California Hospital Outcomes Program

Community-Acquired Pneumonia: Hospital Outcomes in California, 1999-2001

Arnold Schwarzenegger
Governor
State of California

S. Kimberly Belshé
Secretary
Health and Human Services Agency

David M. Carlisle, M.D., Ph.D.
Director
Office of Statewide Health Planning and Development

Healthcare Quality and Analysis Division
California Hospital Outcomes Program

June 2004

oshpd
Office of Statewide Health Planning & Development

Community-Acquired Pneumonia: Hospital Outcomes in California, 1999-2001

Arnold Schwarzenegger, Governor
State of California

S. Kimberly Belshé, Secretary
Health and Human Services Agency

David M. Carlisle, M.D., Ph.D., Director
Office of Statewide Health Planning and Development

Healthcare Quality and Analysis Division
California Hospital Outcomes Program

June 2004

This page left blank intentionally

Office of Statewide Health Planning and Development
Healthcare Quality and Analysis Division
California Hospital Outcomes Program

Mike Kassis
Acting Deputy Director

Steven Lubeck, Ph.D.
Supervising Research Scientist I

Jennifer Haas, M.D., M.S.P.H.
Consultant

Cliff Li, M.P.H.
Research Scientist I

Victor Simon
Research Program Specialist I

Niya Fong
Office Assistant

Julie Jensen
Student Assistant

Acknowledgments: This report is the Office of Statewide Health Planning and Development's first hospital outcomes report on community-acquired pneumonia. It benefited from critical reviews by Andra Zach, RHIA, Jacquelyn Paige, MPA, Loel Solomon, Ph.D., Joseph Parker, Ph.D., Herbert Jew, M.S., Zhongmin Li, Ph.D., Christie Westover, Margaret Arnaud, and Ann Foster. It builds upon a risk-adjustment model that was originally developed and validated using 1996 patient discharge data by Jennifer Haas, MD, MSPH and her analytical and programming staff at the University of California, San Francisco. Dr. Hass' Clinical Advisory Panel included Kathleen Ellstrom, MS, RN, (Pulmonary & Critical Care Division University of California, Los Angeles Medical Center); Alicia Fernandez, MD, (San Francisco General Hospital, University of California, San Francisco); Melissa S. Ferron, RHIA, CCS, (Liaison, California Health Information Association); Scott Flanders, MD, (Department of Medicine, University of California, San Francisco); Bernard Joe Guglielmo, Pharm.D, (Department of Clinical Pharmacy, University of California, San Francisco); Paul Selecky, MD, FACP, FCCP, (Pulmonary Department, Hoag Memorial Hospital Presbyterian). (The 1996 development and validation report can be viewed at www.oshpd.ca.gov.)

Suggested Citation: Hospital Outcomes Center, *Report on Hospital Outcomes for Community-Acquired Pneumonia in California, 1999-2001,* Sacramento, California: Healthcare Quality and Analysis Division, California Office of Statewide Health Planning and Development, February 2004.

California Health Policy and Data Advisory Commission

William Weil, M.D., Chair
Representing Group Prepayment Health Plans

Corinne Sanchez, Esq.
General Member

M. Bishop Bastien
Representing Health Insurance Companies

William Brien, M.D.
Representing Physicians and Surgeons

Paula Hertel, M.S.W.
Representing Long-Term Care Facilities

Janet Greenfield, R.N.
Freestanding Ambulatory Surgery Centers

Howard L. Harris, Ph.D.
General Member

Marjorie B. Fine, M.D., FACS
General Member

Sol Lizerbram, D.O.
General Member

Vacant
Representing Disproportionate Share Hospitals

Hugo Morris
Representing Labor Health Coalitions

Jerry Royer, M.D., M.B.A.
Representing Hospitals

Kenneth M. Tiratira, M.P.A.
Business Health Coalitions

Jacquelyn Paige
Executive Director

California Health Policy and Data Advisory Commission Technical Advisory Committee

Jerry Royer, M.D., M.B.A., Chair
Representing Hospitals

Douglas Bagley
Representing Hospitals

Marilyn Chow, R.N., D.N.Sc.
Representing California Nurses Association

Mark Hlatky, M.D.
Representing Research Community

Diana Petitti, M.D.
Representing Research Community

Laurie Sobel, J.D.
Representing Consumers Union

Jeffrey Rideout, M.D.
Representing California Medical Association

Maida Reavis Herbst, R.H.I.A.
Representing Medical Records Practitioner

Laura B. Gardner, M.D., M.P.H., Ph.D.
Representing Research Community

David E. Hayes-Bautista, Ph.D.
Representing Research Community

Robert H. Brook, M.D., Sc.D.
Representing Research Community

Nancy Donaldson, R.N., D.N.Sc.
Representing California Nurses Association

William S. Weil, M.D.
Representing California Medical Association

This page left blank intentionally

Table of Contents

Community-Acquired Pneumonia in California, 1999-2001 1
Figure 1: Community-Acquired Pneumonia Admissions in California, Jan. 1999-Nov. 2001

Using This Report 4
Hospitals
Employers and Healthcare Purchasers
Government Agencies
Health Plans and Healthcare Payers
Individuals

Evaluating Hospital Quality 5
Measuring Healthcare Quality
Risk Factors

Measuring Mortality 7
Data Sources
Outcome Rates
Table 1: Statewide Frequencies by Year of Discharge

Interpreting the Results 8
Unmeasured Risk
Variations in Reporting
Quality of Care
Limitations of the Report

Mortality Results 9
Table 2: Summary of Risk-Adjusted Mortality Rates, 1999-2001

APPENDIX 1: Technical Appendix 12
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001

APPENDIX 2: Hospital Comment Letters 81

APPENDIX 3: Additional Sources of Information 133

APPENDIX 4: Detailed Hospital Statistics 134

This page left blank intentionally

Community-Acquired Pneumonia in California, 1999-2001

The California Hospital Outcomes Program (CHOP) is an initiative mandated by the State of California, and conducted by the Office of Statewide Health Planning and Development (OSHPD), to develop public reports comparing hospital outcomes for selected conditions treated in hospitals throughout the state. Over the last decade, CHOP has reported hospital mortality rates for heart attack (www.oshpd.ca.gov). Community-acquired pneumonia (CAP) was selected for reporting because –like heart attack—it is common, it is associated with a substantial mortality rate, and because its timely diagnosis and treatment are associated with improved outcomes.

This is the first published CHOP report to make use of the "Condition Present at Admission" (CPAA) and "Do Not Resuscitate" (DNR) discharge data fields that are now being collected by OSHPD. These data fields allow for improved risk adjustment.

Pneumonia is a serious infection or inflammation of the lungs. Various bacteria, viruses, mycoplasmas, and other infectious agents such as fungi or chemicals are its general causes (see American Lung Association's Web site at www.lungusa.org/diseases/lungpneumoni.html). Pneumonia may be classified into four types, depending on how and where it is acquired, (see: Mayo Clinic's Web site at www.mayoclinic.org):

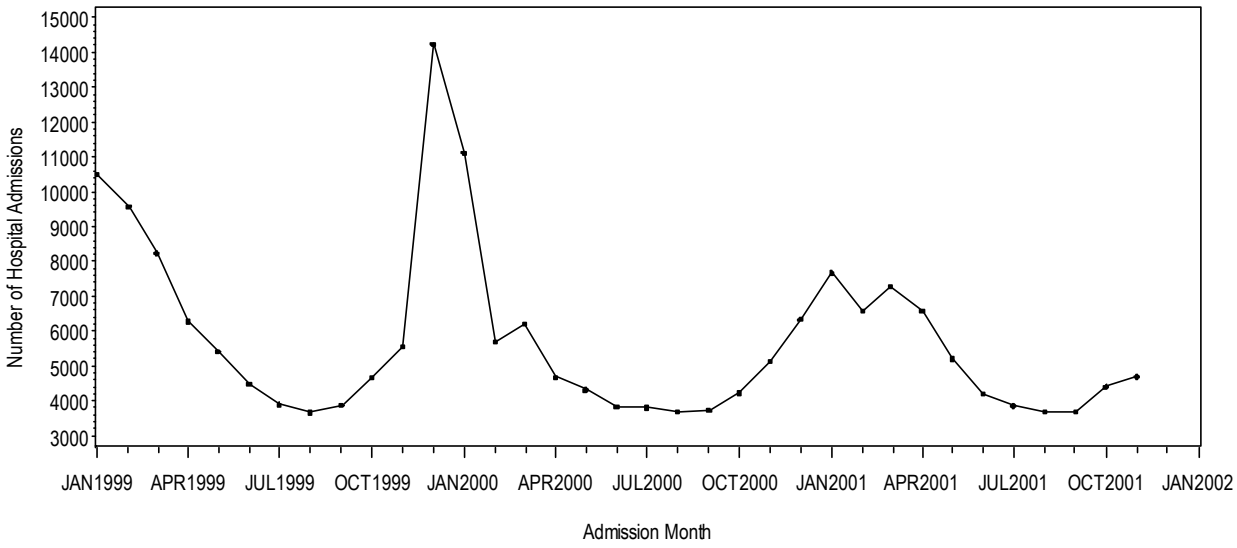
1. **Community-acquired pneumonia** is acquired in the course of normal daily life;
2. **Hospital-acquired pneumonia** is acquired while hospitalized for an illness or surgical procedure;
3. **Aspiration pneumonia** may occur when foreign matter is inhaled (aspirated) into the lungs; and
4. **Pneumonia caused by opportunistic organisms** strikes people with compromised immune systems (such as persons with AIDS or with sickle cell disease).

In 2000, pneumonia resulted in 1.3 million emergency department visits and 1.3 million hospitalizations in the United States. (See: American Lung Association's Web site at www.lungusa.org/diseases/lungpneumonia.html.) During that same year, an estimated 63,548 people in the United States died from pneumonia. (See: National Center for Health Statistics' Web site at http://www.cdc.gov/nchs/fastats/pneumonia.htm.) Together, pneumonia and influenza are the seventh leading cause of death in the United States, and the fifth leading cause of death among people over 65 years of age. (See: National Foundation for Infectious Diseases' Web site at http://www.nfid.org/factsheets).

As shown in Figure 1 on the next page, hospitalizations for community-acquired pneumonia in California for 1999, 2000 and 2001 varied by season, with admissions rising in winter months and then falling during summer months. For the three years covered by the present report, more than 200,000 adult patients were admitted to 406 California hospitals because of community-acquired pneumonia. Approximately one out of eight of these patients (12.23 percent) died within 30 days of admission.

Figure1:

Community-Acquired Pneumonia Admissions in California, January 1999 - November 2001



This report incorporates improvements in the risk-adjustment methodology introduced in the heart attack outcomes reports that preceded it, including:

- Linking hospital records with Vital Statistics records to ascertain deaths occurring outside the hospital; and
- Using six months of pre-CAP hospital records to more completely measure patient risk factors.

The final version of this report will be available on the Internet at: **www.oshpd.ca.gov**

A copy of the final version will also be available by contacting:

Office of Statewide Health Planning and Development
Healthcare Information Resource Center
818 K Street, Room 500
Sacramento, CA 95814
(916) 326-3802

Frequently Asked Questions:

Q: What is the time period covered in this report?
A: The report is based on hospital discharge data collected for 1999, 2000 and 2001. Results aggregated across all three years are presented in the Technical Appendix.

Q: How many hospitals were included in the study?
A: 1999: 400 hospitals
2000: 389 hospitals
2001: 382 hospitals
The number of hospitals varied for each year due to hospital closures and openings, as well as increases or decreases in admissions for community-acquired pneumonia that met the selection criteria of this report. Overall, 406 different hospitals were represented for at least one of the three years of the report.

Q: What was the 30-day rate of death for the 3-year time period?
A: The 203,028 patients admitted (from home only) for community-acquired pneumonia and meeting the inclusion and exclusion criteria of this report exhibited a 30-day death rate of 12 percent. In other words, one out of eight adult patients hospitalized for community-acquired pneumonia died within 30 days of being admitted to a California hospital. For hospitals that admitted more than 100 patients for community-acquired pneumonia during the 3-year time period, the risk-adjusted death rates varied from a low of 5 percent to a high 23 percent.

Q: How does this report differ from previous outcomes reports?
A In an effort to remove redundancy, and to make it easier to read, this report is published in a single electronic volume instead of four separately bound volumes. Also, for the first time, a newly collected measure of a "do not resuscitate (DNR) order within 24 hours after admission" was added to an outcome report's pool of risk factors. A newly collected measure of "condition present at admission" (CPAA) was used to distinguish comorbidities present at admission from complications occurring after admission.

GLOSSARY OF FREQUENTLY USED ACRONYMS

CAP = Community-Acquired Pneumonia
CHOP = California Hospital Outcomes Program
CI = Confidence Interval
CPPA = Condition Present at Admission
CVA = Cardiovascular Accident (stroke)
DNR = Do Not Resuscitate
ICD-9-CM = International Classification of Disease – 9th Revision – Clinical Modification
OSHPD = Office of Statewide Health Planning and Development
PDD = Patient Discharge Data

Using This Report

This report is intended for everyone interested in hospital performance for the treatment of community-acquired pneumonia. This may include hospital staff, employers, government agencies, health plans, insurance companies, other healthcare purchasers and payers, as well as individual consumers.

Hospitals

The *Report on Hospital Outcomes for Community-Acquired Pneumonia* compares community-acquired pneumonia mortality rates for all California hospitals after adjusting for differences in patients' age, sex, and physical health. One of the primary purposes of the report is to improve the quality of care in *all* California hospitals by encouraging members of the medical and nursing administrative staff and other hospital staff to incorporate this information into their quality management activities.

To familiarize yourself with the way this report was created, refer to the information in the Technical Appendix that summarizes the risk-adjustment methodology and results. The last section of this report –"Mortality Results"– lists all hospitals with outcomes that were significantly better or significantly worse than the state average. (Chart 1 in the Technical Appendix may also be used to compare your specific hospital's risk-adjusted mortality rates with the statewide benchmark and with other hospitals within the same county.) To determine if quality improvement interventions are successful compare the figures in this report with subsequent reports.

Employers and Healthcare Purchasers

This information can be useful for employers to select and negotiate insurance carriers. The information can also be passed on to employees to assist in selecting a health plan.

Government Agencies

This report can be useful to state and county agencies arranging care for program beneficiaries. Results may be used in selecting hospitals and in negotiating with managed care organizations.

Health Plans and Healthcare Payers

This report can be a guide in the selection of hospitals to provide services to beneficiaries. Appendix 1 on page 12 of the *Technical Appendix* was designed to help understand how the study was done and how results were calculated.

Individuals

This information can be used in discussions with family members, physicians, health plans, or employers to understand choices in hospital care. It can be used to make informed choices and help individuals in selecting a hospital in the event of contracting community-acquired pneumonia.

Evaluating Hospital Quality

Although this report focuses on outcomes, there are many ways of measuring healthcare quality. No single method is universally accepted as superior. However, some methods are better suited to answering specific types of questions.

Measuring Healthcare Quality

Quality is often measured simply by asking patients if they find care satisfactory. The difficulty with this type of evaluation is that patients have little clinical information upon which to base their judgments. **Patient satisfaction** may be a result of such things as personal interactions with physicians and nurses, the appearance of the facilities, and other factors not necessarily indicative of medical expertise or clinical quality. More sophisticated surveys, including some conducted in California (e.g. “PEP-C”, the Patient Evaluation of Performance in California survey, available at www.chcf.org), ask patients to report on **specific aspects of care**. These reports can capture dimensions of quality such as involvement in decision-making and providers’ ability to communicate that are unavailable from other sources.

Another common way of evaluating healthcare quality is to examine the hospital's staff, equipment, and facilities. These attributes are called the **structure of care.** For example, one might look at staff credentials, staff-to-patient ratios, or the availability of specialized services. Although these characteristics are important and relatively easy to measure, they tell more about the care patients *might* receive than the care patients *actually* receive.

Some quality assessment techniques directly measure the care that is received. This approach evaluates the **process of care**, which includes such things as diagnostic accuracy and the appropriate use of drugs, tests or treatments. This type of quality evaluation can be particularly useful to doctors, nurses, and hospitals even though the most appropriate care is not always easily defined or agreed upon. Process of care measures can be controversial, and also difficult for non-clinicians to interpret.

The above methods fall short of answering the question that is most important to patients - "Which hospital or doctor is most likely to make me better?" Answering this question requires measuring the **outcome of care**. Although measurement of outcomes seems to provide the most direct answers to questions about healthcare quality, it is perhaps the hardest to measure. Positive outcomes, such as improved health or improved ability to do everyday tasks, are common but can be difficult and costly to measure. Adverse outcomes, such as illnesses that develop during a hospital stay, disability, or death are much less frequent. However, such adverse outcomes are easier to directly measure from records that hospitals and government agencies already gather as administrative records. Perhaps the easiest and most reliable adverse outcome to measure is death, but the others are also important to consider.

The mortality outcomes published in this report are useful for comparing the quality of care among California hospitals because:

- **They have been risk-adjusted.** Patient age, gender, and selected diseases were used to adjust for differences in patient risk at the time of hospital admission. While this set of risk factors was limited to information contained in the administrative data file, it represents an effort to allow readers to meaningfully make apples-to-apples comparisons of how hospitals perform for patients with this condition.
- **They have been validated.** A validation study that examined 1,230 medical charts of patients admitted for community-acquired pneumonia at 82 California hospitals during 1996 showed that variations in how hospitals report data to OSHPD did not significantly affect the risk-adjusted death rates. Also, in general, low-mortality hospitals treat community-

acquired pneumonia more aggressively than high-mortality hospitals. [A copy of this validation study will accompany the preliminary draft of this report.]

This report evaluates death rates within 30 days following hospital admissions for community-acquired pneumonia. If one hospital receives sicker patients than another hospital, it would be expected to have more pneumonia-related deaths. Adjusting for patient characteristics helps to compare all hospitals with a statewide benchmark. Comparisons of hospitals only on their "observed" (i.e. unadjusted) death rates are difficult to interpret because different hospitals might treat different types of patients. A technique called **risk-adjustment** helps to account for these differences.

Because some patients, before they are admitted, have higher chances of dying within 30 days, it is important to adjust hospital outcomes for differences in the risk profile of their patients. This is similar to "crediting" hospitals for admitting higher risk patients and "debiting" them for admitting lower risk patients. In other words, in an effort to make this report's hospital comparisons fair, each hospital's outcome was "risk-adjusted" (credited or debited) depending on the presence or absence of various "risk factors" at each patient's admission.

In this report a "risk factor" is defined as a characteristic of a patient or a treatment episode that is known to be associated with the adverse outcome of death and cannot be controlled by the hospital. For example, both male sex and having lung cancer are risk factors associated with a higher chance of dying from community-acquired pneumonia. Under guidance from a clinical panel of pneumonia experts, these and other risk factors for pneumonia-related death were selected on the basis of their importance in the medical literature, as well as their demonstrated importance in predicting death using OSHPD's Patient Discharge Data and the State's Vital Statistics Records.

If a risk factor was present at the time of a patient's admission to a hospital it was considered a "comorbidity." If a risk factor was not present at admission, but developed during a hospital stay, it was considered a "complication." Because complications may indicate lack of quality in the treatment given to patients, it was not appropriate to "credit" hospitals for these occurrences. During the three years covered by this report, OSHPD collected a "condition present at admission" (CPAA) indicator for each diagnosis recorded on a patient's hospital record. The CPAA indicator, represented as either a "yes" or "no," identified if a diagnosis was a "comorbidity" (i.e. present at admission), or if it was "complication" (i.e. not present at admission). Directly measuring CPAA was important because while a few diagnoses are almost always present at admission and others are almost never present at admission, many diagnoses are impossible to accurately classify without the assistance of a CPAA indicator. By using the CPAA indicator, complications are not inappropriately used to "credit" hospitals for illness that developed during a hospital stay.

The most important strength of this report is that it uses risk-adjusted outcomes in an endeavor to create a "level playing field" on which the outcomes of different hospitals can be fairly compared. This enables healthcare purchasers and consumers to assess the relative value of the healthcare for which they pay. A principal weakness of this report is its reliance on a small set of "administrative" data elements that hospitals are required to report to the State's Patient Data Section. Such administrative data provides limited information about demographic and clinical variables. Accordingly, it is possible that some of the deaths predicted by the model used in this report were the result of unmeasured risk rather than poor hospital quality.

Risk Factors

A complete list of risk factors and their weights can be found in Tables A.12 and A.13 of the Technical Appendix. A combination of clinical expertise and statistical tests identified risk factors

used in the adjustment process. This process used all information reported to OSHPD by hospitals, including patient age, sex, and a history of chronic diseases such as those shown in the list that follows.

This is the first outcomes report produced by OSHPD that uses a patient's "Do Not Resuscitate" (DNR) status as a risk factor. The presence of a DNR order in a patient's chart represents a request *not* to have cardiopulmonary resuscitation (CPR) performed if the patient's heart stops or if the patient stops breathing. OSHPD began collecting information on DNR status in 1999, the earliest year covered by this report. From 1999 to 2001, 11 percent of the 203,028 patients included in this report were recorded as having a DNR order within 24 hours of admission. DNR status was included as a risk factor in this report because it indicates underlying severe illness and because it predicts 30-day mortality.

Most Important Risk Factors for Pneumonia Outcomes:

- Male Sex
- Do Not Resuscitate (DNR) order within 24 hours of admission
- Type of Pneumonia
- Chronic Conditions, such as
  - Asthma
  - Cancer
  - Liver Disease
- Acute Conditions present within 24 hours of admission, such as
  - Respiratory Failure
  - Cerebrovascular Accident (stroke)
  - Coagulopathy (abnormal blood clotting)

Measuring Mortality

This report calculates the percent of hospital patients who died within 30 days following hospital admission for community-acquired pneumonia. It compares the death rates among California hospitals after adjusting for the fact that different patients have different chances of dying within 30 days of admission due to patient risk factors.

Data Sources

The data used in this analysis came from two different sources: Patient Discharge Data collected by OSHPD and the Vital Statistics Data collected by the California Department of Health Services. The hospital data were used to identify community-acquired pneumonia patients and their risk of mortality. The vital statistics data were used to determine which patients died within 30 days of being admitted to a hospital for CAP.

The discharge data contain information on all patients admitted to non-federal, acute care hospitals in California. It includes selected patient demographic characteristics such as age, race, and ZIP code of residence, as well as diagnoses and procedures. The information on age, diagnoses, and procedures was used to select the cases to be analyzed. The goal was to include all patients over 18 years of age that were primarily treated for community-acquired pneumonia between January 1, 1999 and December 1, 2001. Patients treated in December of 2001 were excluded because vital statistics data were lacking. Some eligible hospitals were not included in this report because patients meeting the criteria for inclusion in the analysis were not admitted.

Outcomes Rates

The risk-adjustment model described above was used to estimate each patient's probability of dying within 30 days after admission for CAP. At each hospital the total number of actual, or "observed," CAP-related deaths was compared to the total estimated, or "expected," CAP-related deaths derived by adding these probabilities. The total number of observed deaths and the total expected deaths were used to calculate risk-adjusted mortality rates for each hospital. Hospitals were rated as "better than expected," "as expected," or "worse than expected" in relationship to the statewide 30-day mortality rate for CAP.

Table 1 shows the total number of deaths and the 30-day death rate during the three-year period covered by this report. Of the 203,028 patients admitted for CAP, 24,829 (12.23 percent) died within 30 days of being admitted.

Table 1: Statewide Frequencies by Year of Discharge

Year of Discharge	Number of CAP Patients Hospitalized	Number of Deaths within 30 days of Admission	30-day Death Rate
1999	78,541	9,201	11.72 percent
2000	64,957	8138	12.53 percent
2001[1]	59,530	7,484	12.57 percent
TOTAL	**203,028**	**24,829**	**12.23 percent**

Interpreting the Results

Adequate or inadequate quality of care is one reason a hospital's community-acquired pneumonia mortality rate may be unusually high or unusually low. It is important, however, to consider other factors that may contribute to an individual hospital's results.

Unmeasured Risk

As mentioned earlier, the hospital administrative data used in this report do not identify all important clinical risk factors that may increase the risk of death. For example, potentially important clinical risk factors such as "body temperature" or "serum sodium" could not be measured using the administrative data that is the basis for this report.

Variations in Reporting

Variations in reporting practices may affect a hospital's risk-adjusted outcomes. Hospitals that neglect to report important risk factors could have risk-adjusted mortality rates that are too high. However, the community-acquired pneumonia validation study based on 1996 admissions showed that differences in hospital reporting practices explain little of the variation in risk-adjusted mortality.

Quality of Care

Hospitals designated as having better (or worse) than expected outcomes may provide a better (or worse) quality of care than those not so designated. The process of care in hospitals was not measured in this study, so the specific practices that may account for variations among hospital performances are not reported here. However, the validation study for community-acquired pneumonia suggested that there may be a difference between hospitals with low risk-adjusted mortality and those with high risk-adjusted mortality: For patients without a "do not resuscitate"

[1] Figures for year 2001 do not include admissions for the month of December.

order, the best performing hospitals were significantly more likely to perform sputum cultures (i.e. diagnostic tests performed on samples of patients' saliva) at admission. The worst performing hospitals were less likely to perform sputum cultures at admission. However, the sputum culture is probably a marker for procedures that the validation study was unable to measure, as opposed to being an important procedure in its own right.

Limitations of the Report

This report provides information on one aspect of the quality of care at a particular hospital: the care of patients with community-acquired pneumonia. It does not address the quality of care for any other condition and should not be used as a general measure of hospital quality. Furthermore, it addresses only the outcomes of patients *hospitalized* for pneumonia. Thresholds for admission may differ among hospitals, and some patients may be sent home after an outpatient visit; Others may die at home without ever coming to the hospital. This report focuses on 30-day mortality, but does not assess other outcomes such as a patient's quality of life after discharge, or subsequent hospital readmissions. Other organizations, some of which are listed in *Appendix 3* on page 133, monitor different aspects of healthcare quality. Information from these organizations can be used to augment the results published in this report.

Mortality Results

Two models were used to estimate risk-adjusted CAP outcomes for each hospital. The first of the two models is based on the administrative data model developed by the 1996 CAP validation study. It did not include "do not resuscitate (DNR) order present within 24 hours of admission" as a risk factor. The second model includes DNR status as a risk factor.

DNR status is a strong predictor of 30-day mortality (see *Appendix 1,* page 29). Accordingly, its use in the second model often changes hospital ratings when compared to ratings based only on the first model (without DNR). However, because DNR status might measure differences in hospital treatment in addition to underlying illness severity, it is possible that the second model over-adjusts predicted mortality. At the same time, it is possible that the first model under-adjusts predicted mortality because it does not include an indicator of illness severity as a risk factor. This report's use of both models is an effort to balance the prediction error that might result from using only one model.

If the risk-adjusted mortality of a hospital was significantly *lower* than the state average using *both* models, then that hospital's mortality outcome was rated as significantly *better* than expected. If the risk-adjusted mortality rates of a hospital were significantly *high*er than the state average using *both* models, then that hospital's mortality outcome was rated as significantly *worse* than expected. If a hospital's risk-adjusted mortality was as expected according to *either* model, then that hospital was given an overall rating of *as expected*.

Table 2 summarizes the statewide distribution of hospital outcomes ratings for the three-year period covered by this report. Four out of five hospitals were rated *as expected*, with 7 percent rated *better than expected,* and 8 percent rated *worse than expected*. An additional 4 percent of the hospitals had no deaths, and had too few patients to rate. The statistical procedures used to assess statistical significance are described in the *Technical Appendix*.

Table 2: Summary of Risk-Adjusted Mortality Rates, 1999-2001

As Expected (one or both models)	332	81.77
Better than expected (p<.01 on both models)	27	6.65
Worse than expected (p<.01 on both models)	32	7.88
No deaths reported, and too few cases to rate on both models	15	3.69

Using both models, the following 27 hospitals exhibited risk-adjusted 30-day mortality outcomes that were *better than expected*:

HOSPITALS RATED BETTER THAN EXPECTED ON BOTH MODELS	
St. Rose Hospital	Alameda County
Summit Medical Center	Alameda County
Valley Memorial Hospital	Alameda County
San Ramon Regional Medical Center	Contra Costa County
Cedars-Sinai Medical Center	Los Angeles County
Centinela Hospital Medical Center	Los Angeles County
Citrus Valley Medical Center - Queen of the Valley	Los Angeles County
East Los Angeles Doctor's Hospital	Los Angeles County
Garfield Medical Center	Los Angeles County
Granada Hills Community Hospital	Los Angeles County
Monterey Park Hospital	Los Angeles County
Northridge Hospital Medical Center *	Los Angeles County
Presbyterian Intercommunity Hospital	Los Angeles County
Santa Marta Hospital	Los Angeles County
St. John's Hospital and Health Center	Los Angeles County
UCLA Medical Center	Los Angeles County
White Memorial Medical Center	Los Angeles County
Sierra Nevada Memorial Hospital	Nevada County
Alvarado Hospital Medical Center	San Diego County
Paradise Valley Hospital	San Diego County
Scripps Memorial Hospital-Chula Vista	San Diego County
Sharp Chula Vista Medical Center	San Diego County
Community Hospital of Los Gatos	Santa Clara County
El Camino Hospital	Santa Clara County
Redding Medical Center	Shasta County
Sonora Community Hospital	Tuolumne County
Simi Valley Hospital and Health Services *	Ventura County

*Hospital comments letter received. See Appendix 2.

The adjusted 30-day mortality rates of these hospitals can be viewed in Chart 1 of the *Technical Appendix*.

Using both models, the following 32 hospitals showed risk-adjusted 30-day mortality outcomes that were *worse than expected*:

HOSPITALS RATED WORSE THAN EXPECTED ON BOTH MODELS	
Clovis Community Hospital	Fresno County
Fresno Community Hospital and Med Center	Fresno County
University Medical Center	Fresno County
Kern Medical Center *	Kern County
Kaiser Foundation Hospital-Baldwin Park *	Los Angeles County
Kaiser Foundation Hospital-Bellflower *	Los Angeles County
Kaiser Foundation Hospital-Harbor City *	Los Angeles County
Santa Teresita Hospital	Los Angeles County
Anaheim General Hospital	Orange County
Coastal Communities Hospital	Orange County
Garden Grove Hospital and Medical Center	Orange County
Sutter Roseville Medical Center	Placer County
Desert Hospital	Riverside County
Kaiser Foundation Hospital-Riverside *	Riverside County
Parkview Community Hospital	Riverside County
Riverside Community Hospital	Riverside County
Riverside County Regional Medical Center *	Riverside County
San Gorgonio Memorial Hospital	Riverside County
Kaiser Foundation Hospital-South Sacramento *	Sacramento County
Sutter General Hospital	Sacramento County
Community Hospital of San Bernardino	San Bernardino County
High Desert Medical Center	San Bernardino County
Kaiser Foundation Hospital-Fontana *	San Bernardino County
Redlands Community Hospital *	San Bernardino County
Victor Valley Community Hospital	San Bernardino County
Palomar Medical Center *	San Diego County
Pomerado Hospital	San Diego County
Dameron Hospital	San Joaquin County
San Joaquin General Hospital *	San Joaquin County
North Bay Medical Center *	Solano County
Vaca Valley Hospital	Solano County
Emanuel Medical Center	Stanislaus County

*Hospital comments letter received. See Appendix 2.

The adjusted 30-day mortality rates of these hospitals can also be viewed in Chart 1 of the Technical Appendix.

If a hospital is not rated above as *better than expected* or *worse than expected*, then it either performed *as expected* on one or both models, or it had too few cases to be reliably rated. The risk-adjusted outcomes of these hospitals can also be viewed in Chart 1 of the Technical Appendix.

Appendix 1

Technical Appendix: Table of Contents

OVERVIEW..... 14

SELECTION CRITERIA..... 14
Inclusion Criteria
Exclusion Criteria
Table A.1: CAP Diagnoses Included in the Analysis
Table A.2: Pneumonia Diagnoses Excluded from Analysis

LINKING INDEX RECORDS WITH PRIOR HOSPITALIZATION RECORDS AND DEATH RECORDS 18
The Records Linkage Process
Table A.3: Hospitals with 10 Percent or More of their CAP Patients Missing Social Security Number

MEASUREMENT OF 30-DAY MORTALITY..... 20
Identification of Death

SELECTION OF HOSPITALS 21
Table A.4: Number of Annual Admissions per Year for Hospitals with No CAP Admissions in at Least One Year of this Report

DEFINITIONS AND PREVALENCE OF RISK FACTORS..... 21
Demographic and Hospitalization Characteristics
Table A.5: Demographic Characteristics of Community-Acquired Pneumonia Cases (after exclusions)
Table A.6: Hospitalization Characteristics of Community-Acquired Pneumonia Patients (after exclusions)
Criteria for Selecting Clinical Risk Factors
Clinical Risk Factors
Table A.7: ICD-9-CM Codes for Clinical Risk Factors Included in the CAP Rick-Adjustment Model
Table A.8: ICD-9-CM Codes for Risk Factors Considered, but not Included in Final Model
Table A.9: Prevalence (1999-2001) of Clinical Risk Factors

DO NOT RESUSCITATE (DNR) ORDER 29
Table A.10: Distribution of "Percent of Records with DNR Order Present Within 24 Hours of Admission" for Hospitals with Ten or More Admissions
The Accuracy of DNR
DNR as a Risk Factor
Construct Validity and the Use of Two Models
Table A.11: Balanced Hospital Ratings, With and Without DNR as a Risk Factor

TIMING OF CLINICAL RISK FACTORS..... 32

Technical Appendix: Table of Contents (continued)

THE RISK-ADJUSTMENT MODELS 33

Table A.12: Parameters for Model Without DNR as a Risk Factor
Table A.13: Parameters for Model With DNR as a Risk Factor

TESTING THE INTERNAL VALIDITY OF RISK-ADJUSTMENT MODELS 34

Face Validity
Discrimination
Table A.14: Discrimination and Goodness of Fit Tests for Re-Estimated CAP Risk-Adjusted 30-Day Mortality Models
Goodness of Fit

EXCLUSION FROM FULL RISK-ADJUSTMENT 36

Table A.15: Hospitals Excluded from Full Risk-Adjustment
Table A.16: Statewide Prevalence and Range of Key Risk Factors

CALCULATION OF HOSPITAL OUTCOME MEASURES 38

Number of Observed Deaths and Observed Death Rate
Number of Expected Deaths and Expected Death Rate
Risk-Adjusted Death Rate
Confidence Limits for Risk-Adjusted Death Rates

MORTALITY RESULTS..... 40

Comparing Observed and Expected Mortality
Comparing Risk-Adjusted Hospital Rates with the Statewide Death Rate
Chart 1: Community-Acquired Pneumonia Mortality Rates
Table A.17: Risk-Adjusted 30-Day Mortality Rates for Hospitals with Less than 30-Admissions for Community-Acquired Pneumonia, 1999-2001

Overview

This technical appendix is intended for health services researchers, healthcare providers, and others interested in the methods used to calculate risk-adjusted mortality rates.

The risk-adjustment model used to derive hospital-specific results for community-acquired pneumonia (CAP) was developed through a multi-step process, explained in detail in the "*Report for the California Hospital Outcomes Program, Community-Acquired Pneumonia, 1996: Model Development and Validation.*" The development of the model involved reviewing the scientific literature, convening an expert panel, developing criteria for including and excluding cases, identifying adverse outcomes, selecting risk factors, estimating the statistical model, refining and testing the model, and calculating risk-adjusted outcome measures for CAP admissions reported during 1996. For this report, coefficients for risk factors included in that model were re-estimated using discharge data from 1999 to 2001.

Selection Criteria

This report focuses on patients admitted for CAP at acute care hospitals in California. Inclusion and exclusion criteria were developed after careful review of the medical literature and extensive discussions with an expert panel that included a pulmonologist, a nurse researcher, a pulmonary care nurse, a pharmacist, and a health information management professional.

Inclusion Criteria

CAP patients were selected by reviewing the discharge abstracts from all acute care hospitals in California that report data to the Office of Statewide Health Planning and Development (OSHPD). These hospitals do not include facilities operated by the U.S. Department of Veterans Affairs or the Department of Defense. Discharge abstracts that identified patients admitted from a non-acute level of care (e.g., skilled nursing, rehabilitation) were excluded.

For patients with two or more CAP admissions during the three-year period of this report, only the first admission was considered. In other words, the unit of analysis for this report is unduplicated patients. This definition fulfills the general requirement of case independence for the statistical analysis model used in this report. Throughout this report, the first admission will be referred to as the "index admission."

Cases selected for this report were required to meet all four of the inclusion criteria listed below.

1. **A principal diagnosis of community-acquired pneumonia or a specified pneumonia-related principal diagnosis with a secondary diagnosis of community-acquired pneumonia.**

The principal diagnosis is "the condition established, after study, to be chiefly responsible for occasioning the admission of the patient to the hospital for care." Secondary diagnosis is defined as "conditions that coexist at the time of admission, develop subsequently during the hospital stay, affect the treatment received, or affect the length of stay."[2] Table A.1 shows both the principal diagnosis of CAP, and the non-CAP principal diagnosis codes. If CAP was the principal diagnosis, the patient was selected. For patients with CAP-related principal diagnoses (e.g., cough), a secondary diagnosis of CAP was required for selection. This approach was

[2] Office of Statewide Health Planning and Development, March 2001. 1999 Patient Discharge Data File Documentation.

used in prior research on community-acquired pneumonia.[3] Table A.1 and Table A.2, taken together, represent those ICD-9-CM (International Classification of Diseases - 9th Revision - Clinical Modification) diagnoses typically considered to represent community-acquired pneumonia.[4]

2. Age at admission of 18 years or greater.

This study included adults only. The clinical spectrum of pneumonia for children is significantly different, and would therefore necessitate developing more than one risk-adjustment system and validation instrument. This report excluded 72,007 patients because they were younger than 18 at the time of admission.

3. Source of admission is "Home."

Because this study is focused on community-acquired pneumonia, only patients whose source of admission was "Home" were included in the report. Patients admitted from "Residential Care Facilities" and "Prison/Jail" were not included since patients who have been institutionalized may be exposed to organisms with different patterns of antibiotic resistance than individuals who live in non-institutional settings.

Patients admitted from "Long-Term Care" and "Other Inpatient Hospital Care" were not included because they are exposed to bacteria that do not typically exist in the community (i.e., they are exposed to bacteria that cause "hospital-acquired pneumonia"). Bacteria that cause hospital-acquired pneumonia have a different, often more severe, clinical course than bacteria that are typically associated with CAP. Patients transferred from a long-term care facility are also more likely to have a higher incidence of "Do Not Resuscitate" (DNR) orders. Patients with DNR orders have a higher risk of underlying medical conditions that may not be fully measured in a risk-adjustment system using administrative data. In addition, certain life-prolonging measures may not be used for patients with DNR orders, possibly introducing bias into the risk-adjustment process. "Ambulatory Surgery" and "Other" patients were also not included, as it was not known where these patients normally resided. This study excluded 55,367 patients because their source of admission to the hospital was not "home."

4. Date of discharge between January 1, 1999 and December 31, 2001, and date of admission not earlier than November 1, 1998, and date of admission not later than December 1, 2001.

Patients admitted before November 1, 1998 were excluded because the study was designed to capture CAP patients primarily treated between 1999 and 2001. Patients admitted after December 1, 2001 and before January 1, 2002 (N=8,449) were excluded because vital statistics data were not available after December 31, 2001 and their 30-day mortality could not be completely determined.

Exclusion Criteria

Several exclusion criteria, such as a recent history of pneumonia that was acquired in the hospital, were defined to eliminate patients that may not truly represent CAP. Cases with any of the following characteristics were excluded.

[3] Iezzoni LI, Shwartz M, Ash A, Mackieman YD. Using severity measures to predict the likelihood of death for pneumonia inpatients. J Gen Intern Med. 1996; 11:23-31.
[4] Fine M, Singer DE, Hanusa B, et al. Validation of a Pneumonia Prognostic Index Using the MedisGroups Comparative Hospital Database. The American Journal of Medicine. 1993; 94:153-159.

1. **One or more prior acute inpatient hospital admissions within 10 days preceding the index CAP admission (N=11,702 patients excluded).**

A CAP admission was excluded from the study if it was preceded by a prior acute hospital admission for any reason within 10 days (from prior discharge date to index date). This exclusion is important because recent hospitalizations put a patient at risk for hospital-acquired pneumonia. Bacteria associated with hospital-acquired pneumonia may have greater resistance to antibiotics, and therefore may be more difficult to treat than bacteria associated with CAP.

2. **Any diagnosis code on the index hospital record indicating trauma.**

These patients were excluded because it was highly likely that an accident victim would have acquired pneumonia in the hospital (N=7,623 patients excluded).

3. **Discharges with diagnosis codes indicating that a patient had undergone organ transplant, had human immunodeficiency virus (HIV) or AIDS, had cystic fibrosis, tuberculosis, post-operative pneumonia, or certain unusual pathogens as the cause of the pneumonia.**

In addition to typical bacterial pathogens that cause CAP, individuals with AIDS or HIV infection are subject to a variety of HIV-related pathogens that are distinct from those underlying CAP. Therefore, 2,195 records indicating an HIV-related diagnosis were excluded. Similarly, since patients who have undergone an organ transplant receive medications to suppress their immune system, they are susceptible to bacteria and other organisms that do not cause CAP (522 discharges excluded). Patients with cystic fibrosis are not able to clear bacteria effectively from their lungs and are susceptible to frequent pneumonia. The frequency of pneumonia and the associated courses of antibiotics make them susceptible to antibiotic-resistant bacteria, thereby posing problems with treatment (770 discharges excluded). Patients with tuberculosis were excluded because this type of pneumonia requires specific antibiotics and has a very different clinical course than patients with CAP (455 discharges excluded). Patients with postoperative pneumonia are clinically classified as having hospital-acquired pneumonia (1,308 discharges excluded). Some unusual pneumonias (e.g., anthrax) were also excluded because these organisms are treated with specific antibiotics and have a different clinical course (1,423 discharges excluded). Table A.2 lists the pneumonia diagnoses that were excluded because their etiologies and treatment regimes are clinically distinct from most community-acquired pneumonias.

4. **Other exclusions.**

Because a social security number is required for linking index records with prior hospitalization records and with the State's vital statistics records 7,824 patients with missing or invalid social security numbers were excluded.. An additional 636 patients were excluded because they had unresolved social security numbers attributed to different individuals having grossly inconsistent birth dates or genders. Ten patients whose sex was not identified as either male or female were also excluded. In addition, 129 patients with a date of admission that occurred after the date of death were excluded, as well as 7 patients with date of death missing. 4,478 patients with out-of-state ZIP codes were excluded because reliable information about out-of-state vital statistics was not available.

Table A.1: CAP Diagnoses Included in the Analysis

ICD-9-CM Code	Principal Diagnosis	Principal CAP Codes	Non-CAP Principal Diagnosis Codes*
480.0	Pneumonia due to adenovirus	X	
480.1	Pneumonia due to respiratory syncytial virus	X	
480.2	Pneumonia due to parainfluenza virus	X	
480.8	Pneumonia due to other virus not elsewhere classified	X	
480.9	Viral pneumonia, unspecified	X	
481	Pneumococcal Pneumonia (*Streptococcus pneumoniae*)	X	
482.0	Pneumonia due to *klebsiella* pneumoniae	X	
482.1	Pneumonia due to *pseudomonas*	X	
482.2	Pneumonia due to *hemophilus influenza*	X	
482.30	Pneumonia due to *streptococcus,* unspecified	X	
482.31	Pneumonia due to *streptococcus*, Group A	X	
482.32	Pneumonia due to *streptococcus*, Group B	X	
482.39	Other s*treptococcus* species	X	
482.4	Pneumonia due to s*taphylococcus* species	X	
482.81	Pneumonia due to other specified bacteria - Anaerobes	X	
482.82	Pneumonia due to *escherichia coli* (E. Coli)	X	
482.83	Other gram negative bacteria	X	
482.84	Legionnaires' disease	X	
482.89	Other specified disease	X	
482.9	Bacterial pneumonia unspecified	X	
483.0	Pneumonia due to other specified organism-*mycoplasma*	X	
483.1	Pneumonia due to other specified organism - *chlamydia*	X	
483.8	Pneumonia due to other specified organism	X	
485	Bronchopneumonia, organism unspecified	X	
486	Pneumonia, organism unspecified	X	
487.0	Influenza with pneumonia	X	
510.0	Empyema with fistula		X
510.9	Empyema without fistula		X
511.0	Pleurisy without mention of effusion or current tuberculosis		X
511.1	Pleurisy with effusion, with bacterial cause other than tuberculosis		X
512.0	Spontaneous tension pneumothorax		X
512.1	Iatrogenic pneumothorax		X
512.8	Other spontaneous pneumothorax		X
513.0	Abscess of lung		X
518.0	Pulmonary Collapse		X
518.81	Respiratory failure		X
518.82	Other pulmonary insufficiency, not elsewhere classified		X
785.5x	Shock without mention of trauma - shock unspecified		X
786.00	Dyspnea and respiratory abnormalities-respiratory abnormality, unspecified		X
786.09	Other dyspnea and respiratory abnormalities		X
786.2	Cough		X
786.3	Hemoptysis		X
786.4	Abnormal sputum		X
038.xx	Septicemia		X

* To be used as an inclusion criterion, a non-CAP principal diagnosis must occur with a secondary diagnosis of CAP.

