THE CALIFORNIA PREGNANCY-ASSOCIATED MORTALITY REVIEW (CA-PAMR)

Report from 2002-2003 Maternal Death Reviews

Copies of this report are available at the Maternal, Child, and Adolescent Health Program Website, under the California Department of Public Health, Center for Family Health at:
http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

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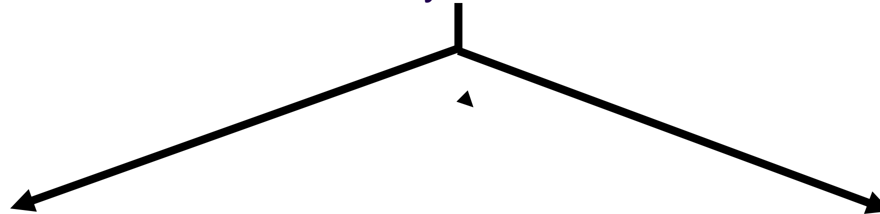
Maternal Mortality Rate

Number of women who die from pregnancy-related causes within 42 days postpartum / the number of live births in that year multiplied by 100,000.

(sometimes referred to as the Maternal Mortality Ratio)

Pregnancy-Associated Deaths

Death of a woman within one year postpartum from any cause



Pregnancy-Related Deaths

Death of a woman within one year postpartum related to pregnancy or aggravated by the pregnancy or its management

Not-Pregnancy-Related Deaths

Death of a woman within one year postpartum unrelated to pregnancy or its management

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 3. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

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Figure 1. Maternal Mortality Rate, California; 1970-2008

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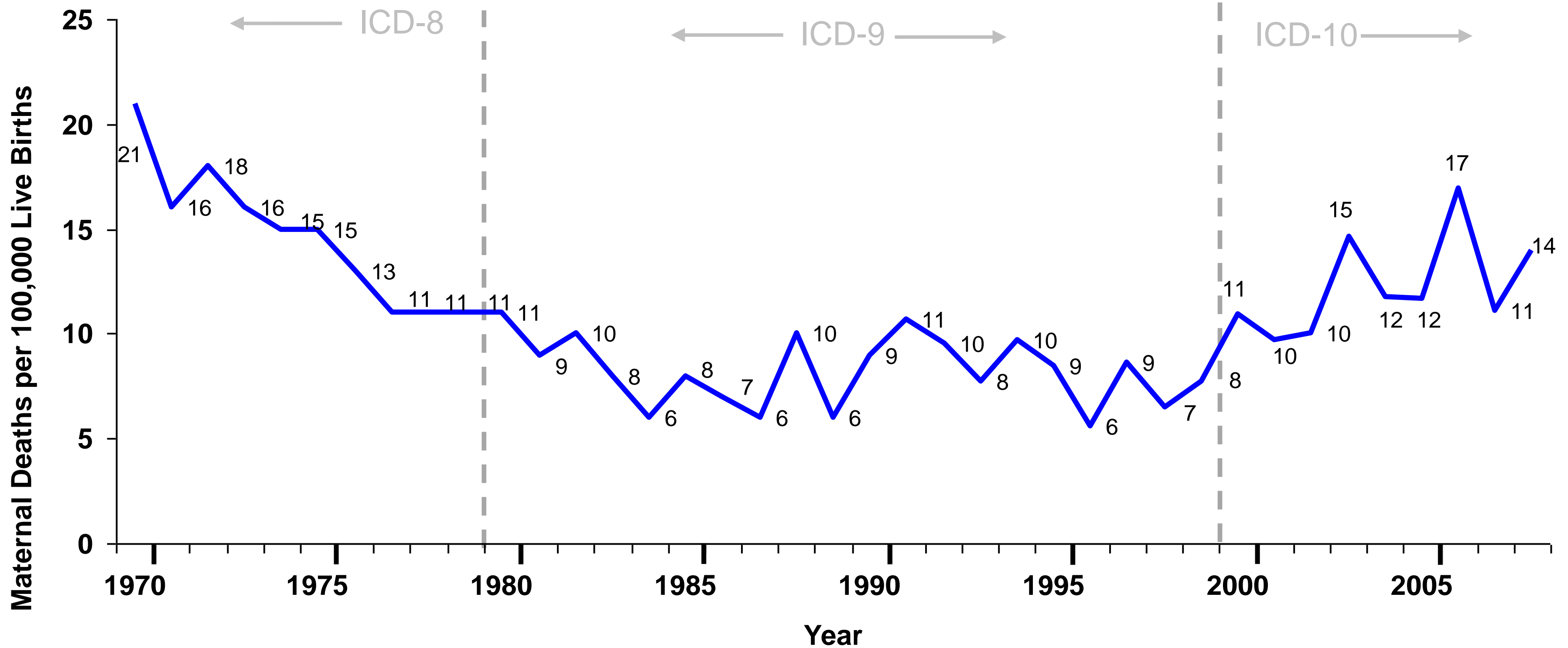
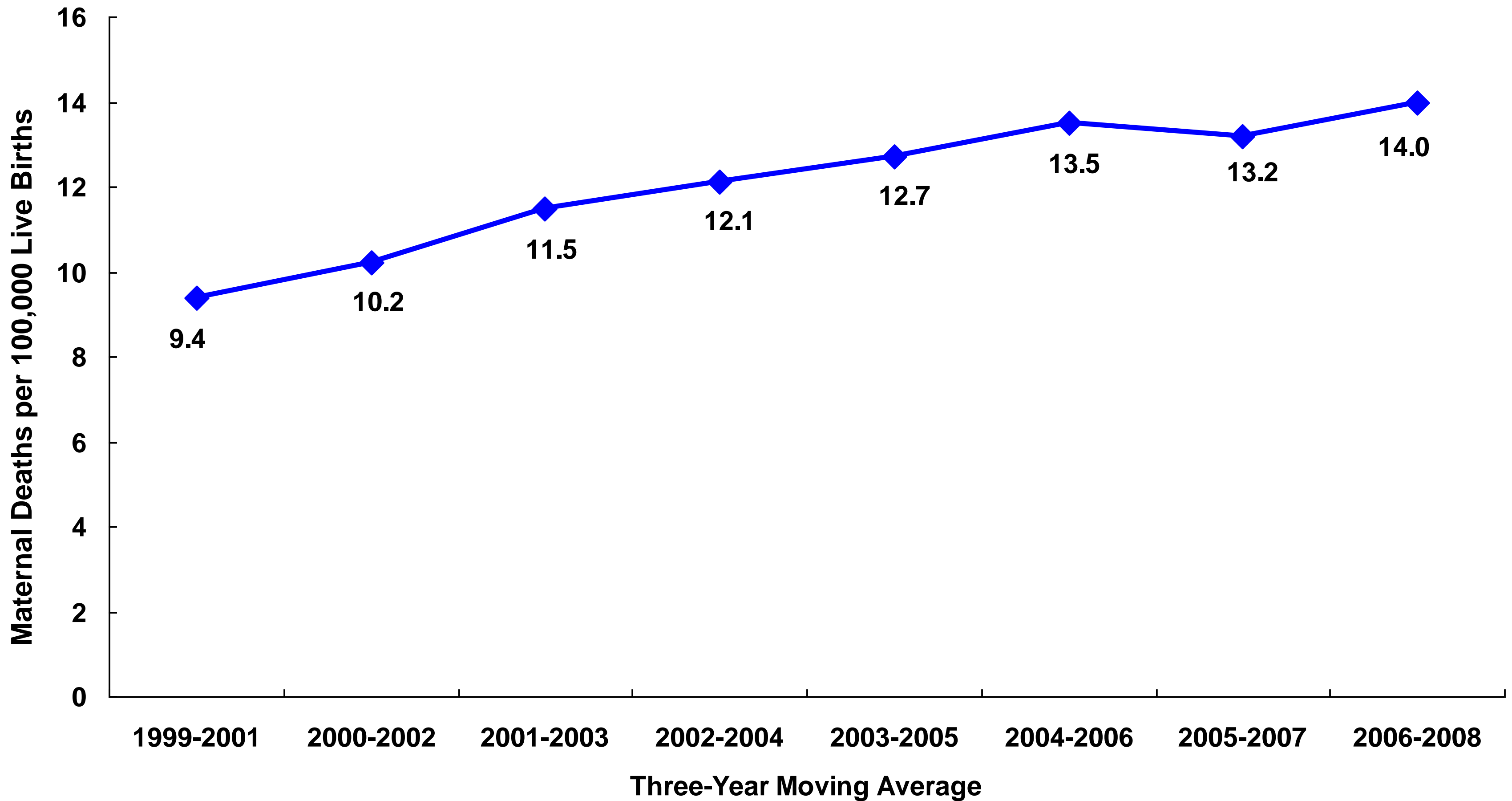


