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Coronary Artery Bypass Graft Surgery in California: 2003 Hospital Data

California CABG Outcomes Reporting Program

Office of Statewide Health Planning and Development

The California Report on Coronary Artery Bypass Graft Surgery

2003 Hospital Data

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THE CALIFORNIA REPORT ON CORONARY ARTERY BYPASS GRAFT SURGERY

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Office of Statewide Health Planning and Development

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Additional copies of the report can be obtained through the OSHPD Web site (www.oshpd.ca.gov).

PREFACE

February 2006

We are pleased to release ***The California Report on Coronary Artery Bypass Graft Surgery 2003 Hospital Data*****,** the first mandatory report from the California Coronary Artery Bypass Graft (CABG) Outcomes Reporting Program (CCORP), pursuant to Senate Bill 680 (Chapter 898, Statues of 2001).

Data on 121 California state licensed hospitals that performed heart bypass surgery in 2003 are summarized in this report. These hospitals performed 21,272 isolated coronary artery bypass graft surgeries in California in 2003, with an overall operative mortality rate of 2.91%.

Measurement and public accountability are requisite steps in the quality improvement process. The transparency of hospital performance information is critical to national efforts to close the quality gap identified in the Institute of Medicine's report *Crossing the Quality Chasm* (2001). Publishing this report is a step toward making a concerted and collaborative effort to measure and reduce performance variation across hospitals to ensure that inpatient care is safe, effective, and efficiently delivered.

The important work of the voluntary California CABG Mortality Reporting Program (CCMRP) over the last seven years (1995-2002) and the mandatory CCORP this year has laid the foundation for public reporting of CABG outcomes and highlighted the differences in mortality rates for hospitals and surgeons in California. The first CCORP surgeon level report, with 2003 and 2004 combined data, is scheduled for release in 2006.

David M. Carlisle, M.D., Ph.D.
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EXECUTIVE SUMMARY

The CCORP 2003 Hospital Data Report presents findings from analyses of data collected from California's 121 licensed hospitals that performed adult CABG surgery during 2003. The report uses risk-adjusted operative mortality to evaluate hospital performance.[1] There were 21,272 isolated CABG surgeries reported in 2003, making CCORP one of the largest public reporting programs on CABG surgery outcomes in the United States. This report also provides information on the relationship between hospital surgery volume and mortality.

Key findings from the 2003 analyses are:

- The overall operative mortality rate for isolated CABG surgery in California was 2.91% for 2003. Nationally, the Society of Thoracic Surgeons (STS) reported 2.4%[2] for the same measure. However, STS does not confirm deaths that occur post discharge by linking with death files as CCORP does.

- The risk-adjusted operative mortality rate for California hospitals ranged from 0% to 8.8%, revealing wide variation in CABG surgery outcomes after adjusting for patients' pre-operative health conditions. However, the majority of hospitals (113 of 121) performed within the expected range compared to the state's overall mortality rate.

- Four of the 121 hospitals performed significantly "**Better**" than the state average, and four hospitals performed "**Worse**" than the state average. They were:

Hospitals with "Better" Performance Ratings	
Hospital	*Region*
Salinas Valley Memorial Hospital	San Francisco Bay Area and San Jose
St. John's Regional Medical Center	San Fernando Valley, Antelope Valley, Ventura and Santa Barbara
St. Vincent Medical Center	Greater Los Angeles
UC Davis Medical Center	Sacramento Valley and Northern California
Hospitals with "Worse" Performance Ratings	
Hospital	*Region*
Alvarado Hospital Medical Center	Greater San Diego
Centinela Hospital Medical Center	Greater Los Angeles
Desert Regional Medical Center	Inland Empire, Riverside and San Bernardino
Doctors Medical Center – Modesto Campus	Central California

[1] Risk adjustment is a statistical technique that allows for fair comparison of hospital mortality rates even though some have sicker or healthier patients than average. Operative mortality includes (1) all deaths during the hospitalization where the hospital performed the operation, regardless of length of stay, and (2) deaths occurring anywhere within 30 days after the procedure. OSHPD did not determine whether deaths occurring outside the hospital directly resulted from the procedure.

[2] Society of Thoracic Surgeons: Spring 2005 Report - Adult Cardiac Database Executive Summary, 24 October 2005.

Other major findings in this report include:

- There was close agreement between the number of deaths predicted by the risk-adjustment model and the actual number of deaths, especially for the most severely ill patients. This means that the risk model gives hospitals appropriate credit for treating the most clinically complex cases. Consequently, hospitals and surgeons should not exclude high-risk patients from appropriate CABG surgeries as a means to improve performance scores.

- There was no significant association found between hospital CABG volume and risk-adjusted hospital operative mortality. Our analyses show that patients have a similar risk of dying from a CABG procedure at hospitals with lower annual volumes as compared to hospitals with higher annual volumes of CABG surgeries.

- Isolated CABG surgery volume has declined in recent years while the volume of Percutaneous Coronary Interventions (PCIs), such as angioplasty with stent insertion, has significantly increased. Utilization of PCIs in California has increased from 42,706 procedures in 1997 to 58,729 procedures in 2004, an increase of nearly 38%. Meanwhile, the number of isolated CABGs has dropped from 28,175 to 19,361, a decrease of approximately 31% during the same period.

ACKNOWLEDGEMENTS

Funding for CCORP was provided by the Office of Statewide Health Planning and Development through its Health Data and Planning Fund.

Important contributions were made by a host of individuals in each of the hospitals who dedicated their time and resources to collect and clean the data for analysis. Hospitals provided ongoing feedback on the design of the program, which was vital to its success. Members of the CCORP Clinical Advisory Panel also made large contributions, providing oversight and policy guidance in data collection, analysis, and presentation of results. The California Department of Health Services provided Vital Statistics files needed for identifying post-surgery deaths after discharge. CCORP also continued to collaborate with the Society of Thoracic Surgeons and its California Chapter to coordinate and improve data collection efforts.

The California CABG Outcomes Reporting Program reflects the efforts and significant contributions of numerous individuals, including:

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I. INTRODUCTION

This report is a public disclosure of the quality of care provided by hospitals performing coronary artery bypass graft (CABG) surgery in California in 2003. It is the first public report developed by the Office of Statewide Health Planning and Development (OSHPD) covering all of California's 121 state licensed hospitals that perform this surgery. Reports published by OSHPD and the Pacific Business Group on Health in previous years used data from a voluntary hospital participation program, the California CABG Mortality Reporting Program (CCMRP).

Unlike previous CCMRP reports, this report uses operative mortality instead of in-hospital mortality as the outcome measure. Operative mortality is defined as 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. This change was necessary to avoid potential manipulation of outcomes through discharge practices and to hold hospitals accountable for patients who died at home shortly after discharge or who were transferred and died in other facilities. The National Society for Thoracic Surgery (STS) also uses operative mortality as their primary outcome measure for CABG quality reporting.

In this report, the operative mortality rate is adjusted statistically to account for variation in the health condition of patients before CABG surgery. The report is intended to encourage hospitals and surgeons to examine their surgical procedures and make changes to improve the quality of care. This report also provides patients and their families with important information they can use when making decisions about CABG surgery.

Prior to the public release, a preliminary version of the report was reviewed by all hospitals over a 60-day period. Four hospitals submitted statements regarding this report and their hospital's rating, which can be found in Appendix C. We encourage readers to review these statements to better understand the perspectives and concerns of some healthcare providers regarding the information released in this report.

II. BACKGROUND

Coronary Artery Disease and Bypass Surgery

In 2003, 123,435 Californians with coronary artery disease (CAD) were admitted to the hospital, which represents 8% of all adult non-maternal admissions. For adult non-maternal patients, heart disease was the leading cause of admission to hospitals in California in 2003.[3]

Coronary artery disease is a chronic disease in which cholesterol and fat solidify and form **plaque** along the linings of the coronary arteries. This process is called **atherosclerosis** or hardening of the arteries. If **plaque** continues to build up, blood vessels can become partially or completely blocked so the heart does not receive enough oxygen, leading to **angina** (chest pain) or even **myocardial infarction** (heart attack).

The two most common procedures for the treatment of coronary artery disease are Percutaneous Transluminal Coronary Angioplasty (PTCA) and Coronary Artery Bypass Graft (CABG) surgery. Despite recent large increases in the number of PTCA procedures performed, CABG surgery is more frequently recommended for patients with extensive coronary disease, reduced left ventricular function, and a greater degree of angina (Zipes et al, 2005).

During CABG surgery, the surgeon uses arteries or veins from another part of the body (e.g., the leg) to reroute blood around a blockage in the **coronary arteries**. That allows oxygen-rich blood to flow freely to nourish the heart muscle. Surgeons often create one or multiple grafts for patients, depending on how many blood vessels and main branches are blocked.

Definition of Isolated CABG Surgery and Operative Mortality

Under state mandate, all California licensed hospitals are required to report all isolated and non-isolated CABG surgeries to CCORP. Isolated CABG is defined as CABG surgery performed without other major heart procedures, such as valve repair, during the same surgery (see Appendix A for the clinical definition of isolated CABG surgery).

In 2003, there were 25,767 adult CABG surgeries performed in California; of these, 21,272 (82.6%) were isolated CABG surgeries, and 4,495 (17.4%) were non-isolated CABG surgeries. The study population for this report consists of all adult patients who underwent isolated CABG surgery and were discharged in 2003. Isolated CABG surgery cases were selected as the study population because the uniformity of the surgical process allows adequate pre-operative risk adjustment for patient conditions. Non-isolated CABG cases were not used to determine hospital mortality rates in this report.

[3] Data source: OSHPD, Patient Discharge Data, 2003. Patients were identified with CAD if the principal diagnosis was coded as ICD-9-CM 410.xx thru 414.xx.

Table 1 shows the number of isolated and non-isolated CABG surgeries performed by California Hospitals in 2003.

Table 1: Isolated, Non-Isolated and Total CABG Surgeries Performed in 121 Reporting Hospitals, 2003

Hospital Name	Isolated	Non-Isolated	Total
Alta Bates Summit Medical Center – Summit Campus	752	100	852
Alvarado Hospital Medical Center	83	12	95
Anaheim Memorial Medical Center	229	22	251
Antelope Valley Hospital Medical Center	45	7	52
Bakersfield Heart Hospital	182	41	223
Bakersfield Memorial Hospital	293	29	322
Beverly Hospital	29	1	30
Brotman Medical Center	44	9	53
California Pacific Medical Center – Pacific Campus	129	42	171
Cedars Sinai Medical Center	250	114	364
Centinela Hospital Medical Center	105	18	123
Citrus Valley Medical Center – IC Campus	163	19	182
Community Medical Center – Fresno	284	23	307
Community Memorial Hospital of San Buenaventura	178	20	198
Dameron Hospital	73	13	86
Desert Regional Medical Center	146	22	168
Doctors Medical Center – Modesto Campus	426	100	526
Doctors Medical Center – San Pablo Campus	56	6	62
Dominican Hospital	105	17	122
Downey Regional Medical Center	78	0	78
Eisenhower Memorial Hospital	222	72	294
El Camino Hospital	79	9	88
Encino Tarzana Regional Medical Center	153	40	193
Enloe Medical Center	175	40	215
Fountain Valley Regional Hospital	140	20	160
French Hospital *(name change 4/8/2003 to French Hospital Medical Center)*	76	27	103
Fresno Heart Hospital *(opened 10/9/2003)*	34	4	38
Garfield Medical Center	100	16	116
Glendale Adventist Medical Center – Wilson Terrace	147	14	161
Glendale Memorial Hospital and Health Center	178	26	204
Good Samaritan Hospital – Los Angeles	334	70	404
Good Samaritan Hospital – San Jose	235	40	275
Granada Hills Community Hospital *(closed 8/7/2003)*	25	0	25

Table 1: Isolated, Non-Isolated and Total CABG Surgeries Performed in 121 Reporting Hospitals, 2003

Hospital Name	Isolated	Non-Isolated	Total
Hoag Memorial Hospital Presbyterian	232	86	318
Huntington Memorial Hospital	142	39	181
Irvine Regional Hospital and Medical Center	31	3	34
John Muir Medical Center	110	25	135
Kaiser Foundation Hospital (Geary San Francisco)	770	228	998
Kaiser Foundation Hospital (Sunset Los Angeles)	992	153	1,145
Kaweah Delta Hospital	338	59	397
Los Angeles Co Harbor – UCLA Medical Center	150	8	158
Los Angeles Co USC Medical Center	123	23	146
Lakewood Regional Medical Center	124	16	140
Lancaster Community Hospital	25	1	26
Little Company of Mary Hospital	79	34	113
Loma Linda University Medical Center	308	92	400
Long Beach Memorial Medical Center	312	47	359
Los Robles Regional Medical Center	163	33	196
Marian Medical Center	121	14	135
Marin General Hospital	51	10	61
Memorial Medical Center of Modesto	306	64	370
Mercy General Hospital	926	327	1,253
Mercy Medical Center – Redding	254	48	302
Mercy San Juan Hospital	153	35	188
Methodist Hospital of Southern California	120	10	130
Mills-Peninsula Health Center *(name change 10/20/2004 to Peninsula Medical Center)*	77	19	96
Mission Hospital Regional Medical Center	202	31	233
Mt. Diablo Medical Center	239	61	300
Northridge Hospital Medical Center	92	15	107
O'Connor Hospital	92	10	102
Palomar Medical Center	152	19	171
Pomona Valley Hospital Medical Center	158	25	183
Presbyterian Intercommunity Hospital	69	0	69
Providence Holy Cross Medical Center	116	15	131
Providence St. Joseph Medical Center	106	32	138
Queen of the Valley Hospital	169	23	192
Redding Medical Center *(name change 11/24/2003 to Shasta Regional MC)*	38	14	52
Rideout Memorial Hospital	158	40	198
Riverside Community Hospital	239	27	266

Table 1: Isolated, Non-Isolated and Total CABG Surgeries Performed in 121 Reporting Hospitals, 2003

Hospital Name	Isolated	Non-Isolated	Total
Saddleback Memorial Medical Center	111	25	136
Salinas Valley Memorial Hospital	219	34	253
San Antonio Community Hospital	63	6	69
San Joaquin Community Hospital	107	18	125
San Jose Medical Center *(closed 12/9/2004)*	52	6	58
San Ramon Regional Medical Center	55	6	61
Santa Barbara Cottage Hospital	209	45	254
Santa Clara Valley Medical Center	60	5	65
Santa Monica - UCLA Medical Center	34	11	45
Santa Rosa Memorial Hospital	109	43	152
Scripps Green Hospital	119	52	171
Scripps Memorial Hospital – La Jolla	406	122	528
Scripps Mercy Hospital	157	35	192
Sequoia Hospital	132	99	231
Seton Medical Center	214	37	251
Sharp Chula Vista Medical Center	230	34	264
Sharp Grossmont Hospital	175	29	204
Sharp Memorial Hospital	175	84	259
Sierra Vista Regional Medical Center	97	17	114
St. Agnes Medical Center	443	70	513
St. Bernardine Medical Center	527	63	590
St. Francis Medical Center	86	8	94
St. Helena Hospital	151	25	176
St. John’s Hospital and Health Center	69	13	82
St. John’s Regional Medical Center	176	27	203
St. Joseph Hospital – Eureka	79	15	94
St. Joseph Hospital – Orange	171	29	200
St. Joseph’s Medical Center of Stockton	253	71	324
St. Jude Medical Center	181	40	221
St. Mary Medical Center	72	16	88
St. Mary’s Medical Center, San Francisco	76	26	102
St. Mary Regional Medical Center	198	20	218
St. Vincent Medical Center	207	16	223
Stanford University Hospital	134	58	192
Sutter Medical Center of Santa Rosa	116	39	155
Sutter Memorial Hospital	608	149	757
Torrance Memorial Medical Center	174	49	223
Tri-City Medical Center	148	30	178

Table 1: Isolated, Non-Isolated and Total CABG Surgeries Performed in 121 Reporting Hospitals, 2003

Hospital Name	Isolated	Non-Isolated	Total
UC Irvine Medical Center	81	12	93
UC Davis Medical Center	136	63	199
UCLA Medical Center	113	79	192
UCSD Medical Center	34	11	45
UCSD Medical Center – La Jolla	55	30	85
UCSF Medical Center	141	28	169
USC University Hospital	135	62	197
Valley Presbyterian Hospital	35	0	35
Washington Hospital – Fremont	159	17	176
West Anaheim Medical Center	28	0	28
West Hills Regional Medical Center	52	6	58
Western Medical Center Hospital – Anaheim	187	14	201
Western Medical Center – Santa Ana	129	10	139
White Memorial Medical Center	109	12	121
Total	21,272	4,495	25,767

III. DATA

The primary data source for this report is the 2003 clinical registry data collected by CCORP from reporting hospitals. These data were linked to Vital Statistics data from the California Department of Health Services to identify patients who died at home or at facilities other than the operating hospital within the 30 days following CABG surgery.

The CCORP clinical data registry draws on a subset of data elements collected by the Society of Thoracic Surgeons (STS) for their National Database of Cardiac Surgery. However, some data elements are exclusive to CCORP. Table 2 presents data elements collected from reporting hospitals for 2003 by CCORP. Although the STS and the CCORP data definitions are virtually identical, CCORP provided additional clarifications to assist hospitals with coding. The definition of each data element can be found in Appendix B.

To improve the quality and comparability of data submitted by hospitals, CCORP provided training sessions in Northern and Southern California in November 2002, prior to the start of data collection in 2003. Additionally, hospitals were provided VHS tapes of these sessions for education and review when hospitals experience data abstractor turnover.

