

MATERNAL MORTALITY IN LOS ANGELES COUNTY 1994-1996

COUNTY OF LOS ANGELES - DEPARTMENT OF HEALTH SERVICES
FAMILY HEALTH PROGRAMS

FETAL-INFANT MORTALITY REVIEW PROJECT
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The national effort to examine infant mortality was spearheaded by Ezra Davidson, MD, as President of the American College of Obstetricians and Gynecologists (ACOG). Dr. Davidson also acts as co-chair of our FIMR Community Advisory Group with Dr. Irwin A. Silberman, Director of Family Health Programs for Los Angeles County Department of Health Services.

Other California FIMR projects were of great assistance in the start-up phase. Because Los Angeles was the last of the initial projects to begin, we benefited from the lessons learned by the pioneers. California DHS MCH Branch staff have worked closely with us, including Ed Graham, Thelma Ellison, Nancy Barrera, Gilberto Chavez, Anna Lopez and Elizabeth Adams.

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Special thanks to the members of the Technical Review Panel (Appendix 1), who have met every month since December 1993, first to review fetal and infant deaths, and for the last two years, to review the very complex and emotionally difficult cases of maternal deaths. Lisa Bollman, Delores Alleyne, Kitty Podolsky, James Ribe, Mark Strassburg, and Jim McGuire gave generously of their time to edit this report.

The Community Advisory Group members (Appendix 2) have guided the FIMR process and disseminated panel findings.

Maternal Mortality in Los Angeles County 1994-96

EXECUTIVE SUMMARY

Since 1992, the California Department of Health Services, Maternal Child Health Branch has provided the County of Los Angeles Department of Health Services with a Federal Title V block grant to fund a Fetal-Infant Mortality Review (FIMR) Project. During 1996-98, a Maternal Mortality Review was requested by the State to be performed under the auspices of this project.

All identified pregnancy-related maternal deaths of Los Angeles County residents that occurred during 1994-96 were reviewed, a total of 63 cases. The purpose of the review was to identify the causes and contributing factors and to find ways to reduce the number of preventable deaths.

During this century, improvements in public health and medical care have made a significant impact on maternal deaths. For example, in 1915, maternal mortality in Los Angeles County was 710 deaths per 100,000 live births, compared to 7.1 maternal deaths per 100,000 live births during 1996 - a vast improvement.

Table A

**Maternal Mortality Rates, Los Angeles County, California, & U.S. (1994-96)
Maternal Deaths per 100,000 Live Births**

	1994	1995	1996
Los Angeles County	13.9	14.9	7.1
California	9.7	8.5	5.6
United States	8.3	7.1	7.6

Table A demonstrates that, although the County maternal mortality rate fell to 7.1 per 100,000 live births in 1996, its rate was still higher than State rate. The County's maternal mortality rate was also higher than the National Year 2000 Objective, which is to reduce maternal deaths in the United States to 3.3 maternal deaths per 100,000 by the year 2000.

The FIMR Public Health Nurse wrote case summaries of abstracted data from death and birth certificates, medical records and coroner's reports removing patient, facility, or provider identifiers. From their review of those case summaries, the FIMR Technical Review Panel, a multi-disciplinary group of health professionals, determined the cause of death, contributing factors, and whether each death was preventable. Based on these data, the panel then developed recommendations designed to reduce the incidence of maternal mortality.

The risks and causes of maternal mortality in this review were similar to other previously reported studies. The three main causes of pregnancy related deaths were hemorrhage, embolism and hypertension. The maternal mortality ratios in our review were higher for:

- women over 30 years of age;
- African Americans;
- women with little or no prenatal care; and
- women with higher numbers of previous live births.

Three-quarters of the deaths had some chance of being prevented. The most commonly cited contributing factors were:

- patients delaying or not seeking prenatal or emergency care;
- health care professionals not recognizing and not properly managing risks;
- diabetes mellitus;
- systemic lupus erythematosus (SLE);
- renal disease;
- hypertension & pre-eclampsia;
- molar pregnancies;
- disseminated intravascular coagulopathies (DIC);
- heart disease;
- failure to consult with perinatologists or other specialists; and
- failure to refer patients to facilities equipped and staffed to handle high-risk pregnancies.

The recommendations of the review panel on how to decrease maternal mortality address many types of contributing factors and deal with all stages of pregnancy from improved women's health care and preconceptional counseling to postpartum education and follow-up. The panel recommended:

- increased services in the areas of family planning, prenatal care, and social services for homeless women;
- specialized prenatal care for substance abusers;
- increased outreach to high-risk women to encourage early and continuous prenatal care;
- case management for high-risk pregnancies;
- improved provider communication;
- improved quality assurance of medical and vital records;
- patient education on danger signs during pregnancy;
- better risk assessment and appropriate level of patient care;
- provider training on management of high-risk conditions of pregnancy and management of obstetric emergencies; and
- formal, multi-disciplinary review of all maternal deaths.

Maternal mortality has decreased greatly in this century; it is a rare occurrence that relatively few obstetricians experience. When it occurs, however, it is a devastating experience for all who are involved. We hope that wide dissemination of this report to health professionals and community-based organizations concerned with improving the outcomes of pregnancy will raise the level of awareness about these potentially improvable factors and contribute to reducing preventable maternal mortality to the lowest possible levels.

INTRODUCTION

History of Los Angeles County FIMR Project

The Los Angeles County Department of Health Services, Family Health Programs received a Federal Title V block grant in 1992 to develop a Fetal-Infant Mortality Review (FIMR) Project, one of thirteen such projects funded through the California Department of Health Services, Maternal and Child Health Branch.

A multidisciplinary Technical Review Panel (TRP) reviewed selected cases of fetal and neonatal deaths for the first three years, in order to identify possible gaps in services which may be amenable to community or government action. The Technical Review Panel consists of 15 professionals in the fields of obstetrics, midwifery, nursing, neonatology, pediatrics, bioethics, social work and public health. (see Appendix 1 for TRP membership)

Staffing for the FIMR Project consists of a project director, who provides overall supervision and administration, a public health nurse, who abstracts vital records, medical records and autopsy reports, and a secretary, who provides office support.

Review of maternal deaths began in 1996 at the urging of the California Department of Health Services Maternal and Child Health Branch and the Centers for Disease Control and Prevention. The FIMR Technical Review Panel reviewed all sixty-three identified maternal deaths in Los Angeles County from the years 1994-1996 in order to examine causes and contributing factors and to seek solutions to any gaps in services or unmet needs which contributed to maternal deaths.

The Community Advisory Group (CAG) has further refined and disseminated recommendations of the Technical Review Panel. In addition to a broad range of professionals on the TRP, members of the CAG represent the fields of education, religion, family planning and come from community-based organizations concerned with perinatal health. (see Appendix 2 for CAG membership)

One recommendation of the CAG was to develop a mechanism for collaborative planning and implementation of public and personal health strategies. From this recommendation and the support of the partners within the CAG, the Los Angeles County Perinatal Health Care Consortium was formed in 1997. The consortium brings together representatives of managed care plans, LA County Public Health Programs and Services, Medi-Cal linked programs and community based organizations concerned with perinatal health. The Perinatal Health Consortium has held several forums to address the public health issues of perinatal care for low-income and often high-risk pregnant women.

Three working groups were formed to develop plans for dealing with high-priority issues identified by the consortium:

- Adverse Perinatal Outcomes of African Americans
- Perinatal Substance Abuse
- In-Utero Transport (Developing a system to ensure delivery in transport to hospitals with the appropriate level of care for mothers and neonates)

Purpose of the Maternal Mortality Review

The purpose of this review is to better understand the scope and nature of the problems of pregnancy-related mortality in Los Angeles County. Reduction of maternal mortality remains an important public health objective. Maternal mortality has been greatly reduced in this century and has become a rare occurrence. However, advances in maternal mortality have slowed or reversed in recent years. The review of maternal mortality is a difficult process. Since maternal mortality is a rare event, it is necessary to utilize a densely populated geographic area in order to find sufficient numbers of cases for patterns to be established. Los Angeles County has a population of over 9 million people and is a suitable site for such a review. In 1915 maternal mortality in Los Angeles was 710 deaths per 100,000 live births (5). The average Los Angeles County maternal mortality for 1994-1996 was 12 deaths per 100,000 live births. The MMR for the US was 8.3 for 1994, 7.1 for 1995, and 7.6 for 1996 (2, 9).

The maternal mortality ratio for black women (34.4 per 100,000 live births) was nearly five times greater than for white women (6.7 per 100,000 live births) during 1994-1996. Healthy People 2000 has objectives of no more than 3.3 maternal deaths per 100,000 live births overall and no more than 5.0 per 100,000 to black women (4). These objectives have obviously not yet been achieved.

A second purpose of the review is to examine the process of reporting pregnancy-related deaths. Several studies have shown that maternal mortality is substantially underestimated in the United States (6,7).

Each maternal death must be considered a sentinel event. For every woman in Los Angeles County who died of pregnancy-related causes, many more had serious complications of pregnancy and many were hospitalized for conditions related to pregnancy. Improvements in perinatal systems to reduce maternal mortality will have the additional effect of reducing pregnancy-related morbidity and hospitalization.

METHODS

Definition of Pregnancy-Related Mortality

The FIMR Project used the Centers for Disease Control definition of pregnancy-related mortality (6). For purposes of this review, a death was considered pregnancy-related if it occurred during pregnancy or within one year of pregnancy termination and resulted from:

- 1) complication of pregnancy itself,
- 2) a chain of events initiated by pregnancy, or
- 3) aggravation of an unrelated event by the physiologic effects of pregnancy.

The California Department of Health Services defines maternal death as a death due to pregnancy, childbirth and the puerperium as identified by the International Classification of Diseases, Ninth Revision (ICD-9) codes 630-676.

Case Identification

An accurate maternal death identification system is necessary to evaluate progress in reducing pregnancy-related mortality. Systemic change can occur through case review. Recent studies show that the actual number of pregnancy-related deaths is significantly higher than the number reported in vital statistics (6,7).

For our review, maternal deaths were identified by Los Angeles County Vital Records staff as the death certificates were processed by the Registrar. Death certificates that mentioned pregnancy or conditions or procedures related to pregnancy were selected for review. Additional cases were identified by the data received for California Vital Records (1). The Vital Records list of deaths uses the ICD-9 coding of causes of deaths.

Table B

	1994	1995	1996	94-96
LA Maternal Deaths	25	26	12	63
LA Live Births	180,394	174,862	168,973	524,229
LA MMR	13.9	14.9	7.1	12.02
CA Maternal Deaths	55	47	30	132
CA Live Births	567,034	551,226	536,628	1,654,888
CA MMR	9.7	8.5	5.6	7.9
U.S. MMR	8.3	7.1	7.6	7.7

For 1996, the project identified 12 maternal deaths. The Los Angeles County Automated Vital Statistics System listed only 5 maternal deaths, using local ICD-9 coding of cause of death. The California Department of Health Services reported 8 maternal deaths in Los Angeles County for 1996. The FIMR Project used two additional methods to identify 1996 cases. Vital Records staff sent death certificates to the project if they mentioned pregnancy or conditions or procedures associated with pregnancy. This method identified a total of 12 cases, but they included four deaths that were not causally related to the pregnancy. Additionally, two student professional workers, using a list of key words related to pregnancy, individually examined 55,579 death certificates to find maternal deaths. They identified three pregnancy-related deaths that no other method had found. ICD-9 codes were not consistent between the California and Los Angeles county DHS systems.

There are several opportunities to miss information about maternal deaths:

- Medical records can be misleading.
- The cause of death written on the death certificate does not always clearly indicate that a death was related to pregnancy.
- Errors in the coding process can obliterate the link to pregnancy.

An example of a coding difference is the case of a woman who died of obstetric hemorrhage with disseminated intravascular coagulopathy due to placental abruption due to cocaine ingestion. The state coded this case as a maternal death, ICD-9 code 641, antepartum hemorrhage, but the local AVSS system did not list it as a maternal death because it was coded 855.2, accidental poisoning by local anesthetic, i.e., cocaine. Sometimes, both the county and the state counted a death as maternal but with very different codes. A woman who died from a pulmonary embolism due to deep vein thrombosis was coded locally as dying of "suspected damage to the fetus from other diseases in mother" and coded by the state as dying of "venous complications in pregnancy and the puerperium."

These cases illustrate the difficulty in accurately identifying maternal deaths. Some states have fields on their death certificates to specify a recent pregnancy so that live birth and fetal death records can be matched with deaths to women of reproductive age to help identify possible pregnancy-related deaths. Medical records can then be reviewed to determine which were pregnancy-associated (time only) and which were truly related to the pregnancy. We recommend adding this field to death certificates.

The FIMR Project compared the number of reported maternal deaths to the number of deaths to women of reproductive age from all causes from 1994-1996. There were 5,206 deaths to Los Angeles County women 15-44 years of age and 63 pregnancy-related deaths from 1994-96 (1.2% of deaths to women of that age group).

