MCAH Bulletin
California

Maternal, Child & Adolescent Health
California Department of Public Health

# The California Pregnancy-Associated Mortality Review (CA-PAMR)

## Report from 2002 to 2004 Maternal Death Reviews

This Bulletin provides an update to the report on Maternal Death Reviews from 2002 to 2003 released in Spring 2011.

## What is known about maternal mortality?

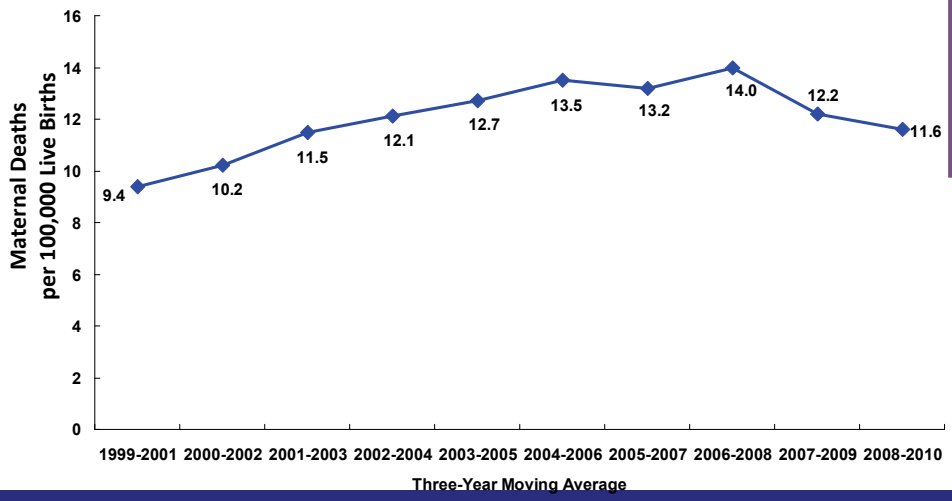
Maternal mortality is an important indicator of maternal health, and maternal mortality rose in California between 1999 and 2010 after decades of declining rates of maternal deaths. Maternal mortality is defined as the number of women who die from a pregnancy-related cause within 42 days postpartum divided by the number of live births in that year multiplied by 100,000. Another measure, pregnancy-related mortality, is similar but extends follow-up time to one year postpartum.

Reasons for the rise in maternal mortality are likely complex and multifactorial. Possible reasons include improved vital statistics data reporting, increasing prevalence of chronic conditions among pregnant women, worsening negative impact of social determinants of health, and quality of care issues in the prenatal period, at time of labor and delivery, or in the postpartum period.

## Increasing Trends, 1999-2010

Rates of maternal deaths in California rose from a rolling three-year average of 9.4 deaths per 100,000 live births in 1999-2001 to 14.0 deaths per 100,000 live births in 2006-2008 with a recent drop to 11.6 in 2008-2010 (Figure 1). During this period African-American women had a three-fold risk of maternal mortality compared to women of other race/ethnicity.

**Figure 1. Maternal Mortality Rates, Moving Average, CA 1999-2010**




SOURCE: State of California, Department of Public Health, California Birth and Death Statistical Master Files, 1999-

### Highlights

- Maternal mortality rates rose in California from 1999 to 2010, after decades of declining rates of death.
- African-American women have a three-fold risk of dying.
- The California Pregnancy-Associated Mortality Review (CA-PAMR) is investigating the rise in maternal mortality.
- Based on CA-PAMR case review, the leading cause of death from 2002 to 2004 is cardiovascular disease, particularly peripartum cardiomyopathy.

## The California Pregnancy-Associated Mortality Review

The California Pregnancy-Associated Mortality Review (CA-PAMR) was initiated in 2004 by the California Department of Public Health (CDPH), Maternal, Child, and Adolescent Health (MCAH) Division to investigate the rise in maternal mortality in California, the persistent racial/ethnic disparity in mortality, and to inform policy and programmatic interventions. CA-PAMR is funded by the federal Title V MCH block grant and was implemented in collaboration with the Public Health Institute, the California Maternal Quality Care Collaborative and expert clinicians from around the state. Each death is reviewed by the multidisciplinary CA-PAMR Committee who arrive at consensus determinations as to whether the maternal death was pregnancy-related, and if so, the causes of death, factors that contributed to the death, the overall chance for the death to have been prevented and opportunities for quality improvement.

In April 2011, CDPH MCAH released a report describing results from the first two years of the maternal mortality review. Since then, a third year of case review and analysis has been completed and is presented in this update. Please refer to the original report for a full description of background to the problem and the methodology used to examine the rise in maternal mortality.

