

# Trends in Maternal Morbidity

Report of Statewide and County Levels of Preexisting Maternal Health Conditions, Pregnancy Complications, Severe Maternal and Neonatal Complications

California, 2007 to 2009

January 2016



Maternal, Child and Adolescent Health Division  
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## EXECUTIVE SUMMARY

Maternal morbidity and mortality is increasing in the United States (U.S.)<sup>1</sup>. The reasons for these increases are unknown, but it has been theorized that maternal preexisting conditions, such as diabetes, hypertension and obesity may be contributing to the rise in obstetrical complications<sup>2-4</sup>. Maternal morbidity surveillance is important because of its likely relationship to maternal mortality, and also because childbirth is the leading cause for hospitalization, which collectively make it the most expensive condition treated in the U.S.<sup>5</sup>.

The California Department of Public Health (CDPH) Maternal, Child and Adolescent Health (MCAH) Division, contracted with the Maternal Quality Indicators (MQI) Workgroup to conduct a study describing trends in maternal and neonatal morbidity in California. This is a report based on those findings and presents statewide and county-level morbidity data with the goal of guiding improvement efforts for public health prevention, clinical service delivery, and in-patient hospital care. Global measures of overall health of childbearing women in California are summarized in addition to specific diagnoses of interest. These findings add to the understanding of maternal morbidity prevalence and trends in California by building upon a previous report, "Trends in Maternal Morbidity in California 1999-2005" published in January 2011, and include data from calendar years 2007, 2008, and 2009. Where possible, continuous trends over the ten-year period are presented.

As in the previous report, maternal morbidity during labor and delivery was defined as a condition that adversely affects a woman's physical health during childbirth beyond what would be expected in a normal delivery. The current report furthers the development of a conceptual framework for evaluating maternal morbidity within the context of **preexisting and pregnancy-related conditions**, with the addition of **childbirth outcomes**, and **composite indicators**. **Preexisting and pregnancy-related conditions** include: diabetes (chronic and gestational), hypertension (chronic, gestational and unspecified), heart disease, mental disorders, and obesity. **Childbirth outcomes** include: anesthesia complications, maternal hemorrhage, maternal infection, obstetric trauma (with and without use of an instrument), nulliparous term singleton vertex (NTSV) cesarean delivery, placenta previa, preterm birth, and 30-day readmission. **Composite indicators** were defined as "ideal" delivery, complicated delivery (the converse of ideal delivery), maternal complications, severe maternal complications, and neonatal complications. A new exploratory measure of **birth spacing** was evaluated in relation to maternal morbidity, using inter-birth intervals of <15 months, 15-26 months, and 27-59 months between successive births. Trends in measures were evaluated for California overall and also by strata of interest including age, race/ethnicity, parity, insurance type, clinical risk category, and route of delivery. Measures were also compared for each of these strata using the combined three years of data. County level analyses were done to identify counties with relatively high rates of morbidity and to examine regional disparities.

## KEY FINDINGS

### Rates of preexisting and pregnancy-related conditions that INCREASED over the study period:

- **Diabetes**, including chronic and gestational, increased across the study period from 7.4% in 2007 to 8.2% in 2009.
  - **Chronic diabetes** increased, from 0.79% in 2007 to 0.90% in 2009.
  - **Gestational diabetes** increased from 6.6% in 2007 to 7.3% in 2009.
- **Hypertension** increased across the study period from 6.6% in 2007 to 7.0% in 2009.
  - **Chronic hypertension** increased from 1.2% in 2007 to 1.4% in 2009.
  - **Gestational hypertension** increased from 4.9% in 2007 to 5.1% in 2009.
- **Mental disorders** increased across the study period, from 2.5% in 2007 to 2.7% in 2009.
- **Obesity** increased across the study period from 19.2% in 2007 to 20.7% in 2009.

### Rates of preexisting and pregnancy-related conditions that DECREASED over the study period:

- **Heart disease** decreased from 0.55% in 2007 to 0.49% in 2009.

### Rates of childbirth outcomes that INCREASED over the study period:

- **Anesthesia complications** increased from 0.26% in 2007 to 0.31% in 2009.
- **Maternal hemorrhage** increased from 1.9% in 2007 to 2.5% in 2009.
- The **Nulliparous Term Singleton Vertex (NTSV) cesarean delivery** rate increased from 27.4% in 2007 to 28.6% in 2009.
- **Readmission within 30 days** of discharge increased from 4.5% in 2007 to 5.0% in 2009.

### Rates of childbirth outcomes that DECREASED over the study period:

- **Maternal infection** decreased from 0.21% in 2007 to 0.18% in 2009.
- **Obstetric trauma due to vaginal delivery with an instrument** decreased from 14.6% in 2007 to 14.0% in 2009.
- **Obstetric trauma due to vaginal delivery without an instrument** decreased from 4.2% in 2007 to 3.8% in 2009.
- **Preterm birth** rate decreased from 7.6% in 2007 to 7.4% in 2009.

**Composite indicators** combine multiple pieces of data to give a “big picture” analysis. Although rates varied annually, there was no consistent trend in the direction of the change of rates for the components of the composite indicators except for an increased rate of severe maternal complications and neonatal complications.

- The **ideal delivery** rate changed across the study period from 85.4% in 2007 to 85.5% in 2008 to 85.1% in 2009.
- The proportion of births experiencing any **complications** varied across the study period, decreasing from 14.6% in 2007 to 14.5% in 2008 and increasing to 14.9% in 2009.
- The rate of **maternal complications** varied across the study period, decreasing from 12.5% in 2007 to 12.3% in 2008, and increased to 12.7% in 2009.
- The rate of **severe maternal complications** increased across the study years. The rates were 1.4% in 2007 and 2008 and 1.6% in 2009.
- The rate of **neonatal complications** increased from 2.8% in 2007 to 2.9% in 2008 to 2.9% in 2009.

## Introduction

Maternal morbidity and mortality is increasing in the United States (U.S.)<sup>1</sup>. The reasons for these increases are unknown, but it has been theorized that maternal preexisting conditions, such as diabetes, hypertension and obesity may be contributing to the rise in obstetrical complications<sup>2-4</sup>. Maternal morbidity surveillance is important because of its likely relationship to maternal mortality, and also because childbirth is the leading cause for hospitalization, which collectively make it the most expensive condition treated in the U.S.<sup>5</sup>. There are ongoing efforts both nationally and regionally to develop standardized measures for tracking and surveillance of childbirth morbidity<sup>6</sup>. Tracking maternal morbidity over time has increased importance with the recent implementation of provisions of the 2010 Patient Protection and Affordable Care Act (ACA). The ACA legislation expanded health care access for many women who previously could not afford health insurance or were excluded because of preexisting conditions.

The Maternal Quality Indicator MQI Workgroup, in collaboration with the California Department of Public Health, Maternal, Child and Adolescent Health Division (CDPH-MCAH), has previously demonstrated an increase in maternal morbidity in the state of California from 1999 to 2005, as measured by preexisting conditions, obstetrical complications and cesarean delivery<sup>7</sup>. Our aim with this report is to update and expand these findings. In addition to preexisting conditions, we have defined a set of pregnancy-related conditions, childbirth outcomes, and composite indicators, which can be trended over time and serve as surveillance measures for pregnancy and childbirth related morbidity.

The preexisting and pregnancy-related conditions include: diabetes, hypertension, heart disease, mental health disorders and obesity. The childbirth related morbidity outcomes include: anesthesia complications, maternal hemorrhage, maternal infection, obstetric trauma with use of an instrument, obstetric trauma without the use of an instrument, nulliparous term singleton vertex (NTSV) cesarean delivery, placenta previa, preterm birth, and 30-day readmission. The first five of the nine childbirth related outcomes are consistent with Agency for Healthcare Research and Quality (AHRQ) measures that have been modified to be specific for pregnancy and childbirth. One indicator is a measure used by The Joint Commission (NTSV cesarean delivery). The composite indicators include ideal delivery, maternal complications, severe maternal complications and neonatal complications, and are designed to capture the absence of any morbidity for the patient (ideal delivery) as well as its complement (complicated delivery) which can measure areas for performance improvement<sup>8</sup>.

Since the last report, data quality has improved and the methodology has changed in order to increase the reliability of estimates. As a result of these analytic changes, continuous trends over the ten-year period are only possible for a subset of the indicators presented. Where methodologically feasible, these ongoing trends are presented.

## **How to Use This Report**

This report was composed as both a summary and a resource document for health professionals and stakeholders interested in the status of maternal morbidity in California. The same format is used to present data for each indicator: trend data, stratified data and GIS mapping data. The inclusion of visuals—charts, maps and tables—to illustrate key concepts will allow easy transfer (with proper source attribution) to presentation slides, web and social media graphics, and smaller reports. These style elements were chosen intentionally with an understanding that readers may not use the report in its entirety and may instead choose to focus on particular measures relevant to their interests and business needs. Extensive internal hyperlinks have been included to facilitate navigation to areas of interest.

# METHODS

## Study Population

California Office of Statewide Health Planning and Development (OSHPD) linked birth cohort and patient discharge data (BCPDD) data for 2007, 2008 and 2009 were used for this analysis, which were the most recent datasets available at the time of analysis. The database links birth certificates to maternal and infant hospital discharge records (linking the delivery discharge, one year of antepartum maternal admissions and one year of postpartum maternal and newborn admissions), and includes 1,580,024 deliveries in 266 hospitals representing 98% of all California deliveries.

OSHPD includes data on patient characteristics, medical diagnoses, and procedures; the latter are coded according to the International Classification of Diseases, Ninth Revision, Clinical Modifications (ICD-9-CM). All linked records of live-born deliveries to mothers who were California residents were included, and for birth spacing, stillborn deliveries were also included. For multiple gestations, only one linked record was retained. For analysis of all composite indicators, multiple gestation and preterm deliveries were excluded. Denominator exclusions for all indicators are described along with their definitions in the [Appendix 1](#). Based on experience in developing the previous report, there was minimal variation in models after adjusting for age, race/ethnicity, parity, insurance type or clinical risk status<sup>7</sup>. Hence, the analysis did not adjust for these case mix variables. Instead, stratified trends and outcome rates were reported over the combined three years for each stratum.

## Diagnostic Codes and Maternal Morbidity

Diagnosis-related groups (DRGs) and ICD-9-CM diagnosis and procedure codes were used to extract records from OSHPD datasets. The assumption was that if codes for a condition or a procedure were lacking then the condition or procedure was not present. This analysis does not distinguish between primary and secondary codes. Rather it loops through all codes to determine the presence or absence of a specific code. For the ICD-9-CM codes listed in the [Appendix](#), those lacking a first and second numeral after the decimal include all of potential subcategories. For example, code 250 includes all potential subcategories for chronic diabetes mellitus 250.00-250.93 (also referred to as 250.xx in the report text). Likewise, codes with one post decimal numeral include all possible second post decimal code options. For example code 648.0 includes all possible second digit codes, 648.00-648.04 and is not specifically referred to as 648.0x in the report text.

## Categorical Morbidity Definitions

Maternal morbidity during labor and delivery was defined as a condition that adversely affects a woman's physical health during childbirth beyond what would be expected in a normal delivery. Maternal morbidity was divided into preexisting and pregnancy-related conditions, childbirth outcomes, and composite indicators.

A preexisting medical condition is an underlying condition that may be aggravated by the pregnancy. For the purpose of this study, diabetes ([chronic](#) and [gestational](#)), hypertension ([chronic](#), [gestational](#) and [unspecified](#)), [heart disease](#), [mental disorders](#), and [obesity](#) were included for analysis. Researchers in the field recognize that there is substantial under-reporting of mental health diagnoses in hospital discharge data, and that the sensitivity and predictive value of these diagnoses have not been clearly established.

Childbirth outcomes include [anesthesia complications](#), [hemorrhage](#), [maternal infection](#), obstetric trauma ([with](#) and [without instrument](#)), nulliparous term singleton vertex ([NTSV](#)) cesarean delivery, [placenta previa](#), [preterm birth](#), and [30-day readmission](#). These outcomes were selected because they have been previously validated, associated with adverse maternal or neonatal outcome, or linked to healthcare safety and quality<sup>9-11</sup>.

Composite indicators include [ideal delivery](#), defined as the proportion of women delivering (vaginal or cesarean) without any maternal or neonatal complications, [complicated delivery](#), [maternal complications](#), [severe maternal complications](#), and [neonatal complications](#)<sup>8</sup>. While some would suggest that cesarean delivery itself is a complication, there are times when it is a necessary and effective treatment. Likewise, there are some instances when it is the indicated route for specific clinical conditions or preferred route by patient request. The resulting outcome has therefore been generalized to a healthy mom and baby without any complications—irrespective of the route of delivery<sup>12</sup>.

An additional new measure evaluated as part of this report includes the concept of [birth spacing](#). We included this measure because short inter-birth intervals have been associated with increased maternal morbidity and perinatal outcomes<sup>13</sup>. For the purposes of this report, we have defined birth spacing as birth intervals of <15, 15-26, and 27-59 months and describe trends by age, race/ethnicity, education and insurance provider.

## **Analyses**

Indicator trends over 2007, 2008, and 2009 were summarized overall and by the stratification variables. Overall trends and trends within each stratification level were tested using the Cochran-Armitage two-sided linear trend test. The percent change between the 2007 and 2009 rates were reported. Note that the percent change calculations were performed with higher precision rates than the two decimals reported here.

In addition, the association of each of the indicators with each of the stratification variables was tested using the combined data over the three years with Chi-square tests. Similar analyses were performed using the inter-birth interval indicator.

Stratification variables used for analyses include maternal age group, maternal race/ethnicity, maternal parity, insurance status, clinical risk category, delivery route and maternal county of residence. Maternal age group was categorized as <35 and ≥35 years old. Race/Ethnicity was categorized as Hispanic, and non-Hispanic Multi-Race, Black, American Indian, Asian, Pacific Islander, White, Other Race and Unknown Race. Parity was categorized as multiparous or nulliparous. Insurance status was categorized as Medi-Cal and other payer. Risk level was stratified between low and high using a previously defined

classification scheme to account for preexisting conditions or pregnancy complications<sup>8,14</sup> (Appendix 2). Route of delivery was separated into six categories: vaginal delivery with labor (no prior CS), cesarean delivery with labor (no prior CS), elective cesarean delivery (no prior CS), vaginal birth after cesarean (VBAC), failed VBAC, and elective repeat cesarean delivery. Differences by route of delivery are emphasized only where clinically relevant.

Maternal county of residence (for each of the 58 individual California counties) was used as an additional stratification variable. For each indicator, county-level maps display those counties with a combined 2007-2009 rate over the 75<sup>th</sup> percentile. The 75<sup>th</sup> percentile is indicative of high burden, except when examining an indicator of desired outcome (e.g., ideal delivery), where it is a positive indication. A second county-level map displays counties with a greater or equal to 20% increase in the indicator rate between 2007 and 2009, indicating a substantial change that may require further investigation. Counties having less than five women with the condition or birth outcome in years 2007, 2008 or 2009 were not included in the calculations of top quartiles or trend testing owing to instability.

Because of the large sample size, small rate changes may have been statistically significant, but may not be clinically significant. This is true for both indicator trends and associations of indicators with stratification variables. Therefore, the findings need to be considered from both a clinical and practical viewpoint. All statements reflect significant differences unless otherwise specified. This research was approved by the Committee for the Protection of Human Subjects (Protocol #12-08-0596) and the Institutional Review Board (IRB) for University of California Los Angeles and Cedars-Sinai Medical Center.

# RESULTS

## Preexisting and Pregnancy-Related Conditions

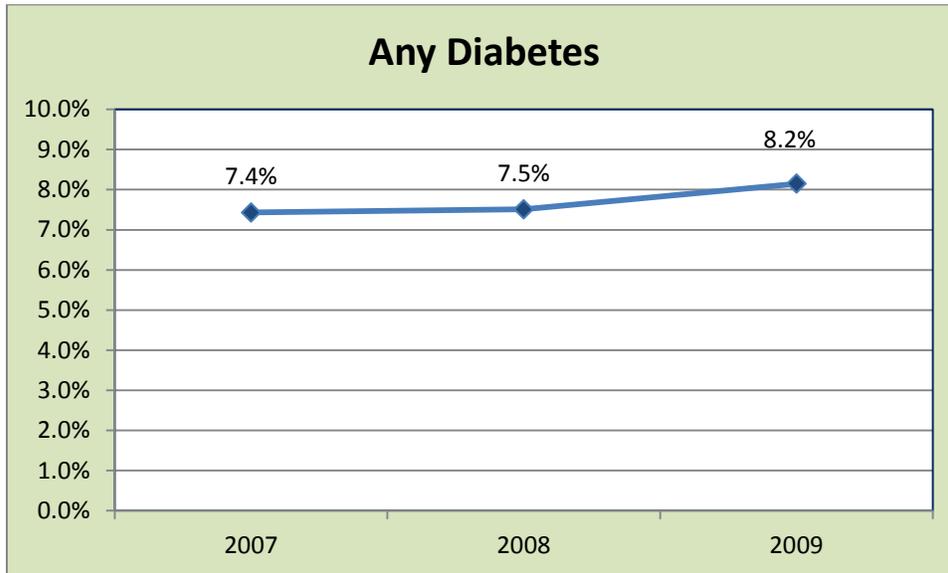
**Table 1: Summary of Overall Trends in Preexisting and Pregnancy-Related Conditions, California, 2007-2009**

	2007	2008	2009	3-Year Denominator	Percent Change	P-value
<b>Preexisting and Pregnancy-Related Conditions</b>						
Any Diabetes	7.4	7.5	8.2	1,580,024	9.7	P<0.001
Chronic Diabetes	0.8	0.8	0.9	1,580,024	14.2	P<0.001
Gestational Diabetes	6.6	6.7	7.3	1,580,024	9.2	P<0.001
Any Hypertension	6.6	6.6	7.0	1,580,024	6.0	P<0.001
Chronic Hypertension	1.2	1.3	1.4	1,580,024	16.1	P<0.001
Gestational Hypertension	4.9	5.0	5.1	1,580,024	4.1	P<0.001
Unspecified Hypertension	0.40	0.40	0.39	1,580,024	-2.5	P=0.532
Heart Disease	0.55	0.49	0.49	1,580,024	-11.7	P<0.001
Mental Disorders	2.5	2.5	2.7	1,580,024	7.9	P<0.001
Obesity	19.2	20.0	20.7	1,420,457	7.8	P<0.001

Percent of all hospital deliveries with listed conditions in California in 2007, 2008 and 2009, OSHPD data.

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

## 1. Diabetes



P<0.0001

Figure 1: Overall Trends in Diabetes (chronic and gestational) in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N=1,580,024.

Diabetes is defined as a condition that causes high levels of glucose in the blood, resulting in multiple health problems. For this measure, we included diabetes mellitus (ICD-9-CM 648.0), glucose intolerance complicating pregnancy, childbirth, or the puerperium (ICD-9-CM 648.8) and diabetes mellitus (ICD-9-CM 250.xx).

- The rate of diabetes, including chronic and gestational diabetes, **increased** across the study period, from 7.4% in 2007 to 8.2% in 2009. This represents a 9.7% increase. The trend in diabetes increased across all categories of age, race/ethnicity, parity, insurance type and route of delivery. However Asian women had the greatest increase (15.5% increase) over the 3-year period, 60% greater than the overall rate (Table 1A).
- When compared within strata, older women, Asian and Pacific Islanders, multiparous women, and women with insurance other than Medi-Cal had higher 3-year rates of diabetes (Table 1B).
  - When stratified by route of delivery, failed VBAC and elective cesarean delivery had the highest 3-year rates (15.6% and 12.5%, respectively).

**Table 1A. Trends in Diabetes in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	7.4	7.5	8.2	100	1,580,024	9.7	p<0.001
<b>Age</b>							
<35	6.1	6.1	6.6	82.6	1,304,383	8.4	p<0.001
>=35	13.9	14.1	15.3	17.5	275,641	10.1	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	7.9	7.9	8.5	52.8	834,492	8.1	p<0.001
Multi-Race	6.3	6.3	6.6	1.7	27,479	4.0	p=0.498
Black	5.3	5.6	5.9	5.3	83,055	11.1	p<0.001
American Indian	7.3	8.6	8.6	0.4	5,582	17.8	p=0.147
Asian	11.0	11.5	12.7	11.9	187,665	15.5	p<0.001
Pacific Islander	10.4	9.7	11.4	0.5	7,112	9.6	p=0.242
White	5.3	5.4	5.8	26.0	410,183	9.1	p<0.001
Other	7.9	5.1	8.0	0.1	920	1.1	p=0.940
Unknown	7.8	7.9	8.5	1.5	23,536	8.6	p=0.118
<b>Parity</b>							
Multiparous	8.5	8.5	9.3	60.3	951,048	9.8	p<0.001
Nulliparous	5.9	6.0	6.4	39.8	627,327	9.4	p<0.001
<b>Insurance Type</b>							
Other Payer	7.8	7.8	8.5	51.8	817,107	10.1	p<0.001
Medi-Cal	7.1	7.2	7.7	48.2	760,151	9.2	p<0.001
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	.
High Risk	14.9	14.6	15.3	48.9	706,919	2.7	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	5.9	5.9	6.4	66.1	1,044,602	9.4	p<0.001
Cesarean Delivery with Labor	9.6	9.5	10.0	13.2	207,972	4.2	p=0.008
Elective Cesarean Delivery	12.0	12.4	13.1	4.6	72,946	9.2	p<0.001
Vaginal Birth After Cesarean	8.7	8.9	10.3	1.3	20,090	18.5	p=0.002
Failed Vaginal Birth After Cesarean	14.6	15.5	16.8	2.2	34,599	15.1	p<0.001
Elective Repeat Cesarean Delivery	10.6	10.7	11.6	12.7	199,815	9.4	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 1B. Stratified Diabetes Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	6.3		
>=35	14.4		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	8.1		
Multi-Race	6.4		
Black	5.6		
American Indian	8.2		
Asian	11.7		
Pacific Islander	10.5		
White	5.5		
Other	7.0		
Unknown	8.1		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	8.7		
Nulliparous	6.1		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	8.0		
Medi-Cal	7.3		
<b>Risk Level</b>		1,447,019	.
Low Risk	0.0		
High Risk	14.9		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	6.0		
Cesarean Delivery with Labor	9.7		
Elective Cesarean Delivery	12.5		
Vaginal Birth After Cesarean	9.3		
Failed Vaginal Birth After Cesarean	15.6		
Elective Repeat Cesarean Delivery	10.9		

**Figures 1a and 1b: Any Diabetes, 2007-2009**

**1a. Top Quartile Counties with Any Diabetes**



**1b. Counties with Increasing Trends in Any Diabetes**

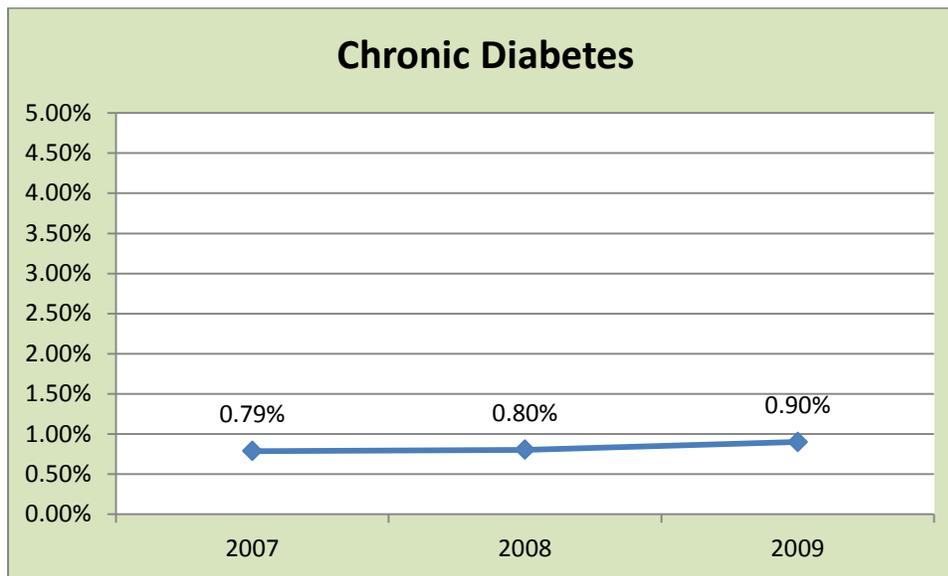


 Number of events too small to perform trend testing.

Proportion of Delivering Women with Any Diabetes Among Top Quartile Counties	
Amador	12.22%
Colusa	10.86%
Santa Clara	10.61%
Monterey	10.28%
Napa	10.00%
Plumas	9.91%
Yolo	9.72%
San Mateo	9.58%
Contra Costa	9.56%
Alameda	9.27%
Solano	9.16%
Sonoma	8.92%
Fresno	8.67%
Sacramento	8.51%

Percentage Increase in Any Diabetes from 2007 to 2009 Among Delivering Women	
Inyo	128.35%
Nevada	97.45%
Plumas	74.94%
San Benito	45.83%
Mendocino	38.32%
Sonoma	32.72%
Stanislaus	30.58%
Contra Costa	30.49%
Santa Barbara	25.97%
San Francisco	25.71%
Merced	24.26%
San Mateo	24.12%
Yolo	20.05%

## 2. Chronic Diabetes



P<0.0001

Figure 2: Overall Trends in Chronic Diabetes in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

Chronic diabetes is a subset of any diabetes and includes adult diabetes mellitus (ICD-9-CM 250.xx) and pre-gestational diabetes complicating pregnancy and childbirth (ICD-9-CM 648.0).

- The overall rate of chronic diabetes **increased** across the study period, from 0.79% in 2007 to 0.90% in 2009. This represents a 14.21% increase. This increased trend was consistent across age, parity and insurance type (Table 2A).
- When compared within strata, older women, American Indian and Pacific Islander women, multiparous women and women with Medi-Cal insurance had higher 3-year rates of chronic diabetes.
  - When evaluated by route of delivery, women with failed VBAC delivery had the highest 3-year rate of chronic diabetes (3.13%) (Table 2B).

**Table 2A. Trends in Chronic Disease in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	0.8	0.8	0.9	100	1,580,024	14.2	p<0.001
<b>Age</b>							
<35	0.6	0.6	0.7	82.6	1,304,383	14.3	p<0.001
>=35	1.5	1.6	1.7	17.5	275,641	11.9	p=0.002
<b>Race/Ethnicity</b>							
Hispanic	0.9	0.9	1.1	52.8	834,492	19.5	p<0.001
Multi-Race	0.9	0.8	0.8	1.7	27,479	-7.9	p=0.613
Black	0.9	1.1	1.1	5.3	83,055	18.2	p=0.056
American Indian	1.2	1.6	2.0	0.4	5,582	68.4	p=0.052
Asian	0.7	0.7	0.8	11.9	187,665	10.4	p=0.133
Pacific Islander	1.8	1.7	1.7	0.5	7,112	-2.9	p=0.900
White	0.6	0.6	0.6	26.0	410,183	1.0	p=0.855
Other	1.4	0.3	0.3	0.1	920	-76.7	p=0.112
Unknown	0.7	0.8	0.9	1.5	23,536	25.2	p=0.234
<b>Parity</b>							
Multiparous	0.9	0.9	1.0	60.3	951,048	16.5	p<0.001
Nulliparous	0.6	0.6	0.7	39.8	627,327	9.1	p=0.023
<b>Insurance Type</b>							
Other Payer	0.8	0.8	0.8	51.8	817,107	8.3	p=0.010
Medi-Cal	0.8	0.9	1.0	48.2	760,151	19.3	p<0.001
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	.
High Risk	1.4	1.4	1.5	48.9	706,919	7.9	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	0.5	0.4	0.5	66.1	1,044,602	5.4	p=0.109
Cesarean Delivery with Labor	1.4	1.5	1.5	13.2	207,972	6.6	p=0.186
Elective Cesarean Delivery	1.6	1.7	1.9	4.6	72,946	18.0	p=0.015
Vaginal Birth After Cesarean	0.7	0.7	1.1	1.3	20,090	48.6	p=0.027
Failed Vaginal Birth After Cesarean	2.9	3.0	3.5	2.2	34,599	22.9	p=0.004
Elective Repeat Cesarean Delivery	1.4	1.4	1.7	12.7	199,815	22.1	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 2B. Stratified Chronic Diabetes Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	0.7		
>=35	1.6		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	1.0		
Multi-Race	0.8		
Black	1.0		
American Indian	1.6		
Asian	0.7		
Pacific Islander	1.7		
White	0.6		
Other	0.7		
Unknown	0.8		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	1.0		
Nulliparous	0.7		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	0.8		
Medi-Cal	0.9		
<b>Risk Level</b>		1,447,019	.
Low Risk	0.0		
High Risk	1.4		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	0.5		
Cesarean Delivery with Labor	1.4		
Elective Cesarean Delivery	1.7		
Vaginal Birth After Cesarean	0.8		
Failed Vaginal Birth After Cesarean	3.1		
Elective Repeat Cesarean Delivery	1.5		

**Figures 2a and 2b: Chronic Diabetes, 2007 -2009**

**2a. Top Quartile Counties with Chronic Diabetes**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Chronic Diabetes Among Top Quartile Counties	
Amador	2.21%
Calaveras	1.95%
San Benito	1.21%
Solano	1.16%
Plumas	1.10%
Kings	1.05%
San Francisco	1.03%
Madera	1.02%
Monterey	1.01%
Kern	1.00%
San Joaquin	0.98%
Del Norte	0.95%
Sacramento	0.95%

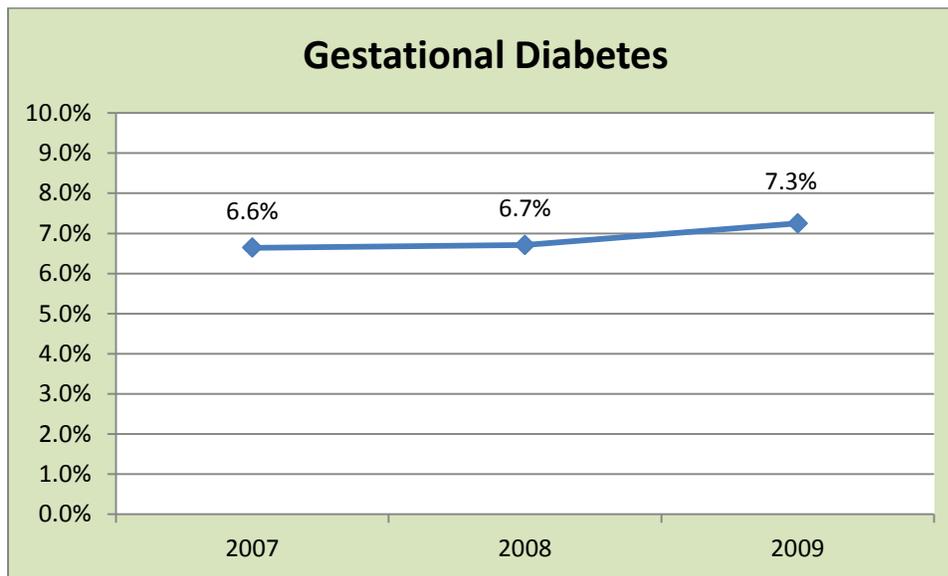
**2b. Counties with Increasing Trends in Chronic Diabetes**



 Number of events too small to perform trend testing.