Technical Review Panel Process

The FIMR public health nurse prepared a case summary of each maternal death. Information was abstracted from death certificates, coroner's records, and medical records. Data from birth or fetal death certificates and/or infant death certificates was also abstracted. No identifiers of the patients, facilities, or health providers were included in the summaries. On average, four case summaries were reviewed each month by a multidisciplinary Technical Review Panel to determine:

- cause of death;
- contributing factors;
- chance to alter the outcome; and
- recommendations for systems change.

Recommendations to help prevent similar deaths in the future were developed from the case reviews. See Appendix 1 for the form used by the panel to review these cases.

An Epi-Info database was developed with the assistance of Elizabeth Adams, a CDC epidemiologist. Data were coded by FIMR project director and public health nurse. The abstracted data, the Technical Review Panel's findings and recommendations were entered into the database. A subset of the data was cross-coded by epidemiologists at the California DHS to ensure accuracy and consistency.

Data Limitations

The completeness of the reporting of maternal deaths is uncertain. Medical records were of varying accuracy and completeness but often were of poor quality, largely illegible and sometimes contradictory. Vital records were also of varying quality and not consistently coded as to cause of death.

The panel members were aware that the task of examining maternal deaths retrospectively, with the advantage of hindsight, is not the same task as managing the care of a pregnant woman in real time. It is not the intent of the panel or the FIMR Project to assign blame for these deaths but to identify systems gaps that are amenable to action.

Autopsies were performed by either the hospital or the coroner in nearly four fifths of the maternal deaths. Valuable additional information was added to the review process from the autopsy reports. In the remaining fifth, it was sometimes difficult to accurately determine the causes and contributing factors.

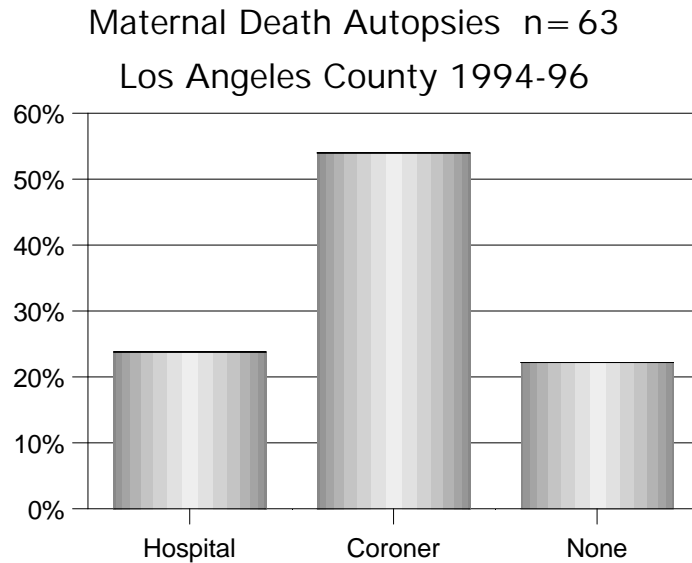


Figure 1 (see Table 1 in Appendix 4)

Three years of maternal deaths were combined in order to see patterns in the data, but with a total sample of only 63 deaths it is still difficult to achieve statistical significance. The information in this report should be considered anecdotal. Since maternal mortality is such a rare event, it is impossible to identify statistically significant findings even in a large urban area over several years. The cases can be treated as paradigms, or sentinels of similar events. H.L. Mencken said, "For every problem there is a solution that is simple, neat and wrong." There is no simple solution to the problem of maternal mortality. It is fortunately a rare event in developed countries and its causes and contributing factors are diverse.

DESCRIPTION OF THE MATERNAL DEATH STUDY POPULATION

Scope of the Problem

During the years 1994 through 1996, 74 Los Angeles County death certificates were brought to the attention of the FIMR Project. Of these, eight deaths were determined not to be pregnancy-related, though they occurred during the pregnancy or within one year of its termination. Additionally, three cases involved residents of other counties. The remaining 63 deaths of Los Angeles County residents were determined to be pregnancy-related. Unless otherwise specified, findings reported here are based on these 63 cases.

Demographics

The total number of identified maternal deaths in 1994-1996 (63 cases) is small. Comparisons between the maternal death cases and all Los Angeles County residents having live births in 1994-1996 do not reach statistical significance. The following comparisons must be used with caution, and are for descriptive purposes only. It is still important to review the data of value to the perinatal community to examine the status of maternal mortality in Los Angeles County.

Among these 63 maternal deaths, there was no typical profile in terms of race, age, education, income, or occupation. The following graphs give background characteristics of the women who died of pregnancy-related causes in Los Angeles County from 1994-96, and of all women who had live births during the same years.

Race

During the years 1994-96 in Los Angeles County the majority (52%) of the maternal deaths (33) were to Hispanics, as were a larger majority of births (61%). There were 7 white maternal deaths (11%), and 19% of live births were to whites. Asians had 8 maternal deaths (13%) and 9% of the live births. There were 15 black maternal deaths (24%) but only 9% of the live births were to blacks. Blacks had the greatest overrepresentation in the maternal deaths.

Race of Maternal Deaths & Live Births
Los Angeles County 1994-96

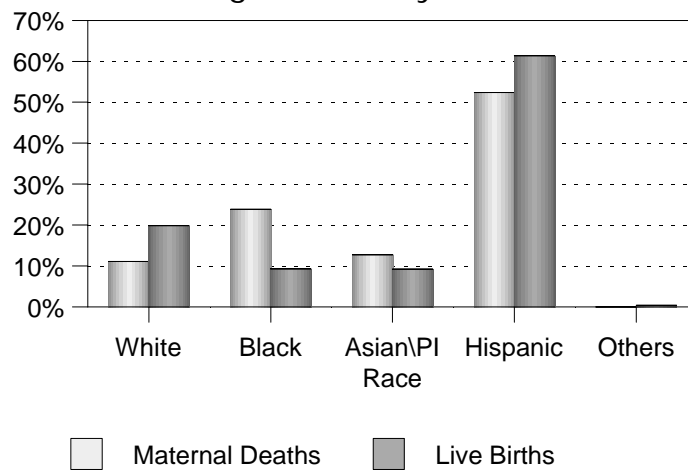


Figure 2 (see Table 2 in Appendix 4)

Age

Women who died of pregnancy-related causes were older than women who gave birth. The majority of women who died were over 30 years of age, while the majority of women who had live births were under 30 years old.

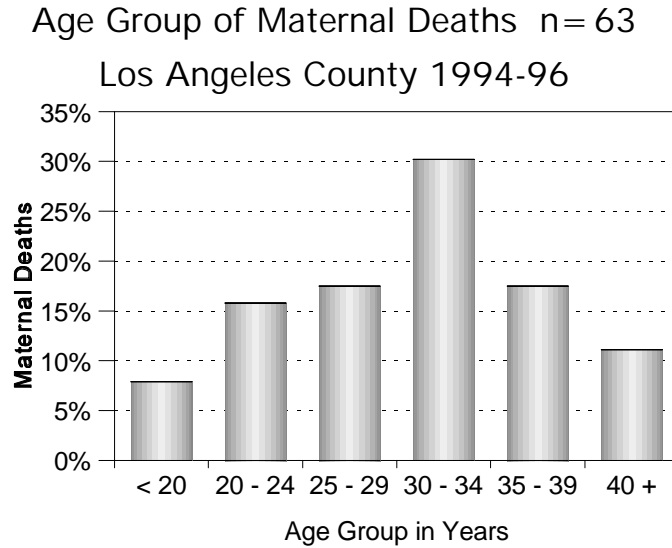


Figure 3 (see Table 3 in Appendix 4)

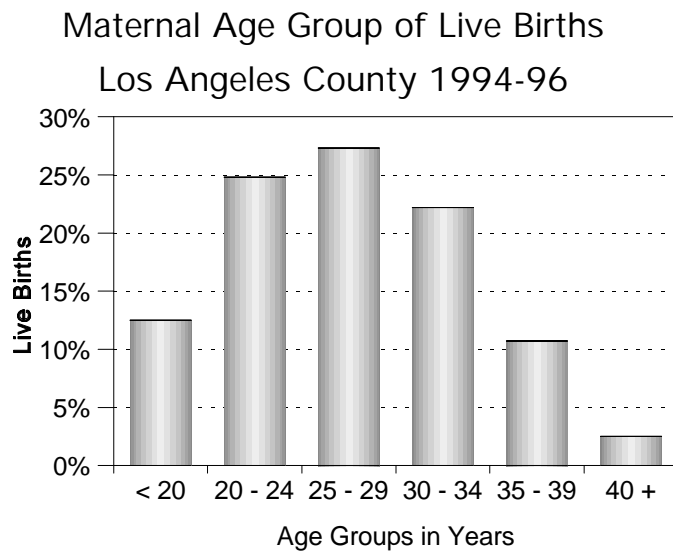


Figure 4 (see Table 4 in Appendix 4)

Education Level

The educational level of women in both groups was very similar. The proportion of women who had less than twelve years education was larger than the proportion of women with either 12 years education or greater than 12 years education. This is largely driven by the fact that 62% of Los Angeles County births are to Hispanics, who have the lowest education levels.

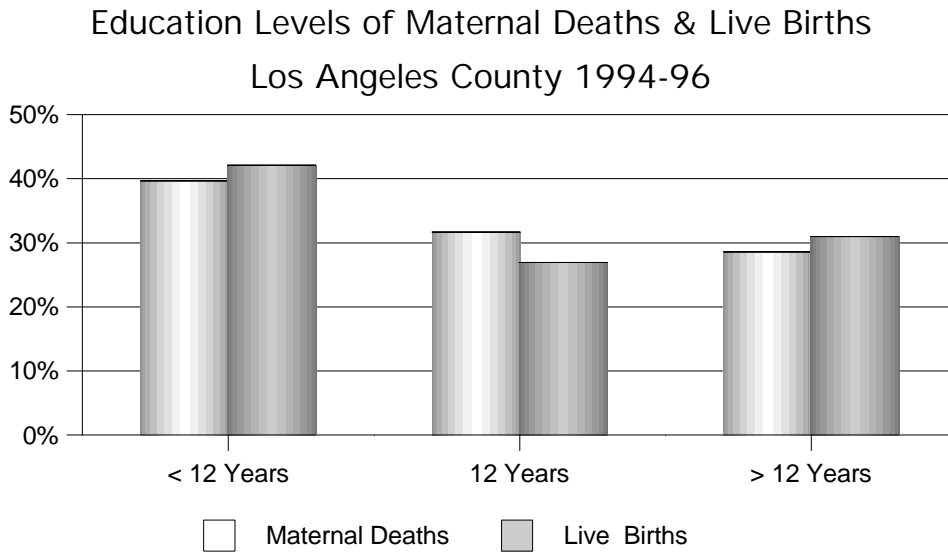


Figure 5 (see Table 5 in Appendix 4)

Education Level by Race

Hispanics had the lowest educational level of all races in both groups. In the maternal death cases, the percentage of Hispanic maternal deaths who had less than a high school education was 40%, compared to 60% of Hispanics who had live births.

