



Recommendations

From The

New Jersey Maternal Mortality Review Team

(2006-2008 deaths)

Acknowledgements

The work and accomplishments of the New Jersey Maternal Mortality Review are possible with the assistance of the following:

- The leadership of Joseph J. Apuzzio, MD, FACOG, FACS and the commitment of all of the members of the review team who volunteer their time.
- The Central Jersey Family Health Consortium staff members, who collaborate with the Department of Health to coordinate the abstraction of medical records, convene meetings of the Maternal Mortality Review Team and draft this report.
- Directors of Health Information Management/Medical Records and their staff in hospitals and ambulatory, rehabilitation and long term care agencies, County Medical Examiners and their staff, local law enforcement agencies, and private health care providers throughout New Jersey who facilitate access to medical, social and other records relevant to case review.

For more information contact:
Reproductive and Perinatal Health Services
Sandra.Schwarz@doh.state.nj.us
609-292-5616

New Jersey Maternal Mortality Case Review Team

Joseph J. Apuzzio, MD, Chair

Anesthesiology

Lee Rosenbaum, MD
Atlantic Health System

Clergy

Rev. Ernest E. Trueblood, Jr.
Pastor
International Revival Tabernacle

Consumer Advocate

Jennifer Valerio
Mount Arlington, NJ

Critical Care Medicine

Deborah Hutter, MD
Department of Internal Medicine/Pulmonary Diseases
Hackensack University Medical Center

Family Planning

Kimberly McKown-Strait, MSW, LCSW
Executive Director
FamCare, Inc.
Gloucester County

Health Care Administrator

Mary McTigue, RNC, MA
Director of Nursing, Maternal Child Health
Trinitas Hospital

Maternal and Fetal Medicine

Joseph J. Apuzzio, MD
Professor of OB/GYN
University of Medicine and Dentistry
New Jersey Medical School

Carlos Benito, MD, MPH
Maternal Fetal Medicine
Saint Peter's University Hospital

Unjeria Jackson, MD
Atlantic Maternal Fetal Medicine
Atlantic Health System

Thomas Westover, MD
Assistant Professor
Cooper University Hospital
Robert Wood Johnson Medical School

Medical Examiner

Frederick DiCarlo, MD, PhD
Assistant Medical Examiner
Middlesex County

Mental Health

Alexis E. Menken, PhD
Private Practice
Montclair, NJ

Michele Preminger, MD
Psychiatrist and Obstetrician/Gynecologist

Minority Advocate

Cloris Bustamante, RNC, LCCE, BSN, MBA
Administrative Director
Clinical Services
Comprehensive Women's Healthcare

**New Jersey Department of Health
Maternal and Child Health Services**

Sandra M. Schwarz, RNC, MS
Program Manager
Reproductive and Perinatal Health Services

Paramedic/EMT

Eric W. Hicken
Public Health Representative II
Emergency Medical Services

Nurse Midwife

Judith Catenacci, RN, CNM
Private Practice

Nutritionist

Kathleen Mahmoud, MS, RD
Nutrition Program Coordinator
Gloucester County Department of Health

Obstetrics and Gynecology

Anthony Caggiano, MD
Associate Professor OB/GYN
University of Medicine and Dentistry
New Jersey Medical School

Demali Campbell, MD
Patterson Community Health Center

Daniel J. Colombi, MD
ACOG District 3

Earl F. Jackman, DO
Department of OB/GYN
Community Medical Center

Courtney Malcarney, MD
Chairman, Department of Obstetrics and Gynecology
Our Lady of Lourdes Medical Center

Philip A. Massimo, MD
Retired OB/GYN

James O'Mara, MD
Department OB/GYN
Capital Health System

Michael R. Petriella, MD
Vice Chair, OB/GYN
Hackensack University Medical Center

Maya Sanghavi, MD
Department of OB/GYN
JFK Medical Center

Obstetric Nursing

Patricia Carpenito, RN
Hackettstown Community Hospital

Terri McIntosh-Mount, RN
Jersey Shore University Medical Center
NJSNA

Perinatal Addiction Specialist

Cathie Vieira, RN, BSN, CARN, CPAS

Perinatal Pathology

Susan Sheen-Schwarz, MD
St. Peter's University Medical Center
Robert Wood Johnson
University Hospital

Public Health

Claire Murphy, RN
Supervisor, Clinics and Ambulatory Care
Ocean County Health Department

Risk Manager

Stephanie Dougherty, RN, BSN
Risk Manager
Hunterdon Medical Center

Social Work

Evelyn Sullivan, MSW
Preferred Behavioral Health
Ocean County

Staff:**Central Jersey Family Health Consortium**

Robyn D'Oria, MA, RNC, APN
Perinatal Clinical Nurse Specialist
Executive Director

Ann Mruk, MSN
Perinatal Nurse Educator
Coordinator, Maternal Mortality Review

INTRODUCTION

The work of the New Jersey Maternal Mortality review team is part of a longstanding commitment among healthcare professionals and other concerned citizens to reduce and prevent the number of deaths related to pregnancy and childbearing among New Jersey residents. This commitment dates back to 1932, when the Medical Society of New Jersey established one of the first maternal mortality reviews in the United States; part of a response to growing concern at the local, state, and national levels over the country's high maternal mortality rate (Marmol, Scriggins, & Vollman, 1969).

To prevent and reduce what was generally agreed to be an excessive number of maternal deaths in New Jersey, members of the New Jersey Medical Society began a formal process to look beyond the basic information provided on a death certificate for the medical and nonmedical causes of maternal death (for a more detailed history, see Callaghan & Berg, 2002).

Over the next forty years, increased recognition of maternal death as a public health issue (Marmol et al., 1969) fostered collaboration between the Medical Society of New Jersey and the New Jersey Department of Health. This collaboration expanded both the membership and scope of the Medical Society's review committee, known today as the New Jersey Maternal Mortality Review.

By the close of the 20th century, following a nationwide trend, the number of maternal deaths had dropped dramatically across New Jersey, with only 12 maternal deaths reported in the year 2000 by the New Jersey Department of Health and Senior Services (Baron Duffy, 2003). By this time, like New Jersey, most states had formed maternal mortality review committees (Marmol et al., 1969; Callaghan & Berg, 2002).

In spite of the improvement in maternal mortality rates across the United States, maternal death remains a key issue on the public health agenda, as

evidenced by the Department of Health and Human Services' *Healthy People 2010* national goal to reduce the maternal mortality rate to 3.3 deaths per 100,000 births (2000). Public concern over maternal mortality persists for two main reasons: first, it is generally agreed that maternal deaths are underreported (Centers for Disease Control and Prevention [CDC], 1998). For example, the CDC estimates the number of maternal deaths attributable to pregnancy and its complications to be 1.3 to 3.0 times the number reported in vital statistics records (CDC, 1998). In New Jersey, this issue is addressed by the use of an expanded maternal mortality identification surveillance system that links maternal death certificates with birth and fetal death certificates issued in the year prior to the woman's death. Since the implementation of this system, the number of deaths attributed to pregnancy identified through expanded surveillance has been 1.4 to 3.5 times greater than the vital records death certificate alone, as shown in Table 2.¹

A second reason for public concern over maternal mortality is the persistence of racial disparities observed in maternal deaths (Hoyert, 2007). For example, in 2003 the U.S. maternal mortality rate was 8.7 among the White population versus 30.5 among the Black population (2007). A similar pattern was observed in New Jersey, where the maternal mortality rate was 9.7 among the White population versus 30.5 among the Black population (Ferraro, 2002). Eliminating social disparities in maternal mortality and other health indicators is a primary goal of *Healthy People 2010* (U.S. Department of Health and Human Services 2000), and related state initiatives, including *Healthy New Jersey 2010* (New Jersey Department of Health and Senior Services, 2001).

This report presents the most recent findings and recommendations of the New Jersey Maternal Mortality Review for the years 2006 to 2008. Section Two provides an overview of the review process.

Review Process

The New Jersey Maternal Mortality Review (NJMMR) process is consistent with the model presented by Berg et al. (2001) for the Centers for Disease Control and Prevention. The model describes a four-step review process that includes: 1) Identification of maternal deaths, 2) Review of maternal deaths, 3) Analysis and interpretation, and, 4) Action. This section presents an overview of each of the four steps as they relate to the New Jersey Maternal Mortality review process:

1) Identification of Maternal Deaths

Based on the definition developed by the American College of Obstetricians and Gynecologists and Centers for Disease Control Maternal Mortality Study Group (see Berg et al., 2001 and Hoyert, 2007 for discussion of definitions), the NJMMR defines maternal death as “the death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of cause.”¹

The NJMMR relies on multiple data sources to locate cases of maternal death for review, including death certificates, labor and delivery records, hospital discharge records and other sources. Sources can include:

- Direct reporting of a maternal death by a hospital, medical examiner or other personnel to the New Jersey Department of Health;
- A checkbox on the death certificate that indicates the woman was pregnant within one year (12 months) prior to her death;
- A linkage of death certificates, live birth and fetal death records, and the hospital discharge file using a probabilistic methodology conducted by the New Jersey Department of Health's Maternal and Child Health MCH Epidemiology Program.²

2) Review of Maternal Deaths

After the final list of maternal deaths is produced, information on the medical and non-medical factors that led to the deaths is collected by a nurse abstractor (for details see Ferraro, 2002). Abstractors use a standardized data abstraction tool. Information is collected on over 300 variables. Data are obtained from all sources including death certificates, autopsy reports, hospitalization records, medical examiner reports, prenatal care records, emergency room and outpatient visit reports and law enforcement reports.