Table A.2: Pneumonia Diagnoses Excluded from Analysis

ICD-9-CM Code	ICD-9-CM Description
Fungal Pneumonia	
112.4	Candida species
114.0	Primary Coccidioimycosis
115.05, 115.15, 115.95	Histoplasmosis Pneumonia
484.6	Aspergillosis Pneumonia
484.7	Pneumonia from Other Systemic Mycoses
Other Miscellaneous Pneumonias	
136.3	Pneumocystis Carinii
484.1	Pneumonia from Cytomegalovirus
484.3	Pneumonia from Whooping Cough
484.5	Pneumonia from Anthrax
484.8	Pneumonia in other Infectious Disease
73.0	Ornithosis with Pneumonia
39.1	Primary Actinomycosis
55.1	Post-Measles Pneumonia
003.22	Salmonella Pneumonia
130.4	Pneumonia Due to Toxoplasmosis
21.2	Pulmonary Tularemia
52.1	Varicella Pneumonitis

*To be used as an inclusion criterion, a non-CAP principal diagnosis must occur with a secondary diagnosis of CAP.

Linking Index Records with Prior Hospitalization Records and Death Records

Record linkages are important for several reasons. First, linking the “index admissions” selected for this report with subsequent hospital discharge abstracts and death certificates provides the basis for measuring death within 30 days. Second, linkage with prior hospitalizations makes it possible to identify possible hospital-acquired pneumonia. Third, linkages provide important information about clinical risk factors. Asthma, liver disease, and other comorbidities are not always coded on discharge abstracts submitted by the index hospital so more complete information can be obtained when linked, multiple admission records are used.

The Record Linkage Process

The goal of the record linkage process was to identify records from different data files for the same individual, and to create a linked single-record analysis file. This was accomplished through the following three general steps:

Step 1. Index admissions were identified that met the selection criteria described above.

Step 2. Index admission records were linked to vital statistics death records. Each death record was linked to all applicable records in the patient discharge data files, but each patient discharge data record was linked to only one possible death. The linkage was performed deterministically, following specific criteria and rules that used social security number as the primary linkage key. A detailed description of the algorithm used to link index CAP records with vital statistics records can be found in the Technical Guide of OSHPD’s report on heart attacks for 1996-1998. (This Technical Guide can be viewed at www.oshpd.ca.gov)

For all CAP discharge records meeting the inclusion criteria of this report, approximately 3.7 percent were missing a social security number. Table A.3 shows which hospitals lacked social security numbers for 10 percent or more of their patient discharge records. Records lacking a social security number could not be used because they could not be linked to vital statistics

records using the linkage algorithm of this report. No hospitals were excluded from the report because of missing social security numbers. No effort was made to assess whether missing social security numbers were correlated with the presence or absence of observed 30-day mortality,

Step 3. Additional discharge records for each patient, for up to six months prior to the index admission, were located and linked with the appropriate index records. Again, social security number was used as the primary linkage key.

Table A3: Hospitals with 10 Percent or More of their CAP Patients Missing Social Security Number, 1999-2001

Hospital Name[5]	Number of Patients	Percent Missing SSN
Children's Hospital of Orange County	10	40.0
Los Angeles County USC Medical Center	1,636	39.1
Los Angeles County Olive View Medical Center	797	32.2
Los Angeles County Rancho Los Amigos Medical Center	13	30.8
Los Angeles County ML King Jr./ Drew Medical Center	1,157	29.2
Los Angeles County Harbor/ UCLA Medical Center	1,003	27.9
George L. Mee Memorial Hospital	124	25.0
Alameda Hospital	327	23.5
San Mateo General Hospital	233	20.2
Sierra View District Hospital	726	20.2
Los Angeles County High Dessert Hospital	59	16.9
Santa Clara Valley Medical Center	752	15.6
Los Angeles Community Hospital- Norwalk	162	14.2
San Bernardino County Medical Center	76	13.2
Madera Community Hospital	458	12.9
Arrowhead Regional Medical Center	795	12.5
Riverside County Regional Medical Center	591	12.5
University of California Irvine Medical Center	544	12.3
California Hospital Medical Center	499	12.2
Coastal Communities Hospital	270	12.2
University Medical Center	708	12.1
Kaiser Foundation Hospital Richmond	321	12.1
Valley Children's Hospital	25	12.0
Natividad Medical Center-Constitution Blvd.	242	12.0
Los Angeles Community Hospital	194	11.9
Doctors Hospital of West Covina	17	11.8
Western Medical Center-Anaheim	214	11.7
Ventura County Medical Center	294	11.6
Lindsay District Hospital	56	10.7
Greater El Monte Community Hospital	265	10.6
Hospitals Statewide	210,852[6]	3.7

[5] One hospital with 1 CAP admission and 100% missing SSN and one hospital with 6 CAP admissions and 33.3% missing SSN were not included in this table because of their small Ns.

[6] This figure is larger than the 203,028 patients used to create the rankings in this report because it includes patients with missing social security numbers.

Measurement of 30-Day Mortality

Only one outcome of hospitalization for community-acquired pneumonia was studied: death within 30 days of admission. Although other measures such as "improved health" or "improved ability to do everyday tasks" are desirable, mortality was chosen because it is important, definitive, and readily available. Thirty-day death rates are used instead of in-hospital death rates because the former measure is insensitive to transfer policies that could bias results and are a more robust outcome. In selecting this outcome measure, statistical and clinical issues were considered. For example, death is a frequent outcome of CAP hospitalizations: One person in eight admitted to a California hospital for CAP between 1999 and 2001 died within 30 days. Also, death resulting from CAP may be prevented by appropriate therapy such as the timely administration of antibiotics.[7] Furthermore, a medical intervention associated with the performance of sputum cultures can reduce the risk of early death after admission to a hospital for CAP.[8]

Identification of Death

Deaths within 30 days of admission were determined using two different data sources: linked hospital discharge abstracts and vital statistics records (death certificates). Hospital discharge abstracts only record deaths that occur in nonfederal acute care hospitals in California. By contrast, a death certificate is generated whenever a California resident dies, regardless of where the death occurs. Patient discharge records were matched with vital statistics records using social security number as the primary linkage key. This allowed for the calculation of 30-day death rates, instead of being limited to inpatient death rates.

To investigate the probability that the linkage with the State's vital statistics file accurately identified all known deaths, the linkage's sensitivity to known inpatient deaths was measured by determining how many of the inpatient CAP deaths recorded by hospitals on the patient discharge abstract were also present in the vital statistics file. Of the 15,681 inpatient deaths that occurred during a CAP admission between January 1, 1999 and December 1, 2001, 15,489 were also recorded in the vital statistics file. This yielded an error rate of 0.01, meaning that nearly all of the CAP patients who died while in the hospital were also accurately represented in the vital statistics file. The small number of inpatient deaths (N=192) not found in California's vital statistics file could represent patients who were out-of-state residents at the time of their death, or patients whose hospital discharge abstracts contained erroneous social security numbers that could not be validly linked.

For the 203,028 CAP patients meeting our selection criterion, 15,148 deaths were reported through the patient discharge files as "in-hospital" within 30 days of admission.[9] Of the 187,347 CAP patients discharged alive from the hospital, an additional 9,681 were identified as having died within 30 days of admission (for a total of 24,829 deaths within 30 days of admission). This means that 39 percent of the deaths measured by this report occurred outside of a hospital.

All 24,829 30-day deaths identified from these data sources were used to measure the outcome of this report. Deaths beyond 30 days were not counted because these later deaths may have resulted from social problems or unrelated illnesses. Not counting later deaths made the outcome comparisons across hospitals more valid. Other cutoffs were considered but the 30-day limit was adopted because it is consistent with previous research in the field.

---

[7] Meehan TP, Fine MJ, Krumholz HM, et al., "Quality of Care, Process, and Outcomes in Elderly Patients with Pneumonia." *JAMA*. 1997; 278(23): 2080-4.

[8] Haas J, et. Al., "Report for the California Hospital Outcomes Project: Community-Acquired Pneumonia, 1996," Sacramento, California: Health Policy and Planning Division, California Office of Statewide Health Planning and Development, November 2000: page "12-9."

[9] This inpatient death figure is lower than 15,681 because 533 inpatient deaths occurred later than 30 days after being admitted for CAP.

Selection of Hospitals

Certain hospitals may not be directly comparable with the majority of hospitals caring for CAP patients in California. For example, non-acute care hospitals are not organized and staffed to treat patients with acute conditions. Any CAP records from these hospitals are probably either miscoded or represent atypical patients.

This report includes cases from all non-federal acute care hospitals in California. Hospitals operated by the U.S. Department of Veterans Affairs or Department of Defense do not report data to OSHPD and therefore could not be included. All acute care hospitals reporting discharge information to OSHPD for patients with CAP were initially eligible for inclusion.[10] Although some hospitals with distinct psychiatric or alcohol and drug rehabilitation patients can report in this category, they should not have patients with principal diagnoses of CAP, or that are CAP-related. Thus, patients with the following reported levels of care were excluded: "Psychiatric," "Alcohol/Drug Rehabilitation," "Skilled Nursing/Intermediate Care," and "Rehabilitation."

If a general acute care hospital consolidated with another general acute care hospital between 1999 and 2001 and then stopped reporting to OSHPD using its original hospital identification number, all discharges reported after the consolidation were attributed to the hospital named in the consolidation. Discharges prior to the consolidation retained their original identification number. If a hospital changed location and then started reporting to OSHPD using a different identification number, it was reported separately using the same hospital name with a different street address.

Twenty-nine hospitals included in this report did not have qualifying admissions for community-acquired pneumonia during one or two of the three years of this report. This could have occurred because a hospital closed or opened later during the three-year interval of this report. The hospitals that were not represented by a full three-year period are listed in Table A.4. Due to small numbers, some of these hospitals were not rated (See Table A.17).

Definitions and Prevalence of Risk Factors

In this study, risk factors were defined as characteristics or conditions that most likely existed at the time of admission and may have influenced patient outcomes. Four types of risk factors were examined:

- demographic characteristics such as gender and age
- hospitalization characteristics such as number of prior admissions
- chronic clinical risk factors such as asthma, liver disease, and lung cancer
- acute clinical risk factors that may or may not be present at admission to a hospital such as respiratory failure, coagulation deficit, and acute cerebrovascular accident

All clinical risk factors --chronic and acute-- were based on the diagnoses and procedures listed on discharge abstracts and coded using the International Classification of Diseases-9th Revision-Clinical Modification (ICD-9-CM). Each patient discharge abstract includes a principal diagnosis and principal procedure, plus as many as 24 other diagnoses and as many as 20 other procedures.

[10] This involved selecting all CAP records with a "level of care" code indicating "General Acute Care."

Table A.4: Number of Annual Admissions per Year for Hospitals with No CAP Admissions in at Least One Year of this Report

County	Hospital	1999	2000	2001
Alameda	Children's Hospital Med Ctr of No Cal	0	4	0
Amador	Sutter Amador Hospital-Court St	111	34	0
Amador	Sutter Amador Hospital-Mission Blvd	0	33	83
Contra Costa	Doctors Med Ctr-Pinole	89	27	0
Los Angeles	Bay Harbor Hospital	139	2	0
Los Angeles	Earl & Loraine Miller Children's Hosp	0	1	3
Los Angeles	Temple Community Hospital	57	0	99
Madera	Chowchilla District Memorial Hosp	3	0	0
Marin	Novato Community Hospital-Rowland	0	0	26
Monterey	Natividad Med Center-Natividad Rd	51	0	0
Orange	Martin Luther Hospital Med Ctr	104	0	0
Orange	Orange Coast Memorial Med Ctr	170	0	238
Orange	Vencor Hospital-Brea	0	1	0
Riverside	The Heart Hospital, Inc.	3	0	0
Sacramento	Mercy American River Hospital	253	103	0
San Bernardino	Heritage Hospital	1	0	0
San Bernardino	Mountains Community Hospital	37	16	0
San Bernardino	San Bernardino County Med Ctr	66	0	0
San Bernardino	Vencor Hospital-Ontario	1	0	0
San Diego	Columbia Mission Bay Hospital	96	82	0
San Diego	Scripps Hospital-East County	218	106	0
San Diego	Sharp Cabrillo Hospital	9	0	0
San Diego	Vencor Hospital-San Diego	3	0	0
San Francisco	UCSF-Mt Zion	177	0	0
San Mateo	Seton Med Ctr-Coastside	1	0	0
Santa Clara	Columbia South Valley Hospital	110	0	0
Santa Clara	Lucile S Packard Children Hosp at Stanford	0	0	2
Santa Clara	St. Louise Health Center	51	0	0
Tulare	Alta Hospital District	76	44	0
Tulare	Lindsay District Hospital	37	13	0

Demographic and Hospitalization Characteristics

The demographic fields available from patient discharge abstracts are gender, race/ethnicity, and age. Table A.5 describes these fields based on the records of the CAP patients selected for this report. For analytic purposes, race/ethnicity was aggregated into six categories: “Caucasian,” “African-American,” “Hispanic,” “Native American,” “Asian/Pacific Islander,” and “Other.” The validation study assessed the possible contributions of all demographic characteristics, but found only age and gender to be sufficiently predictive for use in the risk-adjustment model.

Several fields describing the hospitalization event were available from patient discharge abstracts: expected principal source of payment, source of admission, type of admission, number of prior discharges within the previous six months, and disposition. Each of these is described in Table A.6. Only number of prior discharges within the previous six months was selected by the validation study for use in the risk-adjustment model.

Table A.5: Demographic Characteristics of Community-Acquired Pneumonia Cases (after exclusions)

Characteristic	1999 Number	1999 Percent	2000 Number	2000 Percent	2001 (Jan.-Nov.) Number	2001 (Jan.-Nov.) Percent
Total Patients	78,541		64,957		59,530	
Gender						
Male	37,195	47.4	30,705	47.3	27,963	47.0
Female	41,346	52.6	34,252	52.7	31,567	53.0
Race/Ethnicity						
Caucasian	53,802	68.5	44,728	68.9	40,334	67.8
African-American	6,552	8.3	5,280	8.1	4,806	8.1
Hispanic	10,831	13.8	9,135	14.1	8,766	14.7
Native American	217	0.3	127	0.2	134	0.2
Asian/Pacific Islander	5,555	7.1	4,247	6.5	4,212	7.1
Other	1,049	1.3	980	1.5	930	1.6
Missing/Unknown	535	0.7	460	0.7	348	0.6
Age						
Mean	69.6		69.5		69.2	
Standard Deviation	17.0		17.2		17.3	

Table A.6: Hospitalization Characteristics of Community-Acquired Pneumonia Patients (after exclusions)

Characteristic	1999 Number	1999 Percent	2000 Number	2000 Percent	2001 (Jan.-Nov.) Number	2001 (Jan.-Nov.) Percent
Total Patients	78,541		64,957		59,530	
Admission Type						
Scheduled	2,144	2.5	1,607	2.5	1,462	2.5
Unscheduled	76,269	97.5	63,238	97.4	58,049	97.5
Missing/Unknown	128	0.2	112	0.2	19	0.0
Payment Source						
Missing	125	0.2	27	0.0	1	0.0
Medicare	50,332	64.1	42,169	64.9	37,990	63.8
Medi-Cal	8,092	10.3	6,646	10.2	6,369	10.7
Private Coverage	15,597	19.9	12,630	19.4	11,861	19.9
Worker Compensation	80	0.1	60	0.1	50	0.1
County Indigent Programs	1,470	1.9	1,220	1.9	1,055	1.8
Other Govt.	395	0.5	284	0.4	248	0.4
Other Indigent	213	0.3	172	0.3	170	0.3
Self Pay	1,743	2.2	1,383	2.1	1,367	2.3
Other Payer	494	0.6	366	0.6	419	0.7
Number of Prior Discharges						
Mean	0.5		0.5		0.5	
Standard Deviation	1.1		1.0		1.0	

Criteria for Selecting Clinical Risk Factors

The 1996 CAP development and validation study relied on a review of the recent medical literature and the assistance of a clinical advisory panel, to identify potential clinical risk factors for death after being admitted for CAP. A listing of Clinical Advisory Panel members may be found in the report. Drawing upon the clinical literature, the development and validation study documented the major risk factors associated with 30-day mortality for adults admitted because of CAP. This literature summary was used, in consultation with a clinical advisory panel, to identify potential risk factors to be used in model development. However, only those risk factors reported to OSHPD's patient discharge abstract could be used. The resulting set of clinical risk factors (found in the literature review and in OSHPD's discharge data set) was supplemented with additional risk factors from the patient discharge abstract that exhibited prevalences greater than 1 percent and statistically significant bivariate correlations with 30-day mortality.

Only risk factors found by the validation study to be reliably coded were included in the model. Some risk factors that were significantly correlated with 30-day mortality were excluded from the model due to unreliable coding. Other risk factors that were both reliably coded and significantly correlated with 30-day mortality were not included in the final model because they did not enter into a substantial number of the bootstrap sample-based analyses conducted by the validation study. Risk factors not significantly associated with 30-day mortality in a preliminary multivariate risk-adjustment model, as well as those that the clinical panel reviewed and found to lack clinical justification because of counter-intuitive associations with mortality, were also eliminated. Low frequency, physiologically related risk factors (those present in less than 1 percent of all cases) were —whenever possible— combined with physiologically related risk factors that showed a similar association with mortality.

Clinical Risk Factors

Table A.7 shows the ICD-9-CM codes for clinical risk factors included in the CAP risk-adjustment model. Table A.8 shows the codes for clinical risk factors considered but not included in the model. Table A.9 shows the prevalences of the clinical risk factors included in the model.

The final model created by the development and validation study included a single interaction effect (designated "Age*Liver interaction") between "age" and "chronic liver failure." While this interaction effect was found to be statistically significant, its parameter estimate of 0.003 was relatively low, and its odds ratio of 1.00 indicated that it did not contribute to the model. For the three years of discharge data used in the present report, this interaction effect showed a similar parameter coefficient and odds ratio. After consulting with the risk-adjustment model's developer this interaction was dropped from the final model used in this report.

The risk-adjustment model developed by the validation study did not include DNR status as a risk factor because it was not available on the Patient Discharge Data (PDD) in 1996. DNR status was included as a risk factor in this report because it became available on the PDD in 1999, because it may indicate severe illness, and because it predicts 30-day mortality.

Apart from the addition of DNR status as a risk factor, and the removal of the "Age*Liver Disease" interaction, this report employs the same risk factors included in the development and validation study's risk-adjustment model for 1996 discharges. The risk-adjustment model developed using 1996 data was carefully reviewed with members of the CAP clinical advisory panel and outside consultants. The advisory panel included a pulmonologist, a nurse researcher, a pharmacist, and a coding professional with specialized expertise in the topic. They advised the model development staff about whether the models included appropriate covariates and whether the parameter estimates were consistent with previous research and experience in the field. The advisory panel was not reconvened for this CAP report. The model parameter estimates used in this report were re-estimated to reflect the 1999-2001 discharge data.

Table A.7: ICD-9-CM Codes for Clinical Risk Factors Included in the CAP Risk-Adjustment Model

ICD-9-CM Code	ICD-9-CM Description	Source of Data*	Eligible Positions for Index Admission
	Respiratory Failure	Index Only	Principal or Secondary
518.81	Respiratory failure		
518.82	Other pulmonary insufficiency NEC		
	Solid Non-Lung Cancer	Index or Prior	Secondary
140.x - 160.x	Malignant neoplasm of head, neck, digestive organs and peritoneum		
170.x-172.x	Malignant neoplasm of bone, connective tissue, malignant melanoma of skin		
174.x	Malignant neoplasm of female breast		
179.x-189.x	Malignant neoplasm of genitourinary organs		
191.x-192.x	Malignant neoplasm of brain and other CNS		
193.x-195.x	Malignant neoplasm of thyroid, endocrine glands		
196.x-199.x	Secondary malignant neoplasm		
V10.0x	Personal history of malignant neoplasm		
	Septicemia	Index Only	Principal Only
038.xx	Septicemia		(CPAA coding not accurate enough to justify inclusion if coded in Secondary position)
790.7	Bacteremia		
	Lung Cancer	Index or Prior	Secondary
162.x	Malignant neoplasm of trachea, bronchus, and lung		
163.x	Malignant neoplasm of pleura		
165.x	Malignant neoplasm of other respiratory site		
	Chronic Liver Disease	Index or Prior	Secondary
571.x	Chronic liver disease and cirrhosis		
572.x-573.x	Liver abscess and sequelae of chronic liver disease, other disorders of the liver		
070.22, 070.32, 070.44, 070.54	Chronic hepatitis		
	Blood Cancer	Index or Prior	Secondary
200.x-203.x	Lymphosarcoma and reticulosarcoma, Hodgkin's disease, other malignant neoplasms of lymphoid and histiocytic tissue, multiple myeloma and histiocytic tissue, multiple myeloma and immunoproliferative neoplasms		
204.XX-208.XX	Leukemia		
284.x, 273.8	Aplastic anemia, other disorders of plasma protein metabolism		
	Chronic Renal Disease	Index or Prior	Secondary
585	Chronic renal failure		
403.91	Unspecified hypertensive renal disease with renal failure		
403.01, 403.11	Malignant, benign hypertensive renal disease with renal failure		
404.02, 404.12, 404.92	Malignant, benign, unspecified hypertensive heart and renal disease with renal failure		
996.73	Other complications of internal prosthetic device, implant, and graft due to renal dialysis device		

Table A.7: ICD-9-CM Codes for Clinical Risk Factors Included in the CAP Risk-Adjustment Model (continued)

ICD-9-CM Code	ICD-9-CM Description	Source of Data*	Eligible Positions for Index Admission
V45.1	Renal dialysis status		
	Coagulopathy	Index Only	Secondary
287.4, 287.5, 287.9	Secondary thrombocytopenia, unspecified thrombocytopenia, unspecified hemorrhagic conditions		
286.6, 286.7, 286.9	Defibrination syndrome, acquired coagulation factor deficiency, other and unspecified coagulation defects		
	Staphylococcus Pneumonia	Index Only	Principal or Secondary
482.4	Pneumonia due to Staphylococcus species		
	Congestive Heart Failure (CHF)	Index or Prior	Secondary
398.91	Rheumatic heart failure (congestive)		
402.91	Unspecified hypertensive heart disease with CHF		
404.01, 404.11, 404.91	Malignant, benign, and unspecified hypertensive heart and renal disease with CHF		
404.03, 404.13, 404.93	Malignant, benign, and unspecified heart and renal disease with CHF and renal failure		
425.x	Cardiomyopathy		
428.x	Heart Failure		
	Gram Negative Pneumonia	Index Only	Principal or Secondary
482.0, 482.1, 482.82	Pneumonia due to Klebsiella pneumonia, pneumonia due to Pseudomonas, pneumonia due to Escherichia coli		
	Late Effects of Stroke/Hemiplegia	Index or Prior	Secondary
342xx	Hemiplegia and hemiparesis		
438.xx	Late effects of cerebrovascular disease		
	Asthma	Index or Prior	Secondary
493.xx			
	Acute Cerebrovascular Accident	Index or Prior	Secondary
430;431;432.x-435.x; 437.1	Subarachnoid hemorrhage; intracerebral hemorrhage; other and unspecified intracranial hemorrhage, occlusion and stenosis of precerebral arteries, occlusion of cerebral arteries, transient cerebral ischemia; acute but ill-defined cerebrovascular disease; other generalized ischemic cerebrovascular disease		
	Parkinson's Disease	Index or Prior	Secondary
332.x	Paralysis agitans, secondary parkinsonism		

* Index hospitalization only or also includes data from prior hospitalizations (if any).

Table A.8: ICD-9-CM Codes for Risk Factors Considered, but not Included in Final Model

ICD-9-CM Code	ICD-9-CM Description
	Acidosis
276.2	Acidosis
	Acute Renal Failure
584.x	Acute renal failure
	Airway Obstruction, Chronic
491.x; 492.x; 496	Emphysema; chronic airway obstruction not elsewhere classified
	Alcohol Use
291.x, 357.5x, 303.x, 305.0x, 571.2x, 571.1x, 571.3x, 571.0x, 425.5x, V11.3	Assorted complications of alcohol abuse
	Anemia
280.x, 281.x, 282.x, 283.x, 285.x	Assorted causes of anemia
	Aspiration Pneumonia
507.x	Pneumonitis due to inhalation of food or vomitus, due to inhalation of oils and essences, due to other solids and liquids
	Anoxic Brain Damage
348.1	Anoxic brain damage
	Atrial Fibrillation
427.3x	Atrial fibrillation and flutter
	Cardiac Arrest
427.5	Cardiac arrest
	Cardiac Dysrhythmia, Other
427.8x, 427.9	Other specified cardiac dysrhythmias, unspecified cardiac dysrhythmia
	Coma
780.01	Coma
	Decubiti
707.0	Decubitus ulcer
	Dementia
290.xx; 294.x; 331.xx	Senile and presenile organic psychotic conditions, other specified senile psychotic conditions, unspecified senile psychotic condition; other organic psychotic conditions (chronic); other cerebral degeneration
	Diabetes Mellitus -complicated
250.1x, 250.2x, 250.3x, 250.4x, 250.5x, 250.6x, 250.7x, 250.8x, 250.9x	Assorted complications of diabetes mellitus
	Dysphasis
787.2	Dysphasis
	Electrolyte Disorders, Misc.
275.4x; 276.9	Disorders of calcium metabolism; electrolyte imbalance, hyperchloremia, hypochloremia
	Encephalopathy
348.3	Unspecified encephalopathy
	Empyema
510.x	Empyema
	Fibrosis, Post-Inflammatory
515	Postinflammatory pulmonary fibrosis
	Gastrointestinal Hemorrhage
578.9	Unspecified hemorrhage of gastrointestinal tract

Table A.8: ICD-9-CM Codes for Risk Factors Considered, but not Included in Final Model (continued)

ICD-9-CM Code	ICD-9-CM Description
	Gastrostomy Status
V44.1; V55.1	Artificial opening status of gastrostomy; attention to artificial openings during gastrostomy
	Hemophilus Influenza
482.2	Hemophilus influenza
	Hyperosmolality
276.0	Hyperosmolality and/or hypernatremia
	Hypertension - complicated
401.0x, 401.9x, 402.00, 402.10, 402.90, 403.00, 403.10, 403.90, 404.00, 404.10, 404.90, 437.2x	Assorted complications of hypertension
	Hyperpotassemia
276.7	Hyperpotassemia
	Hyposmolality
276.1	Hyposmolality and/or hyponatremia
	Ischemic Heart Disease
410.x – 414.x	Assorted manifestations of ischemic heart disease
	Kidney Disorder, Unspecified
593.xx	Other disorders of kidney and ureter
	Mixed Acid/ Base Disorder
276.4	Mixed acid/ base disorder
	Nutritional Deficiency
260-262; 263.X-266.X; 267; 268.x-269.x; 799.4	Kwashiorkor, nutritional marasmus, other severe protein-calorie malnutrition, vitamin A deficiency, thiamine and niacin deficiency states, deficiency of B-complex components; ascorbic acid deficiency; vitamin D deficiency, other nutritional deficiencies; cachexia
	Pacemaker
V45.01	Cardiac pacemaker *in situ*
	Paroxysmal Ventricular Tachycardia
427.0, 427.1	Paroxysmal supraventricular tachycardia, paroxysmal ventricular tachycardia
	Peripheral Vascular Disease
440.xx; 441.xx; 442.xx; 443.xx	Atherosclerosis; aortic aneurysm and dissection; other aneurysm; other peripheral vascular disease
	Pleurisy
511.1, 511.8, 511.9	Pleurisy with effusion (with mention of a bacterial cause other than tuberculosis), other unspecified forms of effusion except tuberculosis, unspecified pleural effusion
	Pneumococcal pneumonia
481	Pneumococcal pneumonia
	Pregnancy
640.x-677.x	Assorted conditions associated with pregnancy
	Renal Failure
586	Unspecified renal failure
	Rheumatologic Conditions
710.x,714.xx	Diffuse disease of the connective tissue including systemic lupus erythematosus and rheumatoid arthritis
	Seizure Disorder
345.xx; 780.3x	Epilepsy, other forms of epilepsy, unspecified epilepsy; febrile convulsions, other convulsions

Table A.8: ICD-9-CM Codes for Risk Factors Considered, but not Included in Final Model (continued)

ICD-9-CM Code	ICD-9-CM Description
	Shock
785.5x; 458.0, 458.9	Shock without mention of trauma: unspecified shock, cardiogenic shock, other shock, enlargement of lymph nodes, other symptoms involving cardiovascular system; orthostatic hypotension, unspecified hypotension
	Streptococcus species
482.3x	Streptococcus unspecified, group A, group B, other
	Urinary Tract Infection
599.0	Urinary tract infection, site not specified
	Valvular Heart Disease
394.x, 395.x, 396.x, 397.x	Assorted causes of valvular heart disease
	Viral Pneumonia
480.x; 487.0	Viral Pneumonia due to adenovirus, due to respiratory syncytial virus, due to parainfluenza virus, due to other virus, unspecified; influenza with pneumonia
	Volume Depletion
276.5	Volume depletion
	White Blood Cell Dysfunction
288.x	Diseases of white blood cells

Table A.9: Prevalence (1999-2001) of Clinical Risk Factors

Risk Factor	Prevalence (Percent)
Septicemia	4.6
Respiratory failure	9.6
Staph. Pneumonia	2.8
Chronic liver disease	3.1
Lung cancer	2.5
Solid cancer, non-lung	6.5
Hematologic cancers	4.3
Chronic renal failure	5.6
Late effects of CVA	5.1
Coagulopathy	2.7
Gram negative species	2.7
CHF	27.2
Parkinson's disease	2.3
Acute CVA	1.1
Asthma	9.4
Do not resuscitate order	10.7

Do Not Resuscitate (DNR) Order

During 1999, three years after the 1996 validation study, OSHPD began collecting a clinical data field indicating the presence of a DNR order within 24 hours of a patient's admission. As was shown in Table A.9, the statewide average for the presence of a DNR order for CAP admissions between 1999 and 2001 was 10.7 percent. As can be seen in Table A.10, the percent of admissions with a DNR order varied widely among the 406 hospitals included in this report. At one extreme, thirteen (3.2 percent) of the hospitals reporting CAP admissions did not show any DNR orders, while at the other extreme 24 hospitals (5.9 percent) showed DNR rates of 25 percent or higher.

Between these two extremes, 78 hospitals (19.2 percent) fell within the modal category of "7 to 9 Percent of Admissions with DNR."

Table A.10: Distribution of "Percent of Records with DNR Order Present Within 24 Hours of Admission" for Hospitals with Ten or More Admissions

Percent of Admissions with DNR order	Number of Hospitals	Percent of Hospitals
0	13	3.2
1-3	52	12.8
4-6	61	15.0
7-9	78	19.2
10-12	57	14.0
13-15	44	10.8
16-18	35	8.6
19-21	15	3.7
22-24	13	3.2
25 or more	24	5.9

All Hospitals = 10.7% (N=406[11])

The Accuracy of DNR

Because DNR status was not collected by OSHPD during 1996, the CAP validation study could not assess the reporting accuracy of this data element. Subsequent to 1999, the first year that DNR was included in OSHPD's Patient Discharge Data (PDD), there has not been a systematic assessment of the DNR field's reporting accuracy.

Although the validation study was not able to use a PDD-based measure of DNR, it collected a measure of "DNR order present within 24 hours of admission" directly from hospital charts and found a DNR rate of 27.0 percent. The difference between this rate and the overall rate of 10.7% for 1999-2001 PDD-based data, suggests that the hospitals in this report may have underreported the occurrences of DNR orders. At the same time, the PDD-based rate for this report is similar to a 24-hour DNR rate of 14.9 percent for CAP admissions reported by Marrie et al.[12] Further, the rates of DNR reported herein increased from 10.1 percent in 1999 to 11.2 percent in 2000 and 10.9 percent in 2001, suggesting increased reporting accuracy that is getting closer to the figure reported by Marrie et al. However, before conclusions about the reporting accuracy of the DNR indicator used in this report could be made, a separate sample survey of DNR status as recorded in hospital charts would be required.

DNR as a Risk Factor

A major finding of the 1996 validation study was that DNR status is highly predictive of 30-day mortality. DNR status exhibited an odds ratio of 17.0 that was higher than 23 of the other risk factors used in the validation study's modeling efforts. Further, its inclusion in an expanded model, along with five other clinical risk factors not available in the PDD but also taken directly

[11] Fourteen hospitals reported fewer than 10 CAP admissions, and thus could not provide reliable DNR rates. While these hospitals are included in the total for this table, they are not included in its distribution. For this reason, the Percent of Hospitals column does not add to 100.0%.

[12] See: Marrie TJ, Fine MJ, Kapoor WN, Coley CM, Singer DE, and Obrosky DS, "*Community-Acquired Pneumonia and Do Not Resuscitate Orders*", Journal of the American Geriatric Society, 2002, Feb; 50(2): 290-9. Marrie, et al reported a rate of 14.9% for a sample of 1,339 community-acquired pneumonia admissions to hospitals in the United States and Canada.

from hospital charts, substantially raised the discrimination (measured by the c-statistic) for the PDD-based risk-adjustment models from 0.80 to 0.91.

The findings of the present report are consistent with the 1996 CAP validation study in that they spotlight DNR status as a major predictor of 30-day mortality. For the 1999-2001 data, DNR's odds ratio of 4.3 (see Tables A.12 and A.13) proved to be second only to respiratory failure as the highest odds ratio in the risk-adjustment models. Also, when DNR was added to the risk-adjustment model without DNR, discrimination (measured by the c-statistic) increased from 0.79 to 0.82. It may be of further interest to note that the observed statewide death rate for CAP patients without a DNR order was 9.1 percent and for patients with a DNR order it was more than four times higher at 38.7 percent.

Construct Validity and the Use of Two Models

In this report, DNR status is intended to be an indirect indicator of illness severity at admission. Despite the predictive power of DNR status, its construct validity as an indicator of underlying illness severity has a serious limitation because it might also reflect unmeasured variation in treatment. Such variation might occur due to the reluctance of a hospital staff to provide costly treatments (apart from cardiopulmonary resuscitation) to patients with a DNR order. Furthermore, a DNR order might signal the presence of an advanced medical directive "not to treat" when the patient is terminally ill, or is in a coma with little or no hope for recovery. Under such conditions, in addition to requesting that cardiopulmonary resuscitation not be performed, the patient might request that mechanical respiration, artificial feeding, kidney dialysis, chemotherapy, or other life-saving treatments *not* be performed.

If DNR status indicates *both* underlying illness severity at the time of admission *and* variations in the treatment that might occur subsequent to admission, then its use as a risk factor creates a methodological dilemma for accurate risk-adjustment: On the one hand, risk-adjustment without DNR status could under-adjust predicted mortality because the model lacks a direct clinical indicator of illness severity. On the other hand, risk-adjustment with DNR status could over-adjust predicted mortality because the model might adjust for the type of treatment received after the admission. OSHPD's solution to this dilemma was to rate hospitals using *both* models according to the following rules:

- If the risk-adjusted mortality of a hospital was significantly *lower* than the state average using *both* models, then that hospital's mortality outcomes were rated as significantly *better* than expected.
- If the risk-adjusted mortality rates of a hospital were significantly *highe*r than the state average using *both* models, then that hospital's mortality outcomes were rated as significantly *worse* than expected.
- If a hospital's risk-adjusted mortality was rated as *expected* on *either* model, then that hospital was given an overall rating of *as expected*.

The use of both models to rate hospital performance should balance the prediction error that might result from using only one of the models.

The effect of using both models to rate hospitals is summarized in Table A.11. In this table, the marginal distributions for the separate models are very similar, with 301 hospitals rated "as expected" for both models, and between 42 and 47 hospitals rated as "better than expected" or "worse than expected" for either model. However, the ratings for 57 hospitals (14 percent of the total) changed when DNR was added as a risk factor. More specifically, the ratings of 32 hospitals improved when DNR was added to the model as a risk factor, with 17 changing from "as expected" to "better than expected," and 15 changing from "worse than expected" to "as expected." At the same time, the ratings of 24 hospitals declined, with 14 changing from "better than expected" to "as expected," and 10 changing from "as expected" to "worse than expected."

Table A.11: Balanced Hospital Ratings, With and Without DNR as a Risk Factor

		Hospital Rating With DNR As Risk Factor				
		Better (+)	**As Expected**	**Worse (−)**	**Adjusted mortality rate = 0, and N too small**	**TOTAL**
Hospital Rating Without DNR as Risk Factor	**Better (+)**	27	14	0	1	42
	As Expected	17	274	10	0	301
	Worse (−)	0	15	32	0	47
	Adjusted mortality rate = 0, and N too small	1	0	0	15	16
	TOTAL	45	303	42	16	406

The DNR rates are almost identical for the 27 hospitals rated “better than average” on both models (9.3 percent), and for the 32 hospitals rated “worse than average” on both models (9.7 percent). This suggests that our effort to balance prediction error through the use of the two models was successful.

Timing of Clinical Risk Factors

Before 1996, California hospital discharge abstracts did not include any information on the timing of diagnoses. Therefore, any acute condition could be either a comorbidity (e.g., present at admission) or a complication of care (e.g., present only after admission). After 1996, a new “condition present at admission” (CPAA) field was collected in conjunction with each recorded diagnosis. This field was used to help differentiate comorbidities from complications.

During the 6-month period before the date of their index admission, 27 percent of CAP patients had one or more prior hospitalizations. For these patients, prior discharge abstracts provided additional information about the presence and timing of clinical risk factors. If a risk factor was noted on a prior discharge abstract, then it clearly proceeded the index CAP admission included in the report and thus did not require reference to a CPAA indicator.

The Risk-Adjustment Models

Tables A.12 and A.13 show the parameters of the 1996 CAP risk-adjustment model based on 1999-2001 Patient Discharge Data.[13] In the model represented by Table A.12, that does not use DNR as a risk factor, the following risk factors were associated with a significantly **increased** risk of death within 30 days for CAP patients: increasing age (in years), male gender, septicemia, respiratory failure, staphylococcus pneumonia, chronic liver disease, lung cancer, solid cancer (non-lung), hematologic cancers, chronic renal failure, late effects of cerebrovascular accident (CVA), coagulopathy, gram negative species, congestive heart disease, Parkinson's disease, acute CVA, and number of prior discharges. Asthma was associated with a significantly **decreased** risk of death among these CAP patients. Asthma may be "protective" of mortality in this model because patients with both asthma and CAP are often treated more aggressively with a lower threshold for hospital admission.

In the model represented by Table A.13, that uses DNR as a risk factor, the same set of risk factors were associated with a significantly **increased** risk of death within 30 days for CAP patients: increasing age (in years), male gender, septicemia, respiratory failure, staphylococcus pneumonia, chronic liver disease, lung cancer, solid cancer (non-lung), hematologic cancers, chronic renal failure, late effects of CVA, coagulopathy, gram negative species, congestive heart disease, Parkinson's disease, acute CVA, and number of prior discharges. The presence of a DNR order within 24 hours of admission was also associated with an increased risk of mortality. Again, asthma was associated with a significantly **decreased** risk of death among these CAP patients.

Table A.12: Parameters for Model Without DNR as a Risk Factor

Risk Factor	Parameter Estimate	P-value	Odds Ratio	Lower 95 Percent CI For Odds Ratio	Upper 95 Percent CI For Odds Ratio
Intercept	-6.0745	<0.0001			
Age	0.0447	<0.0001	1.046	1.044	1.047
Male	0.1290	<0.0001	1.138	1.103	1.173
Septicemia	1.1032	<0.0001	3.014	2.854	3.182
Respiratory failure	1.6068	<0.0001	4.987	4.795	5.185
Staph. Pneumonia	0.6539	<0.0001	1.923	1.792	2.064
Chronic liver disease	0.6478	<0.0001	1.911	1.766	2.068
Lung cancer	1.2114	<0.0001	3.358	3.121	3.613
Solid cancer, non-lung	0.9092	<0.0001	2.482	2.363	2.608
Hematologic cancers	0.5478	<0.0001	1.729	1.625	1.840
Chronic renal failure	0.3745	<0.0001	1.454	1.373	1.541
Late effects of CVA	0.2095	<0.0001	1.233	1.162	1.308
Coagulopathy	0.7660	<0.0001	2.151	1.999	2.315
Gram negative species	0.1747	<0.0001	1.191	1.098	1.292
CHF	0.1846	<0.0001	1.203	1.164	1.243
Parkinson's disease	0.3571	<0.0001	1.429	1.316	1.553
Acute CVA	0.4271	<0.0001	1.533	1.369	1.717
Asthma	-0.7030	<0.0001	0.495	0.458	0.535
Number of prior discharges	0.1509	<0.0001	1.163	1.148	1.178

[13] All analyses in this report were conducted using SAS Statistical Software, Version 8.2, SAS Institute Inc., Cary N.C. Model parameters and odds ratios were calculated using PROC LOGISTC.

Table A.13: Parameters for Model With DNR as a Risk Factor

Risk Factor	Parameter Estimate	P-value	Odds Ratio	Lower 95 Percent CI For Odds Ratio	Upper 95 Percent CI For Odds Ratio
Intercept	-5.6876	<0.0001			
Age	0.0359	<0.0001	1.037	1.035	1.038
Male	0.1653	<0.0001	1.180	1.143	1.217
Septicemia	1.0163	<0.0001	2.763	2.614	2.921
Respiratory failure	1.6051	<0.0001	4.978	4.784	5.180
Staph. Pneumonia	0.6515	<0.0001	1.918	1.786	2.061
Chronic liver disease	0.6349	<0.0001	1.887	1.743	2.042
Lung cancer	1.0850	<0.0001	2.960	2.747	3.189
Solid cancer, non-lung	0.8455	<0.0001	2.329	2.215	2.449
Hematologic cancers	0.5591	<0.0001	1.749	1.643	1.862
Chronic renal failure	0.4149	<0.0001	1.514	1.429	1.605
Late effects of CVA	0.1296	<0.0001	1.138	1.072	1.209
Coagulopathy	0.7888	<0.0001	2.201	2.044	2.370
Gram negative species	0.1992	<0.0001	1.220	1.124	1.325
CHF	0.1845	<0.0001	1.203	1.163	1.244
Parkinson's disease	0.2635	<0.0001	1.301	1.196	1.416
Acute CVA	0.4311	<0.0001	1.539	1.371	1.727
Asthma	-0.6611	<0.0001	0.516	0.478	0.558
Number of prior discharges	0.1388	<0.0001	1.149	1.134	1.164
Do not resuscitate status	1.4587	<0.0001	4.300	4.145	4.461

Testing the Internal Validity of Risk-Adjustment Models

For this report, the internal validity of a risk-adjustment model is defined as how well it controls for differences in patient characteristics that would otherwise confound outcome comparisons across hospitals. A model that does not adequately control for such differences may generate biased and misleading estimates of risk-adjusted mortality rates. The internal validity of the risk-adjustment model was assessed in three basic ways: face validity, discrimination, and goodness of fit (i.e. calibration).