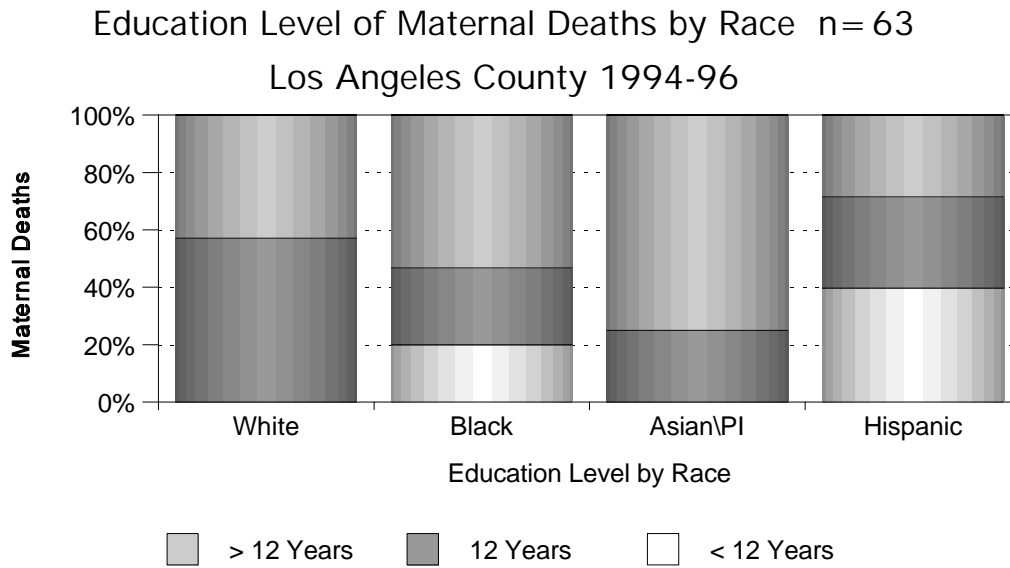


Figure 6 (see Table 6 in Appendix 4)

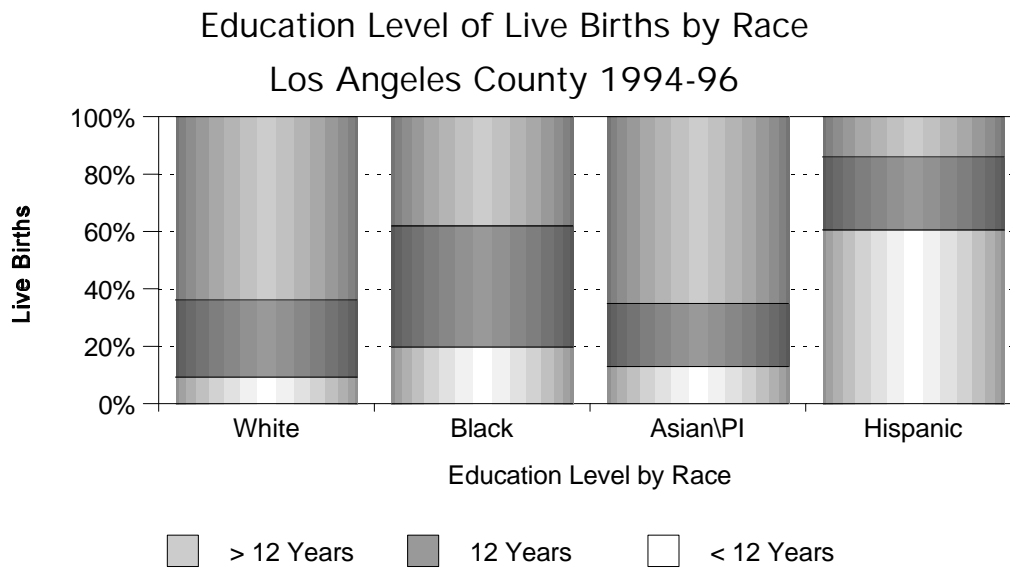


Figure 7 (see Table 7 in Appendix 4)

Marital Status

A higher percentage of women who died were unmarried than of women who gave birth.

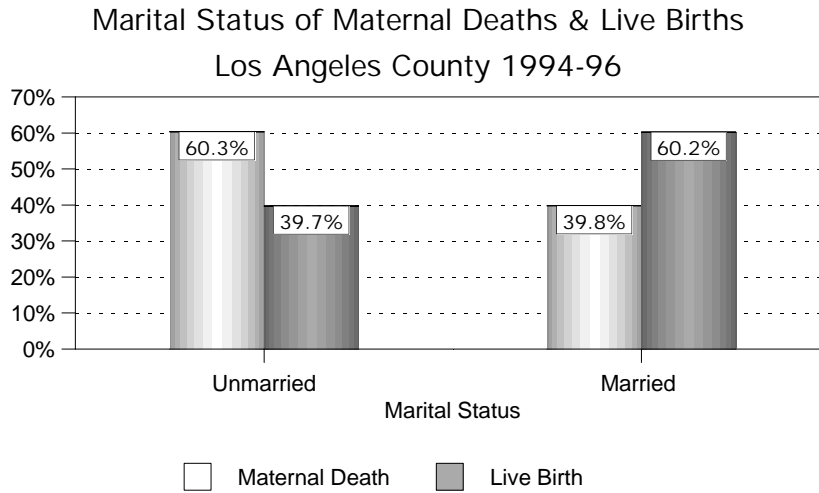


Figure 8 (see Table 8 in Appendix 4)

Marital Status by Race

A higher percentage of blacks were unmarried than of other races in both groups.

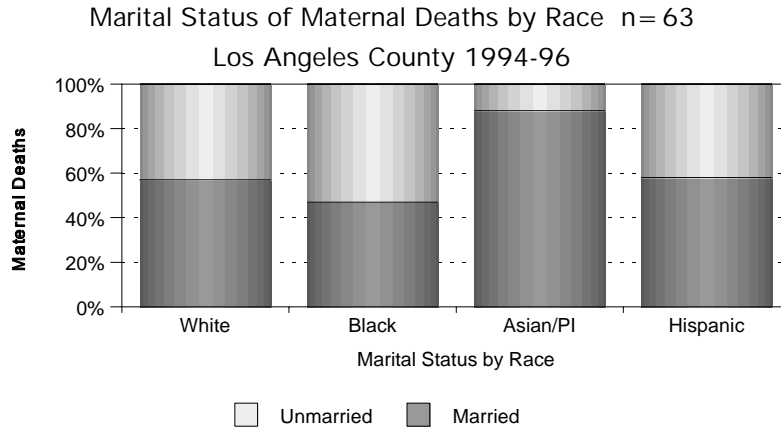


Figure 9 (see Table 9 in Appendix 4)

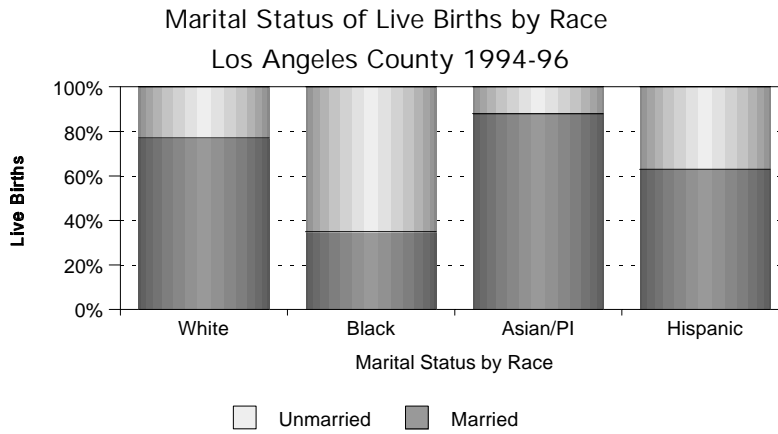


Figure 10 (see Table 10 in Appendix 4)

Occupation

The majority of the maternal deaths were to women who were homemakers. No comparable information was available from the Los Angeles County birth certificates for the years 1994-96.

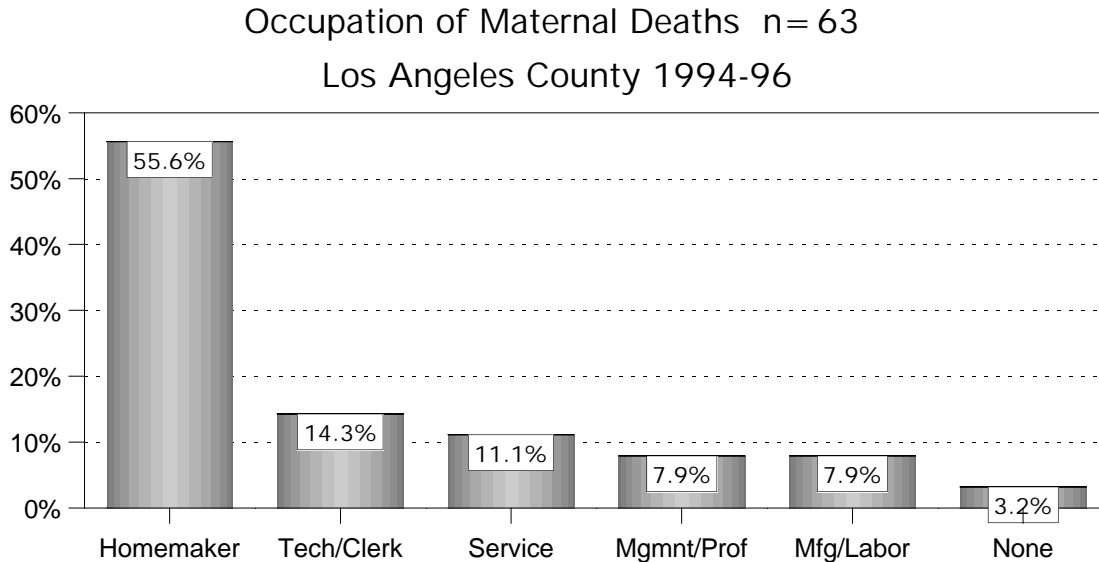


Figure 11 (see Table 11 in Appendix 4)

Source of Payment for Delivery

The source of payment for delivery was used as a proxy for mother's income. Medi-Cal was the most common source of payment, accounting for more than half of the deliveries in both the maternal death and live birth groups. Hispanics had the highest number of deliveries paid for by Medi-Cal in both groups. There were no significant differences in payment source between the two groups.

Delivery Payment Source of Maternal Deaths by Race n= 63
 Los Angeles County 1994-96

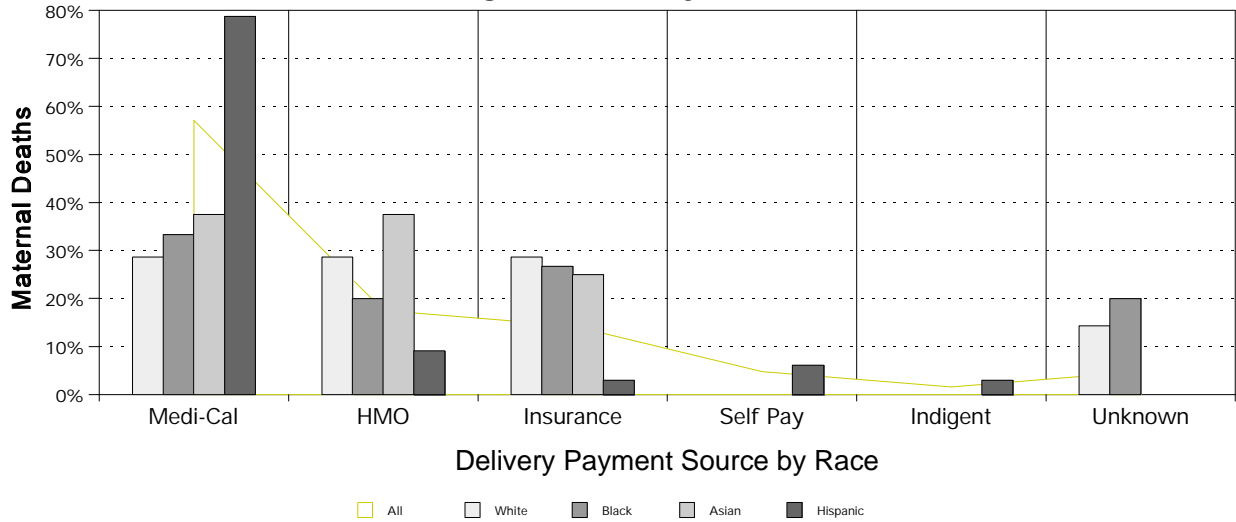


Figure 12 (see Table 12 in Appendix 4)

Delivery Payment Source of Live Births by Race
 Los Angeles County 1994-96

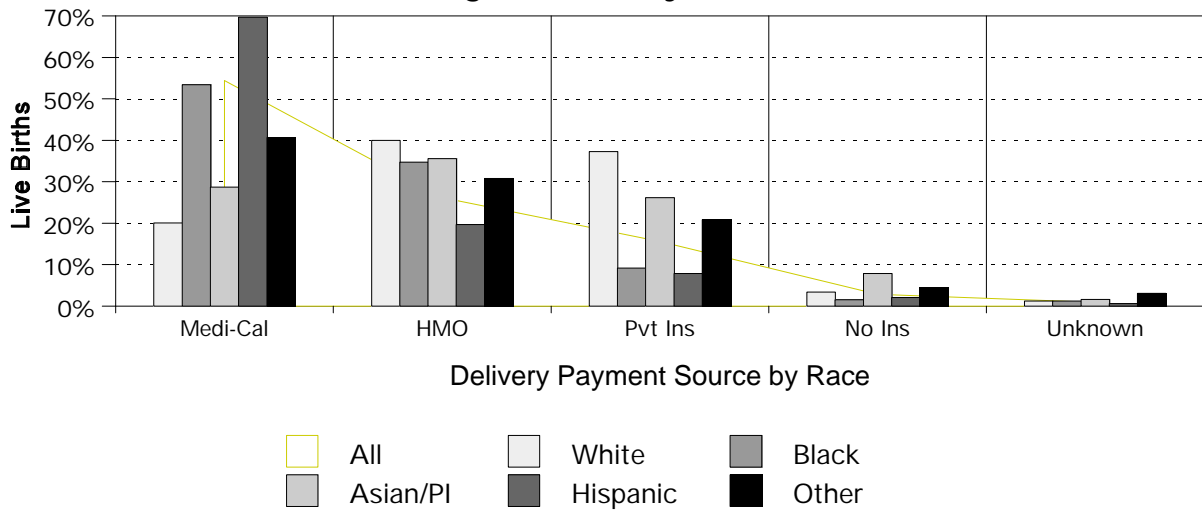


Figure 13 (see Table 13 in Appendix 4)

Mother's Birthplace

Most of the women in both the maternal death and live birth groups were born in the US, with important numbers of women born in Mexico and Central America. Women born in Central and South America as well as Koreans were classified as "Other" in the coded version of the birth certificate data available from the State vital records tape. No significant differences were noted for mother's birthplace between the maternal death cases and Los Angeles County births as a whole during 1994-96.

