruz/Soquel	150	26	3	11.54	4.73	14.66	(3.02, 42.82)	Average
	El Camino Hospital	179	40	4	10.00	7.26	8.26	(2.25, 21.15)	Average
	Good Samaritan Hospital – San Jose	187	34	2	5.88	5.41	6.53	(0.79, 23.57)	Average
	John Muir Medical Center – Concord Campus	518	68	5	7.35	5.51	8.01	(2.60, 18.70)	Average
	John Muir Medical Center – Walnut Creek Campus	1	.	.	.	.	.		Not Available**
	Kaiser Foundation Hospital – San Francisco	852	161	3	1.86	3.62	3.09	(0.64, 9.02)	Average
	Kaiser Foundation Hospital – Santa Clara	641	161	7	4.35	4.68	5.58	(2.24, 11.49)	Average
	Marin General Hospital	81	9	0	0.00	2.67	0.00	(0.00, 92.02)	Average
	North Bay Medical Center	115	8	2	25.00	5.00	29.99	(3.63, 100.0)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% , RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	O'Connor Hospital – San Jose	104	17	1	5.88	9.99	3.53	(0.09, 19.68)	Average
	Peninsula Medical Center	110	21	1	4.76	5.09	5.62	(0.14, 31.29)	Average
	Queen of the Valley Hospital – Napa	131	19	3	15.79	6.19	15.32	(3.16, 44.76)	Average
	Regional Medical of San Jose	160	23	2	8.70	16.34	3.19	(0.39, 11.53)	Average
	Saint Helena Hospital	157	25	4	16.00	7.05	13.63	(3.71, 34.88)	Average
	Saint Mary's Medical Center, San Francisco	45	8	3	37.5	5.75	39.15	(8.07, 100.0)	<b>Worse</b>
	Salinas Valley Memorial Hospital	189	22	1	4.55	4.61	5.91	(0.15, 32.93)	Average
	San Ramon Regional Medical Center	59	6	1	16.67	3.56	28.08	(0.71, 100.0)	Average
	Santa Clara Valley Medical Center	189	23	2	8.70	4.03	12.96	(1.57, 46.78)	Average
	Santa Rosa Memorial Hospital – Montgomery	166	24	1	4.17	5.08	4.92	(0.12, 27.41)	Average
	Sequoia Hospital	172	62	1	1.61	7.27	1.33	(0.03, 7.42)	Average
	Seton Medical Center	108	9	0	0.00	6.80	0.00	(0.00, 36.14)	Average
	Stanford Hospital	245	60	6	10.00	6.04	9.94	(3.65, 21.63)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% , RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	Sutter Medical Center of Santa Rosa	153	32	1	3.13	4.90	3.83	(0.10, 21.33)	Average
	UC San Francisco Medical Center	175	29	3	10.34	6.15	10.10	(2.08, 29.51)	Average
	Valleycare Medical Center	79	13	1	7.69	8.01	5.76	(0.15, 32.11)	Average
	Washington Hospital – Fremont	201	11	3	27.27	7.14	22.93	(4.73, 66.99)	Average
<b>Central California</b>	Bakersfield Heart Hospital	190	27	1	3.70	5.22	4.26	(0.11, 23.72)	Average
	Bakersfield Memorial Hospital	307	49	3	6.12	5.71	6.44	(1.33, 18.81)	Average
	Community Regional Medical Center – Fresno	540	48	6	12.50	5.02	14.96	(5.49, 32.54)	Average
	Dameron Hospital	97	9	1	11.11	9.13	7.30	(0.18, 40.68)	Average
	Doctors Medical Center	516	81	4	4.94	8.07	3.67	(1.00, 9.40)	Average
	Emanuel Medical Center, Inc.	68	4	1	25.00	7.66	19.59	(0.50, 100.0)	Average
	Fresno Heart and Surgical Hospital	384	51	4	7.84	5.96	7.9	(2.15, 20.21)	Average
	Kaweah Delta Medical Center	343	36	4	11.11	5.86	11.37	(3.10, 29.10)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Central California (continued)</b>	Marian Regional Medical Center	145	15	0	0.00	6.99	0.00	(0.00, 21.12)	Average
	Memorial Hospital Medical Center – Modesto	356	58	7	12.07	7.95	9.11	(3.66, 18.77)	Average
	Saint Agnes Medical Center	552	81	7	8.64	5.43	9.55	(3.84, 19.68)	Average
	Saint Joseph's Medical Center of Stockton	471	89	7	7.87	7.86	6.01	(2.41, 12.37)	Average
	San Joaquin Community Hospital	146	14	1	7.14	5.45	7.86	(0.20, 43.80)	Average
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara</b>	Antelope Valley Hospital	40	.	.	.	.	.		Not Available**
	Community Memorial Hospital – San Buenaventura	198	31	2	6.45	8.1.0	4.78	(0.58, 17.27)	Average
	French Hospital Medical Center	220	62	5	8.06	5.53	8.76	(2.84, 20.43)	Average
	Glendale Adventist Medical Center – Wilson Terrace	276	28	2	7.14	4.51	9.51	(1.15, 34.33)	Average
	Glendale Memorial Hospital and Medical Center	263	33	2	6.06	4.92	7.40	(0.90, 26.72)	Average
	Los Robles Hospital and Medical Center	174	38	3	7.89	5.96	7.95	(1.64, 23.22)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% , RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara (continued)</b>	Northridge Hospital Medical Center	139	15	2	13.33	6.80	11.76	(1.42, 42.47)	Average
	Palmdale Regional Medical Center	24	1	0	0.00	3.63	0.00	(0.00, 100.0)	Average
	Providence Holy Cross Medical Center	122	15	2	13.33	4.01	19.94	(2.41, 72.02)	Average
	Providence Saint Joseph Medical Center	123	16	1	6.25	3.99	9.40	(0.24, 52.37)	Average
	Providence Tarzana Medical Center	118	24	0	0.00	5.61	0.00	(0.00, 16.44)	Average
	Saint John's Regional Medical Center	164	32	2	6.25	9.12	4.11	(0.50, 14.85)	Average
	Santa Barbara Cottage Hospital	214	30	1	3.33	4.72	4.24	(0.11, 23.59)	Average
	Valley Presbyterian Hospital	102	8	0	0.00	5.12	0.00	(0.00, 54.01)	Average
	West Hills Hospital and Medical Center	103	15	0	0.00	4.33	0.00	(0.00, 34.07)	Average
<b>Greater Los Angeles</b>	Beverly Hospital	53	4	0	0	3.57	0	(0.00, 100.0)	Average
	California Hospital Medical Center – Los Angeles	41	.	.	.	.	.	.	Not Available**

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% , RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Greater Los Angeles (continued)</b>	Cedars Sinai Medical Center	403	98	7	7.14	4.7	9.13	(3.67, 18.80)	Average
	Centinel Hospital Medical Center	59	5	0	0.00	14.42	0.00	(0.00, 30.71)	Average
	Citrus Valley Medical Center – Inter Community Campus	241	33	2	6.06	5.72	6.36	(0.77, 22.96)	Average
	Downey Regional Medical Center	108	5	0	0.00	4.50	0.00	(0.00, 98.36)	Average
	Garfield Medical Center	286	35	0	0.00	5.20	0.00	(0.00, 12.17)	Average
	Good Samaritan Hospital – Los Angeles	215	35	1	2.86	4.77	3.60	(0.09, 20.04)	Average
	Henry Mayo Newhall Memorial Hospital	23	6	1	16.67	9.95	10.05	(0.25, 55.98)	Average
	Hollywood Presbyterian Medical Center	76	2	0	0.00	5.51	0.00	(0.00, 100.0)	Average
	Huntington Memorial Hospital	196	48	1	2.08	6.09	2.05	(0.05, 11.44)	Average
	Kaiser Foundation Hospital – Sunset	1,323	252	12	4.76	5.53	5.17	(2.67, 9.03)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% , RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Greater Los Angeles (continued)</b>	Keck Hospital of University of Southern California	269	87	4	4.60	5.32	5.19	(1.41, 13.27)	Average
	Lakewood Regional Medical Center	181	19	4	21.05	9.20	13.73	(3.74, 35.15)	Average
	Long Beach Memorial Medical Center	364	38	3	7.89	6.53	7.25	(1.50, 21.19)	Average
	Los Angeles County/Harbor – UCLA Medical Center	179	19	0	0.00	3.94	0.00	(0.00, 29.57)	Average
	Los Angeles County/University of Southern California Medical Center	259	31	1	3.23	4.02	4.82	(0.12, 26.85)	Average
	Methodist Hospital of Southern California	115	17	1	5.88	3.85	9.17	(0.23, 51.05)	Average
	Presbyterian Intercommunity Hospital	284	110	6	5.45	8.93	3.67	(1.34, 7.97)	Average
	Providence Little Company of Mary Medical Center – Torrance	196	43	5	11.63	5.01	13.93	(4.52, 32.50)	Average
	Ronald Reagan UCLA Medical Center	429	112	4	3.57	6.63	3.23	(0.88, 8.27)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Greater Los Angeles (continued)</b>	Saint Francis Medical Center	61	7	0	0.00	3.67	0.00	(0.00, 86.05)	Average
	Saint John's Health Center	108	29	3	10.34	4.63	13.40	(2.76, 39.14)	Average
	Saint Mary Medical Center	100	13	1	7.69	11.17	4.13	(0.10, 23.02)	Average
	Saint Vincent Medical Center	156	13	1	7.69	5.43	8.50	(0.22, 47.36)	Average
	Torrance Memorial Medical Center	123	41	6	14.63	6.86	12.80	(4.70, 27.86)	Average
	White Memorial Medical Center	117	7	0	0.00	10.97	0.00	(0.00, 28.83)	Average
<b>Inland Empire, Riverside &amp; San Bernardino</b>	Desert Regional Medical Center	251	40	3	7.50	5.93	7.59	(1.56, 22.18)	Average
	Desert Valley Hospital	43	6	1	16.67	5.47	18.29	(0.46, 100.0)	Average
	Eisenhower Medical Center	347	44	1	2.27	6.86	1.99	(0.05, 11.08)	Average
	Loma Linda University Medical Center	475	71	7	9.86	7.45	7.94	(3.19, 16.35)	Average
	Loma Linda University Medical Center – Murrieta	157	10	0	0.00	4.68	0.00	(0.00, 47.27)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% , RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Inland Empire, Riverside &amp; San Bernardino (continued)</b>	Pomona Valley Hospital Medical Center	238	23	1	4.35	4.72	5.53	(0.14, 30.79)	Average
	Riverside Community Hospital	446	65	0	0.00	4.83	0.00	(0.00, 7.05)	Average
	Saint Bernardine Medical Center	1,129	38	4	10.53	4.66	13.55	(3.69, 34.68)	Average
	Saint Mary Regional Medical Center	235	27	1	3.70	3.99	5.57	(0.14, 31.03)	Average
	San Antonio Community Hospital	345	52	3	5.77	5.45	6.35	(1.31, 18.56)	Average
<b>Orange County</b>	AHMC Anaheim Regional Medical Center	283	49	2	4.08	4.71	5.21	(0.63, 18.80)	Average
	Fountain Valley Regional Hospital and Medical Center – Euclid	214	17	1	5.88	7.25	4.87	(0.12, 27.14)	Average
	Hoag Memorial Hospital Presbyterian	434	106	4	3.77	4.9	4.63	(1.26, 11.84)	Average
	Mission Hospital Regional Medical Center	279	40	4	10.00	8.41	7.14	(1.94, 18.27)	Average
	Orange Coast Memorial Medical Center	163	27	1	3.70	4.76	4.67	(0.12, 25.99)	Average

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% , RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Orange County (continued)</b>	Saddleback Memorial Medical Center	185	25	2	8.00	6.15	7.80	(0.94, 28.17)	Average
	Saint Joseph Hospital – Orange	229	50	4	8.00	6.28	7.65	(2.08, 19.58)	Average
	Saint Jude Medical Center	191	19	0	0.00	6.07	0.00	(0.00, 19.20)	Average
	UC Irvine Medical Center	121	13	0	0.00	4.36	0.00	(0.00, 39.05)	Average
	West Anaheim Medical Center	47	.	.	.	.	.	.	Not Available**
	Western Medical Center – Anaheim	132	16	1	6.25	9.08	4.13	(0.10, 23.01)	Average
	Western Medical Center – Santa Ana	146	16	0	0.00	8.05	0.00	(0.00, 17.17)	Average
<b>Greater San Diego</b>	Alvarado Hospital	86	13	2	15.38	5.42	17.04	(2.06, 61.52)	Average
	Grossmont Hospital	328	56	5	8.93	7.31	7.33	(2.38, 17.10)	Average
	Palomar Health Downtown Campus	117	17	1	5.88	4.48	7.89	(0.20, 43.92)	Average
	Scripps Green Hospital	123	46	2	4.35	4.35	6.00	(0.73, 21.67)	Average
	Scripps Memorial Hospital – La Jolla	624	150	1	0.67	4.71	0.85	(0.02, 4.73)	<b>Better</b>

**Table D-3: Hospital Risk-Adjusted CABG + Valve Operative Mortality Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	CABG + AV/MV Cases***	CABG + AV/MV Operative Deaths	Observed Operative Mortality Rate (%)	Expected Operative Mortality Rate (%)	Risk-Adjusted Operative Mortality Rate (% RAMR)	95%CI for RAMR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>5,150</b>	<b>309</b>	<b>6.00</b>				
<b>Greater San Diego (continued)</b>	Scripps Mercy Hospital	315	44	6	13.64	6.86	11.94	(4.38, 25.98)	Average
	Sharp Chula Vista Medical Center	231	56	5	8.93	9.44	5.67	(1.84, 13.24)	Average
	Sharp Memorial Hospital	321	89	2	2.25	5.99	2.25	(0.27, 8.13)	Average
	Tri-City Medical Center – Oceanside	175	32	4	12.50	5.20	14.42	(3.93, 36.90)	Average
	UC San Diego Health – Sulpizio Cardiovascular Center	261	44	2	4.55	5.43	5.02	(0.61, 18.14)	Average

AV/MV=aortic valve, mitral valve repair or replacement.

