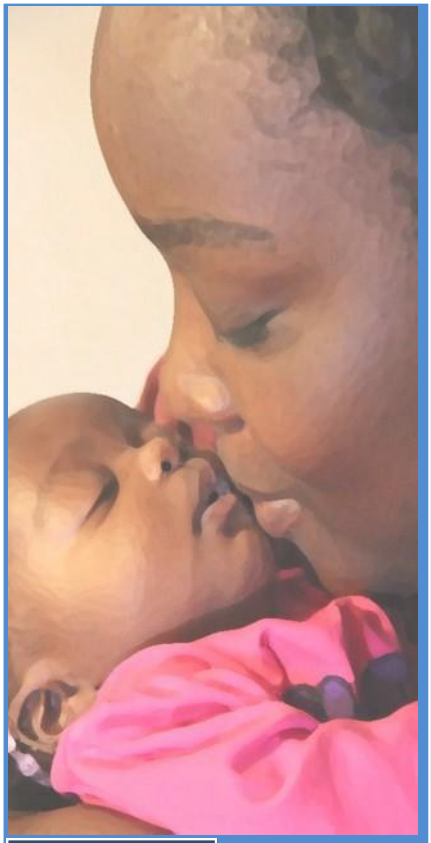

Trends in Statewide Maternal Mortality

New Jersey

2009-2013

NJ Health

NEW JERSEY

TRENDS IN MATERNAL MORTALITY: 2009-2013

200 9 - 201 3

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Acknowledgements

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EXECUTIVE SUMMARY

New Jersey has been a national leader in maternal mortality review for more than 80 years. The work ofthe 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.

The Trends in Maternal Mortality report provides an overview and comparisons of 2009-2013 pregnancy-related death data and not pregnancy-related death data and long-term trends for New Jersey between the years 1999 and 2013. Distributions of deaths are shown by race/ethnicity, age, BMI, the timing of death, delivery outcome, and mode of delivery, the cause of death and other factors. The New Jersey Maternal Mortality Case Review Team (CRT) identified a total of 225 maternal deaths. Of the 225 pregnancy associated deaths, CRT determined 78 (34.7 percent) were pregnancy-related, 129 (57.3 percent) were not pregnancy-related, and 18 (8 percent) were undetermined.

Of the 78 pregnancy-related deaths:

- **Race/Ethnicity**
  - 26.9% were non-Hispanic White women
  - 46.2% were non-Hispanic Black women
  - 15.4% were Hispanic women
  - 7.7% were Asian women

- **Timing of Death**
  - 10.2 % occurred while pregnant
  - 8.9% occurred less than one day postpartum
  - 17.8% occurred 1-42 days postpartum
  - 49.8% occurred 43+ days postpartum

- **Pre-pregnancy Weight**
  - 44.1% were Normal weight (BMI: 18.5-24.9)
  - 20.3% were Overweight (BMI: 25.0-29.9)
  - 22.0% were Obese (BMI: 30.0-39.9)
  - 10.2% were Morbidly Obese (BMI: 40+)

- **Mode of Delivery**
  - 47.7% had a vaginal delivery
  - 50.8% had a cesarean delivery

- **The leading pregnancy related causes of death from 2009-2013 were:**
  - Cardiac (16.7%)
  - Pregnancy-related cardiomyopathy (10.3%)
  - Embolism (9.0%)
  - Septic shock/sepsis (9.0%)
  - Cerebral hemorrhage (7.7%)

INTRODUCTION

Maternal mortality has consistently been a focus of public health nationally and in New Jersey. Although it has had long-standing prominence in the public health arena, its salience has increased in the last 20 years due to the increase in the maternal mortality rate nationally and the persistent disparity in m o r t a l i t y rates for black and African American women (Hoyert 2007).

Rates of pregnancy-related deaths more than doubled over the last 25 years with rates increasing from 7.9 per 100,000 births in 1987 and 15.9 per 100,000 births in 2012. According to the CDC, the increase in maternal deaths may be related to both the increased quality of data collection through the electronic identification of deaths from multiple sources and to the increase in chronic conditions that are linked to pregnancy complications.

Although New Jersey has had an involved maternal mortality review program, state trends mirror national statistics. According to Amnesty International, New Jersey ranks 35th of 50 states in pregnancy-related deaths. Also, significant disparities in maternal mortality persist throughout the state, such that black or African American women experience a pregnancy-related maternal mortality rate of more than five times that of their white counterparts. To address increasing rates of maternal mortality as well as the racial gap in deaths, continued focus on maternal mortality as a public health priority is required.

BACKGROUND

New Jersey has been a national leader in maternal mortality review for more than 80 years. 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. As the second state in the nation to institute a maternal mortality review, New Jersey has brought together an interdisciplinary team of professionals dedicated to the health of pregnant women.

The New Jersey Department of Health in collaboration with numerous experts in the field have reviewed nearly 700 cases of maternal death since 1999. This review has aided in the implementation of numerous quality improvement initiatives that have improved the safety of pregnant women throughout the state. In 2005, under the direction of Acting Governor Richard Codey, the need to create a postpartum wellness initiative was identified. A workgroup was convened and with feedback and representation from the maternal mortality review team present among other healthcare, social service and advocacy groups' legislation was drafted and the Postpartum Depression Initiative was born.

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 and treatment activities statewide.

Additionally, the work conducted by this committee has been recognized both locally and nationally with members working with national professional organizations to address issues of postpartum hemorrhage and other pregnancy-related complications associated with maternal mortality.

HISTORY OF MATERNAL MORTALITY REVIEW IN NEW JERSEY

The Medical Society of New Jersey established the Maternal Death Review Committee as 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). The first report provided by the Maternal Death Review team was completed in 1932 to prevent and reduce maternal deaths in New Jersey. A total of 351 maternal deaths were reported by the New Jersey Department of Health in 1932. Members of t h e 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 (Callaghan & Berg, 2002).

Over the next forty years, increased recognition of maternal mortality 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. By the 1970s, the New Jersey Department of Health joined with obstetricians in reviewing cases of maternal death. Also, NJ DOH provided linkages between birth and death certificates allowing for increased identification of maternal mortality cases. This collaboration expanded both the membership and scope of the Medical Society's review committee, known today as the New Jersey Maternal Mortality Review. Until 1990, the NJ DOH, in collaboration with the Medical Society of New Jersey, reviewed individual deaths occurring during or within 42 days of termination of the pregnancy (the timeframe expanded to within 90 days from 1990-1998). Beginning in 1999, all deaths that occur within one year of the termination of pregnancy were reviewed. As part of the review each maternal death is determined to be pregnancy-related, not pregnancy-related or undetermined.

In addition to reviewing cases, each year the committee identifies at least one educational topic to be presented to obstetricians at the annual meeting for the New Jersey Obstetrical and Gynecological Society and NJ chapter of the American College of Obstetricians and Gynecologists (ACOG). Finally, the committee develops recommendations for improving outcomes and disseminates this information through a variety of systems including clinical practice settings and community advisory boards and committees. Maternal-child health programs sponsored by the Department of Health use this information for program planning and for dissemination to healthcare professionals and community members. The Improving Pregnancy Outcomes program is one example. Through the use of Community Health Workers and Central Intake they work directly with families and community partners within the respective communities to promote preconception and interconception health.