Face Validity

Members of the CAP clinical advisory panel and outside consultants carefully reviewed the CAP risk-adjustment model developed that was based on 1996 discharge data. It advised program staff about whether the model included appropriate covariates and whether the parameter estimates were consistent with previous research and experience in the field. In the judgement of this panel, the model developed by the validation study adequately represents risk factors associated with 30-day mortality for community-acquired pneumonia. The advisory panel was not reconvened for this report because the risk-adjustment procedure was recently created and validated.

Discrimination

A model with perfect discrimination would assign to every patient an expected probability of either zero or one. With perfect discrimination all persons with an expected probability of one, but no one with an expected probability of zero, would experience the outcome of interest. No model has perfect discrimination in the real world, but good models show substantial difference in the expected probability of the outcome (death) between those who actually experienced it and those who did not.

A commonly used measure of discrimination is the “c statistic,” which is based on all pairings of observations with different outcomes (i.e. all pairs involving one decedent and one survivor).[14] In this study, c can be interpreted as the degree to which any CAP patient who died within 30 days of admission had a higher “expected probability of 30-day mortality” than a surviving CAP patient. The c statistic may show a value between 0.00 and 1.00. A value higher than 0.50 indicates an overall pattern of discrimination in an expected direction, where patients who died had higher expected probabilities of death than survivors. A value of exactly 0.50 would indicate random variation, thus indicating lack of discrimination. Values less than 0.5 would indicate discrimination in an unexpected direction where patients who died had lower expected probabilities of death than survivors. There is no widely accepted cutoff for the c statistic that distinguishes "adequate" from "inadequate" risk-adjustment models. Table A.14 shows that the risk model for CAP mortality has c statistic of 0.79 (0.82 with DNR). This figure is identical to the figure reported by the 1996 CAP development and validation study, and is comparable to other models used by OSHPD in previous studies.

Table A.14: Discrimination and Goodness of Fit Tests for Re-Estimated CAP Risk-Adjusted 30-day Mortality Models

	Without DNR as a Risk Factor	With DNR as a Risk Factor
Number of Cases	203,028	203,028
Number of Deaths	24,829	24,829
30-Day Death Rate	12.23%	12.2 %
C statistic	0.79	0.82
Pearson Goodness of Fit Statistic		
Overdispersion Estimate	1.12	1.09
P-value	<0.001	<0.001

Goodness of Fit

Goodness of fit, or calibration, is the extent to which observed outcome rates correspond to predicted rates. A well-calibrated model demonstrates a strong correspondence between observed and predicted outcomes across a broad range of patient characteristics. A lack of such correspondence, or “overdispersion,” can occur for several reasons including the false assumption of a linear relationship between the logit transformation of the dependent variable (i.e. mortality) and its explanatory variables; failure to consider significant interaction terms among explanatory variables; the absence of significant explanatory variables in the model; and the presence of extreme values (i.e. outliers) in the data.

The developers of the 1996 CAP validation report found an overdispersion estimate of 1.18 that was statistically significant at $p<0.001$, thus indicating the possibility of additional interactions (i.e. in addition to “Age*Liver Disease” interaction they reported), the possibility of non-linearity, and the possibility of needing a more complete set of risk factors. However, they concluded that the absence of higher order interactions in the risk-adjustment model probably accounted for the small p value. They also concluded that the very large numbers of patients involved in the report could have resulted in the statistically significant lack of fit, even though departures from model assumptions were small. The model developers found that multiplying estimated variances by the over-dispersion estimate increased the widths of confidence intervals by only 9 percent and

[14] The “c statistic” is equivalent to the area under a receiver operating characteristic curve, which represents a plot of sensitivity versus 1-specificity at various cutoff values for the predicted probability. See: Hanley JA, McNeil BJ. The meaning and use of the area under a receiver operating characteristic (ROC) curve. Radiology 1982; 143:29-36.

did not produce any qualitative changes in the report's findings. They concluded that there was no need for additional terms to model interactions or non-linearity.[15]

The present report obtained over-dispersion estimates of 1.12 and 1.09 that were also significant at $p < 0.001$. Since this estimate is smaller than the estimate reported in the validation study, it was also concluded that there is no need for additional terms to model interactions or non-linearity.

Exclusion from Full Risk-Adjustment

Although hospitals devote considerable effort to produce accurate discharge abstracts, the guidelines that professional coders follow when they abstract medical records are sometimes ambiguous and subject to multiple interpretations. Reimbursements are often based on diagnosis codes. Consequently, the prevalence of various CAP risk factors across hospitals can vary due to coding practices rather than differences in case-mix. In this report there was no evidence that such variability reflected unusual documentation or coding practices that would seriously distort comparisons of risk-adjusted mortality across hospitals.

However, an examination of the CPAA ("condition present at admission") indicators turned up suspected coding error for some hospitals. Generally, a secondary discharge diagnosis for a patient can be present either at the time of admission or afterwards. It is unlikely that *all* secondary diagnoses for *all* of a hospital's CAP patients would be present at admission or that *none* of them would be present at admission for *all* CAP patients, especially for hospitals with relatively large numbers of CAP patients. Among the 15 clinical risk factors used in the model, three (respiratory failure, coagulation deficit, and acute cerebrovascular accident) are regarded as 'acute', meaning they can happen either at the time of admission or afterwards. The remaining 12 clinical variables are considered "chronic" and may be regarded as present at admission. Since chronic risk factors are likely to have preceded an admission, coding errors on CPAA would be relevant primarily to the three acute clinical risk factors. Accordingly, the three acute clinical risk factors were excluded from a hospital's risk-adjustment in any of six bi-annual reporting periods for that hospital when both of the following two criteria were present:

1. There were a sufficient number of CAP discharges (i.e. 80 or more[16]) at a given hospital in a six-month reporting period to reliably assess CPAA coding.
2. Either no secondary diagnoses were reported as present at admission, or, all secondary diagnoses were reported as present at admission during the same reporting period.

Additionally, the Patient Discharge Data Section of OSHPD's Health Information Division checked the logical consistency of the data within each six-month reporting period and noted that some hospitals exhibited unacceptable CPAA indicator coding. These hospitals were excluded from full risk adjustment during a given six-month reporting period along with those meeting the two criteria listed above. Table A.15 lists those hospitals receiving partial risk adjustment for one or more of the six-month reporting periods.

[15] Haas J, et. Al., "*Report for the California Hospital Outcomes Project: Community-Acquired Pneumonia*, 1996," Sacramento, California: Health Policy and Planning Division, California Office of Statewide Health Planning and Development, November 2000: page "9-2."

[16] Haas J, et. Al., "*Report for the California Hospital Outcomes Project: Community-Acquired Pneumonia*, 1996," Sacramento, California: Health Policy and Planning Division, California Office of Statewide Health Planning and Development, November 2000: page "5-3."

Table A.15: Hospitals Excluded from Full Risk-Adjustment

Hospital Name	Six Month Reporting Period					
	1999-1	1999-2	2000-1	2000-2	2001-1	2001-2*
Alhambra Hospital-Alhambra					X	
Barstow Community Hospital		E	E	E	E	E
Bellflower Med Ctr	E					
Coast Plaza Doctors Hospital				E		
Coastal Communities Hospital					X	X
College Hospital-Costa Mesa					X	X
Columbia Mission Bay Hospital				X		
Community Hospital of Gardena					X	X
Corcoran District Hospital	X	X	X	X	X	
Daniel Freeman Marina Hospital				E		E
Eden Med Ctr						X
Emanuel Med Ctr	E	E		E		E
Encino Tarzana Rgnl Mc-Encino	E	E	E			
Fairchild Med Ctr		X	X		X	X
Good Samaritan Hospital-Bakersfield					E	
Hanford Community Hospital		X	XE			
Hollywood Community Hosp-Hollywood	E	E				
Huntington Beach Hosp & Med Ctr		E				
Lancaster Community Hospital	XE	XE	E	E	XE	XE
Lassen Community Hospital	E					
Lodi Memorial Hospital				E		
Los Angeles Co Harbor-UCLA Med Ctr				E		
Los Angeles Metropolitan Med Ctr					X	X
Madera Community Hospital				E	E	E
Mark Twain St. Joseph's Hospital		E				
Mayers Memorial Hospital						X
Memorial Hospital of Gardena					E	
Midway Hospital Med Ctr						E
Mission Community Hospital-Panorama			E	E	E	E
North Bay Med Ctr		E	E	E	E	
Ojai Valley Community Hospital	E		E			
Pacifica Hospital of the Valley	E					
Ridgecrest Community Hospital	E	E	E			
Robert F. Kennedy Med Ctr	E					
San Joaquin Community Hospital						E
San Joaquin General Hospital			E			
Santa Teresita Hospital	E		E		E	
Santa Ynez Valley Cottage Hospital					X	X
Selma District Hospital	E				E	
Sherman Oaks Hospital & Health Ctr			E			
Sierra Kings District Hospital	X	X				
South Coast Med Ctr		E	E			

*Few hospitals were excluded form full risk-adjustment during the second half of 2001. This is due, in part, to the 80 CAP patient per period criterion, which few hospitals in this table satisfied because 2001-2nd half is a low volume, 5-month period.
Key: X = inaccuracies noted by the Patient Data Section of OSHPD's Healthcare Information Division; E = possible inaccuracies detected by empirical analysis according to "criteria 1 and 2."

Table A.15: Hospitals Excluded from Full Risk-Adjustment (continued)

Hospital Name	1999-1	1999-2	2000-1	2000-2	2001-1	2001-2*
St. Francis Memorial Hospital	E	E	E	E	E	
St. Luke Med Ctr					X	X
St. Vincent Med Ctr				E		
Sutter Davis Hospital	E	E	E		E	
Sutter Merced Med Ctr	E		E			
Temple Community Hospital	E				E	
Tri-City Regional Med Ctr	E					
US Family Care Med Ctr-Montclair	E					
Vaca Valley Hospital			E	E		
Victor Valley Community Hospital	E					

*Few hospitals were excluded form full risk-adjustment during the second half of 2001. This is due, in part, to the 80 CAP patient per period criterion, which few hospitals in this table satisfied because 2001-2nd half is a low volume, 5-month period.
Key: X = inaccuracies noted by the Patient Data Section of OSHPD's Healthcare Information Division; E = possible inaccuracies detected by empirical analysis according to "criteria 1 and 2."

When partially adjusting for risk on selected hospitals, only the 12 chronic clinical risk factors and demographic variables were used, but not the three acute clinical risk factors requiring the CPAA field. Hospitals were used partially adjusted only for those six-month reporting periods where CPAA coding errors for the acute clinical risk factors were suspected.

In addition to the previously described exclusions, CHOP considered excluding hospitals (but in fact did not exclude any hospitals) from full risk-adjustment because of unusual patterns of prevalence for "key" risk factors. To assess possible coding abnormalities, the prevalences of three risk factors considered to be "key" by the development and validation study due to their association with mortality were examined. They included congestive heart disease, respiratory failure, and septicemia. Table A.16 shows the statewide prevalence and the prevalence range across hospitals, for each of the key factors. A cut-off for under- or over-coding of the key factors based on the distribution of the data was evaluated on a hospital-by-hospital basis. The hospital-specific analyses did not indicate that any hospital should be removed from the risk-adjustment process. This is consistent with the CAP validation study, which found adequate accuracy of coding on key risk factors.

Table A.16: Statewide Prevalence and Range of Key Risk Factors

Key Risk Factor	Statewide Prevalence	Range Across Hospitals
CHF	27.2 %	0 – 44.6 %
Respiratory Failure	9.6 %	1.1 – 35.0 %
Septicemia	4.6 %	0 - 16.5 %

Note: Range includes only hospitals with 30 CAP admissions and above from 1999 to 2001.

Calculation of Hospital Outcome Measures

Risk-adjusted outcomes are reported in two places: this Technical Appendix reports 30-day mortality for the three-year period using 98 percent confidence limits (see Chart 1); and a laterappendix (Appendix 3) reports each hospital's risk-adjusted death rate with 98 percent, 95 percent and 90 percent confidence limits, using aggregated 1999-2001 data and data for each separate year.

Number of Observed Deaths and Observed Death Rate

The number of observed deaths at a hospital is simply the total number of deaths within 30 days of admission, among qualifying CAP patients. The deaths may have occurred at the index hospitalization, a subsequent hospitalization, or outside a hospital setting. The observed death rate at a hospital equals the number of observed deaths, divided by the total number of qualifying patients at that hospital. This quantity was multiplied by 100 to yield a percentage.

Number of Expected Deaths and Expected Death Rate

The number of expected deaths at a hospital equals the sum of the estimated probabilities of death for all of its qualifying patients.[17] The expected death rate at a hospital equals the number of expected deaths, divided by the total number of qualifying patients at that hospital. If a hospital's expected death rate for CAP admissions is higher than the statewide death rate for CAP admissions, then patients at that hospital tend to be riskier than the statewide average. If a hospital's expected death rate is lower than the statewide death rate, then patients at that hospital tend to be healthier than the statewide average.

Risk-Adjusted Death Rate

The risk-adjusted (or indirectly standardized) death rate at a hospital equals the statewide rate, multiplied by the ratio of the number of observed deaths to the number of expected deaths at that hospital:[18]

$$I_i = s\left(\frac{\sum_{j=1}^{n_i} o_j}{\sum_{j=1}^{n_i} \hat{p}_j}\right) = s\frac{O_i}{\pi_i}$$

Where I_i is the indirectly standardized outcome rate for the ith hospital, s is the statewide outcome rate, o_j is the observed value of the adverse outcome (0 or 1) for the jth patient, and $\hat{p}_j$ is the estimated (expected) probability of the adverse outcome for the jth patient. The latter two variables are summed over all patients at the ith hospital.

The ratio of the number of observed deaths to the number of expected deaths at a hospital provides a quick assessment of that hospital's performance. For a hospital with fewer observed than expected deaths, this ratio is less than one; for a hospital with more observed than expected deaths, this ratio is greater than one. This risk-adjusted death rate provides a basis for comparing the performance of different hospitals, because each hospital's rate is adjusted to reflect what its death rate would be if its patients were about as ill as the statewide average.

Confidence Limits for Risk-Adjusted Death Rates

The size of the confidence interval indicates the reliability a hospital's risk-adjusted death rate. In general, when the upper and lower confidence limits are far apart, the estimated risk-adjusted death rate is unreliable. Assuming that the risk model is accurate, there is a 98 percent chance

that it falls within 98 percent confidence limits. Confidence limits were constructed from the standard deviation and the number of observed deaths at each hospital.[19]

---

[17] All analyses in this report were conducted using SAS Statistical Software, Version 8.2, SAS Institute Inc., Cary N.C. Estimated probabilities of death within 30-days of admission were calculated using PROC LOGISTC.
[18] Williams RL. Measuring the effectiveness of perinatal medical care. Medical Care 1979; 17:95-110.
[19] The methodology used to calculate these limits is described on page 93 of Chapter Eleven in the *Technical Appendix for the 1991-1993 Heart Attack Outcomes report* (www.oshpd.ca.gov).

Mortality Results

Risk-adjusted hospital outcomes based on both models are summarized in Chart 1. A row in the chart where DNR is designated as “No” indicates risk-adjusted rate of 30-day mortality using the model that does *not include DNR* as a risk factor. A row where DNR is designated as “Yes” indicates risk-adjusted 30-day mortality using the model that *includes DNR* status as a risk factor. The hospitals in Chart 1 are alphabetically listed within each county. Hospitals rated significantly better or significantly worse than expected using *both* models are highlighted with gray.

If you cannot find a particular hospital in Chart 1, it is possible that the hospital does not treat community-acquired pneumonia patients or that it is listed under another name. Separate listings of hospitals rated significantly better than average or significantly worse than average may be found in the main body of this report.

Comparing Observed and Expected Mortality

For either risk-adjustment model, two separate one-tailed analyses of statistical significance were performed to determine whether hospitals showed mortality rates that were significantly better (lower) or significantly worse (higher) than expected. Differences that, according to statistical theory, would be expected to occur by chance less than one time in a hundred were considered significant. Such differences are represented by the term “$p<0.01$.” This is a relatively strict level of statistical significance that helps to discriminate hospitals that were “better” or “worse” than expected from those that performed “as expected” when compared to the state average.

The exact probability of the number of observed deaths (or a more extreme number) occurring by chance, given the number of expected deaths at a hospital, was used to identify outlier hospitals. This approach differs from the more widely used normal approximation in that it relies on fewer distributional assumptions and gives better estimates for hospitals with relatively few expected deaths.[20]

If the number of observed deaths exceeded the number of expected deaths, an upper probability (p) value was computed. If the number of observed deaths was less than or equal to the number of expected deaths, a lower probability (p) value was computed. The classification of a hospital’s CAP death rate as "significantly better than expected," "significantly worse than expected," or "not significantly different than expected" was based on a p-value threshold of 0.01. Hospitals classified as significantly better than expected had fewer deaths than expected and a p-value less than 0.01. Hospitals classified as significantly worse than expected had more deaths than expected and a p-value less than 0.01. This is equivalent to a two-tailed significance test based on a 98 percent confidence interval.

Hospitals showing mortality rates significantly better than expected ($p<0.01$) are represented by a plus sign (+). Hospitals showing mortality rates significantly worse than expected ($p<0.01$) are represented by a minus sign (−). Hospitals that were not significantly different than expected (i.e. that were in a middle range because they were neither significantly better nor significantly worse) are not assigned a symbol. An asterisk (∗) represents hospitals that had no CAP-related deaths between 1998-2000, but treated too few community-acquired pneumonia cases to be classified as significantly better than expected.

[20] Luft HS, Brown BW Jr. Calculating the probability of rare events: Why settle for an approximation? Health Services Research 1993; 28:419-439.

Symbols representing results:

(+) Significantly better than expected ($p<0.01$)
(–) Significantly worse than expected ($p<0.01$)
(0) No deaths reported, and too few cases to determine statistical significance

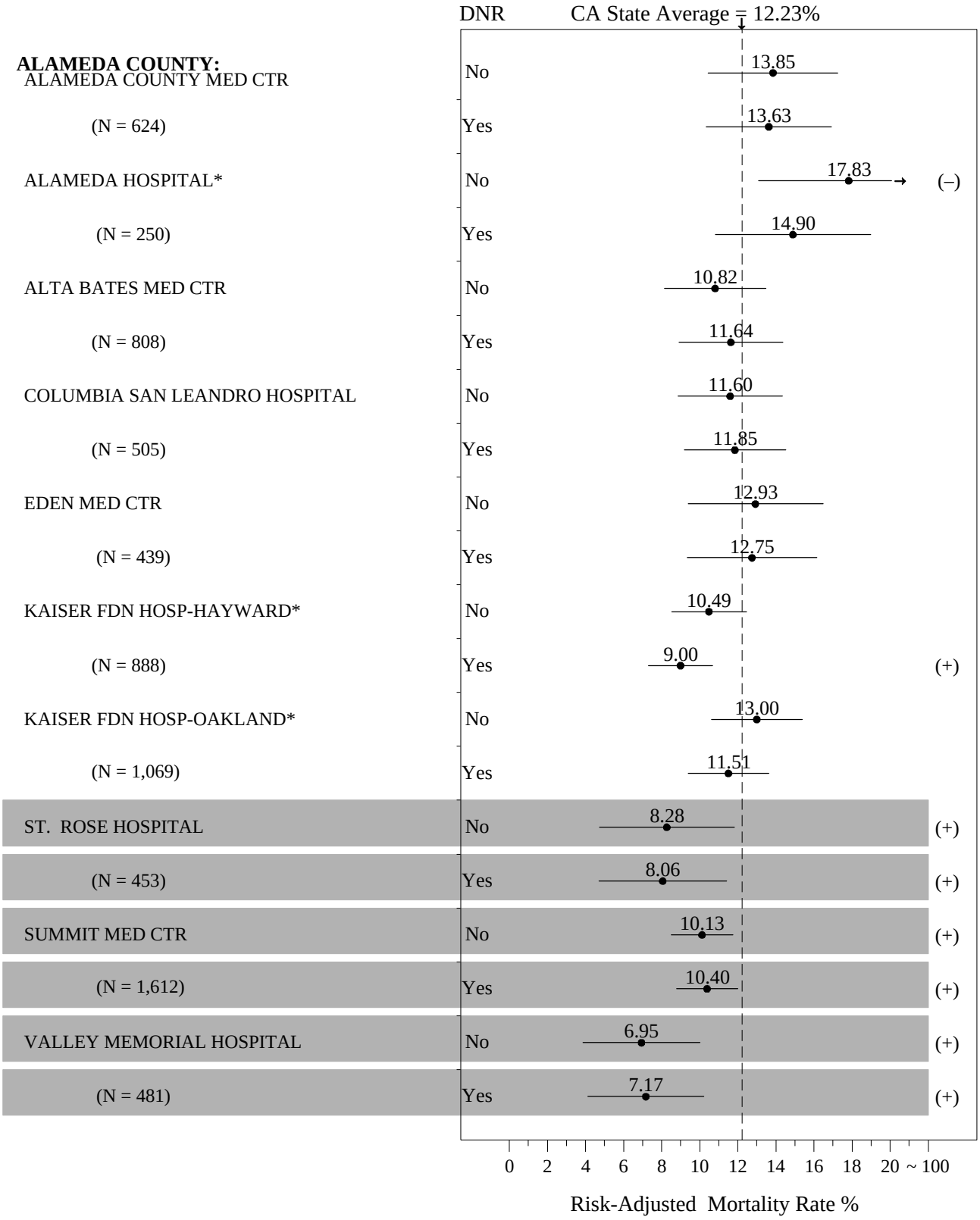
Absence of a symbol indicates performance "as expected"

Comparing Risk-Adjusted Hospital Rates with the Statewide Death Rate

Chart 1 compares the risk-adjusted death rates of hospitals to the statewide rate using both models. The black solid circle (●) on a row's horizontal bar marks the hospital's risk-adjusted mortality rate. The number on the bar is a hospital's risk-adjusted 30-day mortality rate. A vertical hyphenated line extending from the top to the bottom of the chart represents the overall, statewide 30-day mortality rate for CAP admissions.

Two separate one-tailed, 1 percent significance tests were combined to produce the 98 percent confidence intervals around a risk-adjusted rate. The bars represent the 98 percent confidence bounds surrounding an adjusted mortality rate. If each hospital's population of CAP patients in this report is viewed as a separate random sample from the state's population of hospital admissions, then the interval may be interpreted to mean that there is a 98 percent probability that any given hospital's true risk-adjusted mortality rate falls somewhere along that bar. Therefore, if the bar crosses the state average, the hospital's 30-day mortality rate is considered "not significantly different" from the state average. If the bar does not cross the state average, then the difference between the hospital's 30-day mortality rate and the state's rate is considered "statistically significant." In a few instances, the bar representing a hospital's confidence interval was too wide to completely fit onto Chart 1. When this happened, a portion of the interval on one side of a mortality rate (●) was truncated, as represented by an arrow (← or →) at the end of the bar. In general, the more cases a hospital admits, the smaller the confidence interval surrounding its risk-adjusted rate. This is because, according to statistical theory, larger samples yield more reliable results.

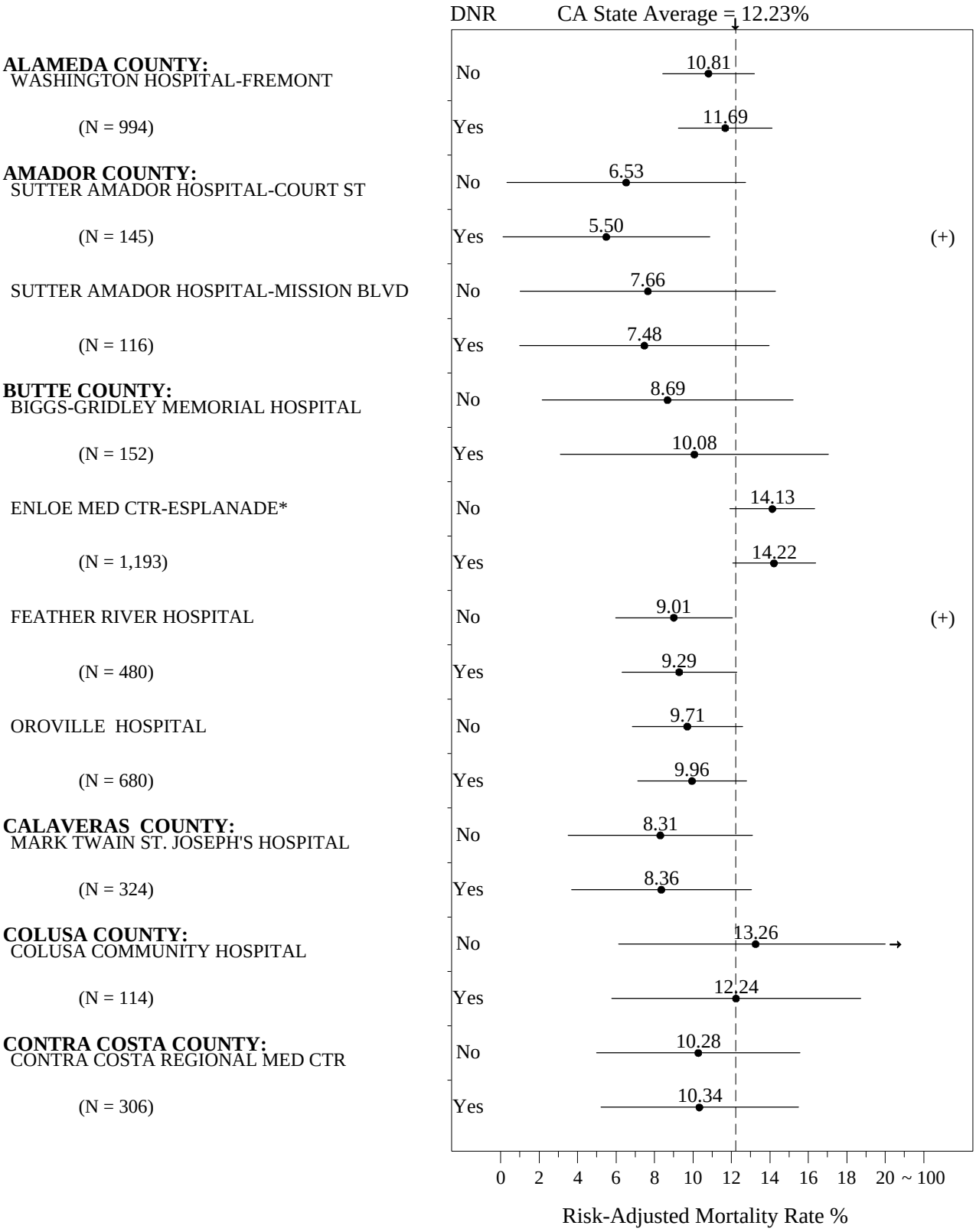
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix2 .

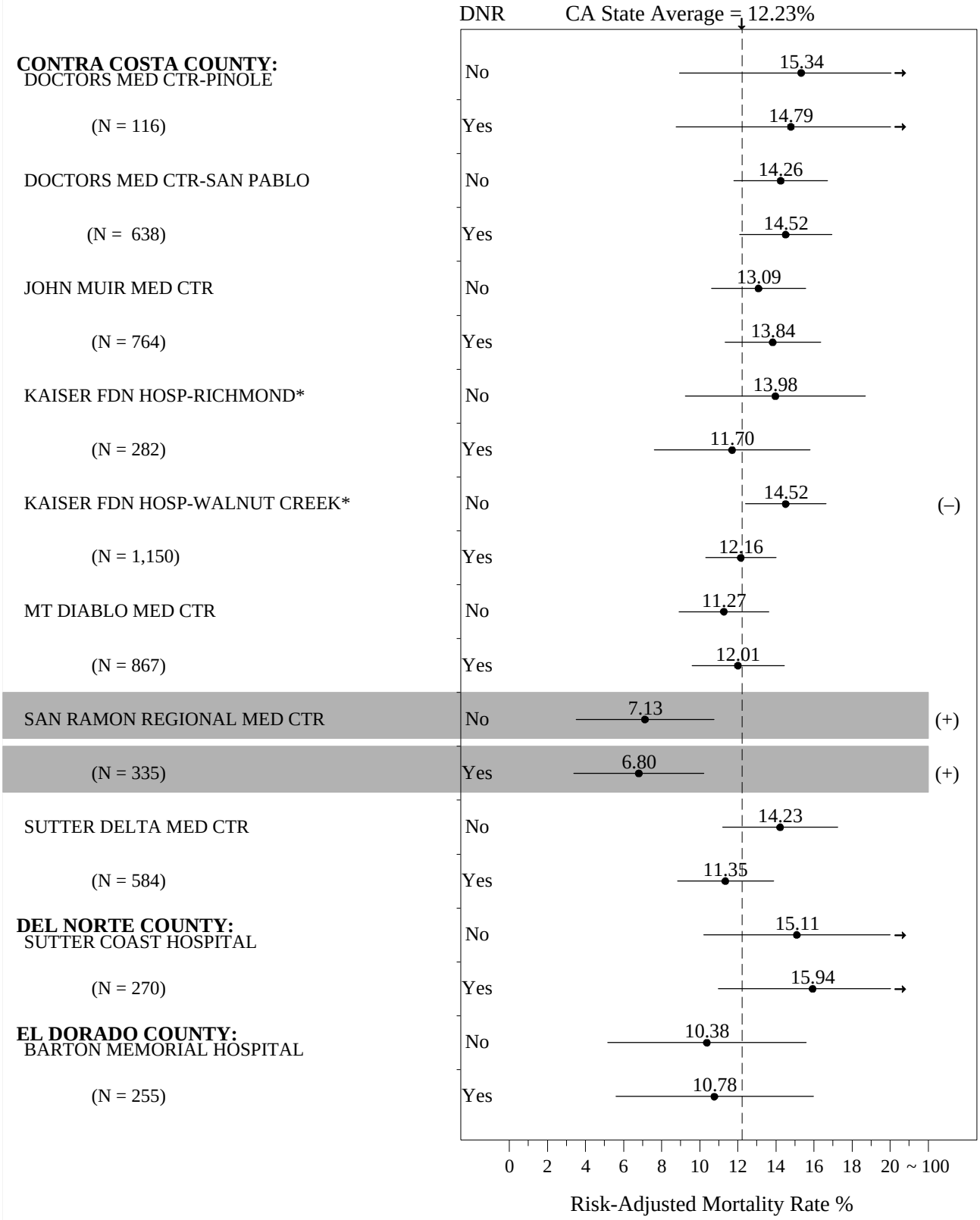
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

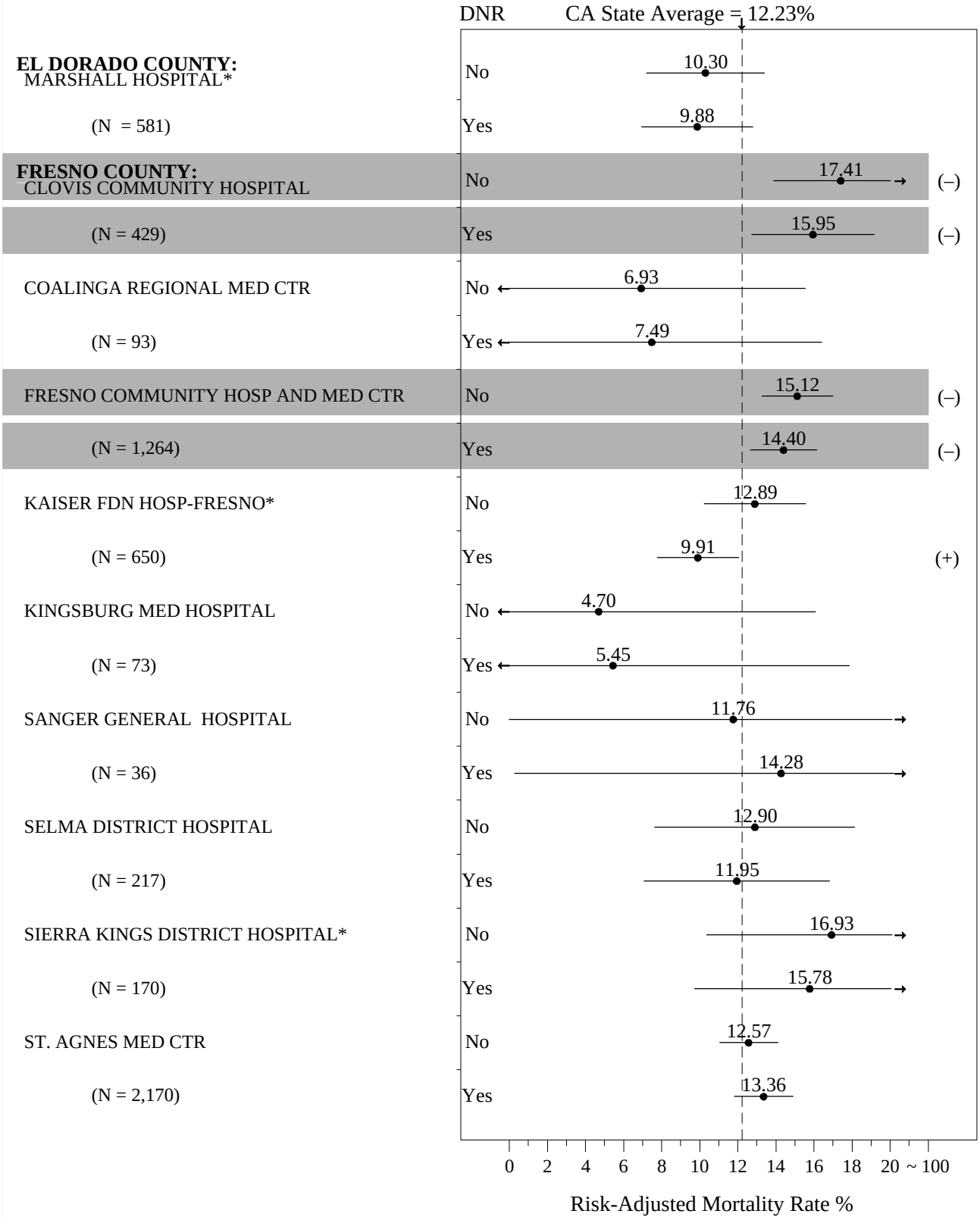
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

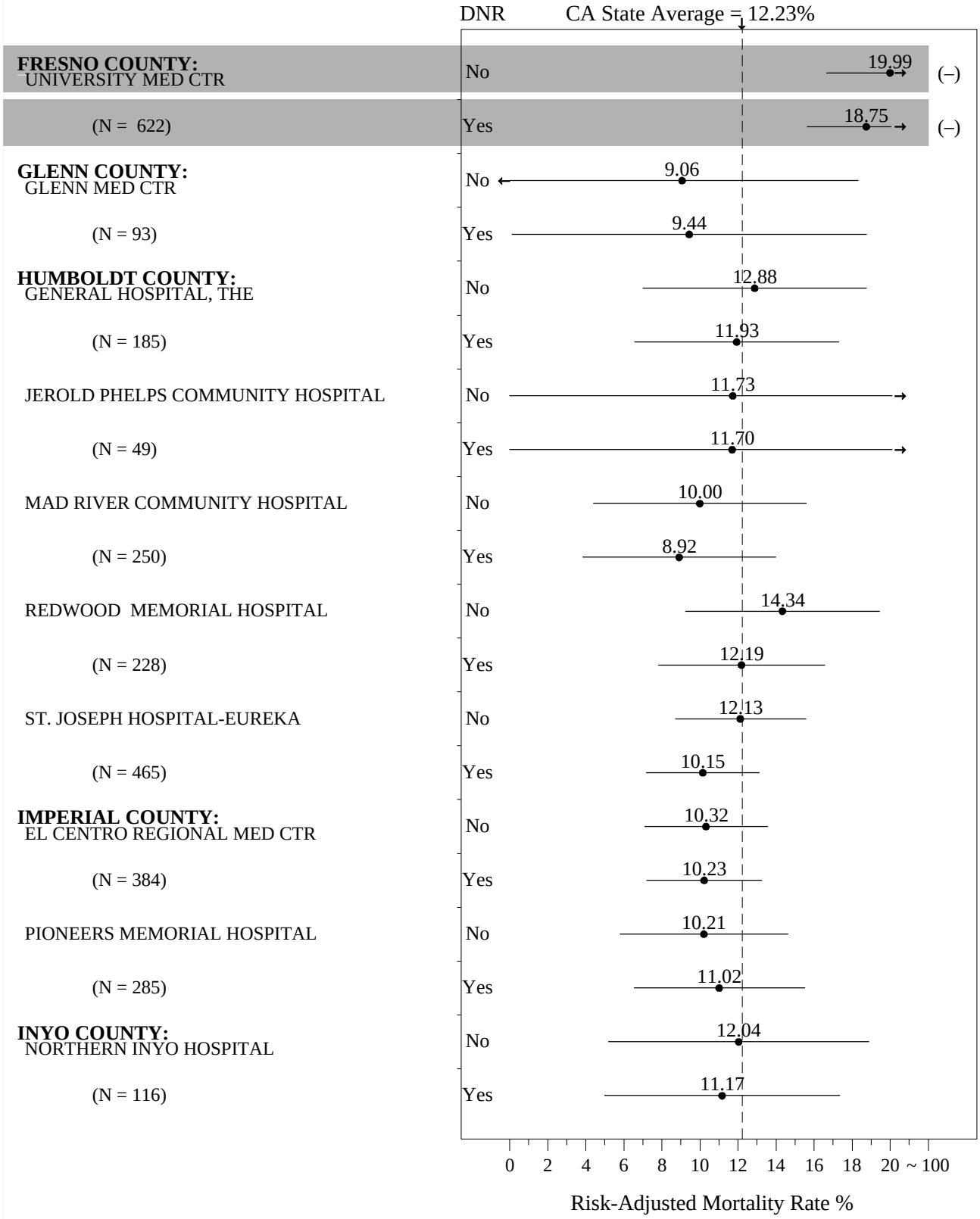
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

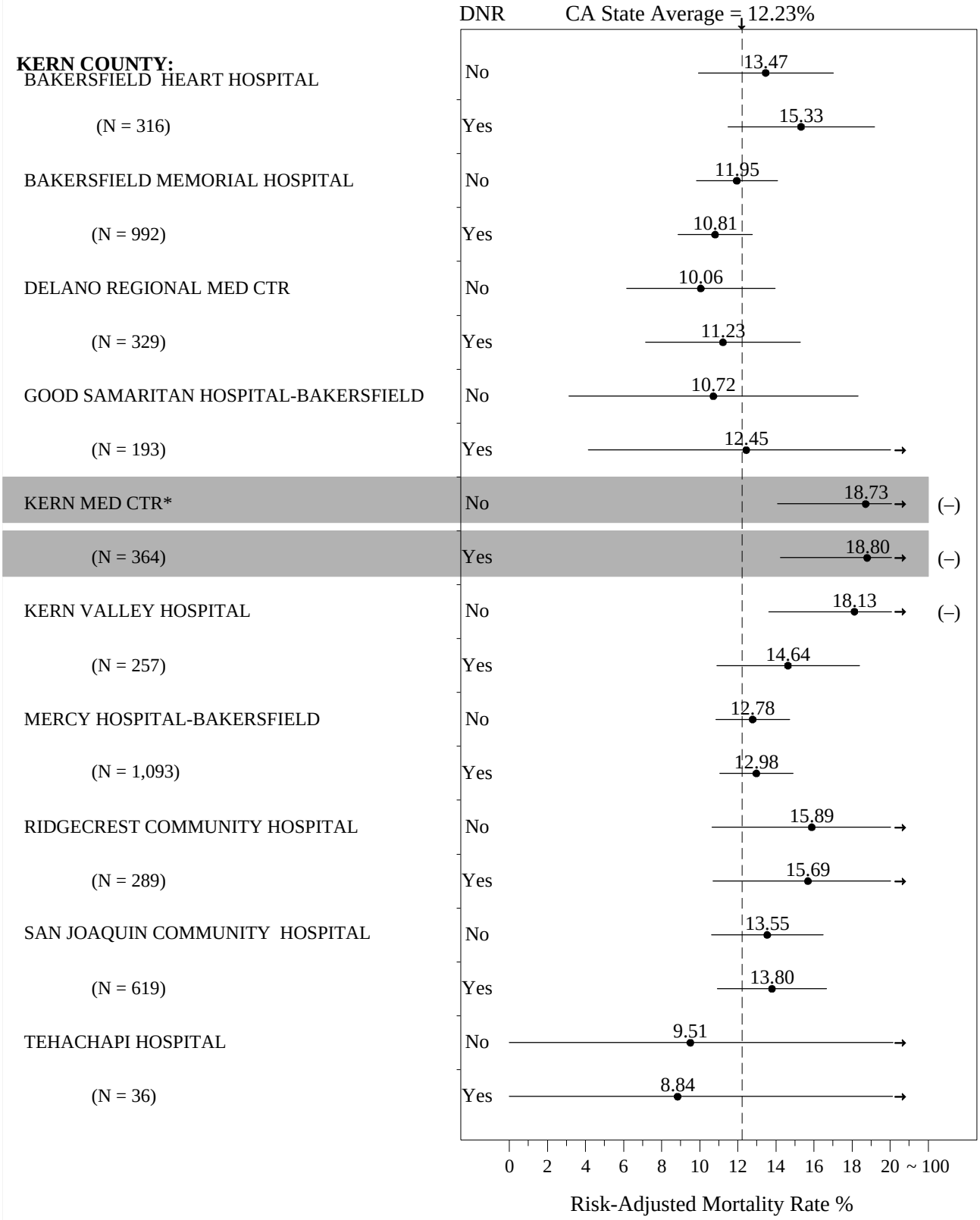
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—•— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

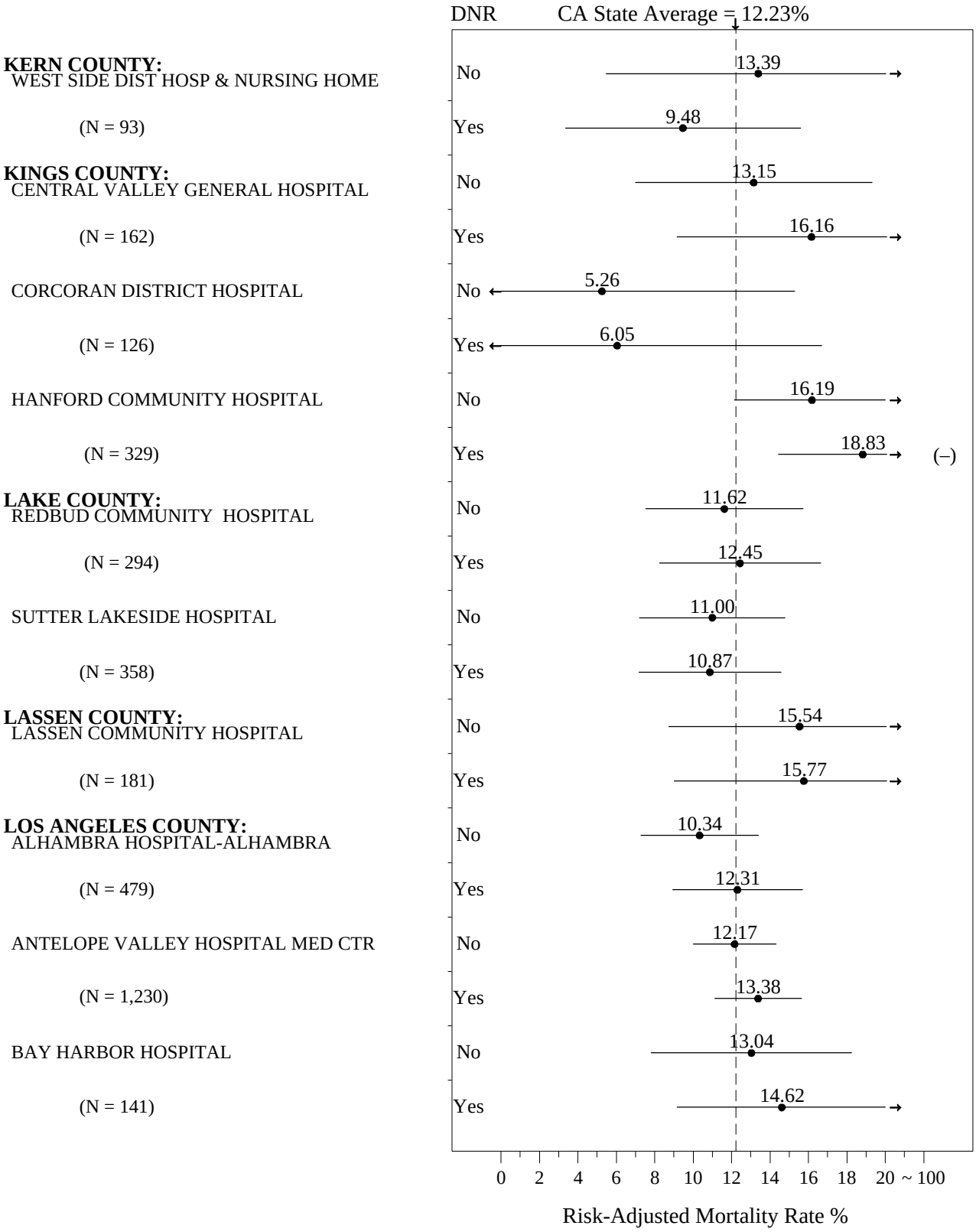
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