Table 2: CCORP Data Elements, 2003	
IDENTIFICATION AND CLASSIFICATION	
Facility Identification Number	Isolated CABG: Yes; No
Responsible Surgeon Name: Last Name, First Name and Middle Initial	Responsible Surgeon CA License Number
Medical Record Number	Date of Birth: mm/dd/yyyy
Date of Surgery: mm/dd/yyyy	Date of Discharge: mm/dd/yyyy
Discharge Status: Alive; Dead	Date of Death: mm/dd/yyyy
RISK FACTOR: DEMOGRAPHIC	
Race: Caucasian; Black; Hispanic; Asian; Native American; Other	Gender: Male; Female
Patient Age	Height (cm)
Weight (kg)	
RISK FACTOR: OPERATIVE	
Status of the Procedure: Emergent/Salvage; Emergent; Urgent; Elective	
RISK FACTOR: COMORBIDITY/OTHER	
Last Creatinine Level Preop (mg/dl)	Dialysis: Yes; No
Diabetes: Yes; No	Peripheral Vascular Disease: Yes; No
Cerebrovascular Disease: Yes; No	Cerebrovascular Accident: Yes; No
Cerebrovascular Accident Timing: Recent (<=2 weeks); Remote (>2 weeks)	Chronic Lung Disease: No; Mild; Moderate; Severe
Hypertension: Yes; No	Immunosuppressive Treatment: Yes; No
Hepatic Failure: Yes; No	
RISK FACTOR: CARDIAC	
Arrhythmia: Yes; No	Arrhythmia Type: Sustained VT/VF; Heart Block; Afib/flutter
Myocardial Infarction: Yes; No	Myocardial Infarction Timing: <=6 hours; >6 hours but <24 hours; 1 to 7 days; 8 to 21 days; >21 days
Cardiogenic Shock: Yes; No	Angina: Yes; No

Table 2: CCORP Data Elements, 2003	
Angina Type: Stable; Unstable	CCS Classification: No Angina = Class 0; Class I; Class II; Class III; Class IV
Congestive Heart Failure: Yes; No	NYHA Classification: Class I; Class II; Class III; Class IV
RISK FACTOR: PREVIOUS INTERVENTIONS	
Number of Prior Cardiac Operations Requiring Cardiopulmonary Bypass	Number of Prior Cardiac Operations Without Cardiopulmonary Bypass
Prior PCI: Yes; No	Interval from Prior PCI to Surgery: <=6 hours; > 6 hours
RISK FACTOR: HEMODYNAMIC STATUS	
Ejection Fraction (%)	Ejection Fraction Method: LV Gram; Radionucleotide; Estimate; Echocardiogram
Left Main Disease (% Stenosis)	Number of Diseased Coronary Vessels: None; One; Two; Three
Mitral Insufficiency: None; Trivial; Mild; Moderate; Severe	
PROCESS OF CARE	
Internal Mammary Artery(ies) Used as Grafts: Left IMA; Right IMA; Both IMAs; No IMA	Cardiopulmonary Bypass Used: Yes; No
Conversion to Cardiopulmonary Bypass: Yes; No	Primary Incision: Full Sternotomy; Partial Sternotomy; Transverse Sternotomy; Right Vertical Parasternal; Left Vertical Parasternal; Right Anterior Thoracotomy; Left Anterior Thoracotomy; Posterolateral Thoracotomy; Xiphoid; Epigastric; Subcostal
Cardioplegia: Yes; No	

Data Quality Review and Verification

The data submitted by each hospital were reviewed for completeness and errors. Prior to the data audit, a two-step process was taken to verify data submissions.

Step 1: Hospital-Specific Data Quality Reports

This process compares hospital-specific prevalence rates for each pre-operative risk factor to the state average, highlighting possible coding issues for hospitals to clean-up. Checks for invalid, missing, and abnormally high or low risk factor values are also included in these summary reports, which are distributed to all hospitals for review and data corrections.

Step 2: Data Discrepancy Report

This process compares the CCORP data against the OSHPD Patient Discharge Data (PDD) files, requiring hospitals to account for discrepancies via chart review. This includes cross checking at the patient level if 1) all CABGs discharged in 2003 were reported; 2) all *Isolated CABGs (*limited to those who died in the hospital*)* were reported; *3) Discharge Status* was consistent; and 4) presence of *Cardiogenic Shock* and *Status of the Procedure “*Emergent/Salvage” was consistent.

This was accomplished by linking the CCORP dataset, via a probabilistic matching algorithm,[4] to all PDD records classified as Major Diagnostic Category 5 (MDC 5), Diseases and Disorders of the Circulatory System, as well as any records with the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) code 36.1x (bypass anastomosis). Also, an ICD-9-CM code-based definition of isolated CABG was developed to identify those PDD records that were isolated CABG surgeries. Among 21,281 originally reported isolated CABG cases, 21,229 (99.8%) cases were successfully linked to PDD, and only 52 cases could not be matched.

Using this matched dataset, a data discrepancy report (DDR) was generated for each hospital when any of the following conditions applied:

1) There was a discrepancy in the number of CABG cases reported.
2) An apparent isolated CABG mortality found in the hospital's PDD was not submitted to CCORP (unreported death).
3) There was a discrepancy in coding of patient *Discharge Status* between the PDD and CCORP (Dead vs. Alive).
4) There was a discrepancy in coding of *Cardiogenic Shock*.
5) There was a discrepancy in reporting *Status of the Procedure for the category "*Emergent/Salvage."

The following discrepancies were found in the data:

For the first condition, 249 cases identified in the PDD as CABGs were not reported to CCORP. Likewise, 884 cases were reported to CCORP as CABGs but not found in the PDD.

For the second condition, 50 deaths identified in the PDD as being isolated CABG deaths were submitted to CCORP as non-isolated CABG deaths. Likewise, 24 reported isolated CABG deaths were found in the PDD to be non-isolated CABG deaths.

For the third condition, four cases with *Discharge Status* coded as "Dead" in the PDD were reported as "Alive" in the CCORP submission. Likewise, six cases where *Discharge Status* was recorded as "Alive" in the PDD were reported as "Dead" in the CCORP submission.

For the fourth condition, 375 cases in CCORP with an indication of preoperative *Cardiogenic Shock* were not found in the PDD (possible over-reporting), and 96 cases with *Cardiogenic Shock* in the PDD were not reported to CCORP (possible under-reporting).

Finally for the fifth condition, 50 cases where *Status of the Procedure* was reported as "Emergent/Salvage," to CCORP but the PDD did not indicate that CPR was performed enroute to the operating room.

Table 3 lists these discrepancies in detail, by data element, and shows the type and number of corrections that hospitals made.

[4] A description of the methodology and mechanics of the data linkage are available from CCORP upon request.

Table 3: Data Discrepancy Report Summary Year 2003						
	Possible Under-Reporting			**Possible Over-Reporting**		
Data Element	*Case Description*	*Number of cases with discrepancy*	*Correction made*	*Case Description*	*Number of cases with discrepancy*	*Correction made*
CABG (Isolated and Non-Isolated)	Not reported to CCORP but were coded as CABG in PDD	249	220 (88%) of the 249 cases not reported to CCORP initially were added	Cases were reported to CCORP as CABGs but not found in PDD	884	779 (88%) of 884 cases initially reported to CCORP were removed
Isolated CABG (limited to deaths only)	Not reported or reported to CCORP as a non-isolated CABG (dead or alive), but PDD indicates an isolated CABG death	50	23 (46%) of the 50 isolated CABG deaths were confirmed and subsequently submitted to CCORP	Reported as an isolated CABG death, but PDD indicates a non-isolated CABG death	24	17 (71%) of the 24 reported isolated CABG deaths were re-coded as non-isolated CABG deaths
Isolated CABG **Discharge Status**	Reported alive in CCORP but PDD indicates died at discharge	4	3 of the 4 cases reported to CCORP as alive were re-coded as dead after confirmation	Reported dead in CCORP but PDD indicates alive at discharge	6	3 (50%) of the 6 cases reported to CCORP as dead were re-coded as alive after confirmation
Cardiogenic Shock before CABG	Not reported in CCORP but PDD indicates that cardigenic shock was present	96	58 (60%) of the 96 cases were re-coded as cardiogenic shock in CCORP database	Reported in CCORP but PDD does not indicate cardigenick shock	375	136 (36%) of 375 cases were re-coded as no cardiogenic shock
Status of the Procedure: **Emergent/Salvage**	NA	0	NA	Reported in CCORP but did not indicate CPR performed enroute to operating room in PDD	50	29 (58%) of the 50 cases were re-coded as other than salvage

Data Audit

A preliminary risk model was developed using the CCORP 2003 data that had been validated through the data verification processes described above to identify outlier hospitals (i.e., “Better” or “Worse” performers). Hospitals that were either outliers, near outliers, or had high over-reporting or under-reporting of risk factors were selected for the data audit. Fifteen hospitals were selected, which provided 958 cases for the 2003 on-site audit. The records to be audited were selected as a proportion of the hospital volume with a minimum of 40 records and maximum of 160 records per selected hospital. All 60 deaths from these 15 hospitals were selected for data audit. The remaining cases were selected as a weighted random sample where the sampling weight is larger for patients with a higher predicted mortality. An additional 10 to 20 cases were identified for each hospital, in case staff were unable to locate charts for the selected audit cases.

Key findings from the data audit include:

- *Discharge Status* was coded correctly for all the records audited.

- Auditors found nine *Isolated CABG* surgeries reported in the CCORP data to be non-isolated CABGs. As a result, the total number of isolated CABG cases in the CCORP 2003 dataset was reduced from 21,281 to 21,272.

- The percent of exact agreement between the CCORP data and the audit data was used as an indicator of coding reliability. The audit found at least 90% of the audited records agreed for *Patient Age*, *Gender, Dialysis, Hepatic Failure, Immunosuppressive Treatment, Arrhythmia Type (*Sustained VT/VF and Heart Block*), Diabetes, Cardiogenic Shock, Cerebrovascular Disease,* and *Cerebrovascular Accident Timing*. This signifies a high level of agreement between auditors and hospital personnel.

- The percent agreement was relatively poor (<80%) for *Status of the Procedure* (Acuity), *Myocardial Infarction Timing, Mitral Insufficiency, Angina Type,* and *NYHA Classification*. Of these, disagreement (under-reporting) was relatively high for *Status of the Procedure*, *NYHA Classification, Angina Type,* and *Mitral Insufficiency*. This means that hospital coding of these variables, on average, incorrectly characterized patients as being lower risk. Also for *NYHA Classification* and *Status of the Procedure*, two variables that significantly affect mortality, 41% of the records for *NYHA Classification* and 16% of the records for *Status of the Procedure* were under-reported. In contrast, for *Status of the Procedure* 33 records (3.5%) were coded in CCORP as Emergent/Salvage while the audit found these were actually Elective/Urgent cases (over-reporting). 20 records (2.1%) were coded as Elective/Urgent in CCORP while the audit reclassified these records as Emergent or Emergent/Salvage (under-reporting).

- The percent of missing values that would have been incorrectly assigned to the lowest risk category by default was low, indicating that missing data are not a major concern for CCORP.

- As a result of substantial problems in the coding of *Angina Type* revealed during this and previous audits, this variable was excluded from the final risk model. Although *NYHA Classification* also had coding problems, for 2003 the *NYHA Classification* I, II, and III were combined as the reference category in the risk model with only NYHA Class IV used as a risk factor. Further evaluation of the coding reliability of this variable is needed prior to decisions to include or exclude it from the risk model in the future.

At the end of the data correction process, the audited data were incorporated into the CCORP data, and a summary of the audit report was sent to hospitals for educational purposes.

IV. RISK MODEL FOR ADJUSTING HOSPITAL OPERATIVE MORTALITY RATES, 2003

Patients treated at different hospitals often vary in the severity of their pre-operative clinical condition. To make fair comparisons of outcomes at different hospitals, it is necessary to adjust for the differences in the case mix of patients across hospitals. CCORP "levels the playing field" by taking into account the pre-operative condition of each patient. Hospitals that handle complex cases (i.e., sicker patients prior to surgery) get a larger risk-adjustment weighting in the risk model, while hospitals that handle less complex cases get a smaller weighting. Thus, hospitals treating sicker patients are not at a disadvantage when their performance is compared to other hospitals.

CCORP used a multivariable logistic regression model to determine the relationship between each of the demographic and pre-operative risk factors and the likelihood of operative mortality. Multivariable logistic regression models relate the probability of death to the explanatory factor (e.g., *Patient Age, Last Creatinine Level Preop*), while controlling for all other explanatory factors in the model.

The risk model was developed in two steps. In the first step, 21,272 isolated CABG cases were evaluated for missing data; 18,972 of these had no missing data in any field and were used for the risk model parameter estimation. The 2,300 (11%) 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. In the second step, missing values for these 2,300 records were imputed by replacing them with the lowest risk category. CCORP assigned the lowest risk value based on the following reasons: 1) Many hospitals may leave data fields blank by design (e.g., blank means a risk factor was not present or the value was normal); 2) to maintain consistency with other major cardiac reporting programs, missing data are replaced with the lowest-risk or normal value; and 3) assigning values for missing data in this way creates an incentive for more complete coding by hospitals. Then the parameters of the risk model were applied to all data records for computation of hospital expected mortality and performance rating.

Although all pre-operative risk variables listed in Table 2 were candidates for the risk-adjustment model, only those associated with mortality in the expected direction from a clinical perspective were selected for the final risk model. Table 4 presents the final model based on the 2003 dataset.

The final risk model included almost all variables used in the last CCMRP risk model except *Prior PCI Timing* because its effect on mortality was counterintuitive. Compared to the prior CCMRP risk model, three new risk factors were added: *Cerebrovascular Accident* (No/<=2 weeks/>2 weeks), *Immunosuppressive Treatment* (Yes/No), and *Hepatic Failure* (Yes/No). In addition, after examining the relationship between operative mortality and variables in continuous terms, *Last Creatinine Level Preop (mg/dl), Ejection Fraction,* and *Left Main Disease* (% stenosis) were all modeled using piecewise linear transformations to ensure a linear relationship between the logit of operative mortality and each risk factor.

Guide for Interpreting the Risk Model

Coefficient	The coefficient for each explanatory factor represents the effect that factor has on a patient's likelihood of dying (in the hospital or within 30 days) following bypass surgery. If the value is positive, it means that the characteristic is associated with an increased risk of death compared to not having the characteristic, while controlling for the effect of all other factors. If the coefficient is negative, having that characteristic is associated with a lower risk of death compared to not having it. The larger the value (whether positive or negative), the greater the effect or weight this characteristic has on the risk of dying. For example, the coefficient for "Congestive Heart Failure" in the 2003 model is 0.39 and statistically significant. This value is positive, so it indicates that CABG patients with congestive heart failure are at an increased risk of dying compared to patients who do not have the disease.
Standard Error	The standard error is the standard deviation of the sampling distribution of an estimate. It measures the statistical reliability of that estimate.
p-value	The p-value is a measure of the statistical significance of the coefficient compared to the reference category. Commonly, p-values of less than 0.05 are considered statistically significant. The smaller the p-value, the more likely the effect of a factor is real, rather than due to chance.
Significance	When the p-value of a coefficient is less than 0.05, it is deemed statistically significant at the 0.05 level and is denoted with one star (*) in the significance column. Two stars (**) indicate statistical significance at the 0.01 level and three stars (***) indicate statistical significance at the 0.001 level. All statistical tests are two-tailed tests.
Odds Ratio	An odds ratio is another way of characterizing the impact of each factor on operative mortality. Mathematically, the odds ratio is the antilogarithm of the coefficient value. The larger the odds ratio, the greater the impact that characteristic has on the risk of dying. An odds ratio close to 1.0 means the effect of the factor is neutral. For example, the odds ratio for congestive heart failure (CHF) in the 2003 model is 1.48. This means that for patients with CHF, the odds of dying are about 48% higher compared to patients without CHF, assuming all other risk factors are the same.