Definitions

Pregnancy associated deaths: The death of a woman while pregnant or within one year of end of pregnancy, irrespective of cause (Hoyert 2007)

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 (Hoyert 2007)

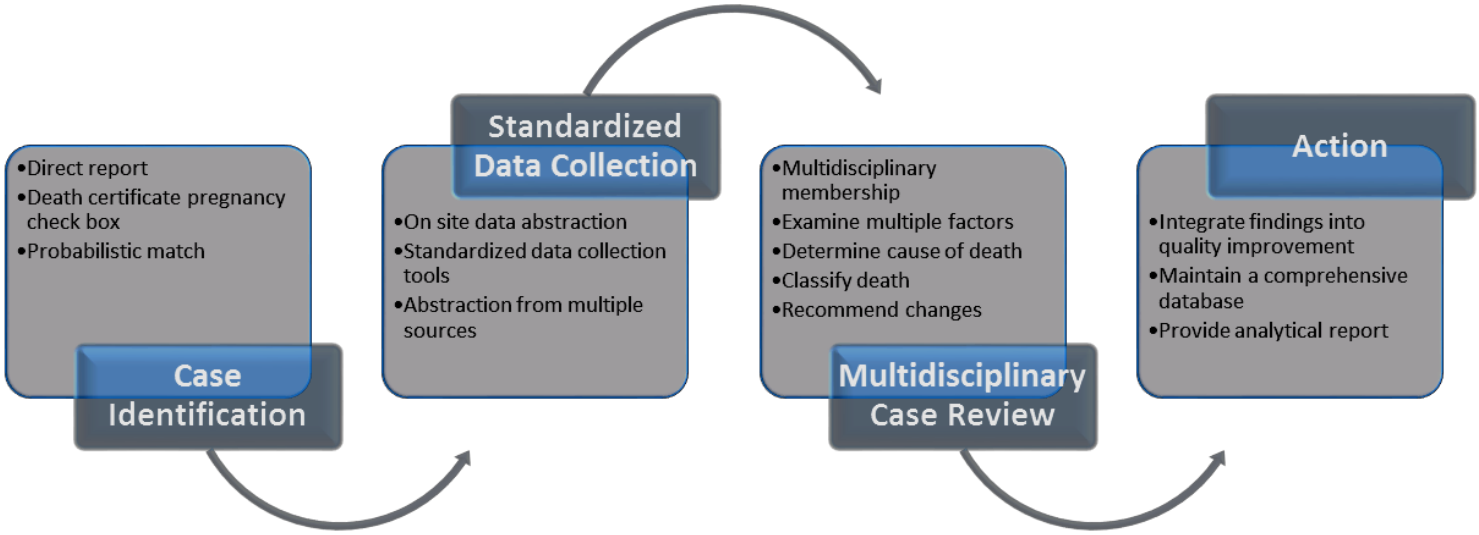
Not pregnancy related: the death of a woman while pregnant or within 1 year of termination of pregnancy, due to a cause unrelated to pregnancy (Hoyert 2007)

Undetermined: consensus not reached by the Case Review Team

Termination of Pregnancy: any event, regardless of pregnancy outcome, that ended the indicator pregnancy

CASE 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) Standardization of data collection, 3) Multidisciplinary case review of maternal mortality, 4) Action. This section presents an overview of each of the four steps as they relate to the review process:



THE 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, the NJMMR defines maternal death as "the death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of cause."

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 Maternal and Child Health (MCH) Epidemiology Program.

2) Standardized Data Collection

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 the primary nurse abstractor. The abstractor uses a standardized data abstraction tool. Information is collected on over 300 variables. Data are obtained from all sources including

THE PROCESS CONTINUED…

death certificates, autopsy reports, hospitalization records, medical examiner reports, prenatal care records, emergency room and outpatient visit reports and law enforcement reports. The standardized tools were modified from the Florida Pregnancy Associated Mortality Review.

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 about the case. All files are kept by program policy at the State offices.

3) Analysis and Interpretation

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, 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 the 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: Pregnancy-related, not pregnancy-related and undetermined.

The primary focus of the Case Review Team is to identify systems related issues. Recommendations are maintained, tallied and shared with healthcare professionals and the public through the Maternal Mortality report and presentations at professional association meetings. Presentations have been given at the NJ American College of Obstetricians and Gynecologists (ACOG), NJ Association of Women's Health Obstetric and Neonatal Nurses (AWHONN) and NJ Perinatal Safety Collaborative. Team recommendations are also used for program planning at the Department of Health.

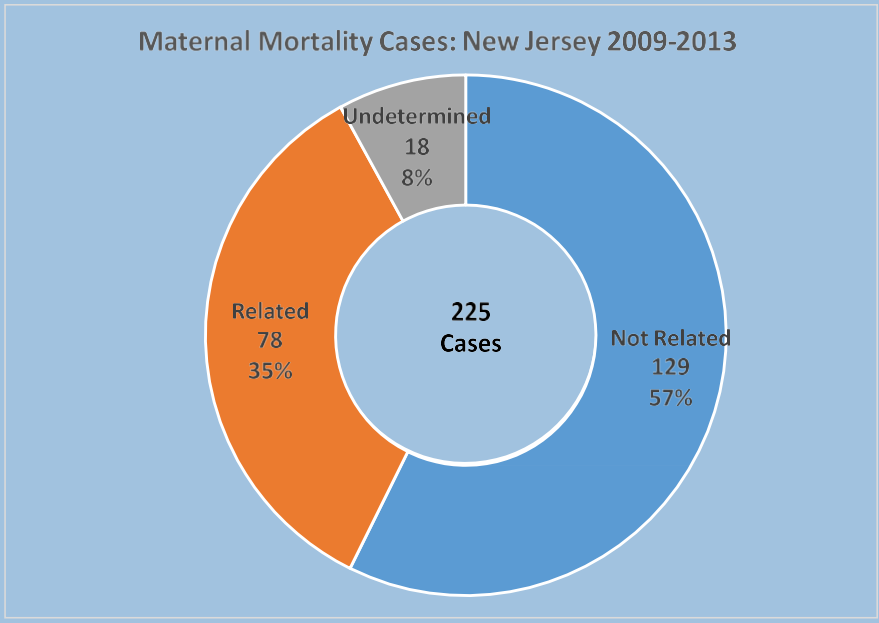
Maternal Mortality Review Team Background	
Obstetrician	Social Worker
Maternal Fetal Medicine	Mental Health Professional
OB Anesthesiologist	Substance Abuse Counselor
Perinatal Pathologist	Family Planning Professional
Critical Care Intensivist	Hospital Administrator
Medical Examiner	Risk Manager/Safety
Public Health Professional	Emergency Medical Technician
OB Nurse	Nutritionist
Certified Nurse Midwife	

Analysis of the maternal mortality data 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 medical history. Also, 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.

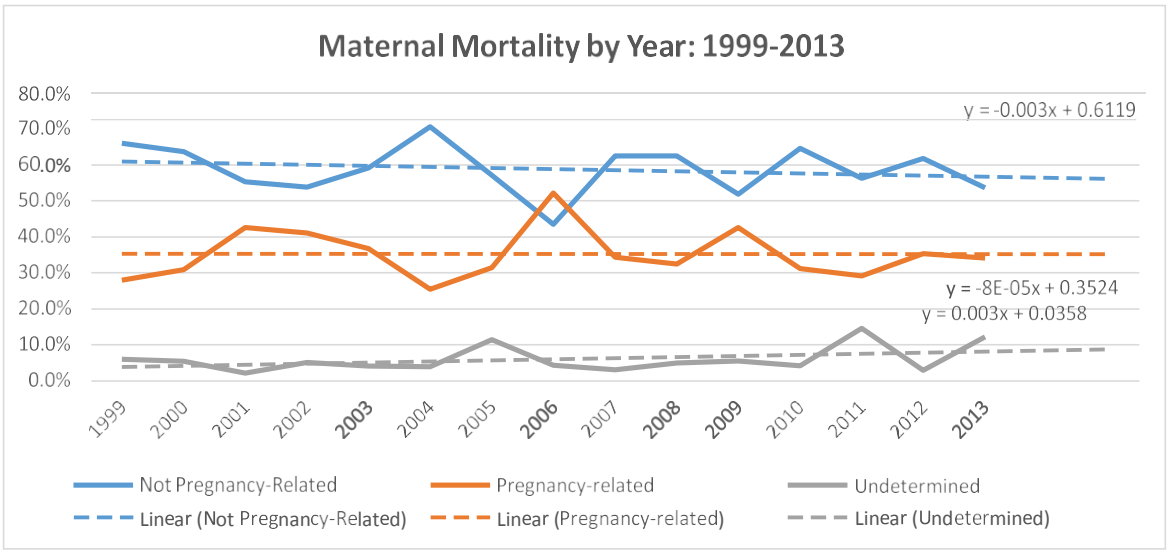
OVERVIEW OF CASES



From 2009 to 2013, the New Jersey Maternal Mortality Case Review Team (CRT) identified a total of 225 maternal deaths. Of the 225 maternal deaths, the CRT determined 78 (34.6 percent) to be pregnancy-related, 129 (57.3 percent) were not pregnancy-related, and 18 (8 percent) were undetermined. The average number of maternal deaths per year was 45.