\*A hospital is classified as **"Better"** if the upper 95% CI of the RAMR falls below the California observed mortality rate (2.11%). A hospital is classified as **"Worse"** if the lower 95% CI of the RAMR is higher than the statewide observed mortality rate. A hospital's performance is considered **"Average"** if the statewide average mortality rate falls within the 95% CI of a hospital's RAMR.

\*\*Not Available: Hospital results are not shown because data necessary to confirm deaths and readmissions were not available.

\*\*\* Total CABG + AV/MV cases statewide are 5,150, however, Good Samaritan Hospital - San Jose and Saint Joseph's Medical Center of Stockton each had one case removed from their individual totals, thus the individual totals do not sum to the statewide case number.

† Hospitals submitted statements regarding this report. See Appendix C for their statements.

## Risk Model for Adjusting Hospital Post-Operative Stroke Rates, 2012-2013

Post-operative stroke is a fairly rare, but serious complication that can occur after CABG surgery. To assess hospital performance on this outcome, CCORP combined 2012 and 2013 data to increase the number of cases and reliability of hospital results. Similar to the methodology used to assess the operative mortality rate, CCORP used a multivariable logistic regression model to estimate the relationship between each of the demographic and pre-operative risk factors and the probability of post-operative stroke following isolated CABG surgery. The risk model, based on the 2012-2013 data, is presented in Table E-1 with statistically significant risk factors identified in bolded text.

**Table E-1: Logistic Regression Risk Model for Post-Operative Stroke, 2012-2013**

Risk Factor		Coefficient	Standard Error	p-value	Odds Ratio
Intercept		-6.945	0.583	<.0001	
<b>Age (Years)</b>		<b>0.023</b>	<b>0.006</b>	<b>&lt;.0001</b>	<b>1.023</b>
Gender	Male	Reference			
	<b>Female</b>	<b>0.415</b>	<b>0.117</b>	<b>0.001</b>	<b>1.515</b>
Race	White	Reference			
	<b>Non-White</b>	<b>0.335</b>	<b>0.113</b>	<b>0.003</b>	<b>1.398</b>
Status of the Procedure	Elective	Reference			
	<b>Urgent</b>	<b>0.285</b>	<b>0.143</b>	<b>0.046</b>	<b>1.330</b>
	Emergent	0.432	0.306	0.158	1.541
Last Creatinine Level Pre-Op (mg/dl)		0.146	0.229	0.524	1.157
Hypertension		0.213	0.211	0.312	1.238
<b>Peripheral Arterial Disease</b>		<b>0.279</b>	<b>0.140</b>	<b>0.046</b>	<b>1.322</b>
<b>Cerebrovascular Disease</b>		<b>0.947</b>	<b>0.174</b>	<b>&lt;.0001</b>	<b>2.577</b>
Cerebrovascular Accident (CVA) Timing	NO CVA	Reference			
	> 2 weeks	-0.080	0.204	0.694	0.923
	<b>&lt;= 2 weeks</b>	<b>0.965</b>	<b>0.473</b>	<b>0.041</b>	<b>2.625</b>
Diabetes Control	No Diabetes	Reference			
	<b>Non-Insulin</b>	<b>0.255</b>	<b>0.125</b>	<b>0.041</b>	<b>1.291</b>
	Insulin	0.104	0.163	0.524	1.109
Chronic Lung Disease (CLD)	None/Mild/Moderate	Reference			
	Severe	0.138	0.247	0.577	1.148
Atrial Fibrillation/Flutter		0.246	0.168	0.143	1.279
Third Degree Heart Block		-0.020	0.599	0.974	0.980
Sustained VT/VF		-0.220	0.308	0.476	0.803

**Table E-1: Logistic Regression Risk Model for Post-Operative Stroke, 2012-2013**

Risk Factor		Coefficient	Standard Error	p-value	Odds Ratio	
Timing of Myocardial Infarction (MI)	No MI	Reference				
	21 or more days ago	-0.154	0.174	0.378	0.858	
	8-21 days ago	0.131	0.221	0.553	1.140	
	1-7 days ago	0.081	0.144	0.574	1.084	
	Within 24 Hours	0.377	0.272	0.165	1.459	
<b>Cardiogenic Shock</b>		<b>0.782</b>	<b>0.358</b>	<b>0.029</b>	<b>2.185</b>	
Heart Failure		0.089	0.158	0.575	1.092	
NYHA Classifications	I,II, or III	Reference				
	IV	0.380	0.195	0.051	1.462	
Ejection Fraction (%)		-0.005	0.004	0.268	0.995	
Left Main Disease (≥ 50%)		-0.067	0.115	0.564	0.936	
Number of Diseased Vessels	None, One or Two	Reference				
	Three or More	0.129	0.139	0.351	1.138	
MELD score		≥ 10 vs. <10	0.265	0.154	0.085	1.303
Year	2012	Reference				
	2013	-0.178	0.109	0.102	0.837	

MELD: Model for End-Stage Liver Disease.

**Bolded text** indicates statistical significance.

Note: "Last Creatinine Level" and "Ejection Fraction" were modeled using piecewise linear transformations.

### Discrimination of Risk Model for Post-Operative Stroke

Discrimination methods are explained in the section for isolated CABG operative mortality. For the 2012-2013 risk model, the C-statistic was 0.725. The CCORP 2012-2013 risk model compares favorably with STS's published post-operative stroke model (C-statistic = 0.716 for isolated CABG surgery).<sup>5</sup>

### Calibration of Risk Model for Post-Operative Stroke

Calibration methods are explained in the section for isolated CABG operative mortality. The p-value of the Hosmer-Lemeshow test statistic for this 2012-2013 post-operative stroke risk model is 0.116, indicating adequate calibration.

As presented in Table E-2, Risk Group 1 shows the patients in the lowest risk group. Among the 2,354 patients in this group, 6 patients had post-operative strokes, but the model predicted 9.8 cases. Assuming a Poisson distribution for a binary outcome, the predicted range of strokes for this group is 3.7 to 15.9. The observed number of 9 strokes falls within the range of predicted strokes. In fact, 9 of the 10 risk groups did not have significantly fewer or significantly more post-operative strokes than were predicted by the model. Overall, the risk model shows no systematic underestimation or overestimation of stroke cases at the extremes.

<sup>5</sup> 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* 2011; 88:S2-22.

**Table E-2: Calibration of Risk Model for Post-Operative Stroke, 2012-2013**

Risk Group	Isolated CABG Cases	Observed Post-Op Strokes	Predicted Post-Op Stroke	Difference	95%CI of Predicted Post-Op Stroke
1	2,354	6	9.8	3.8	(3.7, 15.9)
2	2,355	8	13.4	5.4	(6.2, 20.6)
3	2,354	8	16.2	8.2	(8.3, 24.1)
4	2,353	20	19.1	-0.9	(10.5, 27.6)
5	2,355	22	22.3	0.3	(13.1, 31.6)
6	2,353	36	26.5	-9.6	(16.4, 36.5)
7	2,353	38	32.0	-6.0	(20.9, 43.1)
8	2,353	44	40.3	-3.7	(27.9, 52.8)
9	2,353	57	55.7	-1.3	(41.0, 70.3)
10	2,344	112	115.8	3.8	(94.7, 136.9)
<b>Total</b>	<b>23,527</b>	<b>351</b>	<b>351.0</b>	<b>0</b>	

Note: Risk Group 1 is at lowest risk and Risk Group 10 is at highest risk.

### Process for Calculating Risk-Adjusted Post-Op Stroke Rate and Performance Ratings

The risk-adjusted post-operative stroke rate (RASR) is computed by dividing the provider’s number of patient strokes by the provider’s expected number of patient strokes (based on the risk model) to obtain the observed/expected (O/E) ratio. The O/E ratio is then multiplied by the statewide average post-operative stroke rate (1.49% for 2012-2013) to obtain the provider’s RASR.

The performance rating is based on a comparison of the 95% CI of each provider’s RASR to the statewide post-operative stroke rate. Thus, CCORP treated 2012-2013 data as a sample, and inferred the range in which each provider’s true performance was likely to fall. As shown in Table E-3, if the upper 95% CI of a provider’s risk-adjusted stroke rate is below the state average stroke rate, indicating the provider’s RASR is significantly lower than the state average, the performance rating is “**Better.**” If the lower 95% CI of a provider’s RASR is above the state average stroke rate, indicating the provider’s risk-adjusted stroke rate is significantly higher than the state average, the performance rating is “**Worse.**” If the statewide average stroke rate is within the 95% CI of a provider’s RASR, the performance rating is “**Average.**”

### Hospital Post-Operative Stroke Results, 2012-2013

Table E-3 presents the risk-adjusted post-operative stroke results for each hospital for 2012-2013. The table is sorted by geographic region and contains, for each hospital, the total number of CABG surgeries performed (isolated and non-isolated combined), number of isolated CABG surgeries (excluding salvage cases), number of observed isolated CABG post-operative stroke cases, observed post-operative stroke rate, expected post-operative stroke rate predicted by the risk model, RASR and 95% CI of the RASR, and the associated hospital performance rating.

Among the 23,660 isolated CABG surgeries performed in 2012-2013, 352 patients had a post-operative stroke in-hospital, reflecting overall statewide rate of 1.49%. Among 352 patients with post-operative stroke, 50 (14.2%) died either in-hospital or after discharge but within 30 days of CABG surgery. The observed stroke rate among hospitals ranged from 0% to 8.33%. The expected stroke rates, which are generated by the model and measure patient severity of illness, were between 0.94% and 2.36%. The risk-adjusted stroke rates were ranged from 0% to 9.54%.

Based on the 95% confidence intervals for risk-adjusted stroke rates, 123 of 125 hospitals (98%) performed within the expected range compared to the state's average stroke rate, two hospitals performed significantly "**Worse**" (Rideout Memorial Hospital and Kaiser Foundation Hospital – San Francisco) than the state average and no hospital performed significantly "**Better**" than the state average (Table E-3).