INTERPRETATION: Maternal mortality in California is increasing and is as high as it was in the 1970's. Changes in the coding of maternal deaths on death certificates may account for some (i.e., 30%) of the increase (Hoyert, 2007).

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 2. See Technical Notes (page 55) for full description of calculations and data sources. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

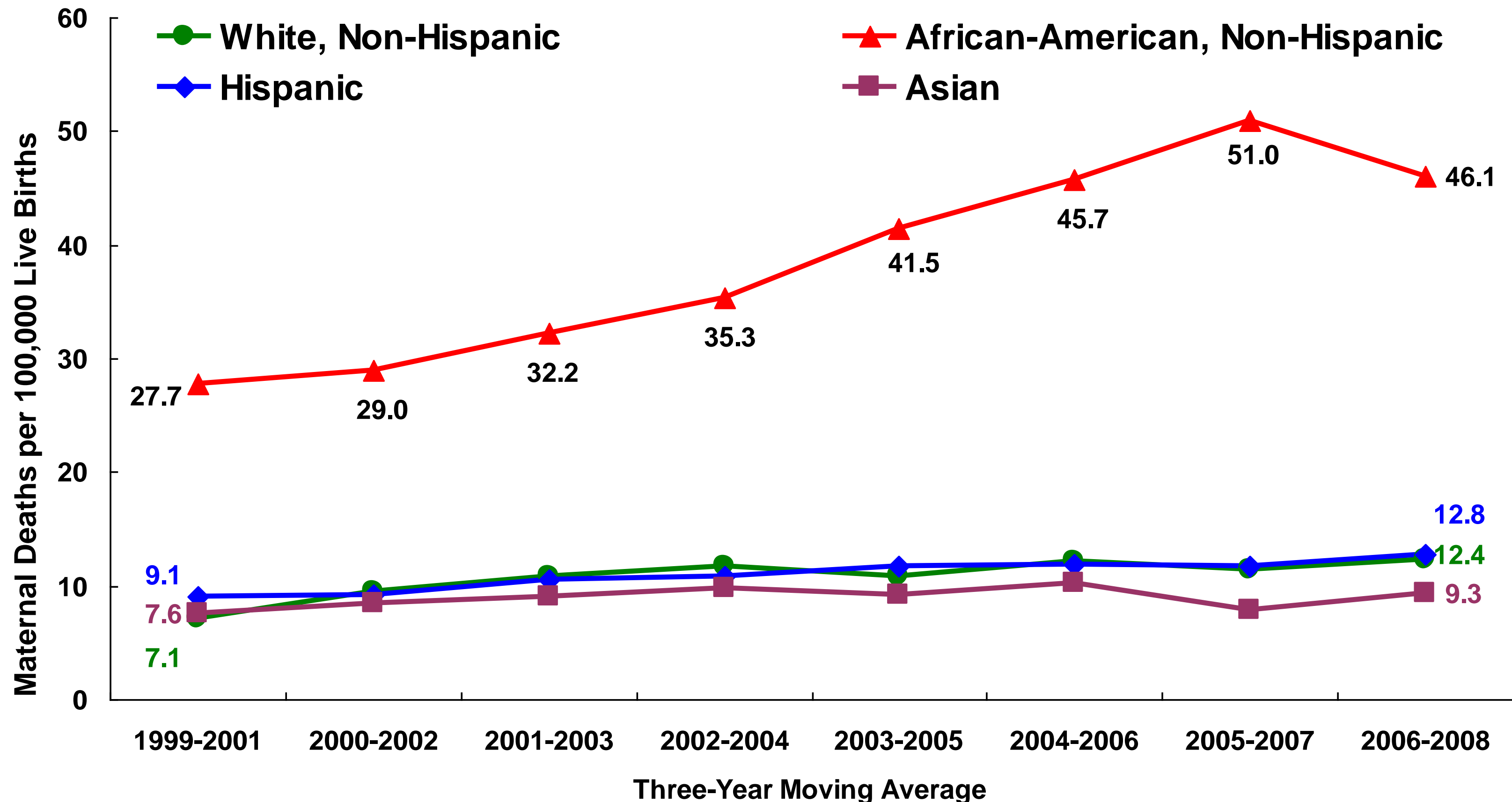
Figure 2. Maternal Mortality Rate, Moving Average, California; 1999-2008