In 1999, not pregnancy-related deaths accounted for 66 percent of all maternal deaths. In New Jersey, by 2013 (using the same identification method) 53.7% of maternal mortality were not pregnancy-related.

Between 1999 and 2013, pregnancy-related deaths accounted for between 28% and 42% of all maternal deaths in New Jersey. During this time, probabilistic matching criteria were used. Maternal mortality was identified using several data sources including Death Certificates, Birth Certificates, Fetal Death Certificates, hospital discharge files, and direct reports from the Hospital, Medical Examiner, or other personnel.



DEMOGRAPHIC CHARACTERISTICS

The population of maternal deaths in New Jersey shares similarities in demographic characteristics to overall births as well as marked differences. For example, the rate of foreign-born mothers who die of pregnancy-related causes is proportional to foreign born mothers delivering in New Jersey. However, black and African American women are disproportionately represented in maternal deaths compared to the population of births. The following provides summary information regarding characteristics of mothers who died between 2009 and 2013.

Timing of Death

Overall, 10.2 percent of maternal mortality occurred while the mother was pregnant, of pregnancy-related deaths, 9.0 percent occurred while the woman was pregnant. Only 7.8 percent of not pregnancy-related deaths took place during pregnancy.

Pregnancy-related deaths occurred at much higher rates within one day of termination of pregnancy compared with non-related deaths (19.2 percent vs. <5 percent, respectively). While nearly 70 percent of pregnancy-related maternal deaths occurred during pregnancy or within 42 days of pregnancy termination, more than 60 percent of not pregnancy-related deaths occurred 43 days or more after the termination of pregnancy.

Age at Death

The largest proportion of deaths took place between the ages of 30 and 34; however, slight differences exist between pregnancy-related and not pregnancy-related deaths. Among pregnancy-related deaths, nearly 55 percent of deaths were to women 25-34, while only 11 percent were to women 20-24. Among not pregnancy -Related deaths, 26.4 percent of deaths were women aged 20-24, more than twice the rate of pregnancy-related deaths. For not pregnancy-related deaths, 20-24-year-old women made up the largest proportion of deaths.

Race and Ethnicity

Of the 225 maternal deaths, 41.8% (n=94) were Black, 40.4% (n=91) were White, 11.1% (n=25) were Hispanic, and 4.9% (n=11) were Asian women. Women of color account for nearly 60 percent of all pregnancy-related maternal deaths between 2009 and 2013. Of the 78 pregnancy-related deaths, 36 were Black, 12 were Hispanic, 21 were White, and 6 were Asian women. Of the 129, not pregnancy-related deaths, 63 or 48.8 percent were White, 49 were Black, 12 were Hispanic, and 4 were Asian women. Of the 18 undetermined deaths, seven were White, nine were Black, one was Hispanic and one was an Asian woman.

DEMOGRAPHIC FACTORS ASSOCIATED WITH MATERNAL MORTALITY, NEW JERSEY, 2009-2013

	TOTAL N (%)	PREGNANCY RELATED N (%)	NOT PREGNANCY RELATED	UNDETERMINED N (%)
TIMING OF DEATH	*N=225*	*N=78*	*N=129*	*N=18*
While pregnant	23 (10.2%)	7 (9.0%)	10 (7.8%)	6 (33.3%)
Less than 1 day postpartum	20 (8.9%)	15 (19.2%)	4	1
1-42 days postpartum	40 (17.8%)	31 (39.7%)	6 (4.7%)	3
43+ days postpartum	112 (49.8%)	25 (32.1%)	81 (62.8%)	6 (33.3%)
Unknown	30 (13.3%)	--	28 (21.7%)	2
AGE	*N=225*	*N=78*	*N=129*	*N=18*
<20	10 (4.4%)	5	5	--
20-24	45 (20.0%)	9 (11.5%)	34 (26.4%)	2
25-29	55 (24.4%)	22 (28.2%)	29 (22.5%)	4
30-34	59 (26.2%)	21 (26.9%)	31 (24.0%)	7 (38.9%)
35-39	37 (16.4%)	14 (17.9%)	21 (16.3%)	2
40+	19 (8.4%)	7 (9.0%)	9 (7.0%)	3

DEMOGRAPHIC FACTORS ASSOCIATED WITH MATERNAL MORTALITY, NEW JERSEY, 2009-2013				
	TOTAL N (%)	PREGNANCY RELATED N (%)	NOT PREGNANCY RELATED N (%)	UNDETERMINED N (%)
RACE/ETHNICITY	***N=225***	***N=78***	***N=129***	***N=18***
White	91(40.4%)	21 (26.9%)	63 (48.8%)	7 (38.9%)
Black	94 (41.8%)	36 (46.2%)	49 (38.0%)	9 (50.0%)
Hispanic	25 (11.1%)	12 (15.4%)	12 (9.3%)	1
Asian	11 (4.9%)	6 (7.7%)	4	1
Other	4	3	1	--
PLACE OF BIRTH	*N=225*	*N=93*	*N=141*	*N=20*
Africa	3	1	1	1
Asia	5	3	2	--
Canada	1	--	1	--
Caribbean Islands	10 (4.4%)	9 (11.5%)	1	--
Central America	6 (2.7%)	3	3	--
Europe	2	1	1	--
India	4	2	2	--
Middle East	1	1	—	--
South America	7 (3.1%)	5	2	--
United States	185 (82.2%)	52 (66.7%)	116 (89.9%)	17 (94.4%)
MARITAL STATUS	N=225	N=78	N=129	N=18
Married	72 (32.0%)	37 (47.4%)	31 (24.0%)	4
Never Married (Single)	136 (60.4%)	38 (48.7%)	87 (67.4%)	11 (61.1%)
Living as Married	1	1	—	—
Divorced	11 (4.9%)	1	8 (6.2%)	2
Separated	3	1	2	—
Widowed	2	—	1	1
OCCUPATION	N=225	N=78	N=129	N=18
Other	111 (49.3%)	40 (51.3%)	61 (47.3%)	10 (55.6%)
Unemployed	43(19.1%)	13 (16.7%)	26 (29.2%)	4
Homemaker	30 (13.3%)	12(15.4%)	17 (13.2%)	1
Student	13 (5.8%)	4 (5.1%)	8 (6.2%)	1

DEMOGRAPHIC CHARACTERISTICS CONTINUED

Foreign Born

More than 80 percent of maternal deaths were among U.S. born women; however, among not pregnancy-related deaths, nearly 90 percent of deaths were to U.S. born women. For pregnancy-related deaths, U.S. born women account for nearly 70 percent of the deaths. The data suggest that among pregnancy- related deaths the number of foreign-born women dying is proportional to the number of foreign-born women delivering in New Jersey. However, the not pregnancy-related deaths are significantly higher among non-foreign-born women. This finding is consistent with literature suggesting that foreign-born women are healthier and have lower rates of risky behavior than their non-foreign born counterparts (Hummer et al., 2007; Landale et al., 1999).

Marital Status

Of the total 225 maternal deaths, 60.4% (n=136) were never married (single), 32.0% (n=72) were married, 4.9% (n=11) were divorced, and three were separated women. Of the 78 pregnancy-related deaths, 38 were never married (single) and 37 were married women. Of the 129, not pregnancy-related deaths, 87 were never married (single), 31 were married, and eight were divorced women. Of the 18 undetermined deaths, 11 were never married (single) women.

PRENATAL/INTRAPARTUM FACTORS

Overall, there are relatively high rates of missing and unknown prenatal and intrapartum factors; therefore, the findings should be interpreted with caution. Missing data are largely due to a lack of a prenatal care record availability or incomplete prenatal records.

Weight Status

More than half of the cases of maternal deaths (where BMI could be calculated) were overweight or obese. Among pregnancy-related deaths, a greater proportion of women were overweight or obese compared with not pregnancy-related deaths (54.5 percent vs. 46.0 percent, respectively).

Prenatal Care

A majority of maternal mortality cased received prenatal care; however, there were significant differences in prenatal care access among pregnancy- related deaths and not pregnancy-related deaths. More than three-fourths of pregnancy-related deaths received prenatal care, while less than half (45.7 percent) of not pregnancy-related deaths received prenatal care. Women who are dying from not pregnancy-related causes may be involved in risky behaviors that deter accessing prenatal care, such as drug use.