Percentage Increase in Chronic Diabetes from 2007 to 2009 Among Delivering Women	
Kings	156.77%
Calaveras	78.99%
Napa	53.41%
Imperial	46.67%
Madera	45.33%
San Joaquin	39.51%
Sacramento	36.54%
Merced	35.70%
San Bernardino	33.67%
Ventura	29.90%
Stanislaus	27.90%
Fresno	26.78%
Orange	21.17%

### 3. Gestational Diabetes



P<0.0001

Figure 3: Overall Trends in Gestational Diabetes in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

Gestational diabetes is defined as abnormal glucose tolerance of the mother that developed during the pregnancy complicating pregnancy, childbirth or the puerperium (ICD-9-CM 648.8).

- The overall rate of gestational diabetes **increased** from 6.6% in 2007 to 7.3% in 2009. This represents a 9.2% increase. This trend was consistent across age, race/ethnicity, parity and insurance type (Table 3A).
- When compared within strata, older women, Asian and Pacific Islander women, multiparous women and women with insurance other than Medi-Cal had higher 3-year rates of gestational diabetes (Table 3B).
  - When evaluated by route of delivery, women with failed VBAC delivery and elective repeat cesarean had the highest 3-year rates of gestational diabetes (12.5% and 10.8%, respectively).

**Table 3A. Trends in Gestational Diabetes in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	6.6	6.7	7.3	100	1,580,024	9.2	
<b>Age</b>							
<35	5.5	5.5	5.9	82.6	1,304,383	7.7	p<0.001
>=35	12.4	12.6	13.6	17.5	275,641	9.7	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	7.0	7.0	7.5	52.8	834,492	6.7	p<0.001
Multi-Race	5.4	5.5	5.8	1.7	27,479	5.7	p=0.356
Black	4.4	4.5	4.9	5.3	83,055	9.7	p=0.016
American Indian	6.1	7.0	6.6	0.4	5,582	8.1	p=0.535
Asian	10.3	10.8	11.9	11.9	187,665	15.5	p<0.001
Pacific Islander	8.6	8.0	9.7	0.5	7,112	13.0	p=0.185
White	4.7	4.8	5.2	26.0	410,183	10.2	p<0.001
Other	6.5	4.8	7.7	0.1	920	17.5	p=0.545
Unknown	7.2	7.1	7.7	1.5	23,536	7.0	p=0.217
<b>Parity</b>							
Multiparous	7.6	7.6	8.2	60.3	951,048	9.0	p<0.001
Nulliparous	5.3	5.3	5.8	39.8	627,327	9.5	p<0.001
<b>Insurance Type</b>							
Other Payer	7.0	7.1	7.7	51.8	817,107	10.1	p<0.001
Medi-Cal	6.3	6.3	6.8	48.2	760,151	8.0	p<0.001
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	.
High Risk	13.5	13.3	13.8	48.9	706,919	2.2	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	5.4	5.5	5.9	66.1	1,044,602	9.6	p<0.001
Cesarean Delivery with Labor	8.2	8.0	8.6	13.2	207,972	4.1	p=0.023
Elective Cesarean Delivery	10.4	10.7	11.2	4.6	72,946	7.7	p=0.004
Vaginal Birth After Cesarean	8.0	8.2	9.2	1.3	20,090	15.7	p=0.010
Failed Vaginal Birth After Cesarean	11.7	12.5	13.2	2.2	34,599	12.8	p<0.001
Elective Repeat Cesarean Delivery	9.2	9.3	9.9	12.7	199,815	7.0	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 3B. Stratified Gestational Diabetes Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	5.6		
>=35	12.9		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	7.1		
Multi-Race	5.6		
Black	4.6		
American Indian	6.6		
Asian	11.0		
Pacific Islander	8.8		
White	4.9		
Other	6.3		
Unknown	7.3		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	7.8		
Nulliparous	5.4		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	7.3		
Medi-Cal	6.4		
<b>Risk Level</b>		1,447,019	.
Low Risk	0.0		
High Risk	13.5		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	5.6		
Cesarean Delivery with Labor	8.3		
Elective Cesarean Delivery	10.8		
Vaginal Birth After Cesarean	8.5		
Failed Vaginal Birth After Cesarean	12.5		
Elective Repeat Cesarean Delivery	9.5		

**Figures 3a and 3b: Gestational Diabetes, 2007-2009**

**3a. Top Quartile Counties with Gestational Diabetes**



**3b. Counties with Increasing Trends in Gestational Diabetes**



 Number of events too small to perform trend testing.

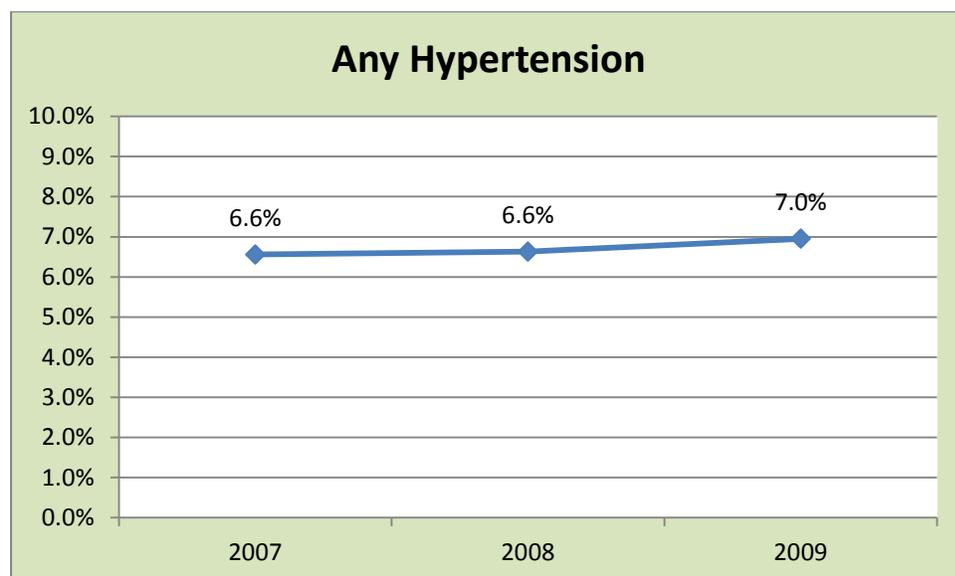
**Proportion of Delivering Women with Gestational Diabetes Among Top Quartile Counties**

Amador	10.01%
Colusa	9.94%
Santa Clara	9.85%
Monterey	9.27%
Napa	9.19%
Yolo	9.08%
Plumas	8.81%
San Mateo	8.78%
Contra Costa	8.76%
Alameda	8.44%
Sonoma	8.08%
Solano	8.00%
Fresno	7.75%
Glenn	7.65%
Sacramento	7.57%

**Percentage Increase in Gestational Diabetes from 2007 to 2009 Among Delivering Women**

Nevada	132.71%
Plumas	74.94%
San Benito	63.89%
Mendocino	59.94%
San Francisco	35.86%
Sonoma	34.37%
Contra Costa	32.73%
Stanislaus	30.88%
Santa Barbara	28.21%
San Mateo	27.19%
Yolo	25.34%
Merced	23.23%
San Luis Obispo	22.38%
Humboldt	22.02%
Tulare	20.37%
Yuba	20.28%

#### 4. Any Hypertension



P<0.0001

Figure 4: Overall Trends in Hypertension in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

Any hypertension includes hypertension complicating pregnancy childbirth and the puerperium (ICD-9-CM 642.0), hypertension secondary to renal disease (ICD-9-CM 642.1), other preexisting hypertension (ICD-9-CM 642.2), transient hypertension of pregnancy (ICD-9-CM 642.3), mild or unspecified preeclampsia (ICD-9-CM 642.4), severe preeclampsia (ICD-9-CM 642.5), eclampsia (ICD-9-CM 642.6) and preeclampsia or eclampsia superimposed on preexisting hypertension (ICD-9-CM 642.7), unspecified hypertension complicating pregnancy childbirth or the puerperium (ICD-9-CM 642.9) and abnormalities including: essential hypertension (ICD-9-CM 401.xx), hypertensive heart disease (ICD-9-CM 402.xx), hypertensive chronic kidney disease (ICD-9-CM 403.xx), hypertensive heart and chronic kidney disease (ICD-9-CM 404.xx) and secondary hypertension (ICD-9-CM 405.xx).

- The overall rate of any hypertension **increased** across the study period, from 6.6% in 2007 to 7.0% in 2009. This represents a 6% increase. The trend increased in women who were Hispanic, Black, Asian, and White. This trend was consistent across age, parity, and insurance type. Asian women had the lowest prevalence of any hypertension, but the greatest increase over the 3-year period (Table 4A).
- When compared within strata, older women, women who were Black, American Indian, or Pacific Islander, nulliparous women and women with insurance other Medi-Cal, had the highest 3-year rates of any hypertension (Table 4B).
  - When evaluated by route of delivery, women with cesarean delivery with labor, failed VBAC delivery, and elective repeat cesarean had the highest 3-year rates of any hypertension (14.5%, 13.2%, and 12.2% respectively).

**Table 4A. Trends in Any Hypertension in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall trend</b>	6.6	6.6	7.0	100	1,580,024	6.0	p<0.001
<b>Age</b>							
<35	6.2	6.2	6.5	82.6	1,304,383	5.4	p<0.001
>=35	8.5	8.8	9.1	17.5	275,641	6.8	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	6.1	6.3	6.5	52.8	834,492	5.2	p<0.001
Multi-Race	8.2	7.9	8.8	1.7	27,479	8.0	p=0.106
Black	11.3	11.6	11.9	5.3	83,055	5.3	p=0.021
American Indian	10.1	8.9	9.1	0.4	5,582	-10.4	p=0.277
Asian	5.0	5.1	5.6	11.9	187,665	12.5	p<0.001
Pacific Islander	10.0	8.4	9.3	0.5	7,112	-7.5	p=0.332
White	7.0	6.9	7.3	26.0	410,183	4.7	p=0.001
Other	6.9	6.3	7.0	0.1	920	2.3	p=0.933
Unknown	7.0	7.3	7.4	1.5	23,536	5.8	p=0.329
<b>Parity</b>							
Multiparous	5.0	5.1	5.4	60.3	951,048	7.8	p<0.001
Nulliparous	8.9	8.9	9.3	39.8	627,327	4.0	p<0.001
<b>Insurance Type</b>							
Other Payer	6.8	6.8	7.2	51.8	817,107	5.0	p<0.001
Medi-Cal	6.3	6.5	6.7	48.2	760,151	7.2	p<0.001
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100		.
High Risk	11.4	11.3	11.5	48.9	706,919	0.9	p=0.117
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	4.8	4.8	5.1	66.1	1,044,602	5.4	p<0.001
Cesarean Delivery with Labor	14.4	14.5	14.8	13.2	207,972	2.8	p=0.032
Elective Cesarean Delivery	11.8	12.1	12.6	4.6	72,946	6.8	p=0.013
Vaginal Birth After Cesarean	4.0	4.3	4.0	1.3	20,090	-2.2	p=0.791
Failed Vaginal Birth After Cesarean	12.9	13.0	13.7	2.2	34,599	6.2	p=0.094
Elective Repeat Cesarean Delivery	4.8	5.0	5.5	12.7	199,815	14.2	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 4B. Stratified Hypertension Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	6.3		
>=35	8.8		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	6.3		
Multi-Race	8.3		
Black	11.6		
American Indian	9.4		
Asian	5.2		
Pacific Islander	9.3		
White	7.0		
Other	6.7		
Unknown	7.3		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	5.2		
Nulliparous	9.0		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	6.9		
Medi-Cal	6.5		
<b>Risk Level</b>		1,447,019	.
Low Risk	0.0		
High Risk	11.4		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	4.9		
Cesarean Delivery with Labor	14.5		
Elective Cesarean Delivery	12.2		
Vaginal Birth After Cesarean	4.1		
Failed Vaginal Birth After Cesarean	13.2		
Elective Repeat Cesarean Delivery	5.1		

**Figures 4a and 4b: Any Hypertension, 2007 -2009**

**4a. Top Quartile Counties with Any Hypertension**



Number of events too small to report prevalence.

Proportion of Delivering Women with Any Hypertension Among Top Quartile Counties	
Modoc	16.91%
Amador	12.92%
Lassen	10.93%
Calaveras	10.03%
Solano	9.38%
Lake	9.37%
Inyo	9.29%
Santa Cruz	9.11%
San Mateo	8.75%
Contra Costa	8.55%
San Francisco	8.39%
Siskiyou	8.31%
Butte	8.30%
Colusa	8.28%

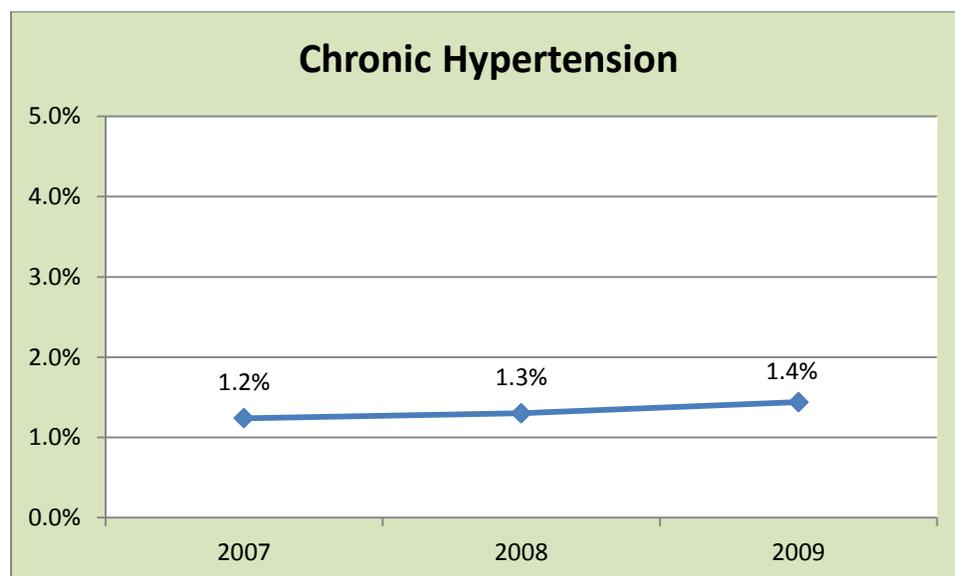
**4b: Counties with Increasing Trends in Any Hypertension**



Number of events too small to perform trend testing.

Percentage Increase in Any Hypertension from 2007 to 2009 Among Delivering Women	
Plumas	63.50%
Mono	42.25%
Glenn	37.52%
Mendocino	32.04%
Kings	23.96%
Yolo	22.42%
Madera	20.95%
Modoc	16.91%
Inyo	9.29%

## 5. Chronic Hypertension



P<0.0001

Figure 15: Overall Trends in Chronic Hypertension in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

Chronic hypertension is a subset of any hypertension and includes hypertension complicating pregnancy childbirth and the puerperium (ICD-9-CM 642.0), hypertension secondary to renal disease (ICD-9-CM 642.1), other preexisting hypertension (ICD-9-CM 642.2), preeclampsia or eclampsia superimposed on preexisting hypertension (ICD-9-CM 642.7) and abnormalities including: essential hypertension (ICD-9-CM 401.xx), hypertensive heart disease (ICD-9-CM 402.xx), hypertensive chronic kidney disease (ICD-9-CM 403.xx), hypertensive heart and chronic kidney disease (ICD-9-CM 404.xx) and secondary hypertension (ICD-9-CM 405.xx)

- The overall rate of chronic hypertension **increased** from 1.2% in 2007 to 1.4% in 2009. This represents a 16.1% increase. The trend increased in Hispanic, Asian, and White women. This increased trend was consistent across age, parity and insurance type (Table 5A).
- When compared within strata, older women, Black women, multiparous women and women with insurance other than Medi-Cal had higher 3-year rates of chronic hypertension (Table 5B).
  - When evaluated by route of delivery, women with failed VBAC delivery had the highest 3-year rate of chronic hypertension (4.4%).

**Table 5A. Trends in Chronic Hypertension in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	1.2	1.3	1.4	100	1,580,024	16.1	p<0.001
<b>Age</b>							
<35	0.93	0.97	1.1	82.6	1,304,383	17.8	p<0.001
>=35	2.8	2.9	3.1	17.5	275,641	9.7	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	0.96	1.02	1.1	52.8	834,492	19.1	p<0.001
Multi-Race	2.2	1.9	2.0	1.7	27,479	-10.9	p=0.251
Black	3.2	3.4	3.4	5.3	83,055	8.6	p=0.071
American Indian	1.9	1.8	2.7	0.4	5,582	40.1	p=0.109
Asian	1.3	1.3	1.5	11.9	187,665	20.8	p<0.001
Pacific Islander	2.8	1.6	2.8	0.5	7,112	-3.2	p=0.779
White	1.3	1.4	1.5	26.0	410,183	11.2	p<0.001
Other	1.4	0.6	1.6	0.1	920	16.8	p=0.783
Unknown	1.4	1.8	1.8	1.5	23,536	27.8	p=0.057
<b>Parity</b>							
Multiparous	1.3	1.4	1.6	60.3	951,048	17.3	p<0.001
Nulliparous	1.1	1.2	1.3	39.8	627,327	11.6	p<0.001
<b>Insurance Type</b>							
Other Payer	1.5	1.5	1.6	51.8	817,107	8.6	p<0.001
Medi-Cal	1.0	1.1	1.2	48.2	760,151	28.0	p<0.001
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	.
High Risk	2.1	2.2	2.3	48.9	706,919	11.0	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	0.79	0.83	0.9	66.1	1,044,602	15.7	p<0.001
Cesarean Delivery with Labor	2.4	2.4	2.6	13.2	207,972	9.8	p=0.006
Elective Cesarean Delivery	2.2	2.4	2.6	4.6	72,946	14.3	p=0.022
Vaginal Birth After Cesarean	1.1	1.3	1.4	1.3	20,090	24.6	p=0.163
Failed Vaginal Birth After Cesarean	4.1	4.2	4.8	2.2	34,599	17.0	p=0.010
Elective Repeat Cesarean Delivery	1.7	1.7	1.95	12.7	199,815	16.8	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 5B. Stratified Chronic Hypertension Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	1.0		
>=35	2.9		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	1.0		
Multi-Race	2.0		
Black	3.3		
American Indian	2.1		
Asian	1.4		
Pacific Islander	2.4		
White	1.4		
Other	1.2		
Unknown	1.7		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	1.4		
Nulliparous	1.2		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	1.6		
Medi-Cal	1.1		
<b>Risk Level</b>		1,447,019	.
Low Risk	0.0		
High Risk	2.2		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	0.8		
Cesarean Delivery with Labor	2.5		
Elective Cesarean Delivery	2.4		
Vaginal Birth After Cesarean	1.2		
Failed Vaginal Birth After Cesarean	4.4		
Elective Repeat Cesarean Delivery	1.8		

**Figures 5a and 5b: Chronic Hypertension, 2007 -2009**

**5a. Top Quartile Counties with Chronic Hypertension**



Number of events too small to report prevalence.

**Proportion of Delivering Women with Chronic Hypertension Among Top Quartile Counties**

Lake	3.03%
Solano	2.70%
Inyo	2.63%
Contra Costa	2.05%
San Benito	1.96%
San Mateo	1.91%
Sacramento	1.85%
Alameda	1.84%
San Francisco	1.73%
Monterey	1.68%
Colusa	1.66%
Mono	1.55%
Santa Clara	1.53%
San Joaquin	1.48%

**5b: Counties with Increasing Trends in Chronic Hypertension**

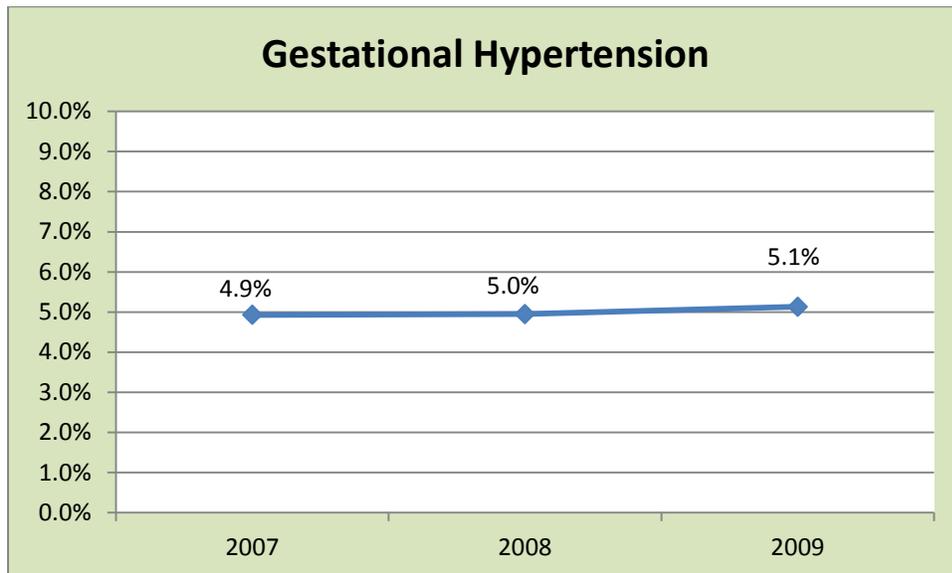


Number of events too small to perform trend testing.

**Percentage Increase in Chronic Hypertension from 2007 to 2009 Among Delivering Women**

Glenn	126.91%
Kings	99.71%
Lake	65.25%
Humboldt	55.66%
Santa Clara	49.28%
Calaveras	43.19%
Merced	40.08%
San Francisco	39.37%
San Luis Obispo	36.05%
San Bernardino	35.94%
Marin	35.17%
San Joaquin	33.23%
Ventura	31.72%
Sonoma	30.96%
Riverside	30.30%
Yolo	30.03%
Stanislaus	29.77%
Mendocino	21.03%

## 6. Gestational Hypertension



P<0.0001

Figure 5: Overall Trends in Gestational Hypertension in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

Gestational hypertension is a subset of any hypertension and includes transient hypertension of pregnancy (ICD-9-CM 642.3), mild or unspecified preeclampsia (ICD-9-CM 642.4), severe preeclampsia (ICD-9-CM 642.5) and eclampsia (ICD-9-CM 642.6).

- The overall rate of gestational hypertension increased during the study period from 4.9% in 2007 to 5.1% in 2009. This represents a 4.1% increase. The trend increased in women who are Hispanic, Multi-race, American Indian, and Asian. This increased trend was consistent across age, parity, and insurance type (Table 6A).
- When compared within strata, older women, women who were Black, American Indian or Pacific Islander, nulliparous women, and women with Medi-Cal insurance had higher 3-year rates of gestational hypertension (Table 6B).
  - When evaluated by route of delivery, women with cesarean delivery with labor had the highest 3-year rate of gestational hypertension (11.5%).

**Table 6A. Trends in Gestational Hypertension in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	4.9	5.0	5.1	100	1,580,024	4.1	p<0.001
<b>Age</b>							
<35	4.9	4.9	5.1	82.6	1,304,383	3.5	p<0.001
>=35	5.1	5.3	5.5	17.5	275,641	6.4	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	4.9	4.9	5.0	52.8	834,492	3.5	p=0.004
Multi-Race	5.4	5.4	6.2	1.7	27,479	15.4	p=0.015
Black	7.3	7.3	7.7	5.3	83,055	4.7	p=0.131
American Indian	7.4	6.2	5.8	0.4	5,582	-21.7	p=0.046
Asian	3.4	3.5	3.8	11.9	187,665	9.9	p<0.001
Pacific Islander	6.6	6.3	5.9	0.5	7,112	-11.0	p=0.298
White	5.2	5.1	5.3	26.0	410,183	3.1	p=0.061
Other	5.5	5.4	5.1	0.1	920	-7.1	p=0.832
Unknown	5.1	5.3	5.3	1.5	23,536	2.7	p=0.705
<b>Parity</b>							
Multiparous	3.3	3.4	3.5	60.3	951,048	5.1	p<0.001
Nulliparous	7.4	7.4	7.6	39.8	627,327	3.1	p=0.007
<b>Insurance Type</b>							
Other Payer	4.9	4.9	5.1	51.8	817,107	4.3	p<0.001
Medi-Cal	4.9	5.0	5.1	48.2	760,151	4.1	p=0.002
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	.
High Risk	8.5	8.4	8.5	48.9	706,919	-0.5	p=0.626
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	3.7	3.7	3.9	66.1	1,044,602	4.3	p<0.001
Cesarean Delivery with Labor	11.4	11.4	11.6	13.2	207,972	1.8	p=0.260
Elective Cesarean Delivery	9.0	9.1	9.3	4.6	72,946	3.9	p=0.174
Vaginal Birth After Cesarean	2.6	2.7	2.3	1.3	20,090	-11.4	p=0.273
Failed Vaginal Birth After Cesarean	8.3	8.2	8.3	2.2	34,599	-0.8	p=0.856
Elective Repeat Cesarean Delivery	2.7	2.8	3.1	12.7	199,815	14.5	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 6B. Stratified Gestational Hypertension Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	4.9		
>=35	5.3		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	4.9		
Multi-Race	5.7		
Black	7.4		
American Indian	6.4		
Asian	3.6		
Pacific Islander	6.3		
White	5.2		
Other	5.3		
Unknown	5.2		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	3.4		
Nulliparous	7.4		
<b>Insurance</b>		1,577,258	p=0.019
Other Payer	5.0		
Medi-Cal	5.0		
<b>Risk Level</b>		1,447,019	.
Low Risk	0.0		
High Risk	8.5		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	3.8		
Cesarean Delivery with Labor	11.5		
Elective Cesarean Delivery	9.1		
Vaginal Birth After Cesarean	2.6		
Failed Vaginal Birth After Cesarean	8.3		
Elective Repeat Cesarean Delivery	2.9		

**Figures 6a and 6b: Gestational Hypertension, 2007-2009**

**6a. Top Quartile Counties with Gestational Hypertension**



**6b. Counties with Increasing Trends in Gestational Hypertension**



 Number of events too small to perform trend testing.

**Proportion of Delivering Women with Gestational Hypertension Among Top Quartile Counties**

Modoc	14.71%
Amador	11.06%
Lassen	9.46%
Calaveras	8.64%
Santa Cruz	7.90%
Siskiyou	7.44%
Butte	6.83%
San Mateo	6.43%
Glenn	6.43%
San Francisco	6.38%
Solano	6.22%
Humboldt	6.15%
Mono	5.96%
Colusa	5.89%
Inyo	5.88%

**Percentage Increase in Gestational Hypertension from 2007 to 2009 Among Delivering Women**

Inyo	178.12%
Mono	81.62%
Plumas	55.64%
Mendocino	47.55%
Lassen	43.66%
Madera	20.61%

## 7. Unspecified Hypertension

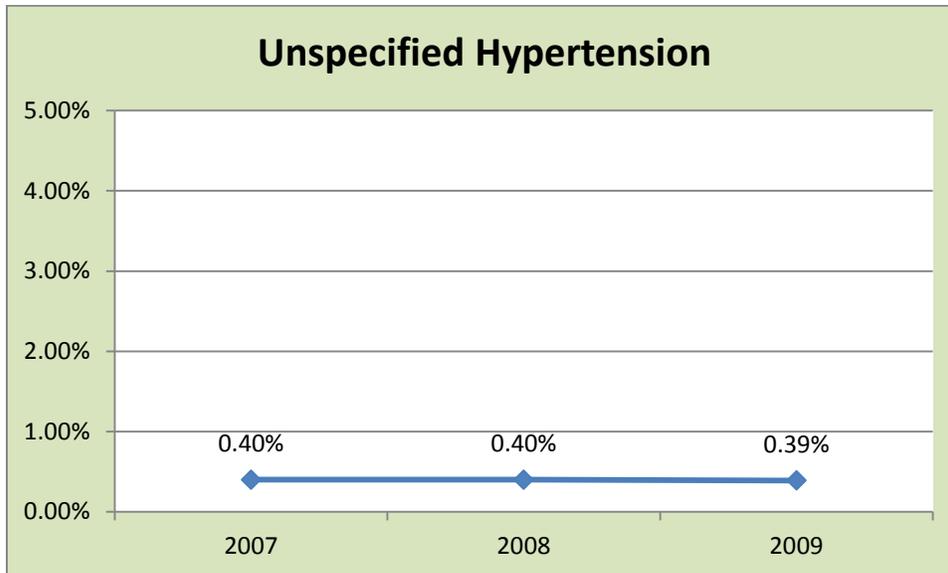


Figure 7: Overall Trends in Unspecified Hypertension in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

Unspecified hypertension was identified using a single code (ICD-9-CM 642.9).

- There was not a statistically significant change in the rate of unspecified hypertension across the 3-year study period (Table 7A).
- When compared within strata, older women, Black and American Indian women, nulliparous women, women with insurance other than Medi-Cal, and women delivering via elective cesarean delivery or cesarean delivery with labor, had higher 3-year rates of unspecified hypertension (Table 7B).