A file is created for each case which includes the summary of the case abstraction; recommendations and systems review sheet, and any other received documents pertaining to the case. All files are kept in accordance to program policy at the State offices and are treated in accordance with CDC public health surveillance guidelines.

All cases are reviewed by the Maternal Mortality Case Review Team. Team members represent a diversity of specialties and professions, including health departments, clinical medicine, social work, clergy, and community groups. If the Case Review Team determines a need for additional expertise, consulting professionals are invited to provide this information on a case by case basis.

During review, each case is individually assessed for the medical and non-medical factors that led to the death, especially the factors that were preventable. Through consensus, the Case Review Team assigns one of three possible categories to each case, based on the maternal death's relationship to pregnancy:

1. *Pregnancy-related*: the death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by her pregnancy or its

management, but not from accidental or incidental causes.

2. *Non-pregnancy-related*: the death of a woman while pregnant or within 1 year of termination of pregnancy, due to a cause unrelated to pregnancy.

3. *Undetermined*: consensus not reached by the Case Review Team (Berg et al., 2001).

The primary focus of the Case Review Team is to identify systems related issues. Recommendations for systems improvement are maintained, tallied and ultimately shared with healthcare professionals and the public through the Maternal Mortality report, and presentations at professional association meetings such as the American Congress of Obstetricians and Gynecologists (ACOG). Team recommendations are also used for program planning at the Department of Health.

3) Analysis and Interpretation

Analysis of the maternal mortality data follows the guidelines of Berg et al. (2001) and includes the use of descriptive statistics to examine maternal demographic characteristics such as age, race and ethnicity; as well as health care characteristics such as prenatal care and insurance status. In addition, maternal mortality rates are calculated to examine the risk of maternal death among various groups.

4) Action

The Case Review Team also uses the case summary data to develop recommendations to address specific areas of concern. Findings have been used for quality improvements at the regional and state levels. For example, the Case Review Team recognized that depressive disorders contributed to the deaths of pregnant and/or postpartum women. This finding in concert with other efforts led to the Governor's formation of a Postpartum Depression (PPD) Task Force. The active support of all involved, including the Governor's office, the Task Force, and the review team led to New Jersey's Postpartum Depression initiative (also known to the public as the Speak Up When You're Down Campaign). The PPD initiative resulted in a consumer and professional awareness campaign on perinatal mood disorders, and legislation that mandates postpartum screening for signs and symptoms of postpartum depression. Since this initiative began in 2005, over \$9 million has been allocated for education, screening, and awareness activities statewide.

The following section presents findings from the New Jersey Maternal Mortality Review for the years 2006 through 2008.

Recommendations

Recommendation 1: **Evaluation of women in the emergency room**

All women of childbearing age should be tested for pregnancy during emergency room visits.

All women of childbearing age (15-40 years) should be tested for pregnancy during emergency room visits.¹ If confirmation of pregnancy is established, women should be advised to follow-up with their OB provider by 10-12 weeks. If the woman does not have an OB provider she should be given a list of OB providers and/or clinics in her area. Immediate referral for advanced prenatal care should be made in cases needing short-term assessment or intervention.² Women should immediately be started on folate supplementation 0.4 mg daily.³

Necessary treatment and diagnostic testing should not be withheld due to pregnancy.

The diagnosis of a health condition should not be delayed due to a limited (or an incomplete) diagnostic workup because a woman is pregnant. Ultrasound imaging is a safe evaluation tool to be used during pregnancy and can be used to evaluate acute abdominal pain in pregnant women.¹

Nuclear medicine administration is generally safe in pregnancy.^{4,5}

MRI can be performed at any stage of pregnancy without the use of gadolinium.⁴

CT scan may be an appropriate test during pregnancy depending on the clinical context. Expedition and accurate diagnosis should take precedence over concern for ionizing radiation. Radiation dosage should be limited to 5-10 rads in the first 25 weeks of pregnancy.⁴

Modifications of imaging protocols, when possible, should be performed to use the least amount of radiation necessary to complete the exam. This can include lead shielding, beam collimation, and reduced imaging dosage/field. It is recommended that informed consents, including pregnancy-related risks, be obtained from patients when possible.⁶ It is recommended that these protocols be established and in place at facilities which routinely care for pregnant patients.

Recommendation 2: **Universal screening for postpartum depression**

All women who experience a termination of pregnancy, either elective or spontaneous, need to be assessed for postpartum depression.

In New Jersey, all women who give birth are screened for depression prior to discharge; however, screening is not routinely done for women experiencing a spontaneous or elective termination. In the U.S., fifteen percent of pregnancies (recognized) end in spontaneous termination and approximately one third ends in elective abortion. Women who experience miscarriage or induced abortion are at greater risk of anxiety and depression than the general population.^{7,8,9} Compared with the general population, women undergoing induced abortion have significantly higher levels of anxiety up to five years after pregnancy termination while those experience miscarriage have significantly higher levels of anxiety up to 6 months after miscarriage compared to the general population. Findings suggest that women who receive induced abortions in later gestational ages may experience symptoms of post traumatic stress disorder.⁸ Additionally, in a study of women experiencing either elective or spontaneous termination, more than 21 percent experienced depression during a subsequent pregnancy.⁷ The presence of

psychological responses to termination of pregnancy are both immediate (within 10 days of termination) and long term (up to five years post termination), all women experiencing termination of pregnancy should receive postpartum depression screening regardless of mode of termination and receive appropriate treatment.^{9,10}

Recommendation 3:

Treatment of pregnant women who are incarcerated

An incarcerated pregnant woman who is receiving prenatal care while in jail should receive a referral to continue prenatal care with a healthcare provider which is accessible to her upon her release from prison.

It is estimated that six percent of women are pregnant at time of arrest.¹¹ Incarcerated pregnant women and their children are at greater risk of perinatal and postnatal morbidity and mortality.¹¹ Prenatal and postpartum treatment is offered in prisons; however, these services are not typically required and only given at the inmate's request.¹² The availability of prenatal care in jails is less clear. With the growing number of women being incarcerated each year, it is important to identify special issues facing women. The identification of pregnant women in jails followed by the provision of prenatal care during incarceration and referrals to continue care post incarceration are needed.

Incarcerated pregnant women with opioid addiction should receive methadone maintenance to improve fetal outcomes.

The Federal Bureau of Prisons, Clinical Practice Guidelines for Drug and Alcohol Detoxification recommend continuing Methadone Maintenance Therapy for inmates who are pregnant.^{13,14} The allocation of methadone maintenance to pregnant women in prison is a shortcoming of the current system.¹² Of 51 prison systems surveyed nationwide (Departments of Corrections for all states, the

Federal Bureau of Prisons, and the District of Columbia prison, with the North Dakota Department of Corrections failing to respond to the survey), only 55 percent offer methadone to inmates.¹⁵ Of those offering methadone, 50 percent offer methadone for pregnant women or for chronic pain management only. Prison systems cite preference of a drug-free detoxification system over the use of methadone or buprenorphine. Upon release from prison, only 45 percent of systems provide referrals to inmates for methadone maintenance.¹⁵ The state of New Jersey Department of Corrections offers both methadone maintenance therapy in prison and provides community referrals to patients upon release.¹⁵

Although methadone is offered to pregnant women in New Jersey state prisons, the use of Methadone Maintenance Therapy in county jails is less clear. Of the 21 counties in New Jersey, only four counties provide information about Methadone Maintenance therapy. Mercer County and Atlantic County are the only counties that list Methadone Maintenance therapy as a service provided to inmates within the county jail.¹⁶

Recommendation 4:

Treatment of pregnant women on methadone

There needs to be a plan in place for continuing methadone maintenance following delivery.

Addiction is a chronic disease that has a high potential for relapse. Maintaining a therapeutic dose of methadone will decrease the cravings for heroin and other opiates.¹⁷ Increased levels of stress are associated with a higher likelihood of relapse for those with drug addiction issues. Reducing cravings is essential for postpartum mothers who are faced with the stress of caring for an infant leading to a high potential for relapse.^{17,18} Mothers who relapse pose a threat to the safety of infants and themselves. US

Department of Health and Human Services Substance Abuse and Mental Health Services Administration Center (SAMHSA) guidelines include continuing methadone after delivery at a dose similar to that of the one before pregnancy, and if methadone was initiated during pregnancy, then postpartum dose should be continued at approximately half the dosage given in the third trimester.¹⁸

The responsibility of postpartum dose adjustment should be kept in the hands of the medical director of the methadone clinic who will see the patient upon discharge from the hospital. As indicated by TIP #43, if signs of overmedication exist or if the patient requests, the dose should be decreased gradually by 5mg a day.¹⁸ Any dose changes need to be indicated on discharge papers for follow up at the clinic. It is important to provide support for the woman maintained on methadone until she is mentally ready to wean off the methadone.¹⁸

Recommendation 5: Treatment of women with chronic disease or history of malignancy

Healthcare providers should assess pregnancy intendedness for all women of childbearing age and provide appropriate guidance.