## Key Findings of CA-PAMR, 2002-2004

**CASE FINDING and CAUSE of DEATH:** In 2002 to 2004, there were 555 pregnancy-associated deaths (deaths from any cause within one year postpartum). After screening for cases most likely to be pregnancy-related, CA-PAMR performed an in-depth case review for 211 of the 555 deaths. After case review, 145 deaths were determined by the CA-PAMR Committee to be pregnancy-related deaths.

The causes of maternal death were more accurately determined through in-depth mortality review than by death certificate data alone (Table 1). Before case review, preeclampsia was the leading cause of pregnancy-related deaths. After case review, the leading causes of pregnancy-related deaths changed and cardiovascular disease became the leading cause of pregnancy-related mortality, accounting for 20% of the pregnancy-related deaths. Of the deaths from cardiovascular disease, peripartum cardiomyopathy was the most frequent cardiovascular condition.

Based on CA-PAMR review, the pregnancy-related status of 58 deaths were changed. Twenty-two deaths reported as pregnancy-related on the death certificate were determined to be unrelated to pregnancy after case review.

**Table 1. Clinical Causes of Death for the 2002 to 2004 Pregnancy-Related Deaths, per CA-PAMR Committee**

| | Pregnancy-Related Deaths *(per death certificate)* N (%) | Not Pregnancy-Related Deaths *(per death certificate)* N (%) | Pregnancy-Related Deaths *(per CA-PAMR Committee)* N (%) |
|---|---|---|---|
| Cardiovascular Disease | 16 (15) | 13 (36) | 29 (20) |
| *Cardiomyopathy* | *10 (9)* | *9 (25)* | *19 (13)* |
| *Other cardiovascular* | *6 (6)* | *4 (11)* | *10 (7)* |
| Preeclampsia/eclampsia | 19 (17) | 6 (17) | 25 (17) |
| Obstetric hemorrhage | 16 (15) | 0 | 16 (11) |
| Amniotic fluid embolism | 15 (14) | 0 | 15 (10) |
| Deep vein thrombosis/pulmonary embolism | 12 (11) | 3 (8) | 15 (10) |
| Other causes | 31 (28) | 14 (39) | 45 (31) |
| **TOTAL** | **109** | **36** | **145** |

## Key Findings of CA-PAMR, 2002-2004, (continued):

Misclassification of pregnancy-related deaths occurred in both directions however, and 36 cases originally classified as not pregnancy-related on the death certificate were classified as pregnancy-related after review. Of these, over half were from cardiovascular causes that occurred between 43 days and a year after delivery. In addition, more than 25% of deaths from preeclampsia complications would have been missed without the medical record reviews.

**Table 2. Demographic Characteristics of Women in the California Birth Cohort and Pregnancy-Related Deaths, 2002-2004. Deaths, per CA-PAMR Committee**

| | CA Birth Cohort (N=1,598,792) N (%) | CA-PAMR Pregnancy-Related Deaths (N=145) N (%) |
|---|---|---|
| **PAYER SOURCE** | | |
| Medi-Cal/other government | 736,088 (46) | 83 (57) |
| Private or self-pay | 855,570 (54) | 59 (41) |
| **EDUCATION** | | |
| Less than high school | 444,138 (28) | 44 (30) |
| High school/12th grade | 444,373 (28) | 44 (30) |
| Beyond high school | 670,636 (42) | 45 (31) |
| **AGE** | | |
| Less than 30 years old | 936,670 (59) | 58 (40) |
| 30-39 years old | 607,674 (38) | 68 (47) |
| Forty or more years old | 54,448 (3) | 19 (13) |

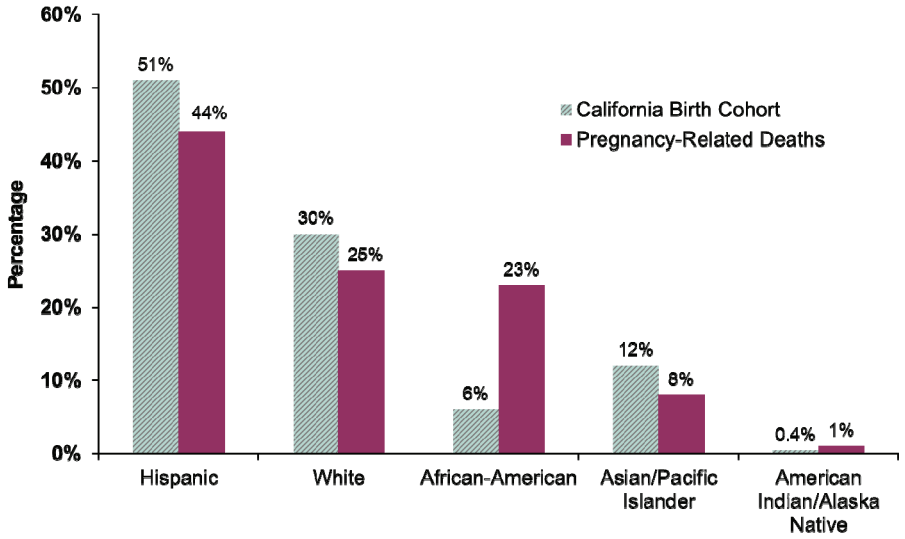
NOTE: Percentages may exceed 100 because of rounding and total percentages for each demographic may not equal 100 because missing data is not presented.
Source: State of California, Department of Public Health, California Birth and Fetal Death Statistical Master Files, 2002 to 2004. The California Birth Cohort is comprised of all live births plus fetal deaths (≥20 weeks gestation) in a given year.