**Table 7A. Trends in Unspecified Hypertension in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	0.4	0.4	0.4	100	1,580,024	-2.5	p=0.532
<b>Age</b>							
<35	0.4	0.4	0.3	82.6	1,304,383	-2.3	p=0.494
>=35	0.6	0.6	0.6	17.5	275,641	-1.9	p=0.749
<b>Race/Ethnicity</b>							
Hispanic	0.3	0.3	0.3	52.8	834,492	-8.8	p=0.056
Multi-Race	0.6	0.6	0.7	1.7	27,479	18.3	p=0.359
Black	0.8	0.8	0.8	5.3	83,055	1.0	p=0.918
American Indian	0.9	1.0	0.6	0.4	5,582	-29.4	p=0.399
Asian	0.3	0.3	0.3	11.9	187,665	9.8	p=0.378
Pacific Islander	0.6	0.60	0.7	0.5	7,112	14.9	p=0.705
White	0.5	0.5	0.5	26.0	410,183	2.0	p=0.732
Other	0.0	0.3	0.3	0.1	920	.	p=0.405
Unknown	0.5	0.4	0.3	1.5	23,536	-29.9	p=0.162
<b>Parity</b>							
Multiparous	0.4	0.4	0.4	60.3	951,048	-4.0	p=0.329
Nulliparous	0.4	0.5	0.4	39.8	627,327	0.7	p=0.865
<b>Insurance Type</b>							
Other Payer	0.4	0.4	0.4	51.8	817,107	-2.5	p=0.570
Medi-Cal	0.4	0.4	0.4	48.2	760,151	-1.4	p=0.763
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	.
High Risk	0.8	0.8	0.7	48.9	706,919	-6.4	p=0.049
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	0.3	0.3	0.3	66.1	1,044,602	-8.1	p=0.052
Cesarean Delivery with Labor	0.6	0.7	0.7	13.2	207,972	0.3	p=0.962
Elective Cesarean Delivery	0.7	0.7	0.7	4.6	72,946	6.7	p=0.566
Vaginal Birth After Cesarean	0.3	0.3	0.3	1.3	20,090	-14.1	p=0.648
Failed Vaginal Birth After Cesarean	0.5	0.6	0.7	2.2	34,599	27.0	p=0.171
Elective Repeat Cesarean Delivery	0.5	0.5	0.5	12.7	199,815	4.5	p=0.601

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 7B. Stratified Unspecified Hypertension Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	0.4		
>=35	0.6		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	0.3		
Multi-Race	0.6		
Black	0.8		
American Indian	0.8		
Asian	0.3		
Pacific Islander	0.6		
White	0.5		
Other	0.2		
Unknown	0.4		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	0.4		
Nulliparous	0.4		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	0.4		
Medi-Cal	0.4		
<b>Risk Level</b>		1,447,019	p<0.001
Low Risk	0.00		
High Risk	0.8		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	0.31		
Cesarean Delivery with Labor	0.7		
Elective Cesarean Delivery	0.7		
Vaginal Birth After Cesarean	0.3		
Failed Vaginal Birth After Cesarean	0.6		
Elective Repeat Cesarean Delivery	0.5		

**Figures 7a and 7b: Unspecified Hypertension, 2007-2009**

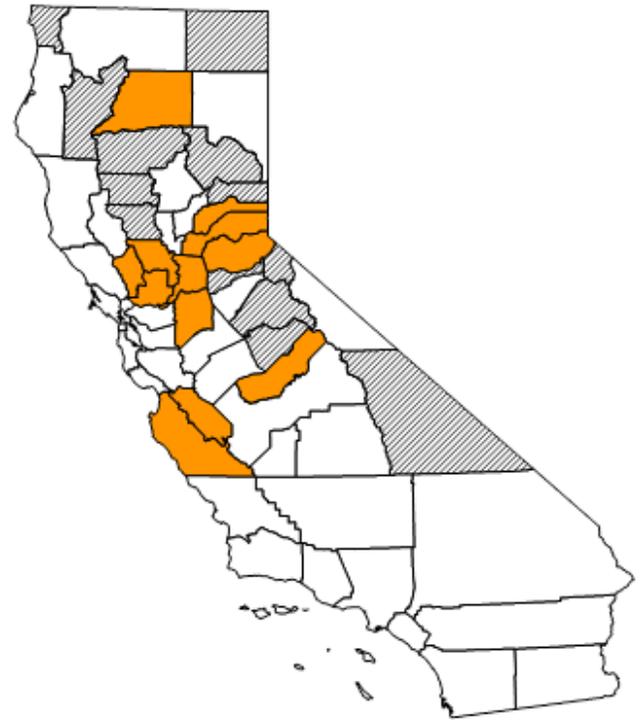
**7a. Top Quartile Counties with Unspecified Hypertension**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Unspecified Hypertension Among Top Quartile Counties	
El Dorado	1.46%
Nevada	1.15%
Amador	1.05%
San Benito	0.96%
Mendocino	0.93%
Colusa	0.92%
Sonoma	0.87%
Ventura	0.81%
Inyo	0.77%
Lake	0.76%
Contra Costa	0.74%
Lassen	0.74%

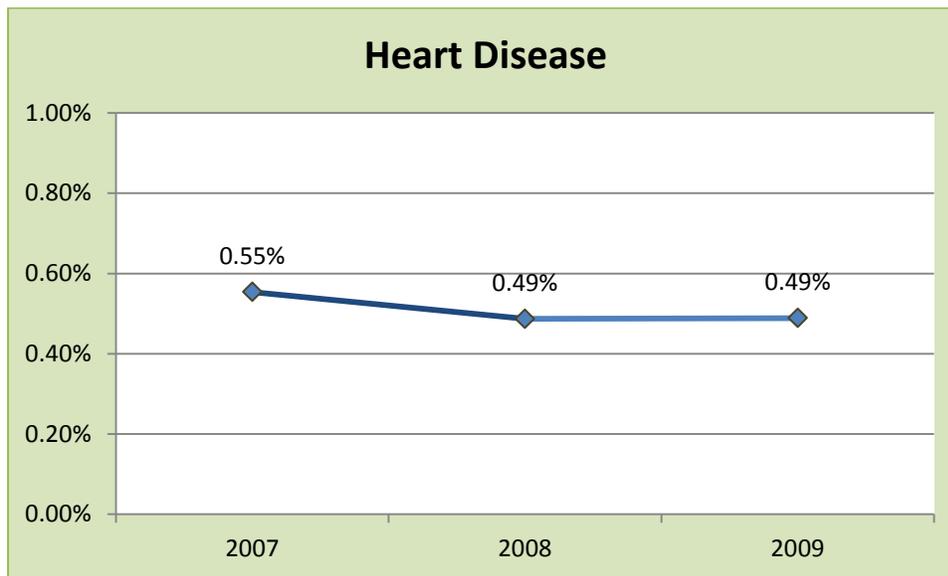
**7b. Counties with Increasing Trends in Unspecified Hypertension**



 Number of events too small to perform trend testing.

Percentage Increase in Unspecified Hypertension from 2007 to 2009 Among Delivering Women	
San Joaquin	110.65%
Colusa	78.47%
Napa	60.71%
Yolo	58.02%
El Dorado	44.67%
Placer	44.42%
Solano	33.53%
San Benito	33.33%
Monterey	31.71%
Sacramento	27.34%
Nevada	25.36%
Shasta	22.64%

## 8. Heart Disease



P<0.0001

Figure 8: Overall Trends in Heart Disease in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= 1,580,024

Heart disease includes congenital heart disease (ICD-9-CM 648.5, 745.xx-747.xx), acute myocardial infarction (ICD-9-CM 410.xx-411.xx), angina (ICD-9-CM 413.xx), other forms of chronic ischemic heart disease (ICD-9-CM 414.xx), acute pulmonary heart disease (ICD-9-CM 415.xx), chronic pulmonary heart disease (ICD-9-CM 416.xx), other diseases of pulmonary circulation (ICD-9-CM 417.xx), acute pericarditis (ICD-9-CM 420.xx), acute/subacute pericarditis (ICD-9-CM 421.xx), acute myocarditis (ICD-9-CM 422.xx), other pericardial (ICD-9-CM 423.xx), other diseases of endocardium (ICD-9-CM 424.xx), cardiomyopathy (ICD-9-CM 425.xx), conduction disorders (ICD-9-CM 426.xx), dysrhythmias (ICD-9-CM 427.xx), heart failure (ICD-9-CM 428.xx), ill-defined descriptions and complications of heart disease (ICD-9-CM 429.xx), and rheumatic heart disease (ICD-9-CM 390.xx-398.xx). Additionally, codes identifying operations on the heart and pericardium are also included (ICD-9-CM 35.xx-39.xx).

- The overall rate of heart disease **decreased** from 0.55% in 2007 to 0.49% in 2009. This represents an 11.73% decrease. The trend in heart disease decreased in Asian and White women, and among women with insurance other than Medi-Cal. This decreased trend was consistent across age and parity (Table 8A).
- When compared within strata, older women and women with Medi-Cal insurance had higher 3-year rates of heart disease. Black, White, and Multi-race women had the highest 3-year rates of heart disease (0.65%, 0.86%, and 0.66% respectively) (Table 8B).
  - When evaluated by route of delivery, women with failed VBAC and elective cesarean delivery had the highest 3-year rates of heart disease (1.03% and 1.02%, respectively).

**Table 8A. Trends in Heart Disease in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	0.6	0.5	0.5	100	1,580,024	-11.7	p<0.001
<b>Age</b>							
<35	0.5	0.4	0.4	82.6	1,304,383	-9.7	p<0.001
>=35	0.9	0.8	0.8	17.5	275,641	-18.4	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	0.3	0.3	0.3	52.8	834,492	-2.7	p=0.504
Multi-Race	0.8	0.7	0.6	1.7	27,479	-26.3	p=0.090
Black	0.6	0.6	0.7	5.3	83,055	8.9	p=0.406
American Indian	0.6	0.7	0.4	0.4	5,582	-34.6	p=0.412
Asian	0.6	0.5	0.5	11.9	187,665	-16.4	p=0.018
Pacific Islander	0.7	0.5	0.6	0.5	7,112	-6.0	p=0.850
White	1.0	0.8	0.8	26.0	410,183	-20.3	p<0.001
Other	0.3	0.0	0.3	0.1	920	-7.3	p=0.967
Unknown	0.7	0.7	0.6	1.5	23,536	-7.9	p=0.659
<b>Parity</b>							
Multiparous	0.6	0.5	0.5	60.3	951,048	-10.6	p<0.001
Nulliparous	0.6	0.5	0.5	39.8	627,327	-13.4	p<0.001
<b>Insurance Type</b>							
Other Payer	0.7	0.6	0.6	51.8	817,107	-15.9	p<0.001
Yes Medi-Cal	0.4	0.3	0.4	48.2	760,151	-2.2	p=0.594
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	p=0.910
High Risk	1.1	0.9	0.9	48.9	706,919	-18.7	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	0.4	0.4	0.4	66.1	1,044,602	-10.6	p=0.002
Cesarean Delivery with Labor	0.9	0.7	0.7	13.2	207,972	-16.7	p=0.002
Elective Cesarean Delivery	1.1	1.0	1.0	4.6	72,946	-9.4	p=0.241
Vaginal Birth After Cesarean	0.5	0.6	0.3	1.3	20,090	-39.0	p=0.110
Failed Vaginal Birth After Cesarean	1.2	1.0	0.9	2.2	34,599	-29.3	p=0.007
Elective Repeat Cesarean Delivery	0.7	0.6	0.6	12.7	199,815	-6.9	p=0.281

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 8B. Stratified Heart Disease Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	0.4		
>=35	0.8		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	0.3		
Multi-Race	0.7		
Black	0.7		
American Indian	0.6		
Asian	0.5		
Pacific Islander	0.6		
White	0.9		
Other	0.2		
Unknown	0.7		
<b>Parity</b>		1,578,375	p=0.489
Multiparous	0.5		
Nulliparous	0.5		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	0.7		
Medi-Cal	0.4		
<b>Risk Level</b>		1,447,019	.
Low Risk	0.0		
High Risk	1.0		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	0.4		
Cesarean Delivery with Labor	0.8		
Elective Cesarean Delivery	1.0		
Vaginal Birth After Cesarean	0.4		
Failed Vaginal Birth After Cesarean	1.03		
Elective Repeat Cesarean Delivery	0.63		

**Figures 8a and 8b: Heart Disease, 2007 -2009**

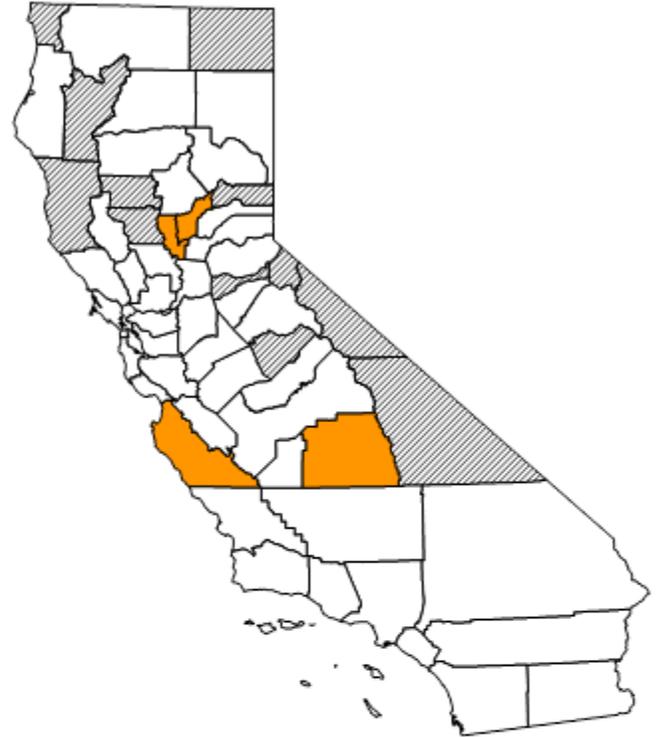
**8a. Top Quartile Counties with Heart Disease**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Heart Disease Among Top Quartile Counties	
Mariposa	1.44%
Tuolumne	1.38%
Sutter	1.21%
El Dorado	1.19%
Plumas	1.10%
Nevada	1.07%
Yuba	0.96%
Lassen	0.86%
Marin	0.85%
Placer	0.82%
Butte	0.74%
Sonoma	0.69%
Ventura	0.68%

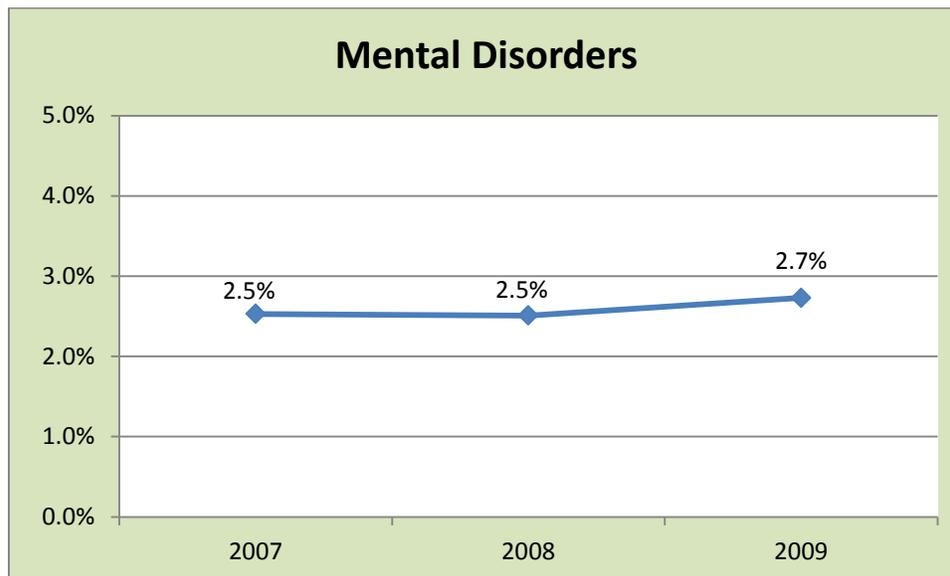
**8b: Counties with Increasing Trends in Heart Disease**



 Number of events too small to perform trend testing.

Percentage Increase in Heart Disease from 2007 to 2009 Among Delivering Women	
Tulare	52.85%
Yuba	37.99%
Monterey	33.28%
Sutter	23.91%

## 9. Mental Disorders



P<0.0001

Figure 9: Overall Trends in Mental Disorders in all hospital deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

For the purposes of this analysis, mental disorders include mood disorders (ICD-9-CM 300.4, 311, 298.0, 296.0, 296.2, 296.3, 296.4, 296.5, 296.6, 296.7, 296.80, 296.81, 296.82, 296.89), anxiety disorders (ICD-9-CM, 300.0, 300.01, 300.2, 300.21, 300.3, 308.0, 309.81), adjustment disorders (ICD-9-CM 309.xx), substance use disorders (ICD-9-CM 291.xx, 292.xx, 303.xx, 304.xx, 305.xx, 648.3), psychotic disorders (ICD-9-CM 295.xx, 297.xx), cognitive disorders (ICD-9-CM 293.0, 293.1) and eating disorders (307.1, 307.50, 307.51, 307.52, 307.53, 307.54).

- Mental disorders **increased** across the study period, from 2.5% in 2007 to 2.7% in 2009. This represents a 7.9% increase. Trends increased in Hispanic and White women. Trends were consistent across age, parity and insurance type (Table 9A).
- When compared within strata, older women, American Indian, Multi-race, Black and White women, multiparous women and women with Medi-Cal insurance had higher 3-year rates of mental disorders (Table 9B).
  - When evaluated by route of delivery, women with failed VBAC delivery had the highest 3-year rate of mental disorders (4.8%)

**Table 9A. Trends in Mental Disorders in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall trends</b>	2.5	2.5	2.7	100	1,580,024	7.9	p<0.001
<b>Age</b>							
<35	2.5	2.5	2.7	82.6	1,304,383	8.0	p<0.001
>=35	2.7	2.8	3.0	17.5	275,641	9.7	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	1.7	1.6	1.8	52.8	834,492	7.3	p<0.001
Multi-Race	5.6	5.3	5.6	1.7	27,479	0.5	p=0.925
Black	5.0	5.0	5.3	5.3	83,055	5.4	p=0.166
American Indian	8.3	6.8	7.2	0.4	5,582	-13.0	p=0.206
Asian	0.8	0.8	0.9	11.9	187,665	8.0	p=0.218
Pacific Islander	2.5	2.3	2.4	0.5	7,112	-6.8	p=0.704
White	4.3	4.3	4.7	26.0	410,183	9.1	p<0.001
Other	2.8	1.9	5.1	0.1	920	85.8	p=0.095
Unknown	3.4	3.1	3.6	1.5	23,536	3.8	p=0.597
<b>Parity</b>							
Multiparous	2.6	2.6	2.8	60.3	951,048	7.6	p<0.001
Nulliparous	2.4	2.4	2.6	39.8	627,327	9.4	p<0.001
<b>Insurance Type</b>							
Other Payer	2.3	2.3	2.6	51.8	817,107	13.4	p<0.001
Medi-Cal	2.7	2.7	2.8	48.2	760,151	3.7	p=0.043
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	740,100	.	.
High Risk	4.9	4.7	5.0	48.9	706,919	3.7	p=0.004
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	2.3	2.3	2.5	66.1	1,044,602	7.4	p<0.001
Cesarean Delivery with Labor	3.0	3.0	3.3	13.2	207,972	7.6	p=0.013
Elective Cesarean Delivery	2.8	3.2	3.1	4.6	72,946	12.6	p=0.023
Vaginal Birth After Cesarean	3.3	3.3	3.6	1.3	20,090	8.6	p=0.384
Failed Vaginal Birth After Cesarean	4.8	4.5	5.0	2.2	34,599	3.1	p=0.616
Elective Repeat Cesarean Delivery	2.6	2.5	2.9	12.7	199,815	10.0	p=0.004

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 9B. Stratified Mental Disorders Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	2.5		
>=35	2.8		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	1.7		
Multi-Race	5.5		
Black	5.1		
American Indian	7.5		
Asian	0.8		
Pacific Islander	2.4		
White	4.4		
Other	3.3		
Unknown	3.4		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	2.7		
Nulliparous	2.4		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	2.4		
Medi-Cal	2.7		
<b>Risk Level</b>		1,447,019	p<0.001
Low Risk	0.0		
High Risk	4.9		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	2.4		
Cesarean Delivery with Labor	3.1		
Elective Cesarean Delivery	3.0		
Vaginal Birth After Cesarean	3.4		
Failed Vaginal Birth After Cesarean	4.8		
Elective Repeat Cesarean Delivery	2.7		

**Figures 9a and 9b: Mental Disorders, 2007 -2009**

**9a. Top Quartile Counties with Mental Disorders**



Number of events too small to report prevalence.

Proportion of Delivering Women with Mental Disorders Among Top Quartile Counties	
Trinity	11.54%
Shasta	8.83%
El Dorado	8.37%
Yolo	8.19%
Amador	8.15%
Humboldt	7.79%
Plumas	6.83%
Lake	6.76%
Nevada	6.75%
Calaveras	5.94%
Sacramento	5.53%
Solano	5.46%
Sonoma	5.29%
Colusa	4.88%
Tulare	4.82%

**9b: Counties with Increasing Trends in Mental Disorders**



Number of events too small to perform trend testing.

Percentage Increase in Mental Disorders from 2007 to 2009 Among Delivering Women	
Siskiyou	107.14%
Yolo	69.31%
Inyo	61.01%
San Benito	48.08%
Humboldt	42.81%
San Mateo	39.75%
Butte	34.14%
Sutter	33.20%
San Joaquin	32.45%
Stanislaus	31.98%
Marin	29.62%
Solano	29.25%
Fresno	25.61%
San Francisco	24.08%
Contra Costa	23.09%
Ventura	22.48%
Sonoma	20.85%

## 10. Obesity



P<0.0001

Figure 10: Overall Trends in Obesity in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,420,457**.

Obesity was calculated using birth certificate data (height and pre-pregnancy weight). Women with a body mass index greater than or equal to 30 kg/m<sup>2</sup> were classified as obese.

- The overall rate of obesity **increased** from 19.2% in 2007 to 20.7% in 2009. This represents a 7.8% increase. The trend was observed across all categories of age, parity, insurance type and route of delivery. Rates increased for all race/ethnicities except Multi-race and Other race (Table 10A).
- When compared within strata, the 3-year rates of obesity were highest for women who were Pacific Islander or American Indian, multiparous, and had Medi-Cal insurance (Table 10B).
  - When evaluated by route of delivery, women with failed VBAC delivery and elective repeat cesarean had the highest 3-year rates of obesity (29.9% all).

**Table 10A. Trends in Obesity in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	19.2	20.0	20.7	100	1,420,457	7.8	p<0.001
<b>Age</b>							
<35	19.3	20.1	20.8	82.4	1,170,290	7.8	p<0.001
>=35	18.9	19.8	20.4	17.6	250,167	7.9	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	23.2	24.1	25.3	51.9	737,181	9.1	p<0.001
Multi-Race	20.0	21.0	20.6	1.8	25,674	3.0	p=0.323
Black	27.1	28.2	28.3	5.2	73,424	4.4	p=0.003
American Indian	32.4	33.3	35.5	0.4	4,965	9.6	p=0.058
Asian	5.1	5.7	5.9	12.1	171,323	16.2	p<0.001
Pacific Islander	39.4	40.0	43.1	0.5	6,372	9.4	p=0.014
White	16.2	16.6	16.7	26.7	379,486	3.1	p<0.001
Other	18.8	17.5	18.1	0.1	784	-3.7	p=0.847
Unknown	15.0	16.0	16.3	1.5	21,248	8.7	p=0.043
<b>Parity</b>							
Multiparous	22.7	23.6	24.2	59.9	851,197	6.6	p<0.001
Nulliparous	14.0	14.7	15.5	40.1	568,791	10.7	p<0.001
<b>Insurance Type</b>							
Other Payer	16.9	17.2	17.4	53.1	753,569	3.0	p<0.001
Medi-Cal	21.9	23.2	24.4	46.9	664,974	11.4	p<0.001
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	50.2	654,642	.	.
High Risk	39.0	39.8	40.1	49.8	650,427	2.8	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	16.2	16.8	17.4	66.1	939,081	7.4	p<0.001
Cesarean Delivery with Labor	22.7	23.7	24.3	13.3	188,789	7.1	p<0.001
Elective Cesarean Delivery	22.8	23.3	24.0	4.6	65,727	5.3	p<0.001
Vaginal Birth After Cesarean	20.6	21.4	21.9	1.2	17,628	6.3	p=0.089
Failed Vaginal Birth After Cesarean	29.3	29.8	30.6	2.2	30,585	4.4	p=0.049
Elective Repeat Cesarean Delivery	28.9	30.0	30.6	12.6	178,647	5.9	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 10B. Stratified Obesity Overall 3 Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,420,457	p<0.001
<35	20.0		
>=35	19.7		
<b>Race/Ethnicity</b>		1,420,457	p<0.001
Hispanic	24.2		
Multi-Race	20.5		
Black	27.8		
American Indian	33.7		
Asian	5.6		
Pacific Islander	40.8		
White	16.5		
Other	18.1		
Unknown	15.8		
<b>Parity</b>		1,419,988	p<0.001
Multiparous	23.5		
Nulliparous	14.7		
<b>Insurance</b>		1,418,543	p<0.001
Other Payer	17.2		
Medi-Cal	23.2		
<b>Risk Level</b>		1,305,069	p<0.001
Low Risk	0.0		
High Risk	39.6		
<b>Route of Delivery</b>		1,420,457	p<0.001
Vaginal Delivery with Labor	16.8		
Cesarean Delivery with Labor	23.6		
Elective Cesarean Delivery	23.4		
Vaginal Birth After Cesarean	21.3		
Failed Vaginal Birth After Cesarean	29.9		
Elective Repeat Cesarean Delivery	29.9		

**Figures 10a and 10b: Obesity, 2007-2009**

**10a. Top Quartile Counties with Obesity**



**10b: Counties with Increasing Trends in Obesity**



 Number of events too small to perform trend testing.

**Proportion of Delivering Women with Obesity Among Top Quartile Counties**

Alpine	47.83%
Inyo	30.53%
Colusa	28.85%
Kings	28.71%
Del Norte	28.48%
Glenn	27.99%
Merced	27.25%
Tehama	26.99%
San Benito	26.90%
Lake	26.67%
Tulare	26.35%
Plumas	25.85%
Yuba	25.79%
Kern	25.78%
Madera	25.65%

**Percentage Increase in Obesity from 2007 to 2009 Among Delivering Women**

Trinity	76.61%
Amador	25.41%
San Luis Obispo	22.84%

## Childbirth Outcomes

**Table 11: Summary of Overall Trends in Childbirth Outcomes**

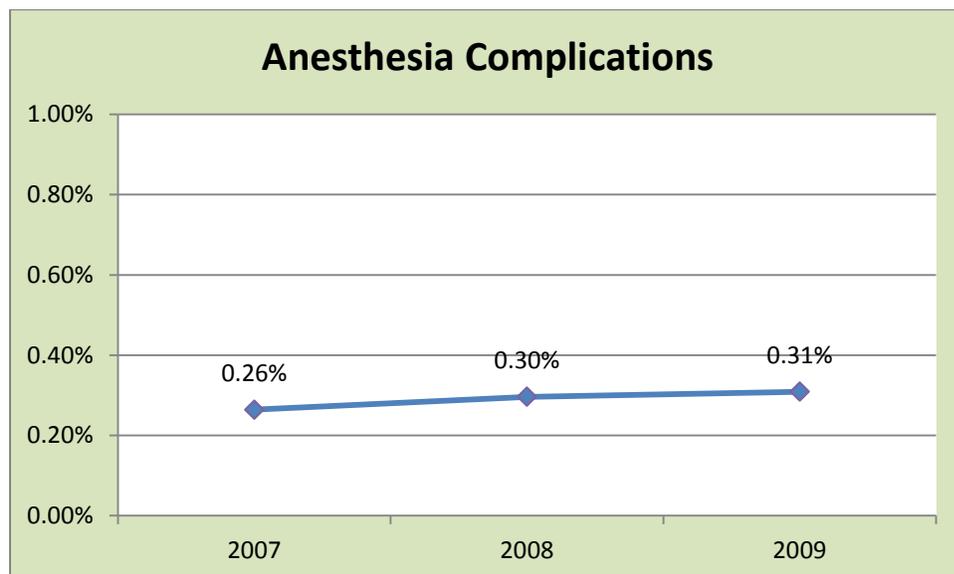
### Summary of Overall Trends, California, 2007-2009

	2007	2008	2009	3-Year Denominator	Percent Change	P-value
<b>Childbirth Outcomes</b>						
Anesthesia Complications	0.3	0.3	0.3	1,579,555	17.1	p<0.001
Maternal Hemorrhage	1.9	2.2	2.5	1,549,476	30.2	p<0.001
Maternal Infection	0.2	0.2	0.2	1,576,284	-17.8	p<0.001
Obstetric Trauma with Instrument	14.6	14.4	14.0	83,743	-4.1	p=0.042
Obstetric Trauma without Instrument	4.2	4.0	3.8	885,046	-9.7	p<0.001
NTSV Cesarean Delivery	27.4	28.0	28.6	545,930	4.4	p<0.001
Placenta Previa	1.5	1.5	1.6	1,580,024	0.7	p=0.490
Preterm Birth	7.6	7.6	7.4	1,549,022	-3.2	p<0.001
30-day Readmission	4.5	4.8	5.0	1,579,933	10.6	p<0.001

Percent of all hospital deliveries with listed conditions in California in 2007, 2008 and 2009, OSHPD data.

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

## 11. Anesthesia Complications



P<0.0001

Figure 11: Overall Trends in Anesthesia Complications in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,579,555**

Reference: AHRQ Patient Safety Indicators Technical Specifications, SAS PSI Software Documentation Version 3.2, March 2008. Available at:

<http://www.qualityindicators.ahrq.gov/Archive/Software.aspx#sas>

*Anesthesia complications is an Agency for Healthcare Research and Quality (AHRQ) Experimental Quality Indicator (EXP #1) that has been modified to apply to childbirth. The denominator includes all delivery diagnosis related groups (DRGs) and includes both surgical and medical diagnosis related DRG's to account for vaginal deliveries. The numerator includes all AHRQ codes for anesthesia: endotracheal tube wrongly placed during anesthetic procedure (ICD-9-CM E876.3), halothane causing adverse effects in therapeutic use (ICD-9-CM E938.1), other gaseous anesthetics causing adverse effects in therapeutic use (ICD-9-CM E938.2), intravenous anesthetics causing adverse effects in therapeutic use (ICD-9-CM E938.3), other and unspecified general anesthetics causing adverse effects in therapeutic use (ICD-9-CM E938.4), surface and infiltration anesthetics causing adverse effects in therapeutic use (ICD-9-CM E938.5), peripheral nerve- and plexus-blocking anesthetics causing adverse effects in therapeutic use (ICD-9-CM E938.6), spinal anesthetics causing adverse effects in therapeutic use (ICD-9-CM E938.7), other and unspecified local anesthetics causing adverse effects in therapeutic use (ICD-9-CM E938.9) and poisoning by other central nervous depressants (ICD9-CM 968.1, 968.2, 968.3, 968.4, 968.7). We maintained exclusion for self-inflicted injury, poisoning, and drug dependence or abuse. Two obstetric codes were added: anesthesia complications (ICD-9-CM 668.xx) and reaction to spinal puncture (ICD-9-CM 349.0). We also added CSF leak (ICD-9-CM 997.09) and dural tear (ICD-9-CM 349.3).*

- The overall rate of anesthesia complications **increased** from 0.26% in 2007 to 0.31% in 2009. This represents a 17.1% increase. The trend in anesthesia complications increased in women who identified as Hispanic or White. The increased trend was consistent across parity, insurance type and risk level (Table 11A).
- When comparing 3-year rates within strata, older women, White women, multiparous women, women with insurance other than Medi-Cal, and women in the high risk clinical category were at increased risk for 3-year anesthesia complications (Table 11B).
  - Women having a cesarean delivery had higher rates of anesthesia complications ranging from 0.41% for cesarean delivery with labor, 0.59% for elective cesarean delivery without labor and 0.52% for elective repeat cesarean.