Chronic disease can have significant impacts on pregnancy for women. Women with a prior history of cancer, diagnosed with cancer, congenital heart conditions, diabetes, lupus, and other chronic disorders should be notified of potential negative impacts associated with pregnancy and their disorder. They should be given adequate education and counseling and access to contraception and family planning. Recommendations for preconception planning and pregnancy intervention vary based on disorder; however, some common disorders are discussed below.

Cancer Prior to Pregnancy

Women with a previous cancer history have lower fertility rates than women in the general

population.^{19,20} All women of childbearing age who have a cancer history should be advised on risks associated with pregnancy. Cancer survivors are three times more likely to have a preterm birth, two times more likely to have a low birth weight baby, and also have an increased risk of miscarriage than the general population. Research suggests that there is no significant association between cancer treatment and future malformations or birth defects.^{19,20} Pregnant women with a history of cancer should be closely monitored by physicians and begin receiving prenatal care early in pregnancy.

Cancer during Pregnancy

Women who receive a cancer diagnosis during pregnancy are not at increased risk for preterm birth or intrauterine growth restriction even if chemotherapy is required. Treatment options that put the fetus in the lowest risk while ensuring the treatment of the mother should be investigated and mothers should be counseled on their treatment options and how these options may impact the fetus.²¹

Website for cancer survivors with pregnancy concerns: www.cancerandpregnancy.com

Congenital heart disease

Women with congenital heart disease generally have limited complications during pregnancy; however, a preconception cardiac evaluation to determine potential pregnancy-related risk is important to determine the safety of both the mother and potential fetus. Additionally, medications may have adverse side effects on the fetus; therefore, all medications should be reviewed prior to conception. Women who are considered to be at significant risk should be advised to avoid pregnancy and be provided contraception and family planning counseling. Should high risk clients become pregnant, mothers should be counseled on pregnancy termination.^{22,23}

Diabetes

The American Diabetes Association provides specific recommendations for the preconception care of women with diabetes. Pregnancy has a profound effect on diabetes with a cyclical impact on the fetus. For example, pregnancy hormones can lead to insulin resistance which causes hyperglycemia in the mother. Hyperglycemia is in turn dangerous to the fetus. All women with diabetes should be educated about the importance of glucose control before becoming pregnant and a multi-disciplinary team of specialists should come together to provide care for the woman and prepare for the pregnancy. Women who are planning on becoming pregnant should be evaluated and treated for disorders associated with diabetes (neuropathy, hypertension, etc). All medications should be evaluated to determine appropriateness for use during pregnancy. Once a woman becomes pregnant regular evaluation, education, and follow-up by the team should be conducted.²⁴ In a study of preconception planning for diabetic patients, findings suggest that women participating in pre-pregnancy planning had fewer adverse pregnancy outcomes, better glycemic control, increased folic acid supplementation, and decreased congenital malformations than diabetic women who do not participate in such planning.²⁵

Recommendation 6: Education for providers to improve outcomes

Education for emergency medical services (EMS) and emergency room (ER) staff on perimortem cesarean section

There is an increase in cardiomyopathy-induced deaths of pregnant patients in the United States.²⁷ For pregnant women in the second half of the pregnancy, the uterus can compress the inferior vena cava and limit venous return to the heart during traditional cardiac compressions.²⁸ In cases where cardiac arrest

has persisted for four minutes or the mother is fatally injured, perimortem cesarean sections (PMC) are recommended. The perimortem cesarean section allows for the resuscitation of the baby and the potential returning of the venous to the heart because the obstruction caused by the fetus has been removed. A perimortem cesarean should be considered if the fetus is greater than 20 weeks gestation.²⁸⁻³¹ Both mother and baby have better outcomes if a PMC is performed quickly. Research suggests that of the pregnant women who suffer from cardiomyopathy and receive a PMC, 50 percent show dramatic improvements with spontaneous circulation within 15 minutes of the PMC.^{32,33} Performing a PMC allows for the best chance of survival for both the mother and her baby.

Importance of simulation training

Training in emergency situations is generally conducted on an individual basis; however, patients are treated by a multidisciplinary team that that must work as a tightly functioning whole during emergency situations. Team training is important to preventing communication errors that lead to avoidable death. By providing simulated obstetric emergency training, teams can work together and improve communications resulting in a reduction in medical errors.³⁴

Deep vein thrombosis (DVT) prophylaxis for all cesarean section patients.

Venous thromboembolism is one of the main causes of maternal mortality in the developed world with cesarean deliveries increasing the risk of such events. Compared with non-pregnant women, pregnant women have an increased risk for thromboembolism. About 80% of thromboembolic events during pregnancy are venous, with pulmonary embolism and other VTE responsible for 1.1 deaths per 100,000 deliveries, or 9% of all maternal deaths in the United States. All women undergoing cesarean delivery should undergo thromboembolism prophylaxis prior to delivery.³⁵

Recommend routine testing for hemoglobinopathies for pregnant women as a standard of care.

Hemoglobinopathies are common autosomal recessive diseases with the highest frequencies in Mediterranean, Middle Eastern, Indian, Caribbean, and African populations. With the increase immigration patterns of these populations, disorders linked to hemoglobinopathies have become a public health problem.³⁶ Screening for specific genetic diseases is recommended to identify disorders or risk for such disorders and offer the mother information about personal health and the potential health impact of her child.^{37,38} Prenatal testing provides an accurate, safe and early diagnosis of disorders allowing parents to have sufficient time to prepare or terminate the pregnancy. Kaiser Permanente introduced a prenatal screening program as part of every woman's prenatal lab work. For women who are carriers, referrals are made to genetic centers for counseling and testing the father to determine his carrier status. Internationally, hemoglobinopathy testing is widely conducted; this standard should also be instituted in the United States.³⁹

**Recommendation 7:
Education for consumers to improve outcomes**

Cardiopulmonary resuscitation

Current standard of CPR training for the public include adult and infant CPR; however, there is currently no standard training included in CPR courses on conducting CPR on pregnant women. Pregnancy creates a unique situation in which the fetus during the second half of pregnancy may compress the inferior vena cava and impede venous return to the heart when the woman is lying in the supine position.²⁸ There are two options that should be covered during CPR training certifications. First, pregnant women in cardiac distress should be

placed in a left lateral tilt position in order to move the uterus off the inferior vena cava. The second method is leaving the mother in the supine position and having a second person manually deflect the uterus. Adding these additional methods to CPR training certification will improve responses to pregnant women experiencing a cardiac event.²⁸

Seatbelt use for pregnant women

Automobile crashes are the leading cause of death for pregnant women and the leading cause of traumatic fetal injury mortality in the U.S.^{40,41,42} Three-point and four-point belts are superior in reducing both maternal and fetal death compared to lap restraints or not using a restraint system.⁴¹ Based on results from both frontal and side impact accidents, the safest place for a pregnant occupant is the passenger seat wearing a three- or four-point belt and utilizing the frontal airbag.^{41,42} Information on seatbelt usage should be provided to all women during preconception and prenatal evaluations.

**Recommendation 8:
Treatment of pregnant or postpartum women with non-obstetric medical conditions**

Medical consults for pregnant women who have non-pregnancy related issues

Women are responsible to disclose all health conditions to their providers. They are encouraged to follow with the same providers and hospital systems to improve continuity of care. Women are responsible to provide an accurate report of all medications (name, dosing and frequency) and substances taken. They are responsible to keep appointments as scheduled, and play an active role in the maintenance of their health.

All women should be informed about the plan for continuing management of current health problems (physical and mental health) during pregnancy.⁴³ Medical records should be

requested by the Obstetrician from the Primary Medical Doctor when beginning the care of new pregnant patients. All pregnant patients should have a medical primary care physician.

Women who are pregnant should receive the same level of medical and surgical care as they would if they were not pregnant. Medical consults should be obtained for pregnant women who have non-pregnancy related issues. It is recommended that consultants' state what the optimal management would be if the patient were not pregnant, and then discuss modifications of this treatment plan for pregnancy with the patient's obstetrician.

Co-management by obstetricians, gynecologist, and appropriate specialists of critically ill obstetrics patients

Rapid response teams should be developed that are capable of recognizing early signs of critical

illness in the pregnant patient. Co-management by obstetricians, gynecologist, and appropriate specialists of critically ill obstetric patients is recommended.

Death certificates should be completed by the primary medical doctor and should accurately reflect the pregnancy status of deceased women.