Delivery

Among women who delivered (live birth or fetal demise), slightly more than half delivered via cesarean section. The rate of cesarean deliveries is substantially higher for pregnancy-related maternal deaths than that of the general population of deliveries (50.8 percent vs. 37.7 percent). Rates of cesarean delivery and vaginal delivery follow a similar trend for not pregnancy-related deaths. Nearly 75 percent of pregnancy-related maternal deaths delivered live births; however, among non-related maternal deaths, the rate of live birth is considerably lower. Less than half of not pregnancy-related deaths delivered a live birth.

Pregnancy History

Pregnancy-related deaths and not pregnancy- related deaths experienced similar pregnancy histories with approximately one-quarter of indicator pregnancies being the first pregnancy. Approximately 40 percent of maternal deaths occurred with the second or third pregnancy being the indicator pregnancy. Among pregnancy-related deaths, 10 women (13.9%) experienced six or more pregnancies and among not pregnancy-related deaths, 19 women (17.4%) experienced six or more pregnancies.

PRENATAL/INTRAPARTUM FACTORS ASSOCIATED WITH MATERNAL MORTALITY, NEW JERSEY, 2009-2013				
	TOTAL N (%)	PREGNANCY RELATED N (%)	NOT PREGNANCY RELATED N (%)	UNDETERMINED N (%)
PREPREGNANCY WEIGHT	N=173	N=59	N=102	N=12
Underweight (BMI: <18.5)	7 (4.0%)	2	5	—
Normal weight (BMI: 18.5-24.9)	79 (45.7%)	26 (44.1%)	50 (49.0%)	3
Overweight (BMI: 25.0-29.9)	33 (19.1%)	12 (20.3%)	18 (17.6%)	3
Obese (BMI: 30.0-39.9)	33 (19.1%)	13 (22.0%)	16 (15.7%)	4
Morbidly Obese (BMI: 40+)	21 (12.1%)	6 (10.2%)	13 (12.7%)	2
PRENATAL CARE	N=225	N=78	N=129	N=18
Received Prenatal Care	131 (58.2%)	63 (80.8%)	59 (45.7%)	9 (50.0%)
No Prenatal Care	54 (24.0%)	37 (28.7%)	37 (28.7%)	6 (33.3%)
Unknown or N/A	40 (17.8%)	4	33 (25.6%)	3
MODE OF DELIVERY	N=140	N=65	N=68	N=7
Vaginal	67 (47.9%)	31 (47.7%)	30 (44.1%)	6 (85.7%)
Cesarean Section	3	33 (50.8%)	35 (51.5%)	—
VBAC	69 (49.3%)	1	2	1
Unknown	1	—	1	—
DELIVERY OUTCOME	N=225	N=78	N=129	N=18
Live Birth	130 (57.8%)	59 (75.6%)	64 (49.6%)	7 (38.9%)
Fetal Demise	9 (4.0%)	3	5	1
Elective Termination of Pregnancy	26 (11.6%)	2	23 (17.8%)	1
Spontaneous Abortion	15 (7.0%)	—	13 (10.0%)	2
Ectopic Pregnancy	2	1	1	—
Pregnant at death	30 (13.3%)	13 (16.7%)	11 (8.5%)	6 (33.3%)
Unknown	13 (5.8%)	—	12 (9.3%)	1
GRAVIDA	N=196	N=72	N=109	N=15
1	47 (24.0%)	19 (26.4%)	24 (22.0%)	4
2-3	78 (39.8%)	29 (40.3%)	43 (39.4%)	6 (40.0%)
4-5	40 (20.4%)	14 (19.4%)	23 (21.1%)	3
6 or more	31 (15.8%)	10 (13.9%)	19 (17.4%)	2

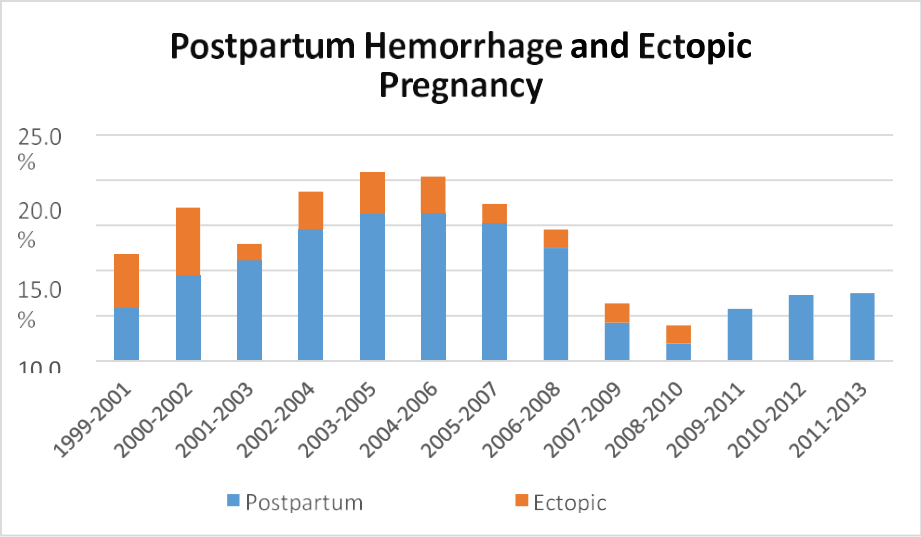
LABOR AND DELIVERY FACTORS

Among maternal deaths, the most commonly reported labor and delivery factors were gynecological issues (e.g., fibroids, uterine atony, infertility), preeclampsia/ eclampsia, and other labor and delivery factors (e.g., breech, cholecystitis, chorioamnionitis). Rates of labor and delivery complications were higher among pregnancy-related deaths; however, overall the rates were relatively low.

From 1999 to 2013, the rate of postpartum hemorrhage and ectopic pregnancy-related maternal mortality have fluctuated between an average of 5.9% between 1999 and 2001 to 7.5%between 2011 and 2013. The rate of postpartum hemorrhage related maternal mortality peaked to 16.3% between 2003 and 2006.

LABOR AND DELIVERY FACTORS AND MATERNAL MORTALITY, NEW JERSEY, 2009-2013

	TOTAL N (%)	PREGNANCY RELATED N (%)	NOT PREGNANCY RELATED N (%)	UNDETERMINED N (%)
Amniotic Fluid Embolism	2	2	--	--
Ectopic Pregnancy	1	—	1	--
Fetal Death	4	2	2	--
Fetal Stress	3	2	1	--
Gestational Diabetes	2	2	--	--
Gynecologic	18 (8.0%)	11 (14.1%)	7 (5.4%)	--
HELLP	1	1	--	--
Multiple Birth	2	--	1	1
Other	8 (3.5%)	3	5	--
Preeclampsia/ Eclampsia	15 (6.7%)	11 (14.1%)	3	1
Premature	15 (6.7%)	7 (9.0%))	6 (4.7%)	2
Postpartum Hemorrhage	7 (3.1%)	6 (7.7%)	1	--
Postpartum Depression	5	4	1	--



In 2005-2007, the rates declined to 2.0% and increased to an average of 7.5% by 2011-2013. The rate of ectopic pregnancy-related maternal deaths averaged 5.9% between 1999 and 2002. In 2001- 2003, the rates declined to 1.9% and increased to 4.7% by 2005. From 2009- 2013, the rates of ectopic pregnancy-related maternal deaths stayed at 0%, this is likely due to the cause of death listed as hemorrhage rather than ectopic pregnancy.