Table 4: CCORP Logistic Regression Risk Model for Operative Mortality, 2003

Risk Factor		Coefficient	Standard Error	p-value	Significance	Odds Ratio
Intercept		-9.66	0.53	0.00	***	
Race	**Caucasian**			Reference		
	Non-Caucasian	0.23	0.10	0.03	*	1.26
Gender	**Male**			Reference		
	Female	0.55	0.10	0.00	***	1.73
Age		0.05	0.01	0.00	***	1.05
Body Mass Index	**18.5-39.9**			Reference		
	< 18.5	1.08	0.27	0.00	***	2.94
	≥ 40.0	0.10	0.27	0.71		1.11
Status of Procedure	**Elective**			Reference		
	Urgent	0.34	0.13	0.01	**	1.41
	Emergent	0.65	0.21	0.00	**	1.92
	Emergent/Salvage	2.37	0.41	0.00	***	10.74
Last Creatinine Level Preop (mg/dl)		0.97	0.21	0.00	***	2.63
Hypertension		0.14	0.13	0.27		1.15
Dialysis		0.56	0.25	0.02	*	1.74
Peripheral Vascular Disease		0.46	0.11	0.00	***	1.58
Cerebrovascular Disease		0.20	0.15	0.19		1.22
Cerebrovascular Accident	**No CVA**			Reference		
	Remote (> 2 weeks)	0.12	0.18	0.51		1.12
	Recent (<= 2 weeks)	0.91	0.47	0.05		2.49
Diabetes		-0.03	0.10	0.77		0.97
Chronic Lung Disease	**No**			Reference		
	Mild	0.00	0.16	0.99		1.00
	Moderate	0.23	0.17	0.18		1.26
	Severe	0.66	0.18	0.00	***	1.93
Immunosuppressive Treatment		0.17	0.26	0.51		1.19
Hepatic Failure		1.54	0.47	0.00	**	4.69
Arrhythmia Type	**None**			Reference		
	Atrial Fibrillation/Flutter	0.52	0.14	0.00	***	1.68
	Heart Block	0.34	0.23	0.15		1.41
	Sustained VT/VF	0.70	0.19	0.00	***	2.01
Myocardial Infarction	**None**			Reference		
	21 or more days ago	0.15	0.14	0.28		1.16
	8 to 20 days ago	0.16	0.20	0.41		1.18
	1 to 7 days ago	0.22	0.12	0.08		1.25
	>6 but within 24 Hours	0.34	0.22	0.13		1.40
	Within 6 Hours	0.64	0.27	0.02	*	1.91
Cardiogenic Shock		0.99	0.18	0.00	***	2.68
Congestive Heart Failure		0.39	0.11	0.00	***	1.48
NYHA Class IV		0.37	0.10	0.00	***	1.45
Prior Cardiac Surgery	**None**			Reference		
	1 or More	0.56	0.16	0.00	***	1.74
Ejection Fraction		-0.01	0.00	0.00	***	0.99
Left Main Disease (% Stenosis)		0.00	0.00	0.55		1.00
Number of Diseased Vessels	**None, One, or Two**			Reference		
	Three or more	0.40	0.13	0.00	**	1.50
Mitral Insufficiency	**None**			Reference		
	Trivial	-0.14	0.18	0.44		0.87
	Mild	-0.04	0.14	0.80		0.97
	Moderate	0.24	0.18	0.18		1.27
	Severe	-0.29	0.54	0.59		0.75

Notes: Last creatinine level preop (mg/dl), ejection fraction, and percent left main stenosis were all modeled using piecewise linear transformations.
* significant at the 0.05 level (two-tailed test), ** significant at the 0.01 level (two-tailed test), *** significant at the 0.001 level (two-tailed test)

Discrimination

Models that distinguish well between patients who die and those who survive are said to have good discrimination. A commonly used measure of discrimination is the c-statistic (also known as the area under the Receiver Operating Curve (ROC)). 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. The c-statistic ranges from 0.5 to 1, with higher values indicating better discrimination. For the 2003 data model the c-statistic is 0.833. In recently published studies of CABG operative mortality using logistic regression models (including those from New Jersey and the Society of Thoracic Surgeons), the c-statistic ranged from 0.76 to 0.78. In comparison, the CCORP 2003 risk model appears to discriminate better than other programs that produce risk-adjusted outcomes data for isolated CABG surgery.

Calibration

Calibration refers to the ability of a model to match predicted and observed mortality across the entire spectrum of the data. A model in which the number of observed deaths matches well with the number of deaths predicted by the model demonstrates good calibration. Good calibration is essential for reliable risk adjustment. A common measure of calibration is the Hosmer-Lemeshow χ^2 test, which compares observed and predicted outcomes over deciles of risk. The p-value of the Hosmer-Lemeshow test statistic for the risk model is 0.078, indicating a nonsignificant likelihood of poor calibration. That is, the predicted mortality was consistent with actual mortality in the data. Table 5 presents details of the calibration of the 2003 risk model by deciles of risk.

Table 5: Calibration of 2003 Risk Model (N=21,272)

Risk Group	Predicted mortality	N	Observed deaths	Predicted deaths	Difference	95% CI of Predicted deaths
1	0.0029	2,129	5	6.09	1.1	(1.3, 10.9)
2	0.0048	2,127	3	10.22	7.2	(4.0, 16.5)
3	0.0067	2,127	10	14.25	4.3	(6.9, 21.6)
4	0.0089	2,127	15	18.86	3.9	(10.3, 27.4)
5	0.0116	2,128	21	24.7	3.7	(15.0, 34.4)
6	0.0152	2,127	22	32.36	10.4	(21.2, 43.5)
7	0.0204	2,127	54	43.4	(10.6)	(30.5, 56.3)
8	0.0289	2,127	60	61.46	1.5	(46.1, 76.8)
9	0.0465	2,127	119	98.89	(20.1)	(79.4, 118.4)
10	0.1448	2,126	309	307.76	(1.2)	(273.4, 342.1)

The first row of Table 5 shows the decile of patients at the lowest risk of predicted mortality in the CCORP 2003 model. Among 2,129 patients in the decile, five patients died, but the model predicted six deaths. Assuming a Poisson distribution for a binary outcome with a mean of 0.0029 (6.09/2,129), the predicted range of deaths for this decile is 1.3 to 10.9. The observed number of five deaths falls within the range of expected deaths. Examination of all the deciles shows only one falls below the expected range (risk group 2) and one where deaths fall above the expected range (risk group 9). Overall, there were no systematic underestimates or overestimates of mortality at the extreme. For the decile with the highest risk of predicted mortality (risk group 10) the number of predicted deaths was nearly identical to the observed number of deaths.

Key Findings Regarding the Risk Model

- Although some of the risk factors are not statistically significant, all significant coefficients (p-value <0.05) appeared with the expected directional sign from a clinical standpoint, i.e., '+' for increased risk and '-' for decreased risk.

- Among demographic variables, *Patient Age* and *Gender* were significant risk factors. The literature suggests that *Gender* may be a proxy for body size and/or coronary artery size (diameter) and smaller coronary arteries in women may be more prone to thrombosis or restenosis. For non-Caucasian patients, the probability of operative death was 26% higher than for Caucasian patients, controlling for all other variables.

- Patients who were underweight (*BMI*<18.5) had a higher risk of dying (OR 2.94) than those in the reference group (*BMI* 18.5-39.9). Patients who were extremely obese (*BMI* ≥ 40.0) were also at increased risk of death (OR 1.11) although the association was not statistically significant. A very low *BMI* may be a proxy for frailty or indicate a wasting comorbid condition not captured by other risk variables.

- Of the comorbidities in the risk model, *Hepatic Failure* (OR 4.69) and severe *Chronic Lung Disease* (OR 1.93) had strong associations with operative mortality. The risk factor *Last Creatinine Level Preop* (OR 2.63) also had a strong association with operative mortality.

- Of the cardiac risk factors, *Cardiogenic Shock* and the *Arrhythmia Type category* "Sustained VT/VF" had the largest effect (OR 2.68 and 2.01, respectively).

- Controlling for all other variables, patients with prior cardiac surgery had a 74% higher chance of operative death after CABG surgery.

- Among hemodynamic risk factors, *Ejection Fraction* had a significant effect on mortality (OR 0.99). Three or more *Diseased Vessels* also was a significant risk factor (OR 1.50). Neither *Left Main Disease* (% stenosis) nor *Mitral Insufficiency* contributed to the risk of operative mortality.

V. HOSPITAL RISK-ADJUSTED OPERATIVE MORTALITY RATES, 2003

A risk-adjusted mortality rate for each hospital was computed using the logistic regression model described in Table 4. Among the 21,272 isolated CABG surgeries performed in 2003, 618 patients died in-hospital or within 30 days of the surgery date, reflecting an overall operative mortality rate of 2.91% in California.

Table 6 and Figure 1 present the risk-adjusted results for each hospital in 2003. Table 6 displays the results alphabetically by hospital name and shows the number of isolated CABGs, number of observed deaths, observed mortality rate, number of expected deaths predicted by the risk model, expected mortality rate, observed-to-expected death (O/E) ratio, risk-adjusted mortality rate with 95% confidence interval (CI), and hospital performance rating.

The hospital performance rating is based on comparison of the 95% CI of each hospital's risk-adjusted mortality rate (RAMR) to the California state average mortality rate. The RAMR is a standardized rate and is the best estimate of a hospital's mortality rate if every hospital had the same case mix. Unlike the observed mortality rate and expected morality rate, which are not comparable across hospitals because those rates are sensitive to patient case differences, the RAMR can be used for direct comparison between hospitals.

We used the 95% CI of RAMR (instead of a point estimate of RAMR) for comparison to the state average.[5] This was done because point estimates of RAMR based on just one year of data can be attributed to chance. Thus, we treated 2003 data as a sample for inference. In Table 6, if the upper limit of the 95% CI of a hospital's risk-adjusted mortality is below the state average mortality rate, indicating the hospital's risk-adjusted mortality rate is significantly lower than the state average, the performance rating will be "**Better**"; if the lower limit of the 95% CI of a hospital's risk-adjusted mortality rate is above the state average mortality rate, indicating the hospital's risk-adjusted mortality is significantly higher than the state average, the performance rating will be "**Worse**"; and if the state average mortality rate is within the 95% CI of a hospital's risk-adjusted mortality rate, the performance rating will be "**No Different**" (blank in the column). The following guide to interpretation provides a detailed explanation of the information presented in Table 6.

Figure 1 shows results graphically, sorted alphabetically by hospital name within geographic region. The bar on the graph represents the 95% confidence Interval (CI) of the risk-adjusted mortality rate for each hospital in a specific geographic region. If the entire bar is located to the left of the vertical line indicating the state average, we conclude with 95% confidence that the hospital's risk-adjusted mortality is significantly lower than the state average ("Better"). If the entire bar is located to the right of the vertical line indicating the state average, we conclude with 95% confidence that the hospital's risk-adjusted mortality is significantly higher than the state average ("Worse"), and if the bar crosses the vertical line, we conclude with 95% confidence that the hospital's risk-adjusted mortality rate is not different from the state average.

Hospital names marked with an asterisk (*) in Table 6 are hospitals that have submitted statements regarding this report. These statements are presented in Appendix C of this report.

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[5] Because the approximation of standard error based on normal or Poisson distribution is problematic if a hospital has very few deaths (e.g., less than 5), the exact probability was used for determining the performance rating of hospitals where the number of deaths was less than 15 (Luft and Brown, 1993).

Guide for Interpreting Operative Mortality Hospital Risk-Adjusted Rates

Isolated CABG Cases	The number of isolated CABG cases submitted to CCORP during 2003 by the facility shown in the left column.
Number of Deaths	The actual number of operative deaths for 2003. The number of deaths includes: (1) all deaths that occur during the hospitalization in which the CABG surgery was performed, even after 30 days, and (2) all deaths occurring within 30 days after the CABG surgery.
Observed Mortality Rate	The ratio of the Number of Deaths and the Isolated CABG cases multiplied by 100: Observed Mortality Rate = Number of Deaths/Isolated CABG Cases * 100.
Number of Expected Deaths	The number of expected operative deaths predicted for a hospital after adjusting for its patient population. The number is rounded to its integer.
Expected Mortality Rate	The ratio of the Number of Expected Deaths (without rounding) to Isolated CABG cases multiplied by 100: Expected Mortality Rate = Number of Expected Deaths/Isolated CABG Cases * 100.
O/E Ratio	The observed *number* of deaths divided by the expected *number* of deaths. An O/E ratio greater than 1.0 indicates that there were more deaths at a hospital than would have been expected. A ratio less than 1.0 indicates that there were fewer deaths at a hospital than expected, given the case mix of patients treated at a hospital.
Risk-Adjusted Mortality Rate (95% CI)	The Risk-Adjusted Mortality Rate (RAMR) is obtained by multiplying the observed California state average mortality rate (CSAMR=2.91%) by a hospital's O/E ratio. The 95% confidence interval represents the confidence we have in the estimate for the RAMR. The lower confidence limit = CSAMR * (O/E ratio - (Standard Error * 1.96)). The upper confidence limit is = CSAMR * (O/E ratio + (Standard Error * 1.96)).
Performance Rating	The performance rating is based on a comparison of each hospital's risk-adjusted mortality rate and the California state average mortality rate (2.91%). This is a test of statistical significance. A hospital is classified as "Better" if the upper 95% confidence limit of its RAMR falls below the California observed mortality rate. A hospital is classified as "Worse" if the lower 95% confidence limit of its RAMR is higher than the California observed mortality rate. A hospital is classified as "No Different" (performance rating is blank) if the California mortality rate falls within the confidence interval of the hospital's risk-adjusted mortality rate.

Table 6: CCORP 2003 Operative Mortality Hospital Risk-Adjusted Results

Hospital Name	Isolated CABG Cases	Number of Deaths	Observed Mortality Rate	Number of Expected Deaths	Expected Mortality Rate	O/E Ratio	Risk-Adjusted Mortality Rate (95% CI)		Performance Rating
California	**21,272**	**618**	**2.91**						
Alta Bates Summit Medical Center – Summit Campus	752	22	2.93	21	2.84	1.03	2.99	(1.83,4.15)	
Alvarado Hospital Medical Center	83	6	7.23	2	2.51	2.88	8.38	(4.55,12.21)	Worse
Anaheim Memorial Medical Center	229	7	3.06	5	2.30	1.33	3.86	(1.48,6.25)	
Antelope Valley Hospital Medical Center	45	1	2.22	1	2.42	0.92	2.67	(0.0,7.73)	
Bakersfield Heart Hospital	182	1	0.55	4	2.15	0.26	0.74	(0.0,3.52)	
Bakersfield Memorial Hospital	293	13	4.44	7	2.55	1.74	5.05	(2.73,7.38)	
Beverly Hospital	29	4	13.79	2	5.43	2.54	7.38	(2.08,12.69)	
Brotman Medical Center	44	2	4.55	1	3.09	1.47	4.28	(0.0,8.97)	
California Pacific Medical Center – Pacific Campus	129	4	3.10	5	4.06	0.76	2.22	(0.08,4.36)	
Cedars Sinai Medical Center	250	6	2.40	6	2.24	1.07	3.11	(0.81,5.41)	
Centinela Hospital Medical Center*	105	7	6.67	3	2.77	2.41	6.99	(3.77,10.22)	Worse
Citrus Valley Medical Center – IC Campus	163	8	4.91	5	3.18	1.54	4.49	(2.15,6.82)	
Community Medical Center – Fresno	284	10	3.52	10	3.35	1.05	3.05	(1.33,4.77)	
Community Memorial Hospital of San Buenaventura	178	3	1.69	4	2.05	0.82	2.38	(0.0,5.21)	
Dameron Hospital	73	5	6.85	3	4.29	1.60	4.64	(1.78,7.5)	
Desert Regional Medical Center	146	9	6.16	4	2.80	2.20	6.39	(3.72,9.07)	Worse
Doctors Medical Center – Modesto Campus	426	16	3.76	9	2.16	1.74	5.05	(3.27,6.83)	Worse
Doctors Medical Center – San Pablo Campus	56	5	8.93	2	3.65	2.44	7.10	(2.17,12.03)	
Dominican Hospital	105	1	0.95	3	2.51	0.38	1.10	(0.0,4.36)	
Downey Regional Medical Center	78	4	5.13	2	2.69	1.90	5.53	(1.74,9.32)	
Eisenhower Memorial Hospital	222	5	2.25	6	2.84	0.79	2.30	(0.17,4.43)	
El Camino Hospital	**79**	**1**	**1.27**	**2**	**2.91**	**0.44**	**1.27**	**(0.0,4.85)**	
Encino Tarzana Regional Medical Center	**153**	**5**	**3.27**	**5**	**3.23**	**1.01**	**2.94**	**(0.6,5.27)**	
Enloe Medical Center	175	3	1.71	5	2.92	0.59	1.71	(0.0,4.12)	
Fountain Valley Regional Hospital	**140**	**3**	**2.14**	**6**	**4.20**	**0.51**	**1.48**	**(0.0,3.56)**	
French Hospital Medical Center	76	0	0.00	2	2.80	0.00	0.00	(0.0,3.71)	
Fresno Heart Hospital	34	0	0.00	1	1.67	0.00	0.00	(0.0,7.46)	
Garfield Medical Center	100	3	3.00	4	3.57	0.84	2.44	(0.0,5.31)	
Glendale Adventist Medical Center – Wilson Terrace	147	7	4.76	4	2.74	1.74	5.05	(2.32,7.78)	
Glendale Memorial Hospital and Health Center	178	10	5.62	7	3.78	1.49	4.32	(2.37,6.27)	

* Indicates hospitals that submitted a response to the CCORP during the 60-day comment period. Hospital responses are included in Appendix C.