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (% RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>Sacramento Valley &amp; Northern California Region</b>	Enloe Medical Center – Esplanade Campus	297	253	2	0.79	1.34	0.88	(0.11, 3.17)	Average
	Mercy General Hospital	1,382	887	15	1.69	1.43	1.77	(0.99, 2.92)	Average
	Mercy Medical Center – Redding	258	204	2	0.98	1.44	1.01	(0.12, 3.67)	Average
	Mercy San Juan Hospital	282	194	1	0.52	1.32	0.58	(0.01, 3.24)	Average
	Rideout Memorial Hospital	205	170	10	5.88	1.39	6.31	(3.03, 11.62)	<b>Worse</b>
	Saint Joseph Hospital – Eureka	53	38	0	0.00	1.20	0.00	(0.00, 12.02)	Average
	Shasta Regional Medical Center †	167	150	3	2.00	1.11	2.69	(0.56, 7.87)	Average
	Sutter Memorial Hospital	918	655	4	0.61	1.35	0.67	(0.18, 1.72)	Average
	UC Davis Medical Center	313	221	5	2.26	1.27	2.65	(0.86, 6.20)	Average
<b>San Francisco Bay Area &amp; San Jose</b>	Alta Bates Summit Medical Center – Summit Campus – Hawthorne	302	233	2	0.86	1.64	0.78	(0.09, 2.81)	Average
	California Pacific Medical Center – Pacific Campus	172	133	1	0.75	1.35	0.83	(0.02, 4.62)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%; RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	Community Hospital of the Monterey Peninsula	192	141	3	2.13	1.16	2.73	(0.56, 8.00)	Average
	Dominican Hospital – Santa Cruz/Soquel	150	122	0	0.00	1.46	0.00	(0.00, 3.09)	Average
	El Camino Hospital	179	125	0	0.00	1.41	0.00	(0.00, 3.12)	Average
	Good Samaritan Hospital – San Jose	187	143	3	2.10	1.75	1.78	(0.37, 5.21)	Average
	John Muir Medical Center – Concord Campus	518	425	3	0.71	1.28	0.82	(0.17, 2.39)	Average
	John Muir Medical Center – Walnut Creek Campus	1	0	.	.	.	.	.	Not Available**
	Kaiser Foundation Hospital – San Francisco	852	654	16	2.45	1.28	2.84	(1.63, 4.62)	<b>Worse</b>
	Kaiser Foundation Hospital – Santa Clara	641	453	5	1.10	1.55	1.06	(0.34, 2.48)	Average
	Marin General Hospital	81	72	1	1.39	1.08	1.91	(0.05, 10.67)	Average
	North Bay Medical Center	115	105	2	1.90	1.58	1.80	(0.22, 6.50)	Average
	O'Connor Hospital – San Jose	104	85	1	1.18	1.77	0.99	(0.03, 5.51)	Average
	Peninsula Medical Center	110	83	0	0.00	1.14	0.00	(0.00, 5.82)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	Queen of the Valley Hospital – Napa	131	107	3	2.80	1.50	2.79	(0.58, 8.16)	Average
	Regional Medical of San Jose	160	132	2	1.52	2.36	0.96	(0.12, 3.46)	Average
	Saint Helena Hospital	157	124	0	0.00	1.63	0.00	(0.00, 2.72)	Average
	Saint Mary's Medical Center, San Francisco	45	36	1	2.78	2.04	2.03	(0.05, 11.32)	Average
	Salinas Valley Memorial Hospital	189	160	5	3.13	1.46	3.19	(1.04, 7.46)	Average
	San Ramon Regional Medical Center	59	52	0	0.00	1.02	0.00	(0.00, 10.40)	Average
	Santa Clara Valley Medical Center	189	155	0	0.00	1.23	0.00	(0.00, 2.88)	Average
	Santa Rosa Memorial Hospital – Montgomery	166	134	0	0.00	1.37	0.00	(0.00, 3.00)	Average
	Sequoia Hospital	172	97	1	1.03	1.48	1.04	(0.03, 5.78)	Average
	Seton Medical Center	108	95	5	5.26	1.89	4.15	(1.35, 9.69)	Average
	Stanford Hospital	245	158	5	3.16	1.11	4.24	(1.38, 9.91)	Average
	Sutter Medical Center of Santa Rosa	153	120	2	1.67	0.94	2.65	(0.32, 9.59)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	UC San Francisco Medical Center	175	136	4	2.94	1.38	3.17	(0.87, 8.13)	Average
	Valleycare Medical Center	79	61	0	0.00	1.55	0.00	(0.00, 5.82)	Average
	Washington Hospital – Fremont	201	189	5	2.65	1.73	2.28	(0.74, 5.32)	Average
<b>Central California</b>	Bakersfield Heart Hospital	190	159	5	3.14	1.37	3.40	(1.11, 7.96)	Average
	Bakersfield Memorial Hospital	307	251	2	0.80	1.66	0.72	(0.09, 2.59)	Average
	Community Regional Medical Center – Fresno	540	447	3	0.67	1.54	0.65	(0.13, 1.90)	Average
	Dameron Hospital	97	87	1	1.15	2.18	0.78	(0.02, 4.38)	Average
	Doctors Medical Center	516	412	6	1.46	1.71	1.27	(0.47, 2.77)	Average
	Emanuel Medical Center, Inc.	68	62	0	0.00	1.46	0.00	(0.00, 6.07)	Average
	Fresno Heart and Surgical Hospital	384	322	3	0.93	1.42	0.98	(0.20, 2.86)	Average
	Kaweah Delta Medical Center	343	303	6	1.98	1.45	2.03	(0.75, 4.43)	Average
	Marian Regional Medical Center	145	114	2	1.75	1.64	1.60	(0.19, 5.77)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>Central California (continued)</b>	Memorial Hospital Medical Center – Modesto	356	289	4	1.38	1.41	1.46	(0.40, 3.74)	Average
	Saint Agnes Medical Center	552	457	4	0.88	1.47	0.89	(0.24, 2.28)	Average
	Saint Joseph’s Medical Center of Stockton	471	368	3	0.82	2.00	0.61	(0.13, 1.77)	Average
	San Joaquin Community Hospital	146	127	2	1.57	1.67	1.40	(0.17, 5.07)	Average
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara</b>	Antelope Valley Hospital	40	40	1	2.50	1.54	2.41	(0.06, 13.46)	Average
	Community Memorial Hospital – San Buenaventura	198	165	1	0.61	1.48	0.61	(0.02, 3.39)	Average
	French Hospital Medical Center	220	153	4	2.61	1.61	2.42	(0.66, 6.21)	Average
	Glendale Adventist Medical Center – Wilson Terrace	276	242	4	1.65	1.16	2.11	(0.58, 5.41)	Average
	Glendale Memorial Hospital and Medical Center	263	225	5	2.22	1.45	2.28	(0.74, 5.32)	Average
	Los Robles Hospital and Medical Center	174	125	4	3.20	1.49	3.19	(0.87, 8.18)	Average
	Northridge Hospital Medical Center	139	122	5	4.10	1.72	3.55	(1.15, 8.30)	Average
	Palmdale Regional Medical Center	24	21	0	0.00	1.37	0.00	(0.00, 19.11)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara (continued)</b>	Providence Holy Cross Medical Center	122	102	2	1.96	1.54	1.89	(0.23, 6.85)	Average
	Providence Saint Joseph Medical Center	123	96	1	1.04	1.12	1.39	(0.04, 7.75)	Average
	Providence Tarzana Medical Center	118	91	1	1.10	1.26	1.29	(0.03, 7.22)	Average
	Saint John's Regional Medical Center	164	120	4	3.33	1.76	2.82	(0.77, 7.23)	Average
	Santa Barbara Cottage Hospital	214	169	3	1.78	1.45	1.83	(0.38, 5.34)	Average
	Valley Presbyterian Hospital	102	90	2	2.22	1.40	2.37	(0.29, 8.57)	Average
	West Hills Hospital and Medical Center	103	85	0	0.00	1.41	0.00	(0.00, 4.59)	Average
<b>Greater Los Angeles</b>	Beverly Hospital	53	48	1	2.08	1.83	1.69	(0.04, 9.43)	Average
	California Hospital Medical Center – Los Angeles	41	40	1	2.50	2.26	1.64	(0.04, 9.17)	Average
	Cedars Sinai Medical Center	403	241	1	0.41	1.08	0.57	(0.01, 3.18)	Average
	Centinela Hospital Medical Center	59	51	1	1.96	1.98	1.48	(0.04, 8.24)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>Greater Los Angeles (continued)</b>	Citrus Valley Medical Center – Inter Community Campus	241	202	7	3.47	1.82	2.83	(1.14, 5.84)	Average
	Downey Regional Medical Center	108	102	0	0.00	1.41	0.00	(0.00, 3.81)	Average
	Garfield Medical Center	286	243	4	1.65	1.78	1.38	(0.38, 3.54)	Average
	Good Samaritan Hospital – Los Angeles	215	173	3	1.73	1.68	1.53	(0.32, 4.49)	Average
	Henry Mayo Newhall Memorial Hospital	23	15	1	6.67	1.04	9.54	(0.24, 53.21)	Average
	Hollywood Presbyterian Medical Center	76	69	0	0.00	1.44	0.00	(0.00, 5.55)	Average
	Huntington Memorial Hospital	196	131	1	0.76	1.54	0.74	(0.02, 4.13)	Average
	Kaiser Foundation Hospital – Sunset	1,323	1,014	11	1.08	1.42	1.13	(0.57, 2.03)	Average
	Keck Hospital of University of Southern California	269	117	1	0.85	1.28	0.99	(0.03, 5.53)	Average
	Lakewood Regional Medical Center	181	160	1	0.63	1.93	0.48	(0.01, 2.69)	Average
	Long Beach Memorial Medical Center	364	311	4	1.29	1.65	1.16	(0.32, 2.98)	Average
Los Angeles County/Harbor – UCLA Medical Center	179	150	4	2.67	1.55	2.56	(0.70, 6.57)	Average	

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>Greater Los Angeles (continued)</b>	Los Angeles County/University of Southern California Medical Center	259	209	2	0.96	1.15	1.24	(0.15, 4.47)	Average
	Methodist Hospital of Southern California	115	93	0	0.00	1.47	0.00	(0.00, 4.02)	Average
	Presbyterian Intercommunity Hospital	284	141	2	1.42	1.80	1.17	(0.14, 4.25)	Average
	Providence Little Company of Mary Medical Center – Torrance	196	135	0	0.00	1.63	0.00	(0.00, 2.49)	Average
	Ronald Reagan UCLA Medical Center	429	211	4	1.90	1.54	1.83	(0.50, 4.68)	Average
	Saint Francis Medical Center	61	52	0	0.00	1.31	0.00	(0.00, 8.05)	Average
	Saint John’s Health Center	108	72	1	1.39	1.33	1.55	(0.04, 8.67)	Average
	Saint Mary Medical Center	100	85	2	2.35	1.99	1.76	(0.21, 6.37)	Average
	Saint Vincent Medical Center	156	138	3	2.17	1.61	2.00	(0.41, 5.87)	Average
	Torrance Memorial Medical Center	123	74	1	1.35	1.61	1.25	(0.03, 6.95)	Average
	White Memorial Medical Center	117	107	5	4.67	1.62	4.29	(1.40, 10.03)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>Inland Empire, Riverside &amp; San Bernardino</b>	Desert Regional Medical Center	251	201	1	0.50	1.33	0.56	(0.01, 3.11)	Average
	Desert Valley Hospital	43	36	3	8.33	1.73	7.18	(1.48, 21.02)	Average
	Eisenhower Medical Center	347	277	1	0.36	1.56	0.35	(0.01, 1.93)	Average
	Loma Linda University Medical Center	475	366	6	1.64	1.56	1.56	(0.57, 3.40)	Average
	Loma Linda University Medical Center – Murrieta	157	139	0	0.00	1.62	0.00	(0.00, 2.45)	Average
	Pomona Valley Hospital Medical Center	238	211	4	1.90	1.67	1.69	(0.46, 4.33)	Average
	Riverside Community Hospital	446	359	4	1.11	1.45	1.15	(0.31, 2.94)	Average
	Saint Bernadine Medical Center	1,129	965	9	0.93	1.38	1.00	(0.46, 1.91)	Average
	Saint Mary Regional Medical Center	235	202	4	1.98	1.32	2.23	(0.61, 5.71)	Average
	San Antonio Community Hospital	345	266	2	0.75	1.44	0.78	(0.09, 2.81)	Average
<b>Orange County</b>	AHMC Anaheim Regional Medical Center	283	216	5	2.31	1.48	2.33	(0.76, 5.44)	Average
	Fountain Valley Regional Hospital and Medical Center – Euclid	214	193	6	3.11	2.13	2.17	(0.80, 4.72)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>Orange County (continued)</b>	Hoag Memorial Hospital Presbyterian	434	266	1	0.38	1.46	0.38	(0.01, 2.13)	Average
	Mission Hospital Regional Medical Center	279	224	2	0.89	1.42	0.94	(0.11, 3.40)	Average
	Orange Coast Memorial Medical Center	163	130	2	1.54	1.19	1.92	(0.23, 6.95)	Average
	Saddleback Memorial Medical Center	185	154	5	3.25	1.20	4.03	(1.31, 9.43)	Average
	Saint Joseph Hospital – Orange	229	160	4	2.50	1.34	2.77	(0.75, 7.09)	Average
	Saint Jude Medical Center	191	164	4	2.44	1.67	2.17	(0.59, 5.57)	Average
	UC Irvine Medical Center	121	100	0	0.00	1.73	0.00	(0.00, 3.18)	Average
	West Anaheim Medical Center	47	47	0	0.00	1.76	0.00	(0.00, 6.64)	Average
	Western Medical Center – Anaheim	132	112	0	0.00	1.67	0.00	(0.00, 2.94)	Average
	Western Medical Center – Santa Ana	146	120	0	0.00	1.60	0.00	(0.00, 2.86)	Average
<b>Greater San Diego</b>	Alvarado Hospital	86	69	1	1.45	1.62	1.33	(0.03, 7.41)	Average
	Grossmont Hospital	328	261	10	3.83	2.04	2.79	(1.34, 5.13)	Average
	Palomar Health Downtown Campus	117	91	2	2.20	1.51	2.16	(0.26, 7.83)	Average

**Table E-3: Hospital Risk-Adjusted Post-Operative Stroke Results by Region, 2012-2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases	Isolated CABG Post-Op Stroke	Observed Post-Op Stroke Rate (%)	Expected Post-op Stroke Rate (%)	Risk-Adjusted Post-Op Stroke Rate (%), RASR)	95%CI for RASR	Performance Rating*
<b>State</b>		<b>30,739</b>	<b>23,660</b>	<b>352</b>	<b>1.49</b>				
<b>Greater San Diego (continued)</b>	Scripps Green Hospital	123	62	2	3.23	1.03	4.68	(0.57, 16.93)	Average
	Scripps Memorial Hospital – La Jolla	624	436	5	1.15	1.33	1.28	(0.42, 3.00)	Average
	Scripps Mercy Hospital	315	255	6	2.35	1.51	2.32	(0.85, 5.06)	Average
	Sharp Chula Vista Medical Center	231	164	5	3.05	2.02	2.24	(0.73, 5.24)	Average
	Sharp Memorial Hospital	321	195	6	3.08	1.37	3.34	(1.23, 7.27)	Average
	Tri-City Medical Center – Oceanside	175	139	1	0.72	1.51	0.71	(0.02, 3.96)	Average
	UC San Diego Health – Sulpizio Cardiovascular Center	261	150	0	0.00	1.37	0.00	(0.00, 2.68)	Average

\*A hospital is classified as **“Better”** if the upper 95% CI of the RASR falls below the California observed stroke rate (1.49%). A hospital is classified as **“Worse”** if the lower 95% CI of the RASR is higher than the California observed stroke rate. A hospital’s performance is considered **“Average”** if the statewide average stroke rate falls within the 95% CI of a hospital’s RASR.

