

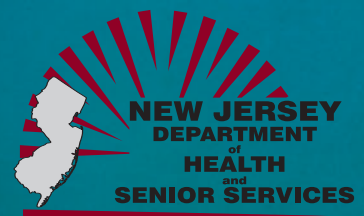
# *New Jersey* **Maternal Mortality** *Review*



**Maternal Mortality  
in New Jersey  
1999-2001**



**Jon S. Corzine**  
Governor



**Fred M. Jacobs, M.D., J.D.**  
Commissioner

# **Maternal Mortality in New Jersey 1999-2001**

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Maternal Child Health Directors and Risk Managers from New Jersey hospitals and County Medical Examiners and their staff who voluntarily report maternal deaths to the New Jersey Department of Health and Senior Services.

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, the Division of Emergency Medical Services in the New Jersey Department of Health and Senior Services, and private health care providers throughout New Jersey who facilitate access to medical, social and other records relevant to case review.

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## **EXECUTIVE SUMMARY**

Despite tremendous improvements in perinatal care, and health care in general, pregnancy continues to pose a risk for death. On the positive side, improvements in prenatal and medical care for pregnant women have resulted in a significant decrease in maternal mortality since the early twentieth century. However, since 1982, the maternal mortality rate, both nationally and in New Jersey, has remained at a constant level, and racial ethnic disparities continue to exist.

New Jersey has long been active in the area of maternal mortality review. The Medical Society of New Jersey initiated a maternal mortality review in 1931, and partnered with the New Jersey Department of Health and Senior Services in the early 1970's. In 1999, the New Jersey Department of Health and Senior Services, and the Medical Society of New Jersey, agreed to revise the maternal mortality review process to incorporate a national trend for multidisciplinary review of maternal deaths using the Centers for Disease Control and Prevention and American College of Obstetricians and Gynecologists definitions of pregnancy-associated and pregnancy-related deaths.

This report, which covers the period 1999 to 2001, is the first report of the outcomes from the revised New Jersey Maternal Mortality Review. It discusses issues influencing the decision to revise the process, how the transition was made from the old to the new process, how the New Jersey Maternal Mortality Review process works, and most importantly, findings and recommendations from the first three years of review of pregnancy-associated deaths. It is these findings and recommendations that the New Jersey Maternal Mortality Review Case Review Team and the New Jersey Department of Health and Senior Services encourage you to integrate into your practice and system of care for women, infants, children and families.

The New Jersey Department of Health and Senior Services, and members of the New Jersey Maternal Mortality Case Review Team are proud that New Jersey is recognized as a leader in maternal mortality review by the Centers for Disease Control and Prevention, Maternal and Child Health Bureau, and the Association of Maternal and Child Health Programs. In September 2003, New Jersey was one of nine states invited to participate in a forum to identify challenges and lessons learned from their work with maternal mortality review. More recently, New Jersey, along with two other states, participated in a Centers for Disease Control and Prevention MCH Epidemiology Web cast, "AMCHP/CDC/HRSA Safe Motherhood Partnership – State Maternal Mortality Review (MMR)," to share its' experience with maternal mortality review.

The New Jersey Maternal Mortality Review process is ongoing; new findings and recommendations will be reported as information is available. We hope you find the information contained in this report useful, and welcome any feedback.

Thank you for your work to decrease maternal mortality in New Jersey.



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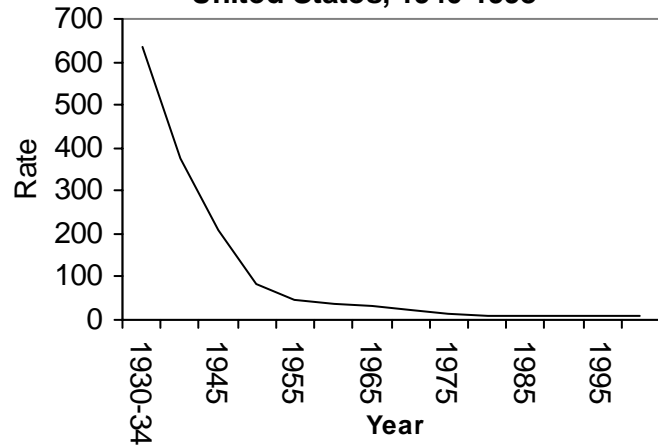


## SECTION I: INTRODUCTION

Early historical accounts attest that pregnancy and childbirth have always had risk for death. In 1930, the national maternal mortality rate was 670 maternal deaths per 100,000 live births. This rate declined substantially during the 1940's and 1950's and continued to decline until 1982. Since 1982, however, the national maternal mortality rate has remained constant, fluctuating between seven and eight maternal deaths per 100,000 live births (Figure 1) (MMWR, September 4, 1998; Hoyert et al., 2000).