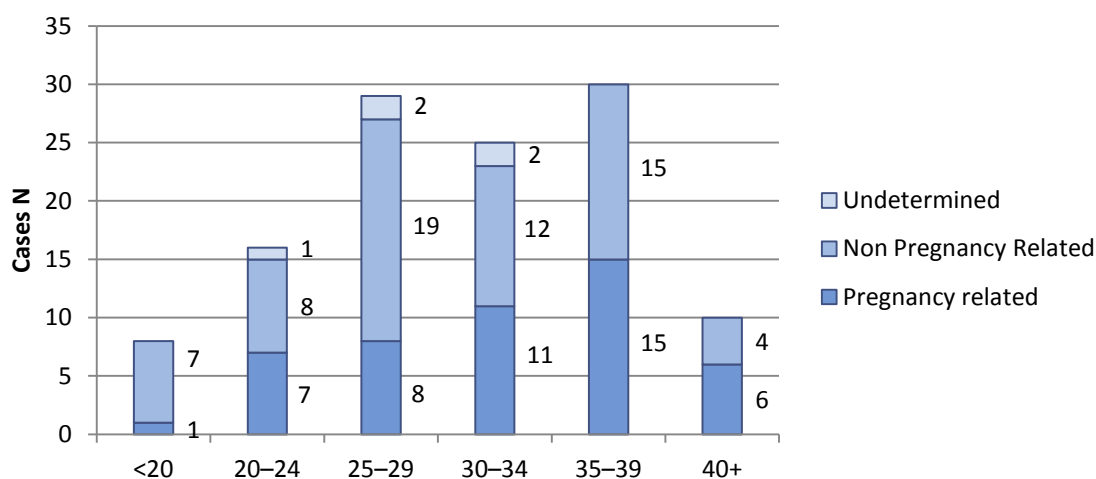
It is recommended that the first post-partum visit occur within 10 days of delivery.⁴⁴ Women should also schedule a follow-up visit with their primary medical doctor within 14 days of delivery. The subsequent frequency of post-partum visits should be determined by the significance and severity of current medical or mental health issues.

Appendix A

Maternal Death

From 2006 to 2008, the New Jersey Maternal Mortality Case Review Team (CRT) identified a total of 118 maternal deaths: 46 in 2006, 32 in 2007, and 40 in 2008.

**Maternal Deaths by Age and Relationship to Pregnancy
New Jersey, 2006–2008 (N=118)**



Of the 46 maternal deaths in 2006, the CRT determined 24 were pregnancy-related, 20 were non-pregnancy-related, and 2 were undetermined.

**Maternal Deaths by Age and Relationship to Pregnancy
New Jersey, 2006–2008 (N=118)**

Age Group	Total		Relationship to Pregnancy					
			Pregnancy-Related		Non-Pregnancy-Related		Undetermined	
	N	%	N	%	N	%	N	%
<20	8	6.8 ²	1	¹	7	10.8 ²	0	0.0
20–24	16	13.6 ²	7	14.6 ²	8	12.3 ²	1	¹
25–29	29	24.6	8	16.7 ²	19	29.2 ²	2	¹
30–34	24	20.3	11	22.9 ²	12	18.5 ²	2	¹
35–39	30	25.4	15	31.3 ²	15	23.1 ²	0	0.0
40+	10	8.5 ²	6	12.5 ²	4	¹	0	0.0
Total	118	100.0	48	100.0	65	100.0	5	100.0

¹ Cell counts with less than 5 cases are considered too small to calculate a reliable percentage (Rudolph, 2004). ² Percentages and rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

Of the 32 maternal deaths in 2007, the CRT determined 11 were pregnancy-related, 20 were non-pregnancy-related, and 1 was undetermined.

**Maternal Deaths by Mean Age at Death and Relationship to Pregnancy
New Jersey, 2006–2008 (N=118)**

Relationship to Pregnancy	N	Maternal Age			
		Minimum	Maximum	Mean	SD
Pregnancy-Related	48	18	45	32.6	6.7
Non-Pregnancy-Related	65	17	44	29.6	7.0
Undetermined	5	21	34	27.8	4.9
Total	118	17	45	30.7	7.0

Of the 40 maternal deaths in 2008, the CRT determined 13 were pregnancy-related, 25 were non-pregnancy-related, and 2 were undetermined.

For the 65 non-pregnancy-related deaths, the distribution by age group was as follows: less than 20 years of age: N=7, 20 to 24 years: N=8, 25 to 29 years: N=19, 30 to 34 years: N=12, 35 to 39 years: N=15, and 40 years and older: N=4.

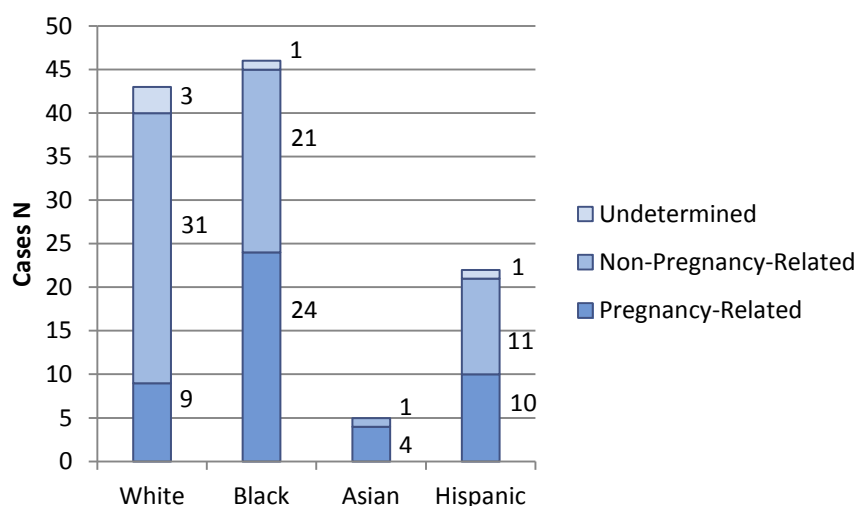
The mean age at death across all cases was 30.7 years. For pregnancy-related deaths, the mean age was 32.6 years and for non-pregnancy-related deaths, the mean age was 29.6 years. For undetermined deaths, the mean age was 27.8 years.

Race and Ethnicity

Of the total 118 maternal deaths, 39% (n=46) occurred to Black, 36.4% (n=43) occurred to White, 18.6% (n=22) occurred to Hispanic, and 4.2% (n=5) occurred to Asian women.

Of the 48 pregnancy-related deaths, 24 occurred to Black, 10 occurred to Hispanic, 9 occurred to White, and 4 occurred to Asian women. Of the 65 non-pregnancy-related deaths, 31 occurred to White, 21 occurred to Black, 11 occurred to Hispanic, and 1 occurred to Asian women. Of the 5 undetermined deaths, 3 occurred to White, 1 occurred to Black, and 1 occurred to Hispanic women.

Maternal deaths by Race, Ethnicity and Relationship to Pregnancy
New Jersey, 2006–2008 (N=118)



Data for White, Black, and Asian do not include Hispanics. Hispanic ethnicity includes persons of any race.

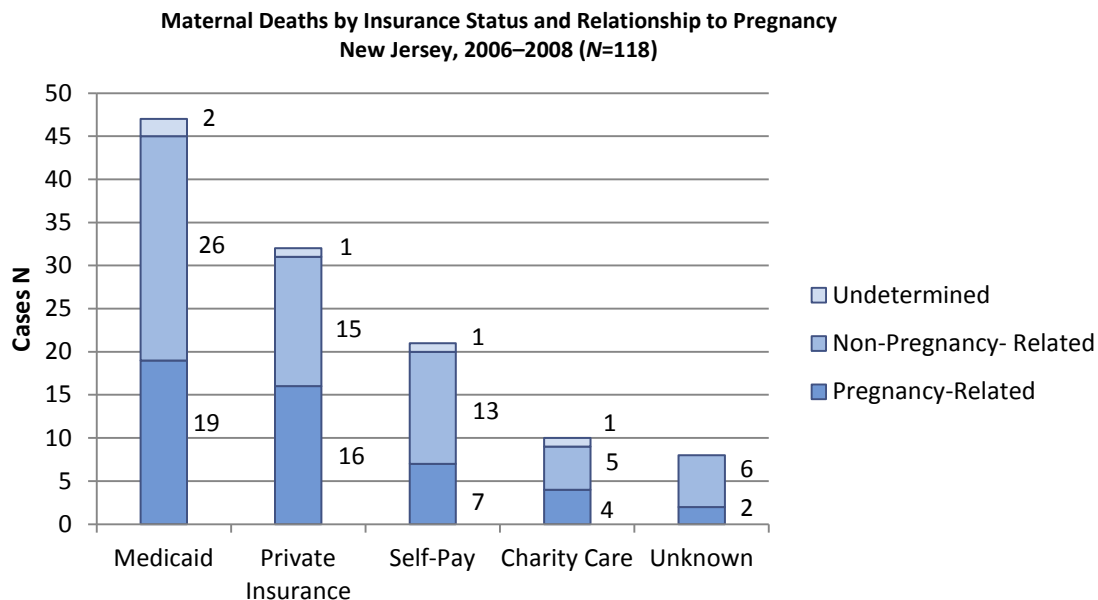
Maternal Deaths by Relationship to Pregnancy and Race and Ethnicity
New Jersey, 2006–2008 (N=118)

Race/Ethnicity	Total		Relationship to Pregnancy					
			Pregnancy-Related		Non-Pregnancy-Related		Undetermined	
	N	%	N	%	N	%	N	%
White	43	36.4	9	18.8 ²	31	47.7	3	¹
Black	46	39.0	24	50.0	21	32.3	1	¹
Asian	5	4.2 ²	4	¹	1	¹	0	0.0
Hispanic	22	18.6	10	20.8 ²	11	16.9 ²	1	¹
Not Stated	2	¹	1	¹	1	¹	0	0.0
Total	118	100.0	48	100.0	65	100.0	5	100.0 ²

¹Cell counts with less than 5 cases are considered too small to calculate a reliable percentage. Percentages and rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution. Data for White, Black, and Asian do not include Hispanics. Hispanic ethnicity includes persons of any race.