† Hospitals submitted statements regarding this report. See Appendix C for their statements.

\*\*Not Available: Hospital results are not shown because data necessary to confirm deaths and readmissions were not available.

## Risk Model for Adjusting Hospital 30-Day Readmission Rates, 2013

Readmissions account for a significant percentage of hospital healthcare costs. With better care and discharge planning hospitals might avoid unnecessary readmissions. To assess hospital performance on this outcome, CCORP limited the analysis to isolated CABG surgery patients readmitted to any acute care hospital within 30 days of being discharged to home or a non-acute care setting. A readmission was counted only if the patient was readmitted with a principal diagnosis that indicated a heart-related condition, or an infection or a complication that was likely related to the CABG surgery (see Appendix B for a list of principal diagnosis categories and their associated ICD-9-CM codes that were included in the readmissions analysis).

Similar to the methodology used to assess operative mortality and post-operative stroke, CCORP used a multivariable logistic regression model to estimate the relationship between each of the demographic and pre-operative risk factors and the probability of 30-day readmission. The risk model, based on the 2013 data, is presented in Table F-1 with statistically significant risk factors identified in bolded text.

**Table F-1: Logistic Regression Risk Model for Hospital 30-Day Readmission, 2013**

Risk Factor		Coefficient	Standard Error	P-value	Odds Ratio
Intercept		-4.139	0.292	<.0001	0.016
Patient Age (Years)		0.005	0.003	0.091	1.005
Gender	Male	Reference			
	<b>Female</b>	<b>0.442</b>	<b>0.069</b>	<b>&lt;.0001</b>	<b>1.556</b>
Race	White	Reference			
	Non-White	0.047	0.065	0.478	1.048
Body Mass Index	18.5-39.9	Reference			
	< 18.5	0.101	0.302	0.738	1.106
	<b>≥ 40</b>	<b>0.467</b>	<b>0.139</b>	<b>0.001</b>	<b>1.594</b>
Status of the Procedure	Elective	Reference			
	Urgent	0.146	0.076	0.054	1.157
	Emergent	-0.003	0.200	0.990	0.997
<b>Last Creatinine Level (mg/dl)</b>		<b>0.618</b>	<b>0.131</b>	<b>&lt;.0001</b>	<b>1.855</b>
Hypertension		0.190	0.111	0.088	1.209
<b>Peripheral Arterial Disease</b>		<b>0.286</b>	<b>0.084</b>	<b>0.001</b>	<b>1.332</b>
<b>Cerebrovascular Disease</b>		<b>0.312</b>	<b>0.082</b>	<b>0.001</b>	<b>1.366</b>
Diabetes Control	No diabetes/No Treatment	Reference			
	Non-Insulin	0.070	0.072	0.326	1.073
	Insulin	0.169	0.089	0.059	1.184
Chronic Lung Disease	None/Mild/Moderate	Reference			
	Severe	0.162	0.147	0.269	1.176
<b>Immunocompromise</b>		<b>0.370</b>	<b>0.166</b>	<b>0.026</b>	<b>1.448</b>
<b>Atrial Fibrillation/Flutter</b>		<b>0.216</b>	<b>0.102</b>	<b>0.034</b>	<b>1.241</b>

**Table F-1: Logistic Regression Risk Model for Hospital 30-Day Readmission, 2013**

Risk Factor		Coefficient	Standard Error	P-value	Odds Ratio
Timing of Myocardial Infarction (MI)	No MI	Reference			
	<b>21 or more days ago</b>	<b>0.257</b>	<b>0.088</b>	<b>0.004</b>	<b>1.293</b>
	8-21 days ago	0.248	0.135	0.067	1.281
	<b>1-7 days ago</b>	<b>0.318</b>	<b>0.081</b>	<b>&lt;.0001</b>	<b>1.374</b>
	<b>Within 24 Hours</b>	<b>0.497</b>	<b>0.180</b>	<b>0.006</b>	<b>1.644</b>
<b>Heart Failure</b>		<b>0.327</b>	<b>0.083</b>	<b>&lt;.0001</b>	<b>1.387</b>
NYHA Classification	I,II, or III	Reference			
	IV	0.081	0.122	0.506	1.085
Mitral Insufficiency	None/Trivial/Mild	Reference			
	Moderate/Severe	0.028	0.121	0.820	1.028
<b>Resuscitation</b>		<b>1.331</b>	<b>0.548</b>	<b>0.015</b>	<b>3.785</b>
MELD Score	< 10	Reference			
	≥ 10	0.184	0.094	0.050	1.202

MELD: Model for End-Stage Liver Disease.

**Bolded text** indicates statistical significance.

Note: “Last Creatinine Level” and “Ejection Fraction” were modeled using piecewise linear transformations.

### Discrimination of Risk Model for Hospital 30-Day Readmission

Discrimination methods are explained in the section for isolated CABG operative mortality. For the 2013 risk model, the C-statistic was 0.661. In a recently published CABG surgery readmission report by Pennsylvania (2013 data), the C-statistic was 0.646,<sup>6</sup> which is similar to the 2013 CCORP model.

### Calibration of Risk Model for Hospital 30-Day Readmission

Calibration methods are explained in the section for isolated CABG operative mortality. The p-value of the Hosmer-Lemeshow test statistic for this 2013 risk model is 0.364, indicating adequate calibration.

As presented in Table F-2, Risk Group 1 shows the patients in the lowest risk group. Among the 1,068 patients in this group, 54 patients were readmitted to the hospital, but the model predicted 57.4 readmissions. Assuming a Poisson distribution for a binary outcome, the predicted range of readmissions for Risk Group 1 is 42.6 to 72.3. The observed number of 54 readmissions falls within the range of predicted readmissions. In fact, 9 of the 10 risk groups did not have significantly fewer or significantly more readmissions than were predicted by the model. Overall, the risk model shows no systematic underestimation or overestimation of readmission at the extremes.

<sup>6</sup> PHC4: Technical Notes for the Cardiac Surgery Report. September 2013. Available at <http://www.phc4.org/reports/cabg/12/docs/cabg2012technotes.pdf>

**Table F-2: Calibration of Risk Model for Hospital 30-Day Readmission, 2013**

Risk Group	Isolated CABG Cases	Observed Readmission	Predicted Readmission	Difference	95%CI of Predicted Readmission
1	1,068	54	57.4	3.4	(42.6, 72.3)
2	1,067	62	68.2	6.2	(52.0, 84.4)
3	1,067	71	77.9	6.9	(60.6, 95.2)
4	1,066	82	87.7	5.7	(69.4, 106.1)
5	1,067	93	96.6	3.6	(77.3, 115.8)
6	1,067	131	108.4	-22.6	(88.0, 128.8)
7	1,067	133	125.5	-7.5	(103.6, 147.5)
8	1,067	151	147.4	-3.6	(123.6, 171.2)
9	1,067	189	184.5	-4.5	(157.9, 211.1)
10	1,070	273	285.5	12.5	(252.3, 318.6)
<b>Total</b>	<b>10,673</b>	<b>1,239</b>	<b>1239.0</b>	<b>0</b>	

Note: Risk Group 1 is at lowest risk and Risk Group 10 is at highest risk.

### Process for Calculating Risk-Adjusted 30-Day Readmission Rate and Performance Ratings

The risk-adjusted readmission rate (RARR) is computed by dividing the provider’s observed readmission by the provider’s expected readmission (based on the risk model) to get the observed/expected (O/E) ratio. The O/E ratio is then multiplied by the statewide average readmission rate (11.66% for 2013) to obtain the provider’s RARR.

However, because a provider’s point estimate of the RARR can be attributed to chance, the performance rating is not based on a point estimate of the RARR, but on a comparison of the 95% CI of each provider’s RARR to the California average readmission rate.<sup>7</sup> CCORP treated the 2013 data as samples, and inferred a range within which each provider’s true performance was likely to fall. As shown in Table F-3, if the upper 95% CI of a provider’s RARR is below the state average readmission rate, indicating the provider’s RARR is significantly lower than the state average, the performance rating is “**Better.**” If the lower 95% CI of a provider’s RARR is above the state average readmission rate, indicating the provider’s RARR is significantly higher than the state average, the performance rating is “**Worse.**” If the state average readmission rate is within the 95% CI of a provider’s RARR, the performance rating is “**Average.**”

### Hospital 30-Day Readmission Results, 2013

Table F-3 presents the risk-adjusted readmission results for each hospital for 2013. The table is sorted by geographic region and contains, for each hospital, the total number of CABG surgeries performed (isolated and non-isolated combined), number of patients discharged alive after isolated CABG surgeries (excluding salvage patients), number of observed isolated CABG readmissions, observed readmission rate, expected readmission rate predicted by the risk model, RARR and 95% CI of the RARR, and the associated hospital performance rating.

<sup>7</sup> The Poisson Exact Probability method is used for computing the 95% confidence interval for the risk-adjusted readmission rate. (Buchan Iain, *Calculating Poisson Confidence Interval in Excel*, January 2004)

Among the 10,740 isolated (non-salvage) CABG surgeries performed in 2013 (with patients discharged alive), 1,252 patients were readmitted to the same or another acute care hospital within 30 days of the surgery date, reflecting a statewide readmission rate of 11.66%. The observed readmission rates among hospitals ranged from 0% to 41.67%. The expected readmission rates, which are generated by the risk model and account for patient severity of illness, range between 9.46% and 12.77%. The RARR, which measure hospital performance, ranged from 0% to 39.29%.

Based on the 95% confidence intervals for risk-adjusted readmission rates, 115 of 124 hospitals (92.7%) performed within the expected range compared to the statewide readmission rate, three hospitals performed significantly **“Better”** than the state average (Marian Regional Medical Center, Stanford Hospital, and Tri-City Medical Center – Oceanside), and six hospitals performed significantly **“Worse”** than the state average (Grossmont Hospital, Henry Mayo Newhall Memorial Hospital, Los Angeles County/Harbor – UCLA Medical Center, Los Angeles County/University of Southern California Medical Center, Orange Coast Memorial Medical Center, and Shasta Regional Medical Center) (Table F-3).