In contrast to the steady decline in the overall national maternal mortality rate, a race/ethnic disparity in maternal mortality remains. A Federal study on racial and ethnic group differences in maternal mortality found that during the period 1991-1997, Black women were approximately 4 times as likely to die as White women (Figure 2).

**Figure 1: Maternal Mortality Rate<sup>1,2</sup>- United States, 1940-1998**

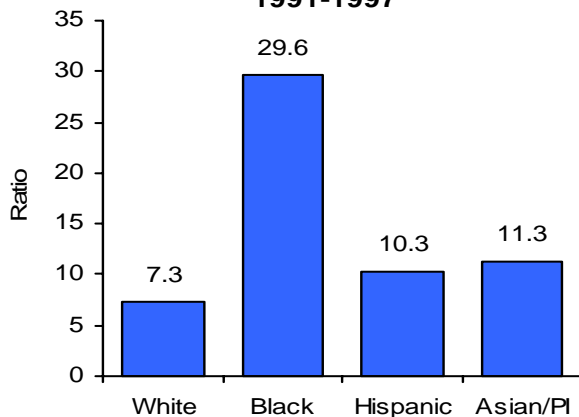


<sup>1</sup> Per 100,000 live births.

<sup>2</sup> Maternal Mortality is defined by the World Health Organization as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes."

SOURCES: National Center for Health Statistics. Vital Statistics of the United States, Data Years 1940-1998. Hyattsville, Maryland: Public Health Services.

**Figure 2: Maternal Mortality Ratios<sup>1,2</sup> by Race/Ethnicity, United States, 1991-1997**



<sup>1</sup> Per 100,000 live births.

<sup>2</sup> Maternal mortality defined as a death that occurred during pregnancy or within 1 year after the end of pregnancy and resulted from 1) complications of pregnancy itself, 2) a chain of events initiated by pregnancy, or 3) aggravation of an unrelated condition by the physiologic effects of pregnancy.

Although the disparity is greatest among Black and White women, a race/ethnic disparity is also seen between Hispanic and White women, and Asian/Pacific Islander and White women. A Hispanic woman was 1.4 times and an Asian/Pacific Islander woman 1.6 times more likely to die a pregnancy-related death than a White woman (MMWR, May 11, 2001).

The maternal mortality rate for New Jersey is consistent with national trends, both in a decline in maternal mortality, and in the race/ethnic disparity. In New Jersey, for the years 1987-1996, the overall maternal mortality rate was 6.9 per 100,000 live births. However, the Black maternal mortality rate for the same period is

more than four times that of White women (19 and 3.9 respectively). This disparity calculates to a Black to White ratio of 4.9 to 1 (MMWR, June 18, 1999).

Although there has been significant improvement in the maternal mortality rate both nationally and in New Jersey since the early 1900's, there has been no improvement in the maternal mortality rate in the last twenty years. As significant, is the persistent racial/ethnic disparity. The United States and New Jersey have not reached an irreducible minimum in maternal mortality; World Health Organization (WHO) estimates demonstrate that 28 countries have lower maternal mortality rates than the United States (WHO, 2004). New Jersey maternal mortality rates calculated for the period 1987 through 1996 reveal 28 states with a lower maternal mortality rate (MMWR, June 18, 1999). Much needs to be done if New Jersey is to make progress towards meeting the Healthy People 2010 objective for maternal deaths.