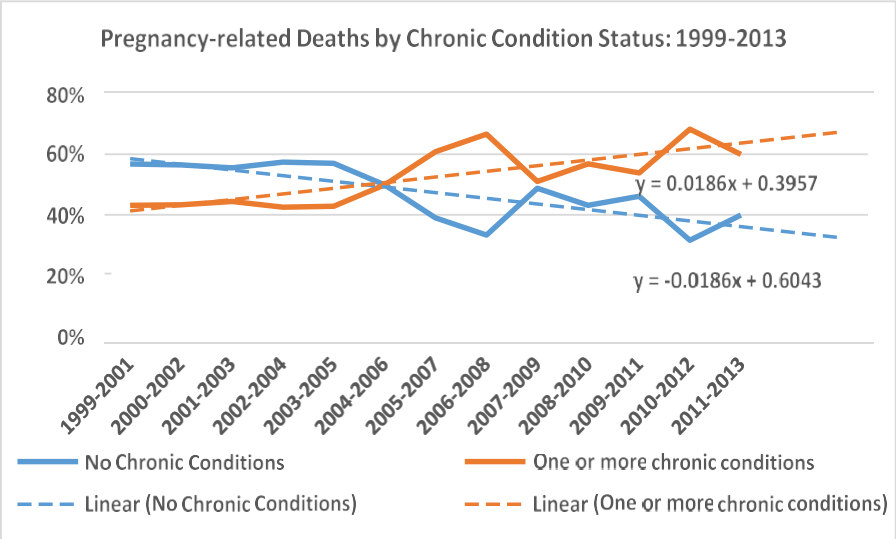
MEDICAL HISTORY

Of the total maternal deaths, 120 (53.3%) had chronic conditions, 90 (40.0%) were overweight/obese, 39 (17.3%) had asthma, 29 (12.8%) had depression/anxiety and 53 (23.6%) had other medical conditions. Of the pregnancy-related deaths, 44 (56.4%) had chronic conditions, 34 (43.6%) were overweight/obese, 8 (10.3%) had asthma, and 20 (25.6%) had other medical conditions. Of the not pregnancy-related deaths, 64 (49.6%) had chronic conditions and 47(36.4%) were overweight or obese. Of the undetermined deaths 12 (66.7%) had chronic conditions, 9 (50.0%) were overweight/obese, 3 had other medical conditions, and 4 had asthma.

MEDICAL CONDITIONS ASSOCIATED WITH MATERNAL MORTALITY, NEW JERSEY, 2009-2013

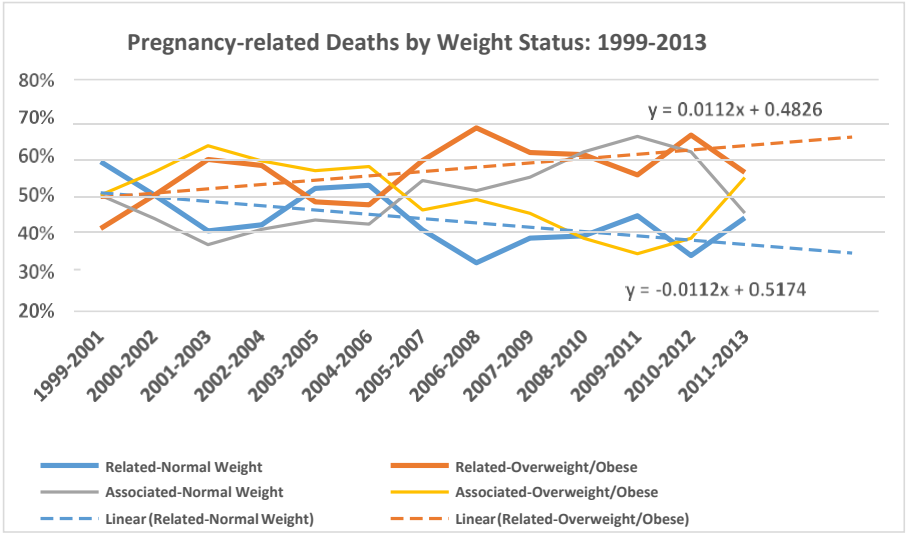
Medical Conditions	TOTAL N (%)	PREGNANCY RELATED N (%)	NOT PREGNANCY RELATED N (%)	UNDETERMINED N (%)
Arthritis	2	1	1	–
Asthma	39 (17.3%)	8 (10.3%)	27 (20.9%)	4
Blood Disorder	7 (3.1%)	3	4	–
Cancer	8 (3.5%)	3	4	1
Cardiac	9 (4.0%)	4	5	–
Cerebral Hemorrhage	1	1	–	–
Cerebrovascular	4	3	1	–
Chronic Hypertension	28 (12.4%)	11 (14.1%)	15 (11.6%)	2
Coded	3	3	–	–
Depression/Anxiety	29 (12.8%)	5	21 (16.3%)	3
Diabetes	6 (2.7%)	2	3	1
Gastrointestinal Problems	13 (5.8%)	2	9 (7.0%)	2
Hepatitis	5	–	5	–
HIV/AIDS	3	–	2	1
Hypertension	3	2	1	–
Infection	2	–	2	–
Lupus	5	3	2	–
Mental Health	14 (6.2%)	3	8 (6.2%))	3
Overweight/Obesity	90 (40.0%)	34 (43.6%)	47 (36.4%)	9 (50.0%)
Other	53 (23.6%)	20 (25.6%)	30 (23.3%)	3
Pneumonia	1	1	–	–
Respiratory	5	3	2	–
Seizure	8 (3.5%)	3	5	–
Sickle Cell	6 (2.7%)	1	3	2
Surgery	2	1	1	–
Thyroid	10 (4.4%)	3	7 (5.4%)	–
Trauma	1	–	1	–

CHRONIC CONDITIONS OVER TIME



There is an increasing trend in pregnancy- related deaths to women with one or more chronic conditions as evidenced by a rise from an average of 43.1% from 1999-2001 to an average of 60.0% from 2012 to 2013. There was a peak in the average pregnancy-related deaths to women with one or more chronic conditions in 2010-2012. The linear trend line forecasts the rate of pregnancy-related deaths with one or more chronic conditions. This trend line suggests that deaths with one or more chronic conditions will continue to increase over time reaching an average of 70% within the next decade.

Similar to trends of chronic conditions, the number of women who die from pregnancy-related causes and are overweight or obese is growing over time. Under current conditions, the number of cases of pregnancy-related deaths that are overweight or obese is forecasted to increase to nearly 65 percent of cases.