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Sacramento Valley &amp; Northern California Region</b>	Enloe Medical Center – Esplanade Campus	140	115	11	9.57	10.17	10.97	(5.48, 19.63)	Average
	Mercy General Hospital	690	393	33	8.40	11.53	8.49	(5.85, 11.93)	Average
	Mercy Medical Center – Redding	121	93	5	5.38	10.98	5.71	(1.85, 13.32)	Average
	Mercy San Juan Hospital	125	74	11	14.86	11.57	14.98	(7.48, 26.81)	Average
	Rideout Memorial Hospital	89	68	14	20.59	11.50	20.87	(11.41, 35.03)	Average
	Saint Joseph Hospital – Eureka	30	20	1	5.00	9.26	6.29	(0.16, 35.07)	Average
	Shasta Regional Medical Center †	89	73	14	19.18	9.96	22.45	(12.28, 37.67)	<b>Worse</b>
	Sutter Memorial Hospital	481	307	27	8.79	11.10	9.24	(6.09, 13.44)	Average
	UC Davis Medical Center	171	101	8	7.92	11.01	8.39	(3.62, 16.53)	Average
<b>San Francisco Bay Area &amp; San Jose</b>	Alta Bates Summit Medical Center – Summit Campus – Hawthorne	156	107	17	15.89	11.95	15.5	(9.03, 24.82)	Average
	California Pacific Medical Center – Pacific Campus	87	52	7	13.46	11.09	14.15	(5.69, 29.15)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	Community Hospital of the Monterey Peninsula	103	64	7	10.94	10.20	12.50	(5.03, 25.76)	Average
	Dominican Hospital – Santa Cruz/Soquel	75	53	6	11.32	11.99	11.01	(4.04, 23.96)	Average
	El Camino Hospital	96	55	4	7.27	12.98	6.53	(1.78, 16.73)	Average
	Good Samaritan Hospital – San Jose	87	58	5	8.62	9.66	10.40	(3.38, 24.28)	Average
	John Muir Medical Center – Concord Campus	245	189	17	8.99	11.21	9.35	(5.45, 14.98)	Average
	John Muir Medical Center – Walnut Creek Campus	1	0	.	.	.	.	.	Not Available**
	Kaiser Foundation Hospital – San Francisco	440	328	33	10.06	10.42	11.26	(7.75, 15.81)	Average
	Kaiser Foundation Hospital – Santa Clara	337	244	20	8.20	12.13	7.88	(4.81, 12.17)	Average
	Marin General Hospital	34	28	5	17.86	8.41	24.77	(8.04, 57.81)	Average
	North Bay Medical Center	56	43	6	13.95	12.96	12.55	(4.61, 27.33)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	O'Connor Hospital – San Jose	39	24	2	8.33	10.79	9.00	(1.09, 32.52)	Average
	Peninsula Medical Center	48	34	6	17.65	11.16	18.44	(6.77, 40.14)	Average
	Queen of the Valley Hospital – Napa	64	37	1	2.70	11.08	2.84	(0.07, 15.84)	Average
	Regional Medical of San Jose	85	66	13	19.70	17.22	13.33	(7.10, 22.81)	Average
	Saint Helena Hospital	90	61	8	13.11	12.01	12.72	(5.49, 25.08)	Average
	Saint Mary's Medical Center, San Francisco	23	15	1	6.67	10.71	7.26	(0.18, 40.44)	Average
	Salinas Valley Memorial Hospital	97	76	4	5.26	12.72	4.82	(1.31, 12.35)	Average
	San Ramon Regional Medical Center	25	17	1	5.88	7.84	8.74	(0.22, 48.72)	Average
	Santa Clara Valley Medical Center	88	63	9	14.29	9.43	17.66	(8.07, 33.52)	Average
	Santa Rosa Memorial Hospital – Montgomery	89	69	2	2.90	9.63	3.51	(0.43, 12.68)	Average
	Sequoia Hospital	79	42	4	9.52	13.03	8.52	(2.32, 21.81)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	Seton Medical Center	66	49	5	10.20	12.82	9.28	(3.01, 21.66)	Average
	Stanford Hospital	122	74	0	0.00	11.46	0.00	(0.00, 5.07)	<b>Better</b>
	Sutter Medical Center of Santa Rosa	65	50	5	10.00	8.82	13.22	(4.29, 30.86)	Average
	UC San Francisco Medical Center	94	65	7	10.77	10.42	12.05	(4.85, 24.83)	Average
	Valleycare Medical Center	35	18	2	11.11	13.73	9.43	(1.14, 34.08)	Average
	Washington Hospital – Fremont	118	93	12	12.90	12.56	11.98	(6.19, 20.93)	Average
<b>Central California</b>	Bakersfield Heart Hospital	90	70	8	11.43	11.18	11.92	(5.15, 23.49)	Average
	Bakersfield Memorial Hospital	160	124	16	12.90	13.63	11.04	(6.31, 17.93)	Average
	Community Regional Medical Center – Fresno	264	194	24	12.37	12.01	12.00	(7.69, 17.86)	Average
	Dameron Hospital	48	38	4	10.53	11.78	10.42	(2.84, 26.69)	Average
	Doctors Medical Center	246	165	24	14.55	13.39	12.67	(8.12, 18.85)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Central California (continued)</b>	Emanuel Medical Center, Inc.	50	46	9	19.57	13.10	17.40	(7.96, 33.05)	Average
	Fresno Heart and Surgical Hospital	160	129	10	7.75	11.32	7.98	(3.83, 14.68)	Average
	Kaweah Delta Medical Center	185	150	16	10.67	11.62	10.7	(6.12, 17.39)	Average
	Marian Regional Medical Center	65	49	1	2.04	12.30	1.93	(0.05, 10.78)	<b>Better</b>
	Memorial Hospital Medical Center – Modesto	184	146	17	11.64	11.30	12.01	(7.00, 19.23)	Average
	Saint Agnes Medical Center	275	177	14	7.91	11.12	8.29	(4.53, 13.92)	Average
	Saint Joseph's Medical Center of Stockton	229	178	22	12.36	13.57	10.62	(6.66, 16.08)	Average
	San Joaquin Community Hospital	79	61	5	8.20	11.53	8.28	(2.69, 19.34)	Average
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara</b>	Antelope Valley Hospital	20	18	4	22.22	10.02	25.85	(7.04, 66.20)	Average
	Community Memorial Hospital – San Buenaventura	88	65	7	10.77	11.79	10.65	(4.28, 21.94)	Average
	French Hospital Medical Center	123	80	12	15.00	10.15	17.23	(8.90, 30.10)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara (continued)</b>	Glendale Adventist Medical Center – Wilson Terrace	149	110	17	15.45	10.78	16.72	(9.74, 26.77)	Average
	Glendale Memorial Hospital and Medical Center	128	95	16	16.84	11.46	17.14	(9.80, 27.83)	Average
	Los Robles Hospital and Medical Center	101	68	10	14.71	11.33	15.13	(7.26, 27.83)	Average
	Northridge Hospital Medical Center	71	55	10	18.18	12.95	16.37	(7.85, 30.11)	Average
	Palmdale Regional Medical Center	10	8	0	0.00	12.90	0.00	(0.00, 41.67)	Average
	Providence Holy Cross Medical Center	50	33	9	27.27	13.24	24.02	(10.98, 45.60)	Average
	Providence Saint Joseph Medical Center	63	46	5	10.87	9.43	13.43	(4.36, 31.36)	Average
	Providence Tarzana Medical Center	68	47	3	6.38	10.20	7.29	(1.50, 21.32)	Average
	Saint John's Regional Medical Center	77	50	6	12	12.53	11.16	(4.10, 24.31)	Average
	Santa Barbara Cottage Hospital	101	73	6	8.22	11.42	8.39	(3.08, 18.26)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara (continued)</b>	Valley Presbyterian Hospital	44	34	5	14.71	10.60	16.17	(5.25, 37.75)	Average
	West Hills Hospital and Medical Center	51	41	4	9.76	11.57	9.83	(2.68, 25.18)	Average
<b>Greater Los Angeles</b>	Beverly Hospital	30	26	3	11.54	14.17	9.49	(1.96, 27.75)	Average
	California Hospital Medical Center – Los Angeles	33	27	2	7.41	15.38	5.61	(0.68, 20.28)	Average
	Cedars Sinai Medical Center	220	116	18	15.52	10.70	16.91	(10.03, 26.73)	Average
	Centinela Hospital Medical Center	31	19	4	21.05	17.36	14.13	(3.85, 36.20)	Average
	Citrus Valley Medical Center – Inter Community Campus	107	84	11	13.1	13.94	10.95	(5.47, 19.60)	Average
	Downey Regional Medical Center	66	53	7	13.21	10.67	14.42	(5.80, 29.72)	Average
	Garfield Medical Center	132	70	11	15.71	11.66	15.71	(7.84, 28.12)	Average
	Good Samaritan Hospital – Los Angeles	111	64	9	14.06	11.99	13.67	(6.25, 25.95)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Greater Los Angeles (continued)</b>	Henry Mayo Newhall Memorial Hospital	19	12	5	41.67	12.36	39.29	(12.76, 91.71)	<b>Worse</b>
	Hollywood Presbyterian Medical Center	50	43	10	23.26	12.44	21.79	(10.45, 40.08)	Average
	Huntington Memorial Hospital	97	64	11	17.19	12.25	16.35	(8.16, 29.27)	Average
	Kaiser Foundation Hospital – Sunset	657	486	47	9.67	11.76	9.59	(7.04, 12.75)	Average
	Keck Hospital of University of Southern California	136	53	7	13.21	11.88	12.96	(5.21, 26.72)	Average
	Lakewood Regional Medical Center	89	70	11	15.71	14.36	12.76	(6.37, 22.83)	Average
	Long Beach Memorial Medical Center	187	137	13	9.49	12.48	8.87	(4.72, 15.17)	Average
	Los Angeles County/Harbor – UCLA Medical Center	95	67	15	22.39	11.55	22.59	(12.65, 37.27)	<b>Worse</b>
	Los Angeles County/University of Southern California Medical Center	123	79	15	18.99	9.94	22.27	(12.47, 36.73)	<b>Worse</b>

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Greater Los Angeles (continued)</b>	Methodist Hospital of Southern California	56	43	4	9.30	10.85	9.99	(2.72, 25.59)	Average
	Presbyterian Intercommunity Hospital	150	63	3	4.76	13.13	4.23	(0.87, 12.36)	Average
	Providence Little Company of Mary Medical Center – Torrance	117	76	15	19.74	12.23	18.82	(10.53, 31.04)	Average
	Ronald Reagan UCLA Medical Center	211	103	20	19.42	12.77	17.73	(10.83, 27.39)	Average
	Saint Francis Medical Center	28	23	3	13.04	11.47	13.26	(2.73, 38.75)	Average
	Saint John's Health Center	60	34	2	5.88	9.89	6.93	(0.84, 25.06)	Average
	Saint Mary Medical Center	60	50	6	12.00	14.16	9.88	(3.63, 21.51)	Average
	Saint Vincent Medical Center	74	60	11	18.33	13.35	16.01	(7.99, 28.65)	Average
	Torrance Memorial Medical Center	58	33	0	0.00	9.27	0.00	(0.00, 14.06)	Average
	White Memorial Medical Center	51	42	2	4.76	13.38	4.15	(0.50, 14.99)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Inland Empire, Riverside &amp; San Bernardino</b>	Desert Regional Medical Center	127	95	13	13.68	11.34	14.07	(7.49, 24.07)	Average
	Desert Valley Hospital	38	25	7	28.00	13.69	23.84	(9.59, 49.13)	Average
	Eisenhower Medical Center	167	119	16	13.45	12.91	12.14	(6.94, 19.72)	Average
	Loma Linda University Medical Center	244	149	26	17.45	13.58	14.98	(9.79, 21.96)	Average
	Loma Linda University Medical Center – Murrieta	110	73	6	8.22	11.19	8.57	(3.14, 18.65)	Average
	Pomona Valley Hospital Medical Center	118	94	16	17.02	11.54	17.20	(9.83, 27.94)	Average
	Riverside Community Hospital	213	142	20	14.08	10.69	15.36	(9.38, 23.72)	Average
	Saint Bernardine Medical Center	546	404	38	9.41	10.36	10.58	(7.49, 14.53)	Average
	Saint Mary Regional Medical Center	131	99	10	10.10	11.33	10.39	(4.99, 19.12)	Average
	San Antonio Community Hospital	184	126	7	5.56	11.11	5.83	(2.34, 12.01)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Orange County</b>	AHMC Anaheim Regional Medical Center	144	95	13	13.68	12.90	12.37	(6.59, 21.15)	Average
	Fountain Valley Regional Hospital and Medical Center – Euclid	109	89	9	10.11	13.33	8.84	(4.04, 16.79)	Average
	Hoag Memorial Hospital Presbyterian	236	146	14	9.59	11.45	9.76	(5.34, 16.38)	Average
	Mission Hospital Regional Medical Center	137	98	12	12.24	10.97	13.01	(6.73, 22.74)	Average
	Orange Coast Memorial Medical Center	89	72	13	18.06	9.46	22.24	(11.85, 38.05)	<b>Worse</b>
	Saddleback Memorial Medical Center	102	76	8	10.53	10.95	11.20	(4.84, 22.08)	Average
	Saint Joseph Hospital – Orange	121	79	4	5.06	10.54	5.60	(1.53, 14.34)	Average
	Saint Jude Medical Center	91	69	7	10.14	12.43	9.52	(3.83, 19.61)	Average
	UC Irvine Medical Center	56	41	7	17.07	10.06	19.78	(7.96, 40.77)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Orange County (continued)</b>	West Anaheim Medical Center	26	19	5	26.32	13.85	22.16	(7.20, 51.71)	Average
	Western Medical Center – Anaheim	62	51	4	7.84	11.31	8.08	(2.20, 20.70)	Average
	Western Medical Center – Santa Ana	86	66	10	15.15	11.52	15.33	(7.35, 28.19)	Average
<b>Greater San Diego</b>	Alvarado Hospital	46	29	3	10.34	11.21	10.76	(2.22, 31.44)	Average
	Grossmont Hospital	151	106	22	20.75	12.77	18.95	(11.88, 28.69)	<b>Worse</b>
	Palomar Health Downtown Campus	50	42	4	9.52	13.28	8.36	(2.28, 21.41)	Average
	Scripps Green Hospital	55	28	2	7.14	8.12	10.25	(1.24, 37.04)	Average
	Scripps Memorial Hospital – La Jolla	330	225	20	8.89	10.40	9.96	(6.09, 15.39)	Average
	Scripps Mercy Hospital	150	115	19	16.52	11.13	17.31	(10.42, 27.04)	Average
	Sharp Chula Vista Medical Center	115	68	12	17.65	12.61	16.32	(8.43, 28.51)	Average