**DEMOGRAPHICS and RISK FACTORS:** Women who died from pregnancy-related causes were more likely to have their delivery services paid for by Medi-Cal (57%) compared to the general childbearing population in California (46%), and were also less likely to have education beyond high school (31% compared to 42%) (Table 2), or to be married (61% compared to 69%; data not shown). Women ages 40 and older had the highest relative risk of pregnancy-related deaths, nearly four times that of women 39 years or younger. However, women aged 30-39 had the highest number (n=68) of deaths, accounting for nearly half (47%) of all pregnancy-related deaths.

The CA-PAMR pregnancy-related deaths were more likely to be overweight and obese than the California childbearing population as represented by the Maternal Infant Health Assessment (MIHA) survey. Sixty-three percent of CA-PAMR pregnancy-related deaths were either overweight or obese at the beginning of pregnancy (Body Mass Index data available for 111 women) compared to 39% of California women who gave birth in 2002 to 2004. (NOTE: MIHA survey respondent data (N= 9,841) are weighted to estimate statewide prevalence; data not shown.)

**RACIAL/ETHNIC and SOCIOECONOMIC DISPARITIES:** Pregnancy-related deaths continue to occur disproportionately among African-American women. African Americans accounted for 6% of women giving birth in California in 2002 to 2004, yet represented 23% (n=33) of the 145 pregnancy-related deaths.

**Figure 3. Race/Ethnicity of all California Births and Pregnancy-Related Deaths, per CA-PAMR Committee 2002-2004**




Source: State of California, Department of Public Health, California Birth and Fetal Death Statistical Master Files, 2002 to 2004. The California Birth Cohort is comprised of all live births plus fetal deaths (≥20 weeks gestation) in a given year.

**RACIAL/ETHNIC and SOCIOECONOMIC DISPARITIES (continued):** Cardiomyopathy was the leading cause of death for African-American women with pregnancy-related deaths (accounting for 47% of the deaths from peripartum cardiomyopathy), which is consistent with literature reporting higher risk for peripartum cardiomyopathy among this racial group. This may account for some, but not, all of the disparity seen among maternal deaths for African-Americans. Hispanics had the highest number of pregnancy-related deaths (n=64, 44%) and were more likely to die from preeclampsia/eclampsia than other racial/ethnic groups (accounting for 64% of the deaths from preeclampsia/eclampsia). Women who died from pregnancy-related causes were more likely to have received public funding for delivery services, indicating that women who died were poorer than women who gave birth but did not die in California. Women who died and whose services were paid for by Medi-Cal also had more risk factors, such as lower educational attainment, higher reported substance use during pregnancy, and more preexisting medical conditions.

**PREVENTABLE DEATHS: CHANCE to ALTER OUTCOME:** The overall proportion of deaths considered by the CA-PAMR Committee to have a good-to-strong chance to alter outcome increased from 38% to 40% with the addition of 2004 data. As with the 2002 to 2003 pregnancy-related deaths, deaths from certain causes were determined to be more preventable (e.g., obstetric hemorrhage, pulmonary embolism, infection and preeclampsia/eclampsia) than others (e.g., amniotic fluid embolism).

## For more information

- To review additional data and graphics regarding the CA-PAMR Maternal Death Reviews from 2002 to 2004 please visit: http://www.cdph.ca.gov/data/statistics/Pages/CaliforniaPregnancy-AssociatedMortalityReview.aspx.
- To access the full report on CA-PAMR Maternal Death Reviews from 2002-2003 please visit: http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf.
- To learn more about how CA-PAMR is informing efforts to improve the quality of maternity care in California, visit the California Maternal Quality Care Collaborative at http://www.cmqcc.org.

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