Table 6: CCORP 2003 Operative Mortality Hospital Risk-Adjusted Results

Hospital Name	Isolated CABG Cases	Number of Deaths	Observed Mortality Rate	Number of Expected Deaths	Expected Mortality Rate	O/E Ratio	Risk-Adjusted Mortality Rate (95% CI)		Performance Rating
Good Samaritan Hospital – Los Angeles	334	7	2.10	11	3.19	0.66	1.91	(0.33,3.49)	
Good Samaritan Hospital*– San Jose	235	11	4.68	6	2.76	1.69	4.92	(2.58,7.26)	
Granada Hills Community Hospital	25	0	0.00	1	5.56	0.00	0.00	(0.0,4.23)	
Hoag Memorial Hospital Presbyterian	232	5	2.16	9	4.04	0.53	1.55	(0.0,3.15)	
Huntington Memorial Hospital	142	5	3.52	4	2.97	1.19	3.45	(0.81,6.08)	
Irvine Regional Hospital and Medical Center	31	0	0.00	0	1.25	0.00	0.00	(0.0,9.04)	
John Muir Medical Center	110	4	3.64	2	2.17	1.67	4.86	(1.29,8.44)	
Kaiser Foundation Hospital (Geary San Francisco)	770	19	2.47	14	1.79	1.38	4.01	(2.55,5.48)	
Kaiser Foundation Hospital (Sunset Los Angeles)	992	36	3.63	27	2.74	1.32	3.84	(2.82,4.87)	
Kaweah Delta Hospital	338	12	3.55	13	3.89	0.91	2.65	(1.17,4.14)	
Los Angeles Co Harbor – UCLA Medical Center	150	7	4.67	6	3.74	1.25	3.62	(1.58,5.66)	
Los Angeles Co USC Medical Center	123	4	3.25	3	2.07	1.57	4.56	(1.07,8.05)	
Lakewood Regional Medical Center	124	6	4.84	3	2.65	1.83	5.31	(2.28,8.33)	
Lancaster Community Hospital	25	1	4.00	1	4.29	0.93	2.71	(0.0,7.78)	
Little Company of Mary Hospital	79	0	0.00	3	3.98	0.00	0.00	(0.0,2.96)	
Loma Linda University Medical Center	308	9	2.92	9	2.97	0.98	2.86	(1.12,4.6)	
Long Beach Memorial Medical Center	312	11	3.53	9	2.74	1.29	3.74	(1.9,5.59)	
Los Robles Regional Medical Center	163	9	5.52	5	3.16	1.75	5.07	(2.7,7.45)	
Marian Medical Center	121	3	2.48	3	2.61	0.95	2.76	(0.0,5.85)	
Marin General Hospital	51	2	3.92	2	3.16	1.24	3.61	(0.0,7.79)	
Memorial Medical Center of Modesto	306	9	2.94	7	2.17	1.35	3.94	(1.8,6.07)	
Mercy General Hospital	926	10	1.08	16	1.71	0.63	1.84	(0.44,3.24)	
Mercy Medical Center – Redding	254	7	2.76	10	3.77	0.73	2.13	(0.47,3.78)	
Mercy San Juan Hospital	153	2	1.31	3	1.73	0.76	2.20	(0.0,5.62)	
Methodist Hospital of Southern California	120	4	3.33	3	2.87	1.16	3.38	(0.49,6.26)	
Mills-Peninsula Health Center	77	1	1.30	3	4.29	0.30	0.88	(0.0,3.38)	
Mission Hospital Regional Medical Center	202	1	0.50	3	1.68	0.29	0.85	(0.0,3.84)	
Mt. Diablo Medical Center	239	7	2.93	7	2.99	0.98	2.85	(0.85,4.84)	
Northridge Hospital Medical Center*	92	5	5.43	3	2.86	1.90	5.51	(2.14,8.89)	
O'Connor Hospital	92	2	2.17	3	3.31	0.66	1.91	(0.0,4.91)	
Palomar Medical Center	152	6	3.95	3	2.20	1.80	5.22	(2.23,8.2)	
Pomona Valley Hospital Medical Center	158	7	4.43	8	5.27	0.84	2.44	(0.74,4.15)	
Presbyterian Intercommunity Hospital	69	2	2.90	2	3.18	0.91	2.64	(0.0,6.26)	
Providence Holy Cross Medical Center	116	5	4.31	4	3.58	1.20	3.50	(0.86,6.14)	

* Indicates hospitals that submitted a response to the CCORP during the 60-day comment period. Hospital responses are included in Appendix C.

Table 6: CCORP 2003 Operative Mortality Hospital Risk-Adjusted Results

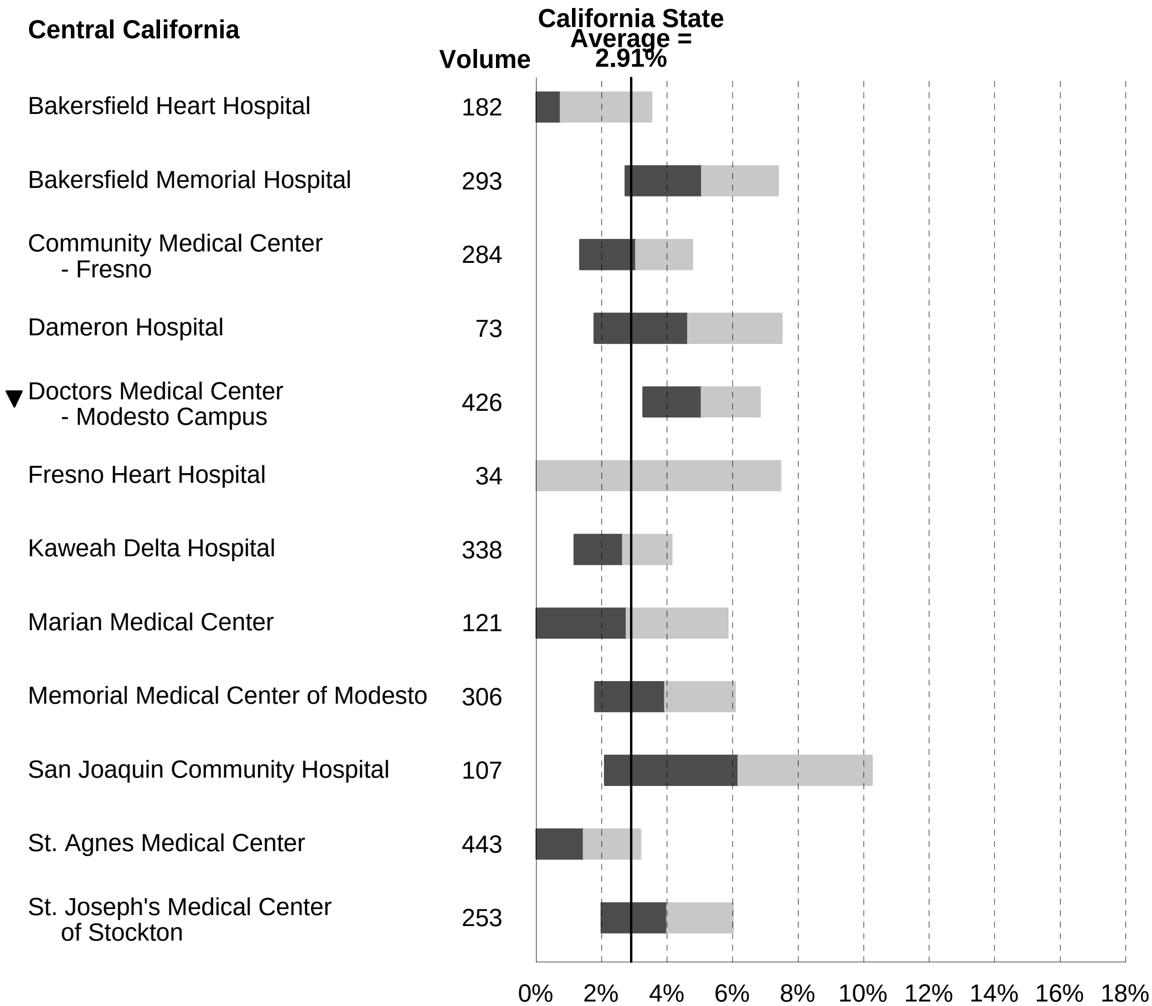
Hospital Name	Isolated CABG Cases	Number of Deaths	Observed Mortality Rate	Number of Expected Deaths	Expected Mortality Rate	O/E Ratio	Risk-Adjusted Mortality Rate	(95% CI)	Performance Rating
Providence St. Joseph Medical Center	106	4	3.77	2	1.75	2.15	6.26	(2.32,10.2)	
Queen of the Valley Hospital	169	2	1.18	6	3.67	0.32	0.94	(0.0,3.08)	
Redding Medical Center	38	3	7.89	2	4.48	1.76	5.12	(1.36,8.88)	
Rideout Memorial Hospital	158	4	2.53	4	2.26	1.12	3.25	(0.35,6.15)	
Riverside Community Hospital	239	10	4.18	7	2.98	1.41	4.09	(2.06,6.11)	
Saddleback Memorial Medical Center	111	3	2.70	2	2.00	1.35	3.93	(0.29,7.58)	
Salinas Valley Memorial Hospital	219	1	0.46	6	2.59	0.18	0.51	(0.0,2.76)	Better
San Antonio Community Hospital	63	3	4.76	2	3.93	1.21	3.52	(0.11,6.94)	
San Joaquin Community Hospital	107	6	5.61	3	2.64	2.13	6.18	(2.1,10.26)	
San Jose Medical Center	52	2	3.85	2	4.16	0.93	2.69	(0.0,6.35)	
San Ramon Regional Medical Center	55	2	3.64	2	2.88	1.26	3.67	(0.0,7.92)	
Santa Barbara Cottage Hospital	209	5	2.39	7	3.24	0.74	2.15	(0.09,4.21)	
Santa Clara Valley Medical Center	60	2	3.33	1	1.28	2.60	7.54	(1.16,13.92)	
Santa Monica – UCLA Medical Center	34	2	5.88	1	2.88	2.04	5.94	(0.47,11.41)	
Santa Rosa Memorial Hospital	109	7	6.42	4	4.11	1.56	4.54	(2.03,7.05)	
Scripps Green Hospital	119	3	2.52	2	1.39	1.81	5.25	(0.9,9.61)	
Scripps Memorial Hospital – La Jolla	406	13	3.20	13	3.29	0.97	2.83	(1.4,4.25)	
Scripps Mercy Hospital	157	8	5.10	5	2.94	1.73	5.03	(2.49,7.57)	
Sequoia Hospital	132	5	3.79	5	3.90	0.97	2.82	(0.61,5.03)	
Seton Medical Center	214	1	0.47	5	2.50	0.19	0.54	(0.0,2.91)	
Sharp Chula Vista Medical Center	230	6	2.61	9	3.94	0.66	1.93	(0.16,3.69)	
Sharp Grossmont Hospital	175	4	2.29	5	2.64	0.86	2.51	(0.0,5.05)	
Sharp Memorial Hospital	175	1	0.57	3	1.82	0.31	0.91	(0.0,4.02)	
Sierra Vista Regional Medical Center	97	2	2.06	4	4.39	0.47	1.36	(0.0,3.9)	
St. Agnes Medical Center	443	5	1.13	10	2.27	0.50	1.45	(0.0,3.19)	
St. Bernardine Medical Center	527	12	2.28	19	3.52	0.65	1.88	(0.67,3.09)	
St. Francis Medical Center	86	4	4.65	2	2.66	1.75	5.07	(1.42,8.73)	
St. Helena Hospital	151	5	3.31	5	3.24	1.02	2.97	(0.54,5.39)	
St. John's Hospital and Health Center	69	0	0.00	2	2.22	0.00	0.00	(0.0,4.43)	
St. John's Regional Medical Center	176	1	0.57	7	3.80	0.15	0.43	(0.0,2.51)	Better
St. Joseph Hospital – Eureka	79	2	2.53	3	3.92	0.65	1.88	(0.0,4.44)	
St. Joseph Hospital – Orange	171	3	1.75	4	2.24	0.78	2.28	(0.0,5.02)	
St. Joseph's Medical Center of Stockton	253	10	3.95	7	2.87	1.38	4.00	(1.99,6.01)	
St. Jude Medical Center	181	7	3.87	4	2.32	1.66	4.84	(2.2,7.47)	
St. Mary Medical Center	72	2	2.78	3	4.44	0.63	1.82	(0.0,4.76)	
St. Mary's Medical Center, San Francisco	76	1	1.32	3	3.36	0.39	1.14	(0.0,4.4)	

Table 6: CCORP 2003 Operative Mortality Hospital Risk-Adjusted Results

Hospital Name	Isolated CABG Cases	Number of Deaths	Observed Mortality Rate	Number of Expected Deaths	Expected Mortality Rate	O/E Ratio	Risk-Adjusted Mortality Rate (95% CI)		Performance Rating
St. Mary Regional Medical Center	198	4	2.02	7	3.35	0.60	1.75	(0.0,3.76)	
St. Vincent Medical Center	207	1	0.48	7	3.41	0.14	0.41	(0.0,2.43)	Better
Stanford University Hospital	134	6	4.48	3	2.47	1.82	5.28	(2.27,8.28)	
Sutter Medical Center of Santa Rosa	116	0	0.00	1	1.06	0.00	0.00	(0.0,5.08)	
Sutter Memorial Hospital	608	22	3.62	17	2.71	1.33	3.87	(2.56,5.19)	
Torrance Memorial Medical Center	174	2	1.15	5	3.05	0.38	1.09	(0.0,3.42)	
Tri-City Medical Center	148	3	2.03	4	2.80	0.72	2.11	(0.0,4.7)	
UC Irvine Medical Center	81	3	3.70	2	1.88	1.97	5.73	(1.24,10.21)	
UC Davis Medical Center	136	0	0.00	4	2.75	0.00	0.00	(0.0,2.64)	Better
UCLA Medical Center	113	4	3.54	3	2.54	1.39	4.05	(0.83,7.27)	
UCSD Medical Center	34	1	2.94	2	4.89	0.60	1.75	(0.0,5.6)	
UCSD Medical Center – La Jolla	55	2	3.64	1	2.38	1.53	4.44	(0.0,9.1)	
UCSF Medical Center	141	6	4.26	6	4.10	1.04	3.02	(0.95,5.08)	
USC University Hospital*	135	8	5.93	4	3.01	1.97	5.72	(2.46,8.98)	
Valley Presbyterian Hospital	35	2	5.71	1	1.88	3.03	8.81	(1.98,15.65)	
Washington Hospital – Fremont	159	1	0.63	4	2.63	0.24	0.70	(0.0,3.36)	
West Anaheim Medical Center	28	1	3.57	1	3.29	1.09	3.16	(0.0,8.42)	
West Hills Regional Medical Center	52	2	3.85	2	3.12	1.23	3.59	(0.0,7.73)	
Western Medical Center Hospital – Anaheim	187	6	3.21	5	2.69	1.19	3.47	(1.05,5.88)	
Western Medical Center – Santa Ana	129	1	0.78	3	2.30	0.34	0.98	(0.0,4.15)	
White Memorial Medical Center	109	2	1.83	4	3.97	0.46	1.34	(0.0,3.9)	

*Indicates hospitals that submitted a response to the CCORP during the 60-day comment period. Hospital responses are included in Appendix C.

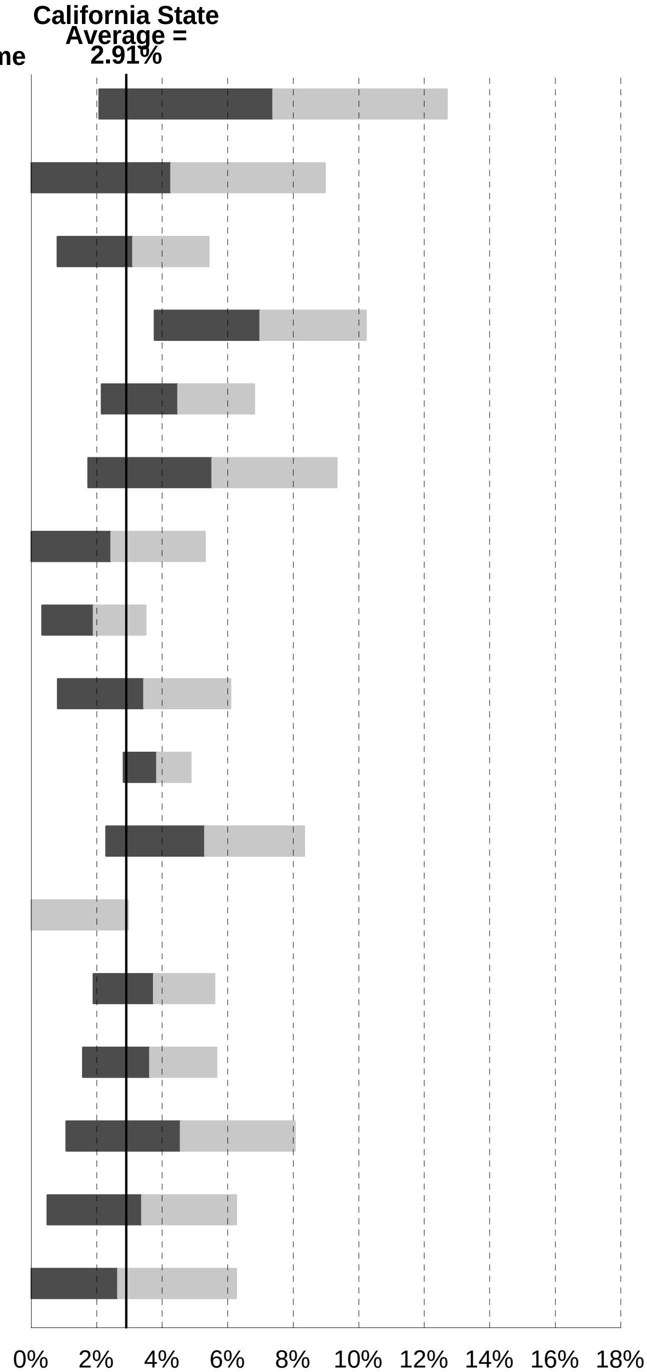
Figure 1: Risk-Adjusted Operative Mortality Rates by Hospital, 2003
(in Alphabetical Order by Geographic Region)



▼ Risk-Adjusted Operative Mortality Rate Significantly Higher than State Average
★ Risk-Adjusted Operative Mortality Rate Significantly Lower than State Average
Range of Risk-Adjusted Operative Mortality Rate (95% Confidence Interval)

Figure 1: Risk-Adjusted Operative Mortality Rates by Hospital, 2003 (cont'd)
(in Alphabetical Order by Geographic Region)

Greater Los Angeles Area	Volume
Beverly Hospital	29
Brotman Medical Center	44
Cedars Sinai Medical Center	250
▼ Centinela Hospital Medical Center	105
Citrus Valley Medical Center - IC Campus	163
Downey Regional Medical Center	78
Garfield Medical Center	100
Good Samaritan Hospital - Los Angeles	334
Huntington Memorial Hospital	142
Kaiser Foundation Hospital - Sunset Los Angeles	992
Lakewood Regional Medical Center	124
Little Company of Mary Hospital	79
Long Beach Memorial Medical Center	312
Los Angeles Co Harbor - UCLA Medical Center	150
Los Angeles Co USC Medical Center	123
Methodist Hospital of Southern California	120
Presbyterian Intercommunity Hospital	69