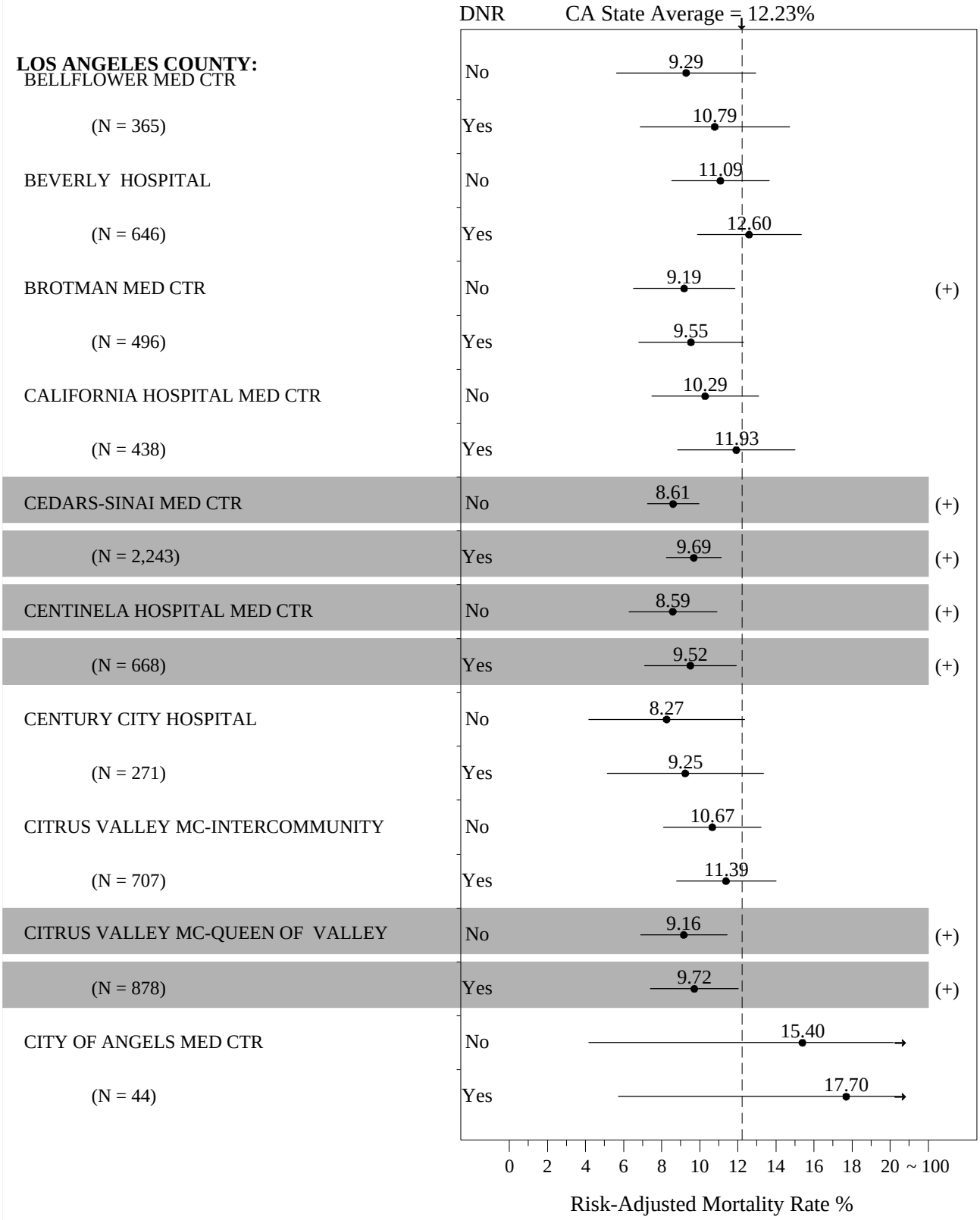
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

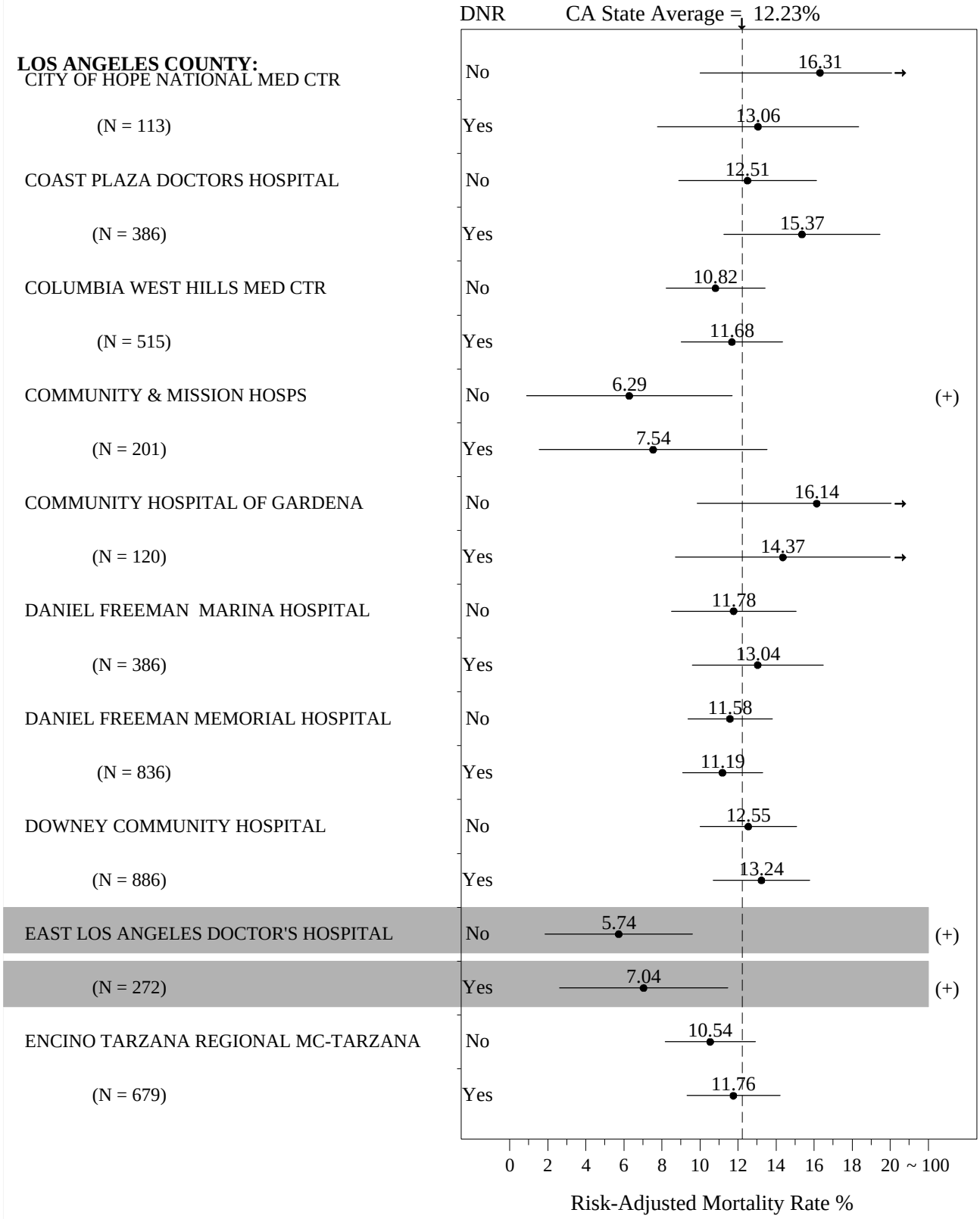
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—•— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

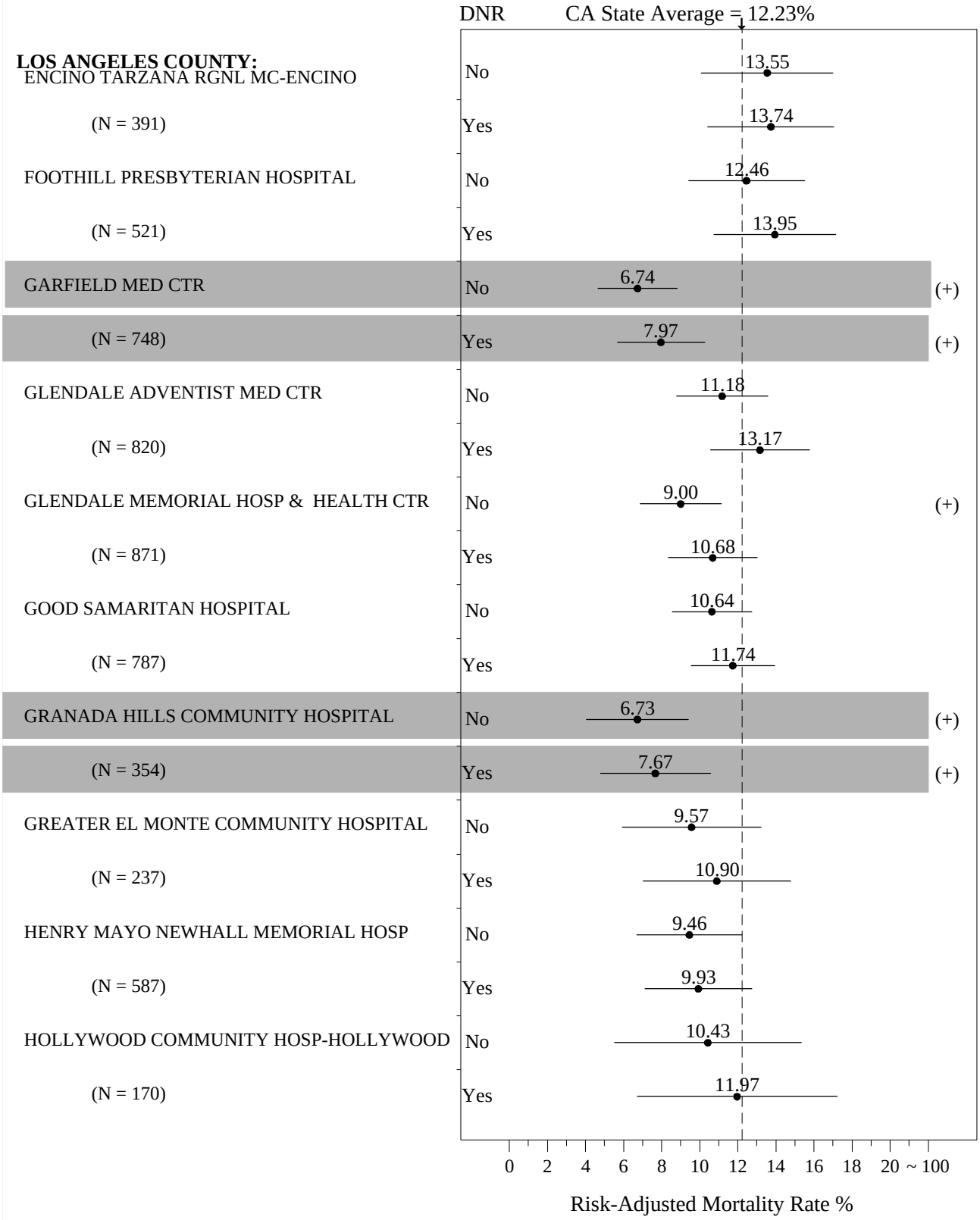
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

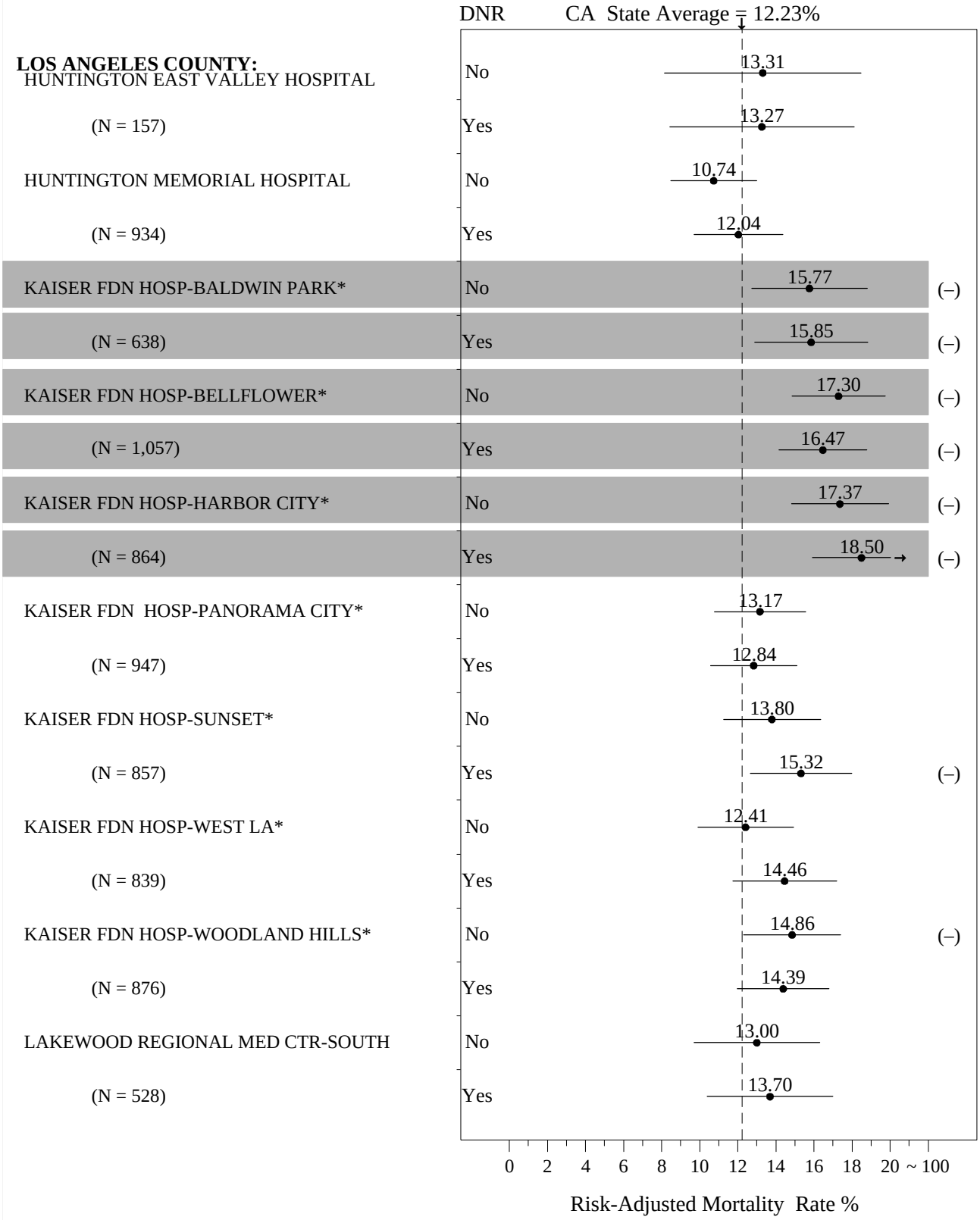
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

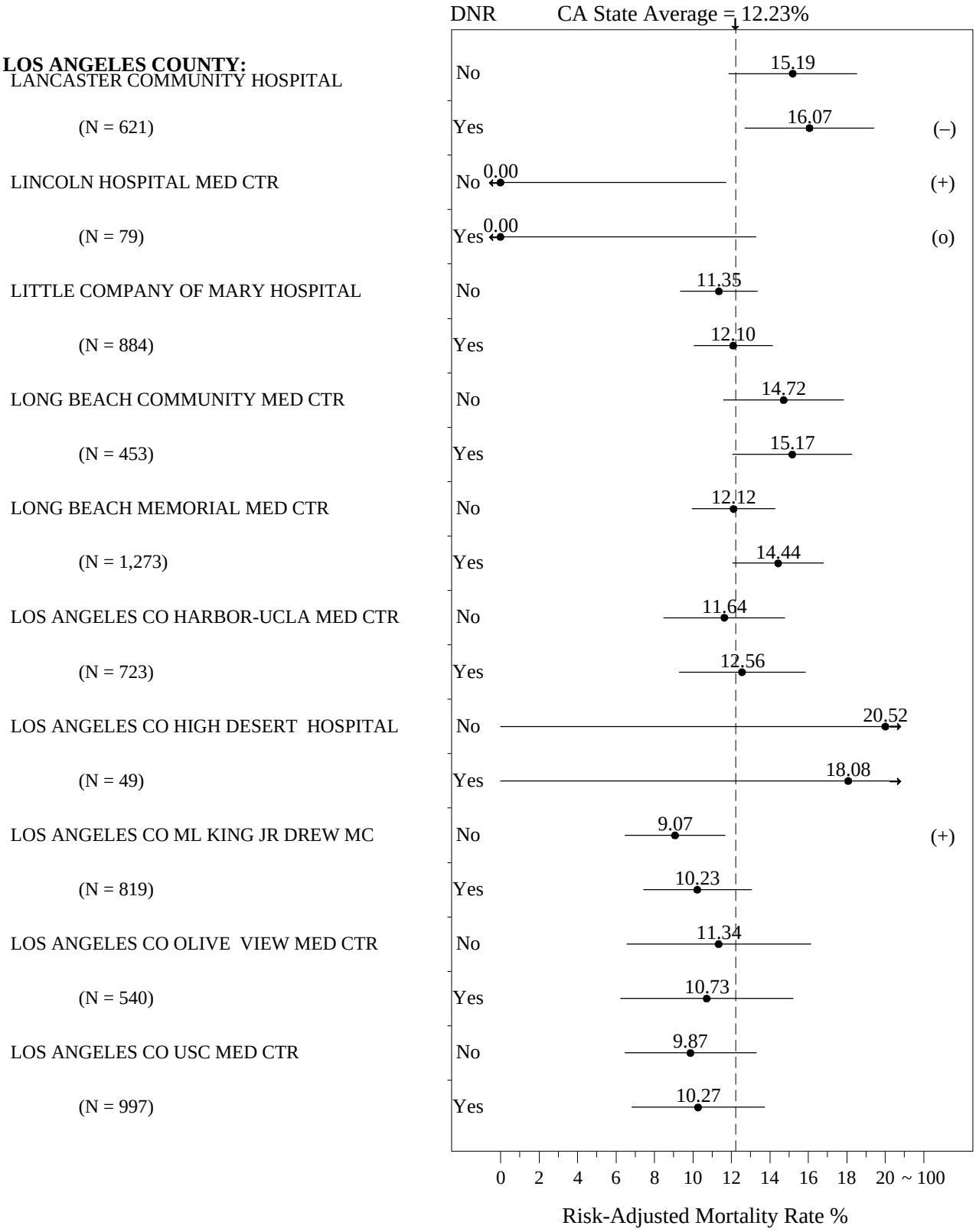
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

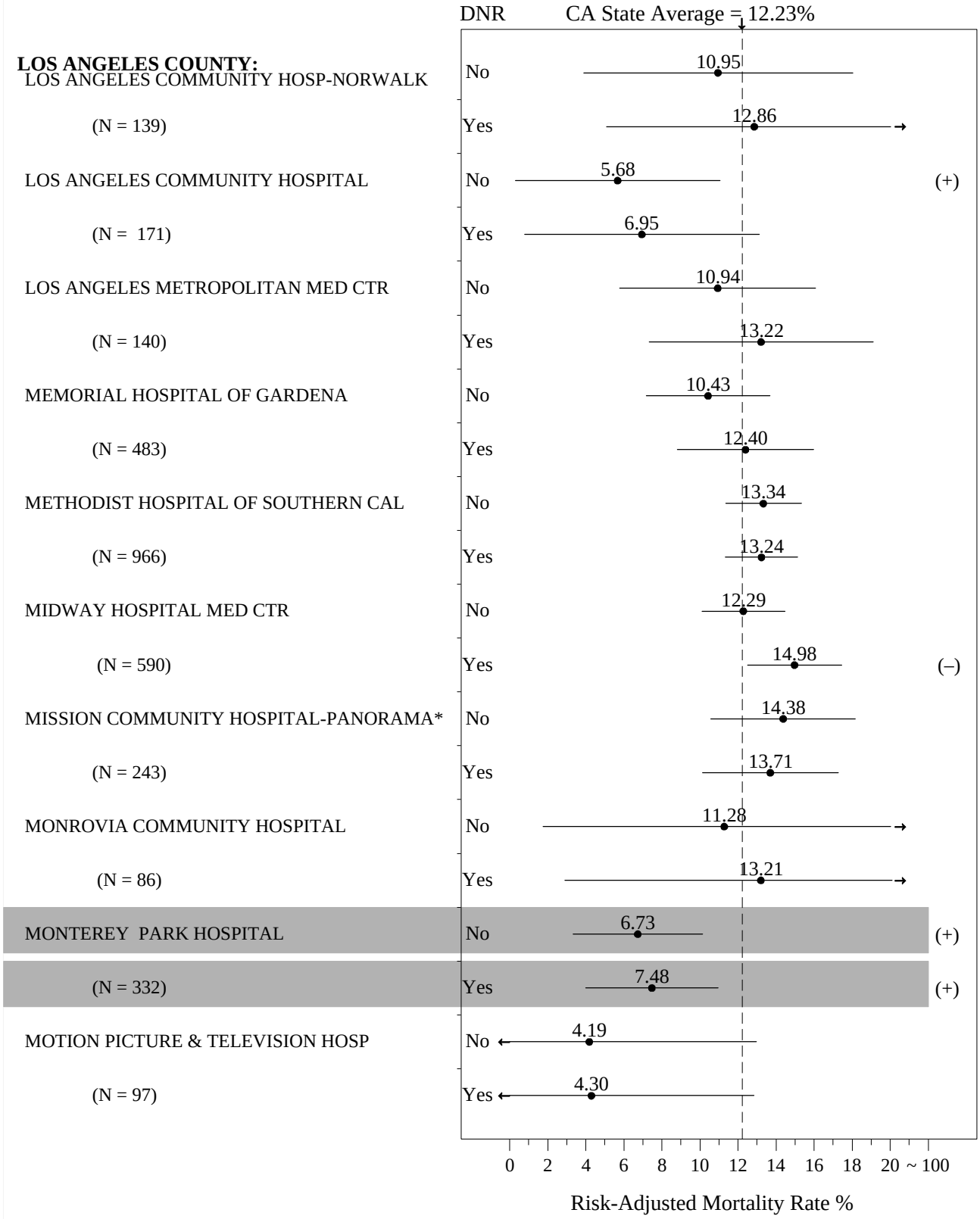
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●—	Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷	Indicates that interval extends beyond graph.
N =	Number of patients
(+)	Mortality rate significantly lower than statewide rate (P-value < .01).
(–)	Mortality rate significantly higher than statewide rate (P-value < .01).
(o)	No deaths reported; too few cases for statistical significance.

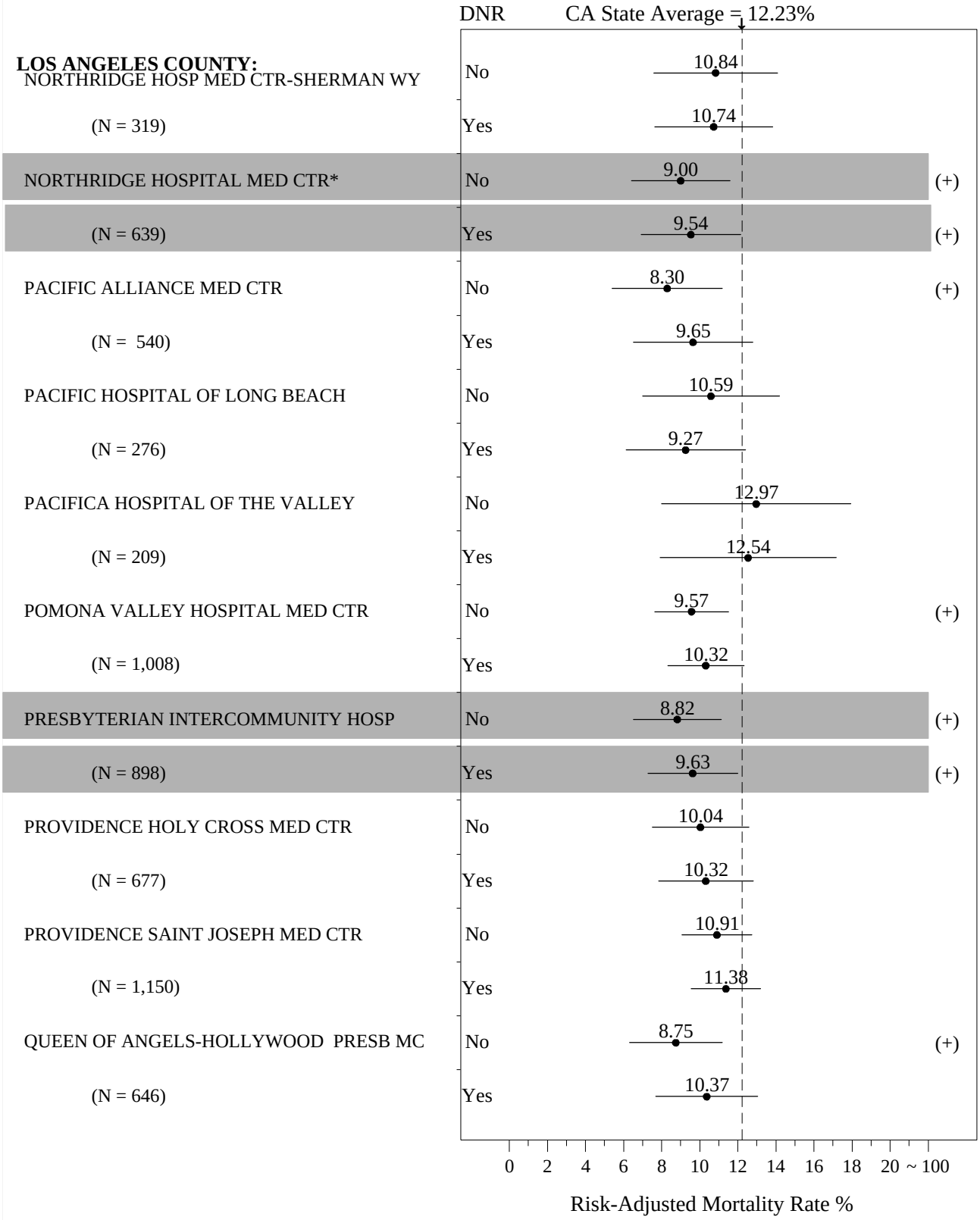
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

- Risk-adjusted mortality rate and confidence interval width (98% CI).
- ⟷ Indicates that interval extends beyond graph.
- N = Number of patients
- (+) Mortality rate significantly lower than statewide rate (P-value < .01).
- (–) Mortality rate significantly higher than statewide rate (P-value < .01).
- * Hospital comments letter received. See Appendix 2.

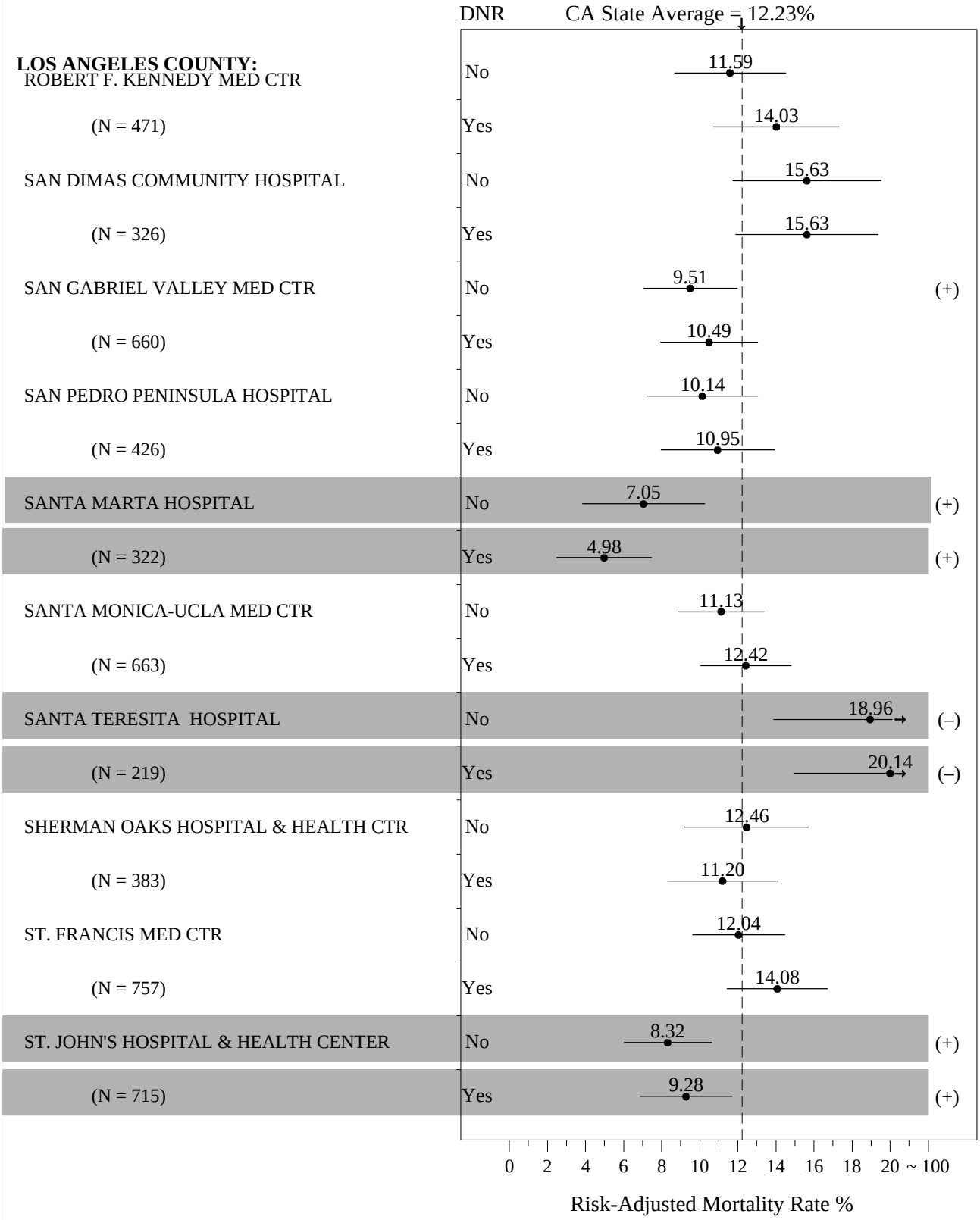
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

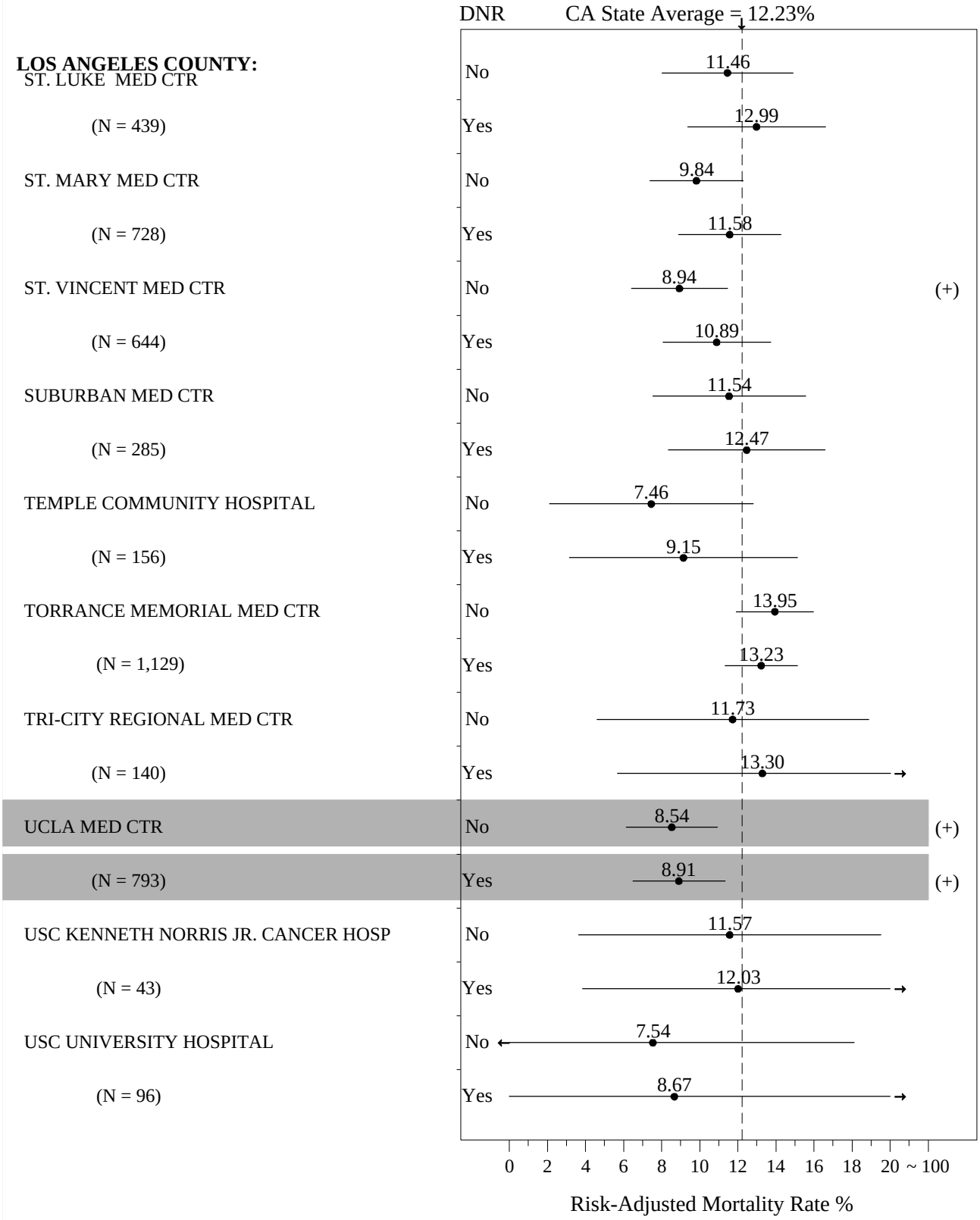
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

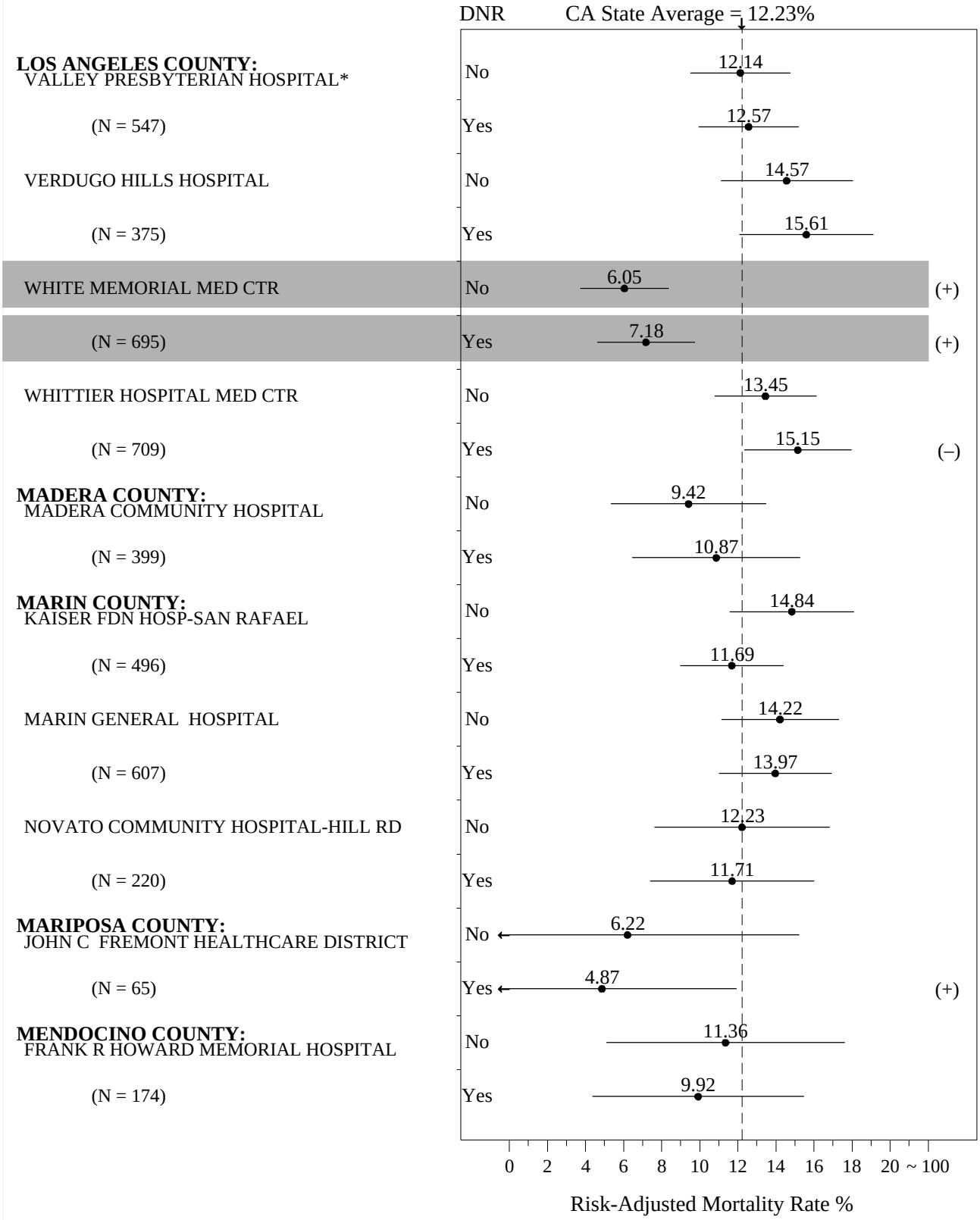
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

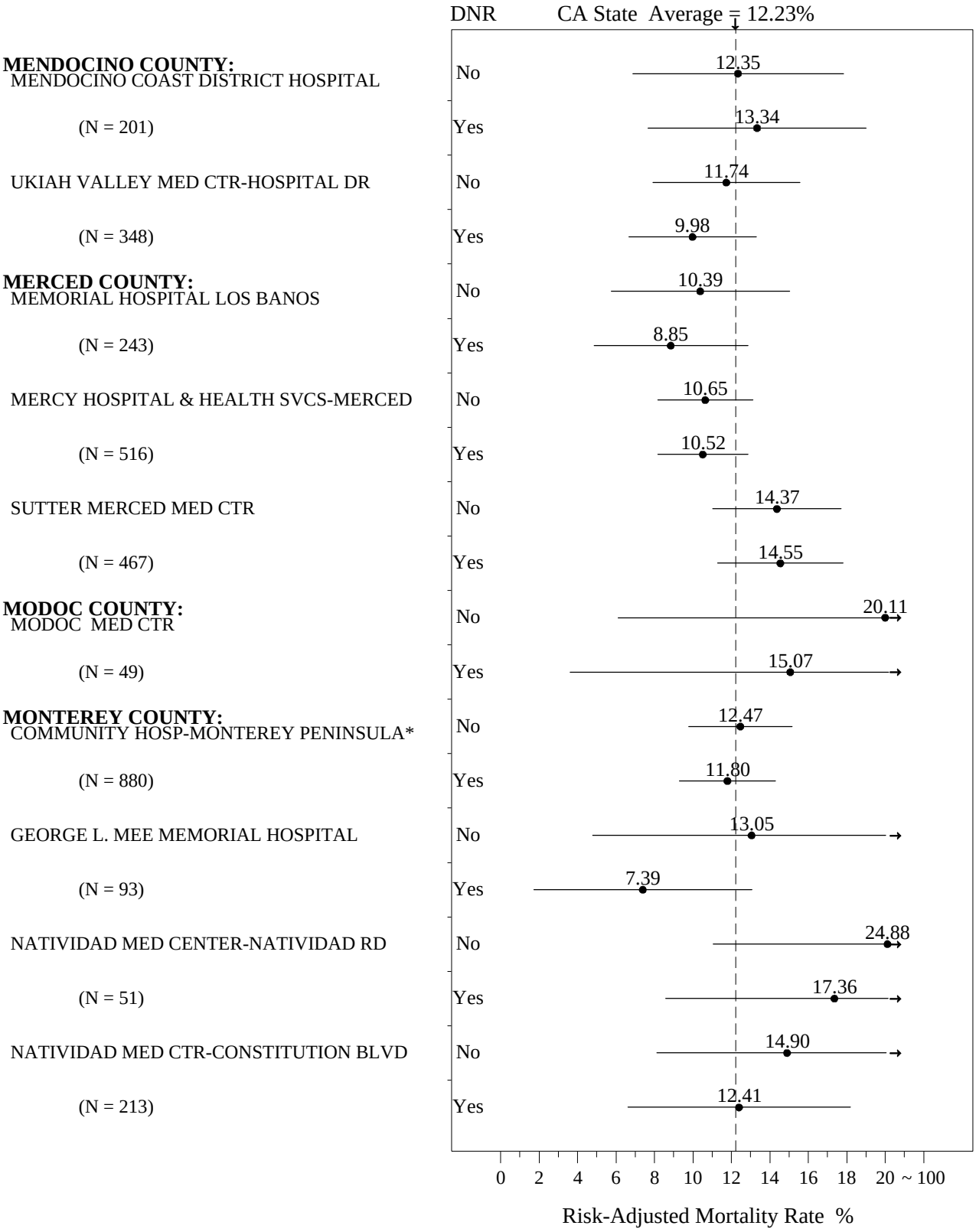
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

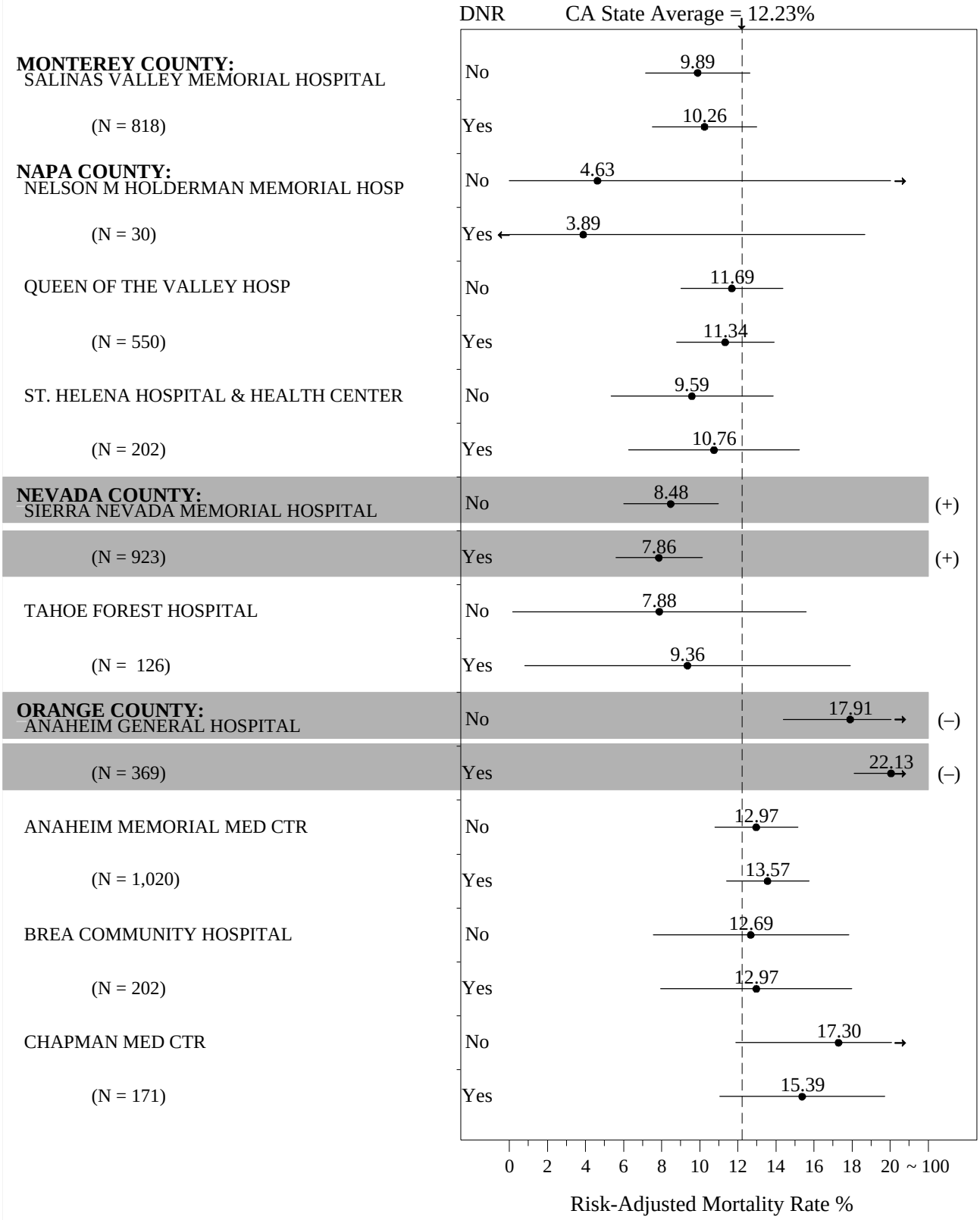
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

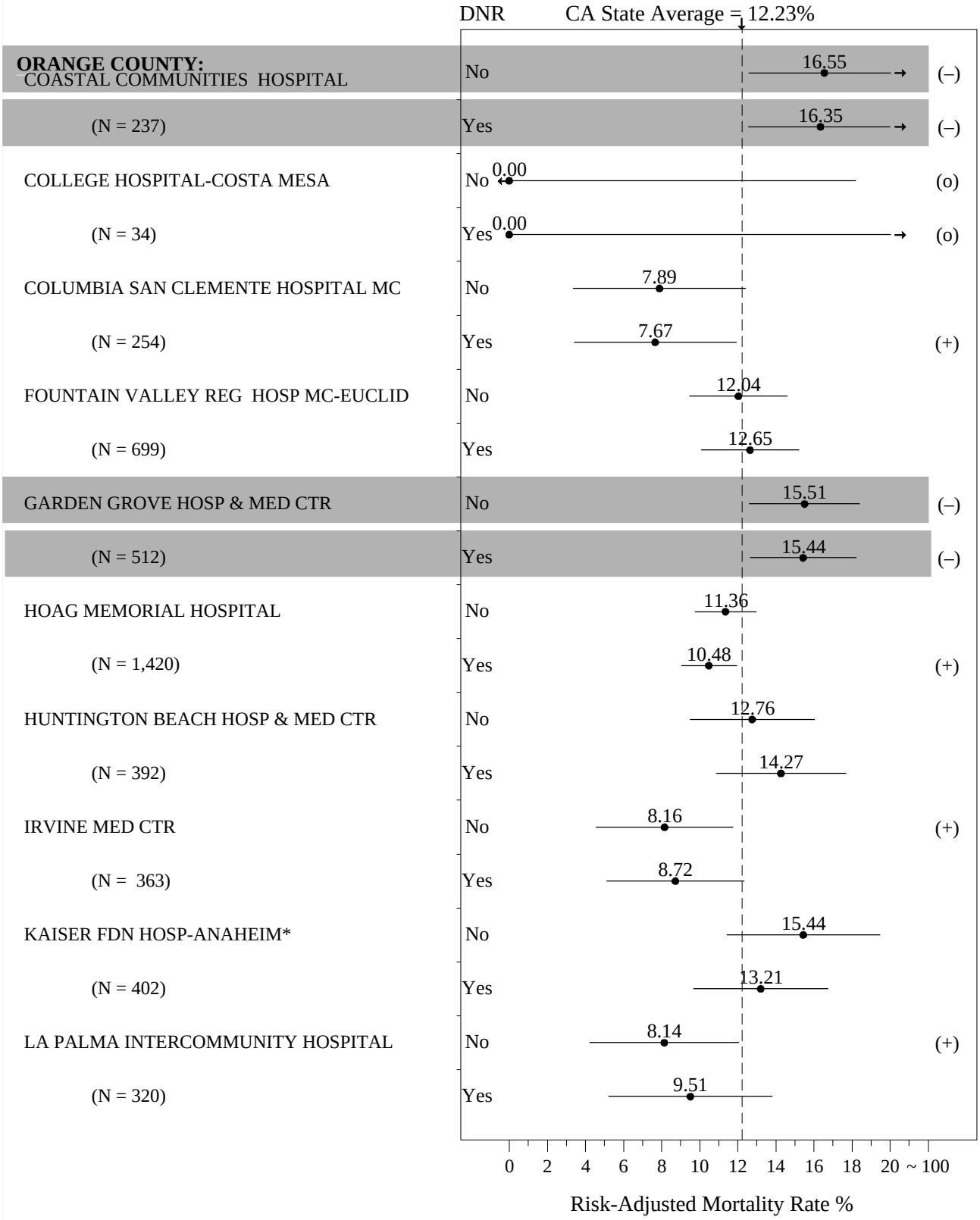
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—•— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).