**Table 11A. Stratified Trends in Anesthesia Complications in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	0.3	0.3	0.3	100	1,579,555	17.1	p<0.001
<b>Age</b>							
<35	0.3	0.3	0.3	82.6	1,304,000	19.0	p<0.001
>=35	0.3	0.4	0.4	17.5	275,555	10.5	p=0.208
<b>Race/Ethnicity</b>							
Hispanic	0.2	0.3	0.3	52.8	834,227	20.4	p<0.001
Multi-Race	0.2	0.4	0.2	1.7	27,472	25.6	p=0.555
Black	0.3	0.2	0.3	5.3	83,031	-2.1	p=0.881
American Indian	0.2	0.3	0.3	0.4	5,580	28.0	p=0.719
Asian	0.3	0.3	0.3	11.9	187,620	10.0	p=0.383
Pacific Islander	0.3	0.2	0.3	0.5	7,110	-19.4	p=0.650
White	0.3	0.4	0.4	26.0	410,064	14.8	p=0.035
Other	0.0	0.0	0.6	0.1	920	.	p=0.088
Unknown	0.2	0.4	0.4	1.5	23,531	110.0	p=0.033
<b>Parity</b>							
Multiparous	0.3	0.3	0.3	60.3	950,727	21.3	p<0.001
Nulliparous	0.2	0.3	0.3	39.8	627,179	9.0	p=0.170
<b>Insurance Type</b>							
Other Payer	0.3	0.3	0.4	51.8	816,855	16.2	p=0.002
Medi-Cal	0.2	0.3	0.3	48.2	759,934	18.8	p=0.003
<b>Risk Level</b>							
Low Risk	0.2	0.2	0.2	51.2	739,943	13.6	p=0.045
High Risk	0.4	0.4	0.4	48.9	706,661	15.3	p=0.003
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	0.2	0.2	0.2	66.1	1,044,392	23.7	p<0.001
Cesarean Delivery with Labor	0.4	0.4	0.4	13.2	207,895	3.1	p=0.708
Elective Cesarean Delivery	0.5	0.4	0.6	4.6	72,904	19.4	p=0.157
Vaginal Birth After Cesarean	0.3	0.4	0.2	1.3	20,081	-20.6	p=0.548
Failed Vaginal Birth After Cesarean	0.4	0.6	0.5	2.2	34,576	26.6	p=0.238
Elective Repeat Cesarean Delivery	0.5	0.5	0.5	12.6	199,707	10.8	p=0.176

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 11B. Stratified Anesthesia Complications Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,579,555	p<0.001
<35	0.3		
>=35	0.4		
<b>Race/Ethnicity</b>		1,579,555	p<0.001
Hispanic	0.3		
Multi-Race	0.3		
Black	0.3		
American Indian	0.3		
Asian	0.3		
Pacific Islander	0.3		
White	0.4		
Other	0.2		
Unknown	0.3		
<b>Parity</b>		1,577,906	p<0.001
Multiparous	0.3		
Nulliparous	0.3		
<b>Insurance</b>		1,576,789	p<0.001
Other Payer	0.3		
Medi-Cal	0.3		
<b>Risk Level</b>		1,446,604	p<0.001
Low Risk	0.2		
High Risk	0.4		
<b>Route of Delivery</b>		1,579,555	p<0.001
Vaginal Delivery with Labor	0.2		
Cesarean Delivery with Labor	0.4		
Elective Cesarean Delivery	0.5		
Vaginal Birth After Cesarean	0.3		
Failed Vaginal Birth After Cesarean	0.5		
Elective Repeat Cesarean Delivery	0.5		

**Figures 11a and 11b: Anesthesia Complications, 2007-2009**

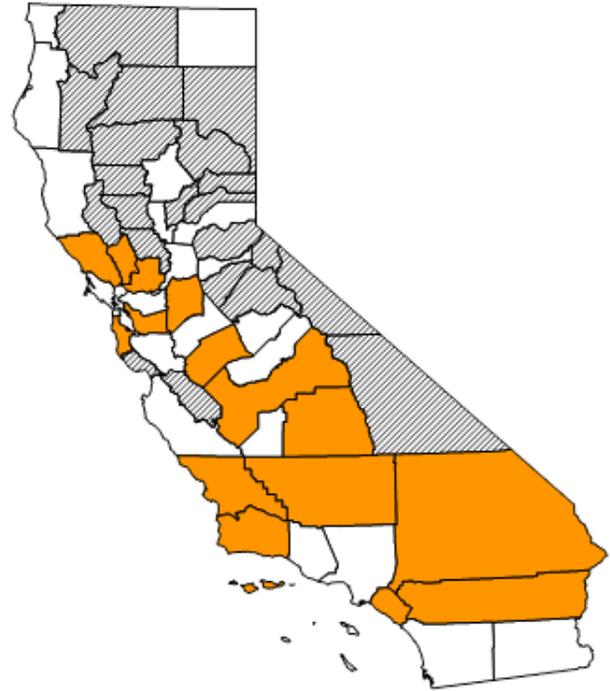
**11a. Top Quartile Counties with Anesthesia Complications**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Anesthesia Complications Among Top Quartile Counties	
Nevada	0.84%
Tehama	0.74%
Humboldt	0.67%
Butte	0.58%
Del Norte	0.53%
Marin	0.48%
Monterey	0.48%
San Mateo	0.46%
San Francisco	0.45%

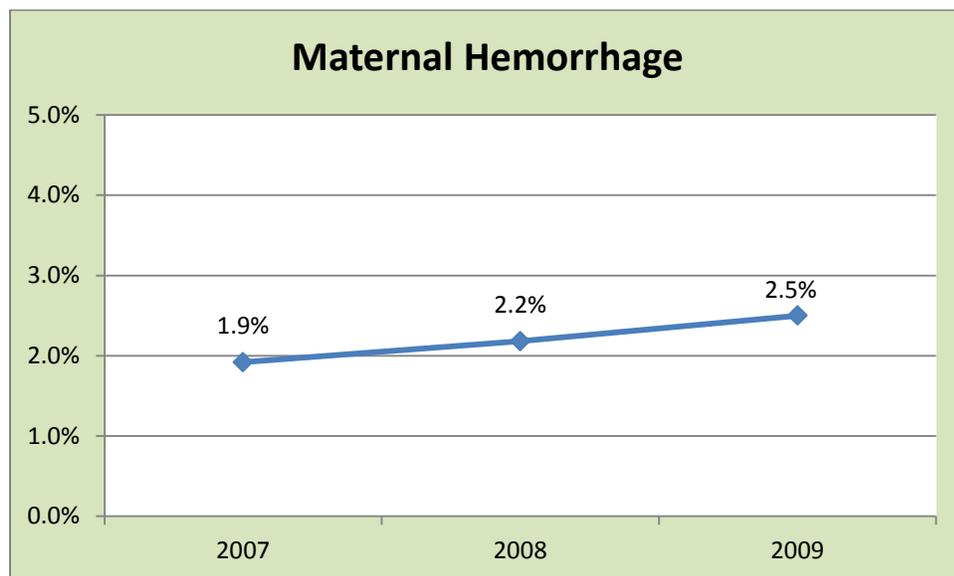
**11b. Counties with Increasing Trends in Anesthesia Complications**



 Number of events too small to perform trend testing.

Percentage Increase in Anesthesia Complications from 2007 to 2009 Among Delivering Women	
Fresno	164.67%
San Joaquin	97.94%
San Luis Obispo	92.35%
Kern	87.10%
San Bernardino	84.33%
Solano	70.91%
Santa Barbara	69.37%
Sonoma	65.18%
Tulare	58.51%
Napa	43.27%
Alameda	30.79%
San Mateo	26.13%
Riverside	24.65%
Orange	24.10%
Merced	20.07%

## 12. Maternal Hemorrhage



P<0.0001

Figure 12: Overall Trends in Maternal Hemorrhage in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,549,476**

Reference: AHRQ Patient Safety Indicators Technical Specifications Version 4.2, September 2010. Available at: [http://www.qualityindicators.ahrq.gov/Archive/PSI\\_TechSpec\\_V42.aspx](http://www.qualityindicators.ahrq.gov/Archive/PSI_TechSpec_V42.aspx).

Maternal hemorrhage is an AHRQ Patient Safety Indicator (#9) that has been modified to apply to obstetrics. The denominator includes all delivery diagnosis related groups (DRGs) and excludes abruption, placenta previa and vasa previa (ICD-9-CM 641.xx, 663.5). We also excluded hemorrhage and hematoma if present on admission (POA) and maintained exclusion for the day of the control or drainage code not preceding the date of delivery. The numerator includes AHRQ codes for hemorrhage and hematoma complicating a procedure (ICD-9-CM 998.11, 998.12), postpartum hemorrhage (ICD-9-CM 666.xx) and other complications of obstetrical surgical wounds (ICD-9-CM 674.3). Note, if only ICD-9-CM codes 998.11 or 998.12 are present, then the following AHRQ control codes are included: ICD-9-CM 287,388.0-388.9, 394.1, 399.8, 499.5, 579.3, 609.4; 180.9, 540, 541.2, 591.9, 610, 699.8, 701.4, 710.9, 759.1, 759.2, 860.4.

- The overall rate of maternal hemorrhage **increased** from 1.9% in 2007 to 2.5% in 2009. This represents a 30.2% increase. The trend in maternal hemorrhage increased for women across age, parity, insurance type, clinical risk category and route of delivery (Table 12A).
- When comparing 3-year rates within strata, older women, American Indian and Pacific Islanders, nulliparous, women with insurance other than Medi-Cal, and women in the high risk clinical category were at increased risk for hemorrhage (Table 12B).
  - When evaluated by route of delivery, women undergoing failed VBAC had the highest 3-year rate of hemorrhage (3.7%).

**Table 12A. Stratified Trends in Maternal Hemorrhage in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	1.9	2.2	2.5	100	1,549,476	30.2	p<0.001
<b>Age</b>							
<35	1.9	2.2	2.5	82.7	1,281,900	29.8	p<0.001
>=35	2.0	2.3	2.6	17.3	267,576	33.3	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	1.9	2.2	2.4	52.9	819,806	28.7	p<0.001
Multi-Race	2.2	2.4	2.6	1.7	26,954	17.4	p=0.084
Black	1.8	2.0	2.3	5.2	81,208	25.7	p<0.001
American Indian	2.9	2.7	3.0	0.4	5,452	2.8	p=0.893
Asian	2.2	2.5	2.9	11.8	182,589	36.7	p<0.001
Pacific Islander	3.3	3.0	4.0	0.5	6,932	20.4	p=0.221
White	1.8	2.1	2.4	26.0	402,611	32.0	p<0.001
Other	2.1	3.5	3.9	0.1	901	83.1	p=0.223
Unknown	2.5	2.5	3.1	1.5	23,023	26.6	p=0.010
<b>Parity</b>							
Multiparous	1.6	1.9	2.2	60.2	931,761	33.5	p<0.001
Nulliparous	2.4	2.6	3.0	39.8	616,122	27.4	p<0.001
<b>Insurance Type</b>							
Other Payer	2.0	2.3	2.6	51.7	800,301	32.2	p<0.001
Medi-Cal	1.8	2.1	2.4	48.3	746,488	27.7	p<0.001
<b>Risk Level</b>							
Low Risk	1.8	2.0	2.3	51.7	738,422	26.8	p<0.001
High Risk	2.0	2.3	2.7	48.3	689,444	31.7	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	2.1	2.5	2.8	66.7	1,033,991	29.4	p<0.001
Cesarean Delivery with Labor	1.9	2.1	2.6	12.8	198,847	35.6	p<0.001
Elective Cesarean Delivery	1.1	1.2	1.5	4.4	67,635	38.2	p<0.001
Vaginal Birth After Cesarean	3.2	3.7	4.2	1.3	19,752	30.3	p=0.003
Failed Vaginal Birth After Cesarean	1.5	2.1	2.3	2.1	32,105	53.0	p<0.001
Elective Repeat Cesarean Delivery	0.9	1.0	1.2	12.7	197,146	36.5	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 12B. Stratified Maternal Hemorrhage Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,549,476	p<0.001
<35	2.2		
>=35	2.3		
<b>Race/Ethnicity</b>		1,549,476	p<0.001
Hispanic	2.1		
Multi-Race	2.4		
Black	2.0		
American Indian	2.9		
Asian	2.5		
Pacific Islander	3.5		
White	2.1		
Other	3.2		
Unknown	2.7		
<b>Parity</b>		1,547,883	p<0.001
Multiparous	1.9		
Nulliparous	2.7		
<b>Insurance</b>		1,546,789	p<0.001
Other Payer	2.3		
Medi-Cal	2.1		
<b>Risk Level</b>		1,427,866	p<0.001
Low Risk	2.0		
High Risk	2.3		
<b>Route of Delivery</b>		1,549,476	p<0.001
Vaginal Delivery with Labor	2.5		
Cesarean Delivery with Labor	2.2		
Elective Cesarean Delivery	1.3		
Vaginal Birth After Cesarean	3.7		
Failed Vaginal Birth After Cesarean	2.0		
Elective Repeat Cesarean Delivery	1.0		

Figures 12a and 12b: Maternal Hemorrhage, 2007-2009

12a. Top Quartile Counties with Maternal Hemorrhage



 Number of events too small to report prevalence.

Proportion of Delivering Women with Maternal Hemorrhage Among Top Quartile Counties	
Modoc	6.67%
Siskiyou	6.42%
Yolo	6.00%
Nevada	5.78%
Lassen	5.46%
Mendocino	5.22%
San Francisco	5.20%
Marin	5.12%
Sonoma	4.51%
San Mateo	4.44%
Monterey	4.34%
Santa Clara	4.29%
Tehama	3.66%

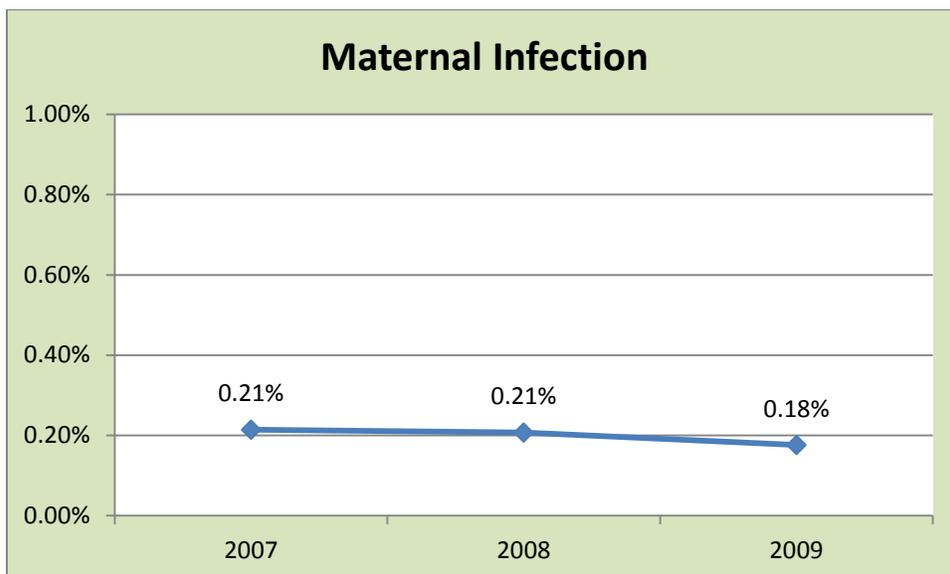
12b: Counties with Increasing Trends in Maternal Hemorrhage



 Number of events too small to perform trend testing.

Percentage Increase in Maternal Hemorrhage from 2007 to 2009 Among Delivering Women	
Colusa	113.83%
Stanislaus	105.66%
Mono	89.26%
Tulare	70.97%
Santa Barbara	68.10%
Contra Costa	61.62%
Santa Cruz	60.32%
Sonoma	56.59%
San Mateo	54.97%
Lassen	48.75%
Alameda	47.48%
Yuba	44.92%
El Dorado	42.08%
Los Angeles	37.96%
Solano	36.08%
Placer	34.24%
San Joaquin	33.71%
San Bernardino	33.68%
San Francisco	33.32%
Tuolumne	32.23%
Orange	29.92%
Fresno	29.28%
Merced	28.19%
Riverside	24.35%
Santa Clara	23.57%
Inyo	22.73%
Kern	21.86%
Nevada	21.51%
Marin	20.98%

### 13. Maternal Infection



P<0.0001

Figure 13: Overall Trends in Maternal Infection in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,576,284**

Reference: AHRQ Patient Safety Indicators Technical Specifications Version 4.2, September 2010. Available at: [http://www.qualityindicators.ahrq.gov/Archive/PSI\\_TechSpec\\_V42.aspx](http://www.qualityindicators.ahrq.gov/Archive/PSI_TechSpec_V42.aspx)

Maternal infection is an AHRQ Patient Safety Indicator (#13) that we have modified to apply to obstetrics. The denominator includes all delivery diagnosis related groups (DRGs). This measure does not exclude infection as a principal diagnosis, does not require an elective surgical procedure and does not require exclusion of patients with a length of stay (LOS) less than four days. We have maintained the exclusion criteria of no cancer or immunocompromise. The numerator includes all AHRQ codes for sepsis (ICD-9-CM 038.0, 785.52, 998.0, 995.91, 995.92), endometritis (670.0) and septicemia during labor (659.3). Per AHRQ criteria, patients with a length of stay (LOS) less than four days were excluded from the numerator.

- The overall rate of maternal infection **decreased** from 0.21% in 2007 to 0.18% in 2009. This represents a 17.8% decrease. The trend in maternal infection decreased for all years for Hispanic and White women. This decreased trend was consistent across age, parity, insurance type and the high risk clinical category (Table 13A).
- When compared within strata, Black women, nulliparous women, women with Medi-Cal insurance and women in the high-risk clinical category had the highest 3-year rates of maternal infection (Table 13B).
  - When evaluated by route of delivery, women who had a cesarean delivery with labor had the highest 3-year rate of maternal infection (0.98%).

**Table 13A. Trends in Maternal Infection in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	0.2	0.2	0.2	100	1,576,284	-17.8	p<0.001
<b>Age</b>							
<35	0.2	0.2	0.2	82.6	1,301,827	-13.7	p=0.004
>=35	0.2	0.2	0.1	17.4	274,457	-36.8	p<0.001
<b>Race/Ethnicity</b>							
Hispanic	0.2	0.2	0.2	52.9	833,054	-17.5	p=0.003
Multi-Race	0.3	0.4	0.3	1.7	27,402	-12.1	p=0.669
Black	0.4	0.4	0.4	5.3	82,820	-10.2	p=0.435
American Indian	0.2	0.1	0.2	0.4	5,565	-22.9	p=0.710
Asian	0.3	0.3	0.2	11.9	187,246	-10.1	p=0.385
Pacific Islander	0.3	0.4	0.4	0.5	7,094	38.3	p=0.525
White	0.2	0.1	0.1	25.9	408,723	-34.4	p<0.001
Other	0.3	0.3	0.0	0.1	918	-100.0	p=0.360
Unknown	0.4	0.3	0.3	1.5	23,462	-4.6	p=0.868
<b>Parity</b>							
Multiparous	0.1	0.1	0.1	60.3	948,990	-20.4	p=0.005
Nulliparous	0.4	0.4	0.3	39.7	625,655	-17.1	p<0.001
<b>Insurance Type</b>							
Other Payer	0.2	0.2	0.2	51.8	814,604	-22.9	p<0.001
Medi-Cal	0.2	0.2	0.2	48.2	758,921	-13.0	p=0.030
<b>Risk Level</b>							
Low Risk	0.1	0.1	0.1	51.2	739,151	-14.4	p=0.092
High Risk	0.3	0.2	0.2	48.8	704,945	-20.2	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	0.1	0.1	0.1	66.2	1,042,831	-3.9	p=0.816
Cesarean Delivery with Labor	1.1	1.0	0.9	13.1	207,062	-20.1	p<0.001
Elective Cesarean Delivery	0.2	0.2	0.2	4.6	72,611	-33.6	p=0.054
Vaginal Birth After Cesarean	0.1	0.1	0.1	1.3	20,039	-8.8	p=0.875
Failed Vaginal Birth After Cesarean	0.7	0.7	0.5	2.2	34,415	-21.9	p=0.179
Elective Repeat Cesarean Delivery	0.1	0.1	0.1	12.7	199,326	-30.6	p=0.026

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 13B. Stratified Maternal Infection Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,576,284	p=0.085
<35	0.2		
>=35	0.2		
<b>Race/Ethnicity</b>		1,576,284	p<0.001
Hispanic	0.2		
Multi-Race	0.3		
Black	0.4		
American Indian	0.2		
Asian	0.3		
Pacific Islander	0.4		
White	0.1		
Other	0.2		
Unknown	0.3		
<b>Parity</b>		1,574,645	p<0.001
Multiparous	0.1		
Nulliparous	0.4		
<b>Insurance</b>		1,573,525	P<0.001
Other Payer	0.2		
Medi-Cal	0.2		
<b>Risk Level</b>		1,444,096	p<0.001
Low Risk	0.1		
High Risk	0.2		
<b>Route of Delivery</b>		1,576,284	p<0.001
Vaginal Delivery with Labor	0.1		
Cesarean Delivery with Labor	1.0		
Elective Cesarean Delivery	0.2		
Vaginal Birth After Cesarean	0.1		
Failed Vaginal Birth After Cesarean	0.6		
Elective Repeat Cesarean Delivery	0.1		

**Figures 13a and 13b: Maternal Infection, 2007 -2009**

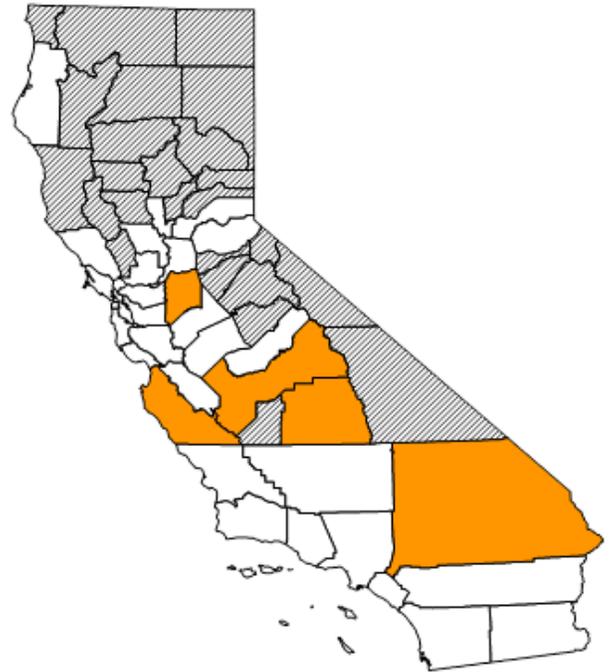
**13a. Top Quartile Counties with Maternal Infection**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Maternal Infection Among Top Quartile Counties	
San Mateo	0.49%
San Francisco	0.46%
Alameda	0.40%
Marin	0.39%
Santa Clara	0.37%
Monterey	0.35%
Nevada	0.31%
Sonoma	0.29%
Contra Costa	0.26%
San Diego	0.25%

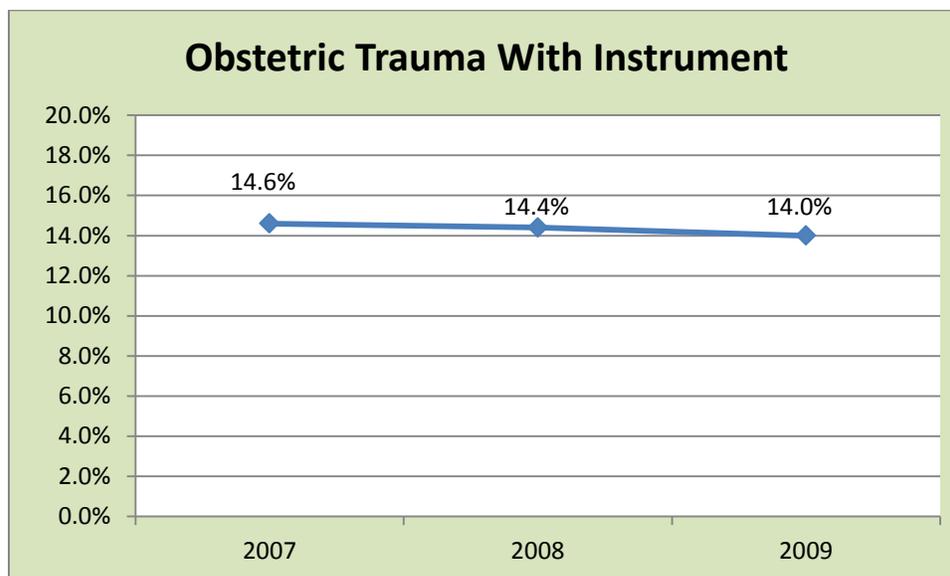
**13b: Counties with Increasing Trends in Maternal Infection**



 Number of events too small to perform trend testing.

Percentage Increase in Maternal Infection from 2007 to 2009 Among Delivering Women	
San Joaquin	113.86%
San Bernardino	63.78%
Fresno	55.28%
Tulare	52.89%
Monterey	22.66%

## 14. Obstetric Trauma With Instrument (Maternal Birth Trauma: Vaginal Delivery with Instrument)



P<0.0001

Figure 14: Overall Trends in Maternal Birth Trauma with Instrument in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **83,743**

Reference: AHRQ Patient Safety Indicators Technical Specifications Version 4.2, September 2010. Available at: [http://www.qualityindicators.ahrq.gov/Archive/PSI\\_TechSpec\\_V42.aspx](http://www.qualityindicators.ahrq.gov/Archive/PSI_TechSpec_V42.aspx).

Vaginal delivery with instrument is an AHRQ Patient Safety Indicator (#18) that we have modified to apply to obstetrics. The denominator includes all vaginal deliveries with any instrument assisted delivery. The numerator includes third and fourth degree perineal lacerations (ICD-9-CM 664.2, 664.3), obstetrical laceration of cervix (ICD-9-CM 665.3), high vaginal laceration (ICD-9-CM 665.4) and obstetrical pelvic hematoma (ICD-9-CM 665.7).

- The overall rate of obstetric trauma with an instrument **decreased** from 14.6% in 2007 to 14.0% in 2009. This represents a 4.1% decrease. The trend in birth trauma with instrument decreased among Hispanic women and women with Medi-Cal insurance (Table 14A).
- When compared within strata, younger women, Asian women and women who identified as Other race, nulliparous women, and women with insurance other than Medi-Cal had higher 3-year rates of obstetric trauma with an instrument (Table 14B).

**Table 14A. Trends in Obstetric Trauma with Instrument in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	14.6	14.4	14.0	100	83,743	-4.1	p=0.042
<b>Age</b>							
<35	14.8	14.5	14.3	84.8	70,970	-3.4	p=0.112
>=35	13.4	13.7	12.5	15.3	12,773	-6.7	p=0.174
<b>Race/Ethnicity</b>							
Hispanic	12.5	12.2	11.5	45.5	38,135	-8.0	p=0.011
Multi-Race	11.6	13.8	13.5	1.9	1,562	16.4	p=0.387
Black	10.7	10.9	9.9	4.2	3,521	-7.6	p=0.538
American Indian	10.6	4.7	13.3	0.2	205	25.5	p=0.546
Asian	19.8	19.6	19.0	18.3	15,360	-4.0	p=0.286
Pacific Islander	15.9	10.5	15.9	0.4	290	0.0	p=0.948
White	15.2	15.1	15.1	27.9	23,385	-0.7	p=0.760
Other	25.0	12.5	26.7	0.1	39	6.8	p=0.765
Unknown	17.8	18.6	17.7	1.5	1,246	-0.6	p=0.916
<b>Parity</b>							
Multiparous	6.1	5.8	5.5	32.5	27,215	-8.4	p=0.154
Nulliparous	18.9	18.4	18.1	67.5	56,458	-4.2	p=0.070
<b>Insurance Type</b>							
Other Payer	16.4	16.3	16.3	54.2	45,239	-0.6	p=0.672
Medi-Cal	12.5	12.1	11.3	45.9	38,298	-9.6	p=0.005
<b>Risk Level</b>							
Low Risk	14.7	14.7	14.2	67.0	53,560	-3.4	p=0.191
High Risk	15.3	14.2	14.2	33.0	26,355	-7.2	p=0.060
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	14.6	14.3	14.0	97.7	81,805	-4.1	p=0.053
Vaginal Birth After Cesarean	16.7	15.9	15.0	2.3	1,936	-10.2	p=0.413

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 14B. Stratified Obstetric Trauma with Instrument Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		83,743	p<0.001
<35	14.5		
>=35	13.2		
<b>Race/Ethnicity</b>		83,743	p<0.001
Hispanic	12.1		
Multi-Race	13.1		
Black	10.5		
American Indian	9.8		
Asian	19.5		
Pacific Islander	14.1		
White	15.1		
Other	20.5		
Unknown	18.1		
<b>Parity</b>		83,673	p<0.001
Multiparous	5.8		
Nulliparous	18.4		
<b>Insurance</b>		83,537	p<0.001
Other Payer	16.3		
Medi-Cal	12.0		
<b>Risk Level</b>		79,915	p=0.930
Low Risk	14.5		
High Risk	14.5		
<b>Route of Delivery</b>		83,743	p=0.251
Vaginal Delivery with Labor	14.3		
Vaginal Birth After Cesarean	15.9		

**Figures 14a and 14b: Obstetric Trauma With Instrument, 2007 -2009**

**14a. Top Quartile Counties with Obstetric Trauma With Instrument**



Number of events too small to report prevalence.

**14b: Counties with Increasing Trends in Obstetric Trauma With Instrument**



Number of events too small to perform trend testing.

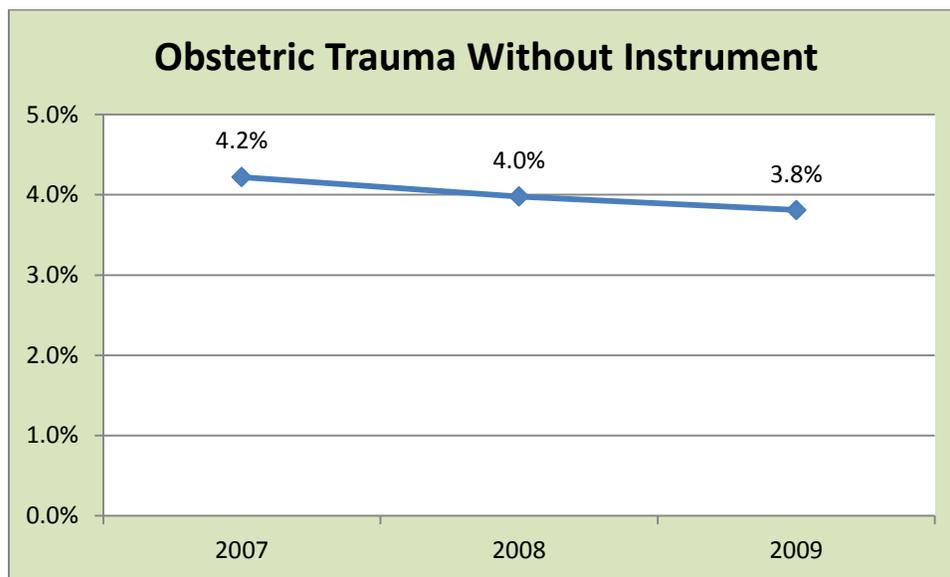
**Proportion of Delivering Women with Obstetric Trauma With Instrument Among Top Quartile Counties**

Mariposa	38.46%
San Francisco	23.75%
Santa Barbara	22.92%
Tuolumne	22.58%
Alameda	20.83%
Santa Clara	20.82%
Yolo	19.46%
Contra Costa	18.59%
Siskiyou	17.95%
Marin	17.94%
San Mateo	17.79%
Sutter	17.57%
Solano	17.53%

**Percentage Increase in Obstetric Trauma With Instrument from 2007 to 2009 Among Delivering Women**

Mendocino	50.12%
Sonoma	32.17%
Nevada	24.75%

## 15. Obstetric Trauma Without Instrument (Maternal Birth Trauma: Vaginal Delivery without Instrument)



P<0.0001

Figure 15: Overall Trends in Maternal Birth Trauma without Instrument in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **885,046**

Reference: AHRQ Patient Safety Indicators Technical Specifications Version 4.2, September 2010. Available at: [http://www.qualityindicators.ahrq.gov/Archive/PSI\\_TechSpec\\_V42.aspx](http://www.qualityindicators.ahrq.gov/Archive/PSI_TechSpec_V42.aspx).