Insurance Status

Of the total 118 maternal deaths, 47 (39.8%) received Medicaid, 32 (27.1%) had private insurance, 21 (17.8%) were self-pay, and 10 (8.5%) received charity care. In 8 cases, insurance status was unknown.



Of the 48 pregnancy-related deaths, 19 (39.6%) received Medicaid, 16 (33.3%) had private insurance, 7 (14.6%) were self-pay, and 4 received charity care. In 2 cases, insurance status was unknown.

**Maternal Deaths by Insurance Status and Relationship to Pregnancy
New Jersey, 2006–2008 (N=118)**

Insurance	Total		Relationship to Pregnancy					
			Pregnancy-Related		Non-Pregnancy-Related		Undetermined	
	N	%	N	%	N	%	N	%
Medicaid	47	39.8	19	39.6 ²	26	40.0	2	¹
Private Insurance	32	27.1	16	33.3 ²	15	23.1 ²	1	¹
Self-Pay	21	17.8	7	14.6 ²	13	20.0 ²	1	¹
Charity Care	10	8.5 ²	4	¹	5	7.7 ²	1	¹
Unknown	8	6.8 ²	2	¹	6	9.2 ²	0	0.0
Total	118	100.0	48	100.0	65	100.0	5	100.0

¹ Cell counts with less than 5 cases are considered too small to calculate a reliable percentage (Rudolph, 2004).

² Percentages and rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

Of the 65 non-pregnancy-related deaths, 26 (40.0%) received Medicaid, 15 (23.1%) had private insurance, 13 were self-pay (20.0%), and 5 (7.7%) received charity care. In 6 cases, insurance status was unknown.

Of the 5 undetermined deaths, 2 received Medicaid, 1 had private insurance, 1 was self-pay, and 1 received charity care.

Stage of Pregnancy at Death

Of the total 118 maternal deaths, 97 (82.2%) occurred during the postpartum period, 9 (7.6%) occurred during the first trimester, 3 occurred during the second trimester, 6 occurred during the third trimester, and 3 occurred during labor and delivery.

**Maternal Deaths by Stage of Pregnancy at Death and Relationship to Pregnancy
New Jersey, 2006–2008**

Stage of Pregnancy	Total		Relationship to Pregnancy					
			Pregnancy-Related		Non-Pregnancy Related		Undetermined	
	N	%	N	%	N	%	N	%
Postpartum	97	82.2	37	77.1	56	86.2	4	¹
1st Trimester	9	7.6 ²	5	10.4 ²	4	¹	0	0.0
2nd Trimester	3	¹	0	0.0	3	¹	0	0.0
3rd Trimester	6	5.1 ²	3	¹	2	¹	1	¹
Labor & Delivery	3	¹	3	¹	0	0.0	0	0.0
Total	118	100.0	48	100.0	65	100.0	5	100.0 ²

¹ Cell counts with less than 5 cases are considered too small to calculate a reliable percentage (Rudolph, 2004). ² Percentages and rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

Of the 48 pregnancy-related deaths, 37 (77.1%) occurred during the postpartum period, 5 (10.4%) occurred during the first trimester, 0 occurred during the second trimester, 3 occurred during the third trimester, and 3 occurred during labor and delivery.

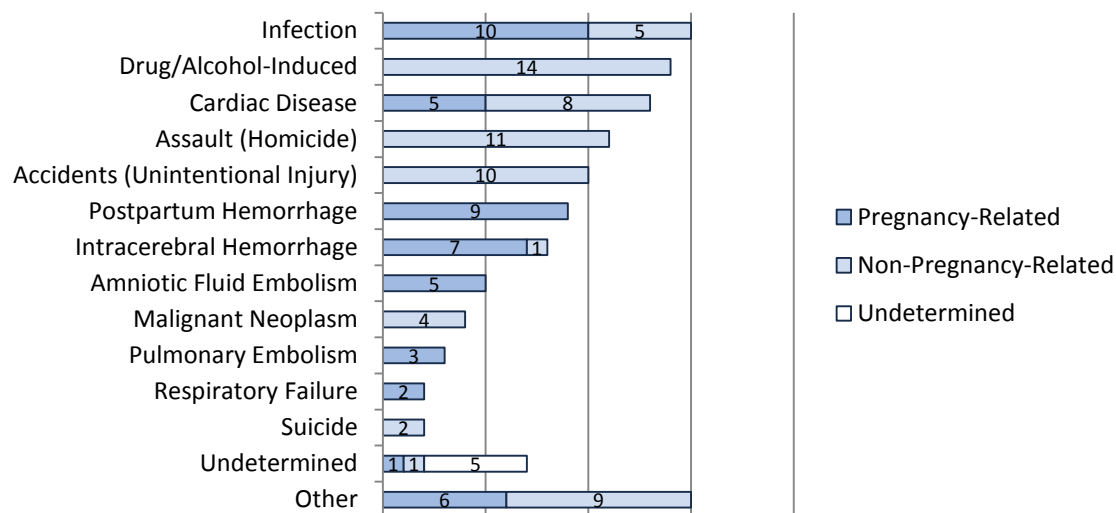
Of the 65 non-pregnancy-related deaths, 56 (86.2%) occurred during the postpartum period, 4 occurred during the first trimester, 3 occurred during the second trimester, and 2 occurred during the third trimester.

Of the 5 undetermined deaths, 4 occurred during the postpartum period, and 1 occurred during the third trimester.

Causes of Death

The cause of death category is assigned following the deliberations of the Review Team. Of the 118 total deaths, the most frequent cause of death was infection (N=15), drug/alcohol-induced (N=14), cardiac disease (N=13), assault/homicide (N=11), accident/unintentional injury (N=10), postpartum hemorrhage (N=9), intracerebral hemorrhage (N=8), amniotic fluid embolism (N=5), malignant neoplasm (N=4), pulmonary embolism (N=3), respiratory failure (N=2), and suicide (N=2). In 7 cases, the cause of death was undetermined. Other causes were cited in 15 cases.¹

Maternal Deaths by Cause of Death and Relationship to Pregnancy: New Jersey, 2006–2008 (N=118)



The most frequent cause of death: infection (N=10), postpartum hemorrhage (N=9), intracerebral hemorrhage (N=7), other (N=6), cardiac disease (N=5), amniotic fluid embolism (N=5), pulmonary embolism (N=3), and respiratory failure (N=2). The cause of death was undetermined in one case

Maternal Deaths by Cause of Death and Relationship to Pregnancy: New Jersey, 2006–2008 (N=118)

Cause of Death	Total		Relationship to Pregnancy					
			Pregnancy-Related		Non-Pregnancy-Related		Undetermined	
	N	%	N	%	N	%	N	%
Infection	15	12.7 ²	10	20.8 ²	5	7.7 ²	0	0.0
Drug/Alcohol-Induced	14	11.9 ²	0	0.0	14	21.5 ²	0	0.0
Cardiac Disease	13	11.0 ²	5	10.4 ²	8	12.3 ²	0	0.0
Assault (Homicide)	11	9.3 ²	0	0.0	11	16.9 ²	0	0.0
Accidents (Unintentional Injury)	10	8.5 ²	0	0.0	10	15.4 ²	0	0.0
Postpartum Hemorrhage	9	7.6 ²	9	18.8 ²	0	0.0	0	0.0
Intracerebral Hemorrhage	8	6.8 ²	7	14.6 ²	1	¹	0	0.0
Amniotic Fluid Embolism	5	4.2 ²	5	10.4 ²	0	0.0	0	0.0
Malignant Neoplasm	4	¹	0	0.0	4	¹	0	0.0
Pulmonary Embolism	3	¹	3	¹	0	0.0	0	0.0
Respiratory Failure	2	¹	2	¹	0	0.0	0	0.0
Suicide	2	¹	0	0.0	2	¹	0	0.0
Undetermined	7	5.9 ²	1	¹	1	¹	5	100.0 ²
Other	15	12.7 ²	6	12.5 ²	9	13.8 ²	0	0.0
Total	118	100.0	48	100.0	65	100.0	5	100.0

¹ Cell counts with less than 5 cases are considered too small to calculate a reliable percentage (Rudolph, 2004). ² Percentages and rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

¹ Other causes of death included: blunt head trauma, acute subarachnoid hemorrhage, sepsis due to pneumonia, seizure disorder of undetermined etiology, cerebral edema/intracranial hemorrhage, bilateral pulmonary micro vascular occlusion by red blood cell thrombi, cardiac tamponade, and thrombotic thrombocytopenic purpura, and other trauma-related.