**Table F-3: Hospital Risk-Adjusted 30-Day Readmission Results by Region, 2013**

Region	Hospital	All CABG Cases	Isolated CABG Cases, Discharged Alive	Isolated CABG Readmission	Observed Readmission Rate (%)	Expected Readmission Rate (%)	Risk-Adjusted Readmission Rate (% RARR)	95%CI for RARR	Performance Rating*
<b>State</b>		<b>15,546</b>	<b>10,740</b>	<b>1,252</b>	<b>11.66</b>				
<b>Greater San Diego (continued)</b>	Sharp Memorial Hospital	183	110	13	11.82	10.45	13.19	(7.02, 22.55)	Average
	Tri-City Medical Center – Oceanside	80	54	1	1.85	10.34	2.09	(0.05, 11.63)	<b>Better</b>
	UC San Diego Health – Sulpizio Cardiovascular Center	142	71	9	12.68	11.96	12.36	(5.65, 23.46)	Average

\*A hospital is classified as “**Better**” if the upper 95% CI of the RARR falls below the California observed readmission rate (11.66%). A hospital is classified as “**Worse**” if the lower 95% CI of the RARR is higher than the California observed readmission rate. A hospital’s performance is considered “**Average**” if the statewide average readmission rate falls within the 95% CI of a hospital’s RARR.

\*\* Hospital results are not shown because data necessary to confirm deaths and readmissions was not available.

† Hospitals submitted statements regarding this report. See Appendix C for their statements.

## Hospital Internal Mammary Artery Usage Results, 2013

A widely accepted definition of healthcare quality contains three dimensions: process, structure, and outcomes.<sup>8</sup> In addition to publishing hospital outcomes, this report also assesses a process of care measure by reporting hospital use of the internal mammary artery (IMA) in surgery. Although outcomes measurement permits comparison of provider performance and can be used for investigating internal processes and structures, assessing process of care provides a more immediate path to improvement in patient care since it involves measurement of the care patients actually receive. If diagnostic and therapeutic strategies with clear links to outcomes are monitored, some healthcare quality problems can be detected long before demonstrable health outcome differences occur.

In most cases of first-time isolated CABG surgery where the operative status is elective or urgent, the surgeon has the option of using the IMA (also known as the internal thoracic artery). Clinical literature strongly supports use of the IMA to promote long-term graft patency (durability) and patient survival. Research also suggests a reduction in immediate operative mortality associated with use of the internal mammary artery rather than saphenous (leg) vein revascularization.<sup>9</sup> The IMA, and especially the left IMA, is considered the preferred conduit for CABG surgery of the left anterior descending (LAD) artery.

Many nationally respected organizations encourage the use of IMA when appropriate. Currently, the Leapfrog Evidence-Based Hospital Referral program endorses the goal of 80% hospital adherence to IMA use. The NQF does not endorse a specific rate but states that the goal is to raise the IMA usage rates of hospitals with low utilization. The STS states that IMA use should be given primary consideration in every CABG surgery patient. Furthermore, a number of healthcare quality advocates recommend public reporting of IMA usage rates for CABG surgery.

Table G-1 presents hospital results by region for usage of the IMA during 2013. *Only first-time isolated CABG surgeries where the operative status is elective or urgent and the LAD was bypassed are included in calculating IMA usage rates.* The statewide IMA usage rate remained virtually unchanged with eligible data for evaluation in 2013 (96.6% in 2011, 96.5% in 2012 and 96.6% in 2013). Of the 123 eligible hospitals, six hospitals received a “**Low**” rating for 2013 (Antelope Valley Hospital, Garfield Medical Center, Memorial Hospital Medical Center – Modesto, Palmdale Regional Medical Center, Sutter Medical Center of Santa Rosa, and Saint Francis Medical Center); two were not rated due to lack of data, and the rest were rated “**Acceptable.**” Hospital IMA usage rates above the statewide average rate were not rated because there is no consensus on what constitutes an optimal IMA usage rate.

### Definitions of Table G. Terms

**Isolated CABG Surgeries:** Includes only first-time, non-cardiogenic shock, isolated CABG surgeries for 2013 where the operative status was elective or urgent and the LAD was bypassed. This number is usually smaller than the total isolated CABG cases performed by the hospital.

<sup>8</sup> Donabedian A. Evaluating the Quality of Medical Care. *The Milbank Quarterly*, 2005; 83(4):691-729.

<sup>9</sup> Ferguson TB Jr., Coombs LP, Peterson ED. “Internal thoracic artery grafting in the elderly patient undergoing coronary artery bypass grafting: room for process improvement?” *Journal of Thoracic and Cardiovascular Surgery*, 2002; 123(5):869-80.

**IMA Usage Rate:** The ratio of the number of CABG surgeries with IMA grafts (including left IMA, right IMA, and bilateral IMA) and selected first-time isolated CABG cases (see footnote\* on Table G) multiplied by 100: Percent IMA use = Number of IMA Grafts used for First-Time Isolated CABG Surgeries/Number of First-Time Isolated CABG Cases × 100.

**Performance Rating:** An “**Acceptable**” rating indicates that the IMA usage rate is within the acceptable range of the statewide average. A “**Low**” rating indicates that the IMA usage rate for a hospital is less than 88.10%, i.e., two standard deviations ( $0.043 \times 1.96$ ) below the hospital statewide average IMA usage rate (96.60%). IMA usage rates above the hospital statewide average IMA usage rate was not evaluated because there is no consensus on what constitutes an optimal rate of usage.

**Table G: Hospital Internal Mammary Artery Usage Results by Region, 2013**

Region	Hospital	Isolated CABGs*	Percent IMA Use (%)	Rank**
<b>State</b>	<b>All Hospitals</b>	<b>10,767</b>	<b>96.60</b>	
<b>Sacramento Valley &amp; Northern California Region</b>	Enloe Medical Center – Esplanade Campus	110	99.09	Acceptable
	Mercy General Hospital	406	99.75	Acceptable
	Mercy Medical Center – Redding	71	100.00	Acceptable
	Mercy San Juan Hospital	71	100.00	Acceptable
	Rideout Memorial Hospital	64	96.88	Acceptable
	Saint Joseph Hospital – Eureka	18	94.44	Acceptable
	Shasta Regional Medical Center †	64	89.06	Acceptable
	Sutter Memorial Hospital	296	97.97	Acceptable
	UC Davis Medical Center	109	100.00	Acceptable
<b>San Francisco Bay Area &amp; San Jose</b>	Alta Bates Summit Medical Center – Summit Campus – Hawthorne	118	99.15	Acceptable
	California Pacific Medical Center – Pacific Campus	67	97.01	Acceptable
	Community Hospital of the Monterey Peninsula	68	100.00	Acceptable
	Dominican Hospital – Santa Cruz/Soquel	58	96.55	Acceptable
	El Camino Hospital	59	100.00	Acceptable
	Good Samaritan Hospital – San Jose	56	100.00	Acceptable
	John Muir Medical Center – Concord Campus	191	97.91	Acceptable
	John Muir Medical Center – Walnut Creek Campus	N/A	N/A	Acceptable
	Kaiser Foundation Hospital – San Francisco	327	96.33	Acceptable

**Table G: Hospital Internal Mammary Artery Usage Results by Region, 2013**

Region	Hospital	Isolated CABGs*	Percent IMA Use (%)	Rank**
<b>State</b>	<b>All Hospitals</b>	<b>10,767</b>	<b>96.60</b>	
<b>San Francisco Bay Area &amp; San Jose (continued)</b>	Kaiser Foundation Hospital – Santa Clara	222	100.00	Acceptable
	Marin General Hospital	30	93.33	Acceptable
	North Bay Medical Center	46	100.00	Acceptable
	O'Connor Hospital – San Jose	25	100.00	Acceptable
	Peninsula Medical Center	38	97.37	Acceptable
	Queen of the Valley Hospital – Napa	43	100.00	Acceptable
	Regional Medical of San Jose	63	96.83	Acceptable
	Saint Helena Hospital	N/A		Acceptable
	Saint Mary's Medical Center, San Francisco	15	100.00	Acceptable
	Salinas Valley Memorial Hospital	79	94.94	Acceptable
	San Ramon Regional Medical Center	16	100.00	Acceptable
	Santa Clara Valley Medical Center	68	98.53	Acceptable
	Santa Rosa Memorial Hospital – Montgomery	63	98.41	Acceptable
	Sequoia Hospital	39	97.44	Acceptable
	Seton Medical Center	50	94.00	Acceptable
	Stanford Hospital	83	97.59	Acceptable
	Sutter Medical Center of Santa Rosa	44	75.00	<b>Low</b>
	UC San Francisco Medical Center	75	100.00	Acceptable
	Valleycare Medical Center	20	100.00	Acceptable
Washington Hospital – Fremont	101	95.05	Acceptable	
<b>Central California</b>	Bakersfield Heart Hospital	75	94.67	Acceptable
	Bakersfield Memorial Hospital	111	94.59	Acceptable
	Community Regional Medical Center – Fresno	187	99.47	Acceptable
	Dameron Hospital	40	97.50	Acceptable
	Doctors Medical Center	165	95.15	Acceptable
	Emanuel Medical Center, Inc.	41	95.12	Acceptable
	Fresno Heart and Surgical Hospital	120	95.83	Acceptable
	Kaweah Delta Medical Center	154	98.05	Acceptable
	Marian Regional Medical Center	49	100.00	Acceptable

**Table G: Hospital Internal Mammary Artery Usage Results by Region, 2013**

Region	Hospital	Isolated CABGs*	Percent IMA Use (%)	Rank**
<b>State</b>	<b>All Hospitals</b>	<b>10,767</b>	<b>96.60</b>	
<b>Central California (continued)</b>	Memorial Hospital Medical Center – Modesto	140	87.86	<b>Low</b>
	Saint Agnes Medical Center	201	99.00	Acceptable
	Saint Joseph's Medical Center of Stockton	173	98.84	Acceptable
	San Joaquin Community Hospital	59	93.22	Acceptable
<b>San Fernando Valley, Antelope Valley, Ventura &amp; Santa Barbara</b>	Antelope Valley Hospital	17	82.35	<b>Low</b>
	Community Memorial Hospital – San Buenaventura	61	100.00	Acceptable
	French Hospital Medical Center	78	98.72	Acceptable
	Glendale Adventist Medical Center – Wilson Terrace	117	94.87	Acceptable
	Glendale Memorial Hospital and Medical Center	103	100.00	Acceptable
	Los Robles Hospital and Medical Center	62	98.39	Acceptable
	Northridge Hospital Medical Center	58	100.00	Acceptable
	Palmdale Regional Medical Center	10	80.00	<b>Low</b>
	Providence Holy Cross Medical Center	37	100.00	Acceptable
	Providence Saint Joseph Medical Center	48	100.00	Acceptable
	Providence Tarzana Medical Center	47	100.00	Acceptable
	Saint John's Regional Medical Center	54	98.15	Acceptable
	Santa Barbara Cottage Hospital	71	92.96	Acceptable
	Valley Presbyterian Hospital	38	100.00	Acceptable
	West Hills Hospital and Medical Center	33	96.97	Acceptable
	<b>Greater Los Angeles</b>	Beverly Hospital	26	96.15
California Hospital Medical Center – Los Angeles		29	96.55	Acceptable
Cedars Sinai Medical Center		116	99.14	Acceptable
Centinela Hospital Medical Center		21	95.24	Acceptable
Citrus Valley Medical Center – Inter Community Campus		80	95.00	Acceptable
Downey Regional Medical Center		58	94.83	Acceptable
Garfield Medical Center		104	87.50	<b>Low</b>