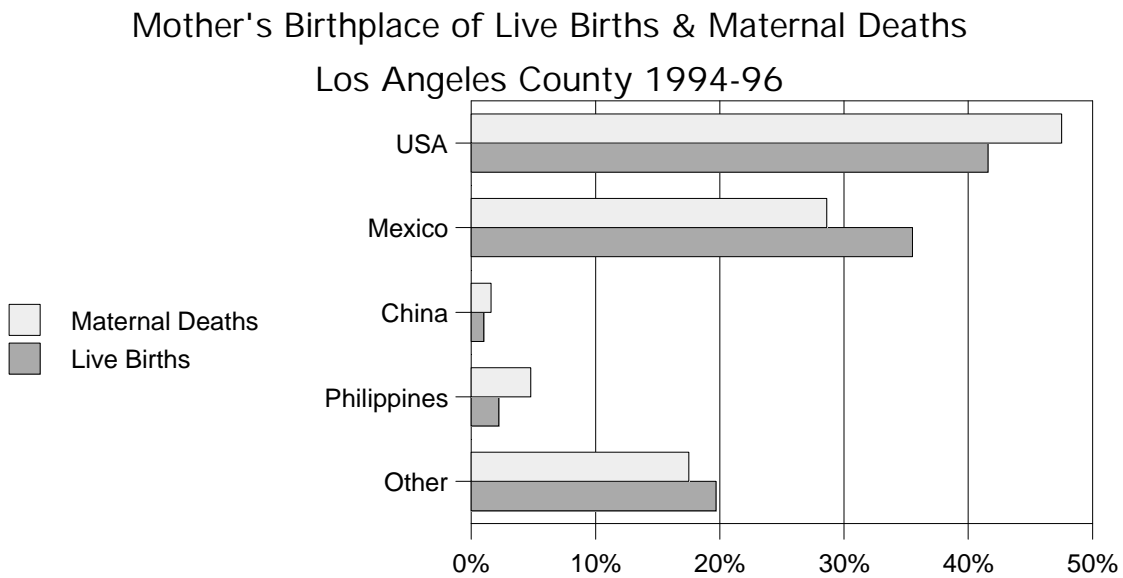


Figure 14 (see Table 14 in Appendix 4)

Outcomes of Pregnancy

More than seven in ten of the 63 maternal deaths were associated with live births (45). Other pregnancy outcomes were: seven stillbirths, five undelivered at the time of maternal death, three ectopic pregnancies, two abortions, and one molar pregnancy.

Pregnancy Outcomes of Maternal Deaths n= 63
Los Angeles County 1994-96

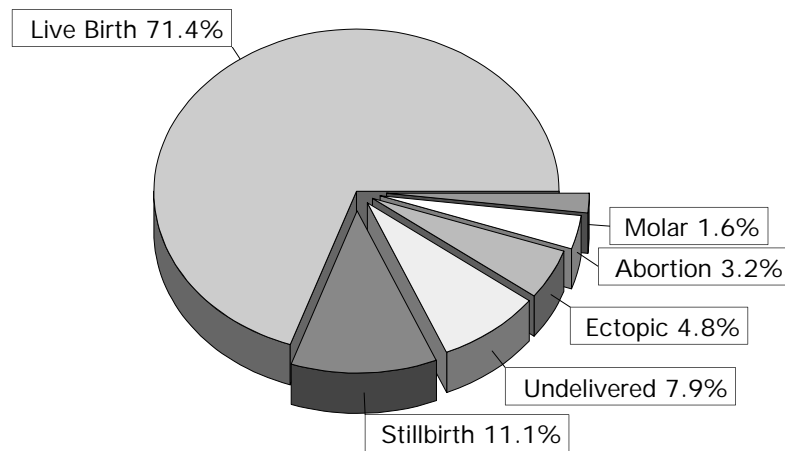


Figure 15 (see Table 15 in Appendix 4)

Infant Outcomes

Pregnancies in 52 of the 63 maternal mortality cases reached 20 weeks gestation.

- Of the 45 live births:
 - 28 were term with 27 of those surviving until hospital discharge.
 - 17 were preterm, with 15 surviving until discharge.
- Of the 7 stillbirths, 5 were preterm.
- The remaining 18 cases were below 20 weeks gestation at the time of maternal death.

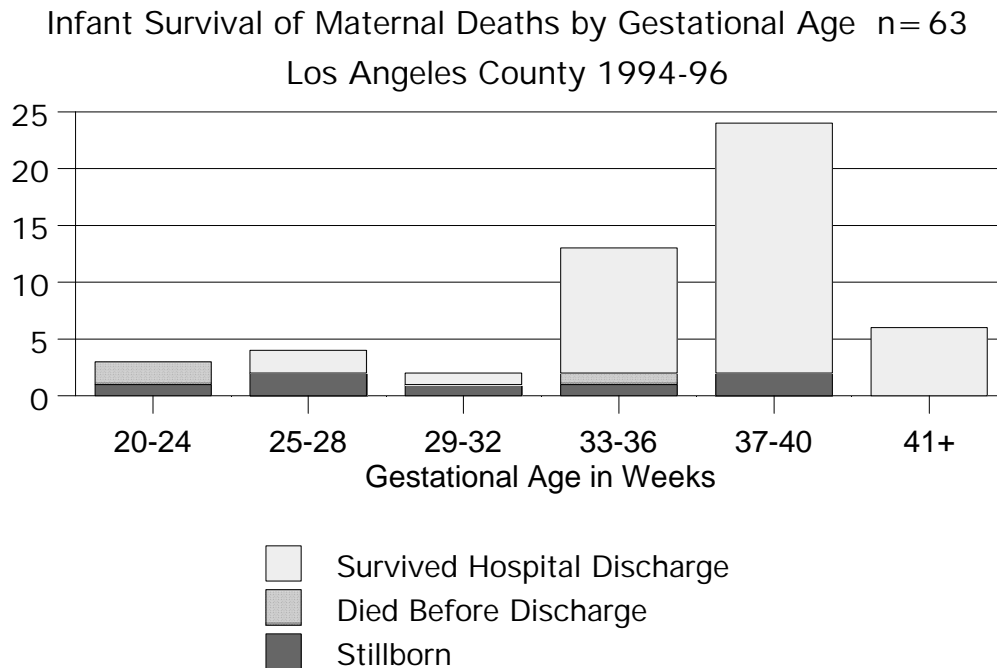


Figure 16 (see Table 16 in Appendix 4)

Interval Between Delivery and Death

The FIMR Project review included pregnancy-related deaths up to one year after termination of the pregnancy. The vast majority of all maternal mortality cases occurred in the first hours to days following the delivery or termination of the pregnancy. Nearly three quarters of the deaths occurred within the first week, with only four cases (7%) occurring after thirty days. Late maternal death (after 30 days) was caused by sepsis (1), intracranial hemorrhage due to hypertension (1), postpartum cardiomyopathy (1), and complications of systemic lupus erythematosus (1).

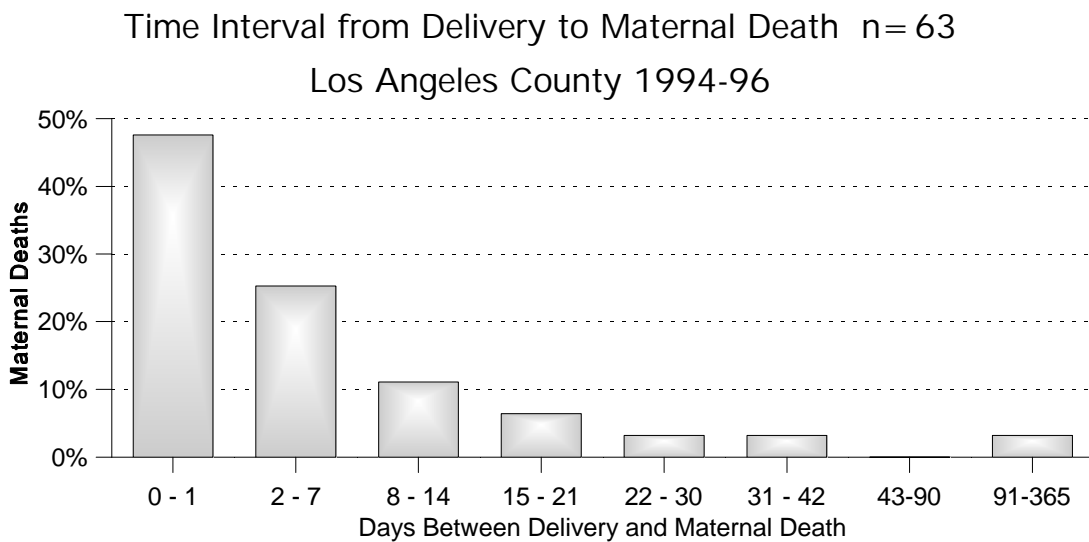


Figure 17 (see Table 17 in Appendix 4)

MATERNAL DEATH RISK FACTORS, CAUSES, AND ASSOCIATED CONDITIONS

Risk Factors

Race as a Risk Factor

The risk of pregnancy-related mortality varies greatly by race. Although most of the maternal deaths in Los Angeles during 1994-96 were to Hispanics (52.4%), most of the births during the same years were also to Hispanics (61.3%). The number of black maternal deaths was smaller than the number of Hispanic maternal deaths; black women, however, had the highest maternal mortality ratios of any racial group. The maternal mortality ratio (MMR) is the number of pregnancy-related deaths per 100,000 live births. An earlier study of Los Angeles County maternal deaths found the observed risk of maternal mortality was three times greater for blacks than for whites for the years 1986-1989 (5). In this FIMR Project review, the observed risk was nearly five times greater for blacks than for whites. This is similar to the pattern found by national studies (6).

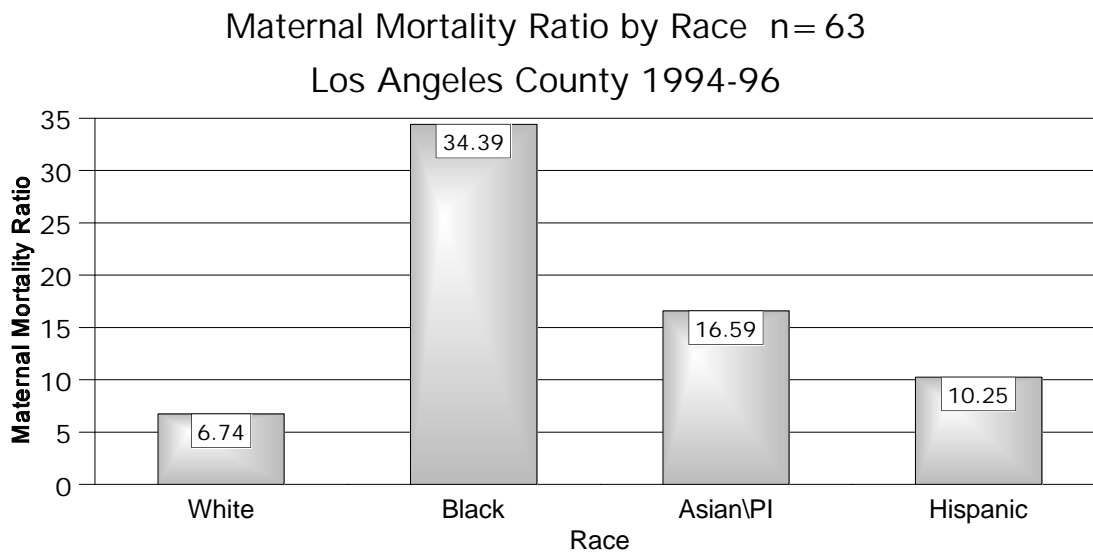


Figure 18 (see Table 18 in Appendix 4)

Age as a Risk Factor

It is well documented that the risk of maternal death increases sharply after age thirty, and even more strikingly after age forty (5,6). In the FIMR Project review, nearly two thirds of all maternal mortality cases were found in women over 35 years of age. The maternal mortality ratio (MMR) for women under age 30 was 7.7. For the 30-34 age group, the MMR more than doubled to 16.4 and increase to 19.5 for the 35-39 year age group. The highest risk of all was in the forty and older group, 53.7 MMR.