### ***Healthy People 2010 - Objective 16-4***

***Reduce the maternal death rate to no more than 3.3 maternal deaths per 100,000 live births.***

According to the Centers for Disease Control and Prevention (CDC), the difference in maternal mortality rates by race remains one of the largest racial disparities among major public health indicators. Race and ethnicity are not risk factors for maternal mortality, but instead may be markers of social, economic, cultural, health-care access and quality, and other interrelated factors that may increase the risk for death among pregnant women (MMWR, 2001). Understanding characteristics, and issues contributing to deaths, of women who die during pregnancy, childbirth, or from causes related to pregnancy or childbirth, is critical to both the prevention of maternal deaths and the improvement of the health of all pregnant women. Once factors contributing to maternal mortality are identified, interventions can be implemented which may decrease the number of maternal deaths. Maternal mortality review is a process that can assist states to improve the surveillance of maternal deaths.

### ***The Historical Perspective***

Since 1931, New Jersey's obstetricians have been examining and analyzing maternal deaths. New Jersey was one of the first states to implement a maternal mortality review process, which was organized by the Medical Society of New Jersey. To maintain confidentiality, meetings were held in the kitchen at the Medical Society offices so no one would suspect the group was reviewing maternal deaths. It was not until the 1970's that a formal collaboration was to develop between the New Jersey Department of Health and Senior Services (previously known as the New Jersey Department of

Health) and the obstetricians of the Medical Society of New Jersey. In 1977, the Public Health Council and the New Jersey Department of Health and Senior Services' Institutional Review Board approved the review process and study of maternal deaths.

Staff from the New Jersey Department of Health and Senior Services, Division of Family Health Services, Maternal, Child and Community Health provided support to the Medical Society of New Jersey by obtaining death certificates and copies of medical records. Identification of maternal deaths relied on voluntary reporting by hospitals, medical examiners, and providers, forwarding of death certificates by the Bureau of Vital Statistics, and a monthly search of the death certificate database by the New Jersey Department of Health and Senior Services.

On an annual basis, the Maternal Mortality Review Committee of the Medical Society of New Jersey met to review individual cases of death of a woman that occurred during pregnancy or within 90 days of termination of the pregnancy. The Chair of the Maternal Mortality Review Committee would come to the New Jersey Department of Health and Senior Services to review the death certificates and medical records before presentation to the whole committee. Cases were sent to Committee members, and each member presented one or more cases to the entire group for discussion at an annual meeting. The Maternal Mortality Review Committee identified at least one topic for which further discussion and education of obstetricians was needed. Presentations of the groups' findings were made at the annual meeting of the New Jersey Obstetrics and Gynecological Society, and a summary was sent to obstetrical department heads at all birthing hospitals with a request to discuss findings with their staff. Additionally, members of the review committee were available to present the findings at individual hospitals.

***Important Dates in the History of Maternal Mortality Review in New Jersey***

- 1931 *The Medical Society of New Jersey begins to review maternal deaths.*
- 1974 *A formal maternal mortality review collaboration is established between the New Jersey Department of Health and Senior Services and the Medical Society of New Jersey.*
- 1977 *The New Jersey Maternal Mortality Review process receives approval from the Public Health Council and the Institutional Review Board.*
- 1980 *Presentation of findings from the maternal mortality review to the New Jersey OB/GYN Society at the annual meeting.*
- 1999 *Major revision of the process of maternal mortality review in New Jersey is implemented.*

### ***Impetus for Change***

Several factors have influenced the maternal death review process in New Jersey:

- ◆ New definition of maternal death;
- ◆ Underreporting of maternal deaths; and
- ◆ Trend towards a systematic, multidisciplinary review process.

### ***New Definition of a Maternal Death:***

In 1987, the CDC, in collaboration with the Maternal Mortality Special Interest Group of the American College of Obstetricians and Gynecologists (ACOG), the Association of Vital Records and Health Statistics, and state and local health departments initiated the Pregnancy Mortality Surveillance System. The Pregnancy Mortality Surveillance System is designed to incorporate national data from multiple reporting sources, which improves the completeness of the reporting. As part of this initiative, the CDC/ACOG Maternal Mortality Study group introduced new definitions of maternal mortality, pregnancy-associated death and pregnancy-related death, which are being used by CDC, researchers, and increasingly by states throughout the country.