INTERPRETATION: A statistically significant upward trend in maternal mortality rates in California is seen, even after annual fluctuations are smoothed.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 3. See Technical Notes (page 55) for full description of calculations and data sources. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

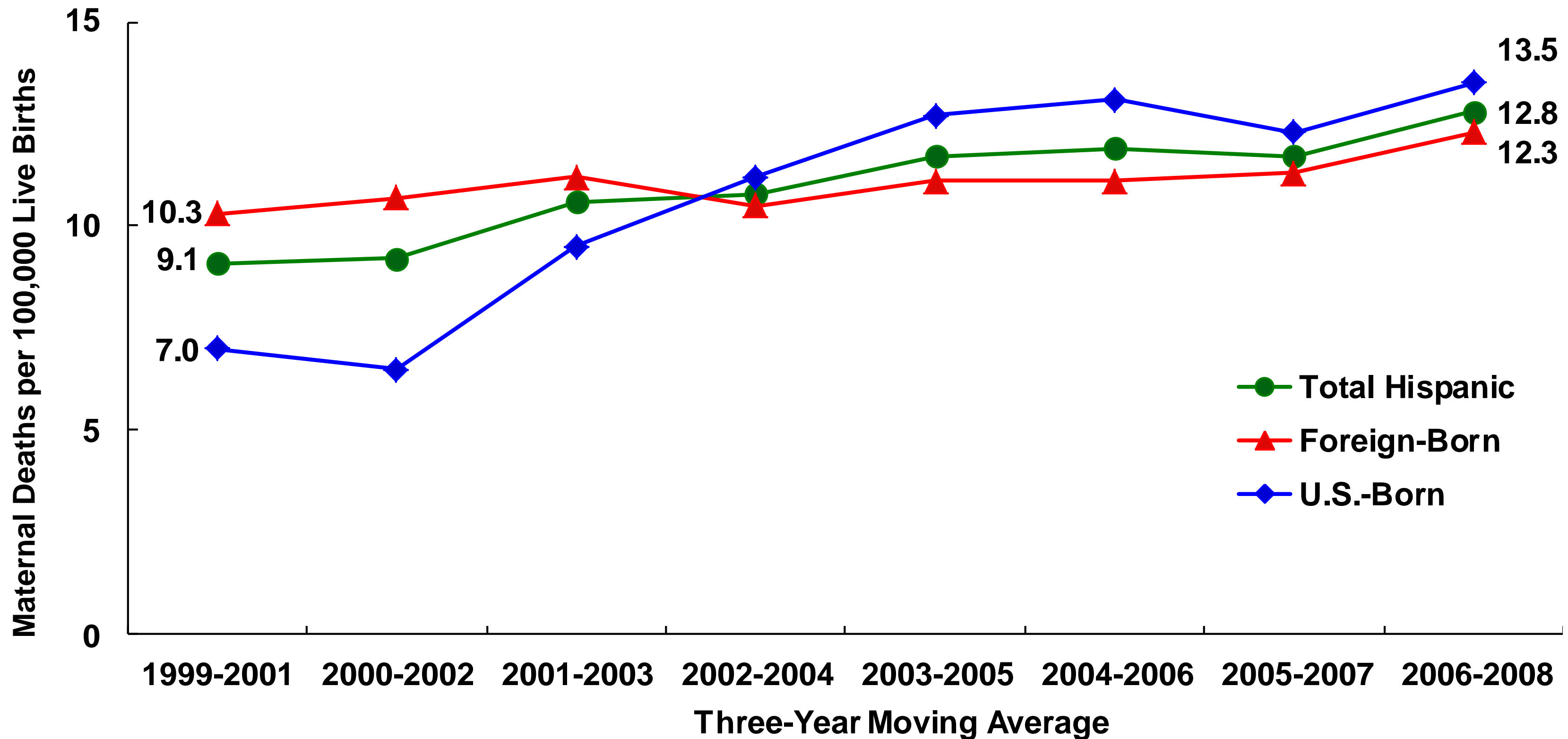
Figure 3. Maternal Mortality Rates by Race/Ethnicity, California; 1999-2008



INTERPRETATION: There is a persistent and widening racial/ethnic disparity in maternal mortality in California.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 4. See Technical Notes (page 55) for full description of calculations and data sources.
http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

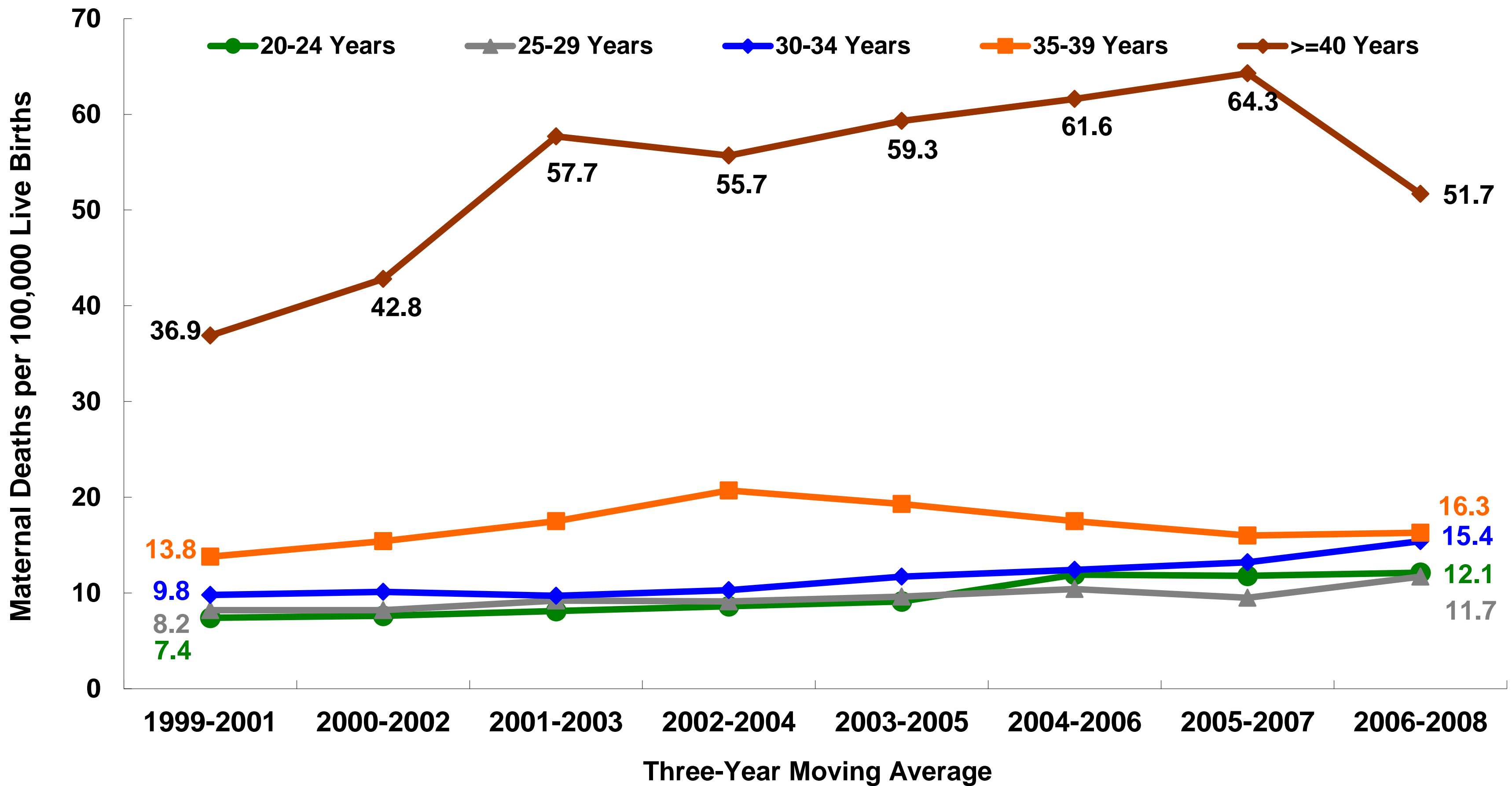
Figure 4. Maternal Mortality Rates for U.S.- and Foreign-born Hispanics, California; 1999-2008