Vaginal delivery without instrument is an AHRQ Patient Safety Indicator (#19) that has been modified to apply to obstetrics. The denominator includes all vaginal deliveries without any instrument assisted delivery. The numerator includes deliveries with third and fourth degree lacerations (ICD-9-CM 664.2, 664.3), obstetrical laceration of cervix (ICD-9-CM 665.3), high vaginal laceration (ICD-9-CM 665.4) and pelvic hematoma (ICD-9-CM 665.7).

- The overall rate of obstetric trauma due to vaginal delivery without an instrument **decreased** across the study years from 4.2% in 2007 to 3.8% in 2009. This represents a 9.7% decrease. Trends decreased in women of Hispanic, Multi-race, White and Unknown race/ethnicity. This trend was consistent across age, parity, insurance type and clinical risk category (Table 15A).
- When compared within strata, younger women, Asian women, nulliparous women, women with insurance other than Medi-Cal, and women in the low risk clinical category had the highest 3-year rates of obstetric trauma without an instrument (Table 15B).

**Table 15A. Trends in Obstetric Trauma without Instrument in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	4.2	4.0	3.8	100	885,046	-9.7	p<0.001
<b>Age</b>							
<35	4.4	4.1	4.0	85.5	756,661	-9.6	p<0.001
>=35	3.2	3.2	2.9	14.5	128,385	-9.3	p=0.013
<b>Race/Ethnicity</b>							
Hispanic	3.9	3.7	3.4	53.9	477,069	-12.2	p<0.001
Multi-Race	3.8	4.2	3.9	1.8	15,587	1.1	p=0.981
Black	3.4	3.0	2.8	5.0	44,204	-16.3	p=0.009
American Indian	4.1	2.1	3.6	0.4	3,220	-10.8	p=0.721
Asian	5.6	5.4	5.3	11.3	99,873	-5.3	p=0.103
Pacific Islander	4.5	3.1	3.6	0.5	4,089	-20.1	p=0.266
White	4.4	4.2	4.1	25.8	228,203	-7.1	p=0.004
Other	1.8	4.1	2.8	0.1	486	60.6	p=0.725
Unknown	4.7	4.3	3.8	1.4	12,315	-19.4	p=0.047
<b>Parity</b>							
Multiparous	2.0	1.8	1.7	62.5	552,527	-13.3	p<0.001
Nulliparous	8.0	7.6	7.3	37.5	331,641	-9.5	p<0.001
<b>Insurance Type</b>							
Other Payer	4.5	4.4	4.2	51.1	451,768	-8.0	p<0.001
Medi-Cal	3.9	3.6	3.4	48.9	431,683	-11.6	p<0.001
<b>Risk Level</b>							
Low Risk	4.3	4.1	4.0	66.2	546,275	-8.8	p<0.001
High Risk	4.3	4.0	3.8	33.8	278,839	-11.8	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	4.2	4.0	3.8	98.2	868,636	-9.8	p<0.001
Vaginal Birth After Cesarean	5.2	5.2	4.9	1.9	16,406	-5.6	p=0.481

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 15B. Stratified Obstetric Trauma w/out Instrument Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		885,046	p<0.001
<35	4.1		
>=35	3.1		
<b>Race/Ethnicity</b>		885,046	p<0.001
Hispanic	3.7		
Multi-Race	4.0		
Black	3.0		
American Indian	3.2		
Asian	5.5		
Pacific Islander	3.7		
White	4.2		
Other	3.1		
Unknown	4.2		
<b>Parity</b>		884,168	p<0.001
Multiparous	1.8		
Nulliparous	7.6		
<b>Insurance</b>		883,451	p<0.001
Other Payer	4.4		
Medi-Cal	3.6		
<b>Risk Level</b>		825,114	p=0.007
Low Risk	4.1		
High Risk	4.0		
<b>Route of Delivery</b>		885,046	p<0.001
Vaginal Delivery with Labor	4.0		
Vaginal Birth After Cesarean	5.1		

**Figures 15a and 15b: Obstetric Trauma Without Instrument, 2007 -2009**

**15a. Top Quartile Counties with Obstetric Trauma Without Instrument**



 Number of events too small to report prevalence.

**Proportion of Delivering Women with Obstetric Trauma Without Instrument Among Top Quartile Counties**

Tuolumne	6.39%
San Francisco	5.93%
Solano	5.85%
San Benito	5.18%
Tulare	4.88%
San Mateo	4.73%
Monterey	4.67%
Santa Barbara	4.64%
Trinity	4.59%
San Bernardino	4.53%
Kern	4.53%
San Joaquin	4.48%
Riverside	4.41%
Humboldt	4.31%

**15b: Counties with Increasing Trends in Obstetric Trauma Without Instrument**

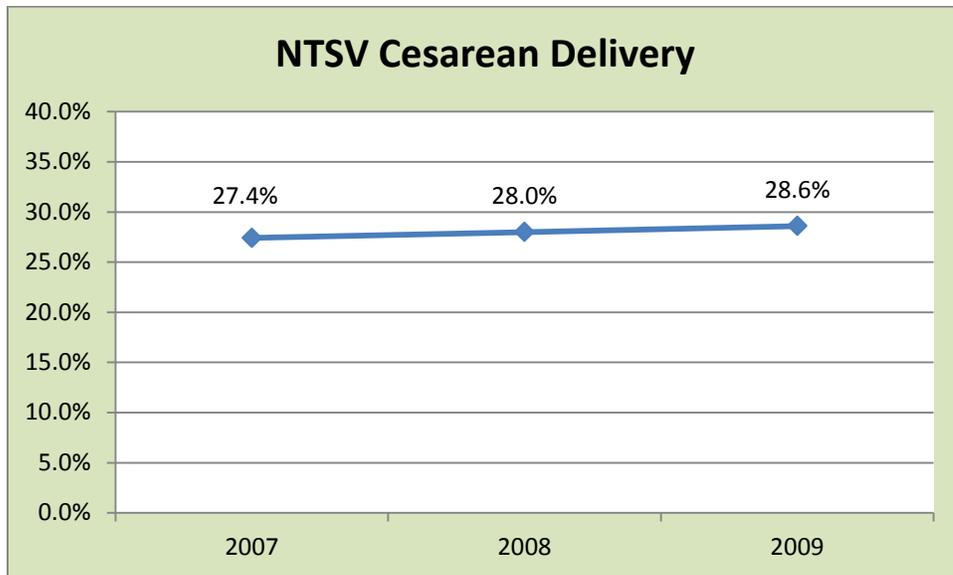


 Number of events too small to perform trend testing.

**Percentage Increase in Obstetric Trauma Without Instrument from 2007 to 2009 Among Delivering Women**

San Benito	59.02%
Shasta	55.26%
Humboldt	25.16%

## 16. Nulliparous Term Singleton Vertex (NTSV) Cesarean Delivery



P<0.0001

Figure 16: Overall Trends in Nulliparous Term Singleton Vertex (NTSV) Cesarean Delivery in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **545,930**

Nulliparous Term Singleton Vertex (NTSV) cesarean delivery rate contributes substantially to the overall cesarean delivery rate. The denominator value includes nulliparous, term, singleton, vertex births and the numerator value includes all cesarean deliveries.

- The overall NTSV cesarean delivery rate **increased** across the study period from 27.4% in 2007 to 28.6% in 2009. This represents a 4.4% increase. The trend in NTSV cesarean delivery increased for Hispanic, Asian, White, and Other race women. This trend was consistent across age and insurance type (Table 16A).
- When compared within strata, older women, Black women and women of Other race, women with insurance other than Medi-Cal, and women in the high risk clinical category had higher 3-year rates of NTSV cesarean delivery (Table 16B).

**Table 16A. Trends in NTSV Cesarean Delivery in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	27.4	28.0	28.6	100	545,930	4.4	p<0.001
<b>Age</b>							
<35	25.6	26.2	26.8	90.4	493,227	4.7	p<0.001
>=35	44.1	44.8	45.2	9.7	52,703	2.5	p=0.049
<b>Race/Ethnicity</b>							
Hispanic	26.5	27.2	27.6	47.4	259,001	4.2	p<0.001
Multi-Race	26.6	28.5	28.4	2.1	11,549	6.8	p=0.072
Black	31.8	32.1	32.4	5.4	29,487	1.9	p=0.385
American Indian	25.6	28.2	27.5	0.3	1,677	7.4	p=0.470
Asian	28.2	28.8	29.8	13.8	75,324	5.7	p<0.001
Pacific Islander	29.7	29.1	28.4	0.4	2,104	-4.4	p=0.601
White	27.7	28.0	28.7	28.8	157,133	3.6	p<0.001
Other	25.8	33.1	39.3	0.1	328	52.3	p=0.045
Unknown	29.4	31.0	31.2	1.7	9,327	6.1	p=0.133
<b>Parity</b>							
Multiparous	.	.	.			.	.
Nulliparous	27.4	28.0	28.5	100.0	544,569	4.0	p<0.001
<b>Insurance Type</b>							
Other Payer	28.8	29.3	29.7	55.3	301,288	3.1	p<0.001
Medi-Cal	25.7	26.6	27.1	44.7	243,611	5.5	p<0.001
<b>Risk Level</b>							
Low Risk	18.3	18.7	18.9	62.9	342,187	3.3	p<0.001
High Risk	43.8	44.2	43.8	37.1	201,564	0.0	p=0.844
<b>Route of Delivery*</b>							
Cesarean Delivery with Labor	.	.	.	23.4	127,898	.	.
Elective Cesarean Delivery	.	.	.	4.2	22,695	.	.

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

\*NTSV is equal to the sum of cesarean delivery with labor and elective cesarean delivery.

**Table 16B. Stratified NTSV Cesarean Delivery Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		545,930	p<0.001
<35	26.2		
>=35	44.7		
<b>Race/Ethnicity</b>		545,930	p<0.001
Hispanic	27.1		
Multi-Race	27.9		
Black	32.1		
American Indian	27.1		
Asian	28.9		
Pacific Islander	29.1		
White	28.1		
Other	33.2		
Unknown	30.6		
<b>Parity</b>		544,569	.
Multiparous	.		
Nulliparous	28.0		
<b>Insurance</b>		544,899	p<0.001
Other Payer	29.3		
Medi-Cal	26.5		
<b>Risk Level</b>		543,751	p<0.001
Low Risk	18.7		
High Risk	43.9		
<b>Route of Delivery</b>		545,930	p<0.001
Cesarean Delivery with Labor	100		
Elective Repeat Cesarean Delivery	100		

**Figures 16a and 16b: Nulliparous Term Singleton Vertex (NTSV) Cesarean Delivery, 2007-2009**

**16a. Top Quartile Counties with NTSV Cesarean Delivery**



**16b: Counties with Increasing Trends in NTSV Cesarean Delivery**



 Number of events too small to perform trend testing.

Proportion of Delivering Women with NTSV Cesarean Delivery Among Top Quartile Counties	
Kings	37.52%
Imperial	35.72%
Los Angeles	32.14%
Amador	31.33%
Tulare	31.26%
Colusa	30.52%
San Diego	30.45%
Tuolumne	30.34%
Orange	29.93%
Mono	29.41%
Fresno	28.17%
Madera	27.74%
Calaveras	27.65%
Riverside	27.46%
Stanislaus	26.83%

Percentage Increase in NTSV Cesarean Delivery from 2007 to 2009 Among Delivering Women	
Calaveras	57.79%
Trinity	44.47%
Lassen	43.36%
Shasta	37.66%
Kings	37.47%
Glenn	33.76%
Colusa	30.77%
Amador	23.62%

## 17. Placenta Previa

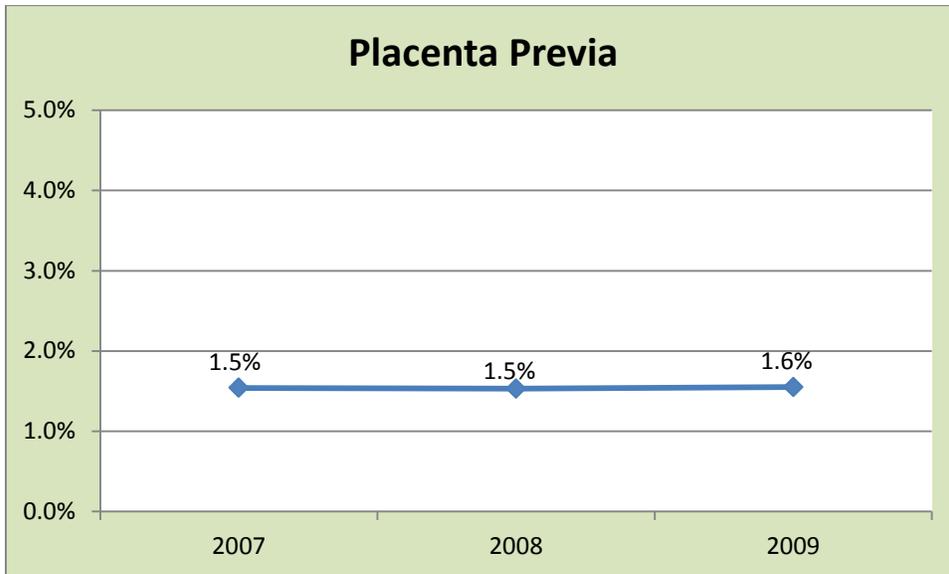


Figure 17: Overall Trends in Placenta Previa in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,580,024**

Placenta previa is a condition in which the placenta lies very low in the uterus and covers all or part of the cervix, complicating vaginal delivery. This measure includes both placenta previa without hemorrhage (ICD-9-CM 649.0) and placenta previa with hemorrhage (ICD-9-CM 641.1).

- There was not a statistically significant change in the rate of placenta previa over the 3-year study period (Table 17A).
- When comparing 3-year rates within strata, older women, American Indian women, multiparous women, women with Medi-Cal insurance, and women in the high-risk clinical category were at a higher risk for placenta previa (Table 17B).
  - When evaluated by route of delivery, women who had a failed VBAC delivery or elective cesarean delivery had the highest 3-year rates of placenta previa (4.1% and 3.2%, respectively).

**Table 17A. Trends in Placenta Previa in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	1.5	1.5	1.6	100	1,580,024	0.7	p=0.490
<b>Age</b>							
<35	1.5	1.5	1.5	82.6	1,304,383	2.7	p=0.103
>=35	1.7	1.6	1.6	17.5	275,641	-6.4	p=0.061
<b>Race/Ethnicity</b>							
Hispanic	0.7	0.7	0.7	52.8	834,492	4.7	p=0.159
Multi-Race	3.8	3.8	3.5	1.7	27,479	-9.1	p=0.205
Black	3.0	3.0	3.2	5.3	83,055	5.9	p=0.218
American Indian	6.8	6.1	6.0	0.4	5,582	-12.5	p=0.286
Asian	0.9	0.9	0.9	11.9	187,665	-3.0	p=0.626
Pacific Islander	3.5	3.4	3.1	0.5	7,112	-11.2	p=0.449
White	3.0	3.1	3.0	26.0	410,183	-1.6	p=0.510
Other	1.7	1.9	1.9	0.1	920	11.6	p=0.858
Unknown	1.7	1.3	1.5	1.5	23,536	-7.9	p=0.569
<b>Parity</b>							
Multiparous	1.8	1.7	1.8	60.3	951,048	1.7	p=0.312
Nulliparous	1.2	1.2	1.2	39.8	627,327	0.0	p=0.818
<b>Insurance Type</b>							
Other Payer	1.1	1.1	1.1	51.8	817,107	-2.7	p=0.369
Medi-Cal	2.0	2.0	2.1	48.2	760,151	3.0	p=0.155
<b>Risk Level</b>							
Low Risk	0.68	0.67	0.65	51.2	740,100	-3.7	p=0.296
High Risk	2.0	2.0	2.0	48.9	706,919	-1.5	p=0.502
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	1.2	1.2	1.2	66.1	1,044,602	0.0	p=0.987
Cesarean Delivery with Labor	2.2	2.1	2.2	13.2	207,972	-0.9	p=0.846
Elective Cesarean Delivery	3.3	3.2	3.2	4.6	72,946	-2.5	p=0.592
Vaginal Birth After Cesarean	1.6	1.5	1.4	1.3	20,090	-11.5	p=0.379
Failed Vaginal Birth After Cesarean	4.0	4.1	4.2	2.2	34,599	5.1	p=0.460
Elective Repeat Cesarean Delivery	1.8	1.8	1.8	12.7	199,815	4.6	p=0.292

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 17B. Stratified Placenta Previa Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,580,024	p<0.001
<35	1.5		
>=35	1.7		
<b>Race/Ethnicity</b>		1,580,024	p<0.001
Hispanic	0.7		
Multi-Race	3.7		
Black	3.1		
American Indian	6.3		
Asian	0.9		
Pacific Islander	3.3		
White	3.0		
Other	1.9		
Unknown	1.5		
<b>Parity</b>		1,578,375	p<0.001
Multiparous	1.8		
Nulliparous	1.2		
<b>Insurance</b>		1,577,258	p<0.001
Other Payer	1.1		
Medi-Cal	2.0		
<b>Risk Level</b>		1,447,019	p<0.001
Low Risk	0.7		
High Risk	2.0		
<b>Route of Delivery</b>		1,580,024	p<0.001
Vaginal Delivery with Labor	1.2		
Cesarean Delivery with Labor	2.2		
Elective Cesarean Delivery	3.2		
Vaginal Birth After Cesarean	1.5		
Failed Vaginal Birth After Cesarean	4.1		
Elective Repeat Cesarean Delivery	1.8		

**Figures 17a and 17b: Placenta Previa, 2007-2009**

**17a. Top Quartile Counties with Placenta Previa**



**17b. Counties with Increasing Trends in Placenta Previa**

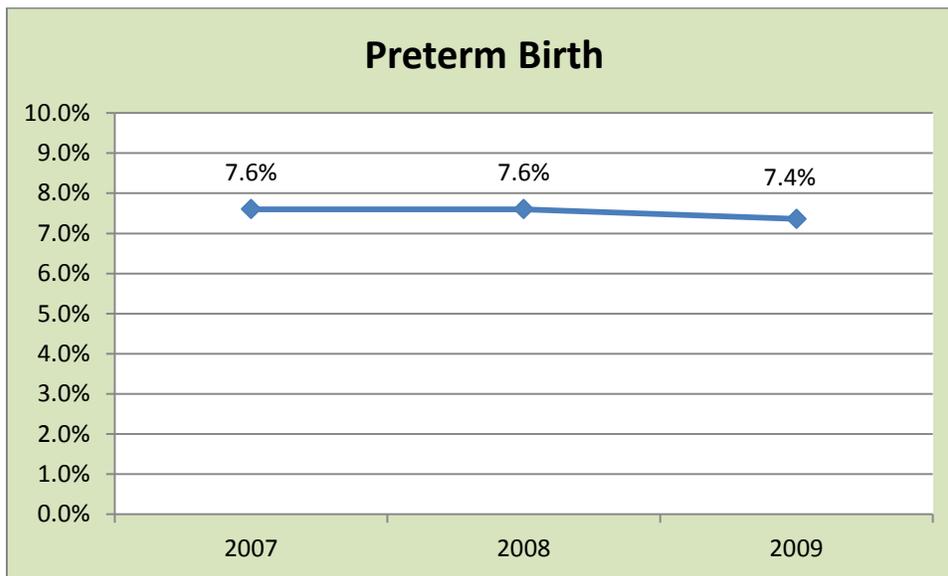


 Number of events too small to perform trend testing.

Proportion of Delivering Women with Placenta Previa Among Top Quartile Counties	
Del Norte	14.63%
Trinity	12.72%
Modoc	11.03%
Plumas	11.01%
Lake	9.75%
Amador	9.55%
Shasta	9.32%
Yuba	8.82%
Mariposa	8.61%
Nevada	8.44%
Lassen	8.35%
Calaveras	7.71%
Humboldt	7.09%
Butte	7.04%
Tuolumne	6.98%

Percentage Increase in Placenta Previa from 2007 to 2009 Among Delivering Women	
Siskiyou	279.76%
Lassen	247.03%
Monterey	84.99%
Tehama	58.13%
Amador	56.26%
Napa	50.97%
Sonoma	42.70%
Stanislaus	41.62%
Calaveras	38.42%
San Mateo	36.10%
Yuba	32.79%
Fresno	32.54%
Sutter	30.90%
Mariposa	30.85%
Ventura	27.25%
Marin	27.08%
Trinity	26.12%
Shasta	24.32%

## 18. Preterm Birth



P<0.0001

Figure 18: Overall Trends in Preterm Birth (PTB) in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,549,022**

Preterm birth is defined as a birth that occurs between 20 and 37 weeks of pregnancy as indicated by the 'obstetric estimate of gestation' on the birth certificate, or lacking that by 'last menstrual period' also from the birth certificate. We identified preterm birth as early onset of delivery (ICD-9-CM 644.2).

- The overall rate of preterm birth **decreased** from 7.6% in 2007 7.4% in 2009. This represents a 3.2% decrease. The trend was consistent among younger women, Hispanic and White women, and across parity and insurance type (Table 18A).
- When compared within strata, older women, Black women and women of unknown race, nulliparous women, and women with insurance other than Medi-Cal had the highest 3-year rates of preterm birth (Table 18B).
  - When evaluated by route of delivery, women who had a failed VBAC delivery had the highest 3-year rates of preterm birth (44.6%).

**Table 18A. Trends in Preterm Birth in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	7.6	7.6	7.4	100	1,549,022	-3.2	p<0.001
<b>Age</b>							
<35	7.2	7.2	6.9	82.5	1,278,226	-3.6	p<0.001
>=35	9.6	9.6	9.3	17.5	270,796	-2.3	p=0.115
<b>Race/Ethnicity</b>							
Hispanic	7.3	7.2	7.1	52.8	817,406	-3.3	p<0.001
Multi-Race	8.4	8.1	8.1	1.7	26,941	-3.1	p=0.534
Black	10.8	11.2	10.6	5.2	80,745	-1.9	p=0.492
American Indian	8.8	9.0	8.0	0.4	5,441	-9.1	p=0.395
Asian	7.5	7.6	7.6	12.0	185,054	1.7	p=0.412
Pacific Islander	8.9	8.6	7.9	0.5	6,917	-11.5	p=0.216
White	7.4	7.4	7.0	26.0	402,768	-5.3	p<0.001
Other	10.7	9.2	8.1	0.1	893	-23.9	p=0.292
Unknown	10.0	10.2	8.8	1.5	22,857	-12.5	p=0.007
<b>Parity</b>							
Multiparous	7.5	7.6	7.3	60.2	932,104	-3.3	p<0.001
Nulliparous	7.7	7.7	7.5	39.8	615,730	-2.7	p=0.013
<b>Insurance Type</b>							
Other Payer	7.7	7.7	7.4	51.9	802,683	-3.8	p<0.001
Medi-Cal	7.5	7.5	7.3	48.1	743,930	-2.4	p=0.018
<b>Risk Level</b>							
Low Risk	0.0	0.0	0.0	51.2	733,253	.	.
High Risk	0.0	0.0	0.0	48.8	699,278	.	.
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	5.6	5.7	5.5	66.1	1,024,532	-2.5	p=0.011
Cesarean Delivery with Labor	16.2	15.8	15.4	13.1	203,370	-4.9	p<0.001
Elective Cesarean Delivery	7.6	7.3	7.4	4.6	71,585	-2.5	p=0.422
Vaginal Birth After Cesarean	8.9	9.5	8.3	1.3	19,628	-6.9	p=0.234
Failed Vaginal Birth After Cesarean	44.4	45.2	44.1	2.2	33,262	-0.7	p=0.762
Elective Repeat Cesarean Delivery	3.0	2.7	2.5	12.7	196,645	-15.9	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 18B. Stratified Preterm Birth Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,549,022	p<0.001
<35	7.1		
>=35	9.5		
<b>Race/Ethnicity</b>		1,549,022	p<0.001
Hispanic	7.2		
Multi-Race	8.2		
Black	10.9		
American Indian	8.6		
Asian	7.6		
Pacific Islander	8.5		
White	7.3		
Other	9.3		
Unknown	10.0		
<b>Parity</b>		1,547,834	p<0.001
Multiparous	7.5		
Nulliparous	7.6		
<b>Insurance</b>		1,546,613	p=0.004
Other Payer	7.6		
Medi-Cal	7.5		
<b>Risk Level</b>		1,432,531	.
Low Risk	0.0		
High Risk	0.0		
<b>Route of Delivery</b>		1,549,022	p<0.001
Vaginal Delivery with Labor	5.6		
Cesarean Delivery with Labor	15.8		
Elective Cesarean Delivery	7.4		
Vaginal Birth After Cesarean	8.9		
Failed Vaginal Birth After Cesarean	44.6		
Elective Repeat Cesarean Delivery	2.7		

**Figures 18a and 18b: Preterm Birth, 2007 -2009**

**18a. Top Quartile Counties with Preterm Birth**



Number of events too small to report prevalence.

Proportion of Delivering Women with Preterm Birth Among Top Quartile Counties	
Fresno	8.57%
Kings	8.46%
Solano	8.17%
Kern	8.08%
Merced	7.89%
San Bernardino	7.86%
Riverside	7.75%
San Joaquin	7.70%
San Diego	7.69%
Los Angeles	7.66%
Stanislaus	7.64%
San Francisco	7.63%
Calaveras	7.61%
Mendocino	7.60%
Shasta	7.58%

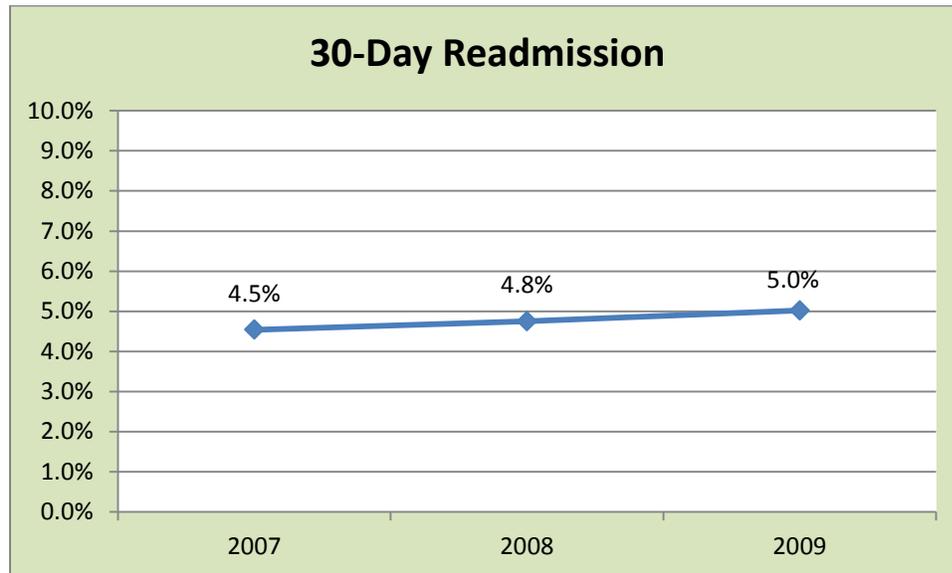
**18b: Counties with Increasing Trends in Preterm Birth**



Number of events too small to perform trend testing.

Percentage Increase in Preterm Birth from 2007 to 2009 Among Delivering Women	
Lassen	58.92%
Inyo	31.08%
Napa	25.09%

## 19. 30-Day Readmission



P<0.0001

Figure 19: Overall Trends in 30-Day Readmission in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,579,933**

The 30-day readmission rate includes all delivery diagnosis related groups (DRGs) and excludes maternal death. The numerator value includes all postpartum admissions within 30 days of delivery discharge.

- The overall rate of readmission within 30 days of discharge **increased** from 4.5% in 2007 to 5.0% in 2009. This represents a 10.6% increase. Trends increased in Hispanic, Black, Asian, and White women. The increased trend was consistent across age, parity, insurance type, clinical risk category and most delivery routes (Table 19A).
- When compared within strata, younger women, American Indian and Black women, nulliparous women, women with Medi-Cal, and women in the high-risk clinical category had the highest 3-year rates of readmission (Table 19B).
  - When evaluated by route of delivery, women with cesarean deliveries, with labor and failed VBAC had the highest 3-year rates of readmission (7.5% and 7.3%, respectively).

**Table 19A. Trends in 30-Day Readmission in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	4.5	4.8	5.0	100	1,579,933	10.6	p<0.001
<b>Age</b>							
<35	4.7	4.9	5.2	82.6	130,4317	11.6	p<0.001
>=35	4.0	4.2	4.2	17.4	275,616	6.0	p=0.011
<b>Race/Ethnicity</b>							
Hispanic	4.3	4.5	4.8	52.8	834,441	13.9	p<0.001
Multi-Race	6.6	6.8	6.5	1.7	27,479	-0.9	p=0.872
Black	7.8	8.6	8.6	5.3	83,044	10.6	p<0.001
American Indian	9.1	8.6	8.8	0.4	5,581	-3.7	p=0.707
Asian	2.9	3.1	3.1	11.9	187,657	7.3	p=0.025
Pacific Islander	5.2	5.4	5.7	0.5	7,108	9.2	p=0.470
White	5.0	5.1	5.4	26.0	410,170	7.0	p<0.001
Other	3.8	6.7	4.8	0.1	920	26.7	p=0.595
Unknown	4.5	4.9	4.7	1.5	23,533	4.7	p=0.583
<b>Parity</b>							
Multiparous	3.5	3.7	4.0	51.2	740,094	12.2	p<0.001
Nulliparous	5.3	5.5	5.7	48.9	706,880	7.7	p<0.001
<b>Insurance Type</b>							
Other Payer	4.1	4.3	4.4	51.8	817,074	8.3	p<0.001
Medi-Cal	5.0	5.3	5.6	48.2	760,096	12.8	p<0.001
<b>Risk Level</b>							
Low Risk	3.5	3.7	4.0	51.2	740,094	12.2	p<0.001
High Risk	5.3	5.5	5.7	48.9	706,880	7.7	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	3.8	3.9	4.2	66.1	1,044,591	12.0	p<0.001
Cesarean Delivery with Labor	7.3	7.6	7.8	13.2	207,934	6.7	p<0.001
Elective Cesarean Delivery	5.5	5.7	6.0	4.6	72,930	9.9	p=0.010
Vaginal Birth After Cesarean	3.8	3.6	3.6	1.3	20,088	-6.0	p=0.468
Failed Vaginal Birth After Cesarean	6.8	7.7	7.4	2.2	34,587	9.8	p=0.053
Elective Repeat Cesarean Delivery	5.2	5.5	5.7	12.7	199,803	10.4	p<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 19B. Stratified 30 Day Readmission Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,579,933	p<0.001
<35	4.9		
>=35	4.1		
<b>Race/Ethnicity</b>		1,579,933	p<0.001
Hispanic	4.5		
Multi-Race	6.6		
Black	8.4		
American Indian	8.8		
Asian	3.0		
Pacific Islander	5.4		
White	5.2		
Other	5.1		
Unknown	4.7		
<b>Parity</b>		1,578,285	p<0.001
Multiparous	4.4		
Nulliparous	5.4		
<b>Insurance</b>		1,577,170	p<0.001
Other Payer	4.3		
Medi-Cal	5.3		
<b>Risk Level</b>		1,446,974	p<0.001
Low Risk	3.7		
High Risk	5.5		
<b>Route of Delivery</b>		1,579,933	p<0.001
Vaginal Delivery with Labor	3.9		
Cesarean Delivery with Labor	7.5		
Elective Cesarean Delivery	5.7		
Vaginal Birth After Cesarean	3.7		
Failed Vaginal Birth After Cesarean	7.3		
Elective Repeat Cesarean Delivery	5.5		

**Figures 19a and 19b: 30-Day Readmission, 2007-2009**

**19a. Top Quartile Counties with 30-Day Readmission**



 Number of events too small to report prevalence.