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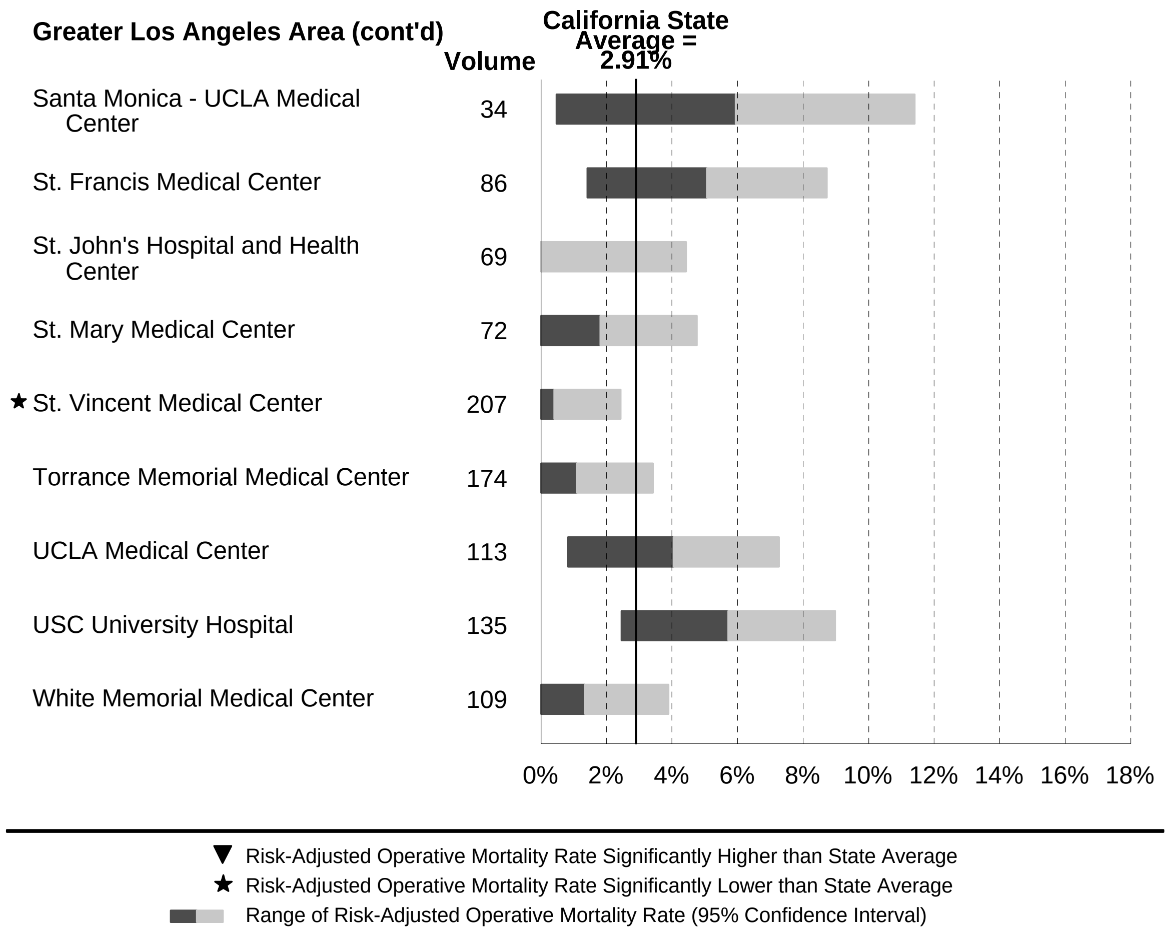
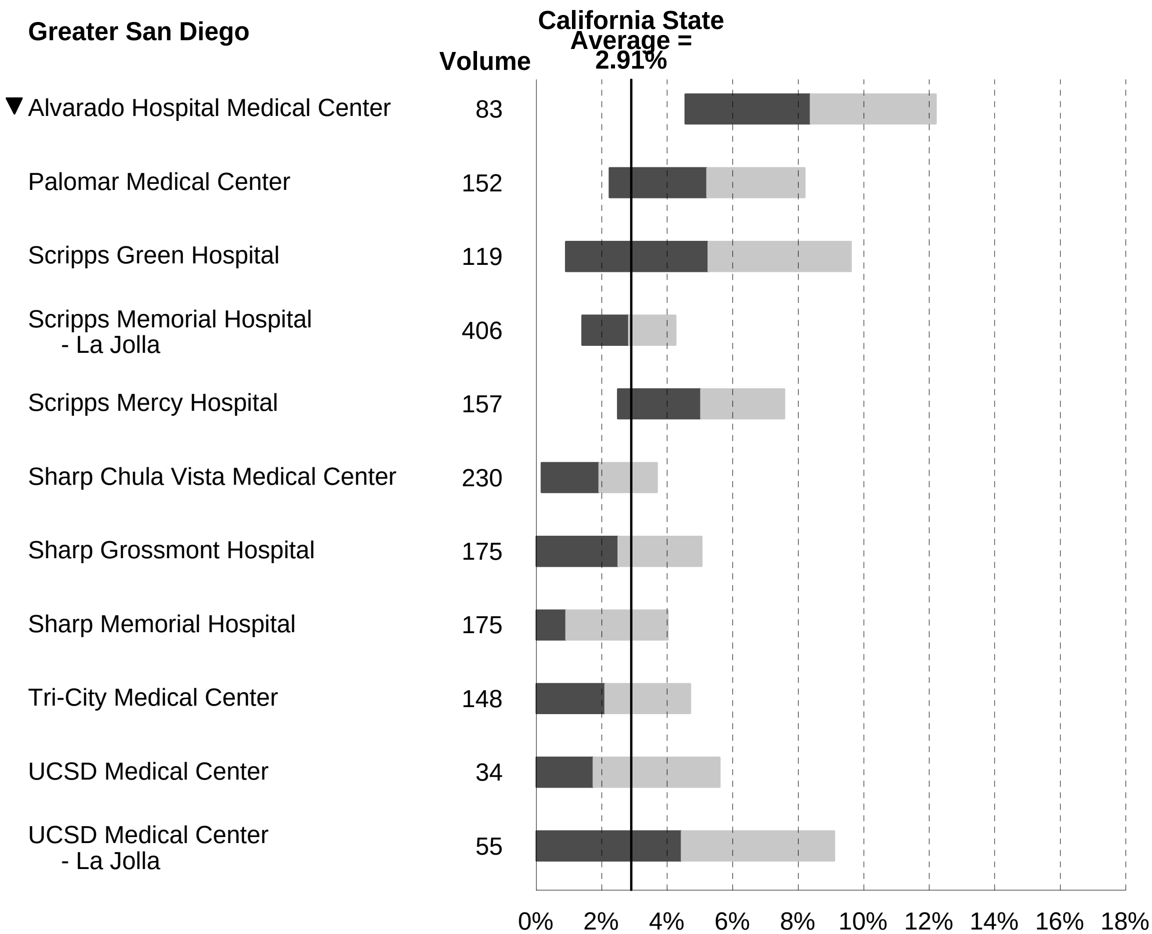


Figure 1: Risk-Adjusted Operative Mortality Rates by Hospital, 2003
(cont'd)
(in Alphabetical Order by Geographic Region)



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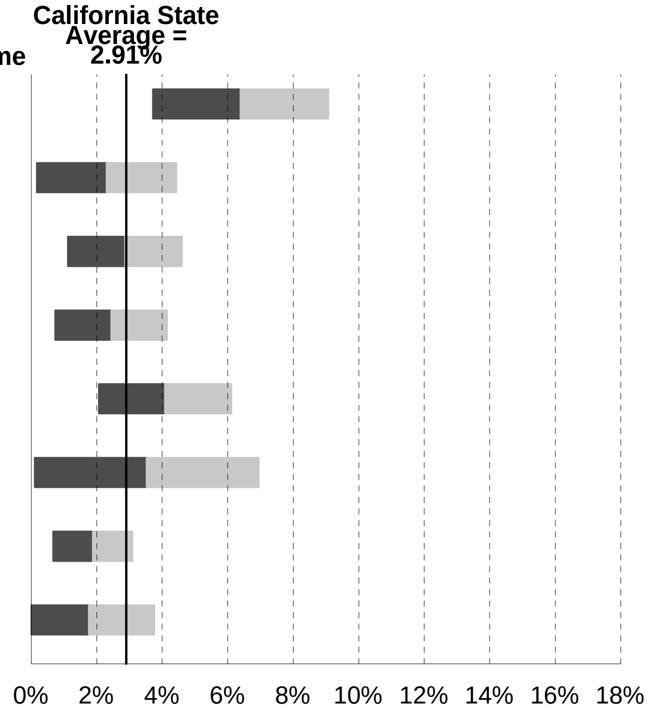
Range of Risk-Adjusted Operative Mortality Rate (95% Confidence Interval)

Figure 1: Risk-Adjusted Operative Mortality Rates by Hospital, 2003
(cont'd) **(in Alphabetical Order by Geographic Region)**

Inland Empire, Riverside, and San Bernardino	Volume
▼ Desert Regional Medical Center	146
Eisenhower Memorial Hospital	222
Loma Linda University Medical Center	308
Pomona Valley Hospital Medical Center	158
Riverside Community Hospital	239
San Antonio Community Hospital	63
St. Bernardine Medical Center	527
St. Mary Regional Medical Center	198



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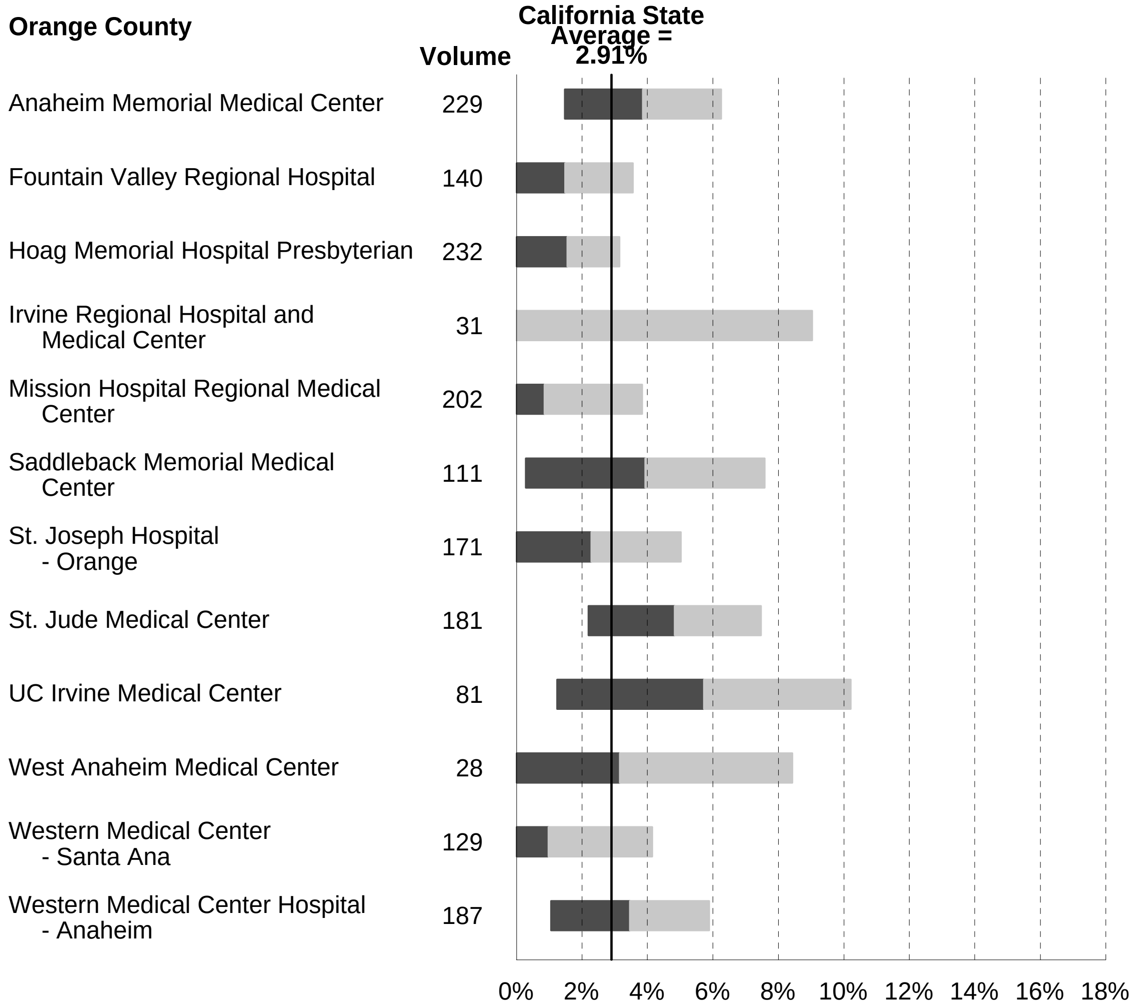
Range of Risk-Adjusted Operative Mortality Rate (95% Confidence Interval)

Figure 1: Risk-Adjusted Operative Mortality Rates by Hospital, 2003
(cont'd) (in Alphabetical Order by Geographic Region)



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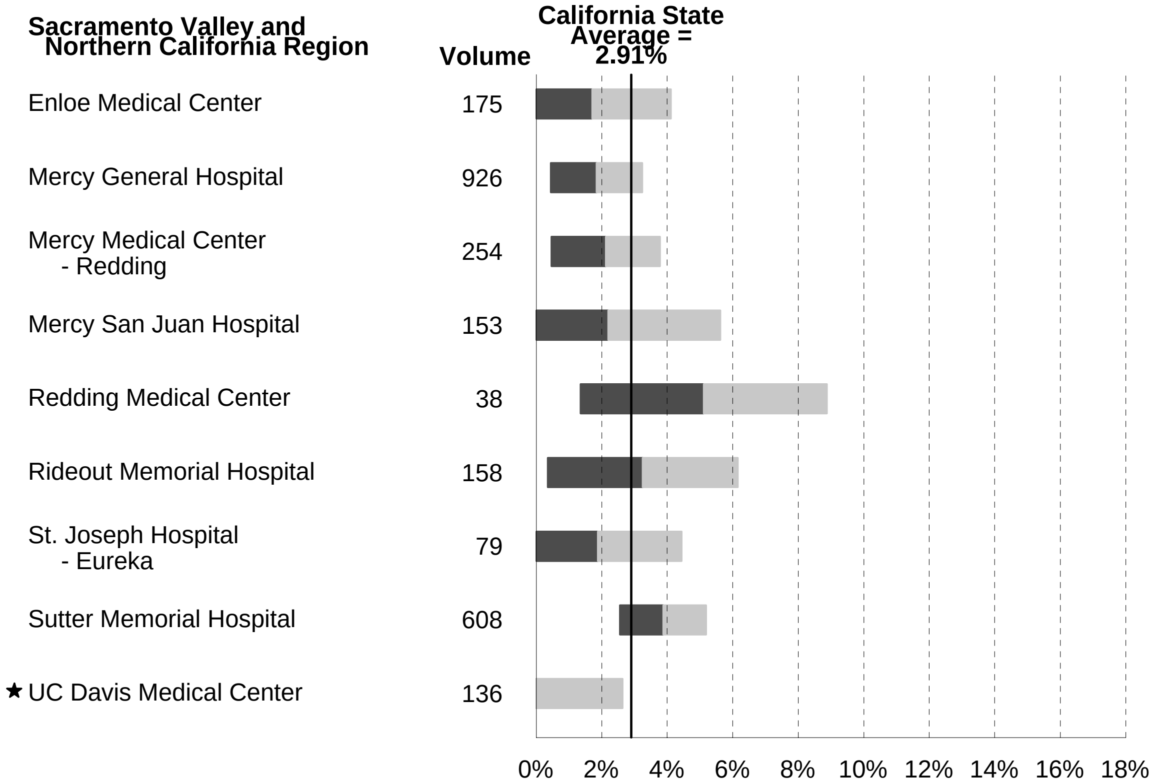
(cont'd) (in Alphabetical Order by Geographic Region)



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(cont'd)
(in Alphabetical Order by Geographic Region)

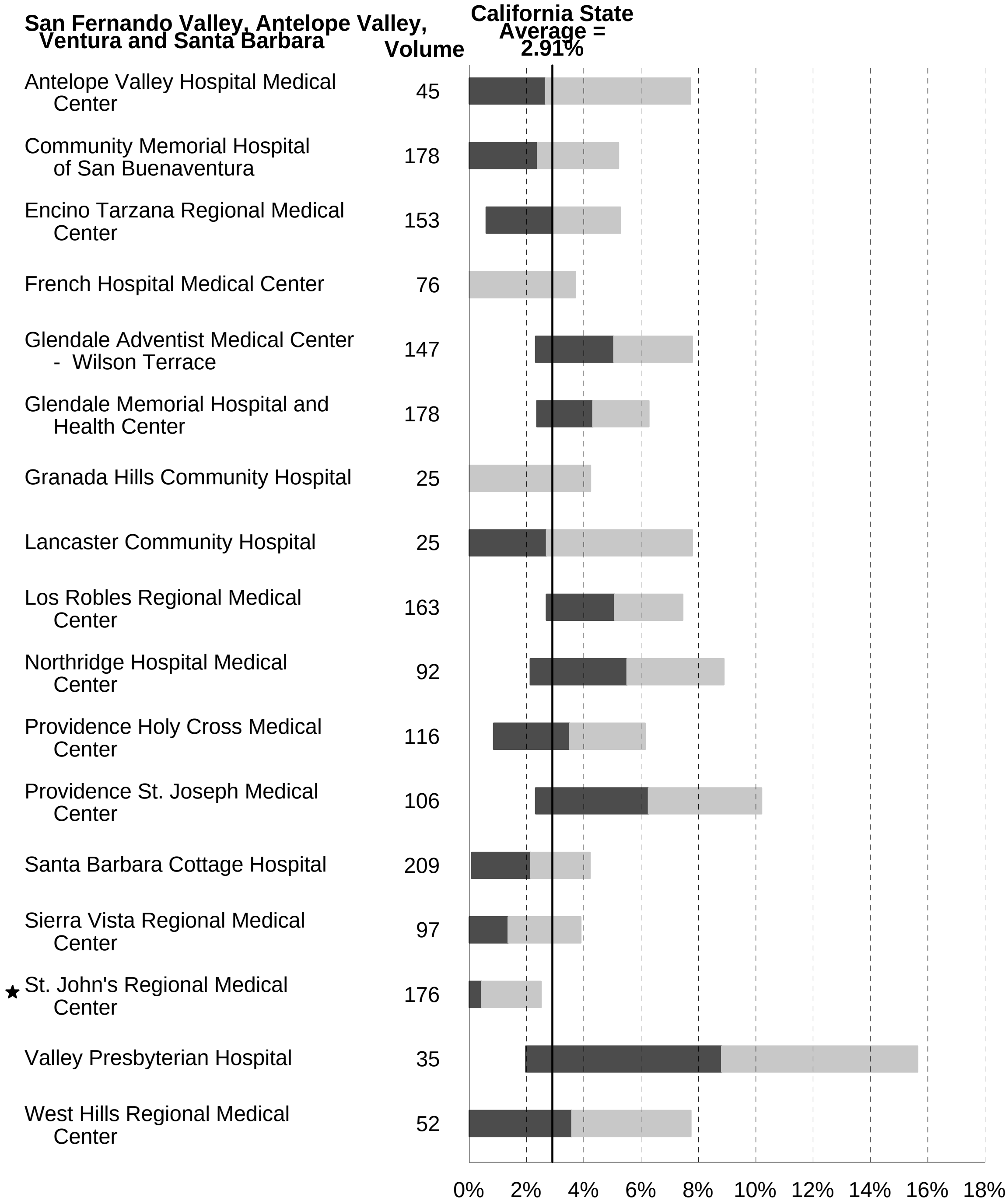

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Figure 1: Risk-Adjusted Operative Mortality Rates by Hospital, 2003
(cont'd) **(in Alphabetical Order by Geographic Region)**