INTERPRETATION: Maternal mortality is also increasing among U.S.-born Hispanics. Over 50% of births in California are to Hispanic women.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 5. See Technical Notes (page 55) for full description of calculation and data sources. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

Figure 5. Maternal Mortality Rates by Age Group, California; 1999-2008



INTERPRETATION: Women over 40 years of age are at higher risk for mortality and have a three-to-four higher risk of death compared to younger women.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 6. See Technical Notes (page 55) for full description of calculation and data sources. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

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Figure 6. Key Steps of CA-PAMR Methodology

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STEP 1: Hospital discharge data linked to birth, death certificates

Identifies women who died within one year postpartum from any cause (*Pregnancy-Associated Cohort*)

STEP 2: Additional data gathered for each death

Coroner Reports, Autopsy Results, and additional information from the Death Certificate (e.g., multiple causes of death, recent surgeries, etc.) are obtained and abstracted.

STEP 3: Cases selected for PAMR Committee review

Documented (ICD-10 obstetric (“O”) code) and suspected pregnancy-related deaths are prioritized for review.

STEP 4: Medical records abstracted and summarized

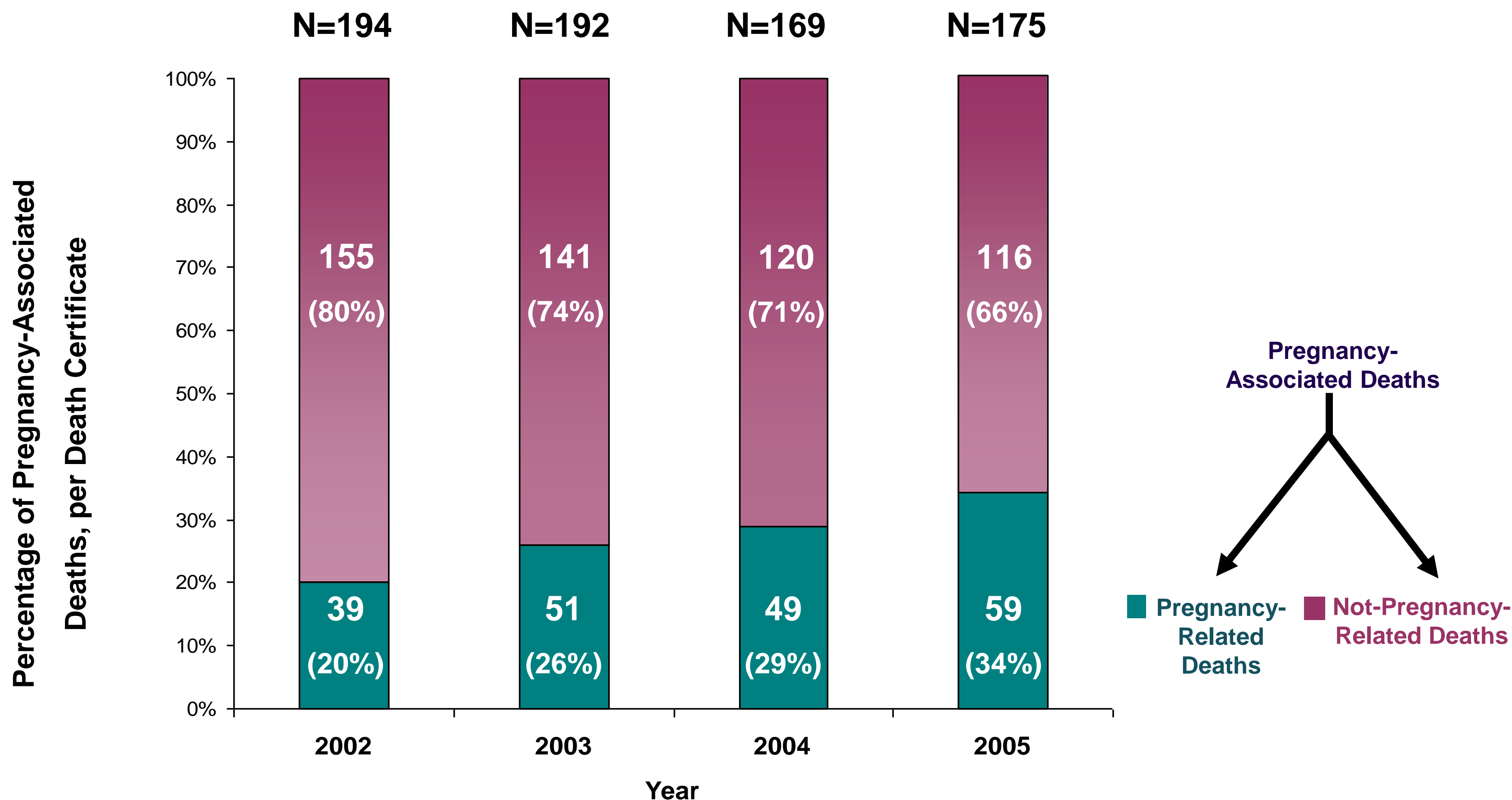
All available labor and delivery, prenatal, hospitalization, transport, and outpatient and emergency department records are obtained and summarized.