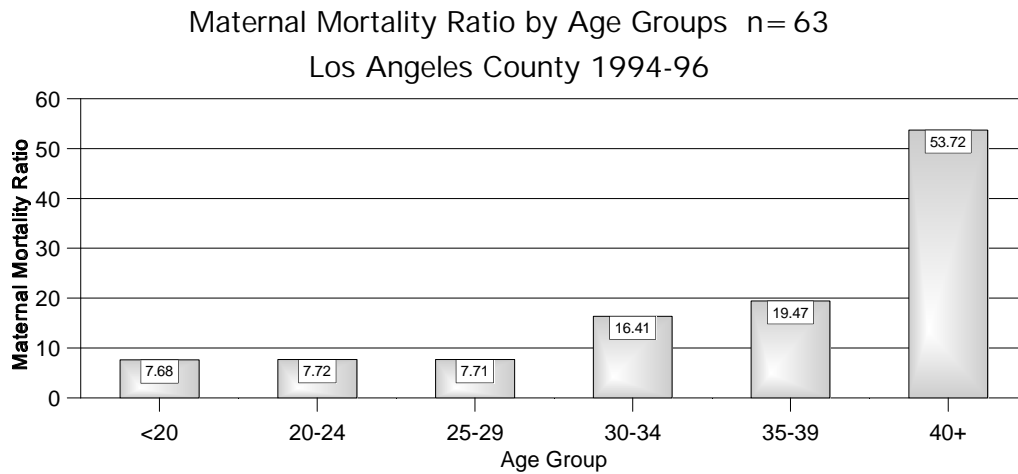


Figure 19 (see Table 19 in Appendix 4)

Comparison of the observed risk by age group for Los Angeles County 1994 and USA 1987-90 shows a very similar pattern of increased risk with age.

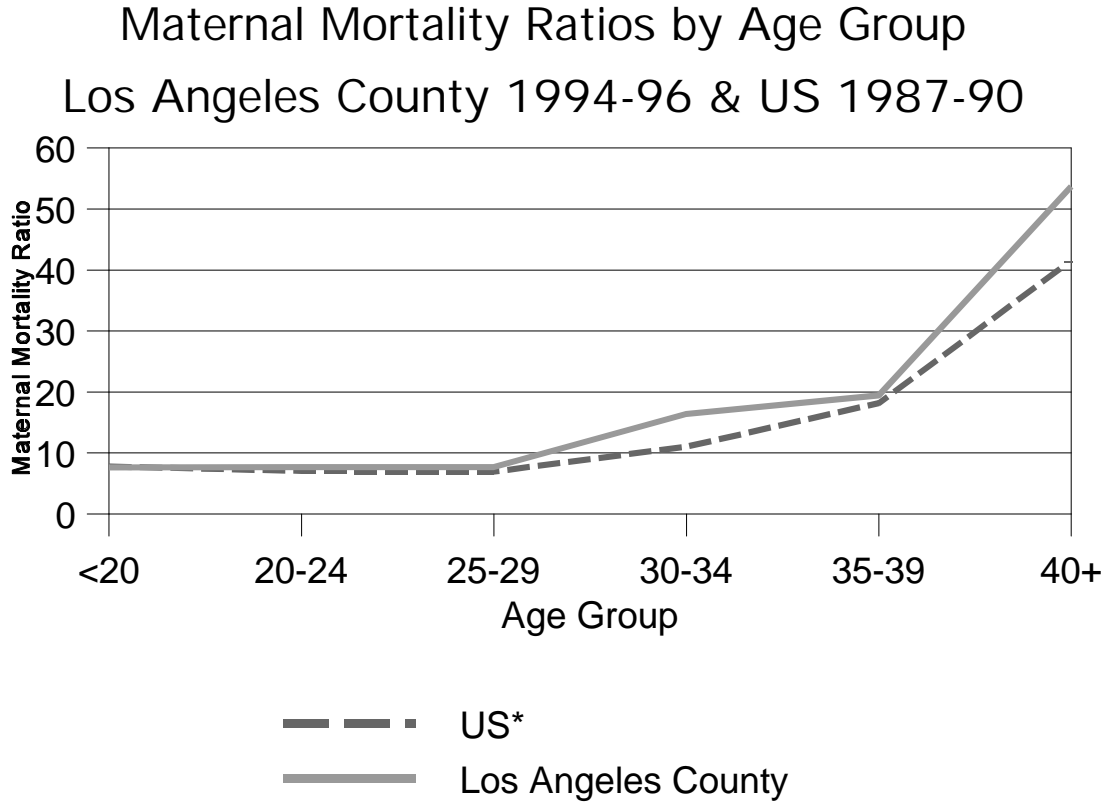


Figure 20 (see Table 20 in Appendix 4)

*US Data from MMWR 46:SS-4, 8/8/97

Live Birth Order as a Risk Factor

In previous studies, the risk of maternal death has been found to increase with live birth order, independent of maternal age (6). This is the number of times a woman has had a live birth, including the pregnancy associated with the maternal death. We compared live birth order of the women who had a pregnancy-related death to live birth order of all women who had a live birth in Los Angeles County during 1994-96. The number of maternal deaths was too small in our data to control for age but our data generally followed the national pattern of increased observed risk with increasing live birth order.

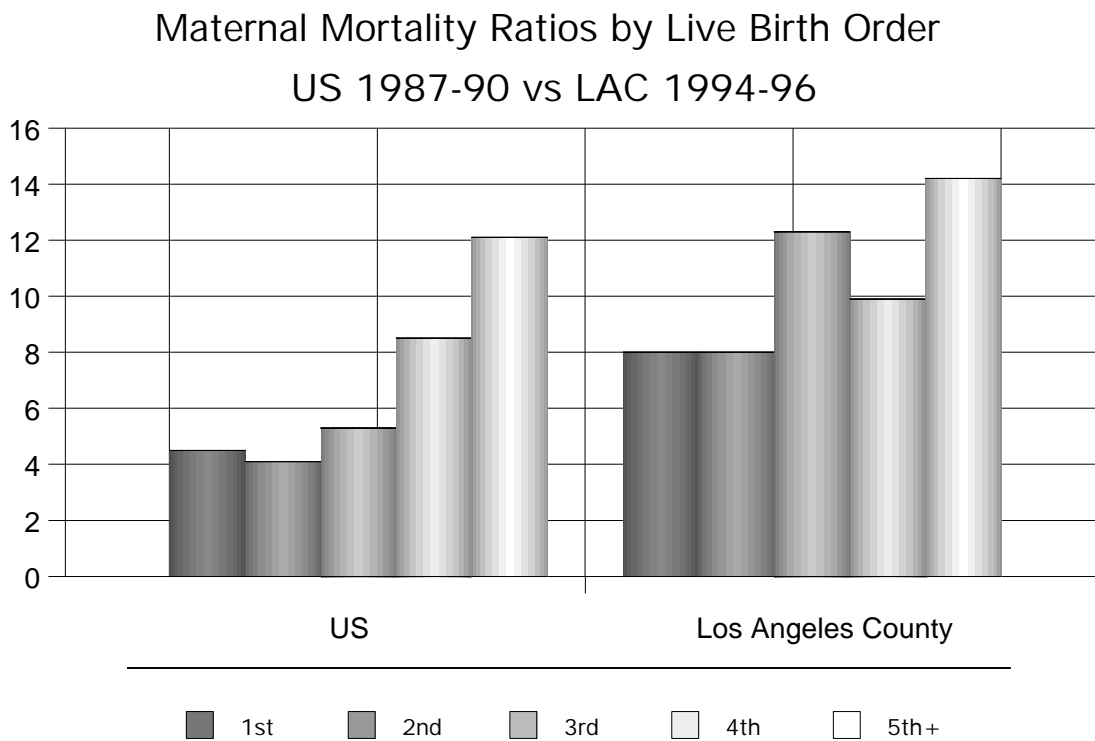


Figure 21 (see Table 21 in Appendix 4)

First Trimester Prenatal Care

The Year 2000 objective for early prenatal care is for 90% of pregnant women to enter prenatal care in the first trimester (1). Overall, 78.13% of women who gave birth in Los Angeles during this time period began care in the first trimester (1). Of those mothers who died after the first trimester, only 48.3% began care in the first trimester.

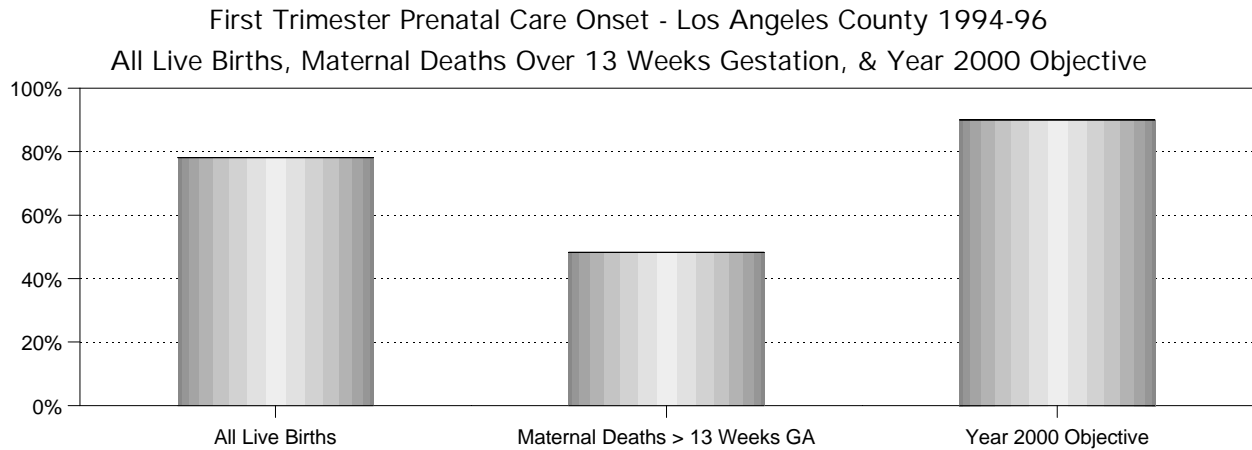


Figure 22 (see Table 22 in Appendix 4)

Adequacy of Prenatal Care

The Kessner Index, (8) measures the adequacy of prenatal care by the onset of care, the total number of visits and the length of the pregnancy, giving ratings of either adequate, intermediate or inadequate care levels. FIMR Project maternal death cases who died after the first trimester (13 weeks gestation) during 1994-96 were compared to all residents who had a live birth during the same period. There was a large difference in the percentage of adequate care between the women who died (37.9%) and all women who had a live birth (75.9%). In our review, five women had care that was found to be inadequate by the Kessner Index. Of these five women, four had no prenatal care. The Kessner Index is not a measure of the quality of the content of prenatal care.

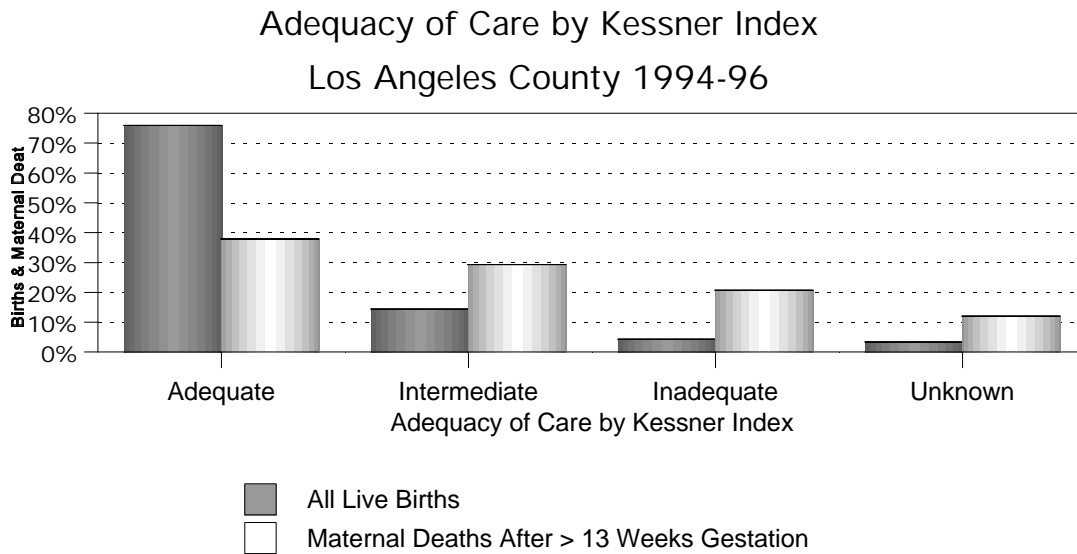


Figure 23 (see Table 23 in Appendix 4)

Prenatal Care and Substance Use

Lack of prenatal care is often cited as a risk factor for adverse perinatal outcomes, including maternal deaths. For the 52 women whose pregnancy outcome was either a live birth (45) or a stillbirth (7), the study compared the substance use (drugs, alcohol, and tobacco) of women who had no prenatal care to those to had at least one prenatal visit. The results were notable. There were 7 women (13.5%) who had no prenatal care. Of those 7 women, 5 (71.4%) used street drugs, alcohol, and/or tobacco; four of the five used street drugs, including cocaine, heroin, methamphetamine or used several street drugs.