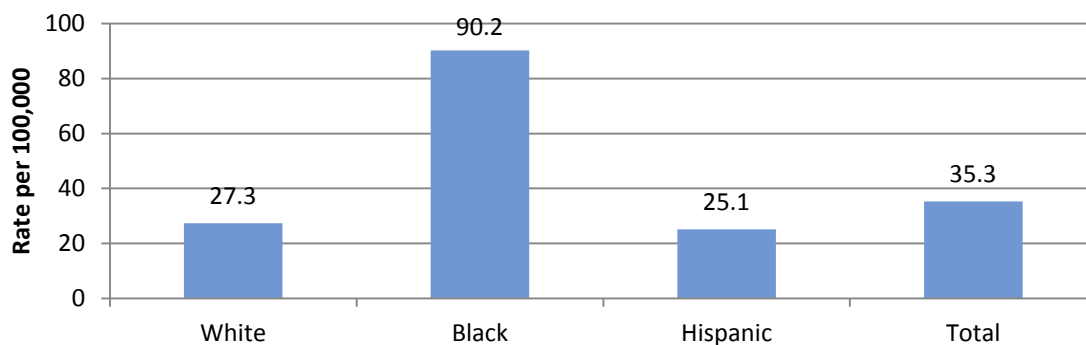
Of the 65 non-pregnancy-related deaths, the most frequent cause of death was drug/alcohol-induced (N=14), followed by assault/homicide (N=11), accident/unintentional injury (N=10), other causes (N=9)¹, cardiac disease (N=8), infection (N=5), malignant neoplasm (N=4), suicide (N=2), intracerebral hemorrhage (N=1). In 1 case, the cause of death was undetermined.

Maternal Mortality Rates

Race/Ethnicity

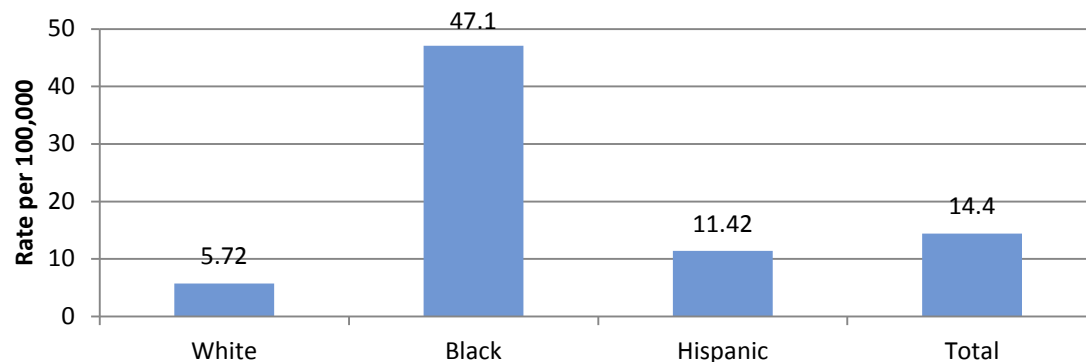
From 2006 to 2008, the maternal mortality rate (per 100,000 births) was 35.3 across all racial and ethnic subgroups, 27.3 for White, 90.2 for Black, and 25.1 for Hispanic. Compared to the White population, the risk of maternal death was 3.3 times higher in the Black population.

Maternal Mortality Rate (per 100,000) by Race/Ethnicity: 2006–2008



From 2006 to 2008, the pregnancy-related mortality rate (per 100,000 births) was 14.4 across all racial and ethnic subgroups, 5.7 for White, 47.1 for Black, and 11.4 for Hispanic. Compared to the White population, the risk of a pregnancy-related death was 8.2 times higher in the Black population and 2.0 times higher in the Hispanic population.

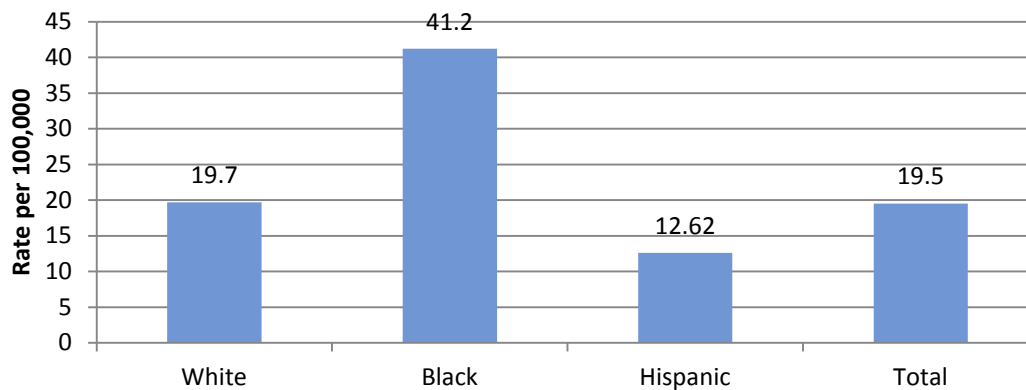
Pregnancy-Related Mortality Rate (per 100,000) by Race/Ethnicity: 2006–2008



From 2006 to 2008, the non-pregnancy-related mortality rate (per 100,000 births) was 19.5 across all racial and ethnic subgroups, 19.7 for White, 41.2 for Black, and 12.6 for Hispanic. Compared to the Hispanic population (the group with the lowest rate) the risk of a non-pregnancy-related maternal death was 3.3 times higher in the Black population and 1.6 times higher in the White population.

The information presented here is descriptive only and does not account for differences in socioeconomic status and other factors that may influence the observed differences.

Non-Pregnancy-Related Mortality Rate (per 100,000) by Race/Ethnicity: 2006–2008



Maternal Mortality Rate (per 100,000) by Race/Ethnicity: New Jersey, 2006–2008

Race/Ethnicity	Number of Deaths	Number of Births	Mortality Rate	Relative Risk
White	43	157,250	27.3	Reference Group
Black	46	50,978	90.2	3.3
Asian	5	32,011	15.6 ²	0.6 ²
Other	0	5,702	0.0	0.0
Hispanic	22	87,640	25.1	0.9
Unknown	2	400	¹	¹
Total	118	333,981	35.3	1.3

¹ Cell counts with less than 5 cases are considered too small to calculate a reliable rate (Rudolph, 2004). ² Rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

Data for White, Black, Asian, and Other do not include Hispanics. Hispanic ethnicity includes persons of any race.

Birth Data Source: New Jersey Department of Health and Senior Services, MCH Epidemiology Program, Electronic Birth Certificate, September, 2010. Provisional.

Pregnancy-Related Mortality Rate (per 100,000) by Race/Ethnicity: New Jersey, 2006–2008

Race/Ethnicity	Number of Deaths	Number of Births	Mortality Rate	Relative Risk
White	9	157,250	5.7 ¹	Reference Group ²
Black	24	50,978	47.1	8.2
Asian	4	32,011	¹	¹
Other	0	5,702	0.0	0.0
Hispanic	10	87,640	11.4 ²	2.0 ²
Unknown	1	400	¹	¹
Total	48	333,981	14.4	2.5

¹Cell counts with less than 5 cases are considered too small to calculate a reliable rate (Rudolph, 2004). ²Rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

Data for White, Black, Asian, and Other do not include Hispanics. Hispanic ethnicity includes persons of any race.

Birth Data Source: New Jersey Department of Health and Senior Services, MCH Epidemiology Program, Electronic Birth Certificate, September, 2010. Provisional.

Non-Pregnancy-Related Mortality Rate (per 100,000) by Race/Ethnicity: New Jersey, 2006–2008

Race/Ethnicity	Number of Deaths	Number of Births	Mortality Rate	Relative Risk
White	31	157,250	19.7	1.6
Black	21	50,978	41.2	3.3
Asian	1	32,011	¹	¹
Other	0	5,702	0.0	0.0
Hispanic	11	87,640	12.6 ²	Reference Group ²
Unknown	1	400	¹	¹
Total	65	333,981	19.5	1.5

¹Cell counts with less than 5 cases are considered too small to calculate a reliable rate (Rudolph, 2004). ²Rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

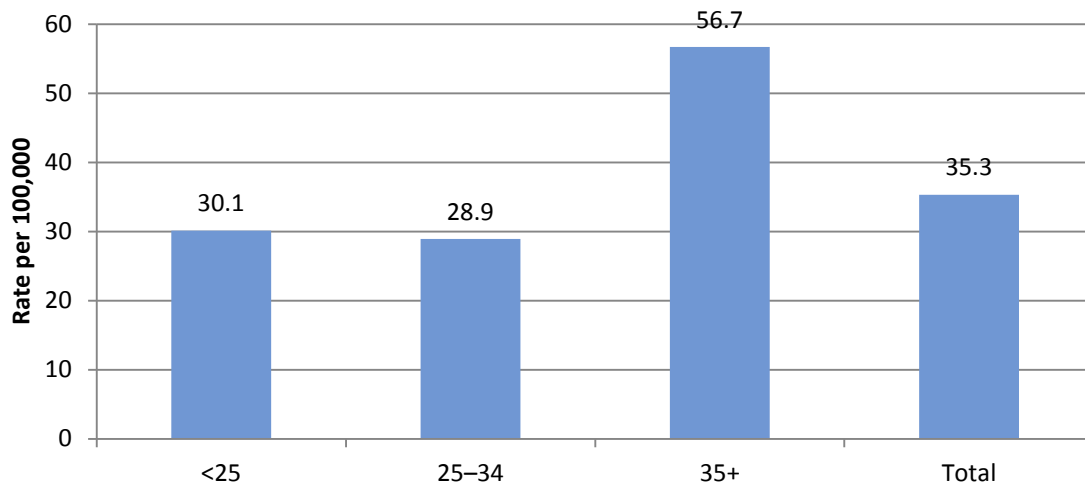
Data for White, Black, Asian, and Other do not include Hispanics. Hispanic ethnicity includes persons of any race.