**Proportion of Delivering Women with 30-Day Readmission Among Top Quartile Counties**

Del Norte	10.50%
Lake	9.37%
Lassen	9.34%
Tehama	8.72%
Imperial	8.55%
Tuolumne	8.21%
Mendocino	8.19%
Modoc	8.09%
Kings	8.01%
Shasta	7.85%
Amador	7.80%
Nevada	7.59%
Siskiyou	7.09%
Solano	6.87%

**19b: Counties with Increasing Trends in 30-Day Readmission**



 Number of events too small to perform trend testing.

**Percentage Increase in 30-Day Readmission from 2007 to 2009 Among Delivering Women**

Inyo	163.48%
Amador	83.79%
Butte	57.29%
Tuolumne	50.14%
Del Norte	49.02%
Nevada	42.16%
Plumas	41.49%
San Francisco	32.45%
Kings	27.46%
Stanislaus	26.48%
Yolo	25.11%
Monterey	21.96%
Merced	20.75%
Santa Cruz	20.45%

## Composite Indicators

**Table 20: Summary of Overall Trends in Composite Indicators**

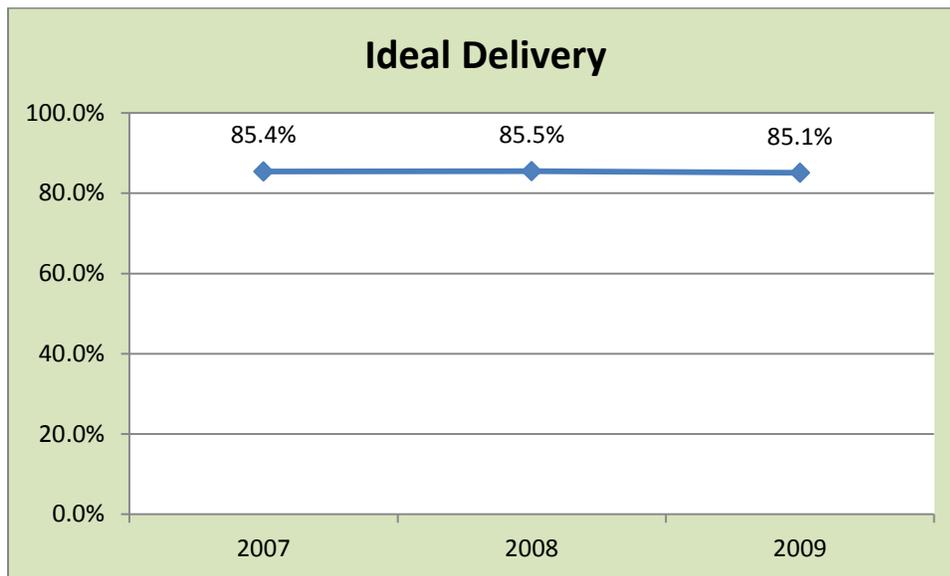
### Summary of Overall Trends, California, 2007-2009

	2007	2008	2009	3-Year Denominator	Percent Change	P-value
<b>Composite Indicators</b>						
Ideal Delivery	85.4	85.5	85.1	1,436,002	-0.4	p<0.001
Complicated Delivery	14.6	14.5	14.9	1,436,002	2.1	p<0.001
Maternal Complications	12.5	12.3	12.7	1,436,002	1.6	p=0.036
Severe Maternal Complications	1.4	1.4	1.6	1,436,002	10.5	p<0.001
Neonatal Complications	2.8	2.9	2.9	1,436,002	5.0	p<0.001

Percent of all hospital deliveries with listed conditions in California in 2007, 2008 and 2009, OSHPD data.

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

## 20. Ideal Delivery



P<0.0001

Figure 20: Overall Trends in Ideal Delivery in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, **N= 1,436,002**

The ideal delivery rate is defined as the proportion of women delivering (vaginal or cesarean) without any maternal or neonatal complications<sup>12</sup> (Appendix 1).

- The overall ideal delivery rate **decreased** from 85.4% in 2007 to 85.1% in 2009. This represents a 0.35% decrease. Trends decreased among younger women, Asian and Multi-race women, multiparous women, and women with Medi-Cal. The decreased trend was observed across clinical risk categories (Table 20A).
- When compared within strata, although statistically significant, the overall percent change did not appear to have clinical significance, except for parity, where multiparous women had the highest 3-year rate (Table 20B).
  - When evaluated by route of delivery, women who had an elective primary cesarean delivery and elective repeat cesarean delivery had the highest 3-year rates of ideal delivery, 90.5% and 92.4% respectively.

**Table 20A. Trends in Ideal Delivery in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	85.4	85.5	85.1	100	1,436,002	-0.4	p<0.001
<b>Age</b>							
<35	85.1	85.2	84.8	83.0	1,192,208	-0.4	p<0.001
>=35	86.7	86.8	86.5	17.0	243,794	-0.2	p=0.258
<b>Race/Ethnicity</b>							
Hispanic	86.1	86.2	85.9	53.0	761,726	-0.2	p=0.052
Multi-Race	84.3	83.1	83.1	1.7	24,808	-1.4	p=0.049
Black	84.6	85.0	84.5	5.0	72,230	-0.1	p=0.717
American Indian	84.2	86.5	84.2	0.4	4,994	0.0	p=0.954
Asian	83.2	83.1	82.5	11.9	170,817	-0.8	p=0.003
Pacific Islander	82.4	84.7	81.7	0.4	6,351	-0.9	p=0.553
White	85.3	85.5	85.1	26.0	373,561	-0.2	p=0.244
Other	85.2	82.1	81.8	0.1	820	-4.0	p=0.301
Unknown	83.6	83.8	82.8	1.4	20,695	-1.0	p=0.212
<b>Parity</b>							
Multiparous	90.1	90.2	89.8	60.2	863,608	-0.3	p<0.001
Nulliparous	78.2	78.4	77.9	39.8	571,320	-0.4	p=0.107
<b>Insurance Type</b>							
Other Payer	84.7	85.0	84.5	51.7	741,955	-0.2	p=0.087
Medi-Cal	86.1	86.0	85.6	48.3	691,947	-0.6	p<0.001
<b>Risk Level</b>							
Low Risk	85.3	85.4	85.0	51.4	737,767	-0.4	p=0.032
High Risk	85.5	85.6	85.1	48.6	698,235	-0.5	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	85.2	85.3	84.9	67.8	974,171	-0.4	p<0.01
Cesarean Delivery with Labor	77.9	77.6	76.8	11.9	171,377	-1.4	p<0.001
Elective Cesarean Delivery	90.5	90.6	90.5	4.4	62,462	0.0	p=0.970
Vaginal Birth After Cesarean	80.1	80.7	80.2	1.3	17,972	0.1	p=0.874
Failed Vaginal Birth After Cesarean	79.5	80.7	80.8	1.3	18,453	1.6	p=0.067
Elective Repeat Cesarean Delivery	92.5	92.7	92.2	13.3	191,567	-0.3	p=0.034

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 20B. Stratified Ideal Delivery Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,436,002	p<0.001
<35	85.0		
>=35	86.7		
<b>Race/Ethnicity</b>		1,436,002	p<0.001
Hispanic	86.0		
Multi-Race	83.5		
Black	84.7		
American Indian	85.0		
Asian	82.9		
Pacific Islander	83.0		
White	85.3		
Other	82.9		
Unknown	83.4		
<b>Parity</b>		1,434,928	p<0.001
Multiparous	90.0		
Nulliparous	78.2		
<b>Insurance</b>		1,433,902	p<0.001
Other Payer	84.8		
Medi-Cal	85.9		
<b>Risk Level</b>		1,436,002	p<0.001
Low Risk	85.3		
High Risk	85.4		
<b>Route of Delivery</b>		1,436,002	p<0.001
Vaginal Delivery with Labor	85.2		
Cesarean Delivery with Labor	77.5		
Elective Cesarean Delivery	90.5		
Vaginal Birth After Cesarean	80.3		
Failed Vaginal Birth After Cesarean	80.3		
Elective Repeat Cesarean Delivery	92.4		

Figures 20a and 20b: Ideal Delivery, 2007 -2009

20a. Top Quartile Counties with Ideal Delivery



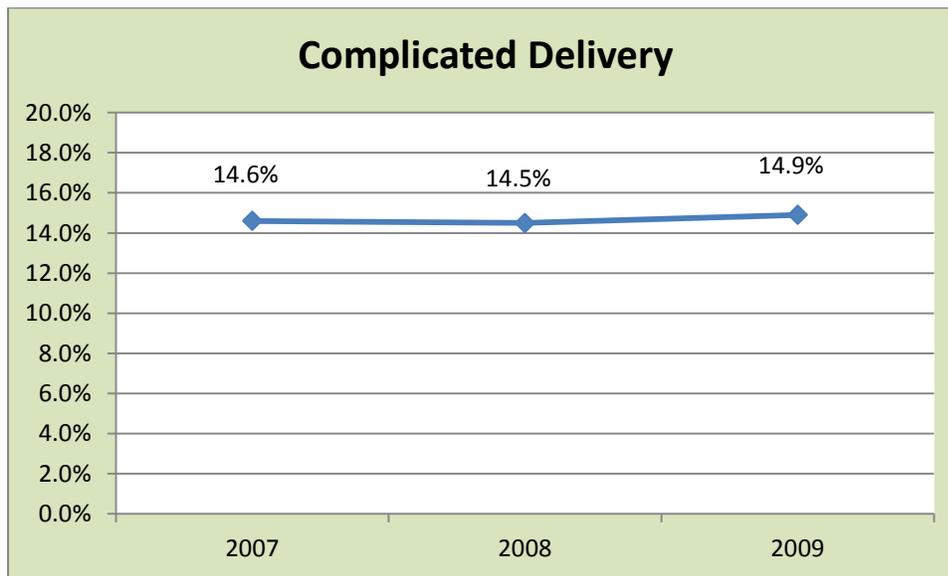
20b: Counties with Increasing Trends in Ideal Delivery



 Number of events too small to perform trend testing.

Proportion of Delivering Women with Ideal Delivery Among Top Quartile Counties	
Madera	91.53%
Alpine	91.30%
Imperial	90.31%
Del Norte	89.81%
Fresno	89.36%
Glenn	89.02%
Amador	89.02%
Merced	88.87%
Stanislaus	88.27%
Butte	87.67%
Colusa	87.59%
Tulare	87.40%
Tehama	87.22%
Lake	87.21%
Sutter	86.98%

## 21. Complicated Delivery



P<0.0001

Figure 21: Overall Trends in Complicated Delivery in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,436,002**

The complicated delivery rate is the complement of the ideal delivery rate. It is the proportion of women delivering (vaginal or cesarean) where either the mother or newborn experienced one or more specified complications listed in Appendix 1<sup>12</sup>.

- The overall complicated delivery rate **increased** from 14.6% in 2007 to 14.9% in 2009. This represents a 2.1% increase. This trend was consistent across age, insurance type and clinical risk categories. Trends increased among younger women, Asian and Multi-race women, multiparous women, women with Medi-Cal and across clinical risk categories (Table 21A).
- When comparing 3-year rates within strata, younger women, Asian and Pacific Islanders, nulliparous women, and women with insurance other than Medi-Cal had higher rates of complicated delivery (Table 21B).
  - When evaluated by route of delivery, elective repeat cesarean and elective cesarean delivery had the lowest complicated delivery 3-year rates (7.6% and 9.5%, respectively), whereas women having both failed and successful VBAC had a rate of 19.7%. Women with cesarean delivery with labor had the highest 3-year rate at 22.5%.
- When comparing 3-year rates within strata, although statistically significant, the overall percent change did not appear to have clinical significance, except for parity, where nulliparous women had the highest 3-year rate (Table 21B).
  - When evaluated by route of delivery, women who had a cesarean delivery with labor had the highest aggregate rate of complicated delivery (22.5%) and women with elective cesarean deliveries (index or repeat) had the lowest 3-year rates.

**Table 21A. Trends in Complicated Delivery in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	14.6	14.5	14.9	100	1,436,002	2.1	p<0.001
<b>Age</b>							
<35	14.9	14.8	15.2	83.0	1,192,208	2.0	p<0.001
>=35	13.3	13.2	13.5	17.0	243,794	1.5	p=0.258
<b>Race/Ethnicity</b>							
Hispanic	13.9	13.8	14.1	53.0	761,726	1.4	p=0.052
Multi-Race	15.7	16.9	16.9	1.7	24,808	7.6	p=0.050
Black	15.4	15.0	15.5	5.0	72,230	0.7	p=0.717
American Indian	15.8	13.5	15.8	0.4	4,994	0.0	p=0.954
Asian	16.8	16.9	17.5	11.9	170,817	4.2	p=0.003
Pacific Islander	17.6	15.3	18.3	0.4	6,351	4.0	p=0.553
White	14.7	14.5	14.9	26.0	373,561	1.4	p=0.244
Other	14.8	17.9	18.2	0.1	820	23.0	p=0.301
Unknown	16.4	16.2	17.2	1.4	20,695	4.9	p=0.212
<b>Parity</b>							
Multiparous	9.9	9.8	10.2	60.2	863,608	3.1	p<0.001
Nulliparous	21.8	21.6	22.1	39.8	571,320	1.4	p=0.107
<b>Insurance Type</b>							
Other Payer	15.3	15.0	15.5	51.7	741,955	1.3	p=0.087
Yes Medi-Cal	13.9	14.0	14.4	48.3	691,947	3.6	p<0.001
<b>Risk Level</b>							
Low Risk	14.7	14.6	15.0	51.4	737,767	2.0	p=0.032
High Risk	14.5	14.4	14.9	48.6	698,235	2.8	p<0.001
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	14.8	14.7	15.1	67.8	974,171	2.0	p=0.003
Cesarean Delivery with Labor	22.1	22.4	23.2	11.9	171,377	5.0	p<0.001
Elective Cesarean Delivery	9.5	9.4	9.5	4.4	62,462	-0.1	p=0.970
Vaginal Birth After Cesarean	19.9	19.3	19.8	1.3	17,972	-0.5	p=0.874
Failed Vaginal Birth After Cesarean	20.5	19.3	19.2	1.3	18,453	-6.3	p=0.067
Elective Repeat Cesarean Delivery	7.5	7.3	7.8	13.3	191,567	4.3	p=0.034

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 21B. Stratified Complicated Delivery Overall 3-Year Rate**

	Rate	N	P-value
<b>Age</b>		1,436,002	p<0.001
<35	15.0		
>=35	13.3		
<b>Race/Ethnicity</b>		1,436,002	p<0.001
Hispanic	14.0		
Multi-Race	16.5		
Black	15.3		
American Indian	15.0		
Asian	17.1		
Pacific Islander	17.0		
White	14.7		
Other	17.1		
Unknown	16.6		
<b>Parity</b>		1,434,928	p<0.001
Multiparous	10.0		
Nulliparous	21.8		
<b>Insurance</b>		1,433,902	p<0.001
Other Payer	15.2		
Medi-Cal	14.1		
<b>Risk Level</b>		1,436,002	p=0.018
Low Risk	14.8		
High Risk	14.6		
<b>Route of Delivery</b>		1,436,002	p<0.001
Vaginal Delivery with Labor	14.8		
Cesarean Delivery with Labor	22.5		
Elective Cesarean Delivery	9.5		
Vaginal Birth After Cesarean	19.7		
Failed Vaginal Birth After Cesarean	19.7		
Elective Repeat Cesarean Delivery	7.6		

**Figures 21a and 21b: Complicated Delivery, 2007 -2009**

**21a. Top Quartile Counties with Complicated Delivery**



**21b: Counties with Increasing Trends in Complicated Delivery**



 Number of events too small to perform trend testing.

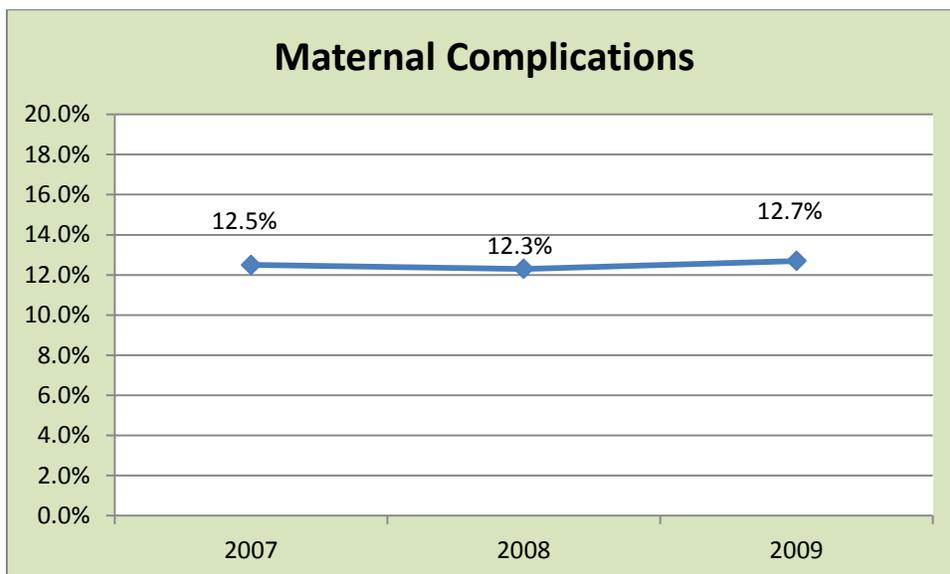
**Proportion of Delivering Women with Complicated Delivery Among Top Quartile Counties**

San Francisco	22.88%
Modoc	22.22%
San Mateo	20.86%
Solano	19.16%
Napa	19.12%
Yolo	18.52%
Alameda	18.40%
Marin	18.31%
Monterey	18.02%
Santa Clara	17.99%
Contra Costa	17.97%
Tuolumne	17.59%
Santa Cruz	17.10%
Sonoma	16.83%
Sacramento	16.52%

**Percentage Increase in Complicated Delivery from 2007 to 2009 Among Delivering Women**

Lassen	77.72%
Inyo	41.46%
Siskiyou	34.35%
Kings	24.96%
Mono	23.74%
Humboldt	20.31%

## 22. Maternal Complications



P<0.0001

Figure 22: Overall Trends in Maternal Complications in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, **N= 1,436,002**

The following maternal complications were considered significant events occurring during the delivery admission: third or fourth degree laceration, anesthesia complication, acute psychosis, bladder laceration, cerebral hemorrhage, high vaginal laceration, hysterectomy, length of stay > 5 days, maternal death, maternal infection, maternal pneumonia, maternal transfer to other acute care hospital, obstetrical hematoma, other lacerations, obstetrical shock, other maternal morbidity, pulmonary embolism, postpartum hemorrhage, transfusion, uterine dehiscence, uterine rupture, wound complication and other potential maternal intensive care unit admission codes <sup>8</sup> (Appendix 1).

- The overall rate of maternal complications **increased** from 12.5% in 2007 to 12.7% in 2009. This represents a 1.6% increase. Younger women, Asian and Multi-race women, multiparous women, women with Medi-Cal insurance, and women in the high-risk clinical category had the highest rates of maternal complications (Table 22A).
- When compared within strata, younger women, Asian, Multi-race and women with unknown race, nulliparous women, women with insurance other than Medi-Cal, and women in the low-risk clinical category had the highest 3-year rates of maternal complications (Table 22B).
  - When compared by route of delivery, elective cesareans (primary and repeat) had the lowest 3-year rates of maternal complications (5.9% and 5.0%, respectively). Women undergoing cesarean delivery with labor and vaginal birth after cesarean (VBAC) had the highest 3-year rates of maternal complications (19.0% and 17.8% respectively).

**Table 22A. Trends in Maternal Complications in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	12.5	12.3	12.7	100	1,436,002	1.6	p=0.036
<b>Age</b>							
<35	12.9	12.6	13.0	83.0	1,192,208	0.8	p=0.042
>=35	11.0	10.9	11.1	17.0	243,794	0.9	p=0.366
<b>Race/Ethnicity</b>							
Hispanic	11.8	11.5	11.8	53.0	761,726	0.0	p=0.663
Multi-Race	13.4	14.3	14.6	1.7	24,808	9.0	p=0.032
Black	12.9	12.3	13.0	5.0	72,230	0.8	p=0.837
American Indian	13.3	11.0	13.4	0.4	4,994	0.8	p=0.896
Asian	15.1	15.2	15.6	11.9	170,817	3.3	p=0.025
Pacific Islander	14.7	12.5	15.1	0.4	6,351	2.7	p=0.669
White	12.7	12.4	12.7	26.0	373,561	0.0	p=0.948
Other	10.2	15.4	15.8	0.1	820	54.9	p=0.062
Unknown	14.0	13.9	14.6	1.4	20,695	4.3	p=0.292
<b>Parity</b>							
Multiparous	7.8	7.7	8.1	60.2	863,608	2.7	p=0.003
Nulliparous	19.7	19.2	19.7	39.8	571,320	0.0	p=0.922
<b>Insurance Type</b>							
Other Payer	13.5	13.2	13.6	51.7	741,955	0.7	p=0.507
Medi-Cal	11.5	11.4	11.7	48.3	691,947	1.7	p=0.010
<b>Risk Level</b>							
Low Risk	13.1	12.9	13.2	51.4	737,767	0.8	p=0.478
High Risk	11.9	11.7	12.2	48.6	698,235	2.5	p=0.002
<b>Route of delivery</b>							
Vaginal Delivery with Labor	13.2	13.0	13.3	67.8	974,171	0.8	p=0.336
Cesarean Delivery with Labor	18.7	18.7	19.6	11.9	171,377	4.8	p<0.001
Elective Cesarean Delivery	6.1	5.6	6.1	4.4	62,462	0.16	p=0.973
Vaginal Birth After Cesarean	17.7	17.7	18.1	1.3	17,972	2.3	p=0.618
Failed Vaginal Birth After Cesarean	14.9	14.3	14.7	1.3	18,453	-1.3	p=0.686
Elective Repeat Cesarean Delivery	5.0	4.8	5.2	13.3	191,567	4.2	p=0.086

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 22B. Stratified Maternal Complications Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,436,002	p<0.001
<35	12.8		
>=35	11.0		
<b>Race/Ethnicity</b>		1,436,002	p<0.001
Hispanic	11.7		
Multi-Race	14.1		
Black	12.7		
American Indian	12.6		
Asian	15.3		
Pacific Islander	14.1		
White	12.6		
Other	13.9		
Unknown	14.2		
<b>Parity</b>		1,434,928	p<0.001
Multiparous	7.9		
Nulliparous	19.5		
<b>Insurance</b>		1,433,902	p<0.001
Other Payer	13.4		
Medi-Cal	11.5		
<b>Risk Level</b>		1,436,002	p<0.001
Low Risk	13.1		
High Risk	11.9		
<b>Route of Delivery</b>		1,436,002	p<0.001
Vaginal Delivery with Labor	13.1		
Cesarean Delivery with Labor	19.0		
Elective Cesarean Delivery	5.9		
Vaginal Birth After Cesarean	17.8		
Failed Vaginal Birth After Cesarean	14.6		
Elective Repeat Cesarean Delivery	5.0		

**Figures 22a and 22b: Maternal Complications, 2007-2009**

**22a. Top Quartile Counties with Maternal Complications**



**22b: Counties with Increasing Trends in Maternal Complications**

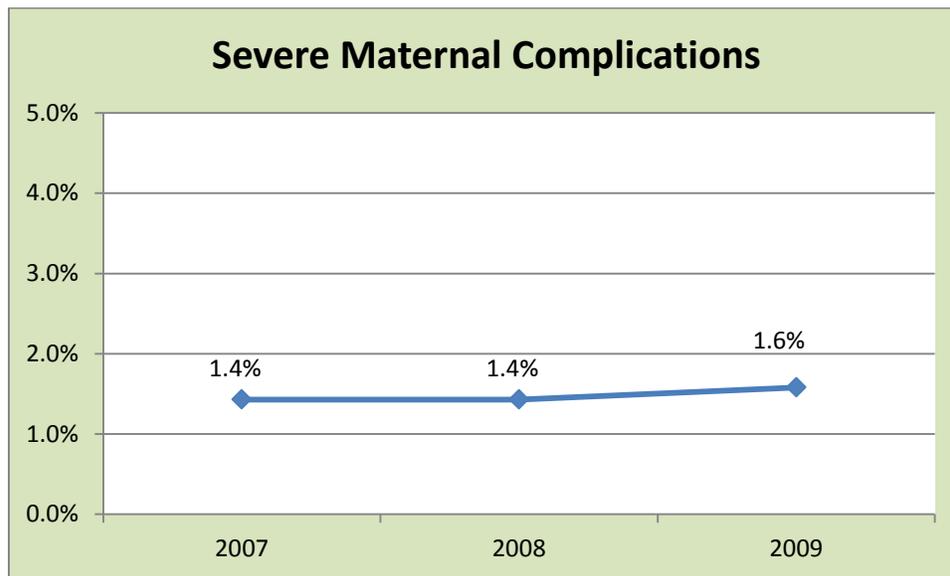


 Number of events too small to perform trend testing.

Proportion of Delivering Women with Maternal Complications Among Top Quartile Counties	
San Francisco	21.59%
San Mateo	19.14%
Modoc	18.25%
Solano	17.94%
Marin	17.01%
Yolo	16.95%
Napa	16.86%
Santa Clara	16.70%
Contra Costa	16.49%
Monterey	16.44%
Alameda	16.41%
Sonoma	15.62%
Tuolumne	15.35%
Nevada	15.12%
Sacramento	14.59%

Percentage Increase in Maternal Complications from 2007 to 2009 Among Delivering Women	
Lassen	81.76%
Inyo	41.96%
Mono	36.36%
Siskiyou	35.76%
Trinity	23.18%
Sonoma	22.54%
Humboldt	22.50%

## 23. Severe Maternal Complications



P<0.0001

Figure 23: Overall Trends in Severe Maternal Complications in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,436,002**

A severe maternal complication was operationalized as a life-threatening condition or life-saving procedure at the time of labor and delivery and included the following: anesthesia complications, cerebral hemorrhage, hysterectomy, maternal death, obstetrical shock, pulmonary embolism, transfusion, uterine rupture, severe pulmonary morbidity, arterial embolization, exploratory laparotomy, circulatory monitoring, respiratory therapy, mechanical ventilation, conversion cardiac rhythm and other maternal morbidity listed in Appendix 1<sup>8</sup>.

- The overall rate of severe maternal complications **increased** from 1.4% in 2007 to 1.6% in 2009. This represents a 10.5% increase. Trends increased among younger women, Hispanic and Asian women. This increased trend was consistent across parity, insurance type and clinical risk level (Table 23A).
- Although statistically significant, the difference in 3-year rates within strata do not seem to be clinically significant except when evaluated by clinical risk level, where high-risk women were twice as likely to have a severe maternal complication relative to women in the low-risk clinical category (Table 23B).
  - When stratified by route of delivery, vaginal delivery with labor had the lowest rate (0.89%) and cesarean delivery with labor and failed VBAC had the highest 3-year rates (3.2% and 4.8%, respectively).