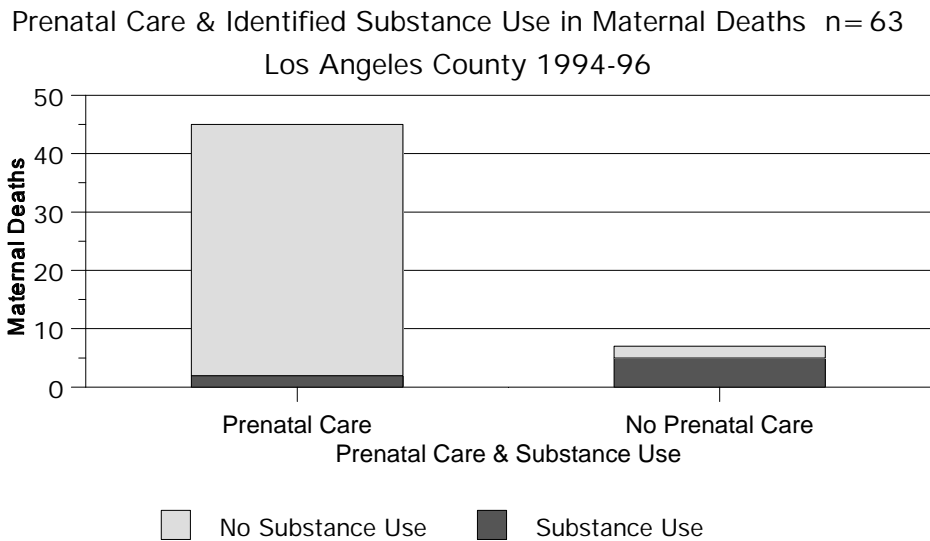


Figure 24 (see Table 24 in Appendix 4)

Note: Includes only cases where the pregnancy reached 20 weeks gestation, i.e., all live births and stillbirths.

Causes of Maternal Death

Primary Causes

The most common cause of pregnancy-related deaths was hemorrhage . There were 18 cases of hemorrhage (28.6%), 12 of embolism (19%), 11 of hypertension (17.5%), and 8 of infection (12.7%). There were no notable differences in cause of maternal death by race. Because hypertension is more common in blacks, we compared the percentage of deaths due to hypertension by race. There was no notable difference between blacks and other races.

Primary Causes of Maternal Deaths n= 63
Los Angeles County 1994-96

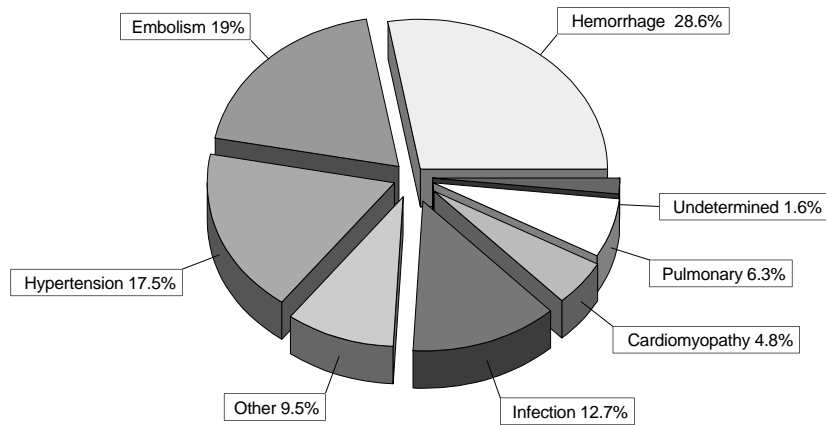


Figure 25 (see Table 25 in Appendix 4)

Hemorrhagic Causes of Death

Obstetric hemorrhage was the cause of maternal death in 18 of the 63 reviewed cases (28.6%). The most common causes of the hemorrhage were: uterine laceration/rupture, placenta accreta, abruptio placentae and ruptured ectopic pregnancy.

All of the women who died of hemorrhage due to placenta accreta had a current placenta previa and previous cesarean section(s). Previous cesarean sections and current placenta previa is known to increase the risk of placenta accreta. Deliveries in these 4 cases were by repeat cesarean sections, and 3 were followed by hysterectomies. Two of the pregnancies involved twin gestations.

A common element in the other hemorrhagic causes of death was provider mismanagement. Of the 5 uterine lacerations or ruptures: one was associated with placenta previa and the spontaneous rupture of a previous cesarean scar; two were iatrogenic; one was related to prolonged labor and a delayed cesarean; and one was caused by tetanic contractions from oxytocin. All 5 resulted in hysterectomies and 2 involved disseminated intravascular coagulopathy (DIC) as an associated condition.

**Hemorrhagic Causes of 18 Maternal Deaths
Los Angeles County 1994-96**

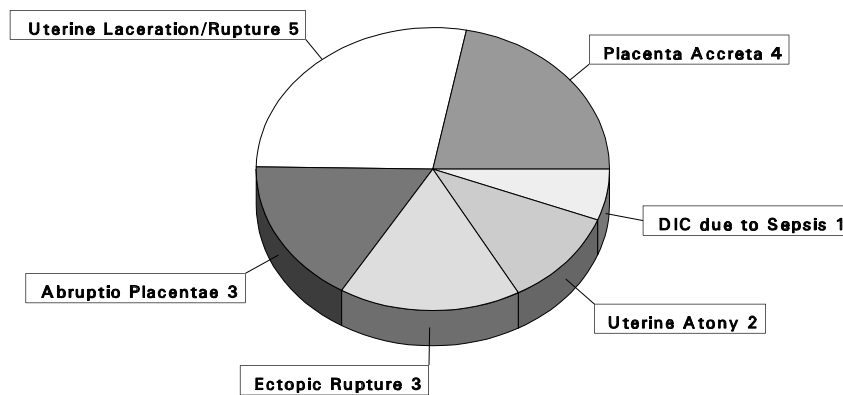


Figure 26 (see Table 26 in Appendix 4)

Associated Conditions Leading to Maternal Death

Each maternal death was coded for associated conditions leading to maternal death in addition to the primary cause of death, based on the findings of the panel. The coding system was adapted from the National Pregnancy Mortality Surveillance Coding Manual, developed by the Centers for Disease Control and Prevention. The following conditions were found to be associated with the maternal deaths:

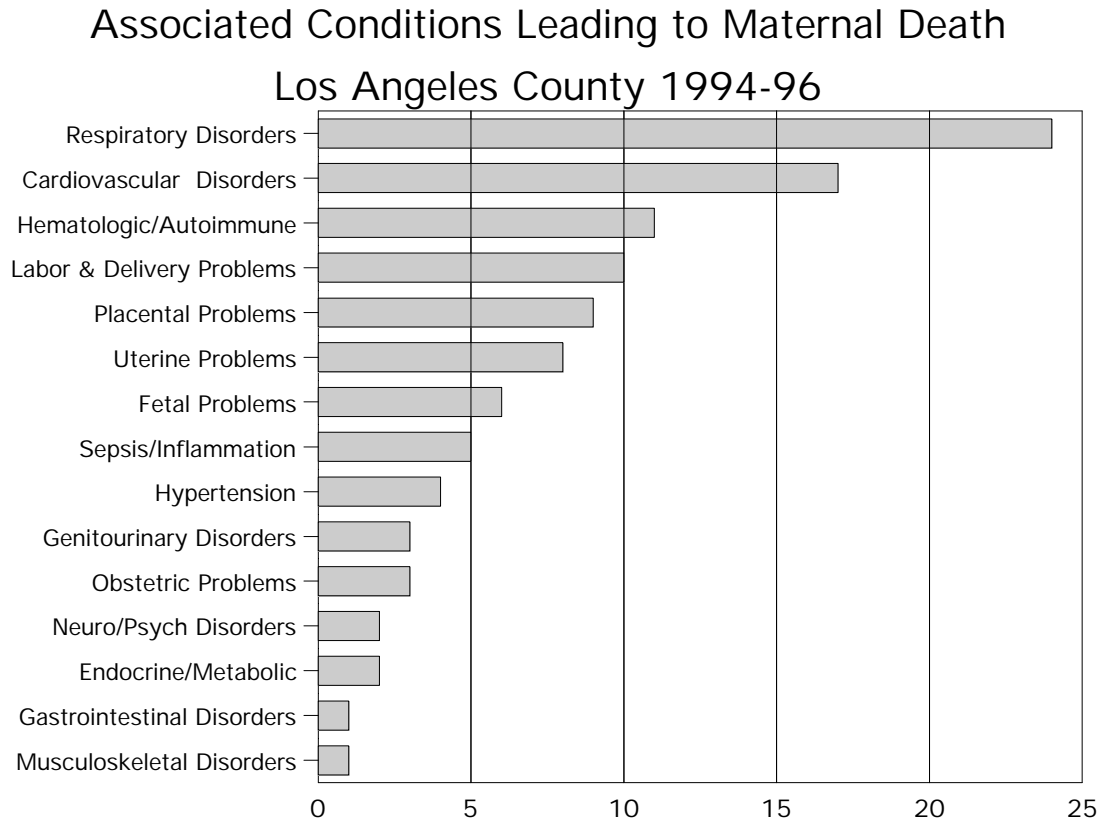


Figure 27 (see Table 27 in Appendix 4)

FACTORS CONTRIBUTING TO PREVENTABLE MATERNAL DEATHS

Proportion of Preventable Maternal Deaths

The FIMR Technical Review Panel was asked to assign a score on a four point scale to represent the degree to which they thought the outcome (maternal death) could have been altered, i.e., whether or not the maternal death was preventable. There were no available guidelines for such a scoring, but the panel found that one third of the women who experienced a maternal death had a good or strong chance to survive and an additional third had some chance. Six maternal deaths were classified as clearly preventable.

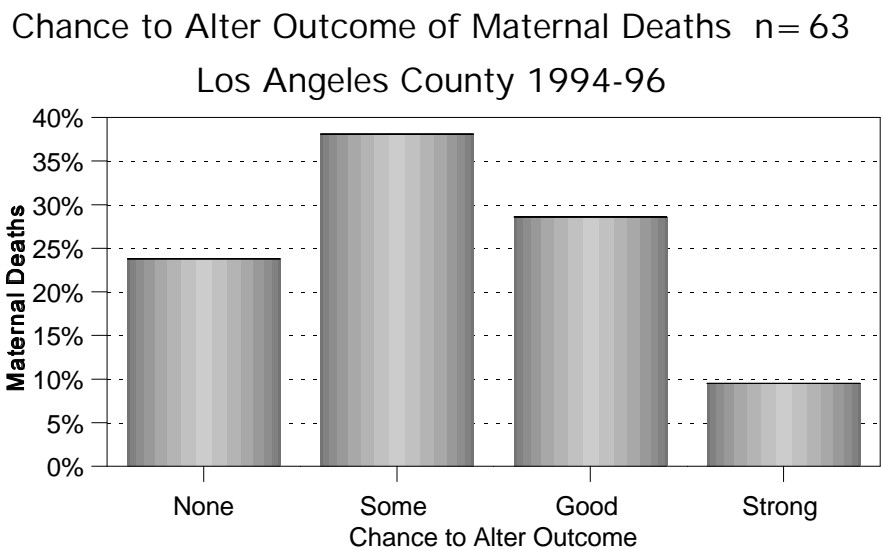


Figure 28 (see Table 28 in Appendix 4)

Four of these deaths involved clear-cut clinical errors as follows:

1. A case of hemorrhage that resulted from failure during prenatal care to diagnose cirrhosis of the liver; failure during delivery to assure that all of the placenta had been delivered; treatment of uterine atony with ineffective drugs.
2. A case of iatrogenic air embolism caused by instrumentation.
3. A failure of routine anesthetic care in an outpatient abortion.
4. A case of high-risk pregnancy, where the delivery was attempted at a hospital not equipped for such cases.

Two cases resulted from routine care for high-risk cases, involving a failure at the screening level to recognize that the women needed specialized obstetric care.

Contributing Factors

The FIMR Technical Review Panel used a check list of possible contributing factors (see Appendix 3) to review each maternal death. These factors were of four types:

- **Community Factors** - Lack of community resources or services, such as unavailable or inaccessible services or lack of transportation or child care.
- **Patient Factors** - Delay or failure to seek care, noncompliance or risk behaviors.
- **Facility Factors** - Inadequate level of facility, equipment, policies, or training of staff.
- **Health Care Professional Factors** - Delay in or lack of diagnosis, treatment or follow-up, use of ineffective treatment, failure to refer or seek consultation, lack of continuity of care.

The purpose of using this list was to identify problems associated with maternal deaths and to guide the process of recommending systemic changes to further reduce maternal mortality in Los Angeles County. By far, the most commonly found contributing factors were health care professional factors and patient factors. Some deaths had no apparent contributing factors and were deemed unpreventable. More than one factor could be attributed to a maternal death case.