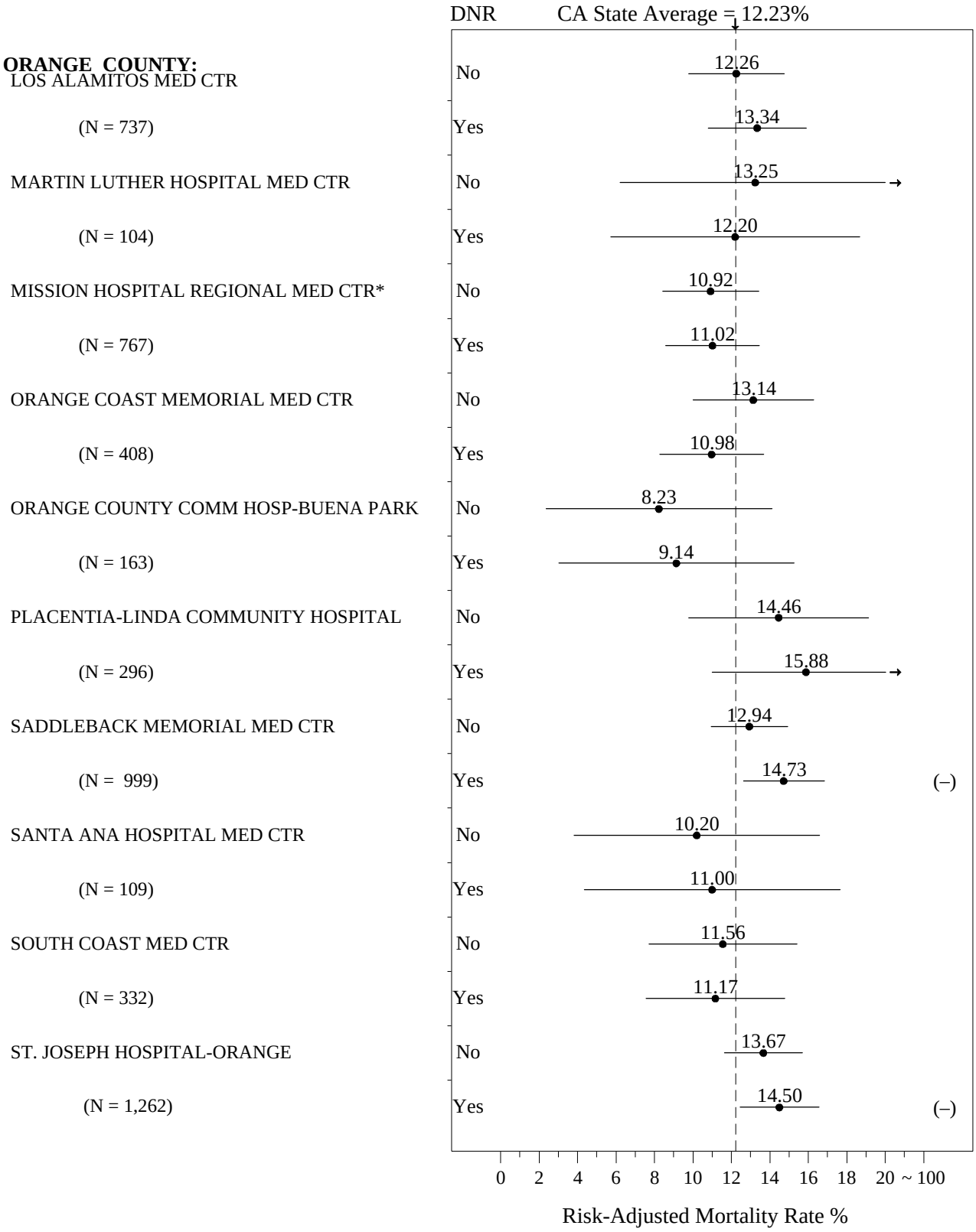
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients; (o) = No deaths; too few cases for statistical signif.
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

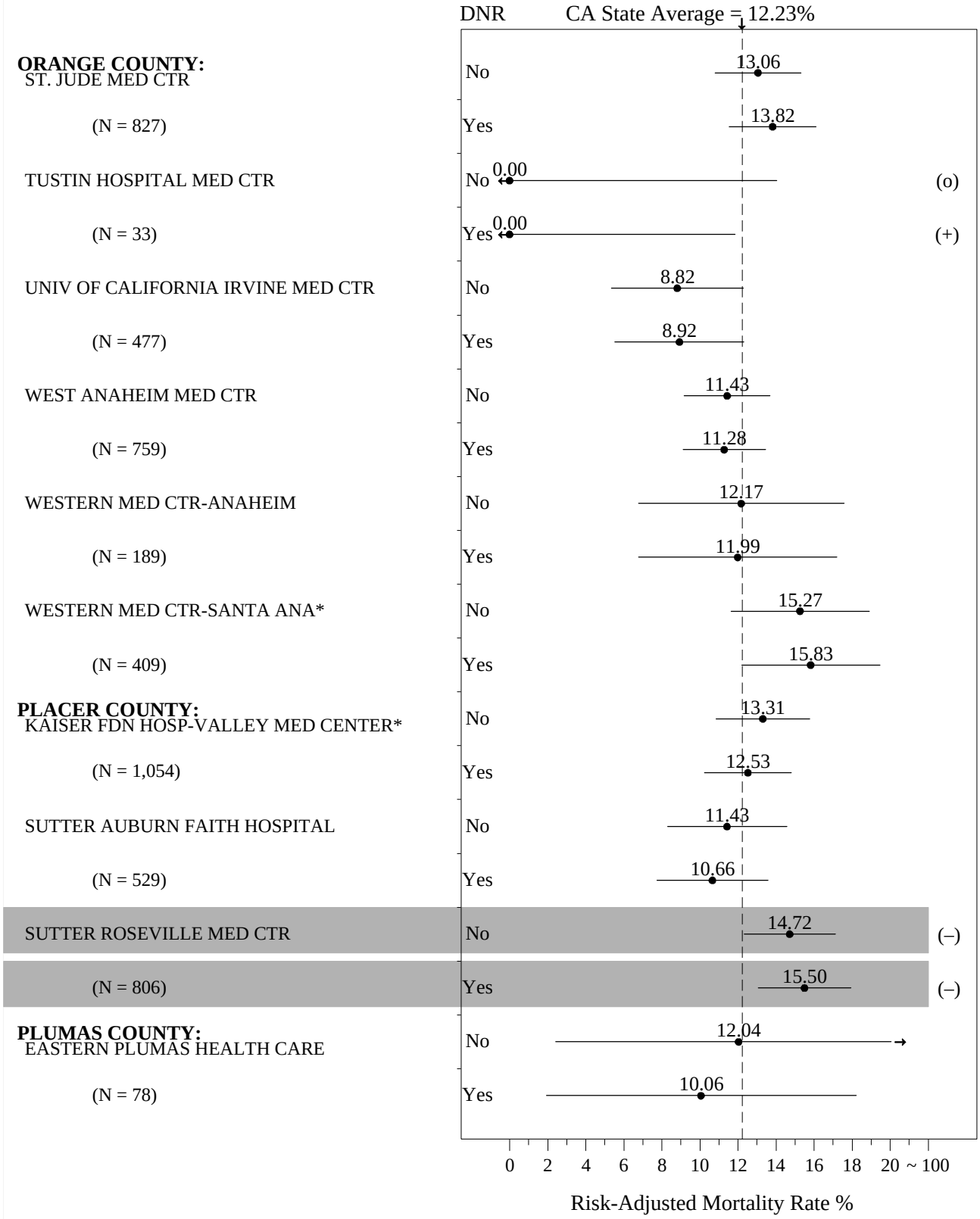
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

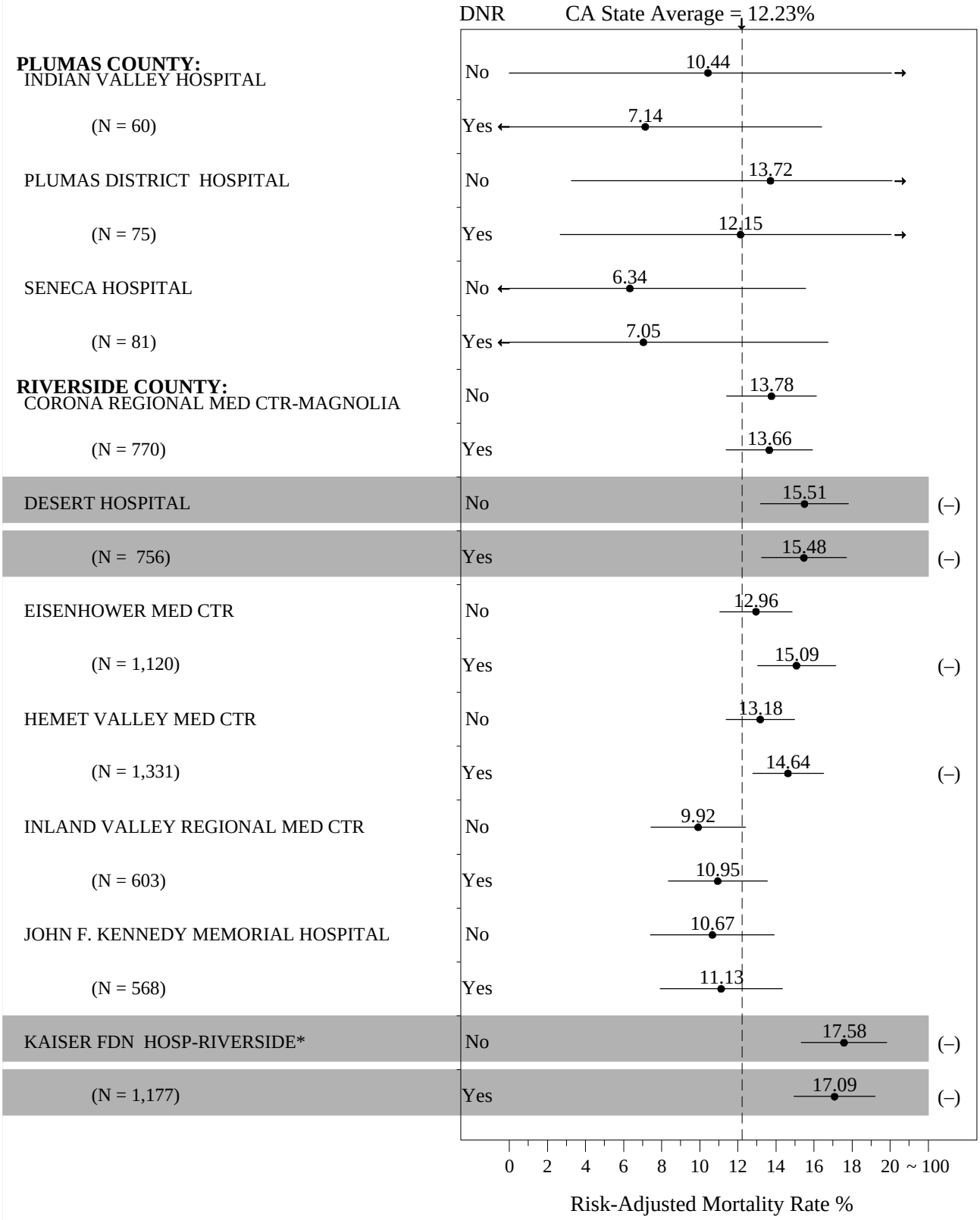
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients; (o) = No deaths; too few cases for statistical signif.
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

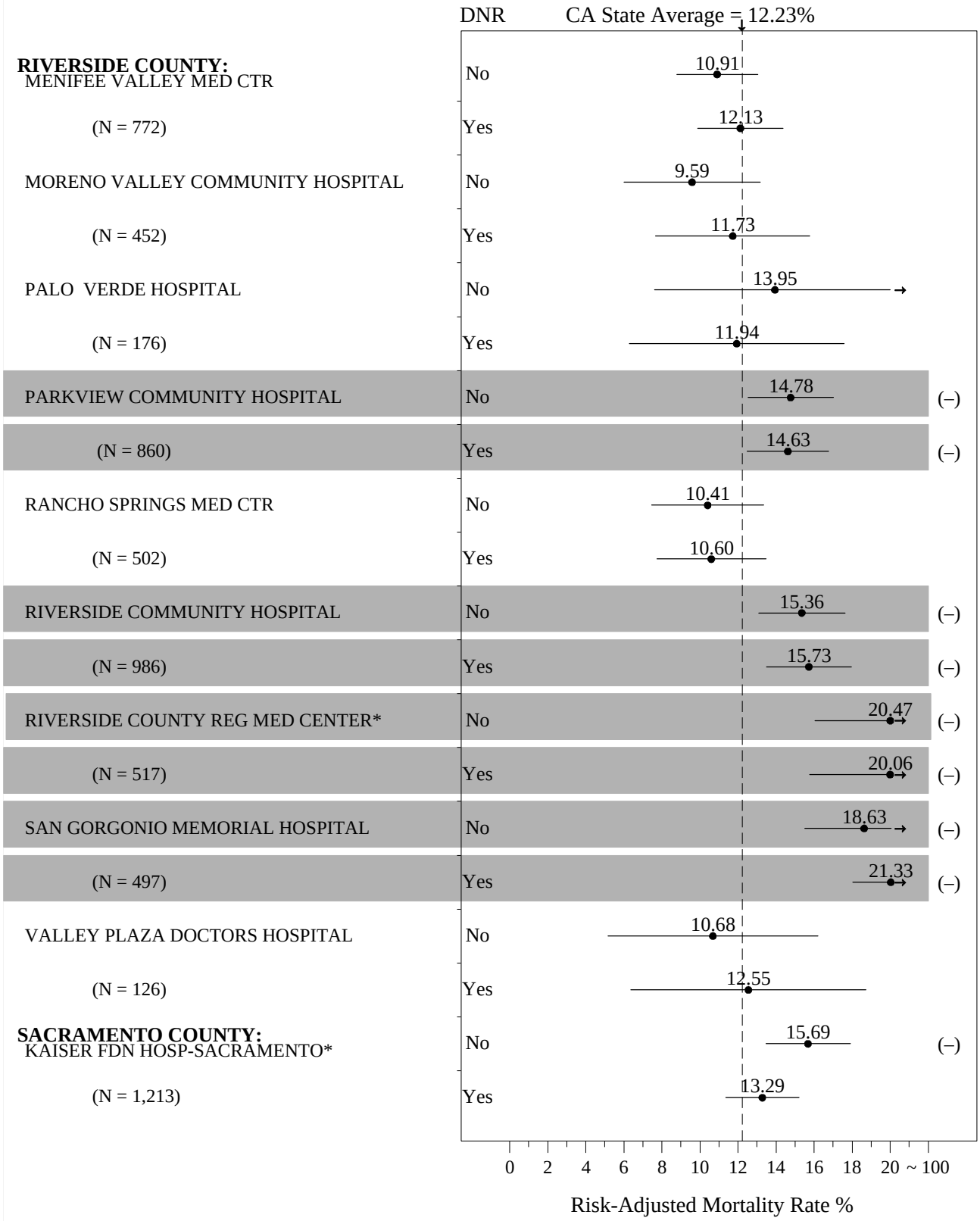
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

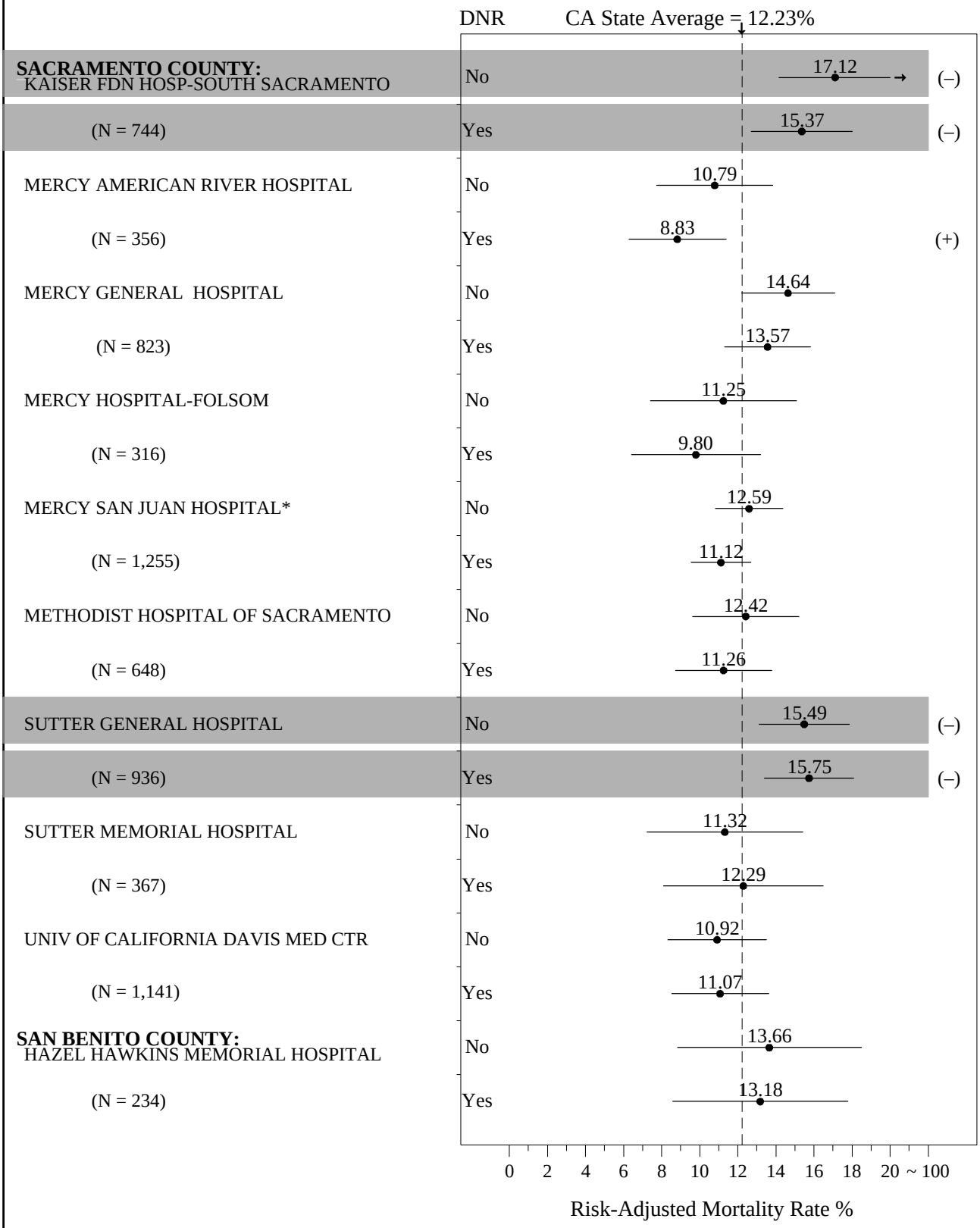
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

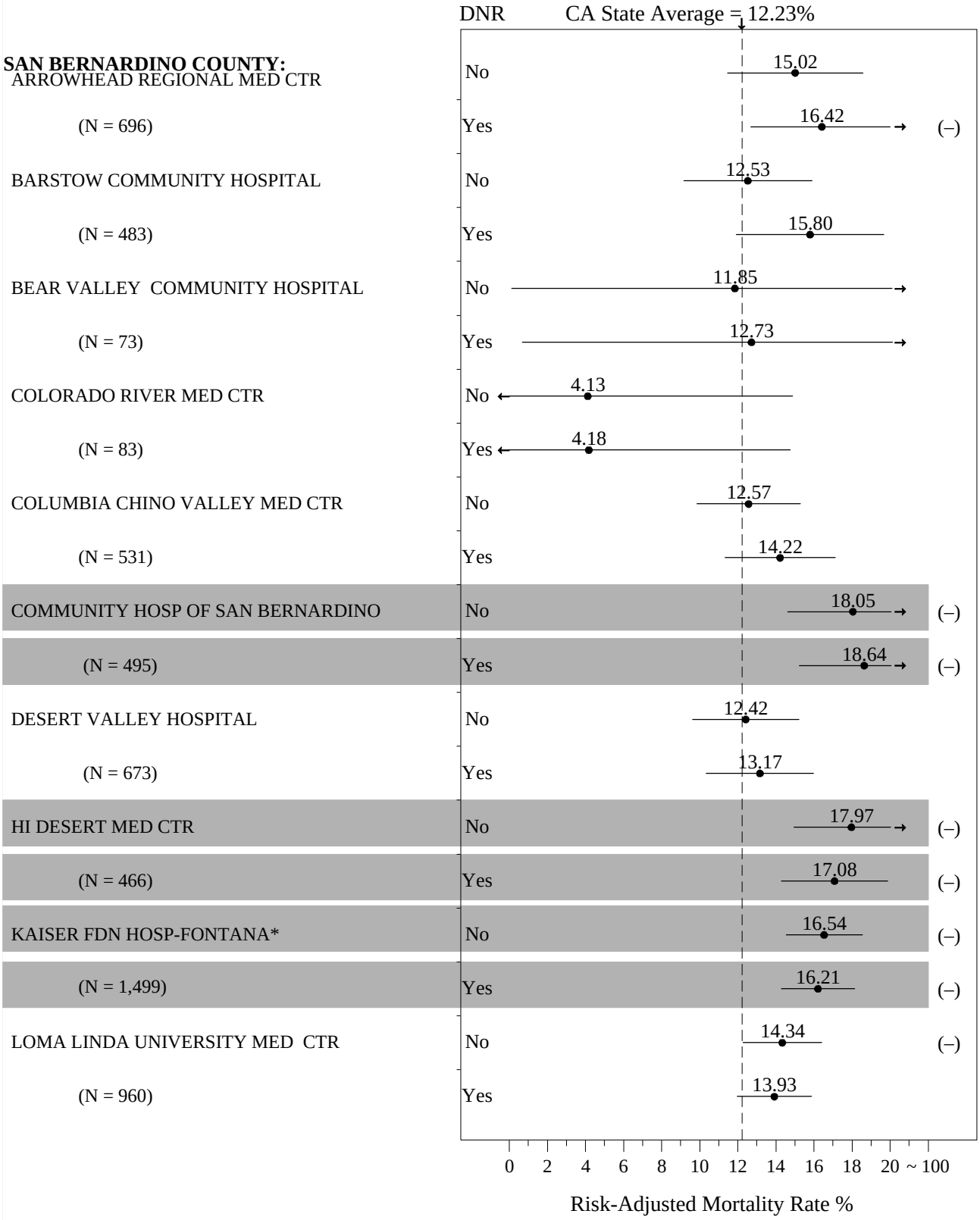
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

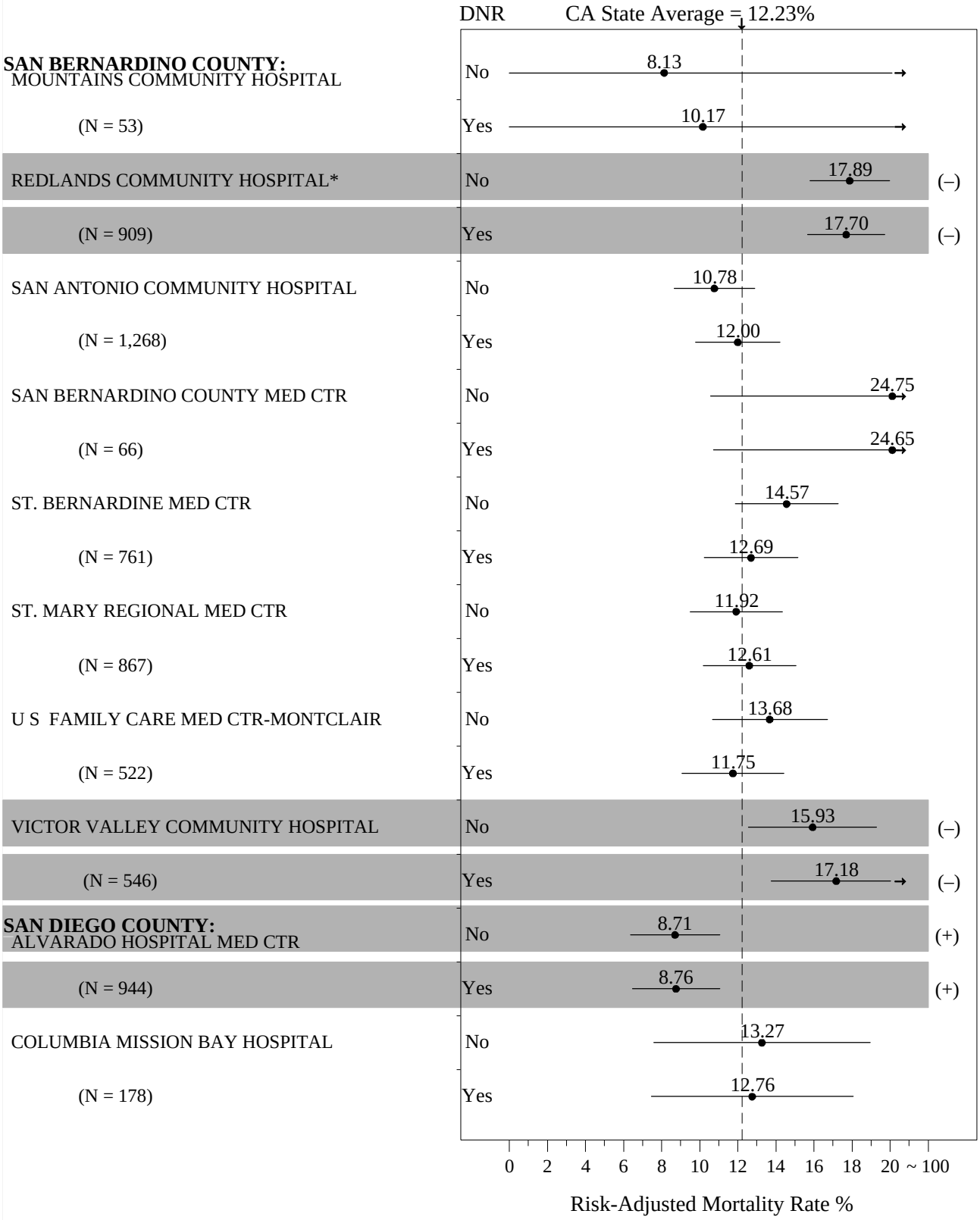
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

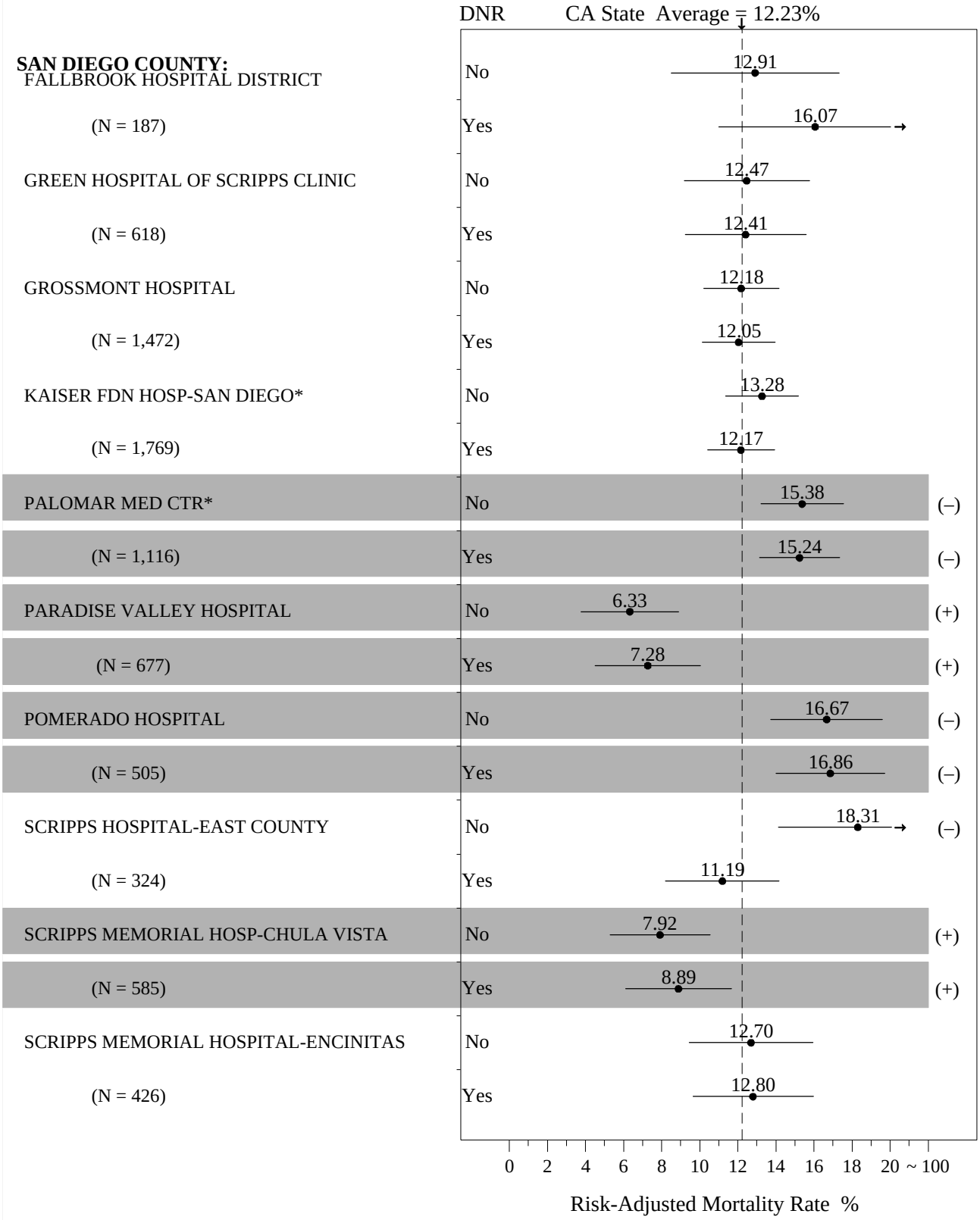
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

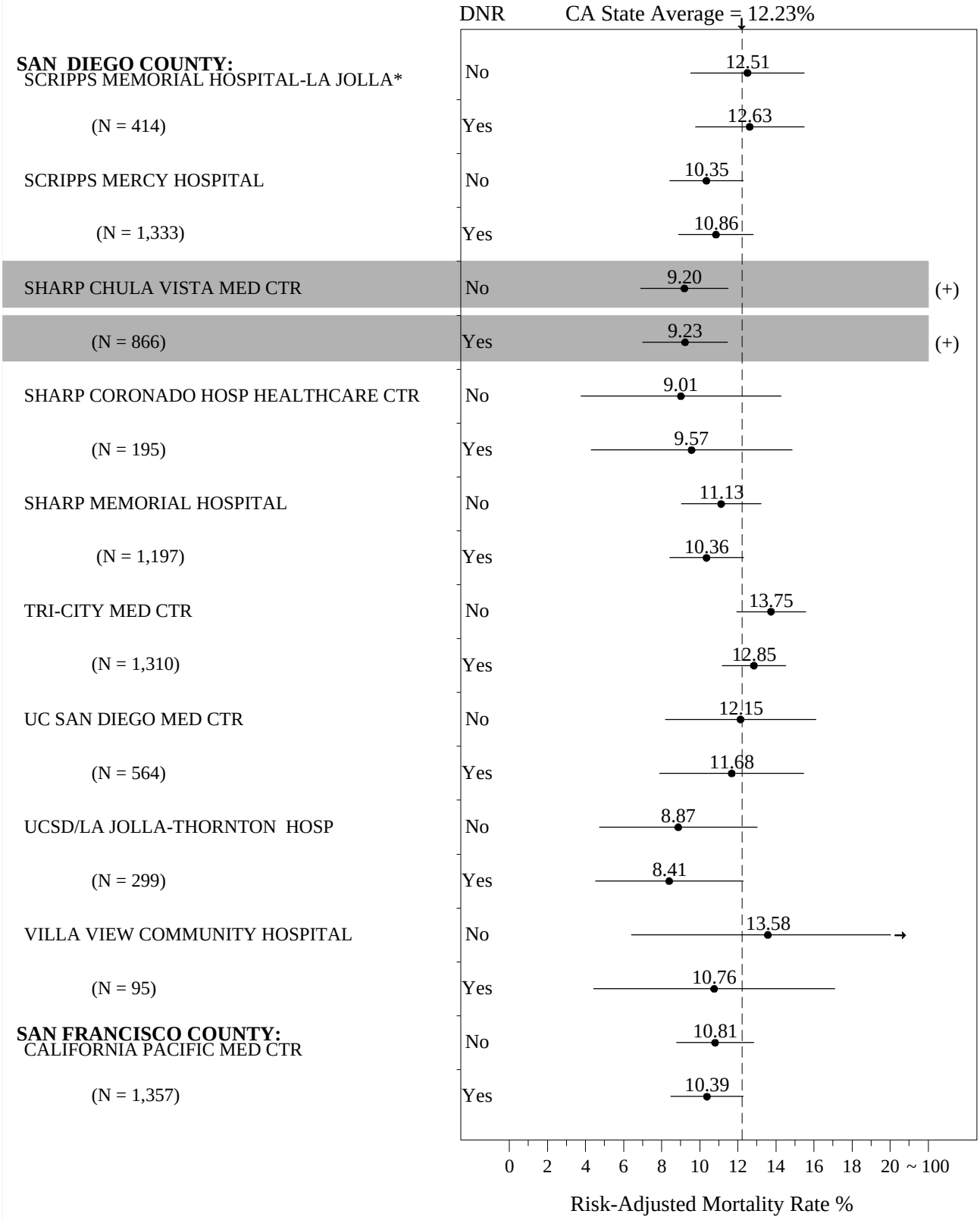
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

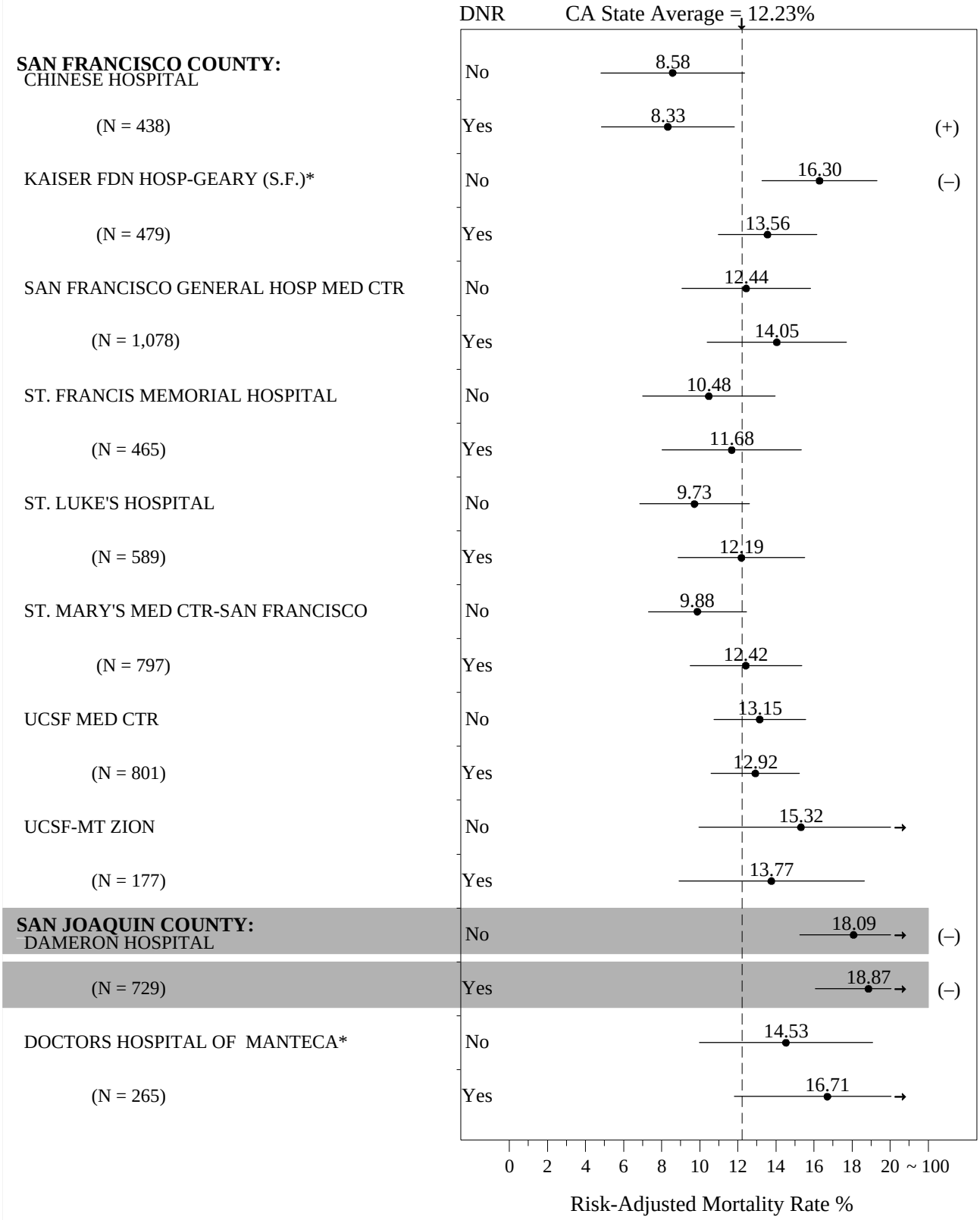
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