**Table 23A. Trends in Severe Maternal Complications in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	1.4	1.4	1.6	100	1,436,002	10.5	p<0.001
<b>Age</b>							
<35	1.4	1.4	1.5	83.0	1,192,208	11.1	p<0.001
>=35	1.8	1.8	2.0	17.0	243,794	7.1	p=0.059
<b>Race/Ethnicity</b>							
Hispanic	1.4	1.4	1.6	53.0	761,726	12.1	p<0.001
Multi-Race	1.4	1.2	1.5	1.7	24,808	6.9	p=0.567
Black	1.9	1.9	2.0	5.0	72,230	4.1	p=0.511
American Indian	1.9	1.8	1.6	0.4	4,994	-12.4	p=0.617
Asian	1.6	1.6	1.8	11.9	170,817	15.1	p=0.001
Pacific Islander	1.8	1.9	2.2	0.4	6,351	26.9	p=0.272
White	1.3	1.2	1.4	26.0	373,561	3.8	p=0.358
Other	0.8	2.5	2.1	0.1	820	170.2	p=0.265
Unknown	1.5	1.5	1.8	1.4	20,695	19.3	p=0.159
<b>Parity</b>							
Multiparous	1.3	1.3	1.4	60.2	863,608	11.6	p<0.001
Nulliparous	1.7	1.6	1.8	39.8	571,320	8.5	p<0.001
<b>Insurance Type</b>							
Other Payer	1.4	1.4	1.5	51.7	741,955	6.3	p=0.018
Medi-Cal	1.4	1.5	1.6	48.3	691,947	14.8	p<0.001
<b>Risk Level</b>							
Low Risk	0.9	0.9	1.0	51.4	737,767	11.7	p<0.001
High Risk	2.0	2.0	2.1	48.6	698,235	5.9	p=0.004
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	0.8	0.9	1.0	67.8	974,171	14.6	p<0.001
Cesarean Delivery with Labor	3.1	3.2	3.4	11.9	171,377	9.9	p=0.003
Elective Cesarean Delivery	2.7	2.3	2.6	4.4	62,462	-4.8	p=0.355
Vaginal Birth After Cesarean	1.2	1.7	1.4	1.3	17,972	20.7	p=0.246
Failed Vaginal Birth After Cesarean	5.1	4.4	4.9	1.3	18,453	-3.4	p=0.643
Elective Repeat Cesarean Delivery	2.2	2.2	2.3	13.3	191,567	4.5	p=0.276

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 23B. Stratified Severe Maternal Complications Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,436,002	p<0.001
<35	1.4		
>=35	1.9		
<b>Race/Ethnicity</b>		1,436,002	p<0.001
Hispanic	1.5		
Multi-Race	1.4		
Black	1.9		
American Indian	1.8		
Asian	1.7		
Pacific Islander	2.0		
White	1.3		
Other	1.8		
Unknown	1.6		
<b>Parity</b>		1,434,928	p<0.001
Multiparous	1.3		
Nulliparous	1.7		
<b>Insurance</b>		1,433,902	p=0.012
Other Payer	1.5		
Medi-Cal	1.5		
<b>Risk Level</b>		1,436,002	p<0.001
Low Risk	1.0		
High Risk	2.0		
<b>Route of Delivery</b>		1,436,002	p<0.001
Vaginal Delivery with Labor	0.9		
Cesarean Delivery with Labor	3.2		
Elective Cesarean Delivery	2.5		
Vaginal Birth After Cesarean	1.4		
Failed Vaginal Birth After Cesarean	4.8		
Elective Repeat Cesarean Delivery	2.2		

**Figures 23a and 23b: Severe Maternal Complications, 2007 -2009**

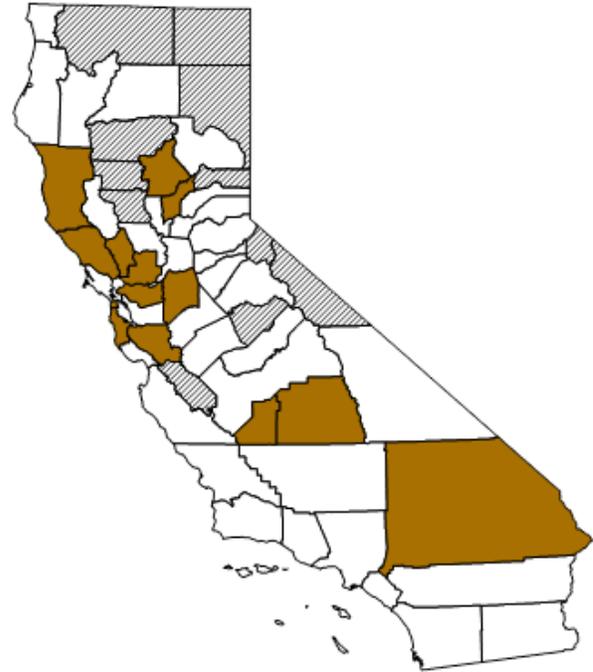
**23a. Top Quartile Counties with Severe Maternal Complications**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Severe Maternal Complications Among Top Quartile Counties	
Tuolumne	2.66%
Calaveras	2.45%
Monterey	2.38%
Plumas	2.29%
San Mateo	2.11%
Mariposa	2.08%
Colusa	1.92%
Inyo	1.89%
Humboldt	1.87%
Kings	1.85%
Santa Cruz	1.83%
Santa Clara	1.80%
Marin	1.78%

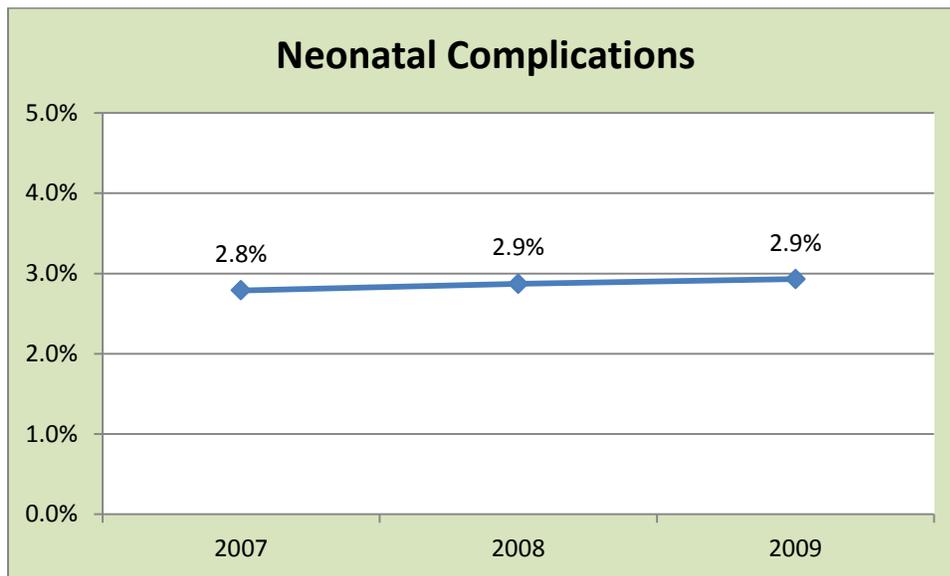
**23b: Counties with Increasing Trends in Severe Maternal Complications**



 Number of events too small to perform trend testing.

Percentage Increase in Severe Maternal Complications from 2007 to 2009 Among Delivering Women	
Yuba	74.89%
Kings	57.46%
Sonoma	51.41%
Solano	51.35%
Mendocino	48.39%
Tulare	44.86%
San Mateo	41.67%
San Joaquin	39.82%
Butte	31.50%
Contra Costa	30.05%
Napa	29.70%
San Bernardino	25.21%
San Francisco	22.99%
Santa Clara	20.75%

## 24. Neonatal Complications



P<0.0001

Figure 24: Overall Trends in Neonatal Complications in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= **1,436,002**

A neonatal complication is defined as a significant event affecting the neonate during labor and delivery. Examples include birth trauma, hypoxia, asphyxia, shock, resuscitation, respiratory complications, infection and neurologic complications. See Appendix 1 for full list <sup>8</sup>.

- The overall rate of neonatal complicated delivery **increased** from 2.8% in 2007 to 2.9% in 2009. This represents a 5.0% increase. This increased trend was observed among younger women, Hispanic, Asian, and White women, and women in the low-risk clinical group and was consistent across parity and insurance type (Table 24A).
- When compared within strata, older women, women of Other race, Pacific Islander and Black race/ethnicity, nulliparous women, women with Medi-Cal insurance, and women in the high-risk clinical category had higher 3-year rates of neonatal complications (Table 24B).
  - When evaluated by route of delivery, vaginal delivery had the lowest rate (2.2%) and women who delivered via cesarean delivery and failed VBAC had the highest 3-year rates (5.8% and 6.9%, respectively).

**Table 24A. Trends in Neonatal Complications in California, 2007-2009**

	2007	2008	2009	3-Year Population Proportion	3-Year Denominator	Percent Change	P-value
<b>Overall Trend</b>	2.8	2.9	2.9	100	1,436,002	5.0	p<0.001
<b>Age</b>							
<35	2.8	2.8	2.9	83.0	1,192,208	6.2	p<0.001
>=35	3.0	3.0	3.0	17.0	243,794	-0.3	p=0.917
<b>Race/Ethnicity</b>							
Hispanic	2.9	2.9	3.0	53.0	761,726	4.5	p=0.006
Multi-Race	3.1	3.4	3.0	1.7	24,808	-1.0	p=0.885
Black	3.6	3.7	3.6	5.0	72,230	0.0	p=0.980
American Indian	3.5	3.0	3.4	0.4	4,994	-2.9	p=0.876
Asian	2.4	2.5	2.7	11.9	170,817	11.6	p=0.003
Pacific Islander	3.9	3.6	4.1	0.4	6,351	3.3	p=0.828
White	2.6	2.7	2.7	26.0	373,561	5.1	p=0.031
Other	5.5	3.6	4.2	0.1	820	-23.0	p=0.492
Unknown	3.3	3.1	3.4	1.4	20,695	3.9	p=0.631
<b>Parity</b>							
Multiparous	2.4	2.5	2.5	60.2	863,608	4.1	p=0.015
Nulliparous	3.3	3.5	3.5	39.8	571,320	6.0	p<0.001
<b>Insurance Type</b>							
Other Payer	2.4	2.4	2.5	51.7	741,955	4.2	p=0.013
Medi-Cal	3.3	3.3	3.4	48.3	691,947	4.9	p=0.002
<b>Risk Level</b>							
Low Risk	2.1	2.2	2.3	51.4	737,767	7.5	p<0.001
High Risk	3.5	3.5	3.6	48.6	698,235	1.4	p=0.397
<b>Route of Delivery</b>							
Vaginal Delivery with Labor	2.1	2.2	2.3	67.8	974,171	9.1	p<0.001
Cesarean Delivery with Labor	5.8	5.8	5.8	11.9	171,377	0.0	p=0.965
Elective Cesarean Delivery	4.1	4.3	4.0	4.4	62,462	-2.9	p=0.571
Vaginal Birth After Cesarean	2.7	2.3	2.5	1.3	17,972	-7.4	p=0.483
Failed Vaginal Birth After Cesarean	7.5	6.7	6.4	1.3	18,453	-13.8	p=0.024
Elective Repeat Cesarean Delivery	2.9	2.9	3.1	13.3	191,567	3.7	p=0.237

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

**Table 24B. Stratified Neonatal Complications Overall 3-Year Rate**

	Rate	3-Year Denominator	P-value
<b>Age</b>		1,436,002	p<0.001
<35	2.8		
>=35	3.0		
<b>Race/Ethnicity</b>		1,436,002	p<0.001
Hispanic	2.9		
Multi-Race	3.2		
Black	3.6		
American Indian	3.3		
Asian	2.5		
Pacific Islander	3.8		
White	2.6		
Other	4.4		
Unknown	3.3		
<b>Parity</b>		1,434,928	p<0.001
Multiparous	2.5		
Nulliparous	3.4		
<b>Insurance</b>		1,433,902	p<0.001
Other Payer	2.4		
Medi-Cal	3.3		
<b>Risk Level</b>		1,436,002	p<0.001
Low Risk	2.2		
High Risk	3.5		
<b>Route of Delivery</b>		1,436,002	p<0.001
Vaginal Delivery with Labor	2.2		
Cesarean Delivery with Labor	5.8		
Elective Cesarean Delivery	4.1		
Vaginal Birth After Cesarean	2.5		
Failed Vaginal Birth After Cesarean	6.9		
Elective Repeat Cesarean Delivery	3.0		

**Figures 24a and 24b: Neonatal Complications, 2007 -2009**

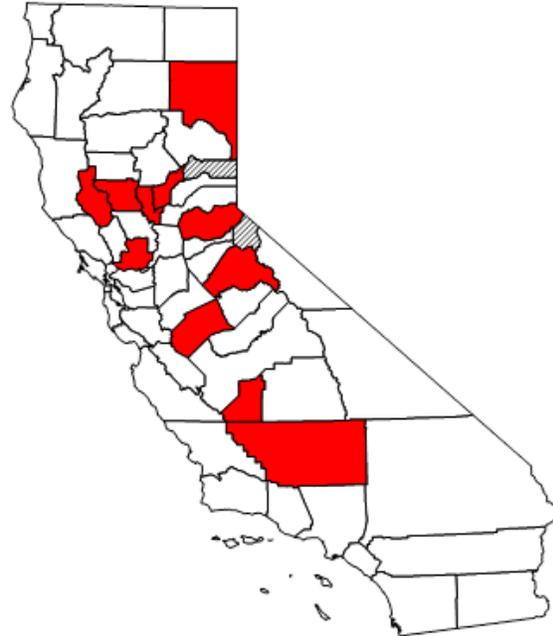
**24a. Top Quartile Counties with Neonatal Complications**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Neonatal Complications Among Top Quartile Counties	
Trinity	4.82%
Modoc	4.76%
San Joaquin	4.22%
Santa Cruz	4.13%
Kern	3.88%
Shasta	3.69%
Lassen	3.67%
Calaveras	3.57%
San Bernardino	3.52%
Ventura	3.48%
Napa	3.39%
Tulare	3.31%
San Diego	3.28%
Tuolumne	3.24%

**24b: Counties with Increasing Trends in Neonatal Complications**



 Number of events too small to perform trend testing.

Percentage Increase in Neonatal Complications from 2007 to 2009 Among Delivering Women	
Kings	86.94%
Sutter	66.54%
Lassen	61.57%
Yuba	54.53%
Lake	43.92%
Colusa	36.83%
Kern	35.49%
El Dorado	35.37%
Merced	32.94%
Tuolumne	25.84%
Solano	24.87%

## Ten-Year Trends of Select Maternal Morbidities

Table 25. Ten-Year Trend Comparisons

	1999	2002	2005	2007	2008	2009	Trend Direction
<b>Preexisting Conditions</b>							
Diabetes*	4.6	5.8	6.5	7.4	7.5	8.2	↑
Gestational Diabetes	4.0	5.0	5.7	6.6	6.7	7.3	↑
Hypertension*	5.6	5.8	6.4	6.6	6.6	7.0	↑
Gestational Hypertension	3.8	4.1	4.3	4.9	5.0	5.1	↑
Heart Disease*	0.67	0.66	0.69	0.55	0.49	0.49	↓
Mental Disorders*	1.8	2.1	2.9	2.5	2.5	2.7	↑
Obesity*	0.8	1.0	1.3	19.2	20.0	20.7	↑
<b>Childbirth Outcomes</b>							
Obstetric Trauma with Instrument	12.6	11.3	9.8	14.6	14.4	14.0	↑
Preterm Birth	5.5	6.1	6.6	7.6	7.6	7.4	↑
<b>Composite Indicators</b>							
Ideal Delivery	.	.	79.2	85.4	85.5	85.1	↑
Complicated Delivery	.	.	20.9	14.6	14.5	14.9	↓
Maternal Complications	.	.	14.9	12.5	12.3	12.7	↓
Severe Maternal Complications	.	.	0.81	1.4	1.4	1.6	↑
Neonatal Complications	.	.	8.0	2.8	2.9	2.9	↓

Percent of all hospital deliveries with listed conditions in California in 2007, 2008 and 2009, OSHPD data.

\*Codes used to identify maternal diabetes, hypertension, heart disease, mental disorders and obesity were updated and are different from previous report<sup>7</sup>; hence some increase may be attributed to improved ascertainment (Appendix 2).

### Preexisting Conditions

- The increase in mental disorders reflects enhanced coding that arose from a mental health advisory group that was assembled to decide on coding rules for measuring mental disorders with the BCPDD data. The increase is also likely due to increased surveillance, as mental health is a condition increasingly known to be linked to maternal and neonatal complications.
- The increase in obesity is due to both increased surveillance and collection of pre-pregnancy weight on the birth certificate starting in 2007. Prior calculations were from codes in the hospital discharge data, which lacked sensitivity.

### Childbirth Outcomes

- The increased trend observed in obstetric trauma with an instrument is likely because of improved attention to coding and case ascertainment owing to the fact that it became a quality indicator for the Joint Commission in 2003<sup>15</sup>.
- Although the overall trend in preterm birth increased from 1999 to 2009, the trend appeared to peak in 2007 and is now decreasing. This likely represents the influence of quality improvement efforts related to late preterm birth and the goal of eliminating elective deliveries <39 weeks<sup>16</sup>.

### **Composite Indicators**

- There is an increase in the ideal delivery rate and a corresponding decrease in maternal and neonatal complication rates. However, there is a rise in the subcategory of severe maternal complications. The rise in severe maternal complications is concerning and likely reflects the increase in maternal chronic medical conditions.

## Differences by Payer Source

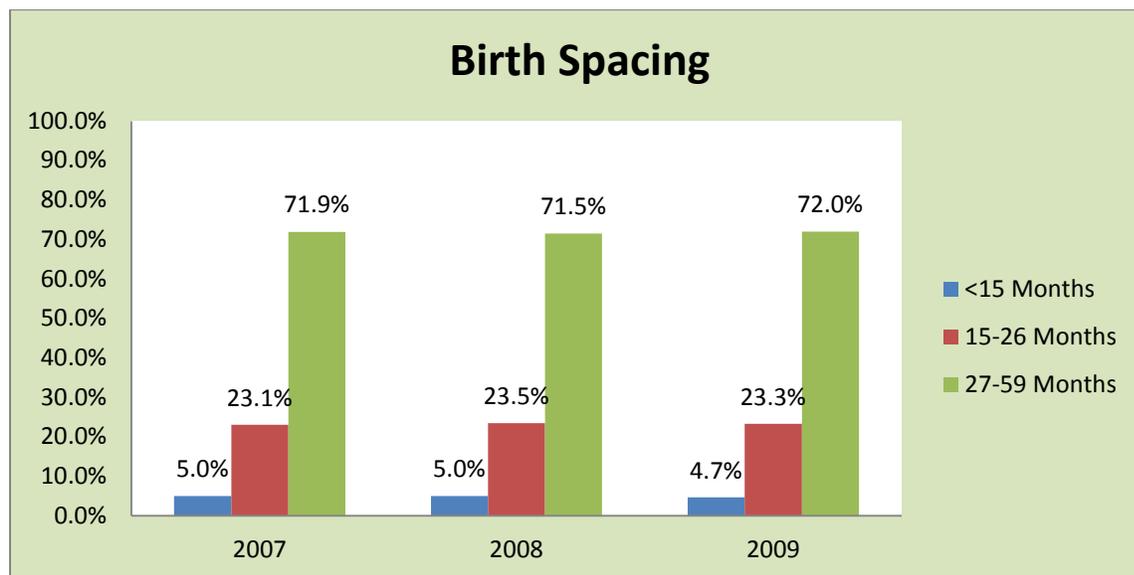
Women with Medi-Cal insurance had increased prevalence in only 9 conditions (37.5%): chronic diabetes, gestational hypertension, obesity, maternal infection, placenta previa and 30-day readmissions. With regard to composite indicators, women with Medi-Cal insurance had higher neonatal complications and severe maternal complications (Table 26).

- Of note, Medi-Cal patients had lower birth trauma and NTSV rates and other significant morbidity, such as anesthesia complications and preterm birth.
- Despite what looks favorable on a global perspective, women with Medi-Cal insurance had increased neonatal complications and increased severe maternal complications which appear to be driving the overall state increases.

**Table 26. Stratified by Insurance Type Childbirth Indicators Overall 3-Year Rate**

	Other Payer	Medi-Cal	3-Year Denominator	P-value
<b>Preexisting and Pregnancy-Related Conditions</b>				
Any Diabetes	8.0	7.3	1,577,258	p<0.001
Chronic Diabetes	0.8	0.9	1,577,258	p<0.001
Gestational Diabetes	7.3	6.4	1,577,258	p<0.001
Any Hypertension	6.9	6.5	1,577,258	p<0.001
Chronic Hypertension	1.6	1.1	1,577,258	p<0.001
Gestational Hypertension	5.0	5.0	1,577,258	p=0.019
Unspecified Hypertension	0.4	0.4	1,577,258	p<0.001
Heart Disease	0.7	0.4	1,577,258	p<0.001
Mental Disorder	2.4	2.7	1,577,258	p<0.001
Obesity	17.2	23.2	1,418,543	p<0.001
<b>Childbirth Outcomes</b>				
Anesthesia Complications	0.3	0.3	1,576,789	p<0.001
Hemorrhage	2.3	2.1	1,546,789	p<0.001
Maternal Infection	0.2	0.2	1,573,525	p<0.001
Obstetric Trauma with Instrument	16.3	12.0	83,537	p<0.001
Obstetric Trauma without Instrument	4.4	3.6	883,451	p<0.001
NTSV Cesarean Delivery	29.3	26.5	544,899	p<0.001
Placenta Previa	1.1	2.0	1,577,258	p<0.001
Preterm Birth	7.6	7.5	1,546,613	p=0.004
30-day Readmission	4.3	5.3	1,577,170	p<0.001
<b>Composite Indicators</b>				
Complicated Delivery	15.2	14.1	1,433,902	p<0.001
Ideal Delivery	84.8	85.9	1,433,902	p<0.001
Maternal Complications	13.4	11.5	1,433,902	p<0.001
Severe Maternal Complications	1.5	1.5	1,433,902	p=0.012
Neonatal Complications	2.4	3.3	1,433,902	p<0.001

## Exploratory Measure: Birth Spacing



P<0.0001

Figure 25: Overall Trends in Birth Spacing in All Hospital Deliveries in California in 2007, 2008 and 2009, OSHPD data, N= 936,002

**Table 27A. Trends in Birth Spacing in California, 2007-2009**

Birth Spacing	2007	2008	2009	3-Year Denominator	Percent Change	P-value
<15 Months	7.2	7.2	6.6	45,722	-7.8	
15-26 Months	33.2	33.7	33.3	217,907	0.2	
27-59 Months	59.6	59.2	60.1	389,293	0.8	
						P<0.001

Note: The percent change calculations were made with higher precision rates than the one decimal reported here.

The inter-birth interval is obtained from the birth certificate by calculating the interval between the 'Date of Last Live Birth' variable and the most recent delivery date. Literature suggests that there is a parabolic relationship between birth interval and childbirth outcomes; the risk of poor childbirth outcomes is high for short birth intervals, decreases as the interval increases, and then begins to increase with very long intervals. The highest risk category is an inter-birth interval less than 15 months, referred to as rapid repeat birth<sup>17</sup>. Women in this category became pregnant less than six months after their most recent delivery. An inter-birth interval between 15 and 26 months is a moderate risk interval, comprised of women who became pregnant 6-17 months after their previous delivery. The interval between 27 months and 59 months is considered the low risk or ideal inter-birth interval. Beyond 60 months the risk of maternal complications begins to increase (data not shown). This report does not include births beyond 60 months, as there was no mechanism to account for women who migrated in and out of California nor to evaluate the validity of extreme outliers.

## Results

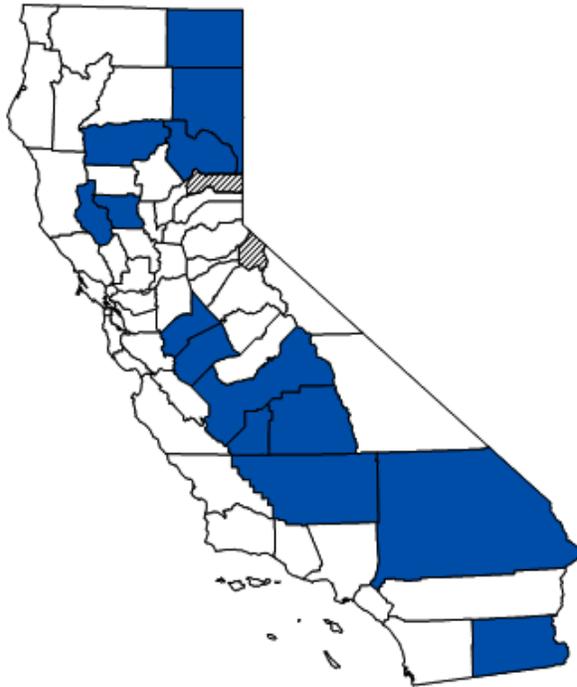
- The rate of rapid repeat birth (inter-birth interval <15 months) decreased from 7.2% in 2007 to 6.6% in 2009. This represents a 7.8% decrease. During the same 3-year period, there were fluctuations in the percentage of women delivering during the moderate risk interval (15-26 months), resulting in a net increase. The percentage of women delivering in the lowest risk interval was relatively unchanged during the 3-year period (Table 27A).
- Women age 24 and younger were most likely to experience rapid repeat birth and least likely to have an inter-birth interval in the lowest risk category (27-59 months). Teenagers (age 19 and younger) had the highest rate of rapid repeat birth (20.4%), a rate nearly seven times higher than the rate of women over age 30 (Table 27B).
- Pacific Islander women had the highest prevalence of rapid repeat birth (14.6%), whereas White and Asian women had the lowest (4.9% and 5.3%, respectively) (Table 27B).
- College educated women had the lowest rates of rapid repeat birth (4.7%), but were more likely to experience a moderate risk interval (15-26 months) than women who completed high school or less than high school (44.3% vs. 33.2% and 32.2%) (Table 27B).
- Women with Medi-Cal insurance were almost twice as likely to experience rapid repeat birth as women with other insurance payers (9.2% and 4.8%, respectively) (Table 27B).

**Table 27B. Demographic Characteristics of Birth Spacing Overall 3-year rate**

	<15 Months	15-26 Months	27-59 Months	3-Year Denominator	P-value	P-value <15 vs. 27-59 months
<b>3-Year Denominator</b>	45,722	217,907	389,293	652,922		
<b>Demographics</b>						
<b>Age</b>				652,922	p<0.001	p<0.001
0-19	20.4	47.5	32.1			
20-24	10.4	36.2	53.4			
25-29	6.7	32.7	60.6			
30-34	4.5	31.8	63.7			
35-39	3.8	30.4	65.8			
40-44	3.2	28.6	68.2			
45+	2.5	22.0	75.5			
<b>Age</b>				652,922	p<0.001	p<0.001
<35	7.7	34.1	58.2			
>=35	3.7	30.1	66.3			
<b>Race/Ethnicity</b>				652,922	p<0.001	p<0.001
Hispanic	8.0	32.1	59.9			
Multi-Race	7.8	35.5	56.7			
Black	10.6	33.9	55.5			
American Indian	12.8	35.5	51.7			
Asian	5.3	33.0	61.8			
Pacific Islander	14.6	38.4	47.0			
White	4.9	35.7	59.4			
Other	8.1	32.5	59.3			
Unknown	5.8	34.4	59.9			
<b>Education</b>				652,922	p<0.001	p<0.001
Less than high school	8.9	32.2	59.0			
High school	8.9	33.2	58.0			
College and beyond	4.7	44.3	61.0			
Missing/unknown	7.0	33.1	59.9			
<b>Insurance Status</b>				651,766	p<0.001	p<0.001
Other Payer	4.8	33.4	61.7			
Medi-Cal	9.2	33.3	57.5			
<b>Risk Level</b>				600,983	p<0.001	p=0.091
Low Risk	6.5	34.4	59.2			
High Risk	6.5	32.5	61.0			

**Figures 25a and 25b: Birth Spacing <15 Months, 2007-2009**

**25a. Top Quartile Counties with Birth Spacing <15 Months**



 Number of events too small to report prevalence.

Proportion of Delivering Women with Birth Spacing <15 Months Among Top Quartile Counties	
Kern	7.27%
Plumas	6.99%
Lake	6.89%
Kings	6.89%
Modoc	6.76%
Fresno	6.73%
Tulare	6.64%
Tehama	6.37%
Colusa	6.31%
San Bernardino	6.30%
Imperial	6.26%
Lassen	6.25%
Merced	5.98%
Stanislaus	5.86%

**25b: Counties with Increasing Trends in Birth Spacing <15 Months**



 Number of events too small to perform trend testing.

Percentage Increase in Birth Spacing <15 Months from 2007 to 2009 Among Delivering Women	
Del Norte	120.54%
Tuolumne	48.44%
Yuba	33.55%
Glenn	26.90%
Kings	26.81%

## County Level Analysis

California is divided into 58 counties (Table 28). The combined delivery volume for the three-year period was calculated using the mother's residential zip code. California county-level maps for each condition were presented above and show counties with the highest proportions of the specified condition over the 3-year period spanning 2007, 2008 and 2009 (above the 75<sup>th</sup> percentile of the 2007 county rate distribution) and counties with substantial ( $\geq 20\%$ ) increases in the condition from 2007 to 2009. Counties having less than five women with the condition or birth outcome in years 2007, 2008 or 2009 were not included in the calculations of top quartiles or trend testing owing to instability.

### Results

County delivery volume ranged between 23 and 429,844 deliveries. The statewide cesarean delivery rate increased across the three-year study period (32.1%, 32.6%, and 33.1% respectively). The county mean 3-year cesarean delivery rate was 32.6% and ranged between 18.5% and 40.9%.

In general, counties with higher rates of maternal and neonatal complications were consistently high across the three years of study, and formed regional clusters that for the most part were distinct. Counties without associated hospitals (Alpine, Calaveras, Glenn, Mariposa, Sierra, and Trinity) performed poorly throughout the 3-year period.

Overall, these data present regional health disparities that likely reflect regional differences in the resources and availability of healthcare facilities throughout the state. Further investigation is needed to understand the resources available to women within their counties and how women access prenatal, labor and delivery and emergency services. Further investigation is also warranted to understand the impact of individual hospital policies and practices on maternal and neonatal outcomes.

**Table 28: Overall 3-Year Rates by County**

County	3-Year Delivery Volume*	3-Year Cesarean Delivery Rate
Alameda	61,167	29.1%
Alpine**	23	39.1%
Amador	863	34.0%
Butte	7,303	28.4%
Calaveras**	1,077	30.9%
Colusa	1,093	35.0%
Contra Costa	38,292	28.1%
Del Norte	951	23.5%
El Dorado	5,220	30.8%
Fresno	49,487	32.8%
Glenn**	1,313	28.0%
Humboldt	4,492	27.2%
Imperial	9,210	40.9%
Inyo	648	29.9%
Kern	44,653	26.5%
Kings	6,915	39.5%
Lake	2,119	28.8%
Lassen	819	29.8%
Los Angeles	429,844	36.6%
Madera	7,412	31.4%
Marin	7,659	29.3%
Mariposa**	419	27.0%
Mendocino	3,239	26.1%
Merced	13,265	28.4%
Modoc	136	25.7%
Mono	457	32.4%
Monterey	21,694	31.2%
Napa	4,835	26.9%
Nevada	2,270	25.7%
Orange	123,713	34.1%
Placer	11,475	27.7%
Plumas	456	26.3%
Riverside	96,454	32.9%
Sacramento	62,377	27.9%
San Benito	2,408	33.6%
San Bernardino	96,213	32.3%
San Diego	122,513	33.9%
San Francisco	26,090	25.8%
San Joaquin	32,915	31.0%

San Luis Obispo	7,932	29.2%
San Mateo	28,400	28.7%
Santa Barbara	18,196	31.7%
Santa Clara	77,583	29.5%
Santa Cruz	10,065	27.7%
Shasta	6,270	29.4%
Sierra**	54	18.5%
Siskiyou	1,149	30.7%
Solano	15,231	28.8%
Sonoma	16,376	26.6%
Stanislaus	24,912	31.4%
Sutter	4,334	29.5%
Tehama	2,316	26.9%
Trinity**	339	31.3%
Tulare	25,092	35.2%
Tuolumne	1,305	35.6%
Ventura	34,703	31.2%
Yolo	7,467	24.6%
Yuba	3,774	28.6%

\*Numbers based on maternal county of residence.

\*\*County does not have associated hospital.

## DISCUSSION

This report presents an analysis of maternal morbidity in California using hospital delivery data for the years 2007, 2008 and 2009. The morbidity data are presented in the following categories: preexisting and pregnancy-related conditions, childbirth outcomes, composite childbirth outcomes, ten-year morbidity trends, differences by payer source, and regional differences by county. Preliminary data regarding inter-birth interval (i.e., birth spacing) and its relationship to maternal morbidity was described as a potential new childbirth outcome measure.

Overall, these data demonstrated a significant statewide increase in maternal morbidity, as well as significant regional variation. While seemingly small, reported increases in rates are consistent with nationally observed trends across the reported measures<sup>4,18,19</sup>. Severe morbidity for example, increased incrementally between 1998 and 2011, impacting approximately 50,000 women per year<sup>1</sup>. Statewide increases may partially be attributed to improved quality monitoring and reporting<sup>20</sup>.

### Preexisting and Pregnancy-Related Conditions

The observed increase in trends for most chronic and pregnancy-related conditions is consistent with prior estimates for the California population from 1999 to 2005<sup>7</sup>. Notably, changes and improvement in coding and data sources have led to improved ascertainment for mental disorders and obesity ([Appendix 2](#)).