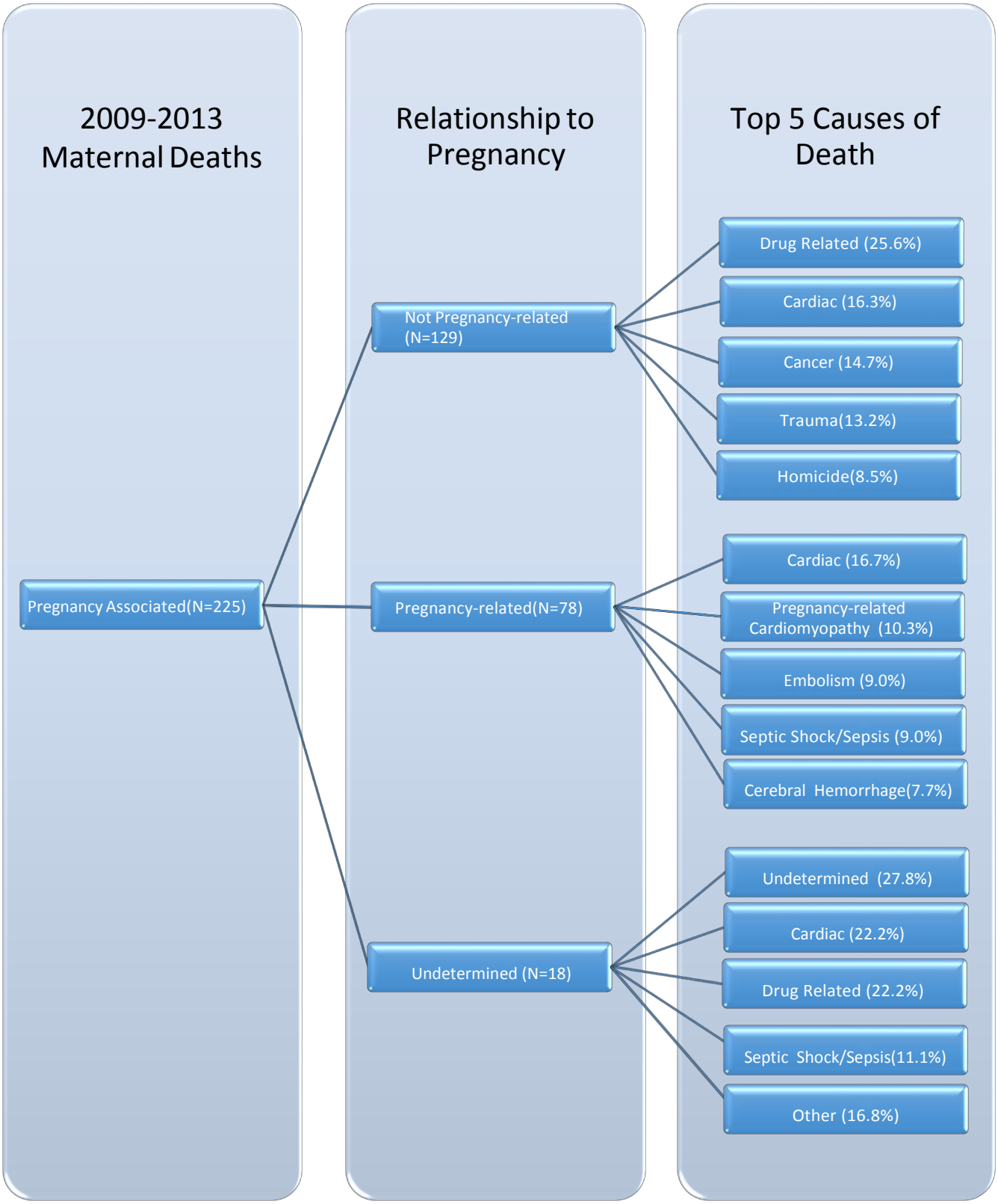
HEALTH RISK BEHAVIORS

Of the total maternal deaths, 41 (17.8%) used tobacco, 35 (15.6%) used drugs, 13 (5.8%) drank alcohol, and 9 (4.0%) had a sexually transmitted disease. Of the pregnancy-related deaths, 9 (11.5%) used tobacco. Of the not pregnancy-related deaths 29 (22.5%) used tobacco, 29 (22.5%) used drugs, 9 (7.0%) drank alcohol, and 6 (4.7%) had a sexually transmitted disease.

HEALTH RISK BEHAVIORS ASSOCIATED WITH MATERNAL MORTALITY, NEW JERSEY, 2009-2013

	TOTAL N (%)	PREGNANCY RELATED N (%)	NOT PREGNANCY RELATED N (%)	UNDETERMINED N (%)
Alcohol	13 (5.8%)	2	9 (7.0%)	2
Drugs	35 (15.6%)	4	29 (22.5%)	2
Tobacco	41 (17.8%)	9 (11.5%)	29 (22.5%)	2
STI	9 (4.0%)	3	6 (4.7%)	0

CAUSES OF DEATH

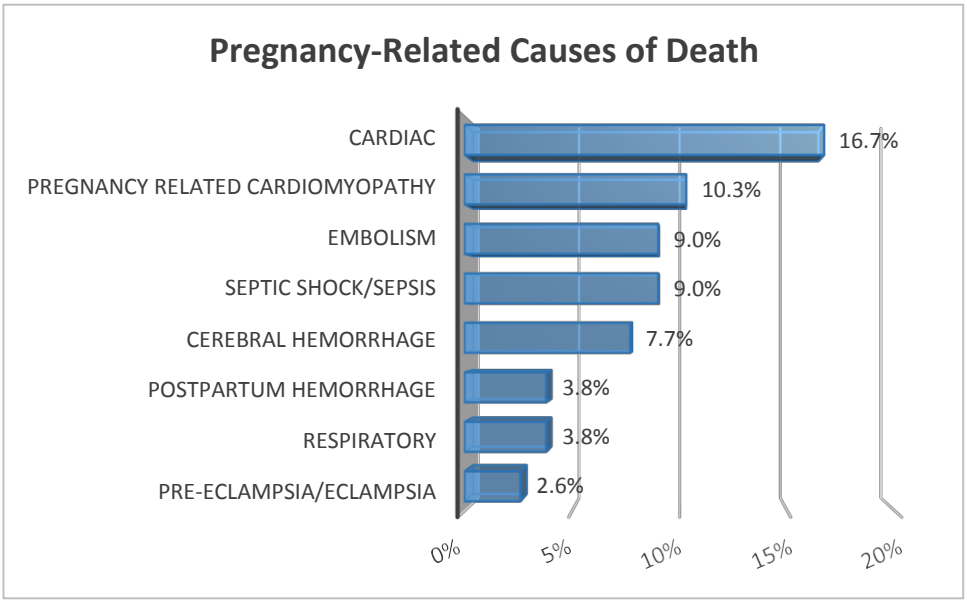


PREGNANCY-RELATED CAUSES OF DEATH

Of the 78 pregnancy-related deaths, the top five causes of death were cardiac (16.7%), pregnancy-related cardiomyopathy (10.3%), embolism (9.0%), septic shock/sepsis (9.0%), and cerebral hemorrhage (7.7%). Pregnancy-related cardiomyopathy deaths increased from 8.7% in 2009 to 14.3% in 2013. Deaths caused by embolism decreased from 13.0% in 2009 to 0% in 2013. Deaths resulting from septic shock/sepsis increased from 4.3% in 2009 to 7.1% in 2013. Deaths resulting from cerebral hemorrhage decreased from 8.7% in 2009 to 7.1% in 2013 Deaths associated with pre-eclampsia and eclampsia have decreased between 2009 (4.3%) and 2013 (0%).

CAUSES OF DEATH FOR PREGNANCY RELATED CASES, NEW JERSEY, 2009-2013

Cause of Death	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	Total (%)
Amniotic Fluid Embolism	4.3%	--	—	--	--	1.3%
Allergic Reaction Med	--	--	7.1%	--	--	1.3%
Aneurysm	4.3%	6.7%	--	--	--	2.6%
Asthma	--	--	--	8.3%	--	1.3%
Cancer	--	--	7.1%	8.3%	--	2.6%
Cardiac	13.0%	33.3%	7.1%	16.7%	14.3%	16.7%
Cerebral Hemorrhage	8.7%	6.7%	14.3%	--	7.1%	7.7%
Cerebrovascular	8.7%	--	--	--	7.1%	3.8%
Drug Related	--	--	--	8.3%	7.1%	2.6%
Embolism	13.0%	13.3%	14.3%	--	--	9.0%
Hematological Other	--	6.7%	--	--	14.3%	3.8%
HIV/AIDS	--	6.7%	--	--	--	1.3%
Homicide	--	--	--	--	--	1.3%
Influenza/Pneumonia/Respiratory	8.7%	--	--	8.3	--	3.8%
Lupus	--	--	--	--	7.1%	1.3%
Other	--	--	--	--	14.3%	2.6%
Postpartum Hemorrhage	--	--	21.4%	--	--	3.8%
Preeclampsia/Eclampsia	4.3%	--	--	8.3%	--	2.6%
Pregnancy-related Cardiomyopathy	8.7%	13.3%	--	16.7%	14.3%	10.3%
Respiratory	4.3%	--	7.1%	8.3%	--	3.8%
Seizure	--	--	--	8.3%	7.1%	2.6%
Septic Shock/Sepsis	4.3%	13.3%	21.4%	--	7.1%	9.0%
Suicide	8.7%	--	--	8.3%	--	3.8%
Undetermined	8.7%	--	--	--	--	2.6%
Total (N)	**23**	**15**	**14**	**12**	**14**	**78**



NOT PREGNANCY RELATED CAUSES OF DEATH

Of the 129, not pregnancy-related deaths, the top five causes of death were drug-related (25.6%) cardiac (16.3%), cancer (14.7%), trauma (13.2%) and homicide (8.5%). Cardiac deaths decreased from 21.4% in 2009 to 18.2% in 2013. Drug-related deaths slightly increased from 17.9% in 2009 to 18.2% in 2013. Deaths caused by cancer increased from 10.7% in 2009 to 18.2% in 2013.