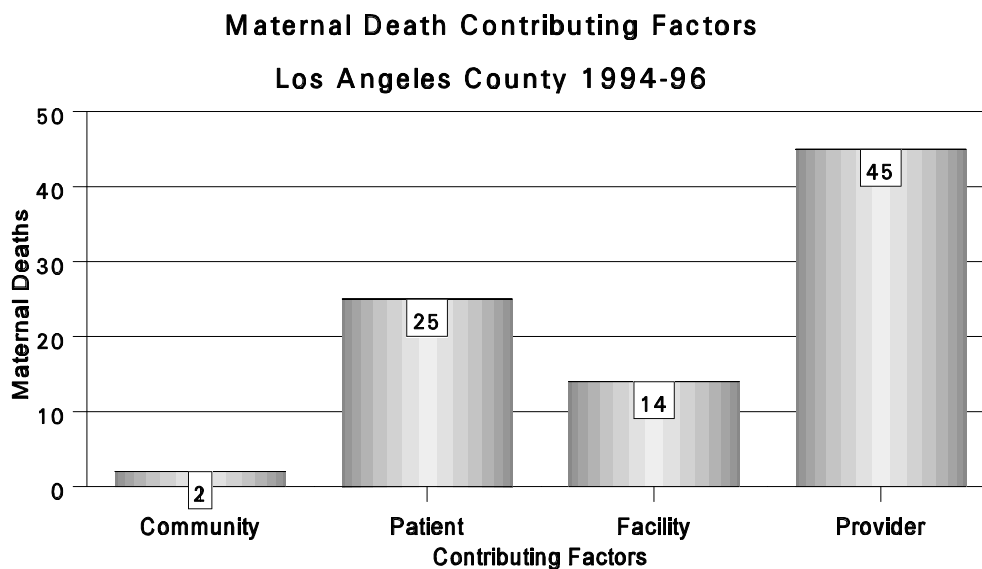


Figure 29 (see Table 29 in Appendix 4)

Community Contributing Factors:

An example of a community factor is problems with access to care.

A morbidly obese woman with a history of heart problems and asthma said she could not start prenatal care early because of over booking at a local clinic. She began care in the second trimester.

Patient Contributing Factors:

An important patient factor involved failure to seek care, both prenatal care and medical care for complications such as bleeding, preterm labor or signs of infection. As mentioned above, many of the women who did not seek any prenatal care also used street drugs, alcohol and/or tobacco. One woman did not seek care because she was unaware of the pregnancy due to obesity. Some of the cases are psychosocially and medically complex. Though information on the intendedness of these pregnancies was not always available, in some cases it was clear that the pregnancy was unintended and undesired.

One pregnant woman arrived at the emergency room with heavy bleeding and a fetal knee protruding from her vagina. She had a placental abruption caused by using cocaine shortly before. She was homeless, out of touch with her family and her other children were all in custody of other family members. She died of hemorrhage.

A young woman with a complicated medical history, including lupus erythematosus (lupus), hypertension, arthritis, serious infections, multiple surgeries, prior miscarriage, and mild stroke, became pregnant and delayed care until the second trimester. Her condition deteriorated with the pregnancy and she died of complications of lupus.

An obese woman with a history of mitral heart valve replacement became pregnant against medical advice. She delayed prenatal care until after the fetus was viable to avoid being counseled to terminate the pregnancy to save her life. She died of valvular heart disease.

A member of a fundamentalist religious group had no prenatal care, refused tocolysis for preterm labor, and refused treatment with antibiotics for sepsis on religious grounds. The baby was stillborn and she died of profound sepsis due to chorioamnionitis.

Another common patient factor is lack of knowledge regarding the importance of an event.

A young woman died of hemorrhage from a ruptured ectopic after having severe stomach pains and vomiting for 17 hours. She was admitted to the emergency room in full cardiac arrest.

Facility Contributing Factors:

A clear example of a facility factor is lack of availability of equipment.

A mechanical system for delivery of blood was broken and caused a delay in providing blood replacement for a woman who was hemorrhaging from an artery which was lacerated during a cesarean delivery. She died of exsanguination.

Health Professional Factor:

The health professional factor found most commonly was delay in or lack of diagnosis, treatment or follow-up. This very broad category covered many types of mismanagement of care.

Some provider factors were noted during the prenatal period. Many times this was due to failure to identify signs that a patient had a high-risk condition.

Several cases involved adherent placentae in patients with a placenta previa and a history of previous cesarean delivery. The risk of placenta accreta did not seem to be taken into account in the planning for these high-risk deliveries.

A woman who had three prior cesareans was pregnant with twins. One placenta was a complete previa. After bleeding on and off throughout the pregnancy, the twins were delivered prematurely. One placenta was adherent and caused massive hemorrhage when removed. The bleeding was never controlled.

Many cases had no documentation of consultation or referral to a specialist for high-risk patients.

A teenager developed fever and respiratory distress after cesarean delivery at a level-two hospital. She had decreased urine output, chest pain, a drop in blood pressure and difficulty breathing. Her condition deteriorated until she was intubated 2 days postpartum. There is no record of consultation with a specialist. She died of massive abdominal hemorrhage.

Poor communication and lack of continuity of care were often cited as contributing factors.

A woman had a cesarean delivery with chorioamnionitis and funisitis and purulent secretions from the uterine cavity. She was treated with antibiotics and sent home several days postpartum without the final lab results, which isolated a streptococcal infection. The next day she collapsed and was taken to an emergency room, where she died of infection.

RECOMMENDATIONS OF THE FIMR TECHNICAL REVIEW PANEL BASED ON CASE REVIEWS OF LOS ANGELES COUNTY MATERNAL DEATHS 1994-1996

Community Resources and Services:

Increased availability of the following resources and services:

- family planning services to high-risk women, including long-acting contraceptives and sterilization.
- substance abuse programs, including outreach, education, and treatment for pregnant women.
- case management for high-risk pregnancies.
- health and social services for homeless women.
- mental health care for women.

Improved outreach to high-risk women to encourage prenatal care.

Records/Communication to Other Providers:

Improved communication:

- from prenatal care providers to delivery hospitals.
- of consultation results to primary provider.

Review of guidelines for notification of physician of significant lab findings.

Improved signs and screening in clinics providing abortion services about risks of anesthesia.

Implementation of a unified electronic access system for patient records.

Quality improvement in medical and vital records.

Add field to death certificates to indicate recent pregnancy.

Patient education on danger signs:

Prenatal education on the:

- signs and symptoms of ruptured ectopic pregnancies.
- urgent need for care for third trimester vaginal bleeding.
- risks of anesthesia and actions to decrease risk.

Level of care/risk assessment:

Change in the hospital classification system to include maternal as well as neonatal risks.

Appropriate level of prenatal and hospital care for high-risk patients.

Quality assurance program to monitor use of appropriate level of care.

Provider training on:

- triage standards.
- criteria for transfer to the intensive care unit.

Referral of high-risk patients from outpatient clinics to hospitals for abortion services.

Patient education on the need to go to a higher level of care for severe pregnancy complications.

Improved referral to high-risk obstetric care for incarcerated women.

Adherence to CPSP guidelines for risk assessment.

Risk-appropriate care, assessed from the first prenatal visit or before and through delivery.

Continuity of care:

Increased availability of case coordination and improved continuity of care.

Standards of Care:

Quality Assurance:

Quality assurance programs in obstetric departments.

Embolism:

Provider training on:

- complications of amnioinfusion and treatment of air embolism.
- screening for risks of thromboembolism and deep vein thrombosis.

Review of hospital policies on:

- immobilization after delivery.
- postpartum complaints of cardiovascular symptoms.

Medical Procedures:

Induction/Augmentation of Labor:

- Provider training on the use of oxytocin.

Cesareans:

- Patient and public education on the risks of cesarean deliveries.

- Provider training on:
 - the risk of placenta accreta with history of previous cesarean deliveries with current placenta previa.
 - indications for and risks of cesarean deliveries.
 - stabilization of patients before cesarean deliveries.

Infections:

Provider training on:

- diagnosis and treatment of β -hemolytic streptococcus infection.
- endometritis follow-up.

Management of medical conditions in pregnancy:

Provider training on the management of:

- diabetes mellitus
- systemic lupus erythematosus (SLE)
- renal disease
- hypertension
- pre-eclampsia
- molar pregnancies
- disseminated intravascular coagulopathies (DIC)
- heart disease

Staffing:

Examination of all pregnant emergency room patients by an obstetrician or nurse midwife before discharge.

Development of multidisciplinary teams for critical care.

Review of hospital policies on senior staff participation in surgeries.

Review of hospital policies on the use of supervising staff in teaching hospitals.

Postpartum Complications:

Provider training on:

- postpartum risks before the six-week follow-up visit.
- need for the anesthesiologist to stay until recovery room discharge.

Appropriate length of stay policies with extension safeguards for high-risk patients.

Office and public health nurse home visits after operative delivery before 6-week follow up.

Increased availability of mental health follow-up for postpartum psychosis.

Improved postpartum discharge instructions after complicated deliveries.

Fetal Maturity:

Provider training on chances of fetal viability at various gestational ages.

Hospital Review Maternal Deaths:

Formal multidisciplinary reviews of all maternal deaths.

CONCLUSIONS

The FIMR Project review of Los Angeles County deaths during the years 1994-96 identified a total of 63 pregnancy-related deaths. The overall maternal mortality ratio during this period was 12 maternal deaths per 100,000 live births. The Year 2000 objective for maternal mortality is an MMR 3.3 overall and an MMR of 5 for African Americans. This objective has not been met.

The risks and causes of maternal mortality in this review were similar to other previously reported studies. The three main causes of pregnancy related deaths were hemorrhage, embolism and hypertension. The maternal mortality ratios in our review were higher for:

- women over 30 years of age;
- African Americans;
- women with little or no prenatal care; and
- women with higher numbers of previous live births.

More than a third of the maternal deaths were determined by the review panel to have a good or strong chance to be prevented. Three quarters of the deaths had at least some chance to be prevented. The most commonly cited contributing factors were:

- patients delaying or not seeking prenatal or emergency care;
- health care professionals not recognizing and properly managing risks;
- failure to consult with perinatologists or other specialists; and
- failure to refer patients to facilities equipped and staffed to handle high-risk pregnancies.

To decrease maternal mortality, the recommendations of the review panel address many types of contributing factors and deal with all stages of pregnancy, from improved women's health care and preconceptional counseling to postpartum education and follow-up. They recommended:

- increased services in the areas of substance use, family planning, social services for homeless women;
- case management for high-risk pregnancies;
- improved provider communication;
- quality improvement in medical and vital records;
- increased outreach to high-risk women to encourage early and continuous prenatal care;
- better risk assessment and appropriate level of patient care;
- patient education on danger signs during pregnancy; and
- provider training on management of high-risk conditions of pregnancy and management of obstetric emergencies.

We encourage ongoing efforts to monitor maternal mortality in Los Angeles County. We hope that wide dissemination of this report to health professionals and community-based organizations concerned with improving the outcomes of pregnancy will raise the level of awareness about these preventable deaths. Maternal mortality has decreased greatly in this century, but we can and must do better.

APPENDICES

Appendix 1

TECHNICAL REVIEW PANEL ROSTER

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Appendix 2

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COUNTY OF LOS ANGELES - DEPARTMENT OF HEALTH SERVICES
FETAL-INFANT MORTALITY REVIEW

MORTALITY CONTRIBUTORS FORM:

Case # 199

(0) No (1) Probably (2) Definitely (3) Insufficient Information (4) Not Applicable

1. COMMUNITY FACTORS

- a. Services unavailable _____
- b. Services inaccessible _____
- c. Inadequate community subsidy of care _____
- d. Lack of transportation _____
- e. Lack of child care _____
- f. Other (Specify: _____)

2. PATIENT AND/OR PARENT FACTORS

- a. Delay or failure to seek care _____
- b. Noncompliance _____
- c. Lack of knowledge regarding importance of an event _____
- d. Lack of knowledge of treatment or follow-up _____
- e. Environmental hazards _____
- f. Inadequate parental supervision _____
- g. Other (Specify: _____)

3. HEALTHCARE FACILITY FACTORS

- a. Inadequately trained personnel _____
- b. Inadequate or unavailable equipment _____
- c. Policies contribute to delay or inadequate treatment _____
- d. Inadequate or unavailable facilities _____
- e. Poor communications _____
- f. Lack of continuity of care _____
- g. Unavailable or inadequate response by EMT _____
- h. Other (Specify: _____)

4. HEALTH CARE PROFESSIONAL FACTORS

- a. Delay in or lack of diagnosis, treatment, or follow-up _____
- b. Use of ineffective treatment _____
- c. Misdiagnosis _____
- d. Failure to refer or seek consultation _____
- e. Lack of continuity of care _____
- f. Other (Specify: _____)