Future implications: A number of these measures have short- and long-term impact on maternal and neonatal health. For example, preterm birth and preeclampsia are associated with maternal lifetime risk of cardiovascular disease<sup>21</sup>. Gestational diabetes is associated with lifetime risk of overt diabetes in both mother and newborn<sup>22</sup>. Some of these conditions are amenable to treatment and prevention via behavioral and system level interventions. If addressed programmatically from a public health perspective, the passage of the 2010 Patient Protection and Affordable Care Act (ACA), enabling access to preventive health services including preconception counseling, well woman care, and contraception, has the potential to arrest these trends. As such, the need to continue to measure and monitor these outcomes is crucial.

### Childbirth Outcomes

The increase in maternal morbidity, particularly preexisting and pregnancy-related conditions, is likely contributing to the upward trend demonstrated in women experiencing severe maternal morbidity (e.g., ICU admission) and mortality<sup>6</sup>.

From a population perspective, severe maternal morbidity events are rare, occurring in 1% of deliveries<sup>1</sup>. However, for over 5,000 California women and 40,000 women in the U.S., these events have significant long-term consequences affecting both mother and baby. For example, rates of depression and post-traumatic stress disorder are increased in these women<sup>23</sup>. Furthermore, maternal depression impacts maternal health, newborn health and development, as well as family economics<sup>24</sup>. Ongoing

monitoring and reporting severe maternal morbidity as a quality measure<sup>25</sup> could serve to provide the impetus for hospitals to develop interventions to improve the recognition and response to severe maternal morbidity and for support programs to mitigate against personal and family sequelae.

### **Composite Childbirth Outcomes**

Overall, maternal morbidity increased across all composite measures (complicated delivery, maternal complications, severe maternal complications and neonatal complications). Complementarily, the ideal delivery rate decreased.

Composite childbirth outcomes have the advantage of being interpretable by patients, laypersons and clinicians. Everyone wants and understands a normal delivery without any complications. Similarly, it is helpful to look across all morbidities to understand how many deliveries are complicated by any condition, in addition to knowing the frequency of individual conditions. Hospitals can focus quality improvement efforts towards individual subcomponents of the composite measures.

### **Ten-Year Trend of Select Morbidities**

With regard to preexisting and pregnancy-related conditions, rates of 9 of 14 presented clinical conditions have increased since 1999: diabetes, gestational diabetes, hypertension, gestational hypertension, mental disorders, obesity, obstetric trauma, preterm birth, severe maternal complications. As women age and delay childbearing they are experiencing more comorbidity<sup>26</sup>.

This decade-long trend raises three important public health implications. The first, as previously stated, suggests a strong need to initiate interventions during the preconception and inter-conception time period. These can be implemented via the ACA, which includes preventive services for women with no cost sharing. Among these preventive services are the well-woman visit and a preventive health visit for women that offers an opportunity for screening and intervention prior to or between pregnancies that was not previously available to many women. Second, there is a need to encourage collaborative practice, interdisciplinary education, and ensure continued training and geographic distribution of clinicians trained in caring for high-risk women with medical conditions. Specifically, the evidence of regional hot spots identified for morbidity analysis provides further evidence for the need to regionalize maternal care and transport systems to improve outcomes for high-risk deliveries. Lastly, there is emerging evidence of the role of Adverse Childhood Experiences (ACEs) in the development of childbirth morbidities which emphasizes the increased need for life course and social determinants of health models to guide interventions.

### **Differences by Payer Source**

Women insured by Medi-Cal had higher rates of morbidity in 9 of the 24 conditions evaluated in this report: chronic diabetes, gestational hypertension, mental disorders, obesity, maternal infection, placenta previa, 30-day readmission, maternal complications and neonatal complications. With the expansion of Medi-Cal under the ACA, continued surveillance of particular conditions can serve as a potential outcome measure of successful implementation. More women with diabetes and obesity

ought to be receiving early and adequate preconception and prenatal care. **For example**, candidates can be identified for aspirin prophylaxis to prevent gestational hypertension/preeclampsia<sup>27</sup>.

### **Differences by Race/Ethnicity**

Patterns of morbidity were distinctive for racial/ethnic groups in California. Of the 24 conditions examined in this report, the three-year rate was higher for Black women for 11 of the conditions, American Indian women for nine of the conditions, Pacific Islander women for seven of the conditions, Asian women for five of the conditions, White, Multi-race and Other race for three of the conditions, and Unknown race for two of the conditions. Hispanic women did not have higher three-year prevalence rates for any of the conditions. The differences seen between the race/ethnic groups demonstrate the disparity in health burden between race/ethnic groups and the need for targeted interventions for specific health conditions. These disparities may represent geographic, cultural and access differences; they also may represent health inequities, defined as differences in health status related to social standing within a society. As such, these factors reflect the macro-economy of systems and institutions. With the establishment of the Office of Health Equity and the ongoing work of the Health in all Policies interagency taskforce, non-traditional partners are convening at the state and local level to develop action plans to reduce community health risk factors under the purview of government agencies and partner institutions.

### **Exploratory Measure: Birth Spacing**

The rate of rapid repeat birth (inter-birth interval <15 months) decreased across the study period. Rapid repeat birth was highest among teenage women, women who identified as Pacific Islander, women who had less than a high school diploma and women who were insured by Medi-Cal. These data are consistent with contextual data about pregnancy intention and healthcare utilization from related data sources. The 2011 California Maternal and Infant Health Assessment data show that, incrementally, younger women with a recent live birth are more likely to report mistimed or unwanted pregnancies than older women. The prevalence of mistimed or unwanted pregnancy was 60.5% among women 15-19, 32.4% among women 0-34 and 19.1% among women 35 and older<sup>28</sup>. Similarly, 2012 data from Medi-Cal Managed Care has demonstrated that postpartum visit attendance is low (42.2% - 60.4%) among women served in that plan<sup>29</sup>.

As the importance of birth spacing as a public health concept receives more attention in the U.S., the postpartum visit provides a key clinical opportunity to provide contraceptive counseling. The preventive services for women included in the ACA support this opportunity by providing coverage for all FDA-approved contraceptive methods and related healthcare visits. Given the research demonstrating that short birth intervals are associated with adverse maternal and neonatal outcomes, public health efforts to increase postpartum visit attendance and to provide focused messages during the visit about the importance of ideal birth spacing (27-59 months) could lead to decreased maternal and neonatal morbidity in California.

### **County Level Analysis**

Marked differences between maternal and neonatal complications were identified on a county level. These disparities may reflect differences in race/ethnicity and socioeconomic status of different counties as well as the availability of clinical resources and level of care of healthcare facilities in the region.

Prior work with this dataset demonstrated minimal change when adjusted for patient specific characteristics such as age, race/ethnicity, education and insurance status<sup>7</sup>. Hence, the current analysis did not attempt any case-mix adjustment and presents crude rates by county. It will be important to consider hospital level policies and practices, community level resources, and women's access to local and regional services, to better understand regional differences and to begin to resolve the regional disparities that currently exist. Understanding hospital and county differences, as well as hospital policies and procedures, will also help inform efforts to regionalize maternal care and transport systems, as well as quality improvement efforts to effect system changes needed to improve maternal and neonatal outcomes.

## References

1. Callaghan WM, Creanga AA, Kuklina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstet Gynecol.* Nov 2012;120(5):1029-1036.
2. Bateman BT, Bansil P, Hernandez-Diaz S, Mhyre JM, Callaghan WM, Kuklina EV. Prevalence, trends, and outcomes of chronic hypertension: a nationwide sample of delivery admissions. *Am J Obstet Gynecol.* Feb 2012;206(2):134.e131-138.
3. Chu SY, Callaghan WM, Kim SY, et al. Maternal obesity and risk of gestational diabetes mellitus. *Diabetes Care.* Aug 2007;30(8):2070-2076.
4. Kuklina EV, Ayala C, Callaghan WM. Hypertensive disorders and severe obstetric morbidity in the United States. *Obstet Gynecol.* Jun 2009;113(6):1299-1306.
5. Wier LM, Andrews RM. The National Hospital Bill: The Most Expensive Conditions by Payer, 2008: Statistical Brief # 107. *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs.* Rockville (MD): Agency for Health Care Policy and Research (US); 2006.
6. CDC. Pregnancy Mortality Surveillance System *Centers for Disease Control and Prevention* Available at: <http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html>. Accessed July 22, 2014.
7. Fridman M, Korst LM, Chow J, Lawton E, Mitchell C, Gregory KD. Trends in maternal morbidity before and during pregnancy in California. *Am J Public Health.* Feb 2014;104 Suppl 1:S49-57.
8. Korst LM, Fridman M, Lu MC, et al. Monitoring childbirth morbidity using hospital discharge data: further development and application of a composite measure. *Am J Obstet Gynecol.* Mar 11 2014.
9. AHRQ. Patient Safety Indicators Technical Specifications Available at: [http://www.qualityindicators.ahrq.gov/Modules/PSI\\_TechSpec.aspx](http://www.qualityindicators.ahrq.gov/Modules/PSI_TechSpec.aspx). Accessed July 22, 2014.
10. Gregory KD, Korst LM, Lu MC, Fridman M. AHRQ patient safety indicators: time to include hemorrhage and infection during childbirth. *Jt Comm J Qual Patient Saf.* Mar 2013;39(3):114-122.
11. Belfort MA, Clark SL, Saade GR, et al. Hospital readmission after delivery: evidence for an increased incidence of nonurogenital infection in the immediate postpartum period. *Am J Obstet Gynecol.* Jan 2010;202(1):35.e31-37.
12. Gregory KD, Fridman M, Shah S, Korst LM. Global measures of quality- and patient safety-related childbirth outcomes: should we monitor adverse or ideal rates? *Am J Obstet Gynecol.* Jun 2009;200(6):681.e681-687.
13. Conde-Agudelo A, Rosas-Bermudez A, Kafury-Goeta AC. Effects of birth spacing on maternal health: a systematic review. *Am J Obstet Gynecol.* Apr 2007;196(4):297-308.
14. Korst LM, Gregory KD, Gornbein JA. Elective primary caesarean delivery: accuracy of administrative data. *Paediatr Perinat Epidemiol.* Mar 2004;18(2):112-119.
15. AHRQ Quality Indicators-Guide to Patient Safety Indicators: Agency for Healthcare Research and Quality; 2003.
16. Main E OB, Chagolla B, Bingham D, Dang-Kilduff L, Kowalewski L. *Elimination of Non-medically Indicated (Elective) Deliveries Before 39 Weeks Gestational Age; Quality Improvement Toolkit* 2010.
17. Conde-Agudelo A, Rosas-Bermudez A, Kafury-Goeta AC. Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. *JAMA.* Apr 19 2006;295(15):1809-1823.
18. Kim SY, Dietz PM, England L, Morrow B, Callaghan WM. Trends in pre-pregnancy obesity in nine states, 1993-2003. *Obesity (Silver Spring).* Apr 2007;15(4):986-993.

19. McCabe JE, Arndt S. Demographic and substance abuse trends among pregnant and non-pregnant women: eleven years of treatment admission data. *Matern Child Health J.* Nov 2012;16(8):1696-1702.
20. Martin JA WE, Osterman MJK, et al. . *Assessing the quality of medical and health data from the 2003 birth certificate revision: Results from two states.* . Hyattsville, MD: National Center for Health Statistics; 2013.
21. Harskamp RE, Zeeman GG. Preeclampsia: at risk for remote cardiovascular disease. *Am J Med Sci.* Oct 2007;334(4):291-295.
22. Kitzmiller JL, Dang-Kilduff L, Taslimi MM. Gestational diabetes after delivery. Short-term management and long-term risks. *Diabetes Care.* Jul 2007;30 Suppl 2:S225-235.
23. Hoedjes M, Berks D, Vogel I, et al. Symptoms of post-traumatic stress after preeclampsia. *J Psychosom Obstet Gynaecol.* Sep 2011;32(3):126-134.
24. Burke L. The impact of maternal depression on familial relationships. *Int Rev Psychiatry.* Aug 2003;15(3):243-255.
25. Callaghan WM, Grobman WA, Kilpatrick SJ, Main EK, D'Alton M. Facility-based identification of women with severe maternal morbidity: it is time to start. *Obstet Gynecol.* May 2014;123(5):978-981.
26. Luke B, Brown MB. Elevated risks of pregnancy complications and adverse outcomes with increasing maternal age. *Hum Reprod.* May 2007;22(5):1264-1272.
27. Duley L, Henderson-Smart DJ, Meher S, King JF. Antiplatelet agents for preventing pre-eclampsia and its complications. *Cochrane Database Syst Rev.* 2007(2):Cd004659.
28. Pippins JR, Brawarsky P, Jackson RA, Fuentes-Afflick E, Haas JS. Association of breastfeeding with maternal depressive symptoms. *J Womens Health (Larchmt).* Jul-Aug 2006;15(6):754-762.
29. Performance Evaluation Report, Molina Healthcare of California Partner Plan, Inc. July 1, 2011– June 30, 2012. *Medi-Cal Managed Care Division California Department of Health Care Services.* Available at: [http://www.dhcs.ca.gov/dataandstats/reports/Documents/MMCD\\_Qual\\_Rpts/1112PlanSpecificPerfEvals/Molina\\_CA2011-12\\_PerfEval\\_Report\\_F1.pdf](http://www.dhcs.ca.gov/dataandstats/reports/Documents/MMCD_Qual_Rpts/1112PlanSpecificPerfEvals/Molina_CA2011-12_PerfEval_Report_F1.pdf). Accessed August 22, 2014.

## APPENDIX

### Appendix 1: Indicator codes developed by MQI

**Note:** For the ICD-9-CM codes listed in the Appendix, those lacking a first and second numeral after the decimal include all of potential subcategories. For example, code 250 includes all potential subcategories for chronic diabetes mellitus 250.00-250.93 (also referred to as 250.xx in the report text). Likewise, codes with one post decimal numeral include all possible second post decimal code options. For example code 648.0 includes all possible second digit codes, 648.00-648.04.

Indicator	Code definition	ICD-9-CM Code	Denominator exclusions
<b><i>Preexisting or pregnancy-related conditions</i></b>			
<b>Diabetes</b>	Chronic diabetes	250 648.0	Stillborn and intrauterine fetal demise
	Gestational Diabetes	648.8	
<b>Hypertension</b>	Any hypertension	401	Stillborn and intrauterine fetal demise
		402	
		403	
		404	
		405	
		642.0	
		642.1	
		642.2	
		642.3	
		642.4	
642.5			
642.6			
642.7			
642.9			
	Chronic hypertension	401	
		402	
		403	
		404	
		405	
		642.0	
		642.1	
		642.2	
642.7 (superimposed)			
	Gestational hypertension	642.3	
		642.4	
		642.5	
		642.6	
	Unspecified hypertension	642.9	
<b>Heart disease</b>	Rheumatic heart	390+ POA	Stillborn and intrauterine

	disease	391+ POA 392+ POA 393+ POA 394+ POA 395+ POA 396+ POA 397+ POA 398 + POA	fetal demise
	Congenital heart disease	648.5 (refer to conditions 745-747)	
	Other heart disease	414 416 417 424 429	
	Acute myocardial infarction (MI)	410-411 + POA	
	Angina	413 + POA	
	Acute pulmonary	415 + POA	
	Acute pericarditis	420+ POA	
	Acute/subacute pericarditis	421 + POA	
	Acute myocarditis	422+ POA	
	Other pericardial	423 + POA	
	cardiomyopathy	425+ POA	
	Conduction disorders	426 + POA	
	Dysrhythmias	427 + POA	
	Heart failure	428 + POA	
	Operations on heart and pericardium	35 36 37 39	
<b>Mental disorders</b>	Mood disorders	296.0 296.2 296.3 296.4 296.5 296.6 296.7 296.80 296.81 296.82 296.89 298.0 300.4 311	Stillborn and intrauterine fetal demise
	Anxiety disorders:	300.0	

		300.01 300.2 300.21 300.3 308.0 309.81	
	Adjustment disorders	309	
	Substance use disorders	291 292 303 304 305 648.3	
	Psychotic disorders	295 297	
	Cognitive disorders	293.0 293.1	
	Eating disorders	307.1 307.50 307.51 307.52 307.53 307.54	
<b>Obesity</b>	Birth certificate	BMI $\geq$ 30 kg/m <sup>2</sup> (	Stillborn and intrauterine fetal demise
<b>Childbirth Outcomes</b>			
<b>Anesthesia complications</b> (AHRQ Patient Safety Indicator #1)	Denominator	All delivery DRG Both surgical and medical DRG to allow for vaginal deliveries	Ignore requirement for surgical DRG and procedure list; maintain exclusion of anesthesia complication as a principal or secondary diagnosis POA  Stillborn and intrauterine fetal demise
	Numerator	349.0 349.3 668 E855.1 E876.3 E938.1 E 938.2 938.3 E938.4 E938.5	Maintain exclusion for self-inflicted injury, poisoning, and drug dependence or abuse

		E938.6 E938.7 E938.8 E938.9 968.1 968.2 968.3 968.4 968.7 997.09	
<b>Hemorrhage</b> (AHRQ Patient Safety Indicator #9)	Denominator	All delivery DRG (including 640)	641 663.5  Day of the control or drainage code not preceding the date of delivery  hemorrhage/hematoma as principal diagnosis if POA  Stillborn and intrauterine fetal demise
	Numerator	666 674.3 998.11 998.12  If only 998.11 or 998.12, then need AHRQ control codes: 287,388.0-388.9, 394.1, 399.8, 499.5,579.3, 609.4; 180.9, 540, 541.2, 591.9, 610, 699.8, 701.4, 710.9, 759.1, 759.2, 860.4	
<b>Maternal infection</b> (AHRQ Patient Safety Indicator #13)	Denominator	All delivery DRGs	Infection as a principal diagnosis if POA  Maintain exclusion of no cancer or immunocompromise  Stillborn and intrauterine fetal demise
	Numerator	038	Length of stay greater than

		659.3 670.0 785.52 995.91 995.92 998.0	four days
<b>Obstetric trauma with instrument</b> (AHRQ Patient Safety Indicator #18)	Denominator	Vaginal delivery with any instrument assisted delivery	Stillborn and intrauterine fetal demise
	Numerator	664.2 664.3 665.3 665.4 665.7	
<b>Obstetric trauma without instrument</b> (AHRQ Patient Safety Indicator #19)	Denominator	Vaginal delivery without any instrument assisted delivery	Stillborn and intrauterine fetal demise
	Numerator	664.2 664.3 665.3 665.4 665.7	
<b>NTSV cesarean delivery</b>	Denominator	nulliparous, term, singleton, vertex births	Stillborn and intrauterine fetal demise
	Numerator	Births via cesarean delivery	
<b>Placenta previa</b>	placenta previa with and without hemorrhage	649.0 641.1	Stillborn and intrauterine fetal demise
<b>Preterm birth</b>	Early onset of delivery	644.2	Stillborn and intrauterine fetal demise
<b>30-day readmissions</b>	Denominator	All delivery DRG	Maternal death  Stillborn and intrauterine fetal demise
	Numerator	All postpartum admissions within 30 days of discharge	
<b>Composite Indicators</b>			
<b>Ideal Delivery</b>			Multiple gestation, preterm gestation, stillborn and

			intrauterine fetal demise
	No maternal and/or neonatal complications		
<b>Complicated Delivery</b>			Multiple gestation, preterm gestation, stillborn and intrauterine fetal demise
	All maternal and neonatal complications (see maternal complication codes and neonatal complication codes)		
<b>Maternal Complications</b>			Multiple gestation, preterm gestation, stillborn and intrauterine fetal demise
	3 <sup>rd</sup> /4 <sup>th</sup> degree perineal laceration	664.2 664.3	
	Anesthesia complication	349.0 349.3 668 968.1 968.2 968.3 968.4 968.7 997.09 E855.1 E876.3 E938.1 E938.2 E938.3 E938.4 E938.4 E938.5 E938.6 E938.7 E938.8 E938.9	
	Acute psychosis	298.10	
	Bladder laceration	665.5	
	Cerebral hemorrhage	348.5 430 431 432 433 434 436	

		437 437.2 671.5 674.0 780.01 780.03	
	High vaginal laceration	665.4	
	Hysterectomy	683 684 685 686 687 689	
	Length of stay >5 days	Admit and discharge dates	
	Maternal death	Disposition on the discharge diagnosis record	
	Maternal infection	038 658.4 659.2 659.3 670. 672.2 785.52 995.91 995.92	
	Maternal pneumonia	507.0	
	Maternal transfer to other acute care hospital	Disposition on the discharge diagnosis record	
	Obstetrical hematoma	664.5 665.7	
	Other lacerations	664.4 664.8 664.9 665.3 665.6 665.8 665.9	
	Obstetrical Shock	669.1 669.2	
	Other maternal morbidity	286.6 410 411 413 415	For 410-228 codes: exclude if POA and/or heart operation  For 480-486 and 867 codes:

		420 421 422 423 425 426 427 428 451.1 451.81 451.83 480 481 482 483 484 485 486 570 584 586 665.2 669.0 669.3 669.4 671.4 674.8 867 997.1 997.32 998	exclude if POA
	Pulmonary embolism	415.11 415.19 673.0 673.1 673.2 673.3 673.8	
	Postpartum hemorrhage	666.0 666.1 666.2 666.3	
	Transfusion	99.0	
	Uterine dehiscence	674.1	
	Uterine rupture	665.0 665.1	
	Wound complication	674.2	

		674.3	
	Additional potential maternal ICU admission (diagnosis codes)	518 674.5 780.1 785.5 786.03 799.1 995.0 995.4 997.01	518.3 518.6 518.83 518.84 518.89
	Additional potential maternal intensive care unit admission (procedure codes)	33.1 38.86 38.88 39.95 46.73 46.75 54.11 54.12 54.19 75.51 75.52 75.61 75.62 75.8 75.9 89.6 (including: 89.60, 89.61, 89.62, 89.63, 89.64, 89.65, 89.66, 89.67, 89.68) 93.90 93.91 93.93 96.01 96.02 96.03 96.04 96.05 96.7 (including: 96.70, 96.71, 96.72) 99.60 99.61 99.62 99.63 99.69	75.99
<b>Severe Maternal Complications</b>			Multiple gestation, preterm gestation, stillborn and intrauterine fetal demise

	Anesthesia complication	668.0 668.1 668.2	
	Cerebral hemorrhage	348.5 430 431 432 433 434 436 437 437.2 671.5 674.0 780.01 780.03	
	Hysterectomy	683 684 685 686 687 689	
	Maternal infection	038 785.52 995.91 995.92  All codes must be associated with LOS >= 4 days	
	Maternal death	Maternal death	
	Obstetrical Shock	669.1 669.2	
	Other maternal morbidity	286.6 669.4 997.1 570 584 586 669.3 669.4 671.4 674.8 997.1 998.0 998.1 998.2	

		998.3 998.30 998.31 998.32 998.33 998.4 998.5 998.51 998.59 998.6 998.7 998.81 998.82 998.83 998.89 998.9	
	Pulmonary embolism	415.11 415.19 673.0 673.1 673.2 673.3 673.8	
	Transfusion	99.00 99.03 99.04	
	Uterine rupture	665.1	
	Additional potential maternal ICU admission (diagnosis codes)	518 518.5 674.5	518.3 518.6 518.83 518.84 518.89
	Additional potential maternal intensive care unit admission (procedure codes)	31.1 38.86 38.88 39.95 54.11 54.12 54.19 89.6 96.70 96.71 96.72 93.90 93.91 93.93 99.60	

		99.61 99.62 99.63 99.69	
<b>Neonatal Complications</b>			Multiple gestation, preterm gestation, stillborn and intrauterine fetal demise
	Neonatal death	Disposition	
	Neonatal transfer to other acute care hospital	Disposition	
	Neonatal length of stay > 5 days	Admit and Discharge Dates	V600 V601 V602 V603 V604 V605 V608 V609 V6105 V6106
<b><i>Birth Trauma/Injuries</i></b>			
	Fetus or newborn affected by: other complications of labor and delivery	763.0 763.1 763.2 763.3 763.4 763.5	
	Subdural/cerebral hemorrhage	767.0	
	Subgaleal hemorrhage	767.11	
	Clavicle fracture	767.2	
	Other skeletal injuries	767.3	
	Spine/spinal cord injuries	767.4	
	Facial nerve injury	767.5	
	Brachial plexus injury	767.6	
	Other cranial/peripheral nerves	767.7	
	Other specified birth trauma	767.8	
<b><i>Hypoxia/Asphyxia</i></b>			
	Congenital or infantile cerebral palsy	343	
	Hypoxic ischemic encephalopathy	768.7	

	Mild or moderate birth asphyxia +/- neurologic involvement	768.6	
	Severe birth asphyxia with neurologic involvement	768.5	
	Unspecified birth asphyxia	768.9	
<b>Shock, Resuscitation and Complications</b>			
	Disseminated intravascular coagulation	776.2	
	Other transitory neonatal electrolyte disturbances	777.5	
	Renal failure	584.5	
	Shock, hypotension	785.5	
<b>Procedures</b>			
	Arterial catheterization	38.91	
	Umbilical venous catheterization	38.92	
	Gastrostomy	43.1	
	Gavage feeding	96.35	
	Total peripheral nutrition	99.15	
	Cardiopulmonary resuscitation	99.60	
<b>Respiratory</b>			
	Clear amniotic fluid aspiration with respiratory symptoms	770.14	
	Meconium aspiration with respiratory symptoms	770.12	
	Other respiratory problems after birth	770.81 770.82 770.83 770.84 770.86 770.87 770.88 770.89	
	Pulmonary hypertension	747.83	
	Respiratory distress syndrome	769	
	Pneumothorax	770.2	

	Pulmonary hemorrhage	770.3	
	Primary and other atelectasis	770.4 770.5	
	Transient tachypnea of the newborn	770.6	
	<b>Procedures</b>		
	Chest tube	34.04	
	Inhaled nitric oxide	00.12	
	Mechanical ventilation delivered through endotracheal tube or tracheostomy (invasive interface)	96.70 96.71 96.72	
	Non-invasive mechanical ventilation <u>without</u> (delivery through) endotracheal tube or tracheostomy	93.90	
	Other respiratory therapy	93.91 93.93 93.94 93.95 93.96 93.98 93.99	
	<b>Infection</b>		
	Congenital pneumonia	770.0	
	Septicemia of newborn	771.81	
	Bacteremia of newborn	771.83	
	Severe sepsis	995.92	
	<b>Neurologic Complications</b>		
	Intraventricular hemorrhage	772.1	
	Subarachnoid hemorrhage	772.2	
	Seizures	779.0 345.3	
	Other/unspecified cerebral irritability	779.1	
	Coma and cerebral depression	779.2	
	Periventricular leukomalacia	779.7	
	Cardiac arrest newborn	779.85 427.5	
	Encephalopathy	348.3	
	Cerebral edema	348.5	

	<b>Procedures</b>		
	Computed tomography of head	87.03	
	Other tomography of head	87.04	
	Magnetic resonance imaging of head	88.91	
	Electroencephalogram	89.14	
<b>Exploratory Measure</b>			
<b>Birth spacing</b>	Birth certificate	Interval between the date of last live birth and the most recent delivery (including stillborn and intrauterine fetal demise) date.	

ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification

POA: Present on Admission

DRG: Diagnosis Related Group

AHRQ: Agency for Healthcare Research and Quality

## Appendix 2: High risk conditions

Condition	ICD-9 CM Codes
Prior cesarean history	654.2
Unengaged head at term	652.5
Soft tissue disorder	654.0 654.1 654.4 654.5 654.6 654.7 654.8
Other uterine scar	654.9
Malpresentation	652 except 652.1, 5
Oligohydramnios	658.0
Hypertension	Any hypertension 401 402 403 404 405 642.0 642.1 642.2 642.3 642.4 642.5 642.6 642.7 (superimposed) 642.9
Antepartum bleeding	641
Liver disorders	646.7
Substance use	304 303 305 648.3
Mental disorders	See Appendix 1 above
Polyhydramnios	657
Herpes	054
Kidney disorder	646.2
Thyroid disorder	648.1  Refers to conditions classifiable as 240-246
Asthma and other pulmonary	493 <u>OR</u>

	518.3 518.6 518.83 518.84 518.89  Also include codes if POA: 480 481 483 484 485 486
Heart disease	35 36 37 39 390+ POA 391+ POA 392+ POA 393+ POA 394+ POA 395+ POA 396+ POA 397+ POA 398 + POA 414 416 417 424 429 410-411 + POA 413 + POA 415 + POA 420+ POA 421 + POA 422+ POA 423 + POA 425 + POA 426 + POA 427 +POA 428 + POA 648.5 (refer to conditions 745-747)
Isoimmune disease	656.1 656. 2
Diabetes (includes gestational)	250 648.0 648.8

Obesity	BMI $\geq$ 30 kg/m <sup>2</sup> (Birth certificate height and pre-pregnancy weight)
Systemic lupus	710
Sickle cell disease	282.6
Fetal macrosomia	656.6
Fetal intrauterine growth restriction (IUGR)	656.5
Fetal chromosome abnormality or CNS malformation	655.0 655.1
Newborn affected by placenta previa or abruption	762.0 762.1
Newborn affected by umbilical cord complications: thromboses , vasa previa, velamentous insertion	762.6
Impaired fetal growth, "light for dates"	764.0 764.1 764.9
Hemolytic disease due to Rh or other isoimmunization and Hemolytic disease due to ABO isoimmunization	773.0 773.1 773.2
Hydrops due to isoimmunization	773.3
Phototherapy of the newborn (procedure code)	99.83
Idiopathic hydrops	778.0
Drug withdrawal	779.5
Laryngeal stenosis	478.74
<b>Fetal Congenital anomalies</b>	
Anencephalus and similar anomalies	740.0 740.1 740.2
Spina bifida	741.0 741.9
Other congenital anomalies of nervous system	742.0 742.1 742.2 742.3 742.4 742.5 742.8 742.9
Congenital anomalies of eye	743.0 743.1 743.2 743.3 743.4 743.5 743.6 743.8 743.9

Congenital anomalies of the cardiac septum	745.0 745.1 745.2 745.3 745.4 745.5 745.6 745.7 745.8 745.9
Other congenital anomalies of heart	746.0 746.1 746.2 746.3 746.4 746.5 746.6 746.7 746.8 746.9
Other congenital anomalies of circulatory system (but not single umbilical artery)	747.0 747.1 747.2 747.3 747.4
Congenital anomalies of the respiratory system	748.0 748.1 748.2 748.3 748.4 748.5 748.6 748.8 748.9
Cleft palate and cleft lip	749.0 749.1 749.2
Congenital anomalies of the upper alimentary tract	750.3 750.4 750.5 750.6 750.7 750.8 750.9
Other congenital anomalies of the digestive system	751.0 751.1 751.2

	751.3 751.4 751.5 751.6 751.7 751.8 751.9
Congenital anomalies of the urinary system	753.0 753.1 753.2 753.3 753.5 753.6 753.8 753.9
Certain congenital musculoskeletal deformities	754.0 754.1 754.2 754.3 754.4 754.5 754.6 754.7 754.8
Ichthyosis congenital	757.1
Chromosomal anomalies (but not balanced translocations and Klinefelter's syndrome)	758.0 758.1 758.2 758.3 758.5 758.6 758.8 758.9
Tuberous Sclerosis	759.5
Other hamartoses	759.6
Multiple congenital anomalies	759.7
Other specified anomalies	759.81 759.2 759.3 759.9
Adrenogenital disorders	255.2