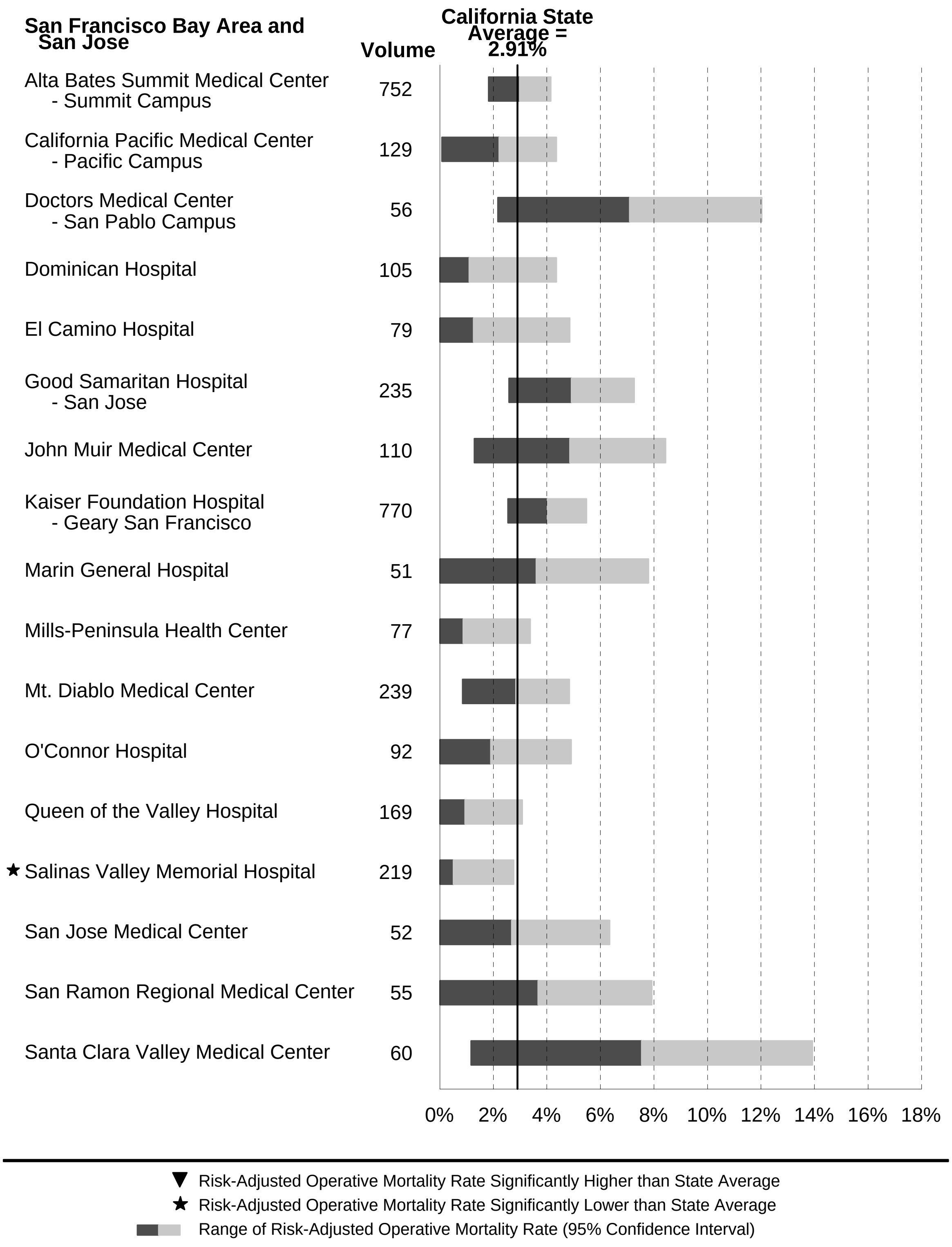
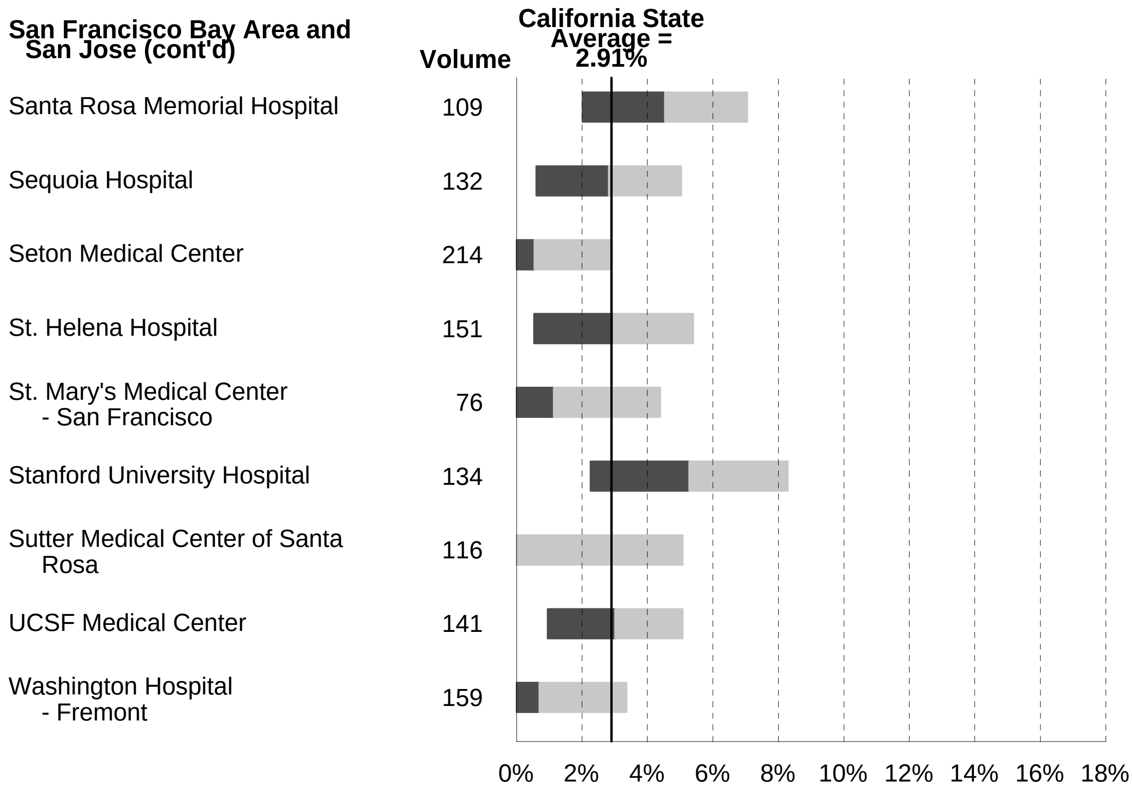


Figure 1: Risk-Adjusted Operative Mortality Rates by Hospital, 2003
(cont'd) (in Alphabetical Order by Geographic Region)



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Range of Risk-Adjusted Operative Mortality Rate (95% Confidence Interval)

VI. HOSPITAL VOLUME AND CORONARY ARTERY BYPASS GRAFT SURGERY OUTCOMES

The association between the quantity of care that a physician or hospital provides and the quality of care that patients receive has been intensely investigated by clinicians and health services researchers. In the majority of the published data investigating this relationship, researchers have generally found that the higher the number of patients a physician or hospital treats with a specific condition, the better, on average, patients' health outcomes. This "volume-outcome" relationship has been documented for a wide variety of medical conditions and surgical procedures at several levels of care, including the physician, clinical team, and hospital level. In a report reviewing the volume-outcome relationship, published by the Institute of Medicine (Hewitt, 2000), the author noted that 77% of the published volume-outcome studies demonstrated a significant relationship between higher physician and hospital volumes and better health outcomes. In fact, in this Institute of Medicine review, no studies were found to demonstrate a significant negative relationship between higher volumes and outcomes (i.e., higher volume resulted in worse health outcomes).

The volume-outcome relationship has been most extensively studied for patients receiving coronary artery bypass graft (CABG) surgery. This observed relationship could imply that regionalizing services, thereby increasing average physician and hospital volumes, would improve the quality of healthcare. However, there is no direct evidence that policy driven regionalization of services improves quality or reduces mortality. Further, while most studies have found that hospitals performing more CABG surgeries have better outcomes, more recent data and analyses using more robust statistical methods have failed to find a clinically relevant relationship (Peterson, 2004; Shahian, 2001; Christiansen, 1997; Kalant, 2004; Panageas, 2003). This is perhaps because of the overall decline of CABG surgery mortality in recent years and because of the standardization of the procedure given evidence-based pathways.

CCORP 2003 Analyses

The following analyses examine the volume-outcome relationship in CABG surgery using the CCORP data from 2003. The primary goal of these analyses is to use the most current methodological techniques to determine whether California hospitals that perform more CABG surgeries have lower risk-adjusted operative mortality than those California hospitals that perform fewer CABG surgeries. First, a patient-level risk-adjusted mortality prediction model was developed using a hierarchical or multi-level technique. Hierarchical models (also referred to as multi-level models, random or mixed-effect models, and random coefficient/intercept regression models) are increasingly used in health services research to analyze multi-level data, particularly when analyses are done on patient data from many hospitals. These models are more appropriate than traditional patient level models for making inferences at the hospital level because they adjust for the "clustering" of patients (Shahian, 2001; Christiansen, 1997; Leyland, 2003; Burgess, 2000). Specifically, it is known that patients are not randomly distributed among all hospitals and that similar patients are cared for at similar hospitals. These techniques adjust for non-randomly distributed, unmeasured characteristics that contribute to a patient's CABG mortality rate. All of these characteristics can contribute to a hospital's observed CABG mortality rate and may not be accounted for in a traditional patient-level logistic regression model. Not accounting for some of these factors, particularly patient-level factors may cause a hospital's CABG mortality rate to appear better or worse than it should be. For example, if one hospital treats more patients from lower socioeconomic neighborhoods (a factor not accounted for in the mortality risk model but known to be correlated with CABG mortality), the "clustering" of such patients may increase the observed mortality rate of this hospital, thereby resulting in a higher than expected "observed-to-expected" (O/E) mortality ratio.

To assess the relationship between hospital CABG volume and mortality, annual hospital volume was first included as a continuous independent variable in the hierarchical logistic regression models (using a random intercepts model). Second, to visualize the hospital volume-outcome relationship, the hierarchical model was used to plot the O/E ratio for each hospital against its 2003 annual volume. Third, hospitals were then grouped into volume categories depending upon the number of annual CABG procedures they performed. These categories were included as indicator variables in the hierarchical logistic regression to determine whether the different volume categories were significantly associated with higher or lower mortality.

Results

The CCORP CABG database contains detailed patient-level clinical data on 21,272 isolated CABG surgery procedures in 121 hospitals in California in 2003. The average annual hospital CABG volume was 176 cases, with a range among individual hospitals of 25 to 992. The overall operative mortality rate was 2.91%, and the average un-weighted hospital operative mortality rate was 3.17%, with a range among individual hospitals of 0% to 13.79%.

In the hierarchical model, when hospital volume was entered into the analysis as a continuous variable, there was no association with risk-adjusted operative mortality (coefficient -0.00005; standard error 0.00030; p-value 0.861; odds ratio 1.000 and 95% confidence interval of odds ratio 0.999~1.001 for every additional patient).

The expected number of operative deaths at each hospital was calculated by summing the probabilities of death for all patients at each hospital, using the hierarchical model. The observed-to-expected (O/E) ratios were then plotted against hospital volume for the 2003 data. This plot is shown in Figure 2. Each dot in the figure identifies a single hospital. The mean O/E ratio computed using the hierarchical logistic regression model was 1.06, with a range of 0 to 3.03. Figure 2 reveals that higher volume CABG hospitals tend to cluster around an O/E of 1.0, with less variation in performance as compared to hospitals with lower annual volumes, where there is significant variation in performance results.

Figure 2: Plot of Observed to Expected (O/E) Ratio of Operative Mortality versus 2003 Hospital CABG Volume

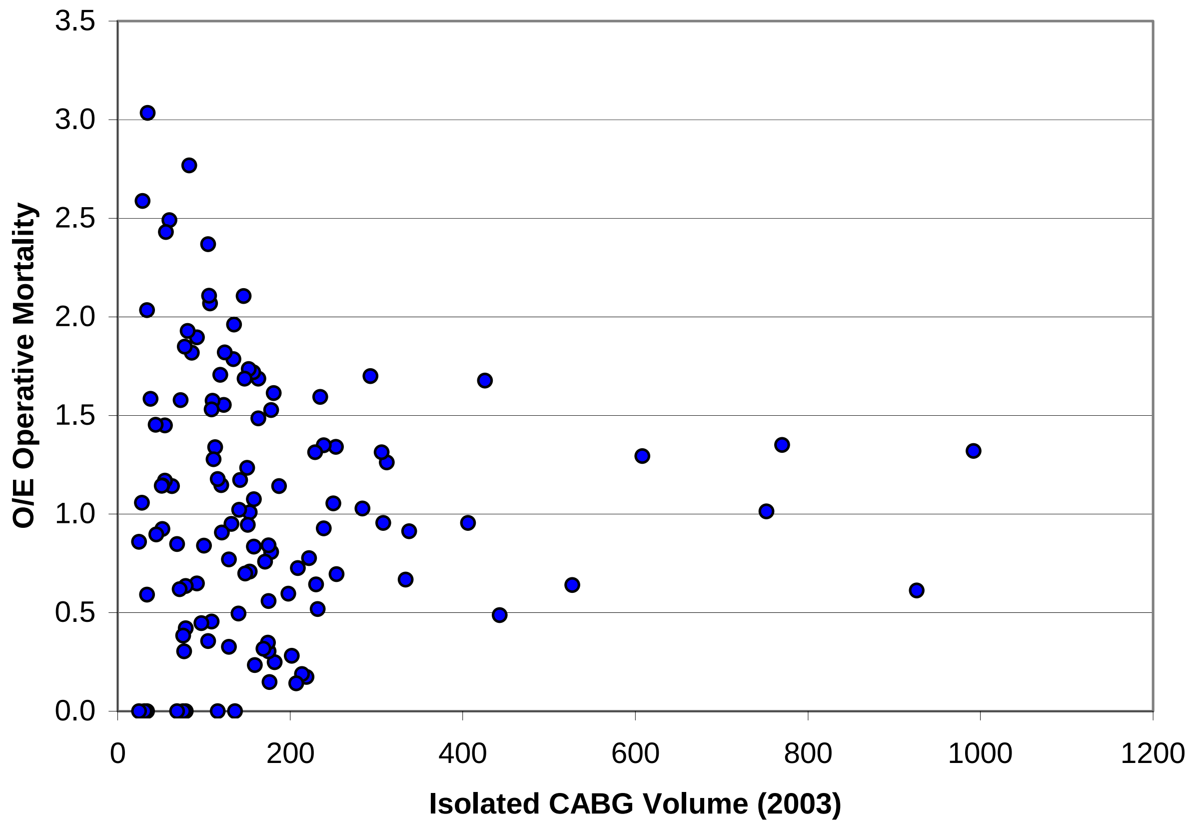


Table 7 presents the summary statistics when hospital volume was categorized into quartiles (<200, 200-299, 300-599, >=600) and dichotomized (>=450 and <450; and >=250 and <250). The quartiles were chosen because these volumes were used in the previous California volume-outcome reports. The split point of 450 procedures per year was chosen because of the past volume recommendations by The Leapfrog Group (www.leapfroggroup.org). Again, the data show that patients have a similar risk of dying from a CABG procedure at hospitals with lower annual volumes as compared to higher annual volumes of CABG surgeries.