STEP 5: Cases reviewed by PAMR Committee

Committee determines whether the death was pregnancy-related, the cause of death, contributing factors and quality improvement opportunities

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 13. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

Figure 7. Pregnancy-Associated Deaths, California, per Death Certificate; 2002-2005



INTERPRETATION: Overall pregnancy-associated deaths (deaths within one year postpartum from any cause) remained fairly consistent from 2002 to 2005, but the proportion of pregnancy-related deaths increased from 20% in 2002 to 34% in 2005.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 20. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

Leading Causes of Pregnancy-Associated Deaths Based on Death Certificates (before CA-PAMR Case Review), California; 2002-2003

Pregnancy-Related
per death certificate
(n=90)

- Preeclampsia/eclampsia (17%)
- Hemorrhage (15%)
- Amniotic fluid embolism (14%)
- Sepsis/infections (7%)
- Venous embolism complications (6%)
- Other complications of labor, delivery and pregnancy, excluding above (41%)

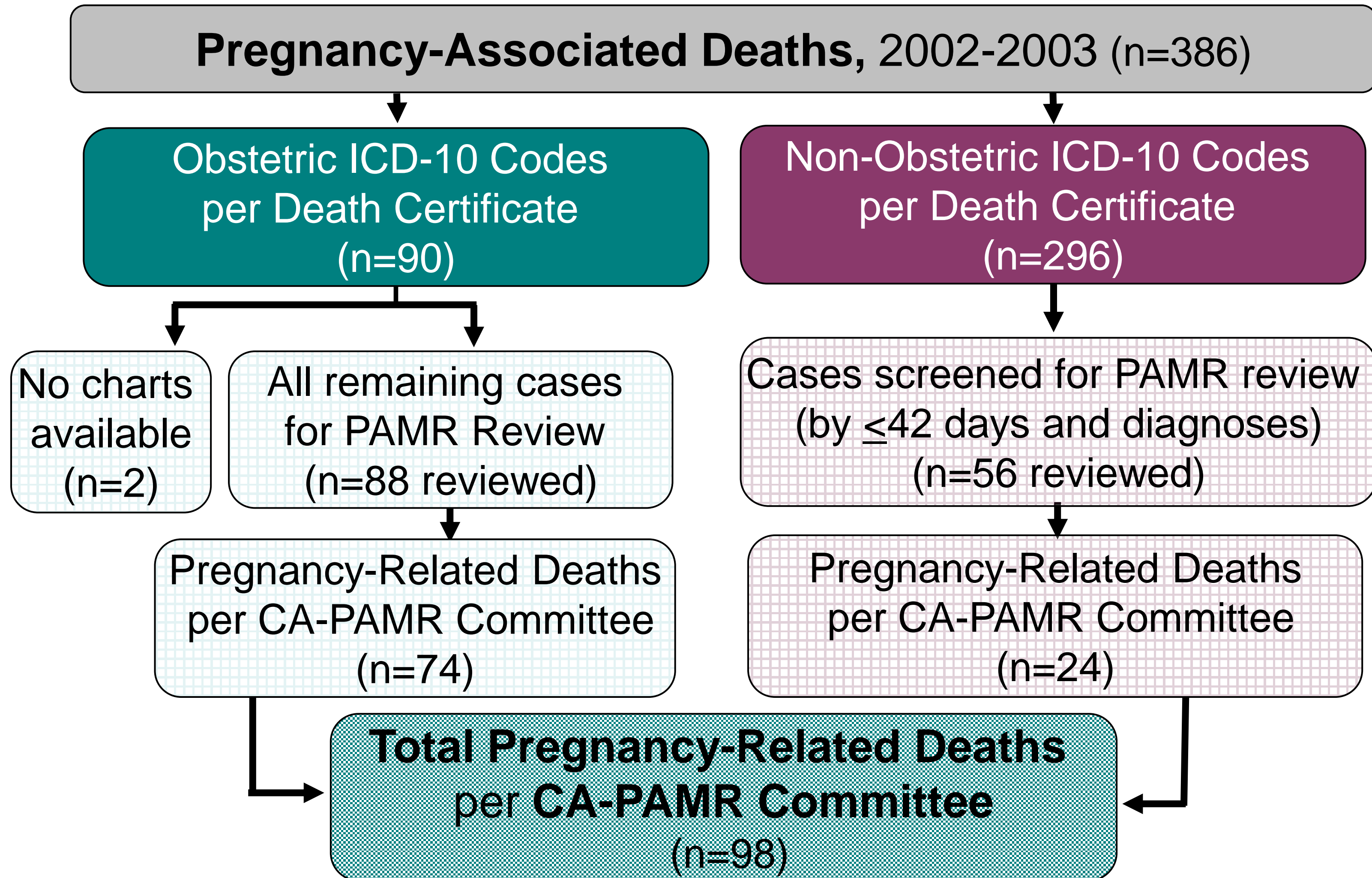
Not Pregnancy-Related
per death certificate
(n=296)

- Motor vehicle crash injuries (21%)
- Violent injuries (homicide and suicide) (16%)
- Cardiovascular disease (16%)
- Cancer or its complications (12%)
- Other unintentional injuries
  (i.e., drug overdose, non-motor vehicle accidents) (8%)

INTERPRETATION: Twenty-three percent (n=90) of pregnancy-associated deaths in 2002-2003 (n=386) were classified as pregnancy-related deaths before CA-PAMR case review. The leading causes of pregnancy-related deaths and not-pregnancy-related deaths in California (shown above) were similar to the causes of death for all women of reproductive age in the U.S. in 2002 and 2003.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; pages 20-21. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

Figure 8. Determination of Pregnancy-Related Deaths by the CA-PAMR Committee upon Case Review, California; 2002-2003



INTERPRETATION: The number of pregnancy-related deaths increased to 98 after the CA-PAMR Committee reviewed all available prenatal, labor and delivery records and coroner and autopsy reports.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; pages 22-23. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

Table 1. Clinical Causes of Death for the 2002-2003 Pregnancy-Related Deaths, per CA-PAMR Committee