CAUSES OF DEATH FOR NOT PREGNANCY RELATED CASES, NEW JERSEY, 2009-2013

Cause of Death	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	Total (%)
Asthma	--	--	7.4%	4.8%	4.5%	3.1%
Cancer	10.7%	25.8%	7.4%	9.5%	18.2%	14.7%
Cardiac	21.4%	12.9%	7.4%	23.8%	18.2%	16.3%
Cerebral Hemorrhage	--	--	--	--	4.5%	0.8%
Cerebrovascular	--	--	--	4.8%	4.5%	1.6%
Drug Related	17.9%	32.3%	33.3%	23.8%	18.2%	25.6%
Embolism	--	6.5%	--	--	--	1.6%
HIV/AIDS	3.6%	--	--	--	--	0.8%
Homicide	10.7%	--	14.8%	19.0%	--	8.5%
Infection	--	3.2%	--	--	4.5%	1.6%
Other	--	--	3.7%	--	9.1%	2.3%
Respiratory	--	--	--	--	4.5%	0.8%
Seizure	3.6%	--	--	--	--	0.8%
Septic Shock/Sepsis	3.6%	--	3.7%	--	4.5%	2.3%
Sickle Cell	3.6%	--	--	--	4.5%	1.6%
Suicide	3.6%	--	3.7%	4.8%	--	2.3%
Trauma	17.9%	16.1%	18.5%	4.8%	4.5%	13.2%
Undetermined	--	3.2%	--	--	--	0.8%
Unintentional Injury	3.6%	--	--	4.8%	--	1.6%
Total (N)	28	31	27	21	22	129

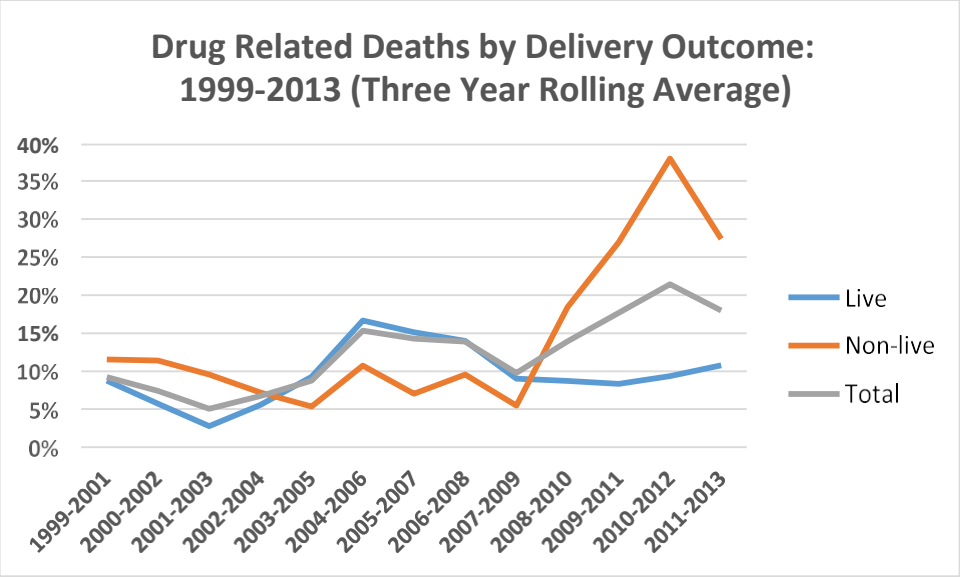
UNDETERMINED CAUSES OF DEATH

Of the 18 undetermined deaths, the top causes of death were undetermined (27.8%) cardiac (22.2%), drug- related (22.2%) and septic shock/sepsis (11.1%).

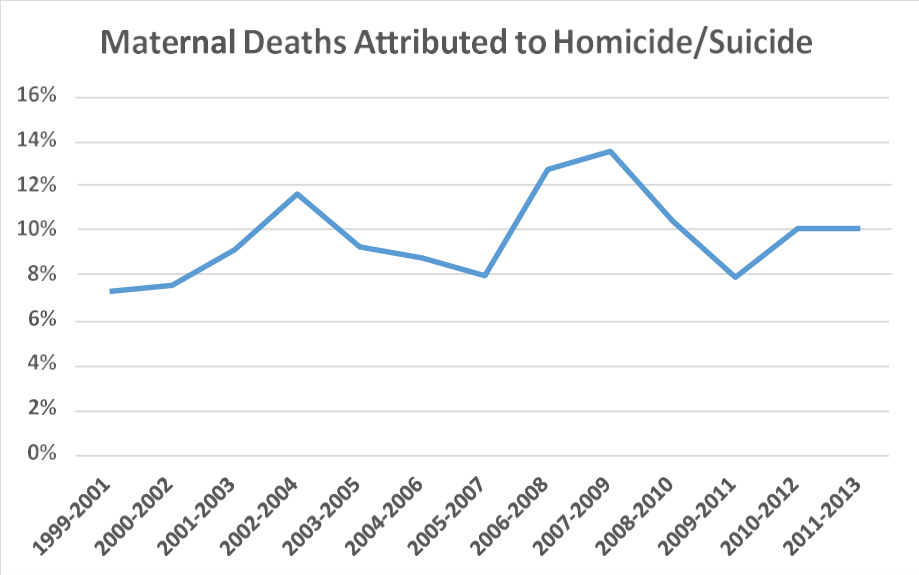
CAUSES OF DEATH FOR UNDETERMINED CASES, NEW JERSEY, 2009-2013						
Cause of Death	**2009 (%)**	**2010 (%)**	**2011 (%)**	**2012 (%)**	**2013 (%)**	**Total (%)**
Cardiac	--	--	28.6%	--	40.0%	22.2%
Drug Related	--	100.0%	--	100.0%	20.0%	22.2%
Septic Shock/Sepsis	--	--	28.6%	--	--	11.1%
Sickle Cell	33.3%	--	--	--	--	5.6%
Suicide	--	--	14.3%	--	--	5.6%
Undetermined	33.3%	--	28.6%	--	40.0%	27.8%
Unintentional Injury	33.3%	--	--	--	--	5.6%
Total (N)	3	2	7	1	5	18

TRENDS IN CAUSES OF DEATH

Over the course of the last decade, there has been a substantial increase in drug-related causes of death. Among maternal deaths, there has been an increase in drug-related deaths beginning from 2007 to 2009 with a peak between 2010 and 2012. Among women who experienced a loss or termination, the rates of drug-related deaths have increased at a significantly higher rate than those with a live birth.



Maternal mortality attributed to homicide and suicide have remained relatively stable over time; however, they have hovered around 10 percent of all maternal deaths. A growing body of research suggests that domestic violence plays a significant role in both homicide and suicide-related deaths among maternal deaths. It has been long observed that women are at greater risk of being killed by their significant other than by other perpetrators. Moreover, a majority of women who are killed by their partners have experienced domestic violence. With the growing literature showing the same may be true among suicides, it is increasingly important to address the issue of domestic violence (Palladino et al. 2011).

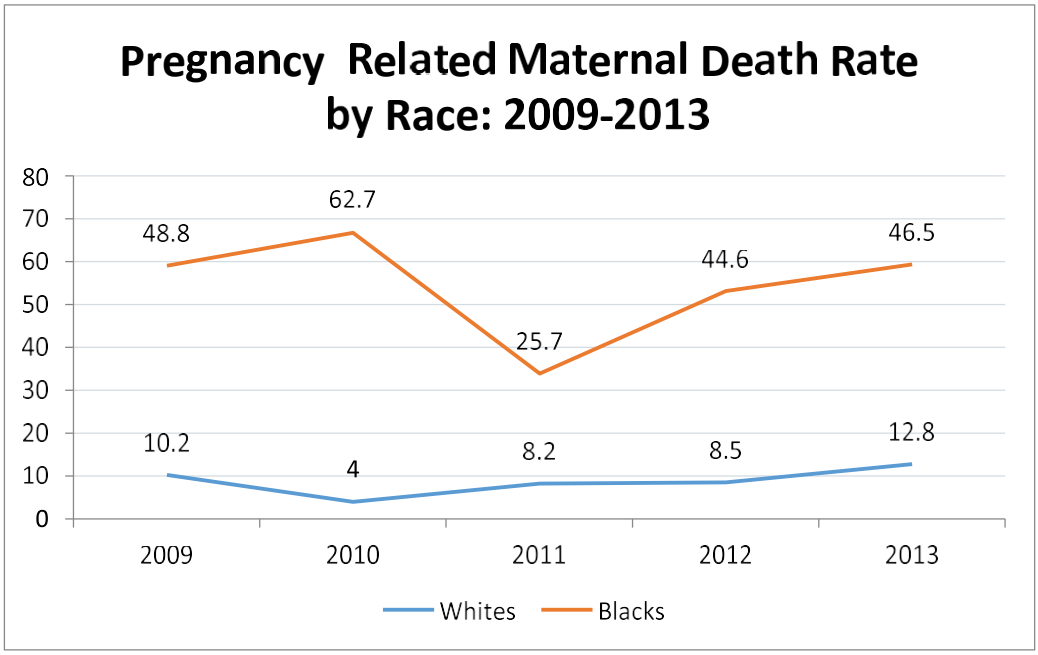


MATERNAL DEATH RATE

NOT PREGNANCY RELATED CAUSES OF DEATH

The overall maternal death rate has decreased between 2009 (51.0 deaths per 100,000 births) and 2012 (32.8 deaths per 100,000 births), the most recent birth data available. However, racial disparities in maternal mortality have persisted with blacks experiencing deaths at a rate of five times that of their white counterparts. Among pregnancy- related deaths, the overall maternal death rate has decreased, and the death rates for whites has also declined; however, the gap in death rates persists.