Table 7: Hospital Volume Groups and Predicted Mortality Outcomes

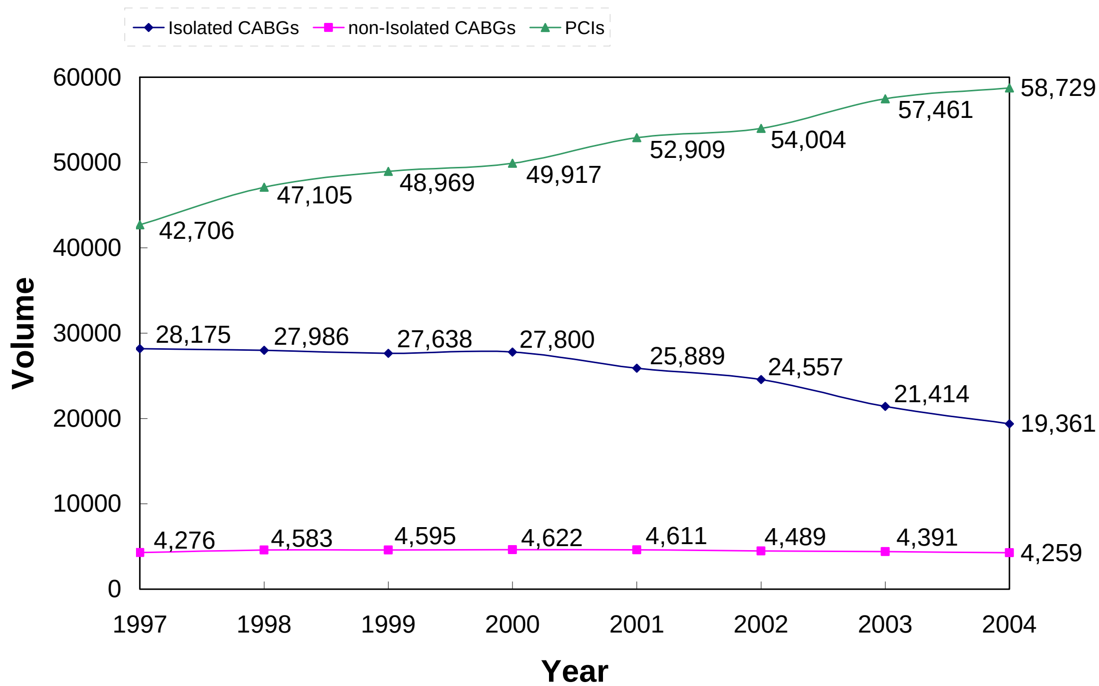
Volume Group	Hospitals (n=121) N (%)	Patients (n=21,272) N (%)	OR (95% CI)
>=600	5 (4.1)	4,048 (19)	1.088 (0.693, 1.706)
300-599	9 (7.4)	3,400 (15.9)	0.900 (0.614, 1.317)
200-299	17 (14)	4,011 (18.8)	0.785 (0.567, 1.085)
<200	90 (74.3)	9,813 (46.1)	Reference
>=450	6 (4.9)	4,575 (21.5)	1.037 (0.688, 1.563)
<450	115 (95)	16,697 (78.4)	Reference
>=250	19 (15.7)	8,782 (41.2)	1.073 (0.816, 1.411)
<250	102 (84.2)	12,490 (58.7)	Reference

Utilization of Cardiac Intervention Procedures

Isolated CABG volume has declined in recent years while Percutaneous Coronary Intervention (PCI) volume has increased. Nationally, the rate of coronary stent insertion increased by 147% from 1996 to 2000 — from 66 per 100,000 in 1996 to 163 per 100,000 in 2000 (Bernstein et al, 2003). As shown in Figure 3, utilization of PCIs in California has grown from 42,706 procedures in 1997 to 58,729 procedures in 2004, an increase of 37%. Meanwhile the number of isolated CABGs has dropped from 28,175 to 19,361, a decrease of 31%. However, non-isolated CABG surgery volume has remained constant at around 4,200 cases per year.

Medical innovations such as the CABG procedure, Percutaneous Transluminal Coronary Angioplasty (PTCA), and intra-coronary stents perfected during the past 30 years have contributed to improved survival for heart attack patients. The introduction of the intra-coronary stent insertion procedure (small wire cylinders that hold a narrow artery open) in clogged arteries is rapidly replacing angioplasty without stents because of lower rates of renarrowing of opened arteries (restenosis) associated with intracoronary stents. New technologies and improved adjunctive medical therapy are making PCI a viable alternative to CABG. The advantages associated with PCI have been widely noted: PCI involves a shorter hospital stay, is suitable for most patients, and can be repeated and performed without anesthesia by a cardiologist or surgeon. On the other hand, the literature also shows that CABG surgery has lower rates of repeat revascularization, less overall angina, and lower long-term mortality. A more comprehensive approach to examining the quality of revascularization procedures at California hospitals would include PCI and its outcomes.

Figure 3: California Isolated CABG, Non-Isolated CABG, PCI Volume (1997-2004)



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APPENDIX A: CLINICAL DEFINITION OF ISOLATED CABG FOR 2003

Definition/Description:
When any of the procedures listed in Section A is performed concurrently with the coronary artery bypass surgery, the surgery will be considered non-isolated and the data element coded 'No.' It is not possible to list all procedures because cases can be complex and clinical definitions are not always precise. When in doubt, the data abstractor should first seek an opinion from the responsible surgeon and then consult CCORP.

Section A (Excluded):

- Any aortic aneurysm repair (abdominal or thoracic)
- Aorta-iliac-femoral bypass
- Aorta-renal bypass
- Aorta-subclavian-carotid bypass
- Caval-pulmonary artery anastomosis
- Coronary artery fistula
- Endarterectomy of aorta
- Excision of aneurysm of heart
- Extracranial-intracranial (EC-IC) vascular bypass
- Head and neck, intracranial endarterectomy
- Heart transplantation
- Implantation of cardiomyostimulation system (Note: Refers to cardiomyoplasty systems only, not other heart-assist systems such as pacemakers or internal cardiac defibrillators (ICDs))
- Mastectomy for breast cancer (not simple breast biopsy)
- Full surgical Maze procedures. Requires that the left atrium be opened to create the 'maze' with incisions. Does not include "mini" Maze procedures limited to pulmonary vein isolation and/or amputation of the left atrial appendage.
- Operations on structures adjacent to heart valves (papillary muscle, chordae tendineae, traebeculae carneae cordis, annuloplasty, infundibulectomy)
- Other open heart surgeries, such as aortic arch repair, pulmonary endarterectomy
- Repair of atrial and ventricular septa, excluding closure of patent foramen ovale
- Repair of certain congenital cardiac anomalies, excluding closure of patent foramen ovale (e.g., tetralogy of fallot, atrial septal defect (ASD), ventricular septal defect (VSD), valvular abnormality)
- Resection of a lobe or segment of the lung (e.g., lobectomy or segmental resection of lung). Does not include simple biopsy of lung nodule in which surrounding lung is not resected, biopsy of a thoracic lymph node, or excision or stapling of an emphysematous bleb.
- Thoracic endarterectomy (endarterectomy on an artery outside the heart)
- Amputation of any extremity (e.g., foot or toe)
- Valve repairs or replacements
- Ventriculectomy

If a procedure listed in Section B is performed concurrently with the coronary artery bypass surgery, the surgery will be considered an isolated CABG and the data element coded ‘Yes,’ unless a procedure listed in Section A is performed during the same surgery. These particular procedures are listed because the Office has received frequent questions regarding their coding.

Section B (Included):

- Coronary endarterectomy
- Internal cardiac defibrillators (ICDs)
- Fem-fem cardiopulmonary bypass (a form of cardiopulmonary bypass that should not be confused with aortofemoral bypass surgery listed in Section A)
- Pacemakers
- Pericardiectomy and excision of lesions of heart
- Repair/restoration of the heart or pericardium
- Transmyocardial laser revascularization (TMR)
- Thymectomy
- Thyroidectomy

APPENDIX B: CCORP DATA ELEMENT DEFINITION

Data Element	Definition
Facility Identification Number	The six-digit facility identification number assigned by the Office of Statewide Health Planning and Development.
Isolated CABG: Yes; No.	Answer 'No' if any of the procedures listed below were performed during coronary artery bypass graft surgery. *(See Appendix A for full definition)*
Responsible Surgeon Name (3 separate fields): Surgeon Last Name; Surgeon First Name; Surgeon Middle Initial	Responsible surgeon means the principle surgeon who performs a coronary artery bypass procedure. If a trainee performs this procedure, then the responsible surgeon is the physician responsible for supervising this procedure performed by the trainee. In situations in which a responsible surgeon cannot otherwise be determined, the responsible surgeon is the surgeon who bills for the coronary artery bypass procedure.
Responsible Surgeon CA License Number	California physician license number of responsible surgeon, assigned by the Medical Board of California of the Department of Consumer Affairs.
Medical Record Number	Patient medical record number at the hospital where surgery occurred.
Date of Birth: mm/dd/yyyy	Patient date of birth.
Date of Surgery: mm/dd/yyyy	Patient date of surgery for the CABG procedure.
Date of Discharge: mm/dd/yyyy	Patient date of discharge.
Discharge Status: Alive; Dead.	Patient status upon discharge from the hospitalization in which surgery occurred.
Date of Death: mm/dd/yyyy	Patient date of death.
Race: Caucasian; Black; Hispanic; Asian; Native American; Other.	Patient race or ethnicity.
Gender: Male; Female.	Patient gender.

Data Element	Definition
Patient Age (calculated)	Patient age in years, at time of surgery. This should be calculated from the Date of Birth and the Date of Surgery, according to convention used in the USA (the number of birth date anniversaries reached by the date of surgery).
Height: Real number 3.2 digits (e.g., 999.99)	Height of the patient in centimeters. Valid values are between 20 and 251 cm.
Weight: Real number 3.2 digits (e.g., 999.99)	Weight of the patient in kilograms. Valid values are between 10 and 250 kg.
Status of the Procedure: Emergent/Salvage; Emergent; Urgent; Elective.	The status that best describes the clinical status of the patient at the time of surgery. **Emergent/Salvage:** The patient is undergoing cardiopulmonary resuscitation en route to the operating room or prior to anesthesia induction. **Emergent:** The patient's clinical status includes any of the following: a. Ischemic dysfunction (any of the following): (A) Ongoing ischemia including rest angina despite maximal medical therapy (medical and/or intra-aortic balloon pump (IABP)); (B) Acute Evolving Myocardial Infarction within 24 hours before surgery; or (C) pulmonary edema requiring intubation. b. Mechanical dysfunction (either of the following): (A) shock with circulatory support; or (B) shock without circulatory support. **Urgent:** ALL of the following conditions are met: a. Not elective status b. Not emergent status c. Procedure required during same hospitalization in order to minimize chance of further clinical deterioration. d. Worsening, sudden chest pain; congestive heart failure (CHF); acute myocardial infarction (AMI); coronary anatomy; (IABP); unstable angina (USA) with intravenous (IV) nitroglycerin; rest angina, valve dysfunction; or aortic dissection. **Elective:** The patient's status has been stable in the days or weeks prior to the operation. The procedure could be deferred without increased risk of compromised cardiac outcome.

Data Element	Definition
Last Creatinine Level Preop (mg/dl): Real number 2.1 digits (e.g., 99.9)	The most recent creatinine level prior to surgery. A creatinine level should be collected on all patients for consistency, even if they have no prior history. Valid values are between 0.1 and 30 mg/dl.
Dialysis: Yes; No.	The patient is on dialysis preoperatively.
Diabetes: Yes; No.	The patient has a history of diabetes, regardless of duration of disease or need for anti-diabetic agents.
Peripheral Vascular Disease: Yes; No.	The patient has a history at any time prior to surgery of Peripheral Vascular Disease, as indicated by claudication either with exertion or rest; amputation for arterial insufficiency; aorto-iliac occlusive disease reconstruction; peripheral vascular bypass surgery, angioplasty, or stent; documented abdominal aortic aneurysm (AAA), AAA repair, or stent; positive non-invasive testing documented. Excludes Cerebrovascular Disease.
Cerebrovascular Disease: Yes; No.	The patient has a history at any time prior to surgery of Cerebrovascular Disease, documented by any one of the following: unresponsive coma > 24 hours; cerebrovascular accident (CVA) (symptoms > 72 hours after onset); reversible ischemic neurological deficit (RIND) (recovery within 72 hours of onset); transient ischemic attack (TIA) (recovery within 24 hours of onset); non-invasive carotid test with > 75% occlusion; or prior carotid surgery.
Cerebrovascular Accident: Yes; No.	The patient has a history, at any time prior to surgery, of a central neurologic deficit persisting more than 72 hours. (i.e., extremity weakness or loss of motion, loss of consciousness, loss of speech, field cuts). Chart documentation of a prior diagnosis of CVA or stroke is sufficient.
Cerebrovascular Accident Timing: Recent (<=2 weeks); Remote (>2 weeks).	Events occurring within two weeks of the surgical procedure are considered recent; all others are considered remote.

Data Element	Definition
Chronic Lung Disease: No; Mild; Moderate; Severe.	Specify if the patient has chronic lung disease and the severity level according to the following classification: **No**: No chronic lung disease present. **Mild**: Forced expiratory volume in one second (FEV1) 60% to 75% of predicted, and/or on chronic inhaled or oral bronchodilator therapy. **Moderate**: FEV1 50-59% of predicted, and/or on chronic steroid therapy aimed at lung disease. **Severe**: FEV1 <50% predicted, and/or room air partial pressure of oxygen (pO2) < 60 or room air partial pressure of carbon dioxide (pCO2) > 50.
Hypertension: Yes; No.	The patient has a diagnosis of hypertension, documented by one of the following: a. Documented history of hypertension diagnosed and treated with medication, diet and/or exercise. b. Blood pressure > 140 systolic or > 90 diastolic on at least 2 occasions. c. Currently on antihypertensive medication.
Immunosuppressive Treatment: Yes; No.	Patient has used any form of immunosuppressive therapy (i.e., systemic steroid therapy) within 30 days preceding the operative procedure. Does not include topical applications and inhalers.
Hepatic Failure: Yes; No.	The patient has cirrhosis, hepatic failure, acute hepatitis or “shock liver” and has a bilirubin greater than 2 mg/dl and a serum albumin less than 3.5 grams/dl.
Arrhythmia: Yes; No.	A preoperative arrhythmia present within two weeks of the procedure, by clinical documentation of any one of the following: Atrial fibrillation/flutter requiring medication; Heart block; Sustained Ventricular Tachycardia; or Ventricular Fibrillation requiring cardioversion and/or intravenous amiodarone.
Arrhythmia Type: Sust VT/VF; Heart Block; Afib/Flutter.	The type of arrhythmia is present within two weeks of the procedure is: Sustained Ventricular Tachycardia or Ventricular Fibrillation requiring cardioversion and/or intravenous amiodarone; Heart Block; and Atrial fibrillation/flutter requiring medication.

Data Element	Definition
Myocardial Infarction: Yes; No.	Refers to any myocardial infarction (MI) in the past. **For MIs prior to the current hospitalization** for which detailed records are not available, chart documentation in which a clinician caring for the patient diagnosed an MI is sufficient. **For MIs during the current hospitalization** for which detailed records are available, conditions A and B below must all be met: A) The patient must have been diagnosed with a myocardial infarction (ST elevation or non ST elevation) by a clinician caring for patient. B) At least 1 of the 3 following biochemical indicators for detecting myocardial necrosis must be present: 1) Troponin T or I: a. Maximal concentration of troponin T or I exceeding the MI diagnostic limit (99th percentile of the values for a reference control group, as defined in section C) on at least one occasion during the first 24 hours after the index clinical event. 2) CK-MB: a. Maximal value of CK-MB more than two times the upper limit of normal on at least one occasion during the first 24 hours after the index clinical event. b. Maximal value of CK-MB, preferable CK-MB mass, exceeding 99th percentile of the values for a reference control group, as defined in section C, on two successive samples during the first 24 hours after the index clinical event. 3) Total CK: a. In the absence of availability of a troponin or CK-MB assay, total CK more than two times the upper limit of normal (99th percentile of the values for a reference control group, as defined in *), or the B fraction of CK may be employed, but these last two biomarkers are considerably less satisfactory than CK-MB. * Reference control values (MI diagnostic limit and upper limit of normal): 1) Reference values must be determined in

Data Element	Definition
	each laboratory by studies using specific assays with appropriate quality control, as reported in peer-reviewed journals. Acceptable imprecision (coefficient of variation) at the 99th percentile for each assay should be defined as less than or equal to 10 percent. Each individual laboratory should confirm the range of reference values in their specific setting.
Myocardial Infarction Timing: <=6 hours; >6 hours but <24 hours; 1 to 7 days; 8 to 21 days; >21 days.	Time period between the last documented myocardial infarction and the CABG surgery.
Cardiogenic Shock: Yes; No.	The patient, at the time of procedure, is in a clinical state of hypoperfusion according to either of the following criteria: 1. Systolic blood pressure (BP) < 80 mm hg and/or Cardiac Index (CI) < 1.8 despite maximal treatment. 2. Intravenous inotropes and/or intra-aortic balloon pump (IABP) necessary to maintain Systolic BP > 80 mm hg and/or CI > 1.8.
Angina: Yes; No.	The patient has ever had angina pectoris.
Angina Type: Stable; Unstable.	The type of angina present within 24 hours prior to CABG surgery is: Stable: Angina not meeting unstable criteria below. Unstable: Requires continuous hospitalization from the episode until surgery and one of the following: 1) Angina at rest. 2) New onset angina in past 2 months of at least Canadian Cardiovascular Society (CCS) Class III. 3) Increasing angina in past 2 months - angina that has become more frequent, longer in duration, or lower in threshold; and increased by greater than or equal to 1 CCS class to at least CCS Class III severity.
CCS Classification: No Angina = Class 0; Class I; Class II; Class III; Class IV.	Canadian Cardiovascular Society (CCS) Classification. This classification represents level of functional status related to frequency and intensity of angina. The CCS may not be the same as the NYHA classification for the same evaluation time period. Code the highest class leading to

Data Element	Definition
	episode of hospitalization and/or intervention: **0**=No angina. **I**= Ordinary physical activity, such as walking or climbing the stairs does not cause angina. Angina may occur with strenuous, rapid or prolonged exertion at work or recreation. **II**= There is a slight limitation of ordinary activity. Angina may occur with moderate activity such as walking or climbing stairs rapidly, walking uphill, walking or stair climbing after meals or in the cold, in the wind, or under emotional stress, or walking more than two blocks on the level, and climbing more than one flight of stairs at normal pace under normal conditions. **III**= There is marked limitation of ordinary physical activity. Angina may occur after walking one or two blocks on the level or climbing one flight of stairs under normal conditions at a normal pace. **IV**= There is inability to carry on any physical activity without discomfort; angina may be present at rest.
Congestive Heart Failure: Yes; No.	The patient has symptoms that occurred within 2 weeks prior to surgery. This does not include patients with chronic or stable non-symptomatic compensated congestive heart failure (CHF). The patient has one or more of the following: Paroxysmal nocturnal dyspnea (PND), Dyspnea on exertion (DOE) due to heart failure, Chest X-Ray (CXR) showing pulmonary congestion; and Pedal edema or dyspnea and receiving diuretics or digoxin.
NYHA Classification: Class I; Class II; Class III; Class IV.	New York Heart Association (NYHA) Classification represents the overall functional status of the patient in relationship to both congestive heart failure and angina. The NYHA may not be the same as the CCS classification for the same evaluation period. Code the highest level leading to episode of hospitalization and/or procedure: **I**= Patients with cardiac disease but without resulting limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea, or anginal pain.