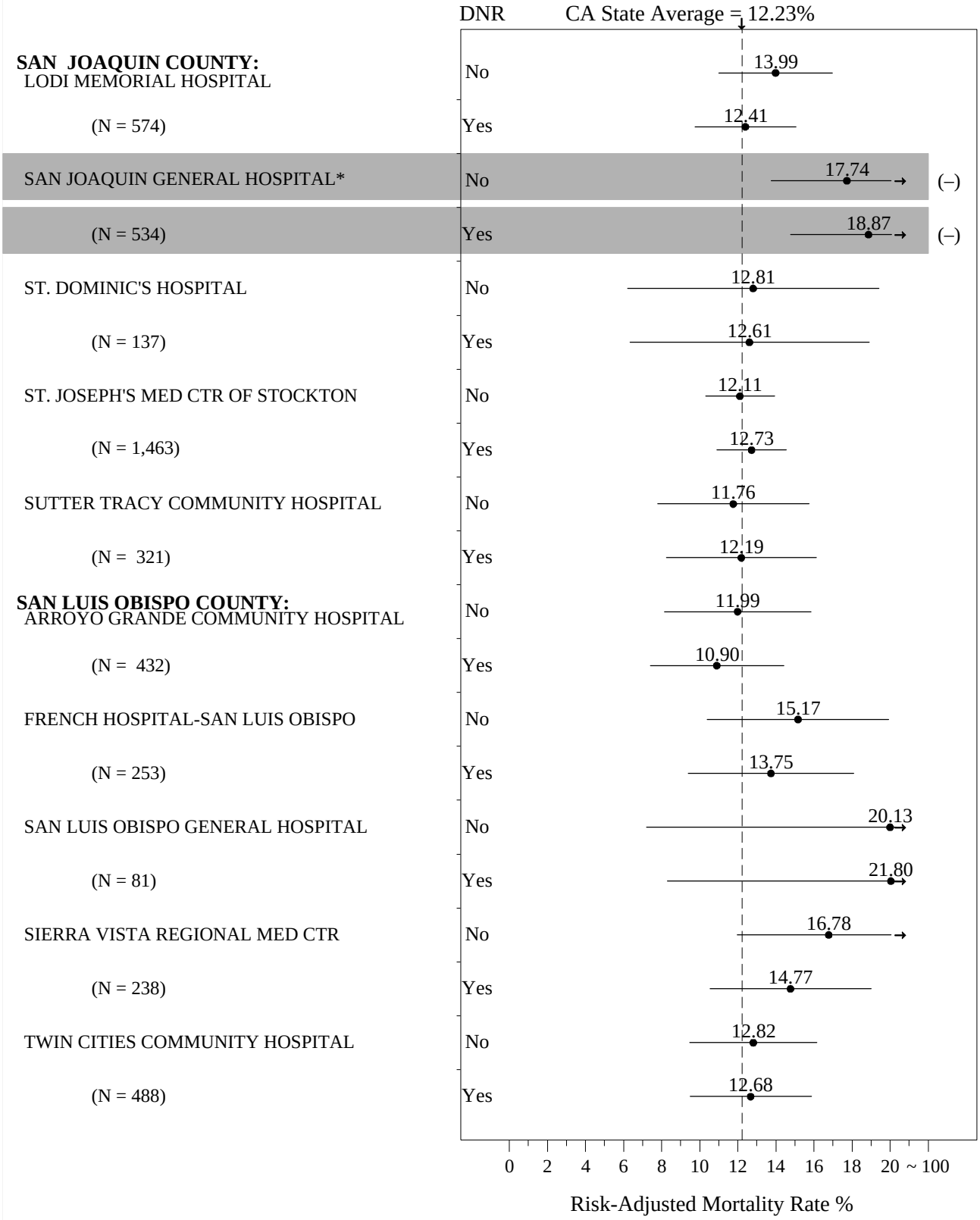
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

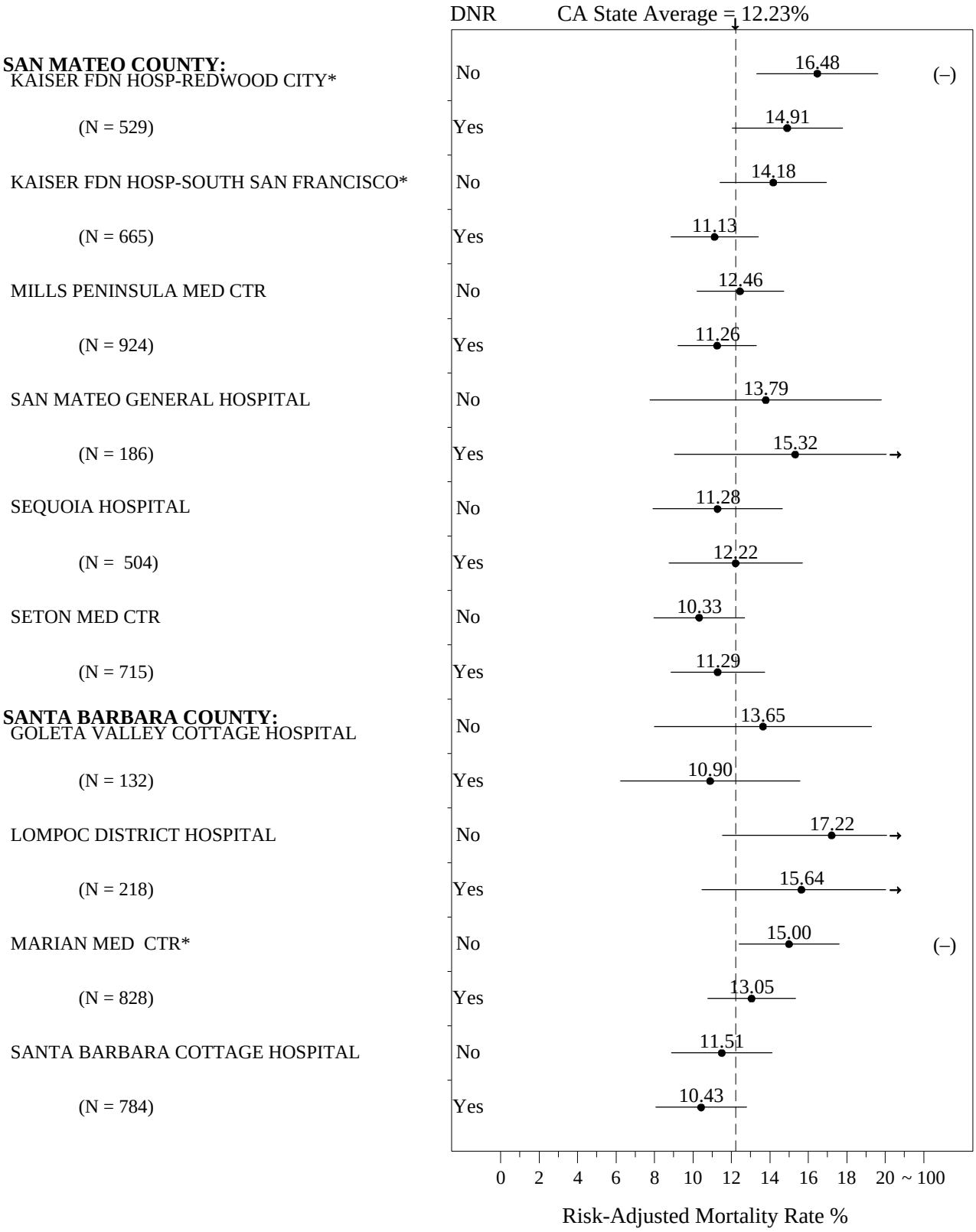
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

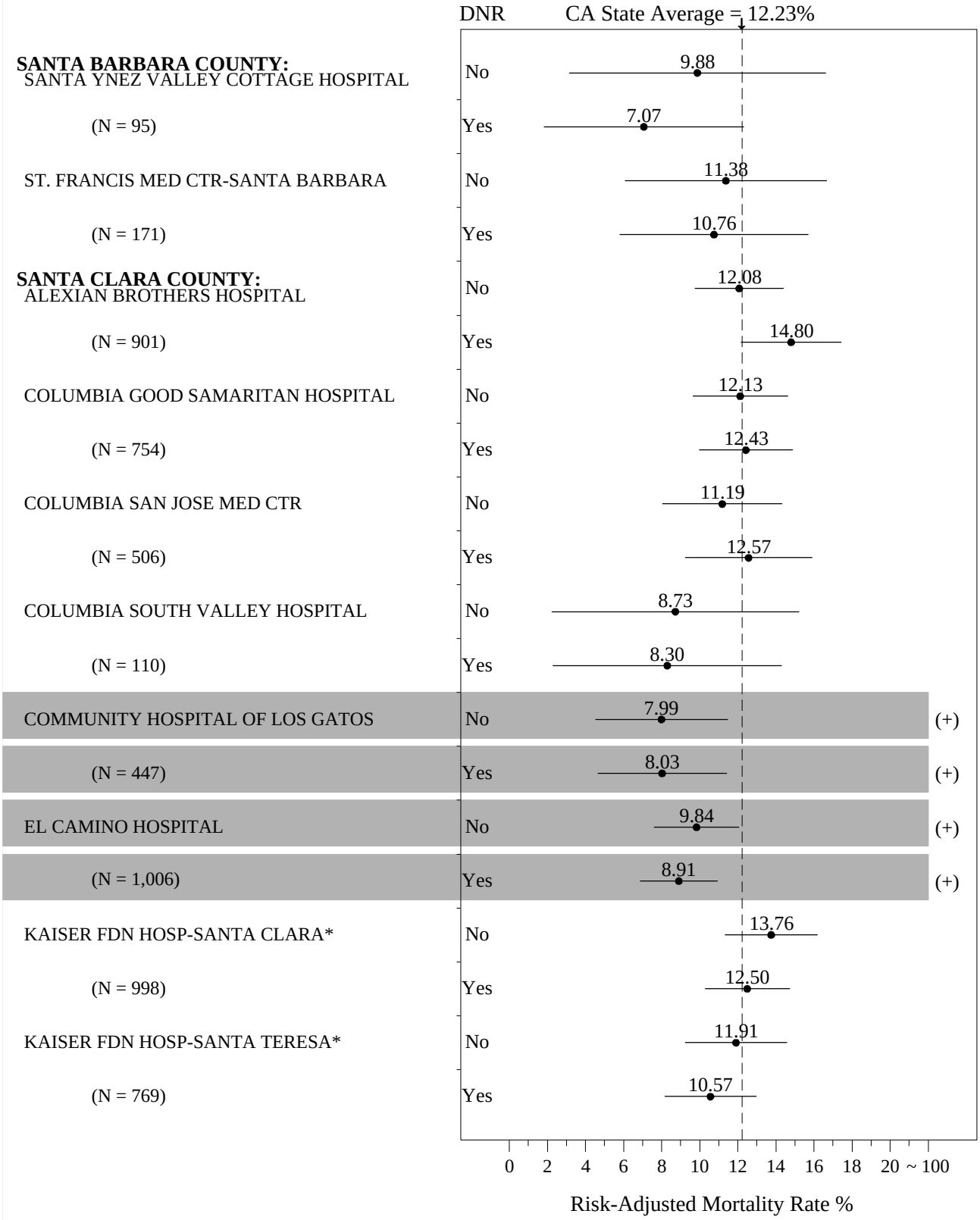
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

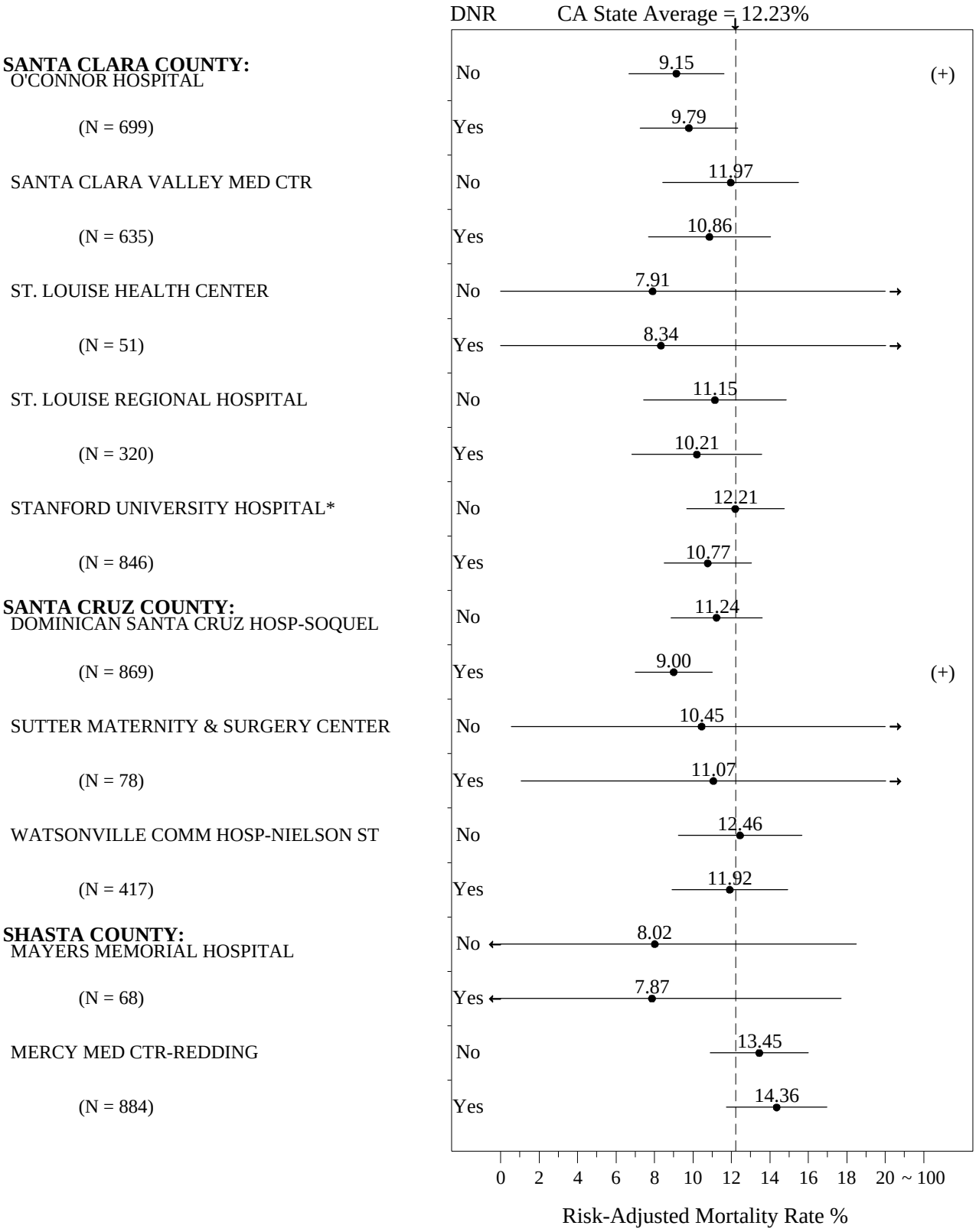
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

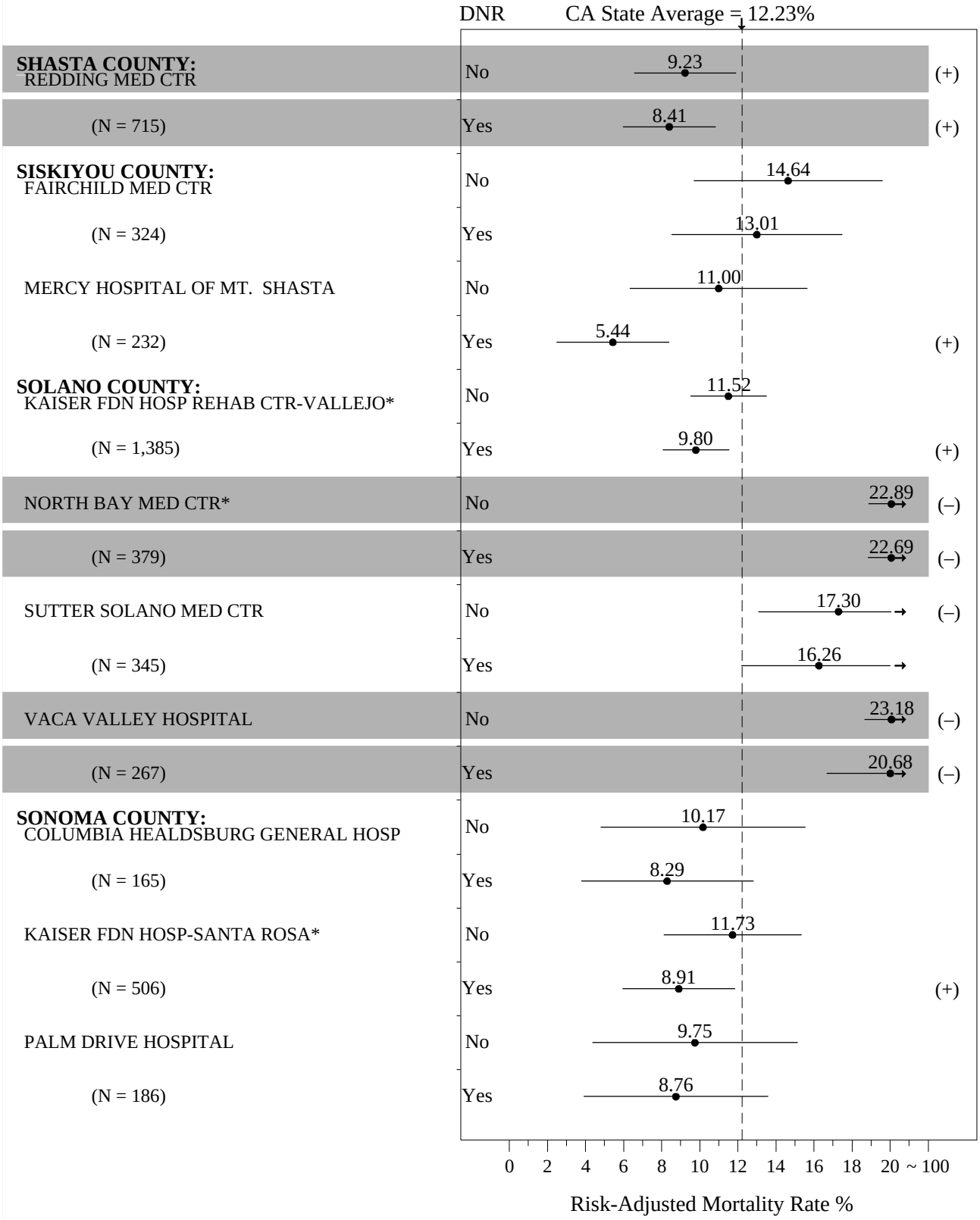
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

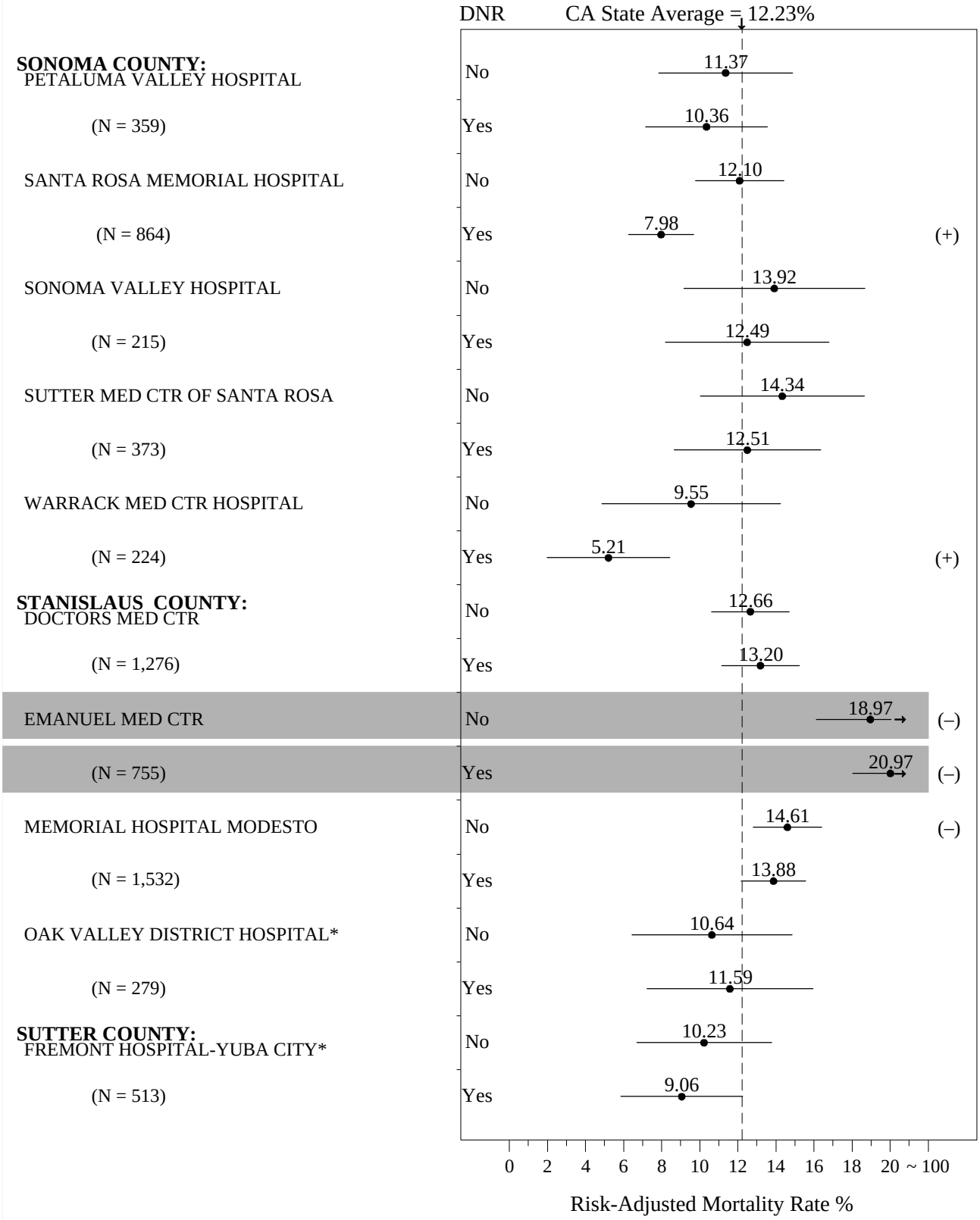
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

- —●— Risk-adjusted mortality rate and confidence interval width (98% CI).
- ⟷ Indicates that interval extends beyond graph.
- N = Number of patients
- (+) Mortality rate significantly lower than statewide rate (P-value < .01).
- (–) Mortality rate significantly higher than statewide rate (P-value < .01).
- * Hospital comments letter received. See Appendix 2.

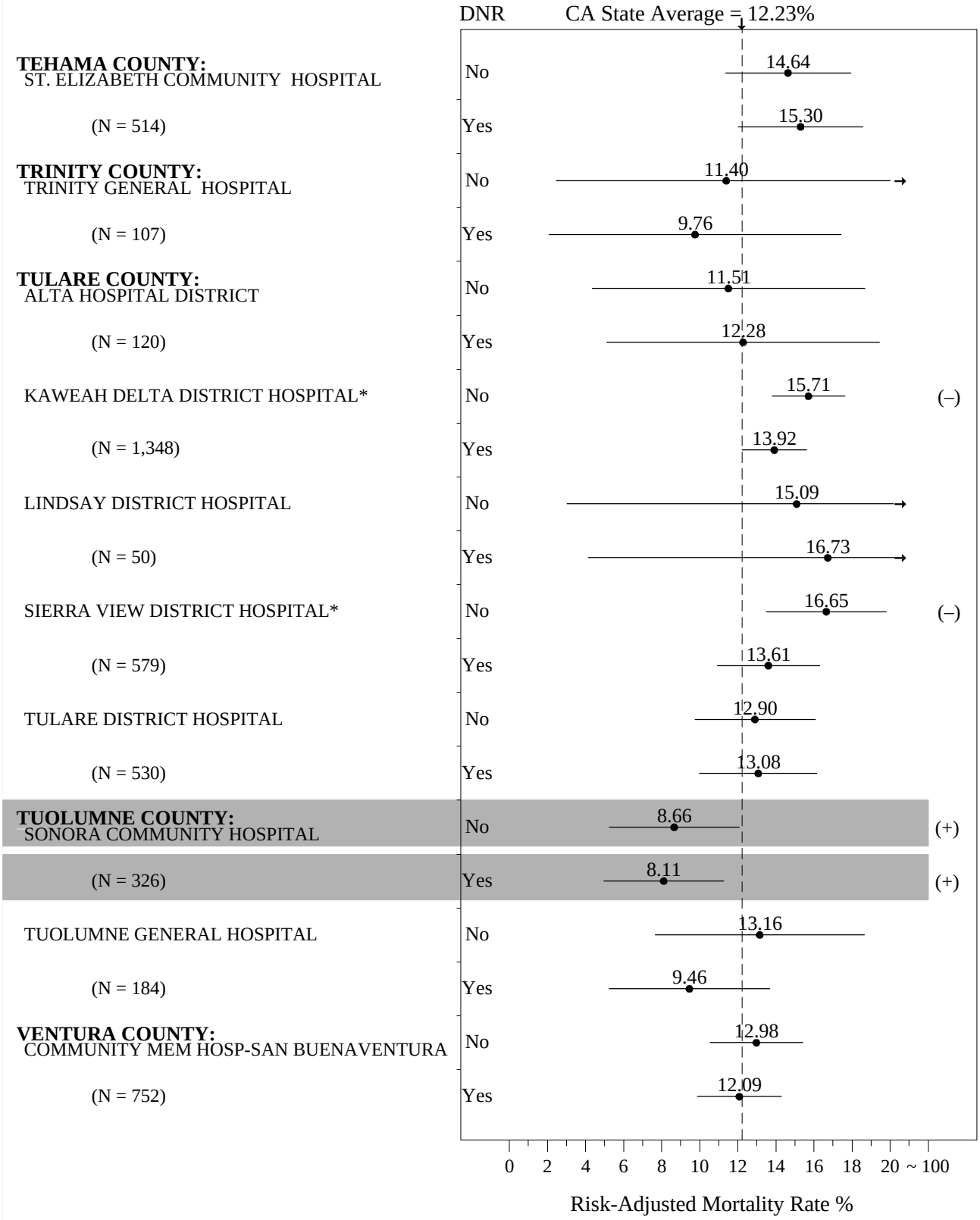
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

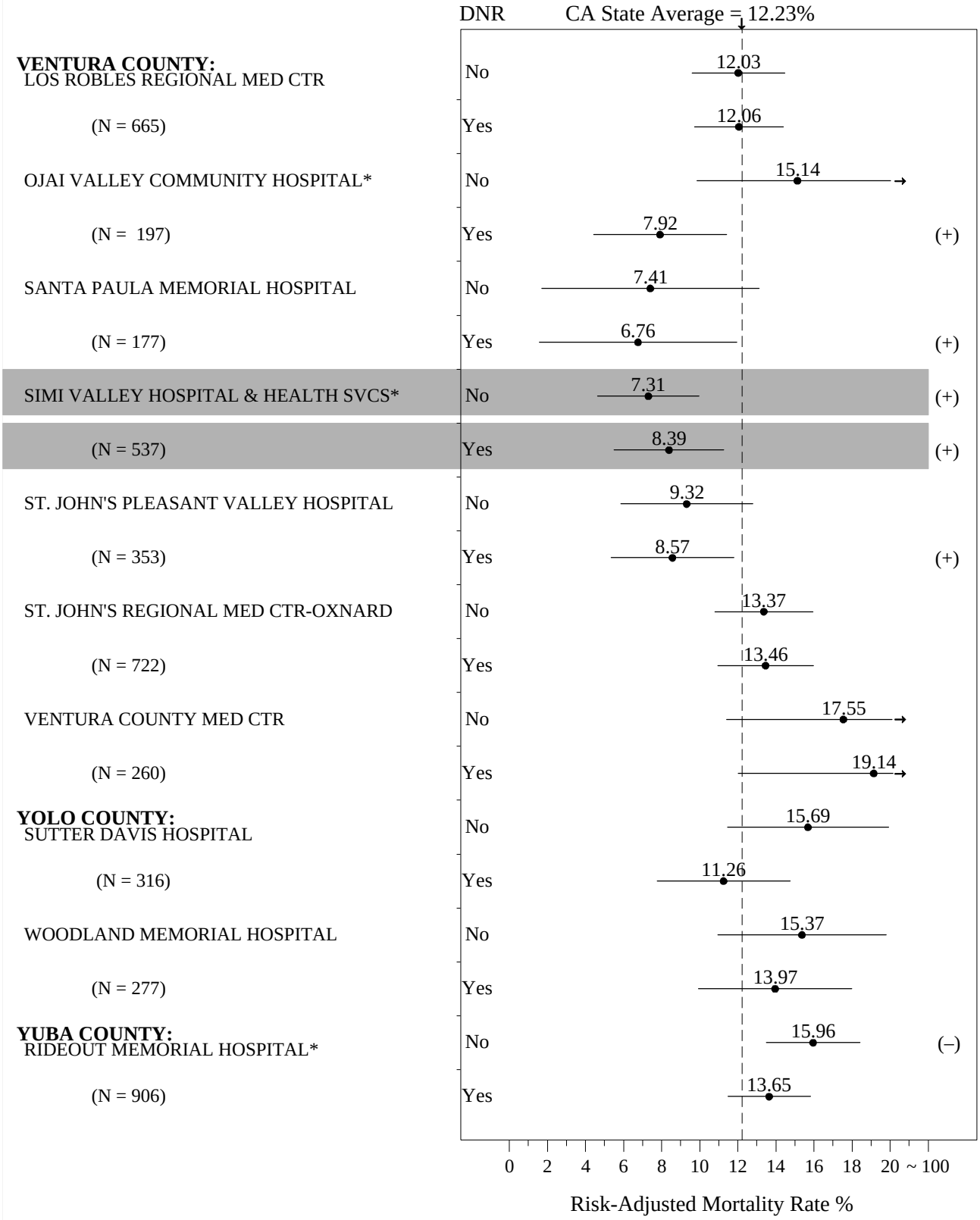
Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

Chart 1: Community-Acquired Pneumonia 30-Day Mortality Rates, 1999-2001



Key:

—●— Risk-adjusted mortality rate and confidence interval width (98% CI).
⟷ Indicates that interval extends beyond graph.
N = Number of patients
(+) Mortality rate significantly lower than statewide rate (P-value < .01).
(–) Mortality rate significantly higher than statewide rate (P-value < .01).
* Hospital comments letter received. See Appendix 2.

Table A.17 shows the number of patients and the number of deaths at hospitals that admitted 30 or fewer patients during the three-year period of this report. These small numbers often resulted in extremely wide confidence intervals that cannot be meaningfully interpreted. Thus, these hospitals were not graphically displayed in Chart 1. None of the hospitals in this table were rated as significantly higher or significantly lower than the statewide 30-day mortality rate. It should be noted that patient data from all of these hospitals were used to create the general, statewide risk-adjustment models of this 1999-2001 report.

Table A.17: Number of Observed Deaths Within 30-Days of Admission for Hospitals with Less than 30 Adult Admissions for Community-Acquired Pneumonia, 1999-2001

County	Hospital	Number of Patients Admitted	Number of Deaths
Alameda	Children's Hospital Med Center of No Cal (o)	4	0
Inyo	Southern Inyo Hospital	23	3
Los Angeles	Avalon Municipal Hospital & Clinic	8	1
Los Angeles	Barlow Hospital	15	2
Los Angeles	Children's Hospital of Los Angeles	24	1
Los Angeles	Orthopaedic Hospital (o)	10	0
Los Angeles	Doctors Hospital of West Covina	15	2
Los Angeles	Los Angeles County Rancho Los Amigos MC (o)	9	0
Los Angeles	Earl & Loraine Miller Children's Hosp (o)	4	0
Madera	Chowchilla District Memorial Hosp (o)	3	0
Madera	Valley Children's Hospital *	22	3
Marin	Novato Community Hospital-Rowland	26	3
Merced	Dos Palos Memorial Hospital *	18	1
Modoc	Surprise Valley Community Hospital	17	3
Mono	Mammoth Hospital (o)	28	0
Napa	Nelson M Holderman Memorial Hosp	30	1
Orange	Children's Hospital of Orange County (o)	6	0
Orange	Vencor Hospital-Brea (o)	1	0
Riverside	The Heart Hospital, Inc. (o)	3	0
San Bernardino	Vencor Hospital-Ontario (o)	1	0
San Bernardino	Heritage Hospital (o)	1	0
San Diego	Children's Hospital-San Diego (o)	21	0
San Diego	Sharp Cabrillo Hospital (o)	9	0
San Diego	Vencor Hospital-San Diego	3	1
San Mateo	Seton Med Ctr-Coastside	1	1
Santa Clara	Lucile S Packard Children’s Hosp at Stanford (o)	2	0
Sierra	Sierra Valley District Hospital	8	1

(o) = No deaths and too few cases to determine statistical significance.
* = Hospital comments letter received. See Appendix 2.

Appendix 2

Hospital Comment Letters

SUMMARY

Each of the hospitals included in this report was provided with a preliminary copy of the report and encouraged, but not required, to formally submit comments to OSHPD. The 29 letters[21] received are reproduced in this appendix.

Hospitals' comments acknowledged many limitations of the present report and also reiterated its strengths and potential usefulness. Eleven of the 32 hospitals rated "significantly worse than average" are represented by letters, and two of the 27 hospitals rated "significantly better than average" submitted a letter. Six hospitals indicated that they are using this report to develop improved methods of care, including clinical practice guidelines and protocols for treating community-acquired pneumonia.

Most of the concerns raised by the letters have been summarized below in six areas.

1. CODING ACCURACY

Hospital Comments: Ten letters expressed concern that, after hospitals linked data from this report with their own medical records, coding inaccuracies were discovered. Such inaccuracies included representing source of admission as "home" when in fact it was either "long-term care" or "residential care," under-reporting "DNR (do not resuscitate) order present within 24 hours of admission," and failing to code all of the diagnosis fields used to measure the clinical risk factors.

Response: Incorrectly coded admissions from "long-term" or "residential" care as admissions from "home" resulted in inappropriately including some institutional pneumonia patients in the report as community-acquired pneumonia patients. Three of the hospitals affected by this type of reporting error indicated that their risk-adjusted mortality rates markedly improved (i.e. decreased) after the error was corrected. Improved reporting by the hospital of the DNR and the diagnosis fields would also likely improve the risk-adjusted outcomes of affected hospitals.

OSHPD staff continues to work closely with hospitals, both directly and through the California Health Information Association,[22] to improve the uniformity and validity of hospital discharge data. Many hospitals have improved their coding practices since the first report of the California Hospital Outcomes Program was published in 1993. By law, hospitals must report to OSHPD all diagnoses that "affect the treatment received and/or the length of stay."[23] Specifically, reportable diagnoses include "conditions that affect patient care in terms of requiring: clinical evaluation... therapeutic treatment... diagnostic procedures... extended length of hospital stay...

[21] The letter from the Northern California Kaiser Foundation Hospitals represents all of its Northern California hospitals, and the letter from the Kaiser Foundation Hospitals/Health Plan in Southern California represents all of its Southern California hospitals.

[22] See: Steven Lubeck, "*Improving Data for Measuring Hospital Outcomes,*" *CHIA Journal*, California Health Information Association, 51, 2, (May, 2001): 6.

[23] *The California Hospital Discharge Data Reporting Manual,* January 1985. Title 22, California Code of Regulations, Division 7, Chapter 10, §97212(e)(11).

increased nursing care and/or monitoring."[24] According to these guidelines, conditions that require inpatient evaluation or treatment (e.g., laboratory tests, medications) should always be reported. Hypertension, shock, diabetes, and congestive heart failure are clear examples of such conditions.

2. ADDITIONAL RISK FACTORS

Hospital Comments: Nine letters claimed that the risk-adjustment models used in this report did not include important predictors of mortality: They pointed out that such predictors might have explained some of the observed variation in mortality across hospitals. Unmeasured risk factors mentioned in the letters included: key clinical prognostic factors that can influence mortality (e.g. vital signs, lab results, and X-ray findings at admission); lower socioeconomic status; lack of medical insurance; abuse of drugs, alcohol, or tobacco; mental impairment; dementia; illness severity; terminally ill patient status that results in declining further treatment; DNR orders that take place later than 24 hours after admission; and indicators of which patients are "immunocompromised."

Response: Every CHOP report assesses the need to redevelop its risk–adjustment model. The risk-adjustment model used in this report was developed and validated under the guidance of a clinical advisory panel, using patient discharge data reported during 1996. It may be in need of future updating to reflect advances in medical care, as well as demographic patterns that have changed. Thus, future reports will consider hospitals' suggestions to add new risk factors, or might omit some of the risk factors that were used in the present report.

The CAP validation study published in 1996 (presently available on OSHPD's Web site) identified five clinical risk factors that are not available from discharge abstracts but that would significantly improve the risk-adjustment models used in this report. They are: heart rate, systolic blood pressure at presentation, temperature, sodium <130 mEq/l; and Multi-lobar pneumonia. Future regulatory changes to the Patient Discharge Data Set might allow for the inclusion of these and other factors, resulting in the improved measurement of risks.

Unmeasured risk factors bias the results in this report only if they are distributed unevenly across hospitals. In fact, the CAP validation study found no evidence that patients at high-mortality hospitals possess significantly higher risk, based on physiologic factors, than patients at low mortality hospitals.

3. OLD DATA

Hospital Comments: Eight letters commented that the data used in this report are too old to be useful. Two of these letters pointed out that the report does not fairly reflect recent improvements in how their organizations treat CAP patients.

Response: Recent data are clearly more useful than older data in comparing hospital outcomes. However, the timeliness of the present report was limited by two factors. First, most hospitals have too few cases in one year to provide reliable results. When a hospital has very few cases in a given period, the relatively higher likelihood of chance variations reduces confidence in its outcome statistics. By combining three years of data, hospital outcome statistics become more reliable and more useful. Year 2001 was the third year during which OSHPD collected information on the new DNR field, and thus it defined one boundary of the first three-year period that could be used as a basis for this report: Work on this report could not begin until data for 2001 became available.

[24] *Coding Clinic*, Second Quarter 1990, 12-13; *ICD-9-CM Coding Handbook*, 1991 Revised Edition, 24.

A second factor affecting the timeliness of this report was that it took 15 months for hospitals to submit data for 2001, and for OSHPD to edit and compile, patient discharge abstracts for year 2001. Because of this, the patient discharge data required for this report was not available until March of 2003. It is not unusual for first-time reports to take more time to produce than established reports. Another 6 months was needed to estimate the coefficients in the risk-adjustment models, to calculate outcome rates and to finalize the preliminary draft of this first report. This was followed by the 60-day period needed to solicit comments from hospitals, and then by additional time to prepare and disseminate the final version of the report. For this reason, patient discharge data submitted to OSHPD after December 31, 2001 could not be used.

OSHPD has recently implemented data reporting and editing procedures to accelerate this entire process, which will provide a basis for faster publication. The next report cycle will benefit from the precedents (i.e. computer programs, production templates, improvements suggested in hospital letters, etc.) established by this first report. The next CAP report should be produced faster than the present report.

4. METHODOLOGY

Hospital Comments: Four letters expressed dissatisfaction with the underlying methodology of this report, including the following concerns: it was claimed that the validation study did not demonstrate an association between processes of care and 30-day mortality that would justify the categorization of hospitals as "better than," "worse than" or "as expected." Furthermore, the results of the report may mislead the public to conclude that mortality outcomes are due solely to interventions initiated by hospitals, when in fact patients' health maintenance behaviors and compliance with treatment regimens are key to 30-day survival. Concern was also expressed that if the range of values (i.e. the confidence interval) for Hospital A overlapped the range for Hospital B, then it could not be concluded that either hospital had a better performance in terms of 30-day mortality. For example, many hospitals that were labeled "better than expected" exhibited a range of values that overlapped hospitals labeled "as expected." Finally, it was pointed out that the mix of different types of patients receiving care at each of the different hospitals is not the same. Because of this, inter-hospital comparisons of risk-adjusted outcomes should not be viewed as participants in a controlled study where identical patients with identical conditions are admitted to the hospitals being compared.

Response: In response to the claim that the validation study did not demonstrate an association between any of the processes of care in the "better than," "worse than" or "as expected" hospitals, readers are again referred to the 1996 CAP validation study. It found a trend towards greater "use of sputum cultures" in "better than" hospitals compared with the other two mortality categories. Although this trend was not statistically significant, analysis indicated that odds of dying within 30 days of admission[25] were about 40 percent lower for patients receiving a sputum culture than they were for patients who did not receive a sputum culture. Further, among patients who did not have DNR orders within 24 hours of admission, those admitted to "worse than" hospitals were significantly less likely to have received a sputum culture than patients admitted to "better than" hospitals (44.5% vs. 56.9%, $p<.05$). However, the validation study pointed out that while the performance of a sputum culture may result directly in better care through a more tailored choice of antibiotics, this variable was most likely a proxy for "more conscientious care" (that was not directly measured). Pneumonia, like many medical conditions, does not have a clearly defined set of interventions that represent "best care" practices. The validation study did not find a significant association between "mechanical

[25] Instead of measuring outcomes with inpatient mortality, OSHPD based its measure on mortality within 30-days of admission. This is because in its earlier outcomes reports on AMI it was found that this removed any bias due to variation in average lengths of stay across hospitals. Accordingly, in this report a hospital's early discharge of CAP patients cannot reduce its risk-adjusted mortality.

ventilation," "admission to an ICU," or "time to the administration of antibiotics" and mortality. The possible impact of patients' post-discharge health maintenance behaviors and compliance with treatment regimens were not measured by the validation study or by this report.

In response to the concern that many hospitals labeled "better than expected" exhibited a range of values that overlapped hospitals labeled "as expected," it should be noted that the categorization of a hospital as significantly "better than," "worse than," or "no different than" average was not based on the presence or absence of overlap between pairs of hospital's confidence intervals, but on the difference between any hospital's risk-adjusted 30-day mortality rate and the state's overall mortality rate for CAP admissions. This tripartite categorization was based on a cutting point that separated statistically significant differences from non-significant differences. Two hospitals with similar risk-adjusted rates, but on different sides of the cutting point, were assigned to different categories even if their confidence intervals overlapped.

Anyone concerned that this report might be confused with a controlled study is reminded that, at best, risk-adjusted comparisons represent a reasonable, albeit imperfect, use of multivariate statistics to create a level playing field where different hospitals can be meaningfully compared. As was discussed under issue #2 above, in spite of the best efforts to create such a level field, there will always be unmeasured risk factors that might account for variations in observed mortality across hospitals. Accordingly, this report should not be elevated to the "gold standard" status of a controlled study: Individual patients were not randomly assigned to hospitals, nor were identical cohorts of patients systematically matched to different hospitals.

5. MEASUREMENT OF CAP

Hospital Comments: Three letters claimed that this report did not accurately measure community-acquired pneumonia, and therefore misrepresented their organizations. (This issue is separate from hospitals' miscoding of "source of admission," discussed above).

Two of the letters claimed that the report included patients who did not have community-acquired pneumonia. One organization's review of a sample of 143 medical records led it to conclude that one-third of its (approximately 11,000) community acquired pneumonia patients represented by the report did not have CAP at all. However, it did not specify what illness these patients did have. A second organization indicated that only 25% of the deaths recorded for its facility met criteria for a principal diagnosis of community-acquired pneumonia. It claimed that 75 percent of its patients were admitted for cancers, pulmonary emboli, congestive heart failure, tuberculosis, AIDs, and a variety of other conditions.

A third letter asserted that, in measuring pneumonia, the report relied on diagnosis codes from administrative data that were found to be inaccurate by the 1996 CAP validation study.

Response: Hospital datasets from the two organizations claiming that this report included patients who did not have community-acquired pneumonia were re-examined to determine if any patients other than CAP admissions were mistakenly included. Results showed that all patients included from the two organizations had CAP as measured by the criteria specified in Table A.1 of the Technical Appendix. These criteria are consistent with prior work using administrative data to examine CAP.

In response to the third letter's assertion that the measurement of pneumonia using administrative data was inaccurate, note that the 1996 CAP validation study found that 9.5 percent of its sample had "no CAP." Of the 98 discharges without CAP, 59 had insufficient documentation of pneumonia of any type, 34 had pneumonia with insufficient documentation to determine whether it was present on admission, and 5 had pneumonia that clearly developed after admission. (Whether or not improved coding practices during 1999-2001 lowered these figures cannot be determined in the absence of further validation research.) The 9.5 percent

figure representing “no CAP” was considered an acceptable margin of error by OSHPD’s Technical Advisory Committee.