Cause of Death	Pregnancy-Related Deaths N (%)
Cardiovascular disease	**20** (20)
Cardiomyopathy	13 (13)
Other cardiovascular	7 (7)
Pre-eclampsia/eclampsia	**16** (16)
Amniotic fluid embolism	**14** (14)
Obstetric hemorrhage	**10** (10)
Sepsis	**8** (8)
Deep vein thrombosis/ Pulmonary embolism	**8** (8)
All other causes	**22** (22)
TOTAL	**98**

INTERPRETATION: Cardiovascular disease became the leading cause of pregnancy-related death in California, in 2002 and 2003 after case review by the CA-PAMR Committee.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 24. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

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Table 2. Demographic Characteristics of Women in the CA Birth Cohort and Pregnancy-Related Deaths, California; 2002-2003

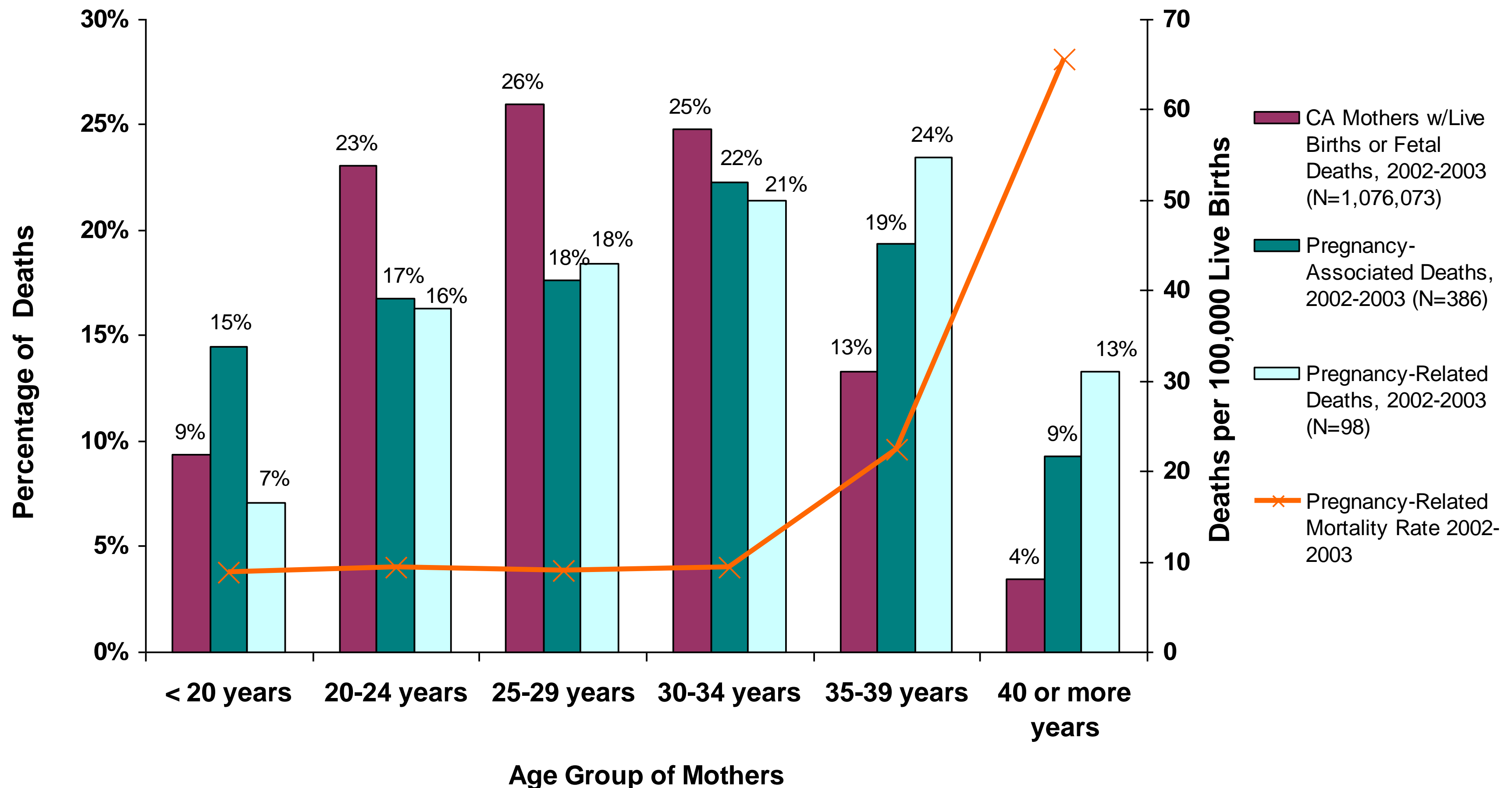
MATERNAL, CHILD, ADOLESCENT HEALTH CA Dept of Public Health

	CA Birth Cohort (N=1,076,073) N (%)	**Pregnancy-Related Deaths** (N=98) N (%)
Marital Status		
Married/Living as Married	**363,601** (69)	**53** (54)
Unmarried	**165,644** (31)	**41** (42)
Payer Source		
Medi-Cal / other government	**486,140** (45)	**56** (57)
Private or self-pay	**585,102** (54)	**39** (40)
Education		
Less than High School	**118,973** (11)	**30** (31)
High School/12th grade	**480,047** (45)	**31** (32)
Beyond High School	**452,321** (42)	**29** (30)

INTERPRETATION: Women with pregnancy-related deaths were less likely to be married or have graduated high school, and were more likely to have delivery services paid by California's public insurance, Medi-Cal.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 26. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