Birth Data Source: New Jersey Department of Health and Senior Services, MCH Epidemiology Program, Electronic Birth Certificate, September, 2010. Provisional.

Age

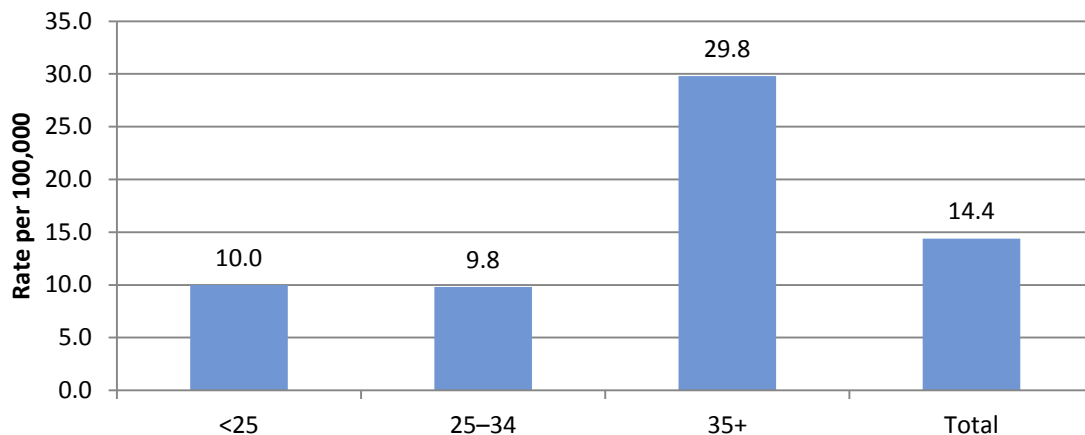
From 2006 to 2008, the maternal mortality rate was 35.3 (per 100,000) for all age groups. The mortality rate was lowest for women aged 25 to 34 (28.9), and women less than 25 years (30.1), while for women aged 35 and older, the mortality rate was highest (56.7). The risk of a maternal death was two times higher for women aged 35 and older compared to women aged 25 to 34 years of age.

Maternal Mortality Rate by Age: New Jersey, 2006–2008

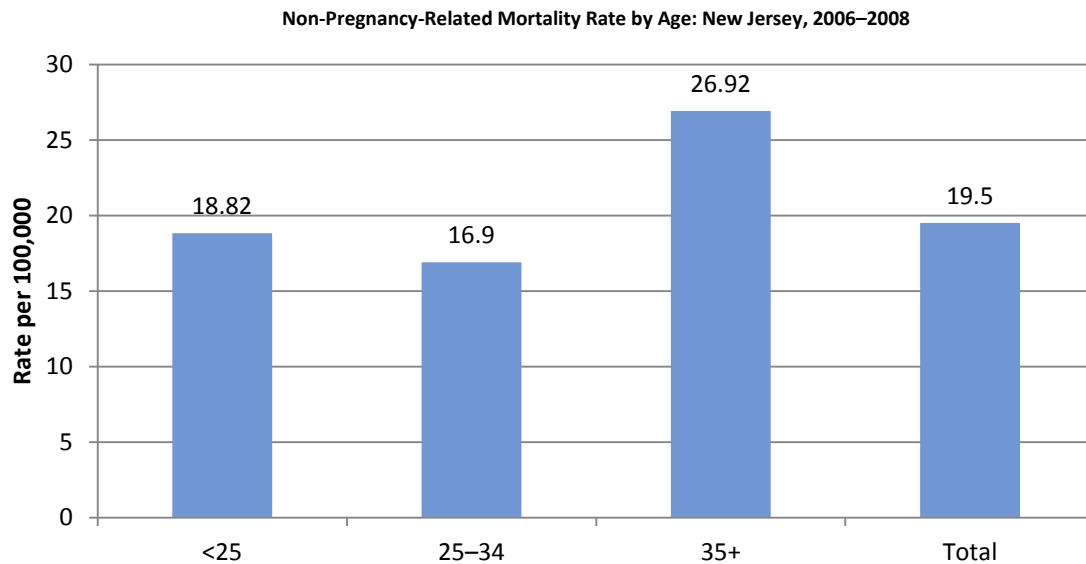


From 2006 to 2008, the pregnancy-related mortality rate was 14.4 (per 100,000) for all age groups. The pregnancy-related mortality rate was lowest for women aged 25 to 34 (9.8), and women less than 25 years (10.0), while for women aged 35 and older, the mortality rate was highest (29.8). The risk of a maternal death was three times higher for women aged 35 and older compared to women aged 25 to 34 years of age.

Pregnancy-Related Mortality Rate by Age: New Jersey, 2006–2008



From 2006 to 2008, the non-pregnancy-related mortality rate was 19.5 (per 100,000) for all age groups. The non-pregnancy-related mortality rate was lowest for women aged 25 to 34 (16.9), and women less than 25 years (18.8), while for women aged 35 and older, the maternal mortality rate was highest (26.9). The risk of a maternal death was 1.6 times higher for women aged 35 and older compared to women aged 25 to 34 years of age.



Maternal Mortality Rate (per 100,000) by Age: New Jersey, 2006–2008

Age Group (Years)	Number of Deaths	Number of Births	Mortality Rate	Relative Risk
<25	24	79,743	30.1	1.0
25–34	53	183,412	28.9	Reference Group
35+	40	70,527	56.7	2.0
Unknown	1	299	¹	¹
Total	118	333,981	35.3	1.2

¹Rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).²Cell counts with less than 5 cases are considered too small to calculate a reliable rate (Rudolph, 2004).

Birth Data Source: New Jersey Department of Health and Senior Services, MCH Epidemiology Program, Electronic Birth Certificate, September, 2010. Provisional.

Pregnancy-Related Mortality Rate (per 100,000) by Age: New Jersey, 2006–2008

Age Group (Years)	Number of Deaths	Number of Births	Mortality Rate	Relative Risk
<25	8	79,743	10.0 ²	1.0 ²
25–34	18	183,412	9.8 ²	Reference Group
35+	21	70,527	29.8	3.0
Unknown	1	299	¹	¹
Total	48	333,981	14.4	1.5

¹Cell counts with less than 5 cases are considered too small to calculate a reliable rate (Rudolph, 2004). ²Rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004).

Birth Data Source: New Jersey Department of Health and Senior Services, MCH Epidemiology Program, Electronic Birth Certificate, September, 2010. Provisional.

Non-Pregnancy-Related Mortality Rate (per 100,000) by Age: New Jersey, 2006–2008

Age Group (Years)	Number of Deaths	Number of Births	Mortality Rate	Relative Risk
<25	15	79,743	18.8 ²	1.1 ²
25–34	31	183,412	16.9	Reference Group
35+	19	70,527	26.9 ²	1.6 ²
Unknown	0	299	0.0	0.0
Total	65	333,981	19.5	1.2

¹Rates based on fewer than 20 cases are considered unreliable and should be interpreted with caution (Rudolph, 2004). ²Cell counts with less than 5 cases are considered too small to calculate a reliable rate (Rudolph, 2004).

Birth Data Source: New Jersey Department of Health and Senior Services, MCH Epidemiology Program, Electronic Birth Certificate, September, 2010. Provisional.