At the same time, 90.5 percent of the 1996 validation sample was found to have definite or possible CAP at admission. Definite CAP was considered present if the patient had a diagnosis of CAP and there was a documented radiographic infiltrate that was not known to be old. These data had to be confirmed by at least one of the following: the documented presence of a new onset of cough or sputum production; fever; and a white blood cell count of >15,000 or greater than 15 percent band forms on differential. Possible CAP was considered present if the treating physician or radiologists noted pneumonia or the presence of a radiographic infiltrate that was not known to be old. A physician’s diagnosis of CAP with confirmatory signs (listed above) was considered possible CAP in the absence of a documented radiographic infiltrate. For the pneumonia to be considered present at admission, the clinical signs had to be documented within 24 hours of admission, and the confirming chest x-ray had to be taken within a 48-hour time period immediately before or after admission.

6. DEATHS MAY BE UNRELATED TO CAP OR TO HOSPITAL CARE

Hospital Comments: One letter expressed concern that the report charged hospitals with all deaths that occurred within 30 days after admission regardless of the immediate cause or location. Some of these deaths may not have been related to patients' CAP, or to the quality of care received during the index hospitalization.

Response: Deaths unrelated to CAP cannot be excluded, for three reasons: (1) without detailed information about the date, severity, and treatment of each diagnosis, we cannot identify which diagnosis led to death; (2) the true cause of death can often be established only by autopsy, yet relatively few CAP fatalities are autopsied; and (3) even if CAP is not the primary underlying cause of death, it is probably a contributing cause in many cases. Previous studies have shown substantial error in the attribution of "cause of death" on death certificates, especially among patients with multiple contributing factors.

HOSPITAL LETTERS

The Law that created the *California Hospital Outcomes* program specified that hospitals and their medical staff be given 60 days to review a draft of this report, along with the patient data on which it is based. Hospitals and their chiefs of staff were encouraged, but not required, to submit written comments. These comments have been published as part of this report, so that readers can better appreciate this report's strengths and limitations. Enclosed are all letters received in response to this report.

This page left blank intentionally

Alameda Hospital

CITY OF ALAMEDA HEALTH CARE DISTRICT

November 25, 2003

Joseph Parker, Ph.D
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning & Development
818 K Street, Suite 200
Sacramento, CA 95814

Re: City of Alameda Health Care District Response to California Hospital Outcomes Report on Community Acquired Pneumonia (CAP)

Dear Dr. Parker:

Alameda Hospital appreciates the opportunity to review and respond to the CAP data provided for years 1999 through 2001.

As indicated by the report, only one aspect of the quality of care, that being death, was provided. Although the CAP statistics table for Risk Adjusted Death Rate (RADR) for patients without Do Not Resuscitate (DNR) status was above the Statewide Death Rate, DNR status is a strong predictor of 30-day mortality in this aged island community population. The CAP detail for RADR in patients with DNR status was not significantly different from the state average.

There were 42 deaths reported in the 250 cases reviewed. Of those, only 18 were reported to not have a DNR in place. After reviewing those 18 cases, seven (7) actually were DNR status; one (1) had metastatic lung cancer; one (1) was conserved by Alameda County, which prohibited DNR at the time, even though it was indicated; three (3) arrived in the emergency room code blue with a grave prognosis; two (2) had multiple severe co-morbidities with notes from the MD that the prognosis was poor/grave; and in one (1) case the MD requested a DNR of the family but was denied.

There appears to have been a significant under-reporting of DNR status and possibly other risk factors that could have significantly changed the Expected Death & RADR rates for patients with and without DNR status. It also should be noted that outcomes in this limited value improved over the course of the review even though Alameda Hospital performed as expected in the patients with DNR status category.

Alameda Hospital prides itself in the quality care it provides to all of its patients. Our statistics have historically demonstrated a better than average result in local and national benchmarks. To better enable us to take a more current, intensive look at the care in the CAP patient, we will add CAP to our 2004 JCAHO core measures data reporting. This will afford us the opportunity to involve the medical staff in root cause analysis and review of all core measures' indicators. The outcomes and analysis of the data will be reviewed by the Medical Executive Committee and process improvement activities implemented which will be reported to the Board of Directors.

We thank you for the opportunity to participate in this important aspect of patient care.

Sincerely,

David D. O'Neill
Chief Executive Officer

DDO/ll

Children's Hospital
Central California

9300 Valley Children's Place
Madera, California 93638-8762
T: 559.353.3000
www.childrenscentralcal.org

December 10, 2003

Joseph Parker, Ph.D.
Acting Deputy Director, Healthcare Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, California 95814

Dear Dr. Parker:

We, at Children's Hospital Central California, appreciate the opportunity to review and comment on the 1999-2001 Community-acquired Pneumonia (CAP) report published by the Office of Statewide Health Planning and Development (OSHPD). While sharing OSHPD's commitment to improving quality through the measurement of care outcomes, we feel that the inclusion of children's hospitals in a study that was designed to analyze adult patients exhibits a significant bias.

Children's Hospital Central California is an acute care facility that primarily serves neonate and pediatric populations. However, a very select number of adults with serious congenital diseases are treated at our facility. Unfortunately, in this study, the risk factors used that attributed to mortality were developed with adult-related medical conditions in mind and do not take into consideration some other factors that contribute to mortality in adult patients with serious diseases present from birth. That being noted, the specific patients included in this study suffered from severe medical conditions, which led their families to decline resuscitation efforts. In honoring their wishes, all three patients were placed on "do not resuscitate" (DNR) status. Although DNR status was considered in the study, the specification that DNR status is assigned within 24 hours of admission is a limitation which distorts the analysis. Additionally, we offer the following observations for the noted mortalities:

- The first patient was admitted from a skilled facility where they had lived for the past 17 years. This patient's coexisting medical conditions included spastic quadriplegia (inability to control all four limbs along with abnormal muscular tone), obstructive hydrocephalus (an abnormal increase in the amount of cerebrospinal fluid within the skull, that causes pressure on the brain that leads to deterioration of the brain) which was treated with a ventriculoperitoneal shunt (this drains cerebrospinal fluid from the brain into the peritoneal cavity), agranulocytosis (absence of a type of blood cell involved in the immune system), scoliosis (unnatural curvature of the

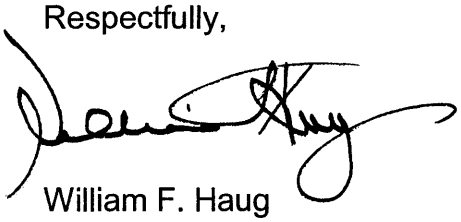
spine), dysphagia (difficulty swallowing), autosomal deletion syndrome (genetic disorder involving the deletion of chromosomes), recurrent urinary tract infections secondary to vesicoureteral reflux (reflux of urine from the bladder back into the kidney), bilateral hydronephrosis of the kidneys (dilation of the structure that collects urine in the kidney), anemia, cerebral palsy and severe mental retardation. This patient was placed on a DNR on the fourth day of admission.

- The second patient had several previous admissions for pneumonia and was placed on a DNR status on admission. This patient's related medical conditions included cerebral palsy, spastic quadriplegia, intractable seizures, severe scoliosis, swallowing dysfunction, and chronic lung disease.

- The third patient was placed on a DNR status within 30 hours of admission. This patient suffered from thrombocytopenia (persistent decrease in number of blood platelets, often associated with hemorrhagic conditions), cerebral palsy, and esophageal reflux (backward flow of gastric contents into the esophagus), swallowing dysfunction, scoliosis and asthma.

The care we provide to our patients is based on best practice, and our outcomes demonstrate exceptional performance based on the Pediatric Health Information System (PHIS) and the Pediatric Intensive Care Unit Evaluation (PRISM) national databases. By utilizing both external and internal benchmarking and performance improvement strategies, we continuously strive to provide the best possible care to our patients. Again, thank you for the opportunity to submit these comments for publication.

Respectfully,



William F. Haug
President & Chief Executive Officer

Community Hospital of the Monterey Peninsula®

Innovative healthcare with a human touch

December 1, 2003

Joseph Parker, Ph.D., Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker:

Community Hospital of the Monterey Peninsula strives to be the healthcare organization in our region most concerned for those we serve, most chosen for the quality and value of our services, and most respected for the integrity, competency, and commitment of our employees, medical staff, and volunteers.

To accomplish that vision, employees and medical staff set aggressive targets for clinical improvements, and we are committed to achieving those targets year after year. We have formed a team of physicians, nurses, pharmacists, and other caregivers who are working to improve the care we provide for patients with community-acquired pneumonia. Since this data was collected, we have already reduced the average time it takes us to give the first dose of antibiotics and we have also improved immunization rates for pneumonia.

We strongly support your right to receive information that will assist you in making informed decisions about your healthcare. We also believe it is important for you to understand the limitations and complexity of this type of data. We encourage you to discuss this information with your own physician, so that together you can make the best possible choices for your healthcare.

Although we are pleased with our overall results in this study, we are confident that we will do even better in the future. At Community Hospital, we know that providing quality care requires vigilance and continuous effort. We're never satisfied. We always strive to do better for our community.

Sincerely,

Steven J. Packer, M. D.
President/CEO

Post Office Box HH, Monterey, California 93942-1085 ▪ (831) 624-5311

Doctors Hospital
Of Manteca

Tenet California

Administration
1205 E. North Street
Manteca, CA 95336
Tel 209.239.8361

Katherine A. Medeiros, CEO
e-mail
:katherine.medeiros@tenethealth.com

November 18, 2003

Office of Statewide Health Planning and Development
Healthcare Quality and Analysis Division
Healthcare Outcomes Center
818 K Street, Room 200
Sacramento, California 95814

Doctors Hospital of Manteca has received and reviewed the California Hospital Outcomes Report on Community Acquired Pneumonia for 1999-2001. Our Medical Staff has also reviewed the content and has approved the information provided. Please publish the Doctors Hospital of Manteca data as presented.

Sincerely,

Kathy Medeiros, CEO

Carmen Silva, CNO/COO

Katy Marconi, Director Clinical Quality Improvement

Stephen Lin MD., Chief of Medical Staff

Michael Davis MD., Chief of Pulmonary Care

DOS PALOS MEMORIAL HOSPITAL
2118 Marguerite Street
Dos Palos, CA 93620
209-392-6121
FAX 209-392-6881

December 8, 2003

Joseph Parker, Ph.D.
Acting Deputy
Office of Statewide Health Planning and Development
Healthcare Quality and Analysis Division
818 K Street, Room 2000
Sacramento, CA 95814

Dear Dr. Parker,

Thank you for sharing an early copy of the California Hospital Outcomes Report on Community-Acquired Pneumonia, 1999-2001. This gives us an opportunity to respond to certain data points.

The single case which seems to produce a glaring statistic of one death in four cases in 2000 was investigated closely. This was a patient (M..... P.....) presented with possible pneumonia and was admitted. She was a 69 year old smoker. The background issue was that the patient had had a cardiac bypass surgery in 1995.

The chest x-ray here (attached) was not typical but was read as some sort of interstitial process, perhaps pulmonary edema. She did not get better on pneumonia treatment and was transferred to what is now Mercy Medical Center of Merced for ICU care under a cardiologist and pulmonologist.

Although she improved enough to leave the ICU, the lung problem was so unusual that it did not get better. At one time it was called "bronchiolitis obliterans organizing pneumonia" (attached "Expiration Summary"). Then she had a cardiac rhythm event causing death.

The physicians were still not sure of the diagnosis in the chest and made the case a coroner's case. We do not have any autopsy report but would be interested.

This patient does not fall into the simple Community-Acquired Pneumonia category and should be removed from that category. There should be an attempt by the State to get the autopsy report from Merced County and find out the real diagnosis if the case is kept in.

We believe that our care was excellent and that our referral to a high center was timely when the problem proved to be more complex than pneumonia. Her sudden death on the medical ward of the referral hospital could easily have been a myocardial infarction with ventricular fibrillation.

Sincerely,

Charles Phillips MD

Dr. Charles Phillips
Chief Clinic Physician

Robert Hill

Robert Hill
Administrator

ENLOE
MEDICAL CENTER

ESPLANADE
1531 Esplanade
Chico, CA 95926

COHASSET
560 Cohasset Road
Chico, CA 95926

REHABILITATION CENTER
340 W. East Avenue
Chico, CA 95926

CANCER CENTER
265 Cohasset Road
Chico, CA 95926

OUTPATIENT CENTER
888 Lakeside Village Commons
Chico, CA 95928

HOMECARE & HOSPICE SERVICES
1390 E. Lassen Avenue
Chico, CA 95973

CHILDREN'S HEALTH CENTER
277 Cohasset Road
Chico, CA 95926

A local, not-for-profit organization

1531 Esplanade
Chico, CA 95926

www.enloe.org

(530) 332-7300

November 26, 2003

Joseph Parker, Ph.D., Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker:

Enloe Medical Center is committed to the delivery of high quality health care for patients through out the North Valley. Thus, Enloe commends the Office of Statewide Health Planning and Development (OSHPD) for the work it is doing to help track and trend the provision of quality care at California hospitals. The most recent reporting of statistical data regarding community-acquired pneumonia is an important step toward helping hospitals meet their quality improvement goals.

The medical staff and administration of Enloe Medical Center have reviewed the data, and concur that the hospital's results fall within the expected range with no statistically significant variance. Since this report is based on data that is two years old, it does not reflect current practice and the efforts that have been taken to improve pneumonia patient outcomes. One example is the addition of a Hospitalist Program at our facility, which provides patients with immediate access to an onsite physician seven days a week. We have also initiated free, community wide flu shot vaccinations, and are working with our medical community to overcome barriers that may limit vulnerable populations from receiving pneumococcal vaccinations. We believe these initiatives will reduce the occurrence, severity and mortality resulting from pneumonia within our region.

Additionally, and as reflected by our comparatively high volume, Enloe Medical Center is a tertiary referral center for rural hospitals and skilled nursing facilities in the North Valley. Accordingly, the number of patients we receive from convalescent homes, skilled nursing facilities, and other hospitals may be disproportionately higher than other facilities, and the risk adjustment model does not account for this variable.

Enloe Medical Center appreciates the contributions made by the OSHPD study. The study is one of a number of tools that is being used by our physicians and clinical staff to monitor, assess and improve the quality of care at our hospital.

Sincerely,

Dan Neumeister
Senior Vice President & Chief Operations Officer

THE
FREMONT-RIDEOUT
HEALTH GROUP

December 4, 2003

Joseph Parker, PhD.
Acting Deputy Director, Healthcare Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K. Street, Room 200
Sacramento, CA 95814

ADMINISTRATION
989 Plumas Street
Yuba City, CA 95991
530/751-4010

RIDEOUT MEMORIAL HOSPITAL
726 Fourth Street
Marysville, CA 95901
530/749-4300

FREMONT MEDICAL CENTER
970 Plumas Street
Yuba City, CA 95991
530/751-4000

THE FOUNTAINS
1260 Williams Way
Yuba City, CA 95991
530/751-4888

FREMONT-RIDEOUT FOUNDATION
989 Plumas Street
Yuba City, CA 95991
530/751-4280

FREMONT-RIDEOUT HOMECARE
319 G Street
Marysville, CA 95901
530/749-4386

VALLEY HOSPICE
319 G Street
Marysville, CA 95901
530/749-4368

Dr. Parker:

Thank you for the opportunity to review and comment on the preliminary draft of the first report on Care of Community Acquired Pneumonia (CAP) patients 1999-2001. This data has been shared with key physicians on the Fremont-Rideout Health Group Medical Staff, the Director of Quality / Risk Management, the Director of Inpatient Nursing, the Assistant Administrator for Patient Care Services, the Director of Medical Records, the Chief Medical Officer and the Chief of Staff.

Our commitment is to provide high quality care to citizens of our region and strive to improve patient outcomes on an on-going basis. This data is helpful to us; however, it is unfortunate that the data to be published will be 3-5 years old before it is ever published. Community Acquired Pneumonia is the most common admitting diagnosis at Rideout Memorial Hospital and therefore has been a focus of our on-going performance improvement initiatives for many years. In fact, in 2002, we elected to participate in the Joint Commission on Accreditation of Healthcare Organizations' (JCAHO) Core Measures on Community Acquired Pneumonia. In doing so we will be able to continually monitor several process and outcome indicators associated with CAP and benchmark our performance with other participating hospitals.

While the actual 30-day mortality rate during the study period was within one standard deviation of the statewide median, our efforts have been directed at improving the outcomes for patients admitted with CAP. In collaboration with key members of the medical staff we have recently revised our pre-printed order set for CAP. The revisions are based on best practices and will standardize the care and treatment of these patients. Research has shown that when standardized order sets (based on current

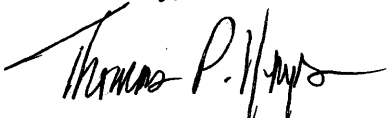
December 4, 2003
Page 2
Joseph Parker, PhD.
Acting Deputy Director, Healthcare Quality and Analysis Division
Office of Statewide Health Planning and Development

clinical research and best practices) are utilized, outcomes such as 30-day mortality improve dramatically. Through various mechanisms, the use of these order sets by all physicians who admit patients with CAP will be encouraged. On-going review, both retrospective and concurrent will assist our efforts to continually monitor for improvement. We have also revised our admission data collection to include history of immunizations for influenza and pneumoccus – this enables us to assure that these patients are immunized prior to discharge. In addition, we provide information to patients and access to education on smoking cessation. We believe that both of these measures will improve outcomes for patients with CAP.

We have reviewed published data from Yuba County's Health Status Profile which shows that residents of Yuba County have higher mortality rates for other conditions such as cancer and heart disease compared to other California counties. We believe this to be due, at least in part to lower socioeconomic status, a high percentage of uninsured patients and a significant rate of abuse of drugs, alcohol and tobacco. Many patients in Yuba County do not seek routine or preventative medical care, therefore have lower rates of immunizations against influenza and pneumoccus than other counties. Yuba County residents who do not have a primary care provider may also delay seeking care, resulting in complications and comorbidities that result in poorer outcomes. Fremont-Rideout Health Group works closely with and supports the efforts of the Yuba County Health Department and two federally qualified healthcare clinics to improve access to primary care services. We are also working with local officials to educate the community on smoking cessation, health maintenance and the importance of establishing regular care with a primary care provider. We believe all these efforts collectively will have a positive effect on patient outcomes.

In summary, Rideout Memorial Hospital is committed to improving care for all residents of the Yuba-Sutter area and are confident that our performance improvement efforts will help us to achieve this goal. We look forward to receiving data on an on-going basis to determine if our efforts have been successful in decreasing mortality for patients with Community Acquired Pneumonia.

Sincerely,



Thomas P. Hayes
Chief Executive Officer
Rideout Memorial Hospital

THE
FREMONT-RIDEOUT
HEALTH GROUP

December 4, 2003

Joseph Parker, PhD.
Acting Deputy Director, Healthcare Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K. Street, Room 200
Sacramento, CA 95814

ADMINISTRATION
989 Plumas Street
Yuba City, CA 95991
530/751-4010

RIDEOUT MEMORIAL HOSPITAL
726 Fourth Street
Marysville, CA 95901
530/749-4300

FREMONT MEDICAL CENTER
970 Plumas Street
Yuba City, CA 95991
530/751-4000

THE FOUNTAINS
1260 Williams Way
Yuba City, CA 95991
530/751-4888

FREMONT-RIDEOUT FOUNDATION
989 Plumas Street
Yuba City, CA 95991
530/751-4280

FREMONT-RIDEOUT HOMECARE
319 G Street
Marysville, CA 95901
530/749-4386

VALLEY HOSPICE
319 G Street
Marysville, CA 95901
530/749-4368

Dr. Parker:

Thank you for the opportunity to review and comment on the preliminary draft of the first report on Care of Community Acquired Pneumonia (CAP) patients 1999-2001. This data has been shared with key physicians on the Fremont-Rideout Health Group Medical Staff, the Director of Quality / Risk Management, the Director of Inpatient Nursing, the Assistant Administrator for Patient Care Services, the Director of Medical Records, the Chief Medical Officer and the Chief of Staff.

Our commitment is to provide high quality care to citizens of our region and strive to improve patient outcomes on an on-going basis. This data is helpful to us; however, it is unfortunate that the data to be published will be 3-5 years old before it is ever published. Community Acquired Pneumonia is one of the most common admitting diagnoses at Fremont Medical Center and therefore has been a focus of our on-going performance improvement initiatives for many years. In fact, in 2002, we elected to participate in the Joint Commission on Accreditation of Healthcare Organizations' (JCAHO) Core Measures on Community Acquired Pneumonia. In doing so we will be able to continually monitor several process and outcome indicators associated with CAP and benchmark our performance with other participating hospitals.

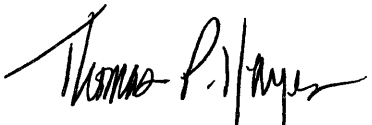
While the actual 30-day mortality rate during the study period was within the expected range, our efforts have been directed at improving the outcomes for patients admitted with CAP. In collaboration with key members of the medical staff we have recently revised our pre-printed order set for CAP. The revisions are based on best practices and will standardize the care and treatment of these patients. Research has shown that when standardized order sets (based on current clinical research and

best practices) are utilized, outcomes such as 30-day mortality improve dramatically. Through various mechanisms, the use of these order sets by all physicians who admit patients with CAP will be encouraged. On-going review, both retrospective and concurrent will assist our efforts to continually monitor for improvement. We have also revised our admission data collection to include history of immunizations for influenza and pneumoccus – this enables us to assure that these patients are immunized prior to discharge. In addition, we provide information to patients and access to education on smoking cessation. We believe that both of these measures will improve outcomes for patients with CAP.

Fremont-Rideout Health Group works closely with and supports the efforts of the Sutter County Health Department and two federally qualified healthcare clinics in our area to improve access to primary care services. We are also working with local officials to educate the community on smoking cessation, health maintenance and the importance of establishing regular care with a primary care provider. We believe all these efforts collectively will have a positive effect on patient outcomes.

In summary, Fremont Medical Center is committed to improving care for all residents of the Yuba-Sutter area and are confident that our performance improvement efforts will help us to achieve this goal. We look forward to receiving data on an on-going basis to determine if our efforts have been successful in decreasing mortality for patients with Community Acquired Pneumonia.

Sincerely,



Thomas P. Hayes
Chief Executive Officer
Fremont Medical Center

1950 Franklin Street, 20st Floor
Oakland, CA 94612-3434

December 9, 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Mr. Parker:

Thank you for the opportunity to review and respond to the California Hospital Report on Community-Acquired Pneumonia (CAP). We appreciate OSHPD's effort to provide the public outcome-based reports. We strongly support continuous improvements in health care outcomes and public reporting of valid information to help facilitate accountability and inform consumer decision-making. However, it is important to point out that we believe this report misrepresents the implied quality of care at the Kaiser-Permanente Northern California medical centers because of two underlying flaws in the reporting: 1) because of its reliance on billing codes and administrative data sets, the report significantly under-reports patient risk at Kaiser-Permanente and 2) the methodology does not take into account clinical factors that impact the risk for mortality. It is essential that readers of this report consider these reporting flaws and not accept the premise that the outcomes reflect better or worse quality.

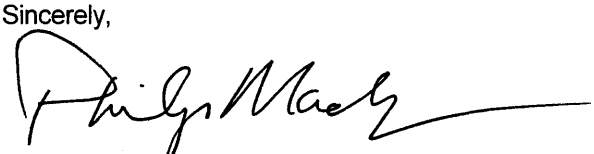
As the largest pre-paid, integrated health care system in California, Kaiser-Permanente does not use the same kind of billing systems commonly seen in other hospitals. Hospital billing codes are known to be inaccurate as the foundation for outcomes reporting for CAP, yet they are relied on in this study. The validation study recognized a 40% error rate for properly categorizing patient admissions as having Community Acquired Pneumonia. In other words, potentially 40% of the patients in this study may not have had Community Acquired Pneumonia. Electronic outpatient clinical information is readily available to clinicians treating patients in the hospital, decreasing the utility of coding co-morbidities upon admission. The study model relied on admission diagnosis (and previous admissions) but because of our coding practices, we are certain that the risk of our population is underreported. As recognized in the validation study, there is a significant level of under-reporting of Do-Not-Resuscitate orders when comparing the medical record to the administrative data. We also found that to be true thereby greatly underreporting this critical risk factor.

The validation study did not show an association between any of the processes of care in the "worse than" or "better than" hospitals. Additionally, key prognosticating clinical factors which can influence mortality were not taken into account (vital signs, lab results, specific x-ray findings on admission and more). More rigorous and predictive study methods have been utilized to assess outcomes for patients with CAP, but it is recognized that such studies involve resource intensive medical record data abstraction.

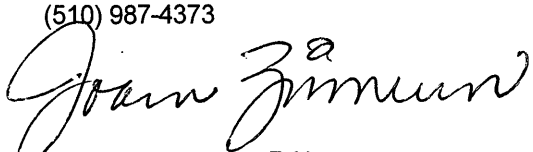
Kaiser-Permanente is a strong proponent of evidence based practices in medical care to promulgate superior quality. We developed a clinical practice guideline for CAP in 1998. Several changes have occurred since this data was extracted for this report, including the development of new clinical tools for physician and nursing staff to support the evidence-based principles. We are in the process of implementing a one-of-a-kind sophisticated electronic medical record that will span the continuum of care and significantly enhance communication and the transfer of information between the care team. We are investing in this system to recognize the goal of obtaining optimal health outcomes.

Overall, we commend OSHPD for reporting on CAP and other conditions and we recognize the maturation in methodology over time. However, this report is not reflective of the quality of care provided by Kaiser-Permanente. We believe that the next round of reports should continue to evolve and consider critical clinical parameters and not rely so heavily on primary and secondary billing codes. The people of Kaiser-Permanente are committed to improving quality of care and maximizing health outcomes for our patients. We look forward to participation in future outcome reports and eagerly await the next publication on Community-Acquired Pneumonia.

Sincerely,



Philip Madvig, M.D.
Associate Executive Director
The Permanente Medical Group, Inc.
(510) 987-4373



Joann Zimmerman, R.N.
Senior Vice President Operations
Northern California
Kaiser Foundation Hospitals
(510) 987-3189

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker:

The Kaiser Permanente Medical Care Program in Southern California would like to thank the Office of Statewide Health Planning and Development (OSHPD) and its contractors for giving us an opportunity to review and comment on the release of OSHPD's *Report on Hospital Outcomes for Community-Acquired Pneumonia in California*". Kaiser Permanente welcomes carefully planned and thoughtfully executed strategies to measure and improve quality of health care. We applaud OSHPD's attempt to measure and report hospital outcomes for pneumonia, and accept the accountability that comes with public reporting. We reviewed the Report very carefully, and attempted to validate the Report's findings by reviewing a sample of medical records of patients who were part of this study. Regrettably, our findings indicate that the assessment and hospital rankings are flawed. Our concerns are outlined below.

Unsubstantiated diagnosis: This outcomes assessment was meant to apply to patients with pneumonia. If patients do not have the diagnosis in question – pneumonia – then the hospital ratings are meaningless. In our review of 143 records of Kaiser Foundation Hospital patients in the OSHPD study, we found that one third did not actually have community-acquired pneumonia at all. These patients should never have been included in the study. Our own findings are entirely consistent with OSHPD's 1996 validation study, when OSHPD itself found that fewer than 59% of cases in its sample had a definitive diagnosis of pneumonia. Accuracy of diagnosis is crucial in research on the outcomes in patients with that diagnosis, and fundamental for public policy. When the State itself cannot confirm the diagnosis in four out of ten cases, the validity of the rating of hospital outcomes for patients with the diagnosis is dubious.

Inaccurate or incomplete diagnostic coding: The validity of the model depends on accurately coding co-morbidities that were present at hospital admission, as it is these co-morbidities that drive the risk-adjustment. In our chart review, we found that documented co-morbidities were uncoded or miscoded over 20% of the time. In other words, several of our hospitals were systematically undercoding during the study period. In the Kaiser system, hospital care – like ambulatory care – is prepaid. In such systems, there is little or no financial incentive for complete diagnostic coding, as reimbursement is not linked to coded data. With incomplete coding, patients who were seriously ill and had a greater risk of mortality were unable to be risk-adjusted, and were assigned an inappropriately low risk of death, yielding a skewed (inaccurately elevated) risk-adjusted mortality. We have been aware of sub-optimal coding practices for a number of years, and have implemented a re-examination and systematic improvement of coding practices at Kaiser Foundation Hospitals. Here, we can be very blunt: our coding practices during the study period were sub-optimal, opportunities for improvement have been identified, and improving medical record coding is a top priority of Kaiser Permanente senior leadership. However, the distinction between quality of *medical care* and quality of *medical record coding* is important, and readers of the Report should keep that distinction in mind.

Designation of pneumonia as community acquired: Although this category is related to both unsubstantiated diagnosis and inaccurate coding, it is worth identifying as a distinct concern. In our chart validation review, we found numerous cases of admission from skilled nursing facilities, as well as of aspiration pneumonia acquired in the patient's home. These should not be classified as "community-acquired pneumonia" per the OSHPD inclusion criteria, and these patients should have been removed from the study. Similarly, we found a number of cases of hospital-acquired pneumonia misclassified as community-acquired, reflecting coding inaccuracies. Although this misclassification is entirely our responsibility, the inclusion of these patients in the study cohort calls into question the validity of the results.

DNR policies and practices: In OSHPD's model, the presence of a DNR order is second only to respiratory failure as a predictor of death. Yet in its 1996 validation study, OSHPD itself found that fewer than half of chart-documented DNR's were recorded in the administrative data set used to construct risk-adjusted mortality rates and hospital ratings. For a variable of such prognostic significance, 50% underreporting is unacceptable. The under-recording of DNR orders in administrative data again calls into question the validity of the rating of hospital performance. We question whether it is possible to develop a model of outcomes of community acquired pneumonia that adequately take into account the contribution of patient and family preferences for management of pneumonia, a condition that is common in chronically ill patients making end of life decisions.

Unmeasured risk/inherently limited administrative data: OSHPD's assessment relies solely on administrative data. However, OSHPD itself acknowledges the limitations of administrative data, and that "clinical variables [temperature, systolic blood pressure, heart rate, sodium < 130 mEq/l, presence of multi-lobar infiltrate] substantially improve the risk-adjustment models". Administrative data are admittedly convenient, but if clinical variables not routinely recorded on datasets "substantially" improve the model's prognostic value, the public is not well-served by a report that highlights hospital ratings from incomplete data.

In sum, unsubstantiated diagnoses, incomplete coding, and incomplete documentation of DNR orders, combined with the model's use of administrative data that do not include key prognostic variables, strongly suggest that the outcome assessment is not a valid indicator of the quality of hospital performance in the management of pneumonia.

We would like to emphasize that *processes* of care are as important as clinical outcomes. Indeed, outcomes cannot reliably be measured until their antecedent processes are identified, understood, and implemented as a routine part of care. In electing to limit its assessment to outcomes based on administrative data, the *Report on Hospital Outcomes for Community-Acquired Pneumonia in California* is unable to measure and compare hospital performance on key aspects of pneumonia management that the clinical literature has demonstrated truly make a difference in outcomes.

Given the inherent limitations of OSHPD's administrative dataset, it is essential to explore alternative approaches to measuring and reporting hospital performance on management of pneumonia. We would like to point to three specific areas where Kaiser Permanente is actively working to improve the documentation, coding, and most importantly *delivery* of care to improve health outcomes, including pneumonia outcomes.

1. We are routinely auditing a random sample of medical records from each of our medical centers for accuracy of diagnosis and adequacy of coding. Findings from the audits are reviewed at least three times a year, with hospital leadership directly accountable for maintaining high levels of performance.
2. All of Kaiser Permanente's hospitals participate in the Joint Commission on Accreditation of Healthcare Organization's (JCAHO's) ORYX/core measure initiative. As part of this initiative, each of our hospitals will be measuring and reporting its performance on important aspects of pneumonia care, including timing of antibiotic administration, initial selection of antibiotic agent, and oxygenation assessment. Because these and other measures in the JCAHO pneumonia dataset are incontrovertibly linked to improved outcomes – and because they are more "real-time" than the OSHPD data, some of which are as much as five years old – the ORYX/JCAHO process of care data are likely to have a more direct and "actionable" impact on hospital performance than risk-adjusted outcomes.
3. Kaiser Permanente is in the process of implementing an electronic medical record at all its facilities. The scope of this project is enormous, but the long-term benefits to our patients will be incalculable for documenting and delivering medical care, as well as for studying and improving health outcomes.

Once again, although we believe that the OSHPD Community-Acquired Pneumonia hospital ratings do not accurately reflect quality of care (either good or bad), the Report is nonethless helpful in identifying pneumonia as one of the conditions we should focus on to improve chart documentation and coding, and we acknowledge and appreciate the considerable work that OSHPD has done to bring this opportunity to our attention.

Sincerely,

John Brookey, M.D.
Assistant Associate Medical Director for
Clinical Services/Operations
Southern California Permanente Medical Group

Carolyn Days, RN, MSN, CPHQ
Vice President for Quality
Kaiser Foundation Hospitals/Health Plan
in Southern California

November 25, 2003

Joseph Parker, Ph.D
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street
Room 200
Sacramento, CA 95814

Dear Mr. Parker:

Kaweah Delta Health Care District Community Acquired Pneumonia patients have an acceptable risk adjusted mortality rate only when DNR status is included in the calculation of risk. Analysis of other conditions associated with mortality reveal that Kaweah Delta has much higher rates than the statewide prevalence for chronic renal failure, acute CVA, and CHF. Surprisingly, for high-risk patients, for those with predicted mortality rates of greater than 40%, our observed mortality rate is better than predicted. Future efforts to improve outcomes at KDDH will include emphasis on rapid treatment with antibiotics according to IDSA and ATS guidelines, assessment and documentation of oxygen saturation, documentation of immunization status, and attention to the accuracy of diagnosis and coding in the lower risk populations who seem to be the source of our excess mortality.

Sincerely,

Lindsay K. Mann

Lindsay K. Mann
Chief Executive Officer

400 West Mineral King • Visalia, CA 93291-6263 • 559 624-2000 • FAX 559 635-4021

KERN MEDICAL CENTER

AFFILIATED WITH UNIVERSITY OF CALIFORNIA SCHOOLS
OF MEDICINE AT LOS ANGELES, SAN DIEGO, AND IRVINE

December 10, 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker:

Thank you for the opportunity to respond to the data reported in your Community-Acquired Pneumonia Project. We appreciated your ongoing efforts to improve care by providing outcome-based data. In conjunction with the study we submit the following comments.

The risk adjustment models utilized for the study has no consideration for the patients with the co-morbidities of alcoholism, drug abuse, mental impairment, or dementia. In the population Kern Medical Center serves, we feel these co-morbidities impact the incidence of both community-acquired pneumonia and aspiration pneumonia. Using these co-morbidities may have had an impact on Kern Medical Center's incidence of CAP because over 30% of the patients involved had those conditions. For Kern Medical Center it raises the question about the adequacy of our documentation and coding practices. Your study highlighted this shortcoming and we are strengthening our educational efforts regarding appropriate documentation and awareness of clinical data that supports patient diagnosis. We do ask, however, that you consider these additional co-morbidities in your outcome study results.

Lastly, in 2002 we selected CAP as one of our core measures for Joint Commission because we recognized our need to improve treatment protocols. Modifications have already been made initially focusing on the timely administration of medications. We continue to actively pursue process improvement that will enhance the care for those we serve.

We look forward to continuing to work with OSHPD to improve care provided in Kern County and ask that you give consideration to our comments for your final report.

Sincerely,

Peter K. Bryan
Chief Executive Officer
Kern Medical Center

PKB:abra
O:\Letters\121003OSHPD.doc

Marian Medical Center
CHW

1400 East Church Street
P.O. Box 1238
Santa Maria, CA 93456
805 739 3000 Telephone

December 9, 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker,

The Office of Statewide Health Planning and Development recently completed the preliminary draft of its first report on the care of Community-Acquired Pneumonia at California Hospitals between 1999 and 2001. Please accept this letter as an official response from Marian Medical Center.

The data for Marian Medical Center does not appear to correlate with the severity of illness for CAP patients. Because the expected mortality rate is based on the acuity of patients, understating patient acuity can, and most likely will, result in a higher than expected mortality rate.

In order for hospitals to have the greatest impact on improving the quality of care for patients, information and data must be made available quickly. Marian Medical Center appreciates recent improvement in the effort by OSHPD to gather and report data to California hospitals in a timely manner.

Sincerely,

Charles J. Cova,
President
Marian Medical Center

MARSHALL MEDICAL

December 2, 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Subject: California Hospital Outcomes Report on Community-Acquired Pneumonia, 1999-2001

Dear Mr. Parker;

Marshall Medical Center is committed to providing patients and their families with the latest in scientific medicine delivered in a healing environment. This report, as well as our internal performance audit, shows that we are performing well. For example, our 2003 pneumonia data indicates a significantly lower than expected mortality rate.

Although the Hospital Outcomes Report is interesting, the limitations of the Mortality Prediction Model make it difficult to draw conclusions about the quality of care in hospitals. In the spirit of continuous performance improvement, we want to express our concerns about Hospital Report Cards and note that the American Hospital Association shares these concerns.

Limitations of the Mortality Prediction Model:

1. Your risk adjustment model does not consider patients who are terminally ill and have declined further treatment. Patient wishes for "Palliative-Comfort Care Only" were found in 26% of our deaths.

2. It is difficult for a model based solely on computer-generated data to identify all of the risk factors of a patient. Because hospitals have a variety of types of personnel reviewing and entering clinical data, the quality of the data varies. Therefore, computer data alone cannot be reliably used to evaluate outcomes. As one example, when we reviewed the medical records of the patients in this study who died, we found that they were much sicker than indicated in our computer-generated data.

Thank you for the opportunity to review and comment on the draft of this report. We can appreciate the difficulty of developing a reliable mortality prediction model and encourage you to work with the American Hospital Association to develop a more reliable approach to help consumers judge the quality of hospital care.

Sincerely,

James Whipple
CEO
Cc: American Hospital Association

MARSHALL WAY · PLACERVILLE, CALIFORNIA · 95667
916.933.0913 | 530.622.1441
WWW.MARSHALLMEDICAL.ORG

Mercy San Juan Medical Center
CHW

6501 Coyle Avenue
Carmichael, CA 95608
Telephone (916) 537-5000

November 5, 2003

Joseph Parker, PhD
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street
Room 200
Sacramento, CA 95814

Dear Dr. Parker:

Thank you for the opportunity to respond to the California Hospital Outcomes Report on Community-Acquired Pneumonia 1999-2001on behalf of Mercy San Juan Medical Center prior to its release to the media and general public.

The findings for Mercy San Juan Medical Center indicate risk-adjusted mortality rates close to, and not statistically significantly different from, the statewide average in both groups (DNR YES and DNR NO). We fully acknowledge the tremendous work put forth by the OSHPD in developing and executing a risk-adjusted evaluation in such a complex patient population and in the preparation of a public report. Although the size of the data set and the sophistication of the risk adjustment methodology provide valuable comparative information, the utility of the findings are limited by the timeliness of data and failure to include or account for potentially important risk factors in the process of risk adjustment. In addition, factors beyond the control of the hospital may bias findings when 30-day mortality is selected for study as the outcome variable.

We support the State's efforts to inform the public about the quality of healthcare provided by California hospitals.

Sincerely,

Michael J. Uboldi
Hospital President

Mission Community Hospital™
Compassionate Healthcare. Quality Healthcare.

November 13, 2003

Joseph Parker, Ph.D.
Action Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95184

Dear Dr. Parker,

Mission Community Hospital is committed to delivering high quality healthcare in the San Fernando Valley. Our patients and their families look to us to deliver on that promise.

Our results published in OSHPD's "California Hospital Outcomes Report on Community-Acquired Pneumonia, 1999 – 2001" indicated that Mission Community Hospital's Community-Acquired Pneumonia (CAP) mortality rate is "not significantly different from the state average." However, the 1999 outcome, with only 17 cases, skews the overall results since that outcome had a very high probability that the rate occurred by chance.

We established and have continued a performance improvement process to examine the care of the pneumonia patient and we monitor the JCAHO Core ORYX measures for CAP. Further we developed a clinical pathway and patient education tools directed at improving our treatment protocols. It is important to note that a significant number of our pneumonia patients enter Mission Community Hospital through the Emergency Department where timely assessment and treatment is implemented. Our outcomes for patient assessment and implementation of antibiotic therapy in less than 8 hours have been outstanding.

While we are not taking exception to the data provided, we are disappointed that the age of the data makes it difficult for organizations to respond.

Thank you for the opportunity to respond to the outcomes report.

Sincerely,

Bill Daniel
Chief Executive Officer

14850 Roscoe Boulevard • Panorama City, CA 91402 • (818) 787-2222
www.MCHonline.org

Peter F. Bastone
President & Chief Executive Officer

Mission Hospital
ST. JOSEPH HEALTH SYSTEM

27700 Medical Center Road
Mission Viejo, CA 92691

Tel 949.365.2248
Fax 949.364.2056
www.mission4health.com

November 25, 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health and Planning and Development
818 K Street, Room 200
Sacramento, California 95814

Dear Dr. Parker,

Thank you for the preliminary report on the care of Community-Acquired Pneumonia (CAP) at California hospitals between 1999 and 2001. We appreciate the comparison data on CAP mortality.

We have reviewed the hospital specific outcome measures for our facility. Mission Hospital physicians and staff are pleased with the outcomes reported for its patient population of CAP/mortality. For the third year, Mission Hospital remains on the low end of the expected mortality range for both the observed and the risk adjusted death rates for CAP.

Mission Hospital is very proud of the care we deliver. We very much appreciate your interest in our comments regarding this study and thank you for the opportunity to participate. The study feedback will be used as a part of our internal systems for our continuous performance improvement.

Sincerely,

Peter F. Bastone
President and Chief Executive Officer

NORTHBAY HEALTHCARE
A Non-Profit NorthBay Healthcare System Affiliate

1 December 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 220
Sacramento, CA 95814

Dear Dr. Parker:

The NorthBay Healthcare Group (NorthBay Medical Center and VacaValley Hospital) appreciates the opportunity to review and respond to the draft California Hospital Outcomes Report on Community Acquired Pneumonia, 1999-2001. Our organization is committed to continuous quality improvement and we consider the findings of reports such as this very seriously, using it as a tool to initiate a process of self-evaluation and consequent performance improvement.

Once we received the comparative data that you sent to us, a Quality Improvement (QI) team of four medical staff physicians and two QI Department staff was empanelled to analyze the findings of the OSHPD study and to design interventions aimed at lowering the mortality rate of patients admitted with community acquired pneumonia. Our findings and plans are detailed below:

1. The first activity of the QI team was to evaluate the veracity of the data submitted to OSHPD and to evaluate whether there were any trends in patient care that could have explained the observed mortality rate. During the 3 years between 1999-2001, there were 134 cases identified as meeting criteria for mortality from community acquired pneumonia. The medical records of 132 patients were successfully retrieved and abstracted. In a significant number of cases at both NorthBay Medical Center and VacaValley Hospital, the data contained in the OSHPD report was different from that found in our review of the hospital medical records. The findings from each site are as follows:

<u>NorthBay Medical Center</u>

CAP deaths in OSHPD study		75
Deaths with incorrect admission source	20	
Did not die of community acquired pneumonia	1	
Corrected deaths		54
Corrected death rate (prior=19.8%)		15.08%
Corrected risk adjusted death rate, without DNR		17.98%
Corrected risk adjusted death rate, with DNR		17.33%

<u>VacaValley Hospital</u>

CAP deaths in OSHPD study		59
Deaths with incorrect admission source	12	
Did not die of community acquired pneumonia	1	
Had hospital acquired pneumonia	1	
Corrected deaths		45
Corrected death rate (prior=22.1%)		17.13%
Corrected risk adjusted death rate, without DNR		18.56%
Corrected risk adjusted death rate, with DNR		16.45%

From this re-analysis of deaths from community acquired pneumonia, it is clear that incorrect coding data previously submitted by NorthBay to OSHPD explains in part the high degree of disparity between observed and expected mortality rates from community acquired pneumonia. The corrected mortality rates significantly reduce our overall mortality rate and the degree to which the performance of the NorthBay hospitals varies from other hospitals.