**Table G: Hospital Internal Mammary Artery Usage Results by Region, 2013**

Region	Hospital	Isolated CABGs*	Percent IMA Use (%)	Rank**
<b>State</b>	<b>All Hospitals</b>	<b>10,767</b>	<b>96.60</b>	
<b>Greater Los Angeles (continued)</b>	Good Samaritan Hospital – Los Angeles	75	94.67	Acceptable
	Henry Mayo Newhall Memorial Hospital	11	100.00	Acceptable
	Hollywood Presbyterian Medical Center	39	92.31	Acceptable
	Huntington Memorial Hospital	64	100.00	Acceptable
	Kaiser Foundation Hospital – Sunset	476	98.95	Acceptable
	Keck Hospital of University of Southern California	53	94.34	Acceptable
	Lakewood Regional Medical Center	71	88.73	Acceptable
	Long Beach Memorial Medical Center	144	95.14	Acceptable
	Los Angeles County/Harbor – UCLA Medical Center	80	100.00	Acceptable
	Los Angeles County/University of Southern California Medical Center	92	94.57	Acceptable
	Methodist Hospital of Southern California	42	97.62	Acceptable
	Presbyterian Intercommunity Hospital	64	95.31	Acceptable
	Providence Little Company of Mary Medical Center – Torrance	67	89.55	Acceptable
	Ronald Reagan UCLA Medical Center	78	100.00	Acceptable
	Saint Francis Medical Center	24	79.17	<b>Low</b>
	Saint John’s Health Center	37	97.30	Acceptable
	Saint Mary Medical Center	40	95.00	Acceptable
	Saint Vincent Medical Center	59	91.53	Acceptable
	Torrance Memorial Medical Center	37	97.30	Acceptable
	White Memorial Medical Center	45	100.00	Acceptable
<b>Inland Empire, Riverside &amp; San Bernardino</b>	Desert Regional Medical Center	91	97.80	Acceptable
	Desert Valley Hospital	29	96.55	Acceptable
	Eisenhower Medical Center	118	100.00	Acceptable
	Loma Linda University Medical Center	158	98.10	Acceptable
	Loma Linda University Medical Center – Murrieta	84	95.24	Acceptable

**Table G: Hospital Internal Mammary Artery Usage Results by Region, 2013**

Region	Hospital	Isolated CABGs*	Percent IMA Use (%)	Rank**
<b>State</b>	<b>All Hospitals</b>	<b>10,767</b>	<b>96.60</b>	
<b>Inland Empire, Riverside &amp; San Bernardino (continued)</b>	Pomona Valley Hospital Medical Center	89	98.88	Acceptable
	Riverside Community Hospital	139	96.40	Acceptable
	Saint Bernardine Medical Center	436	98.39	Acceptable
	Saint Mary Regional Medical Center	100	96.00	Acceptable
	San Antonio Community Hospital	119	98.32	Acceptable
<b>Orange County</b>	AHMC Anaheim Regional Medical Center	110	95.45	Acceptable
	Fountain Valley Regional Hospital and Medical Center – Euclid	94	93.62	Acceptable
	Hoag Memorial Hospital Presbyterian	130	93.08	Acceptable
	Mission Hospital Regional Medical Center	94	98.94	Acceptable
	Orange Coast Memorial Medical Center	68	97.06	Acceptable
	Saddleback Memorial Medical Center	76	97.37	Acceptable
	Saint Joseph Hospital – Orange	81	97.53	Acceptable
	Saint Jude Medical Center	64	98.44	Acceptable
	UC Irvine Medical Center	44	97.73	Acceptable
	West Anaheim Medical Center	24	91.67	Acceptable
	Western Medical Center – Anaheim	48	100.00	Acceptable
	Western Medical Center – Santa Ana	67	100.00	Acceptable
	<b>Greater San Diego</b>	Alvarado Hospital	34	100.00
Grossmont Hospital		112	100.00	Acceptable
Palomar Health Downtown Campus		39	100.00	Acceptable
Scripps Green Hospital		26	100.00	Acceptable
Scripps Memorial Hospital – La Jolla		215	99.07	Acceptable
Scripps Mercy Hospital		115	100.00	Acceptable
Sharp Chula Vista Medical Center		73	100.00	Acceptable

**Table G: Hospital Internal Mammary Artery Usage Results by Region, 2013**

Region	Hospital	Isolated CABGs*	Percent IMA Use (%)	Rank**
<b>State</b>	<b>All Hospitals</b>	<b>10,767</b>	<b>96.60</b>	
<b>Greater San Diego (continued)</b>	Sharp Memorial Hospital	109	94.50	Acceptable
	Tri-City Medical Center – Oceanside	52	98.08	Acceptable
	UC San Diego Health – Sulpizio Cardiovascular Center	75	97.33	Acceptable

\* Only includes first-time non-cardiogenic shock isolated CABGs where the operative status was elective or urgent and LAD was bypassed.

\*\* Rank: “Low” IMA usage rate for a hospital is less than 88.1%, i.e., two standard deviations (0.043x1.96) below the hospital statewide average IMA usage rate (96.60%).

## Appendix A: Definition of Terms

**All CABG Cases:** The total number of isolated and non-isolated CABG cases submitted to CCORP. To improve statistical reliability, some measures combine data from two years.

Hospital Operative Mortality: 2012

Hospital Post-Operative Stroke: 2013

Hospital 30-Day Readmission: 2012

Surgeon Operative Mortality: 2011 and 2012

**Isolated CABG Cases:** The number of isolated CABG cases submitted to CCORP during the time period indicated for the outcome listed above. All patients in salvage operative status are excluded from the isolated CABG cases, thus only isolated CABG cases without salvage operative status are used to calculate performance ratings.

**CABG + Valve Cases:** The number of CABG cases performed that included aortic valve replacement, mitral valve repair or replacement or a combination thereof.

### Isolated CABG Outcomes:

**Operative Mortality:** The number of operative deaths for isolated CABG cases for the time period indicated. The number of deaths includes 1) all deaths that occur during the hospitalization in which the CABG surgery was performed, including those occurring after 30 days; and 2) all deaths occurring within 30 days after the CABG surgery. (2013 data)

**Post-Operative Strokes:** The number of post-operative strokes that were unresolved after 24 hours for isolated CABG cases for the time period indicated. (2012-2013 data)

**30-Day Readmission (for Isolated CABG Cases Discharged Alive):** The number of hospital readmissions within 30 days of being discharged from the hospital where an isolated CABG operation was performed, irrespective of the hospital to which they were readmitted. A readmission was included only if the patient was readmitted with a principal diagnosis that indicated a heart-related condition, an infection, or a complication that was likely related to the CABG surgery. Readmission was attributed to the hospital performing the initial CABG surgery. (2013 data)

### CABG + Valve Outcome:

**Operative Mortality:** The number of operative deaths for CABG + valve cases for the time period indicated. CABG + Valve cases are defined as CABG surgery with aortic valve replacement, mitral valve repair or replacement or a combination thereof. The number of deaths includes 1) all deaths that occur during the hospitalization in which the CABG surgery was performed, including those occurring after 30 days; and 2) all deaths occurring within 30 days after the CABG surgery. (2012-2013 data)

**Observed CABG Outcome Rate:** The ratio of the number of (isolated or + valve) CABGs with an outcome (operative deaths or post-operative strokes) and the number of (isolated or + valve) CABG cases multiplied by 100: Observed Outcome Rate (operative death or post-operative stroke) =  $\frac{\text{Isolated CABG Cases with Outcome}}{\text{Isolated CABG Cases}} \times 100$ .

The *observed CABG readmission* rate is calculated a little differently – the ratio of the number of isolated CABG readmissions within 30 days of discharge and the number of

discharged-alive isolated CABG cases multiplied by 100: Observed Readmission Rate = Isolated CABG Readmissions within 30 Days of Discharge/Discharged-Alive Isolated CABG Cases × 100.

**Expected CABG Outcome Rate:** The ratio of the expected number of outcomes (operative deaths or post-operative strokes) predicted for a provider (after risk adjusting for the provider's patient population) and the number of isolated CABG cases multiplied by 100: Expected CABG Outcome Rate = Expected CABG Outcomes/Isolated CABG Cases × 100.

For the *expected CABG readmission rate*: The ratio of the expected number of readmissions predicted for a provider (after adjusting for their patient population) and the number of discharged-alive isolated CABG cases multiplied by 100: Expected Readmission Rate = Expected Readmissions/Discharged-Alive Isolated CABG Cases × 100.

**Risk-Adjusted Outcome Rate (95% CI):** The risk-adjusted outcome rate (Mortality Rate [RAMR]; Post-Operative Stroke Rate [RASR]; or Readmission Rate [RARR]) is obtained by multiplying the California observed CABG outcome rate by the provider's relevant Observed/Expected ratio. The 95% confidence interval represents the confidence we have in the estimate for the risk-adjusted rate. The lower and upper confidence limits are calculated using Poisson exact confidence interval calculations.

**Performance Rating:** The performance rating is based on a comparison of each provider's risk-adjusted outcome rate and the California observed outcome rate. This is a test of statistical significance. A provider is classified as "**Better**" if the upper 95% confidence limit of its rate falls below the California observed rate. A provider is classified as "**Worse**" if the lower 95% confidence limit of its outcome rate is higher than the California observed rate. A provider is classified as "**Average**" if the California outcome rate falls within the confidence interval of the provider's risk-adjusted outcome rate.

## Appendix B: Definition of Readmission

A readmission was counted only if the patient was readmitted with a principal diagnosis (i.e., the reason for the readmission) that indicated a heart-related condition, or an infection or a complication that was likely related to the CABG surgery hospitalization. California adopted the diagnosis categories and associated ICD-9-CM codes for readmissions that are used by the Pennsylvania Healthcare Cost Containment Council. The following list of categories shows the ICD-9-CM codes that were counted as readmissions if the code was located in the principal diagnosis position (<http://www.phc4.org/reports/cabg/12/docs/cabg2012technotes.pdf>).

### CIRCULATORY SYSTEM

#### Cardiac Dysrhythmias

Heart Block: 426.0, 426.10, 426.11, 426.12, 426.13, 426.2, 426.3, 426.4, 426.50, 426.51, 426.52, 426.53, 426.54, 426.6, 426.7, 426.81, 426.82, 426.89, 426.9  
 Paroxysmal Tachycardia: 427.0, 427.1, 427.2  
 Atrial Fibrillation and Atrial Flutter: 427.31, 427.32  
 Ventricular Fibrillation and Ventricular Flutter: 427.41, 427.42, 427.5  
 Premature Heart Beats: 427.60, 427.61, 427.69  
 Other Cardiac Dysrhythmias: 427.81, 427.89, 427.9

Heart Failure: 398.91, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9

Functional Disturbances Follow Cardiac Surgery (Postcardiotomy Syndrome): 429.4

#### Hypertension and Hypotension

Essential Hypertension: 401.0, 401.1, 401.9  
 Hypertensive Heart Disease: 402.00, 402.01, 402.10, 402.11, 402.90, 402.91  
 Hypertensive Chronic Kidney Disease: 403.00, 403.01, 403.10, 403.11, 403.90, 403.91  
 Hypertensive Heart and Chronic Kidney Disease: 404.00, 404.01, 404.02, 404.03, 404.10, 404.11, 404.12, 404.13, 404.90, 404.91, 404.92, 404.93  
 Secondary Hypertension: 405.01, 405.09, 405.11, 405.19, 405.91, 405.99  
 Hypotension: 458.0, 458.1, 458.21, 458.29, 458.8, 458.9, 796.3

#### Myocardial Infarction and Ischemia

Acute Myocardial Infarction, Initial Episode: 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91  
 Acute Myocardial Infarction, Unspecified or Subsequent Episode: 410.00, 410.02, 410.10, 410.12, 410.20, 410.22, 410.30, 410.32, 410.40, 410.42, 410.50, 410.52, 410.60, 410.62, 410.70, 410.72, 410.80, 410.82, 410.90, 410.92  
 Other Forms of Myocardial Ischemia: 411.0, 411.81, 411.89, 429.79

Angina Pectoris and Chest Pain: 411.1, 413.0, 413.1, 413.9, 786.50, 786.51, 786.59

#### Atherosclerosis

Coronary Atherosclerosis: 414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.07, 414.2, 414.3  
 Other Atherosclerosis: 429.2, 440.0, 440.1, 440.20, 440.21, 440.22, 440.23, 440.24, 440.29, 440.30, 440.31, 440.32, 440.8, 440.9

Heart Aneurysm and Dissection: 414.10, 414.11, 414.12, 414.19

Pericarditis, Endocarditis and Myocarditis: 397.9, 398.0, 420.90, 420.91, 420.99, 421.0, 421.9, 422.90, 422.91, 422.92, 422.93, 422.99, 423.1, 423.2, 423.3, 423.8, 423.9, 424.90, 424.99, 429.0, 429.1