PREGNANCY RELATED MATERNAL DEATH RATE									
Year	Deaths	Births	Rate	White Deaths	White Births	Rate	Black Deaths	Black Births	Rate
2009	23	109,543	21.0	5	48,837	10.2	8	16,402	48.8
2010	15	106,571	14.1	2	49,458	4.0	10	15,945	62.7
2011	14	105,474	13.3	4	48,701	8.2	4	15,586	25.7
2012	12	103,778	11.6	4	46,892	8.5	7	15,692	44.6
2013	14	102,326	13.7	6	46,863	12.8	7	15,064	46.5



NOT PREGNANCY-RELATED CAUSES OF DEATH

Among not pregnancy-related deaths, the overall death rate is noticeably higher compared with pregnancy-related deaths. Also, the racial disparity in maternal deaths for not pregnancy-related deaths is substantial, such that blacks experience a maternal death rate of nearly four times that of whites.

NOT PREGNANCY RELATED MATERNAL DEATH RATE									
Year	Deaths	Births	Rate	White Deaths	White Births	Rate	Black Deaths	Black Births	Rate
2009	28	109,543	26.6	11	48,837	22.5	14	16,402	85.4
2010	31	106,571	29.1	20	49,458	40.4	8	15,945	50.2
2011	27	105,474	25.6	16	48,701	32.9	7	15,586	44.9
2012	21	103,778	20.2	6	46,892	12.8	13	15,692	82.8
2013	22	102,326	21.5	10	46,863	21.3	7	15,064	46.5

RECOMMENDATIONS

CASE IDENTIFICATION

Public Health/Vital Statistics

Case identification is critical to the success of the maternal mortality review team. Efforts are needed to continue to improve the accuracy and efficiency of identifying possible cases for review. Possible strategies include:

- Identify techniques to ensure proper completion of the death certificate particularly as it relates to the pregnancy check box. By having the pregnancy check box checked in the event of a maternal death it aids in the correct identification of maternal mortality cases and reduces the time and effort spent on investigating records which are not true matches.
- Streamline the process used to identify possible maternal death cases. This can help reduce duplicative efforts when the strategies are performed concurrently.
- Develop statewide communications for entities and persons responsible for the timely completion and submission of mandated reports of maternal deaths.

SCREENING AND INTERVENTION

Universal screening for postpartum depression

Postpartum depression (PPD) screening is supported in NJ by the Postpartum Mood Disorders Program overseen by the Department of Health. This screening is performed by healthcare providers and has been mandated by law in NJ for nearly ten years. It has been very successful in identifying women who are in need of supportive services. Efforts to implement this screening for all women who experience a pregnancy loss (spontaneous or induced) is suggested by this committee. Recommendations related to screening for PPD include:

- Each hospital develops policies to ensure that women who experience a pregnancy loss are appropriately screened for PPD.
- Scheduling of a psychiatric or mental health consultation for all women who have a history of PPD in a previous pregnancy or delivery, regardless of current Edinburgh score.
- Including a postpartum depression screening checkbox on all fetal death certificates to be completed in the Vital Information Platform (New Jersey's web based registration system).

Treatment for Drug Use

The number of women who die from drug related causes has increased dramatically both nationally and in NJ. The Perinatal Addictions Prevention Program overseen by the Department of Health has increased awareness of this problem and provided educational opportunities for healthcare professionals and the public for nearly a decade. Efforts to continue to screen and provide treatment to women with drug abuse are needed to battle this problem. Special focus is needed for women who experience a pregnancy loss, regardless of type, due to the risk for post-traumatic stress and depression/ anxiety after such an event which can increase risk of drug overdose. Next steps can include:

- Use of the Pregnancy Risk Assessment (PRA) tool by all healthcare providers who care for pregnant women in NJ.
- Screening of pregnant women for prescription or illicit drug use throughout pregnancy and at the time of delivery.
- Education of healthcare providers of the increased risk for overdose in postpartum women with a history of drug use.
- Provision of referral opportunities to all healthcare professionals providing direct care to women of childbearing age.
- Provision of referral opportunities to all hospital emergency rooms and labor and delivery departments
- Wider distribution of all drug addiction resources throughout the state among all healthcare providers as well as the public.

Universal screening for domestic violence

Efforts to improve identification and provide support services for all women who experience domestic violence is currently being done statewide in NJ with the use of the Perinatal Risk Assessment. This could be further enhanced by:

- All obstetric healthcare providers using the Perinatal Risk Assessment.
- Provision of referrals to women who screen positive for domestic violence with follow-up to ensure referrals are successful.
- Educating professional and lay community of the increased incidence of domestic violence against women during pregnancy.

CLINICAL PRACTICE AND EDUCATION

Reproductive life planning and treatment of women with chronic disease

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. Efforts for improvement can include a focus on:

- Determining pregnancy intendedness at every healthcare visit.
- The need for a thorough review of medical history at each healthcare visit.
- Encouraging a comprehensive postpartum visit after each pregnancy to review potential areas of concern during the interconceptual period.
- Counseling for women with chronic health conditions regarding risk of morbidity or mortality during pregnancy.
- Obtaining ongoing treatment for any health related disorder during pregnancy. For example implementation of an asthma action plan should be in place for women with a history of asthma.
- Importance of differential diagnosis should a woman seek care from a healthcare provider either during pregnancy or within one year of a pregnancy event for a medical issue. The effect of a pregnancy event can influence a woman's health for up to a year post delivery.

Importance of simulation training

Training for an emergency situation requires a multidisciplinary approach to ensure the best care possible. Team training is important to prevent communication errors as well as practice errors or omissions which can lead to death. By providing simulated obstetric emergency training, teams can work together and improve communications and practices resulting in a reduction in medical errors. This may include:

- The need for specialized equipment to imitate common labor and delivery emergencies.
- Implementation of specialized trainers to provide individual trainings within the hospital setting.
- Continued practice drills to enhance and maintain skill levels.
- Coordinating partnerships with key stakeholders to implement trainings.

Recognition and rapid response for postpartum hemorrhage

Often postpartum hemorrhage is a preventable event. Healthcare providers should assess for the risk of postpartum hemorrhage and recognize early warning signs of potential hemorrhage. Training on recognition, prevention and response can assist in prevention of postpartum hemorrhage. Efforts to reduce mortality and morbidity associated with postpartum hemorrhage can include:

- The need for implementation of risk assessment on admission, prior to birth and after birth.
- Quantification of cumulative blood loss.
- Protocols for hemorrhage management (general and massive transfusion policies).
- Team debriefing.

Pregnancy testing for all women of childbearing age in emergency room departments

All women of childbearing age treated in an emergency room should be assessed for pregnancy to ensure any care received is appropriate depending on the presence of a pregnancy or intendedness for future pregnancy. Efforts for improvement could include:

- Standard orders for pregnancy assessment upon initial assessment of women presenting in the ER.
- If confirmation of pregnancy is established, women should be advised to follow-up with their OB provider as soon as possible.
- If the woman does not have an OB provider she can 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.
- Necessary treatment or diagnostic testing should not be withheld due to pregnancy. Referral to or consult with high risk providers should be done to determine appropriateness of needed medical care or follow up.

CONSUMER EDUCATION

Medication education for all consumers

In addition to the opportunities for consumer education mentioned earlier in this report, special attention should be given to educating consumers regarding the danger in combining prescription and non-prescription medication. This danger is not only during pregnancy but extends into the postpartum period as well. Efforts to expand education could include:

- Development of public health service announcements to raise awareness of this issue for women and their families.
- Recommendation to all pharmacists to educate consumers on negative interactions of prescribed medication and over-the-counter medication when dispensing prescriptions.
- Development and distribution of medication education bulletins to healthcare providers to share with patients.

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