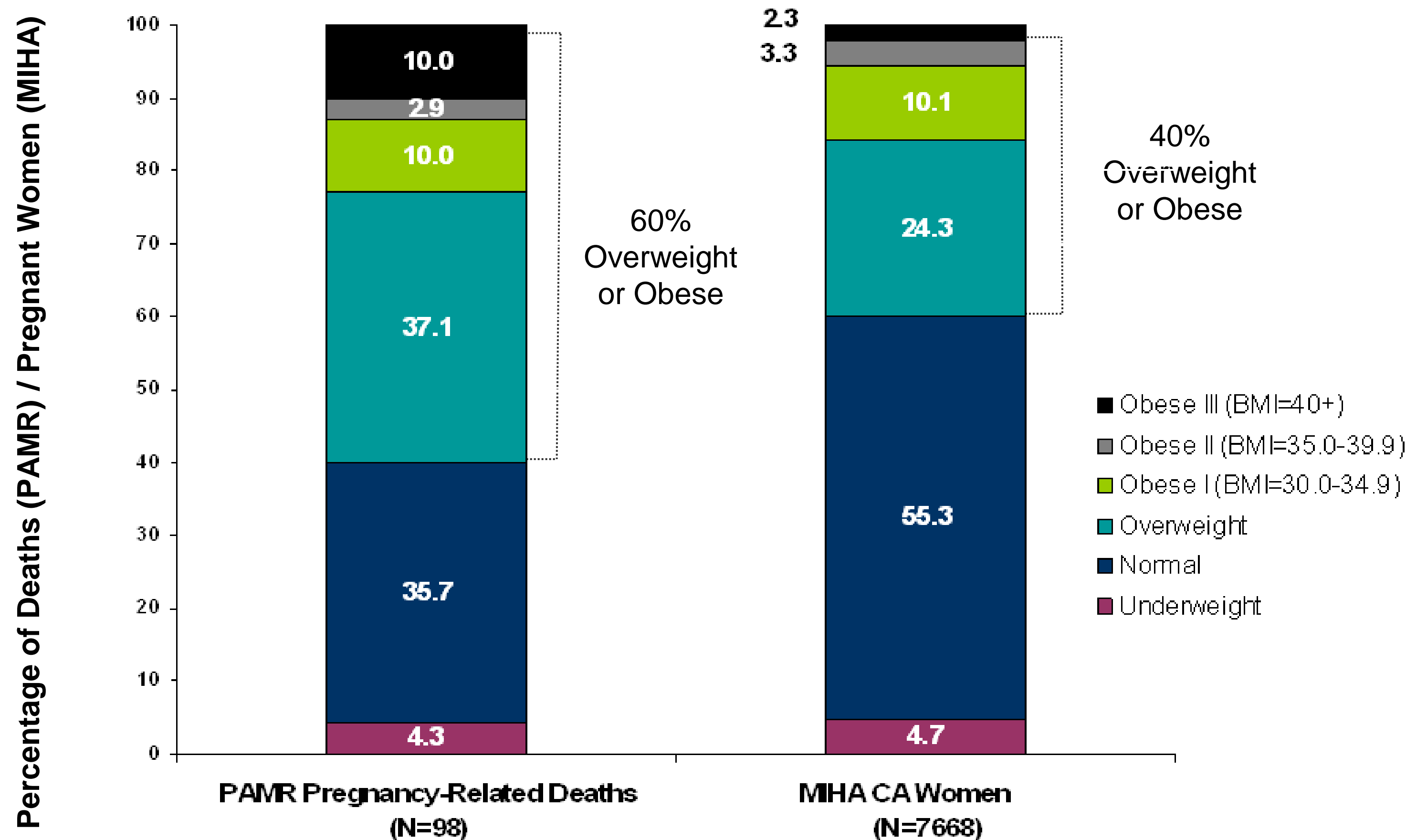
Figure 9. Age of Mother at Death and Pregnancy-Related Death Rates, California; 2002-2003



INTERPRETATION: Mortality rates for women ages 40 years and older are three-to-five time higher than mortality rates for younger women. However, while the greatest relative risk of dying is at the uppermost maternal age group, the highest numbers of deaths (n=161) occur in the 30-39 year old age group.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 27. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

Figure 10. Pre-Pregnancy BMI Status of CA-PAMR Pregnancy-Related Deaths and all Women with Live Births, California; 2002-2003

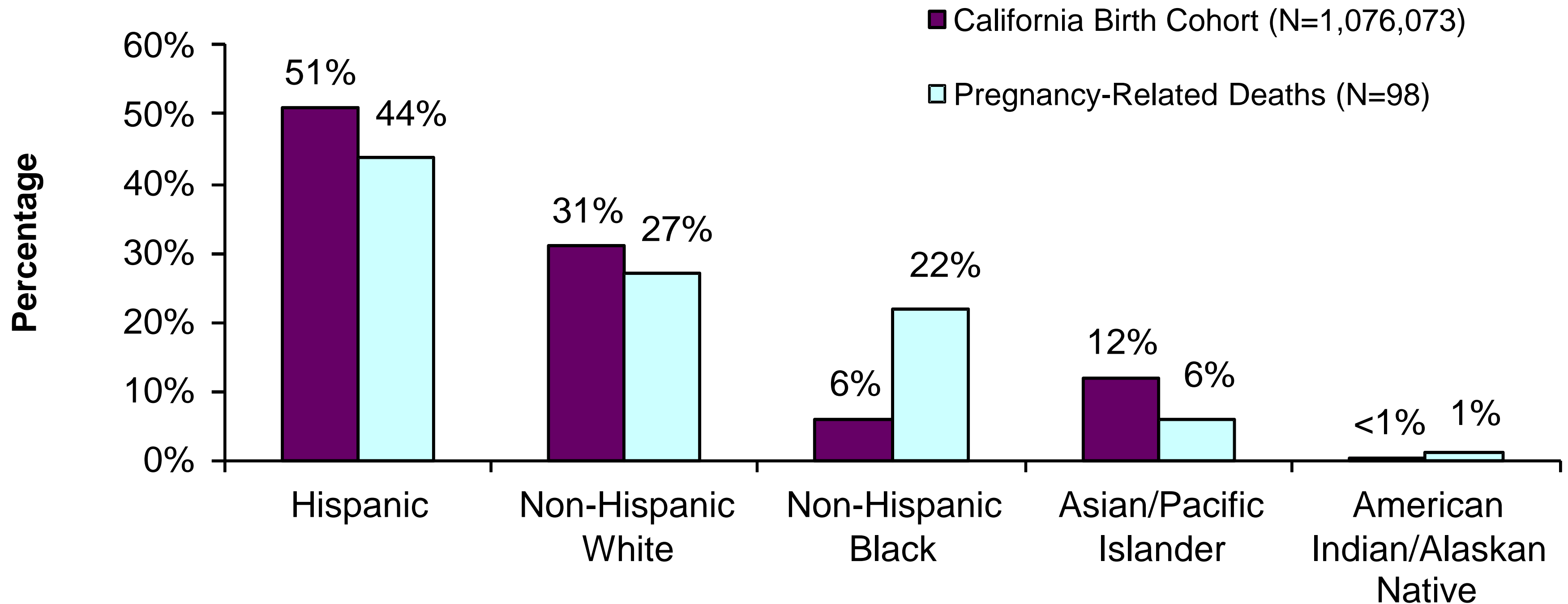


INTERPRETATION: 60% of women with pregnancy-related deaths were obese or overweight pre-pregnancy, compared to 40% of the larger childbearing population (per MIHA*) in California in 2002-2003.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 32. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

* MIHA: The California Maternal and Infant Health Assessment Survey, a survey of over 7000 women who gave birth in California in 2002-2003. MIHA is administered by the MCH Program. More information about MIHA is available at: http://www.cdph.ca.gov/data/surveys/Pages/MaternalandInfantHealthAssessment(MIHA)survey.aspx.