#### Heart Valve Disease

Mitral Valve Disease: 394.0, 394.1, 394.2, 394.9, 424.0  
 Aortic Valve Disease: 395.0, 395.1, 395.2, 395.9, 424.1  
 Tricuspid Valve Disease: 397.0, 424.2  
 Pulmonary Valve Disease: 397.1, 424.3  
 Multiple Valve Disease: 396.0, 396.1, 396.2, 396.3, 396.8, 396.9  
 Other Endocardial Structure Disease: 429.5, 429.6, 429.71, 429.81

Cardiomyopathies: 425.0, 425.1, 425.3, 425.4, 425.9

#### Other Aneurysm and Dissection

Aortic Aneurysm and Dissection: 441.00, 441.01, 441.02, 441.03, 441.1, 441.2, 441.3, 441.4, 441.5, 441.6, 441.7, 441.9

Other Arterial Aneurysm: 442.0, 442.1, 442.2, 442.3, 442.81, 442.82, 442.83, 442.84, 442.89, 442.9  
 Other Arterial Dissection: 443.21, 443.22, 443.23, 443.24, 443.29

**Arterial Embolism and Thrombosis**

Abdominal and Thoracic Aorta: 444.0, 444.1  
 Arteries of the Extremities: 444.21, 444.22, 445.01, 445.02  
 Other Arteries Excluding Precerebral and Cerebral Arteries: 444.81, 444.89, 444.9, 445.81, 445.89, 449, 593.81

**Venous Embolism and Thrombosis**

Lower Extremity Venous Embolism and Thrombosis: 453.40, 453.41, 453.42  
 Renal Vein Embolism and Thrombosis: 453.3  
 Other Venous Embolism and Thrombosis: 453.8, 453.9

**Phlebitis and Thrombophlebitis**

Lower Extremity Phlebitis and Thrombophlebitis: 451.0, 451.11, 451.19, 451.2  
 Upper Extremity Phlebitis and Thrombophlebitis: 451.82, 451.83, 451.84  
 Other Vessel Phlebitis and Thrombophlebitis: 451.81, 451.89, 451.9

**Occlusion and Stenosis**

Precerebral Artery Occlusion and Stenosis: 433.00, 433.20, 433.30, 433.80, 433.90  
 Cerebral Artery Occlusion and Stenosis: 433.10, 434.00, 434.10, 434.90  
 Retinal Artery Occlusion and Visual Loss: 362.30, 362.31, 362.32, 362.33, 362.34, 362.35, 362.36, 362.37, 368.11, 368.12, 368.40

Other Diseases and Symptoms of the Circulatory System: 398.90, 398.99, 414.8, 414.9, 423.0, 429.3, 429.82, 429.89, 429.9, V533.1, V533.2, V533.9

**RESPIRATORY SYSTEM**

**Pulmonary Embolism and Infarction**

Pulmonary Embolism and Infarction: 415.0, 415.12, 415.19  
 Postoperative Pulmonary Embolism and Infarction: 415.11

Pleural Effusion and Atelectasis: 511.0, 511.8, 511.89, 511.9, 518.0

**Pneumothorax**

Pneumothorax: 512.0, 512.8  
 Postoperative Pneumothorax: 512.1

Pulmonary Edema: 514, 518.4, 518.5

Acute Respiratory Failure: 518.81, 518.82, 518.84, 799.1

Other Diseases and Symptoms of the Respiratory System: 518.1, 519.19, 519.2, 733.6, 786.00, 786.02, 786.04, 786.05, 786.06, 786.09, 786.3, 786.52, 786.6, 786.7, 786.8, 786.9, 998.81

**NERVOUS SYSTEM**

**Stroke**

Ischemic Stroke: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91  
 Hemorrhagic Stroke: 430, 431, 432.0, 432.1, 432.9  
 Transient Cerebral Ischemia: 435.0, 435.1, 435.2, 435.3, 435.8, 435.9  
 Postoperative Stroke: 997.02

Encephalopathies: 348.30, 348.31, 348.39, 349.82, 437.2

Cerebral Edema and Brain Compression: 348.4, 348.5

Anoxic Brain Damage: 348.1

Coma and Stupor: 780.01, 780.03, 780.09

Postoperative Pain: 338.12, 338.18

Other Diseases and Symptoms of the Nervous System: 336.1, 436, 780.2, 780.4, 780.97

## DIGESTIVE SYSTEM

Ischemic Bowel and Vascular Insufficiency of the Intestine: 557.0, 557.9

Intestinal Obstruction and Ileus: 560.1, 560.81, 560.89, 560.9

Ulceration, Bleeding and Perforation of the Digestive System: 528.00, 528.02, 528.09, 530.10, 530.12, 530.20, 530.21, 530.82, 531.00, 531.01, 531.10, 531.11, 531.20, 531.21, 531.30, 531.31, 531.40, 531.41, 531.50, 531.51, 531.60, 531.61, 531.70, 531.71, 531.90, 531.91, 532.00, 532.01, 532.10, 532.11, 532.20, 532.21, 532.30, 532.31, 532.40, 532.41, 532.50, 532.51, 532.60, 532.61, 532.70, 532.71, 532.90, 532.91, 533.00, 533.01, 533.10, 533.11, 533.20, 533.21, 533.30, 533.31, 533.40, 533.41, 533.50, 533.51, 533.60, 533.61, 533.70, 533.71, 533.90, 533.91, 534.00, 534.01, 534.10, 534.11, 534.20, 534.21, 534.30, 534.31, 534.40, 534.41, 534.50, 534.51, 534.60, 534.61, 534.70, 534.71, 534.90, 534.91, 535.00, 535.01, 535.40, 535.41, 535.50, 535.51, 535.60, 535.61, 569.3, 569.82, 569.83, 578.9

Acute Liver Failure: 570, 572.2

Other Diseases and Symptoms of the Digestive System: 560.30, 560.39, 568.81, 577.0, 578.0, 578.1

## URINARY SYSTEM

Acute Glomerulonephritis and Pyelonephritis: 580.0, 580.4, 580.89, 580.9, 590.10, 590.11, 590.80

Nephrotic Syndrome: 581.0, 581.1, 581.2, 581.3, 581.89, 581.9

Acute Renal Failure: 584.5, 584.6, 584.7, 584.8, 584.9

Other Diseases and Symptoms of the Urinary System: 593.9, 599.7, 599.70, 599.71, 599.72, 788.20, 788.29

## COMPLICATIONS OF SURGICAL AND MEDICAL CARE

Mechanical Complication of Cardiac Device, Implant and Graft

Mechanical Complication of Cardiac Pacemaker and AICD: 996.00, 996.01, 996.04

Mechanical Complication of Heart Valve Prosthesis: 996.02

Mechanical Complication of Coronary Artery Bypass Graft: 996.03

Other and Unspecified Mechanical Complication: 996.09, 996.1, 996.59

Other Complication of Internal Prosthetic Device, Implant and Graft

Other Complication of Heart Valve Prosthesis: 996.71

Other Complication of Other Cardiac Device, Implant and Graft: 996.72

Other Complication of Vascular Device, Implant and Graft: 996.74

Shock

Postoperative Shock: 998.0

Cardiogenic Shock: 785.51

Other Shock: 785.50, 785.59

Hemorrhage and Hematoma Complicating a Procedure: 459.0, 998.11, 998.12, 998.13

Foreign Body Accidentally Left or Accidental Laceration During a Procedure: 998.2, 998.4, 998.7

Dehiscence and Rupture of Operation Wound: 998.31, 998.32, 998.6, 998.83

Other Complications of Surgical and Medical Care

Nervous System Complication: 997.00, 997.01, 997.09

Circulatory System Complication: 997.1, 997.2, 997.71, 997.72, 997.79, 999.1, 999.2

Respiratory System Complication: 519.00, 519.02, 519.09, 997.3, 997.39

Digestive System Complication: 536.40, 536.42, 536.49, 997.4

Urinary System Complication: 997.5

Other Complications: 998.89, 998.9, 999.8, 999.89

## INFECTIONS

Postoperative Infections: 997.31, 998.51, 998.59, 99.3, 999.31, 999.39

Sepsis and Bacteremia: 038.0, 038.10, 038.11, 038.12, 038.19, 038.2, 038.3, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9, 785.52, 790.7, 995.90, 995.91, 995.92

**Pneumonia**

Pneumonia: 481, 482.0, 482.1, 482.2, 482.30, 482.31, 482.32, 482.39, 482.40, 482.41, 482.42, 482.49, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 485, 486, 511.1  
Aspiration Pneumonia: 507.0  
Empyema and Abscess of Lung: 510.0, 510.9, 513.0, 513.1

**Infection due to Device, Implant and Graft**

Cardiac Device, Implant and Graft: 996.61  
Vascular Device, Implant and Graft: 996.62  
Other and Unspecified Infections due to Device, Implant and Graft: 519.01, 536.41

Urinary Tract Infection: 590.3, 590.9, 595.0, 599.0, 996.64

Cellulitis: 681.00, 681.01, 681.02, 681.10, 681.11, 681.9, 682.0, 682.1, 682.2, 682.3, 682.4, 682.5, 682.6, 682.7, 682.8, 682.9

Osteomyelitis: 730.03, 730.06, 730.07, 730.08, 730.09

Intestinal Infection due to Clostridium difficile: 008.45

Other Infection Related Conditions and Symptoms: 567.21, 567.29, 567.9, 590.2, 780.6, 780.60, 780.61, 780.62

**FLUID AND ELECTROLYTE IMBALANCE**

Hyperosmolality and Hyposmolality: 276.0, 276.1

Acidosis and Alkalosis: 276.2, 276.3, 276.4

Dehydration and Hypovolemia: 276.50, 276.51, 276.52

Fluid Overload: 276.6

Hyperpotassemia and Hypopotassemia: 276.7, 276.8

Other Electrolyte and Fluid Disorders: 276.9

**ANEMIA AND COAGULATION DEFECTS**

**Anemia**

Acute Posthemorrhagic Anemia: 285.1  
Anemia: 280.0, 285.8, 285.9

**Coagulation Defects**

Hemorrhagic Disorders due to Anticoagulants: 286.5  
Thrombocytopenia: 287.4, 287.5, 289.84, 446.6  
Other Coagulation Defects: 286.6, 286.7, 286.9, 289.82, 790.92

## **Appendix C: Hospital Statements**

CCORP provided each hospital with a preliminary report containing the risk-adjusted models, explanatory materials, and results for all hospitals. Hospitals were given a 60-day review period to submit statements to CCORP for inclusion in this report. One hospital submitted a statement, which is included here.



August 28, 2015

Holly Hoegh, Ph.D.  
Manager of Clinical Data Program  
Office of Statewide Planning and Development  
400 R Street, Room 250  
Sacramento, CA 95811

Dear Dr. Hoegh:

Thank you for the opportunity to comment on the readmission rate for Coronary Artery Bypass (CABG) surgery outcomes.

At Shasta Regional Medical Center we evaluate readmissions and complications on all of our CABG patients. In 2013, we rated well on all of our CCORP Cardiac Surgery measures with the exception of 30 day readmissions. We have reviewed these cases and there were no specific trends identified.

Shasta Regional Medical Center has embarked on quality improvement efforts to reduce all hospital readmissions which include CABG patients. We have put a multi-disciplinary team together to work on decreasing all readmissions. We have implemented immediate post discharge phone calls to patients, collaborated with the home health agencies and skilled nursing facilities regarding follow up care. We have seen a steady decrease in our readmission rates since putting these efforts into effect.

Our aim is to make our hospital a safe place for our patients and we continually work on ways to improve quality in our hospital.

Thank you for the opportunity to respond.

Sincerely,

A handwritten signature in cursive script that reads "Cyndy Gordon".

Cyndy Gordon, RN, BSN, MBA  
Chief Executive Officer

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1100 BUTTE STREET, REDDING, CA 96001

## Appendix D: Acknowledgments

The California Coronary Artery Bypass Graft (CABG) Outcomes Reporting Program (CCORP) is funded by the Office of Statewide Health Planning and Development’s California Health Data and Planning Fund.

This report represents the contributions of many individuals. Hospital staff dedicated time and resources to collect, report, and review the data for analysis. Hospitals provided ongoing feedback on the design of the program, which is vital to its success, and members of the CCORP Clinical Advisory Panel provided oversight and policy guidance for data collection and analysis. The Healthcare Information Division and the Healthcare Information Resource Center within the division provided expertise in report concept, editing, and design. The California Department of Public Health provided Vital Statistics files needed for identifying post-surgery deaths after discharge. CCORP also benefited from collaboration with the Society of Thoracic Surgeons and its California Chapter to coordinate and improve data quality.

CCORP reflects the efforts and significant contributions of the following individuals:

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