1200 B. Gale Wilson Boulevard
Fairfield, CA 94533-3587
Telephone 707/429-3600

1 December 2003
Page Two

2. NorthBay Healthcare recently has installed Midas DataVision software as a method to track process and outcomes of care provided in our hospitals, as compared to hospitals of similar size. In order to determine whether there has been improvement in pneumonia mortality after the time interval contained in the OSHPD study, we evaluated pneumonia mortality using JCAHO Core Measure definitions for 2002 and the first quarter of 2003. The findings are as follows:

	2002	1stQ 2003
NorthBay Medical Center	6.67%	6.42%
VacaValley Hospital	7.77%	9.48%
DataVision benchmark for similar hospitals	6.23%	5.96%

While the JCAHO Core Measures have different criteria than the OSHPD community acquired pneumonia study, it is reassuring to us that in a more recent time frame, the performance of our two hospitals is closer to expected mortality rates than in the OSHPD study. Whether this is due to actual improvements in outcomes over time or differences in selection criteria is not known at this point, but will be further evaluated.

3. By any measure, it is a matter of concern to us that the corrected mortality rates for community acquired pneumonia are higher at the NorthBay hospitals than they are at comparable community hospitals, as it is our goal to perform well above average in the care that we provide. As a consequence, the Quality Improvement team has embarked upon the following activities in an effort to substantially reduce the rate of pneumonia mortality in our patients:

- With the data abstracted from the medical records of patients in the OSHPD report, we are searching for trends that may explain the observed deaths during this period, thereby providing opportunities for system improvements or educational interventions with individual staff members.

- In an effort to improve the veracity of data submitted by NorthBay Healthcare to OSHPD, a detailed review of hospital coding practices and data submission will be performed.

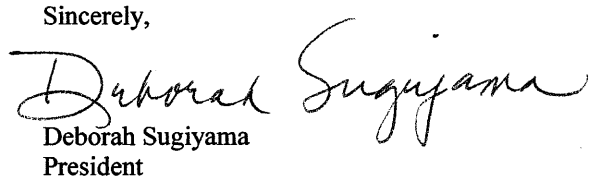
- The Quality Improvement team is working on the development of an evidence-based Community Acquired Pneumonia Care Pathway, which once approved by the Medical Staff, will be implemented in both hospitals. This will include the development of clinical practice guidelines, use of pre-printed order sets, and daily concurrent review of care provided to patients with pneumonia to ensure that the pathway is being followed.

- Systems of care (involving physicians, nursing staff, pharmacists, respiratory therapists, etc.) within each of the hospitals will be evaluated and redesigned. This is especially critical in regard to coordination of care between the Emergency Department, where medical care for pneumonia patients typically is initiated, and the in-patient units where on-going treatment of pneumonia is provided.

- We will continue to utilize the Midas DataVision information to monitor our progress in reducing pneumonia deaths so that performance data is analyzed and acted upon at a time that is more proximate to when care is given.

We look forward to participation in future OSHPD outcome projects and other quality measurement efforts.

Sincerely,



Deborah Sugiyama
President
NorthBay Healthcare Group

Michael S. Policar, MD, MPH
Vice President for Medical Affairs
NorthBay Healthcare Group

Northridge Hospital Medical Center
CHW

Roscoe Boulevard Campus
18300 Roscoe Boulevard
Northridge, California 91328
(818) 885-8500 Telephone

Sherman Way Campus
14500 Sherman Circle
Van Nuys, California 91405
(818) 997-0101 Telephone

Date: December 3, 2003

To: Joseph Parker, Ph.D.
Acting Deputy Director, Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA. 95814

Dear Dr. Parker,
Thank you for the opportunity to review the California Hospital Outcomes Report on Community-Acquired Pneumonia (CAP). Northridge Hospital is committed to delivering high quality heath care. Our patients have high expectations and we strive to exceed them. Patients can be assured that each case involving CAP is individually reviewed.

We have carefully reviewed our hospital's results in OSHPD's Report on CAP mortality. Our risk adjusted 30 day outcomes are rated better than expected on both models (with and without DNR, P value <0.01). In addition, our mortality rate is significantly lower than the statewide rate (P value <0.01).

Northridge Hospital physicians and other clinical team members are trained in state of the art treatment and strive for the highest quality outcomes. They welcome any opportunity to improve the quality of care that is given. In keeping with their intent, any patient death or complication that results from CAP is reviewed in depth by the medical staff via their peer review mechanism.

Our outcomes related to CAP will continue to be closely monitored internally. Thank you for the opportunity to gain perspective on our performance as it relates to the larger healthcare community.

Sincerely,

Michael L. Wall
President

Oak Valley Hospital
A Division of Oak Valley Hospital District

October 16, 2003

Joseph Parker, Ph.D.
Office of Statewide Health Planning & Development
Healthcare Quality and Analysis Division
818 K Street, Room 200
Sacramento, CA 95814

RE: California Outcomes Report on Community-Acquired Pneumonia, 1999-2001

Dear Mr. Parker,

Oak Valley Hospital District (OVHD) is a 35 acute-bed rural facility located in the San Joaquin Valley. As a rural facility, the number of cases seen at the facility is limited. Despite the relative low incidence of patients with a diagnosis of pneumonia, Oak Valley Hospital District is committed to ongoing clinical quality improvement not only for patients with pneumonia, but all patients.

We support the analytic approach undertaken by the Office of Statewide Health Planning and Development with this project. The California Hospital Outcomes Project on Community-Acquired Pneumonia provides a unique opportunity to evaluate our performance in relationship to hospitals across the state. While we applaud the efforts to obtain information of this nature from hospitals, one of the limitations is that this data reflects patient care rendered from 1999-2001.

Over the last several years, OVHD has moved to a focus on continuous quality improvement. Data is now assessed on a continual basis and strategies are implemented and modified continuously to improve processes and outcomes. This focus on CQI is a change from the focus of quality assurance, which was in place at the time data collection began. Another hallmark change during the data collection period was initiation of Core Measures by the Joint Commission on Hospital Accreditation (JCAHO). JCAHO has identified Community-Acquired Pneumonia as one of the core measures hospitals can chose to provide comparative data. As the outcomes for Oak Valley Hospital District demonstrate, improvements in care have come to the forefront, ultimately improving outcomes. Overall, OVHD realized an observed death rate less than expected. The rate was slightly higher in 1999, but as identified earlier, our commitment to continuous

350 South Oak Avenue • Oakdale, CA 95361 • (209) 847-3011

quality improvement lead to the observed death rate being significantly lower than expected. One area of concern is related to the number of cases included in the patient category "with a Do Not Resuscitate (DNR) in place". We found that during the study period there were 7 patients with DNR, and not 30, as identified.

An additional concern with release of this information to the lay public relates to the implication that patient outcomes, such as mortality, are solely due to the interventions initiated by the treating facility, when in fact the patient's own health maintenance and willingness to comply with the treatment regime is key to long term survival. Despite these few identified concerns, we feel that the information presented to the public from this project will be favorable. Our participation in the California Hospital Outcomes Report on Community-Acquired Pneumonia demonstrates our commitment to the residents of our community to provide optimum care.

Sincerely,

John Friel
Chief Executive Officer

Ojai Valley
Community Hospital

December 5, 2003

Office of Statewide Health Planning and Development
Health Care Quality and Analysis Division
818 K Street, Room 200
Sacramento, CA 95814

Attn: Joseph Parker, Ph.D, Acting Deputy Director

RE: California Hospital Outcomes Report on Community-Acquired Pneumonia, 1999-2001

Dear Dr. Parker:

Ojai Valley Community Hospital is committed to delivering high quality healthcare. Our patients have very high expectations and we strive to exceed them.

Our results on OSHPD's Community-Acquired Pneumonia Outcomes in California demonstrated a lower than expected mortality rate. We are committed to quality healthcare as well as our commitment to honor our patients' wishes. Our patients have the final say in their treatment decisions. As evidenced by our participation in the Patients Evaluation of Performance-California (PEP-C), our survey showed an above average rating by our patients.

Ojai Valley Community Hospital appreciates the contributions presented in the OSHPD study. This report gives us the opportunity to continually improve protocols, which in turn help us to better serve our patients.

Sincerely,

Victoria A. Alexander
Chief Executive Officer

1306 Maricopa Highway, Ojai, California 93023 Telephone (805) 646-1401 Facsimile (805) 640-2204

ADMINISTRATION

November 14, 2003

Joseph Parker, PhD.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health and Planning and Development
818 K Street, Room 200
Sacramento CA 95814

Re: California Hospital Outcomes Report On Community-acquired Pneumonia

Dear Dr. Parker:

We have reviewed our results and find, unfortunately, that our mortality rates appear to be higher than they actually were because of an error our hospitals made in sending OSHPD our data. Patients admitted via our emergency rooms from skilled nursing facilities have erroneously been included in the study.

The reported mortality rates for this category of patients, excluding, as it is supposed to do, patients admitted from skilled nursing (SNFs) and residential care facilities, is substantially higher than the rates that we have been tracking internally for the past several years. On reviewing the material that was sent to us on disc, we discovered that large numbers of patients not admitted from "home" were mistakenly included in the study. During the period of the report, 1999-2001, we did not have a specific identifier for patients admitted to our hospitals via the emergency departments who were residents of skilled nursing or residential care facilities. The data that we submitted to OSHPD only indicated that these patients were admitted via our emergency department, with the result that these patients appear in OSHPD's database and this study as having been admitted from "home." Obviously residents of long-term care facilities who contract pneumonia will have a higher mortality rate than those living at "home", and this falsely inflated our mortality rates.

15255 Innovation Drive, Suite 204 San Diego, CA 92128-3410 Tel 858.675.5100 Fax 858.675.5103 Web www.pph.org
A California Health Care District

It would not be practical to go back and manually review some 1500 charts to determine which patients were admitted from SNFs, nor for OSHPD to alter our data on such short notice based upon this review. We established new internal codes allowing the identification of patients admitted from SNFs in 2002. We have now examined our data for our fiscal year 2003, and we hope this can shed light on the magnitude of the error introduced by inappropriate inclusion of SNF patients in OSHPD's study results.

The mortality rate for all patients meeting OSHPD's criteria for the study, but including patients admitted from SNFs, was 11.4%. When these patients were excluded, the rate fell to 10.8%. We believe that these figures would closely approximate those during the 1999-2001 period.

We would be grateful if you could arrange to refer the reader of OSHPD's published report to this letter of comment.

We appreciate the opportunity to review our data. Thank you in advance for your cooperation.

Respectfully yours,

PALOMAR POMERADO HEALTH

Michael H. Covert
President and CEO

350 Terracina Blvd.
P.O. Box 3391
Redlands, CA 92373-0742
909-335-5500
Fax 909-335-6497

December 16, 2003

Joseph Parker, Ph.D
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker:

This is in response OSHPD's Draft Community Acquired Pneumonia (CAP) report, which we recently received. Thank you for providing us a copy of the data we gave OSHPD for this study and for answering our questions over the past few weeks. After careful review of Redlands Community Hospital (RCH) data and current CAP literature and practice guidelines, we respectfully request that this study not be published in its current form.

RCH Data

The CAP study population included patients admitted to hospitals from home. Due to abstracting errors, RCH unintentionally provided OSHPD incorrect "admission source" data for about half of the patients included in the study. The abstracting error incorrectly assigned skilled nursing and board and care patients to the admit source category "home," rather than to the appropriate category "long term care." These patients should have been excluded from the study. When we adjust our data and consider only the patients truly admitted to RCH from home, our actual mortality rate is reduced from 17.8% to an estimated 9.0%, significantly below the average expected statewide mortality rate of 12.2%. We brought this important correction to the attention of OSHPD, but we were told that OSHPD would not accept the corrected data.

It is surprising to us that OSHPD would intentionally publish a report that OSHPD knows contains incorrect data. Further, it is reasonable to assume that other hospitals may also have had problems with data quality, so the extent of error may well be larger than the relatively small number of discharges reported in RCH data.

Current CAP Literature and Practice Guidelines

OSHPD indicates the methodology used to produce this report is based on a 1996 model that includes a literature review through June 2000. While OSHPD is apparently aware of published critical risk factors that are associated with an increased rate of CAP mortality, they were rejected for this study.

OSHPD's methodology does not include the widely accepted study published by the Infectious Diseases Society of America (IDSA) in September 2000. The IDSA study includes clinical management guidelines approved by the Centers for Disease Control (CDC) and Centers for Medicare and Medicaid Services (CMS) for CAP patients. The IDSA report defines community acquired pneumonia as community-acquired pneumonia in immuno-*competent* adults, which is consistent with what most practitioners think of as community-acquired pneumonia. Unfortunately, the OSHPD definition of CAP includes immuno-*compromised* adults, i.e., individuals who were admitted with respiratory failure and requiring ventilatory support, or septicemia, abscess of the lung, pulmonary collapse, and pleurisy, among other conditions.

The IDSA report also provides a comprehensive list of risk factors associated with a higher likelihood for mortality in CAP patients. Unfortunately, only a few of these risk factors were included in the OSHPD methodology, while 49 of these published risk factors were excluded from the OSHPD methodology.

As an example of the significance of excluding or including risk factors, RCH compared the clinical severity of the RCH CAP patients who died against the excluded risk factors. All (100%) of the RCH CAP patients who died had at least one of these risk factors. In most cases, the patients had multiple risk factors identified on the exclusion list, and over half of these patients had at least five excluded risk factors. The presence of these risk factors clearly indicates all of these patients were in an immuno-compromised state, and they should not have been included in the study universe. The true clinical picture and conclusions about quality for these patients are considerably different from what the draft OSHPD report suggests.

Another Perspective

RCH also compares its CAP data with published Joint Commission on Accreditation of Healthcare Organizations (JCAHO) benchmark data. Only immuno-competent patients are included in this CAP data base. The results of this ongoing study are remarkably different from the draft OSHPD CAP study.

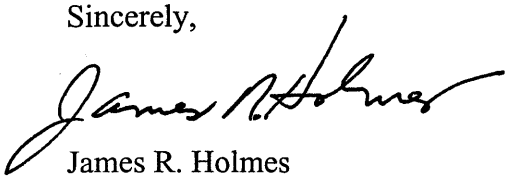
Since 2002, Redlands Community Hospital has routinely measured the CAP mortality rates of our patients and compared them against the JCAHO published CAP National Mortality Rates. The findings of this comparison reveal an average RCH CAP mortality rate of 7% during a 30 month period. This unadjusted-risk mortality rate is well below the reported national CAP mortality rate of 9% as published March 2002 by the JCAHO in their CAP core measure overview.

Recommendation

We support OSHPD's desire to assist the public in making informed healthcare decisions. As all of us in the healthcare industry are aware, identifying and agreeing to definitions of quality and providing the data to measure and compare against these definitions is difficult, at best. To further complicate matters, medical practice continues to evolve and improve. OSHPD has an important but difficult responsibility to identify, report, and measure standards of practice that represent the current state of the art of medicine, rather than to compare current outcomes to dated concepts, as in the draft CAP report.

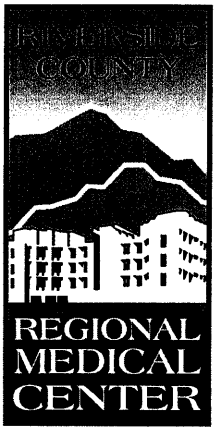
OSHPD should not publish the draft CAP study without further review and modification, and we believe that OSHPD's presentation of the CAP data as it now exists will mislead the public. Contrary to OSHPD's intent, this report misrepresents hospitals and their medical staffs and does a disservice to the general public. Rather than assisting individuals in making more informed decisions about healthcare, this report is inaccurate, out of date, and not in keeping with the level of service and quality the public expects from its government officials.

Sincerely,



James R. Holmes
President/CEO

OFFICE OF THE DIRECTOR



December 4, 2003

Office of Statewide Health Planning & Development
Healthcare Quality and Analysis Division
818 K Street, Room 200
Sacramento, CA 95814

Subject: California Outcomes Report on Community Acquired Pneumonia, 1999 – 2001 OSHPD Data

We are submitting comments regarding the above referenced study, which was sent to us for review and comment. We would like to alert you to concerns we have about significant problems with this study.

Upon receiving the draft report, we undertook a thorough review of our own practices in providing for community acquired pneumonia. Our objective was to look for opportunities to improve our processes of patient care and improve outcomes. We looked at every one of the deaths in the study that occurred at our facility. In this review, we were quite shocked to see that only 25% met criteria for a principal diagnosis of community acquired pneumonia. Cancers, pulmonary emboli, congestive heart failure, tuberculosis, AIDS, and a variety of other conditions accounted for the other 75%.

Furthermore, we then looked at our coding and found the coding was substantially correct.

We therefore conclude that there is a problem with the methodology to identify community acquired pneumonia cases and that, in fact, the codes chosen to represent community acquired pneumonia do not accurately represent such cases.

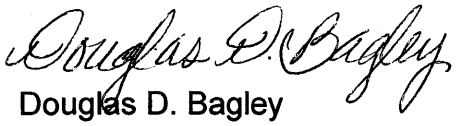
Additionally, we identified another problem with one of the exclusion criteria, namely DNR within 24 hours. We do not believe that is an appropriate time frame to use to identify DNR in facilities such as ours. The majority of our patients do not have an existing continuity-of-care arrangement with a physician in practice, and often arrive with medical history and family matters not known. Consequently, we often do not write DNR orders within that short a time frame. We may need a longer period of time to assess the overall patient and family situation in an ethical and responsible manner, and feel 24 hours is not a wide enough time frame for capturing DNR orders. Of our 53 deaths, CHOP only identified 13 DNRs, whereas in fact there were 22.

26520 Cactus Avenue, Moreno Valley, California 92555
Phone: 909-486-4470 • FAX: 909-486-4475 • TDD: 909-486-4397

Because these issues are probably systemic to the study, we feel that the results cannot be accepted with confidence as to their accuracy. Therefore, we strongly urge OSHPD not to release the study until these issues can be examined and resolved. To release the study as it presently stands, without addressing these issues, could seriously mislead the public.

We are available to discuss these issues further. Please contact Dr. W. Benson Harer, Medical Director, at 909-486-4474.

Sincerely,



Douglas D. Bagley
Chief Executive Officer

DB:sg

P:\Users\Shgibb\Doug\OSHPD ltr.doc

26520 Cactus Avenue, Moreno Valley, California 92555
Phone: 909-486-4470 • FAX: 909-486-4475 • TDD: 909-486-4397

San Joaquin General Hospital / A Division of San Joaquin County Health Care Services

December 20, 2003

Joseph Parker, Ph.D., Acting Deputy Director
Health Care Quality and Analysis division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker:

Thank you for providing San Joaquin General Hospital the opportunity to review the community-acquired pneumonia data for 1999-2001 associated with our facility and for providing us the opportunity to respond to the findings published in your report. We have gone through an extensive review of the data and our patient records to determine whether the data upon which our mortality rate is based is accurate, especially because it was so far outside the statewide norm. The data and the patient records have been reviewed by the Chief of Pulmonary Medicine, the Chief of our Internal Medicine Department, Performance Improvement staff, as well as the Directors of Nursing and Information Management.

Our process given the time allowed for response was to review the 60 cases listed as mortalities within 30 days. We found that a full thirty-two (32) of the cases should have been excluded from the report based on OSHPD's exclusion criteria. Twenty-one (21) of the patients were admissions from nursing homes, so should not have been a part of the study. In addition, eleven (11) cases met the clinical exclusion criteria based on such factors as co-morbidities which were the actual cause of death and therefore should not have been included as deaths from community-acquired pneumonia.

Our review has revealed to us that we need to make improvements in our processes here for accurately coding patients upon arrival, particularly those from nursing homes, and to improve our discharge coding so that correct information is transmitted as part of the statewide database. We have instituted correction plans with the Admitting Department, the Information Management Department, and the medical staff to enhance communication which will result in improved data and more accurate risk adjustments.

Based on our review, we believe that our mortality rate is likely in line with the statewide average and not at the level conveyed in the report. We are committed to working with your agency to ensure that our data accurately reflects our patient care in future reports.

Sincerely,

Steve Ebert
Hospital Director

SE:DH

Cc: Dr. Deepak Shrivastava, Pulmunologist
Dr. Sheela Kapre, Internal Medicine Chief
Dr. Lee Adams, Medical Director
Dr. Christopher Flores, President of the Medical Staff

Post Office Box 1020 / Stockton / California 95201 / 209 468-6000

Scripps Green Hospital
10666 North Torrey Pines Road
La Jolla, CA 92037-1092
Tel 858-455-9100

October 21, 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Parker,

After reviewing the Scripps Green Hospital specific data and the preliminary draft in general in the **Community-Acquired Pneumonia: Hospital Outcomes in California, 1999-2001,** I would like further clarification on the RADR.

How many ICD 9 codes for co-morbidities do you use for each patient medical record when calculating RADR? Do you believe that each patient record includes a complete list of co-morbidities or is there a limit to the number that are utilized. For example, if one of the patients has 15 comorbidities and the record does not have them ranked in an order of severity for CAP, would some of them not show up on your risk adjustment calculation?

I am pleased with our rating, but wonder if you can provide any more clarification on this issue.

Sincerely,

Robin Brown
Administrator

SIERRA KINGS
DISTRICT HOSPITAL

December 3, 2003

Joseph Parker, Ph.D.
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, California 95814

Dear Dr. Parker:

Thank you for the opportunity to respond to the preliminary report of the care of Community Acquired Pneumonia for California hospitals between 1999 – 2001. The preliminary report for Sierra Kings District Hospital CAP without DNR and with DNR, rates us significantly under the risk adjusted death rate percent.

Sierra Kings District Hospital physicians and staff assure each patient individual treatment and strive to give the highest quality of care.

Sierra Kings appreciates the contributions made by the OSHPD study. The report on Community Acquired Pneumonia outcomes in California gives us the opportunity to re-evaluate and improve our pneumonia protocols.

Thank you for helping us to better serve our patients.

Sincerely,

Melvyn Patashnick
Chief Executive Officer

372 West Cypress Avenue, Reedley, CA 93654 (559) 638-8155 FAX (559) 637-7555

465 W Putnam Ave
Porterville, Ca 93257

November 10, 2003

Dear Mr. Parker,

Thank you for the opportunity to respond to the release of data on our hospital's outcomes for community acquired pneumonia. Sierra View District Hospital is a 157-bed, acute care facility that serves a population of over 100,000 people. The second largest hospital in Tulare County, Sierra View has 190 births per month and our Emergency Room serves over 38,000 patients annually. Our 29-bed Subacute Unit provides for short or long term 24-hour nursing care and the Cancer Treatment Center offers a full range of radiation and oncology services under one roof.

We at SVDH are committed to analyzing our patterns of care and patient outcomes to provide the highest quality of care possible. One hundred percent of unexpected death cases are screened by the Quality Management Department to ensure that they are not related to a quality of care issue.

OSHPD's CAP data for 1999-2001 has been analyzed carefully by our hospital's Medical Director of Quality, CEO, CNO and Director of Quality Management. The results of the study shows our observed risk –adjusted mortality rate for the No code patient's to be just above the California State average of 12.23% with the confidence interval width crossing the state average and the full code patient's rate to be significantly higher than statewide rate.

Joining the ORYX study for CAP patients in July of 2002 and CMRI in 2003 has identified opportunities to improve care and has prompted education for patient's and their families, hospital staff, and physicians. We also established a performance improvement team to examine the processes around the care of the CAP patient. This multi-disciplinary team is concentrating on the amount of time it takes to administer first dose antibiotics from admission, Pneumococcal screen and vaccinating and Smoking cessation advise/counseling. In addition, the Health Information Management department will be conducting an audit to ensure accuracy of our coding practices for CAP patients here at Sierra District Hospital.

In reviewing our statistics from January 2002 through 2003 to date we found our in house mortality rate to be <5% for those admitted with a primary diagnosis of pneumonia.

We look forward to opportunities to participate in improving the OSHPD CAP outcomes project as well as continuing with other benchmark efforts such as CMRI and ORYX. This report affirms our already noted dedication to improving care for the community acquired pneumonia patient's in our community.

Sincerely,

Kelly Morgan,
President and CEO

Simi Valley Hospital

Adventist Health

Mailing Address
2975 N. Sycamore Drive
Simi Valley, CA 93065
Tel 805-955-6000

December 22, 2003

Joseph Parker, PhD
Acting Deputy Director
Health Care Quality and Analysis Division
Office of Statewide Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Mr. Parker,

Simi Valley Hospital is in receipt of the California Hospital Outcomes report released to us in October 2003. We have reviewed the hospital specific measures of outcome for our facility and are pleased that we are below the statewide average for overall risk adjusted mortality rates for Community–Acquired Pneumonia.

We are currently participating in JCAHO's ORYX Core Measure reporting and CMS Hospital Quality Incentives involving Community-Acquired Pneumonia as a part of our quality improvement for the care of pneumonia patients.

Thank you for the opportunity to respond to the study results.

Sincerely,

Margaret R. Peterson

Margaret R. Peterson, PhD
President & Chief Executive Officer

MRP/blc

STANFORD
HOSPITAL & CLINICS
Stanford University Medical Center

ADMINISTRATION

November 25, 2003

Joseph Parker
Acting Deputy Director
800 18th K Street
Room 200
Sacramento, CA 94814

Dear Mr. Parker,

Stanford Hospital and Clinics is committed to providing the highest quality of patient care to all of its patients. In that endeavor, Stanford Hospital and Clinics is continuously seeking opportunities to further improve and validate the quality of care it provides. The OSHPD Community Acquired Pneumonia (CAP) study provided Stanford Hospital and Clinics an opportunity to participate in and utilize the findings from the study to direct improvement efforts.

Stanford Hospital and Clinics supports the OSHPD evaluation of the study and believes the study data support the excellent quality of care provided.

No study, however well-designed and executed, can answer all questions. All studies necessarily make compromises in gathering and summarizing data, especially when the information comes from dissimilar hospitals. As a result, there are limitations on conclusions that can be drawn from this report. We draw your attention to two particular points which are supported in the detail of the report itself.

(1) Comparing two or more healthcare facilities may yield conflicting or unreliable results because:

- The number of relevant patients (sample sizes) are too few to reach firm estimates of a healthcare organization's performance. Such a comparison would be similar to comparing two baseball player's batting performance based on their results from a few games rather than the entire season. A typical approach in estimating true differences in performance is to attach a "margin of error" to each estimate as is done with public opinion and election polls. By adding and subtracting the "margin of error" to the estimate a range of values is formed. If, after accounting for sampling error in this way, the range of values for one organization overlaps with the range for another then we cannot conclude which organization has better performance. It should be noted the "margin of error" is quite large in this study and that, in many cases organizations that were labeled "better than expected" have a range of values that overlaps with organizations that were labeled to be performing "as expected."

300 Pasteur Drive • Room H3200, M/C 5230 • Stanford, CA 94305
t: 650.723.5708 • f: 650.723.0074

- The mix of different patient types and condition of patients receiving care at each of these organizations are not the same. Healthcare organizations providing care to the sickest and most complicated patients may then display only average performance compared to organizations with more routine and uncomplicated patients. Returning to the baseball analogy, one would resist comparing two baseball teams if they each played in dissimilar leagues with strong pitching in one league and weaker pitching in the other. The report uses a "risk adjustment model" to try to correct for such differences but usually cannot eliminate the impact of differences in patient mix and patient condition:

  "A principal weakness of this report is its reliance on a small set of 'administrative' data elements that hospitals are required to report to the State's Patient Discharge Data Program. Such administrative data provide limited information about demographic and clinical variables. Accordingly, it is possible that some of the deaths predicted by the model used in this report were the result of unmeasured risk rather than poor hospital quality."

  This "risk adjustment model" comparison should not be viewed in the same light as, say a controlled study on automobile safety. In such a study, similar cars from different manufactures can be put through performance tests under the same circumstances, such as the car's breaking distance when traveling 30 mph. Since each car is tested under the same circumstances, differences in performance can be determined without need for a "risk adjustment model." Such controlled studies are not possible in healthcare since that would require an identical patients with identical conditions to be admitted to each healthcare facility we would like to compare. The "risk adjustment model" is an attempt mathematically create a "typical" patient.

(2) The risk-adjusted mortality rate alone does not portray an organization's performance. As noted in the report, aspects of patient care other than 30-day mortality are not being measured here:

"This report focuses on 30-day mortality, but does not assess other outcomes such as a patient's quality of life after discharge, or subsequent hospital readmissions."

Stanford Hospital and Clinics is devoted to three goals: to care, to educate, and to discover. Stanford Hospital and Clinics will continue to seek opportunities to improve patient care, even while validating all measures of its performance.

The data provided by OSHPD to Stanford Hospital and Clinics will form part of the Community Acquired Pneumonia Core Measurement Program. The program is focused on both improving care delivery to the individual patient, regardless of how sick he/she may be, and improving the group's overall rates of successful outcomes.

Martha H. Marsh
President & CEO
Stanford Hospital & Clinics

Larry Shuer, MD
Chief of Staff
Stanford University Medical Center

P:\userapps\nl\oshpd letter.doc
NL:dd

Valley Presbyterian
HOSPITAL
15107 Vanowen Street
P.O. Box 9102
Van Nuys, CA 91409-9102
(818) 782-6600

November 20, 2003

David M. Carlisle, M.D., Ph.D., Director
Office of Statewide Health Planning and Development
818 K Street, Suite 200
Sacramento, CA 95814

Dear Dr. Carlisle,

Thank you for the opportunity to review and comment on the preliminary draft of OSHPD's 1999-2001 Community-Acquired Pneumonia Mortality outcomes report.

We appreciate the magnitude and scope of compiling, analyzing and publishing this data. However, we are concerned that consumers and other users of this report will view this data as the current state of quality in California hospitals, when in fact; the data is 3-5 years old. Hospitals strive to improve the quality of care they provide continuously. Data that is 3-5 years old does not reflect the positive effects of these efforts.

We agree with most aspects of the risk adjustment methodology utilized. We recognize that death within 30 days of admission is an important data point; however, we have significant concerns that a death from any cause or location is linked to the initial hospitalization. Reporting of thirty-day mortality introduces many variables beyond the control of the hospital. Some patient deaths occurring after discharge may not relate to the patient's pneumonia, or to the quality of care during the patient's hospitalization. Extraneous factors such as the patient's quality of life after discharge, adherence to medical treatment or follow-up post discharge are not considered.

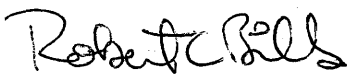
Another area of concern with this report is its reliance on a limited set of "administrative" data elements that hospitals are required to report to the State's Patient Discharge Data Program. As stated in the outcomes report, such administrative data provides limited information about demographic and clinical risk factors that may increase the risk of death. Additionally, only risk factors found by the validation study to be reliably coded were included in the risk-adjustment model. Some risk factors that were significantly correlated with 30-day mortality were excluded from the model due to unreliable coding.

Valley Presbyterian
HOSPITAL
15107 Vanowen Street
P.O. Box 9102
Van Nuys, CA 91409-9102
(818) 782-6600

We are pleased to see that we are slightly below the statewide average for overall risk-adjusted mortality. Enhancing the level of care to our patients remains a top priority at Valley Presbyterian Hospital. The data from the OSHPD California Outcomes Project is only one of many reports that we utilize to assist us in our performance improvement efforts. Despite the concerns listed above, we do take this data seriously and have shared the information with the members of our medical staff, nursing leadership and administrative staff for the purpose of continuing to improve outcomes for our patients.

Again, thank you for the opportunity to submit these comments for publication with the final draft of the "Community-Acquired Pneumonia Outcomes Report". As always, Valley Presbyterian Hospital remains dedicated to providing the utmost in quality patient care to the communities we serve.

Sincerely,



Robert C. Bills
Chief Executive Officer

Western Medical Center
Santa Ana
Tenet HealthSystem

1001 North Tustin Avenue
Santa Ana, CA 92705
Tel: 714.835.3555
http://www.tenethealth.com

December 19, 2003

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

Re: California Hospital Outcomes Report on Community-Acquired Pneumonia, 1999-2001

Dear Mr. Parker:

Western Medical Center Santa Ana appreciates the opportunity to respond to the Annual Report of the California Hospital Outcomes Project published by the Office of Statewide Health Planning and Development (OSHPD). We support the State's efforts to better inform the public regarding the quality of health care being delivered in California hospitals. Unfortunately, the usefulness of the 1999-2001 Community-Acquired Pneumonia Study does not recognize the severity of the patient's illness.

Western Medical Center Santa Ana conducts reviews of all mortalities and patient resuscitations as part of our continuous quality improvement process. The medical staff has taken opportunities to identify and improve patient outcomes. We believe our review processes provide a continuous feedback that allows us to meet quality standards of care and identify opportunities to improve. Additionally, Western Medical Center Santa Ana has a Commitment to Quality program which addresses evidence-based medicine for pneumonia patients.

Thank you again for the opportunity to respond prior to publication. If you have any questions, feel free to contact me at 714.953.3610.

Sincerely,

Dan Brothman
Chief Executive Officer

DB:lm

Appendix 3

Additional Sources of Information

Bay Area Consumers Checkbook
52 Sylvan Way
Oakland, CA 94610
(510) 397-8305

Rates the quality and prices of local service firms ranging from auto repair shop to hospitals

California Department of Managed Healthcare
980 9th Street, Suite 500
Sacramento, CA 95814
1-888-HMO-2219
www.dmhc.ca.gov

Licenses HMOs that meet specific standards

California Medical Review, Inc.
1 Sansome Street, Suite 600
San Francisco, CA 94101-4448
(415) 677-2000
www.cmri-ca.org

Reviews quality for Medicare programs

California Public Employees Retirement System
400 P Street
Sacramento, CA 95814
(916) 326-3000
www.calpers.ca.gov

Publishes a report card on health plans

Joint Commission on Accreditation of Healthcare Organizations
One Renaissance Boulevard
Oakbrook Terrace, IL 60181
(630) 792-5000
www.jcaho.org

Accredits hospitals that meet specific standards

National Committee on Quality Assurance
1350 New York Avenue NW, Suite 700
Washington, DC 20005
(202) 628-5788
www.ncqa.org

Accredits health plans that meet specific standards

Pacific Business Group on Health
33 Montgomery Street, Suite 450
San Francisco, CA 94105
(415) 281-8660
www.healthscope.org

Works to improve the quality of healthcare for its 2.5 million represented employees, dependents, and retirees

U.S. Agency for Healthcare Research & Quality
2101 E. Jefferson Street, Suite 501
Rockville, MD 20852
(301) 594-1364
www.ahrq.gov

The federal government's lead agency supporting research to improve quality of healthcare

Internet Links to Further Information about Community-Acquired Pneumonia:
www.lungusa.org/diseases/lungpneumoni.html
www.mayoclinic.org
www.cdc.gov/nchs/fastats/pneumonia.html
www.lungusa.org/diseases/pneumonia_factsheet.html

Appendix 4

Detailed Hospital Statistics

The purpose of this section of the Technical Appendix is to provide yearly detailed statistical results associated with community-acquired pneumonia (CAP) 30-day mortality in California hospitals. Yearly statistics might enable hospitals to analyze trends associated with quality improvement efforts. The summary results shown in Part A of this report are based on the same discharge data as the yearly, detailed statistics.

An Example Table

Table A.18: Statistics for Community-Acquired Pneumonia (CAP) Mortality at Hypothetical General Hospital

Model:	Without DNR				With DNR			
Statisitics:	All Years	1999	2000	2001	All Years	1999	2000	2001
Statewide Death Rate (percent)	12.23	11.72	12.53	12.57	12.23	11.72	12.53	12.57
Number of Cases Included	353	130	131	92	353	130	131	92
Number of Observed Deaths	37	10	18	9	37	10	18	9
Number of Expected Deaths	48.53	15.68	19.14	13.88	52.78	15.29	23.01	14.65
Observed Death Rate (percent)	10.48	7.69	13.74	9.78	10.48	7.69	13.74	9.78
Expected Death Rate (percent)	13.75	12.07	14.61	15.08	14.95	11.76	17.57	15.92
Risk Adjusted Death Rate (RADR) (percent)	9.32	7.47	11.78	8.15	8.57	7.66	9.80	7.72
RADR Lower Bound: 90 percent CI	6.87	2.96	7.75	3.62	6.29	3.39	6.31	3.45
RADR Upper Bound: 90 percent CI	11.78	11.99	15.81	12.69	10.85	11.94	13.29	12.00
RADR Lower Bound: 95 percent CI	6.39	2.42	6.98	2.75	5.85	2.57	5.64	2.63
RADR Upper Bound: 95 percent CI	12.25	12.53	16.58	13.56	11.29	12.76	13.96	12.82
RADR Lower Bound: 98 percent CI	5.85	1.47	6.08	1.74	5.35	1.62	4.87	1.68
RADR Upper Bound: 98 percent CI	12.80	13.48	17.48	14.57	11.80	13.71	14.73	13.77
Probability This Rate Occurred by Chance	0.031	0.061	0.442	0.069	0.005	0.074	0.122	0.038

Table A.18 summarizes the results for a Hypothetical General Hospital. The first column on the left identifies the year(s) of data included in the results. The outcome is death within 30 days after admission for the index CAP admission.

The model used to risk adjust the reported outcomes is described in general terms in the *Part A* of this report and in detail in this appendix.

The results are displayed year-by-year as well as for all years combined. For example, the results in a row labeled “1999" include only eligible patients discharged from the hospital for CAP in 1999. The row labeled “All Years” includes all eligible patients in 1999, 2000, and 2001 combined. Some hospitals do not have any CAP patients in a particular year, but do have patients in other years. In this case, the row corresponding to the year in which the hospital had no cases would be blank.

The hypothetical General Hospital shown in Table A.18 is used as an example for the following explanation of hospital-level summary statistics (only model “without DNR” is discussed here, same definition applies to the model “with DNR”).

The Statewide Death Rate (percent) is the total number of patients included in this report who died within 30 days of admission, divided by the total number of patients included in this report,

multiplied by 100. As Table A.18 shows, the overall *Statewide Death Rate* for CAP during 1999-2001 was 12.23 percent.

The Number of Cases Included tells how many cases from each hospital were selected for risk-adjustment. A general description of patient inclusion and exclusion criteria is provided in Part A of this report and a detailed description is provided in this appendix.

The Number of Observed Deaths is the number of patients at a facility who died within 30 days of admission for CAP. The death may have occurred at the index hospital, a transfer hospital, or outside the hospital setting.

The Number of Expected Deaths among patients included in the analysis is presented in the next row. The influence of patient characteristics on the risk of death was estimated from the risk-adjustment model. A predicted probability of death was computed for each patient. Summing these probabilities over all patients treated at a hospital gave the predicted number of deaths among those patients.

The Observed Death Rate (percent) is the number of patients at this hospital who died, divided by the number of patients at this hospital included in the analysis, multiplied by 100. The overall *Observed Death Rate* for CAP is (37/353) x 100, or 10.48 percent.

The Expected Death Rate (percent) is the expected number of patients at this hospital who died, divided by the number of patients at this hospital included in the analysis, multiplied by 100. Hypothetical General had 353 CAP patients. With 48.53 patients expected to die, the *Expected Death Rate* is 13.75 percent.

The Risk-Adjusted Death Rate (percent) is derived using a technique known as indirect standardization. It adjusts the observed death rate at the hospital to reflect what the rate would be if the patients were about as ill as the "average" patient in the State. The *Risk-Adjusted Death Rate (percent)* is calculated as the statewide rate, multiplied by the ratio of the number of *observed* deaths to the number of *expected* deaths at this hospital. This adjusted death rate can be used to compare the performance of different hospitals.

At this hypothetical hospital, 37 patients died whereas 48.53 were expected to die. The risk-adjusted death rate is 12.23 percent x (37/48.53) = 9.32 percent. Adjusting for patient mix, the risk-adjusted death rate is lower than its observed rate of 10.48 percent.

Note that the expected death rate 13.75 percent is higher than the statewide rate (12.23 percent). This difference reflects the fact that patients at the hypothetical hospital had higher risk, on average, than the statewide population of patients. The risk-adjusted figure of 9.32 is an estimate of what the death rate would be at the hypothetical hospital if its patients matched the state average in terms of risk.

The Risk-Adjusted Confidence Bounds reflect the level of confidence in the hospital's risk-adjusted death rate. For example, with the 98 percent confidence bounds, assuming that the risk model is correct, there is a 98 percent chance that the hospital's true risk-adjusted CAP death rate falls between the *Lower 98 percent Confidence Bound* of 5.85 percent and the U*pper 98 percent Confidence Bound* of 12.80 percent. Narrower intervals, providing 90 percent and 95 percent confidence in addition to 98 percent confidence, are provided in these tables for the benefit of individual hospitals and physician groups that are interested in evaluating their performance using more liberal statistical criteria.

The Probability this Rate Occurred by Chance is a measure of the likelihood that this many (or more) deaths occurred by chance, given the expected number of deaths from the risk-adjustment model. If the observed number of deaths is less than or equal to the expected

number, a *lower p-value* is computed. If the observed number of deaths is more than the expected number, an *upper p-value* is computed.

The lower p-value is the probability of the observed number of deaths or fewer. The lower p-value represents a "test" of whether this hospital has systematically **better** outcomes than expected based on its patients' risk characteristics. A lower p-value of less than 0.05 indicates that there would be less than a 1 in 20 chance of this hospital having this few or fewer deaths, given its mix of patients, if quality of care were average.

The upper p-value is the probability of the observed number of deaths or more. The upper p-value represents a "test" of whether this hospital has systematically **worse** outcomes than expected based on its patients' risk characteristics. An upper p-value of less than 0.05 indicates that there would be less than a 1 in 20 chance of this hospital having this many or more deaths, given its mix of patients, if quality of care were average.

Because the hospital had fewer deaths than expected, the lower p-value of 0.031 was used. Thus, in this hospital with 353 patients (and 48.53 expected deaths), the probability of observing 37 or fewer deaths due to chance alone is about 3 in 100. Such a finding proves that the hospital's outcomes differ significantly from the statewide average at 90 percent confidence boundary, but not at 95 and 98 percent boundary, which are more conservative criteria. In order to be significant at 98 percent confidence interval, the probability this rate occurred by chance has to be less than 0.01. The pair numbers for 95 percent and 90 percent confidence interval are 0.025 and 0.05 respectively. Thus, the criteria of 90 percent, 95 percent and 98 percent is from liberal to more conservative one.

The classification of hospitals into one of four categories in the main report, based on all three years of data, was based on a p-value of 0.01. Hospitals classified as significantly better than expected had fewer deaths than expected and a lower p-value of less than 0.01. Hospitals classified as significantly worse than expected had more deaths than expected and an upper p-value of less than 0.01. When two separate one-tailed tests using p-values of 0.01 are combined, they create the equivalent of a 98 percent confidence interval. While the significant tests used here are based on either one of two "directional" one-tail tests that show hospitals as either significantly better or significantly worse than average, the calculation of the "non-directional" confidence interval boundaries is based on a 98 percent level of confidence. To help hospitals look the risk-adjusted rate in a "loosing" standard, both 95 percent and 90 percent confidence intervals, in addition 98 percent confidence interval, are provided in the detail statistics table delivered to each hospital.

Summarizing the contents of Table A.18, the hypothetical hospital has an overall risk-adjusted death rate of 9.32 percent. This rate is lower than the overall statewide death rate of 12.23 percent, but is not statistically significant.

For all California hospitals that admitted CAP patients between 1999 and 2001, detailed statistical tables following the format of Table A.18 may be found at: www.oshpd.ca.gov.

Additional copies of the *Community-Acquired Pneumonia: Hospital Outcomes, 1999-2001* can be obtained by contacting OSHPD's Healthcare Information Resource Center at (916) 322-2814 or HIRC@osphd.ca.gov.

THE GREAT SEAL OF THE STATE OF
EUREKA
CALIFORNIA