5. CLASSIFICATION

Chance To Alter Outcome: (1) None (2) Some (3) Good (4) Strong _____

6. PREGNANCY RELATED. YES / NO

7. RECOMMENDATIONS FOR SYSTEM CHANGE

Appendix 4

TABLES

Table 1. Maternal Death Autopsies - Los Angeles County 1994-96

Hospital	23.8%
Coroner	54%
None	22.2%

Table 2. Race of Maternal Deaths & Live Births- Los Angeles County 1994-96

Race	Maternal Deaths #	Maternal Deaths %	Live Births #	Live Births %
White	7	11.1%	103,909	19.82%
Black	15	23.8%	48,614	9.27%
Asian/PI	8	12.7%	48,204	9.20%
Hispanic	33	52.4%	321,645	61.36%
Others	0	0%	1,857	0.35%
Total	63	100%	524,229	100%

Table 3. Age Group of Maternal Deaths - Los Angeles County 1994-96

Age Group	#	%
0-19	5	7.9%
20-24	10	15.8%
25-29	11	17.5%
30-34	19	30.2%
35-39	11	17.5%
40+	7	11.1%
Total	63	100%

Table 4. Maternal Age Group of Live Births - Los Angeles County 1994-96

Age Group	#	%
0-19	65,344	12.5%
20-24	129,870	24.8%
25-29	143,006	27.3%
30-34	116,183	22.2%
35-39	56,735	10.7%
40+	13,091	2.5%
Total	524,229	100%

Table 5. Education Level of Maternal Deaths & Live Births* - Los Angeles County 1994-96

Education	MD #	%	LB #	%
> 12	18	28.6%	161,647	31%
12	20	31.7%	140,713	26.9%
< 12	25	39.7%	220,012	42.1%
Total	63	100%	522,372	100%

*not including 1857 Live Births for Native Americans, Others, & Unknowns

Table 6. Education Level of Maternal Deaths by Race - Los Angeles County 1994-96

Education Level	White #/%	Black #/%	Asian/PI #/%	Hispanic #/%	Total #/%
< 12 Years	0 0%	3 20%	0 0%	22 66.7%	25 39.7%
12 Years	4 57.1%	4 26.7%	2 25%	10 30.3%	20 31.7%
> 12 Years	3 42.9%	8 53.3%	6 75%	1 3%	18 28.6%
Total	7 100%	15 100%	8 100%	33 100%	63 100%

Table 7. Education Level of Live Births by Race - Los Angeles County 1994-96*

Education Level	White #/%	Black #/%	Asian/PI #/%	Hispanic #/%	Total #/%
< 12	9,591 9.2%	9,594 19.7%	6,266 13%	194,561 60.5%	220,012 42.1%
12	28,016 27%	20,583 42.3%	10,549 21.9%	81,565 25.4%	140,713 26.9%
> 12	66,302 63.8%	18,437 38%	31,389 65.1%	45,519 14.1%	161,647 31%
Total	103,909 100%	48,614 100%	48,204 100%	321,645 100%	522,372 100%

*not including 1857 Live Births for Native Americans, Others, & Unknowns

Table 8. Marital Status of Maternal Deaths & Live Births - Los Angeles County 1994-96

Marital Status	Maternal Death #	Maternal Death %	Live Birth #	Live Birth %
Single	38	60.3%	208,634	39.8%
Married	25	39.7%	315,595	60.2%
Total	63	100%	524,229	100%

Table 9. Marital Status of Maternal Deaths by Race - Los Angeles County 1994-96

		Married	Unmarried
White	7	4 57%	3 43%
Black	15	7 47%	8 53%
Asian/PI	8	7 88%	1 12%
Hispanic	33	19 58%	14 42%
Other	0	0	0
Total	63	37 59%	26 41%

Table 10. Marital Status of Live Births by Race - Los Angeles County 1994-96

	Married	Unmarried	Total
White	80,226 77%	23,683 23%	103,909
Black	16,838 35%	31,776 65%	48,614
Asian/PI	42,359 88%	5,845 12%	48,204
Hispanic	175,118 63%	146,527 37%	321,645
Other	1054 57%	803 43%	1857

Table 11. Occupation of Maternal Deaths - Los Angeles County 1994-96

Occupation	#	%
Homemaker	35	55.6%
Technical & Clerical	9	14.3%
Service	7	11.1%
Managerial/Professional	5	7.9%
Manufacturing & Labor	5	7.9%
None	2	3.2%
Total	63	100%

Table 12. Delivery Payment Source of Maternal Deaths by Race - Los Angeles County 1994-96

Delivery Payment Source	Medi-Cal	Private Insurance	HMO	Uninsured	Unknown	Total
White	2 28.6%	2 28.6%	2 28.6%	0 0%	1 14.3%	7 100%
Black	5 33.3%	4 26.7%	3 20.0%	0 0%	3 20.0%	15 100%
Asian/PI	3 37.5%	2 25.0%	3 37.5%	0 0%	0 0%	8 100%
Hispanic	26 78.8%	1 3.0%	3 9.1%	3 9.1%	0 0%	33 100%
Total	36 57.1%	9 14.3%	11 17.5%	3 6.4%	4 4.8%	63 100%

Table 13. Delivery Payment Source for Live Births by Race - Los Angeles County 1994-96

Delivery Payment Source	Medi-Cal	Private Insurance	HMO	Uninsured	Unknown	Total
White	20,904 20.1%	38,760 37.3%	39,439 40%	3571 3.4%	1,235 1.2%	103,909
Black	25,979 53.4%	4,464 9.2%	16,844 34.7%	745 1.5%	582 1.2%	48,614
Asian/PI	13,806 28.7%	12,646 26.2%	17,170 35.6%	3,801 7.9%	781 1.6%	48,204
Hispanic	224,071 69.7%	25,449 7.9%	63,221 19.7%	6,761 2.1%	2,143 0.6%	321,645
Native American, Other, & Unknown	756 40.7%	387 20.8%	572 30.8%	84 4.5%	58 3.1%	1857
Total	285,516 54.4%	81,706 15.6%	137,246 26.2%	14,962 2.9%	4799 0.9%	524,229

Table 14. Mother's Birthplace of Live Births & Maternal Deaths - Los Angeles County 1994-96

Mother's Birthplace	LB #	%	MD #	%
US	217,284	41.6%	30	47.5%
Mexico	185,064	35.5%	18	28.6%
China	5,018	1%	1	1.6%
Philippines	11,424	2.2%	3	4.8%
Other	102,611	19.7%	11	17.5%
Totals	521,357	100%	63	100%

Table 15. Pregnancy Outcomes of Maternal Deaths - Los Angeles County 1994-96

Pregnancy Outcome	#	%
Live Birth	45	71.4%
Stillbirth	7	11.1%
Undelivered	5	7.9%
Ectopic	3	4.8%
Abortion	2	3.2%
Molar	1	1.6%
Total	63	100%

Table 16. Infant Survival of Maternal Deaths by Gestational Age - Los Angeles County 1994-96

Weeks Gestational Age	20-24	25-28	29-32	33-36	37-40	41+	Total
Survived Hospital Discharge	0	2	1	11	22	6	42
Died Before Discharge	2	0	0	1	0	0	3
Stillborn	1	2	1	1	2	0	7
Total	3	4	2	13	24	6	52

Table 17. Time Interval from Delivery to Maternal Death - Los Angeles County 1994-96

Interval in Days	#	%
0-1	30	47.6%
2-7	16	25.3%
8-14	7	11.1%
15-21	4	6.4%
22-30	2	3.2%
31-42	2	3.2%
43-90	0	0%
91-365	2	3.2%
Total	63	100%

Table 18. Maternal Mortality Ratio (MMR) by Race - Los Angeles County 1994-96

Race	White	Black	Asian/PI	Hispanic	Other	Total
Maternal Deaths	7	15	8	33	0	63
Live Births	103,905	48,614	48,204	321,654	1,857	524,229
MMR	6.74	34.39	16.59	10.25	0	12.02

Table 19. Maternal Mortality Ratio (MMR) by Age Groups - Los Angeles County 1994-96

Age Group	< 20	20-24	25-29	30-34	35-39	40+	Total
Live Births	65,344	129,870	143,006	116,183	56,735	13,091	524,229
Maternal Deaths	5	10	11	19	11	7	63
MMR	7.65	7.70	7.69	16.35	19.39	53.47	12.02

Table 20. Maternal Mortality Ratios (MMR) by Age Groups Los Angeles County 1994-96 and US 1987-90

Age Group	< 20	20-24	25-29	30-34	35-39	40+	Total
US 1987-90 MMR	n157 7.8	n306 7.1	n351 7.0	n367 11.1	n206 18.2	n72 41.6	n1459 9.2
LA County 1994-96 MMR	n5 7.65	n10 7.70	n11 7.69	n19 16.35	n11 19.39	n7 53.47	n63 12.02

Table 21. Maternal Mortality Ratios by Live-Birth Order US 1987-90 vs LAC 1994-96

Age Group Live-birth Order	< 20	20-29	30+	All Ages
First live birth US LAC	3.7 5.9	4.2 5.7	6.6 16.0	4.5 8.0
Second live birth US LAC	3.9 8.1	2.8 6.4	6.7 10.8	4.1 8.0
Third live birth US LAC	4.2 0	3.9 6.4	7.5 19.8	5.3 12.3
Fourth live birth US LAC	44.0 0	6.0 5.8	10.1 13.2	8.5 9.9
Fifth or more US LAC	0 0	9.1 0	13.7 21.9	12.1 14.2

Table 22. First Trimester Prenatal Care Onset - Los Angeles County 1994-96

	All Live Births n= 522,731	Maternal Deaths @ > GA13 n= 58	Year 2000 Objective
1st Trimester Care	409,560	28	-----
%	78.35%	48.3%	90%

Table 23. Adequacy of Care by Kessner Index - Los Angeles County 1994-96

Adequate	Intermediate	Inadequate	Unknown
22	17	12	7
37.9%	29.3%	20.7%	12.1%

Table 24. Prenatal Care & Substance Use in Maternal Deaths - Los Angeles County 1994-96

	Prenatal Care	No Prenatal Care	Total
No Use	43	2	45
Substance Use	2	5	7
Total	45	7	52

Table 25. Primary Cause of Maternal Death - Los Angeles County 1994-96

Cause of Death	#	%
Hemorrhage	18	28.6%
Embolism	12	19%
Hypertension	11	17.5%
Infection	8	12.7%
Cardiomyopathy	3	4.8%
Anesthesia	1	1.6%
Pulmonary	3	4.8%
Other	6	9.5%
Undetermined	1	1.6%
Total	63	100%

Table 26. Hemorrhagic Causes of Maternal Death - Los Angeles County 1994-96

Hemorrhage Causes of Death	#	%
Uterine Laceration\Rupture	5	27.8%
Placenta Accreta	4	22.2%
Abruptio Placenta	3	16.7%
Ectopic Rupture	3	16.7%
Uterine Atony	2	11.1%
DIC due to Sepsis	1	5.6%
Total	18	100%

Table 27. Associated Conditions Leading to Maternal Death - Los Angeles County 1994-96

Respiratory Disorders	24
Cardiovascular Disorders	17
Hematologic/Autoimmune	11
Labor & Delivery Problems	10
Placental Problems	9
Uterine Problems	8
Fetal Problems	6
Sepsis\Inflammation	5
Hypertension	4
Genitourinary Disorders	3
Obstetric Problems	3
Neuro\Psych Disorders	2
Endocrine\Metabolic	2
Musculoskeletal Disorders	1
Gastrointestinal Disorders	1

Table 28. Chance to Alter the Outcome of Maternal Deaths - Los Angeles County 1994-96

Chance to Alter Outcome	#	%
No Chance	15	23.8%
Some Chance	24	38.1%
Good Chance	18	28.6%
Strong Chance	6	9.5%
Total	63	100%

Table 29. Maternal Death Contributing Factors - Los Angeles County 1994-96

Contributing Factors	#
Community	2
Patient	25
Facility	14
Provider	45

REFERENCES

1. California Department of Health Services, Birth and Death Records 1994-96.
2. Centers for Disease Control and Prevention, National Center for Health Statistics. Vital Statistics of the United States, vol II, mortality, part A, for data years 1950-95, Washington: Public Health Service.
3. National Center for Health Statistics. Healthy People 2000 Review, 1992. Hyattsville, MD: US Department of Health and Human Services, Public Health Service, CDC, 1993.
4. Healthy People 2000: Maternal & Infant Health Objective, 1995 Midcourse Review, Los Angeles County Status.
5. Reporter R, Silberman I. Maternal Mortality in Los Angeles County, 1986-89.
6. Berg CJ, Atrash HK, Koonin LM, Tucker M. Pregnancy-related mortality in the United States, 1987-1990. *Obstetrics & Gynecology* 1996;88:2:161-7.
7. New York State Department of Health, Maternal mortality in New York State: An assessment of completeness of reporting and the impact on vital statistics-based rates, 1980-1986, 1988.
8. Kotelchuck, M., An evaluation of the Kessner adequacy of prenatal care index and a proposed adequacy of prenatal care index. *Am J Public Health* 1994;84:1414-20.
9. Deaths: final data for 1996, NVSR vol 47, no.9, November 10, 1998.

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