Data Element	Definition
	II= Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitations, dyspnea, or anginal pain. **III**= Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary physical activity results in fatigue, palpitations, dyspnea, or anginal pain. **IV**= Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency or of the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.
Number of Prior Cardiac Operations Requiring Cardiopulmonary Bypass	Prior to this operation, the number of cardiac surgical operations performed on this patient utilizing cardiopulmonary bypass. Valid values are between 0 and 9.
Number of Prior Cardiac Operations Without Cardiopulmonary Bypass	Prior to this operation, the number of cardiac surgical operations performed on this patient without cardiopulmonary bypass. Valid values are between 0 and 9.
Prior PCI: Yes; No.	Percutaneous coronary intervention (PCI) was done at any time prior to this surgical procedure (which may include during the current admission). PCI includes percutaneous transluminal coronary angioplasty (PTCA), intracoronary fibrinolysis without PTCA, laser recanalization, stent implantation, rheolysis with angiojet, brachytherapy, and other catheter-based percutaneous recanalization techniques.
Interval from prior PCI to Surgery: <=6 hours; > 6 hours.	The time between prior percutaneous coronary intervention (PCI) and surgical repair of coronary occlusion:<=6 hours; > 6 hours.
Ejection Fraction (%): Integer length 2	The percentage of blood emptied from the ventricle at the end of the contraction. Use the most recent determination prior to intervention. Enter a percentage in the range of 5-90.

Data Element	Definition
Ejection Fraction Method: LV Gram; Radionucleotide; Estimate; ECHO.	Method of obtaining ejection fraction measurement information: **LV Gram:** Left Ventriculogram. **Radionucleotide:** MUGA Scan. **Estimate:** From other calculations, based upon available clinical data. **ECHO:** Echocardiogram.
Left Main Disease (% Stenosis): Integer length 3	Percentage of compromise of vessel diameter in any angiographic view. Valid values are between 0 and 100.
Number of Diseased Coronary Vessels: None; One; Two; Three.	The number of major coronary vessel systems (Left anterior descending (LAD) system, Circumflex system, and/or Right system) with >50% narrowing in any angiographic view. NOTE: Left main disease (>50%) is counted as TWO vessels (LAD and Circumflex). For example, left main and right coronary artery (RCA) would count as three total.
Mitral Insufficiency: None; Trivial; Mild; Moderate; Severe.	Indicate if there is evidence of mitral valve regurgitation and if so, the severity level.
Internal Mammary Artery(ies) Used as Grafts: Left IMA; Right IMA; Both IMAs; No IMA.	Internal Mammary Artery(ies) (IMA) used for grafts, if any.
Cardiopulmonary Bypass Used: Yes; No.	Use of Cardiopulmonary Bypass (CPB) at any time during the procedure.
Conversion to Cardiopulmonary Bypass: Yes; No.	The patient needed to be placed on cardiopulmonary bypass (CPB) after the off-pump procedure was attempted.
Primary Incision: Full Sternotomy; Partial Sternotomy; Transverse Sternotomy; Right Vertical Parasternal; Left Vertical Parasternal; Right Anterior Thoracotomy; Left Anterior Thoracotomy; Posterolateral Thoracotomy; Xiphoid; Epigastric; Subcostal.	The primary incision used as the initial intention for treatment.
Cardioplegia: Yes; No.	Cardioplegia was used.

APPENDIX C: HOSPITAL RESPONSES

Each of the hospitals included in the CCORP 2003 report was provided with a preliminary report containing the risk-adjustment model and outcome results for all hospitals and allowed a 60-day review period for submitting statements to OSHPD. Letters were received from four hospitals and they are included in this appendix. Hospital comments have been summarized in the following three categories:

1. Complexity of Quality Reporting

Comment: One hospital noted that quality reporting was a complex issue and the CCORP report should be considered only one of many sources of information and not the only source. The letter stated that the CCORP study is a source of information reflecting a very narrow period of time and recommended that consumers look at information available through CMS and publicly available reports such as those prepared by Hospital Compare and the Leapfrog Group. The hospital also recommended that consumers take into consideration their doctor's experience and learn about the clinical quality improvement programs available in specific hospitals in addition to using this report. It was also noted that methods used in each study vary, so hospital performance can differ from one report to another.

Response: Using multiple sources of information to assess the quality of cardiac care provided by hospitals can certainly help consumers make more informed choices. However, not many people have the time or the resources at hand to do the research. Readers also need to be cautious about the limitations of data sources and the methods used in some reports developed outside California. The CCORP report represents a cooperative effort between the State and all hospitals performing CABG surgeries in California. The clinical data have been corrected and cleaned through an intensive multi-step process, and the risk-adjustment technique was approved by a clinical advisory panel made up of experts including cardiac surgeons, cardiologists, and health services researchers to ensure a fair comparison among hospitals.

2. Patient Case Mix and Inter-Hospital Variability

Comments: One hospital raised the concern that it treated predominantly Hispanic and African American patients who routinely sought medical care in the late stages of illness, often with multiple co-morbid conditions. Another hospital noted that there are many confounding factors, such as inter-hospital variability (private versus public), different patient recruitment strategies (particularly for hospitals that take "all comers" and accept complicated cases), and variability in surgeon skill level, that need to be taken into account for comparison's sake. These factors impact O/E statistics. This hospital recommended groupings involving three categories (lower than expected, same as expected and higher than expected) rather than the numerical O/E ratio, thereby avoiding misinterpretation of the O/E ratio data.

Response: The CCORP report used a risk adjustment methodology that takes into account the demographic and pre-operative risk factors reflecting severity of illness and risk of mortality for each patient treated by each hospital. Although additional socioeconomic factors may improve the risk model, the measurement and data collection would be difficult and costly. The CCORP risk model gave appropriate consideration to hospitals that treat a larger share of severely ill patients. The performance rating used by the CCORP report categorizes hospitals as “worse than expected,” “as expected,” and “better than expected.” These ratings are based on how the risk-adjusted mortality rate (with 95% confidence interval) of a hospital compares with the state mortality rate. Section IV explains this process in detail.

3. Data Update/Submission Issue

Comment: One hospital mentioned that its corrected and updated information was not submitted by the deadline and hence was not incorporated in the final data used for this report. The concern was that this resulted in inaccurate information being used to calculate their risk-adjusted mortality rate. The letter also stated that the hospital had taken steps to make sure its submissions were on time in the future.

Response: The data collection and cleaning process is a time-bound process. The program has to abide by set deadlines in order to give hospitals time to check their data, provide data corrections and resubmissions, and conform to the law. To give all hospitals a fair chance to submit their edits, the data submission has to close by a specific date. CCORP appreciates the effort the hospitals are making to improve the timeliness of data reporting, and subsequently the timeliness of future reports.

Enclosed are all letters received in response to this report.

Centinela Freeman
HEALTHSYSTEM

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November 10, 2005

Joseph Parker, Ph.D.
Director Healthcare Outcomes Center
Office of Statewide Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker,

Thank you for the opportunity to respond to the 2003 California CABG Outcome Reporting Program report. The CCORP Report for 2003 for Centinela Hospital Medical Center data collection process does not adequately reflect the severity of our cases. The cases treated at Centinela are a real reflection of the hospital's service area which is predominately Hispanic and African American. These patients routinely seek medical care in late stages of illness often with multiple co-morbid conditions. Patients in our service area suffer from a substantially higher incidence of hypertension, diabetes and renal disease than the national average incidence rates.
According to STS Summary report for spring 2005, there are significant differences in Centinela's population compared to other participants:

- Centinela had a greater % of women (40% vs. 27.8%)
- Centinela had a greater % of minorities (82% vs.12.8%)
- Centinela had a greater % of renal patients (20% vs. 5.4%)

In November 2004, the hospital was acquired from Tenet Healthcare by Centinela Freeman HealthSystem. Under new ownership, our cardiac surgery team is being led by medical director, Taro Yokoyama, MD a nationally respected cardiac surgeon with extensive experience in adult CABG surgery, minimally invasive CABG and valve surgery and pediatric cardiac surgery. Centinela Hospital Medical Center is now called Centinela Freeman Regional Medical Center, Centinela Campus.

Centinela Freeman Regional Medical Center has expanded its cardiac prevention services through our Center for Healthy Living. We have developed pre-diabetes, blood pressure screening and education programs for our community. Under the direction of Dr. Taro Yokoyama, we have made significant progress in our cardiac surgery program. Our year to date results for 2005 indicate significant improvement in patient outcomes as a result of our prevention, screening and treatment programs and our advanced cardiac surgery team. We look forward to reporting 2005 results of our program under its new leadership and ownership in the near future. Once again I thank you for the opportunity to report our current progress and to respond to the 2003 CCORP report.

Sincerely

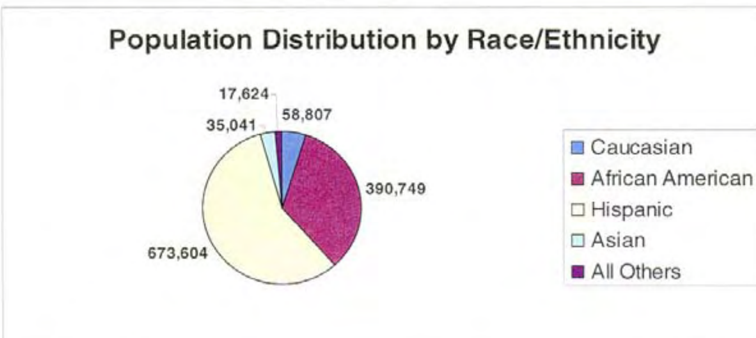
Michael A. Rembis
President and CEO

Joseph Parker, Ph.D.
November 10, 2005
Page 2 of 3

Centinela Freeman Regional Medical Center Service Area
(formerly Centinela Hospital Medical Center)

DEMOGRAPHIC CHARACTERISTICS		
2000 Total Population	1,113,530	
2004 Total Population	1,175,825	
2009 Total Population	1,251,606	
% Change 2004 - 2009	6.4%	

Hospital Service Area Demographics (Source Claritas based on 2000 US Census)



	2004	% of Total	2009	% of Total
Caucasian	58,807	5.0%	52,445	4.2%
African American	390,749	33.2%	367,427	29.4%
Hispanic	673,604	57.3%	784,381	62.7%
Asian	35,041	3.0%	32,439	2.6%
All Others	17,624	1.5%	14,914	1.1%
Total	1,175,825	100.0%	1,251,606	100.0%

Centinela Freeman Regional Medical Center
Service Area Demographics - continued

2004 Adult Education Level			Pop Age 25+	% of Total
Less than High School			164,749	25.1%
Some High School			133,971	20.4%
High School Degree			132,124	20.1%
Some College/Assoc. Degree			155,943	23.8%
Bachelor's Degree or Greater			69,662	10.6%

GOOD
SAMARITAN
HOSPITAL

November 2, 2005

Joseph Parker, Ph.D.
Director, Healthcare Outcomes Center
Office of Statewide Health Planning and Development
818 K St. Room 200
Sacramento, CA 95814

Dear Dr. Parker:

As OSHPD releases the first publicly reported comparison of California hospitals' performance on Coronary Artery By-Pass Grafts, we encourage consumers to look at this single report as one thread in a complex fabric of quality reporting.

Good Samaritan Hospital is committed to continuous quality improvement in all of our clinical services, including CABG, and we utilize information from many sources to evaluate our performance. The methods used in each study vary, often significantly, so how a hospital appears to perform can differ from study to study.

Many hospitals consider the information available through CMS national reporting to be one of the best benchmarks of care. **CMS studies show that patients undergoing CABG at Good Samaritan Hospital survive at a higher rate than patients nationally and at the same rate as patients in California**, where many would argue hospital performance is better than much of the nation.

In addition to CMS, Good Samaritan Hospital uses comparative data from The Society of Thoracic Surgeons (STS) and CHOIS (Clinical Hospital Outcome Information System) to evaluate our performance on CBG. With a database of more than two million cases going back almost 15 years, the STS database is often considered "the gold standard." As you know, the CCORP includes less than 22,000 cases in a single year. With only four hospitals in the state identified as doing significantly better than expected and four doing significantly worse, that leaves a very wide middle range of performance as expected.

Savvy consumers will ask: Does the CCORP report tell me everything I need to know about how good a hospital is? The short answer is "No." The CCORP study is only one source of information reflecting a very narrow period of time. We encourage consumers to also use publicly available reporting such as Hospital Compare, the Leapfrog Group and JCAHO—and above all else to talk with their doctors about the experience, patient outcomes and clinical quality improvement programs at any specific hospital they are considering for their care.

Very truly yours,

Paul Beaupré M.D.

Paul Beaupré MD
Vice-President of Medical Affairs

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Medical Center
CHW

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818 885-8500 Telephone

November 1, 2005

Joseph Parker, Ph.D.
Director, Healthcare Outcomes Center
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Re: California CABG Outcomes Reporting Program

Dear Mr. Parker,

Northridge Hospital Medical Center's Cardiovascular Center program appreciates the opportunity to participate in the Annual Report of the California Hospital Outcomes Project. We support the effort in collecting and reporting information for the public for cardiovascular care in California.

In reviewing the data submitted for 2003, we identified an issue that we feel deserves clarification to the public. It was discovered that correctly updated information reflecting our risk stratification was sent but did not make the deadline. Therefore, some of our data that will be posted for 2003 may not be accurate.

As a result of this, Northridge Hospital has implemented a plan for assuring accurate data collection and timely submission of this data. This plan includes the creation of a Cardiovascular Data Management department that will employ a dedicated cardiovascular-trained register nurse to collect and monitor real time data. Our cardiovascular medical staff and service line leadership will routinely review this data. We are also refining our documentation and coding practices to better risk stratify. Finally, as an additional step, we have instituted a CABG performance review team that will review this and other pertinent data to further enhance our performance improvement process.

Sincerely,

Michael A. Wall

Michael Wall
Chief Executive Officer

USC
UNIVERSITY
HOSPITAL

November 14, 2005

Joseph Parker, PhD Director, Healthcare Outcomes Center
Healthcare Quality and Analysis Division
818 K Street, Room 200
Sacramento, California 95814

Dear Dr. Parker,

The OSHPD report summarizing the outcome data of the CABG procedure in the State of California should be reviewed with caution when comparing differences across all California Hospitals. There are numerous covariate/confounding factors that impact the O/E statistics, which need to be taken into account for comparison purposes. These covariate/confounding factors include:

1. Inter-hospital variability (e.g. Private versus public versus University training hospital, etc.)
2. Inter-hospital variability with regard to patient recruitment (e.g. hospitals that take "all comers" and will accept "the complicated case" from other hospitals that are reluctant to perform procedures on this type of patient versus the hospital that is very selective regarding the "acuity" of the cases that reach the operating room
3. Surgeon variability with regard to surgical skills and experience.

For example, there are several University Hospitals in the State of California, which perform all aspects of Cardiothoracic Surgery and receive direct admission as well as transfers of complicated cases from other hospitals. USC University Hospital and most other university hospitals do not transfer any type of patient to another institution for Cardiothoracic Surgery.

USC University appears in the OSHPD data to have O/E ratio greater than 1. However the program does remain within the boundaries of "acceptable results." Our outcomes are similar to other academic hospitals in California in spite of not having an Emergency Department.

The OSHPD data is supposed to provide the public with a guide to the quality of performance of the CABG procedure for Coronary Artery Disease in individual hospitals in California.

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Based on the above discussion, a suggestion that we would recommend to OSHPD to consider before releasing the CABG data to the public.
To avoid the misinterpretation of O/E ratio data, the OSHPD report should be modified to a form similar to the State of Pennsylvania, i.e. hospitals are categorized into 3 categories:
(1) Lower than expected (2) Same as expected and (3) Higher than expected, rather than the numerical O/E ratio. (www.phc4.org)

If you have any questions, please contact me.

Sincerely,

David Thordarson, M.D., Chief of Staff

February 2006

Additonal copies of The California Report on Coronary Artery Bypass Graft Surgery can be obtained by contacting HIRC at (916) 322-2814 or HIRC@oshpd.ca.gov