Figure 11. Race/Ethnicity of Pregnancy-Related Deaths and all California Births; 2002-2003

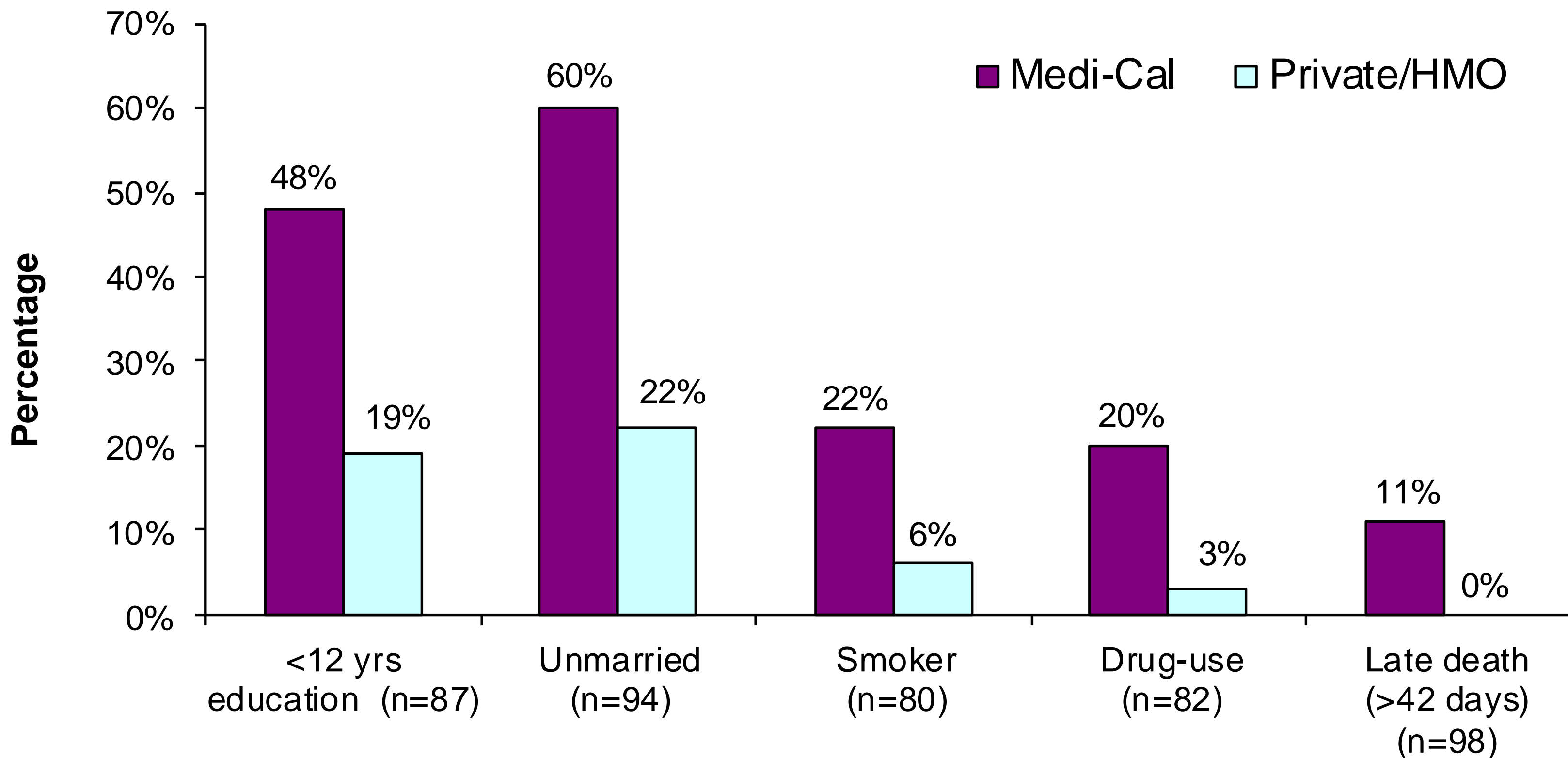


INTERPRETATION: African-American women account for 6% of all California births (and fetal deaths), but constituted 22% of the 2002-2003 pregnancy-related deaths.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 36. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

The California Birth Cohort is comprised of all live births plus fetal deaths (≥20 weeks gestation)in a given year.

Figure 12. Disparities in Payer Source among Pregnancy-Related Deaths, California; 2002-2003



INTERPRETATION: Medi-Cal was the payer source for 45% of women who gave birth in California in 2002-2003, but for 57% of the pregnancy-related deaths (data not shown), indicating that women who died were poorer. Women who died and whose delivery services were paid for by Medi-Cal also had more risk factors, such as lower educational attainment and higher reported substance use.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 39. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf

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Table 9. Chance to Alter Fatal Outcome by Grouped Cause of Death, Pregnancy-Related Deaths; 2002-2003

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Cause of Death	Chance to Alter Outcome				
	Strong/ Good (N)	Strong/ Good (%)	Some (N)	None (N)	Total
Obstetric hemorrhage	7	**70%**	2	1	10
Sepsis/infection	5	**63%**	3	0	8
Preeclampsia/eclampsia	9	**60%**	6	0	15
Deep vein thrombosis/ Pulmonary embolism	3	**37%**	4	1	8
Cardiomyopathy and other cardiovascular	5	**29%**	12	2	19
Amniotic Fluid Embolism	0	**0**	12	2	14
All other causes of death	7	**32%**	8	7	22
Total	**36**	**38%**	**47**	**13**	**96**

INTERPRETATION: The CA-PAMR Committee judged that there was a strong-to-good chance to have altered the fatal outcome in 38% of the pregnancy-related deaths in California in 2002 and 2003. Some pregnancy-related deaths may have had a better chance of being prevented, for example deaths from obstetric hemorrhage, compared to others, such as amniotic fluid embolism.

SOURCE: The California Pregnancy-Associated Mortality Review. Report from 2002 and 2003 Maternal Death Reviews, April 2011; page 47. http://www.cdph.ca.gov/data/statistics/Documents/MO-CA-PAMR-MaternalDeathReview-2002-03.pdf