References

1. Schuur JD, Tibbetts SA, Pines JM. Pregnancy testing in women of reproductive age in US emergency departments, 2002-2006: Assessment of a national quality measure. *Ann Emerg Med* 2010;55:449-457
2. Department of Veteran Affairs, Department of Defense. VA/DoD clinical practice guideline for management of pregnancy. Washington (DC): Department of Veteran Affairs, Department of Defense; 2009. 163 p.
3. Good health before pregnancy: preconception care. ACOG Patient Education. American College of Obstetricians and Gynecologists. January 2007.
4. Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). Guidelines for diagnosis, treatment and use of laparoscopy for surgical problems during pregnancy. Los Angeles, CA. Society of American Gastrointestinal and Endoscopic Surgeons (SAGES): 2007; Sep 25p.
5. Toppenberg KS, Hill DA, Miller DP. Safety of radiographic imaging during pregnancy. *Am Fam Physician*. 1999;59:1813-1818
6. ACR Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation. 2008 (Resolution 26).
7. Hamama L, Rauch SAM, Sperlich M, Defever E, Seng JS. Previous experience of spontaneous or elective abortion and risk of posttraumatic stress and depression during subsequent pregnancy. 2010; 27:699-707.
8. Colman PK, Coyle CT, Rue VM. Late-term elective abortion and susceptibility to posttraumatic stress symptoms. *Journal of Pregnancy*. 2010; 2010:1-10.
9. Broen AN, Moum T, Bodtker AS, Ekeberg O. The course of mental health after miscarriage and induced abortion: a longitudinal, five-year follow-up study. *BioMed Central Medicine*. 2005; 3:3-18.
10. Horowitz JA, Murphy CA, Gregory KE, Wojcik J. Best practices: community-based postpartum depression screening: Results from the CARE study. *Psychiatric Services*. 2009; 60:1432-1434.
11. Hotelling BA. Perinatal needs of pregnant, incarcerated women. *The Journal of Perinatal Education*. 2008; 17:37-44.
12. AcocA, L. (1998). Diffusing the time bomb: Understanding and meeting the growing health care needs of incarcerated women in America. *Crime and Delinquency*; 44 (1), 49-70.
13. CDC. Substance abuse treatment for injecting drug users: a strategy with many benefits. Centers for Disease Control and Prevention; Atlanta: 2002.
14. WHO. WHO Status Paper on Prisons, Drugs and Harm Reduction. 2005
15. Nunn A, Zaller N, Dickman S, Trimbur C, Nijhawan A, Rich JD. Methadone and Buprenorphine prescribing and referral practices in US prison systems: Results from a nationwide survey. *Drug and Alcohol Dependence*. 2009; 105:83-88.
16. New Jersey County Jail Wardens Association. 2012. <http://www.njciwa.com/#/nj-county-jails/4560537766>
17. Jansson LM, DiPietro JA, Velez M, Elko A, Knauer H, Kivlighan KT. Maternal methadone dosing schedule and fetal neurobehavior. *Journal of Maternal, Fetal, and Neonatal Medicine*. 2009; 22:29-35.
18. US Department of Health and Human Services Substance Abuse and Mental Health Services Administration Center for Substance Abuse Treatment. Medication-assisted treatment for opioid addiction in opioid treatment programs: A treatment improvement protocol TIP 43. 2005.
19. Mueller BA, Chow EJ, Kamineni A, Daling JR, Fraser A, Wiggins CL, Mineau GP, Hamre MR, Severson RK, Drews-Botsch C. Pregnancy outcomes for female childhood and adolescent cancer survivors: a linked cancer-birth registry analysis. *Archives of Pediatric and Adolescent Medicine*. 2009; 163:879-886.
20. Reulen RC, Zeegers MP, Wallace WHB, Frobisher C, Taylor AJ, Lancashire ER, Winter DL, Hawkins MM. Pregnancy outcomes among adult survivors of childhood cancer in the British childhood cancer survivor study. *Cancer Epidemiology Biomarkers Prevention*. 2009; 18:2239-2247.

21. Litton JK, Theriault RL. Breast cancer and pregnancy: Current concepts in diagnosis and treatment. *The Oncologist*. 2010; 15:1238-1247.
22. Wald RM, Sermer M, Colman JM. Pregnancy and contraception in young women with congenital heart disease: General considerations. *Pediatric and Child Health*. 2011; 16:e25-e29.
23. Siu SC, Sermer M, Colman JM, Alvarez AN, Mercier LA, Morton BC, Kells CM, Bergin ML, Kiess MC, Marcotte F, Taylor DA, Gordon EP, Spears JC, Tam JW, Amankwah KS, Smallhorn JF, Farine D, Sorensen S, Cardiac Disease in Pregnancy (CARPREG) Investigators: Prospective multicenter study of pregnancy outcomes in women with heart disease. *Circulation* 2001, 104(5):515-521.
24. Kitzmiller JL, Block JM, Brown FM, Catalano PM, Conway DL, Coustan DR, Gunderson EP, Herman WH, Hoffman LD, Inturrisi M, Jovanovic LB, Kjos SI, Knopp RH, Montoro MN, Ogata ES, Paramsothy P, Reader DM, Rosenn BM, Thomas AM, Kirkman MS. Managing preexisting diabetes for pregnancy: Summary of evidence and consensus recommendations for care. *Diabetes Care*. 2008; 31:1060-1079.
25. Murphy HR, Roland JM, Skinner TC, Simmons D, Gurnell E, Morrish NJ, Soo SC, Kelly S, Lim B, Randall J, Thompsett S, Temple RC. Effectiveness of a regional pre-pregnancy care program in women with type 1 and type 2 diabetes: Benefits beyond glycemic control. *Diabetes Care*. 2010; 33:2514-2520.
26. Smyth A, Oliveira GHM, Lahr BD, Bailey KR, Norby SM, Garovic VD. A systematic review and meta-analysis of pregnancy outcomes in patients with systemic lupus erythematosus and lupus nephritis. *Clinical Journal of American Soc Nephrology*. 2010; 5:2060-2068.
27. Kiss G, Arvieux CC: Remarks on guidelines ERC 2000: cardiac arrest associated with pregnancy. *Resuscitation* 2004, 61(3):367.
28. Jeejeebhoy FM, Zelop CM, Windrim R, Carvalho JC, Dorian P, Morrison LJ: Management of cardiac arrest in pregnancy: a systematic review. *Resuscitation* 2011, 82(7):801-809.
29. Baugher KM, Mattu A. Ten rules to assess and manage the acutely deteriorating patient: a practical mnemonic. *Patient Safety in Surgery*. 2011; 5:1-7.
30. Tan HL, Lie KI: Treatment of tachyarrhythmias during pregnancy and lactation. *Eur Heart J* 2001, 2(6):458-464.
31. Vanden Hoek TL, Morrison LJ, Shuster M, Donnino M, Sinz E, Lavonas EJ, Jeejeebhoy FM, Gabrielli A: Part 12: cardiac arrest in special situations: 2010 American Heart Association Guidelines for cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2010, 122(18 Suppl 3):S829-S861.
32. Katz V, Balderston K, DeFreest M: Perimortem cesarean delivery: were our assumptions correct? *Am J Obstet Gynecol* 2005, 192:1916-1920.
33. Dijkman A, Huisman CM, Smit M, Schutte JM, Zwart JJ, van Roosmalen JJ, Oepkes D: Cardiac arrest in pregnancy: increasing use of perimortem caesarean section due to emergency skills training. *BJOG* 2010, 117(3):282-287.
34. Van de Ven J, Houterman S, Steinweg RAJQ, Scherpbier AJJA Wijers W, William B, Oei SG, TOSTI-trial group. Reducing errors in health care: cost-effectiveness of multidisciplinary team training in obstetric emergencies (TOSTI study); a randomized controlled trial. *Pregnancy and Childbirth*. 2010; 10:59.
35. American Congress of Obstetrician Gynecologists (ACOG) Practice Bulletin: September 2011. Thromboembolism in Pregnancy.
36. Rosatelli MC, Saba L. Prenatal diagnosis of beta-thalassemias and hemoglobinopathies. *Mediterranean Journal of Hematology and Infectious Diseases*. 2009; 1.
37. Cousens NE, Gaff CL, Metcalfe SA, Delatycki MB. Carrier screening for beta-thalassaemia: a review of international practice. *European Journal of Human Genetics*. 2010; 18:1077-1083.
38. Griffiths PD, Mann JR, Darbyshire PJ, Green A. Evaluation of eight and a half years of neonatal screening for hemoglobinopathies in Birmingham. *British Medical Journal*. 1988; 296:1583-1585.
39. Kaiser Permanente. Screening Programs. 2008. Accessed November 2012. http://mydoctor.kaiserpermanente.org/ncal/specialty/genetics/screening_programs/hgbscreening.jsp
40. Attico NB, Smith III RJ, Fitzpatrick MB. Automobile safety restraints for pregnant women and children. *J Reprod Med*. 1986;31(3):187-92.

41. Moorcroft DM, Duma SM, Stitzel JD, Duma GG. Computational Model of the Pregnant Occupant: Predicting the Risk of Injury in Automobile Crashes. *American Journal of Obstetrics and Gynecology*. 2003a;2003;189(2):540–544.
42. Weiss HB, Strotmeyer S. Characteristics of pregnant women in motor vehicle crashes. *Injury Prevention*. 2002;8(3):207–214
43. Department of Veteran Affairs, Department of Defense. VA/DoD clinical practice guideline for management of pregnancy. Washington (DC): Department of Veteran Affairs, Department of Defense; 2009. 163 p
44. Clark SL, Belfort MA, Dildy GA, Englebright J, Meints L, Meyers JA, Frye DK, Perlin JA. Emergency department use during the postpartum period: implications for current management of the puerperium. *Am J of Obstet Gynecol* 2010;203:38.e1-6.