#### ***Pregnancy-associated death:***

*The death of any woman, from any cause, while pregnant or within one calendar year of termination of pregnancy, regardless of the duration and the site of pregnancy.*

#### ***Pregnancy-related death:***

*A pregnancy-associated death resulting from complications of the pregnancy itself, the chain of events initiated by the pregnancy that led to death, or aggravation of an unrelated condition by the physiologic or pharmacologic effects of the pregnancy that subsequently caused death.*

### ***Underreporting of Maternal Deaths:***

Maternal mortality rates as reported by the National Center for Health Statistics (NCHS), the only source of national mortality statistics, are believed to be underestimates since individual states' investigations have reported rates 2 to 6 times higher than the NCHS rate (Dye, et al., 1992; Horon & Cheng, 2001; MMWR, November 29, 1985; MMWR, February 10, 1995; Ziskin et al., 1979). There are several reasons for this.

The National Center for Health Statistics uses the World Health Organization (WHO) definition of maternal death. According to the WHO definition, a maternal death is "the death of a woman while pregnant or within 42 days of termination of the pregnancy, irrespective of the duration and the site of pregnancy, from any cause related to or

aggravated by the pregnancy or its management, but not from accidental or incidental causes.” With advances in medicine in general, the 42-day interval may not capture all deaths that can be attributed to pregnancy and its complications. The International Classification of Disease, 10<sup>th</sup> Revision (ICD-10) classification has improved on the reporting of maternal deaths through the inclusion of new categories that capture deaths related to or aggravated by pregnancy or pregnancy management, but which occur 42 days to one year after the pregnancy event.

Using death certificates alone to identify maternal deaths is also problematic. The cause of death information may not indicate a relationship to pregnancy because events in the death were so complex that events earlier in the causal chain are not mentioned, or the pregnancy is not documented to prevent disclosure of the pregnancy or because no one was aware of the pregnancy (Berg et al., 2001, p.17).

Having a check box on the death certificate to indicate the decedent had been pregnant within a specified time period prior to death (in New Jersey, during the period covered by this report, this time period was 90 days), can improve reporting of maternal deaths. However, some maternal deaths are still missed because either the certifier does not mark the check box when the decedent was pregnant, or marks the checkbox when the decedent was not pregnant.

***Trend Towards a Multidisciplinary, Systems Focused Review Process:***

Several states have implemented a maternal mortality review process modeled after the fetal-infant mortality review process. This process differs from the traditional hospital morbidity/mortality review process in several ways. Information on a maternal death is gathered not only from the hospital medical record, but from autopsy reports, medical examiner investigative reports, vital statistics records, emergency medical services, law enforcement, and private providers. A de-identified case summary is prepared to protect the identity of the individual and their healthcare providers, and is presented to a Case Review Team. The Case Review Team is multidisciplinary, representing a variety of professional organizations, public and private agencies, consumers and maternal child health advocates. The Case Review Team reviews the case summaries in order to identify gaps in service, barriers to care, and systemic service delivery problems or issues. Recommendations are made to improve the system of care for pregnant women, infants and children and families, as well as topics for professional and/or consumer education. Findings and recommendations are shared with health care professionals, agencies and organizations, and policy makers for action on the State and local level.





## **SECTION II: NEW JERSEY'S PROCESS**

In 1999, the New Jersey Department of Health and Senior Services began a process of revising the traditional, physician-based maternal mortality review process to one that was modeled after the National Fetal-Infant Mortality Review program and the Pregnancy Associated Mortality Review program in Florida. The key elements to be incorporated into the review process were:

- ◆ improved reporting of maternal deaths, including use of multiple database matching strategies,
- ◆ consistent methods of data abstraction,
- ◆ review of cases by a multidisciplinary team,
- ◆ integration of the CDC's expanded definition,
- ◆ trending of data from year to year, and
- ◆ integration of findings into quality improvement activities.

In early 1999, the New Jersey Department of Health and Senior Services released a Request for Proposals to identify a partner to implement the new review program. In May 1999, the Central New Jersey Maternal and Child Health Consortium, Inc., a private, non-profit organization, was selected to implement a two-year pilot project. The Central New Jersey Maternal and Child Health Consortium, Inc. is one of six maternal and child health consortia in New Jersey established and licensed by the New Jersey Department of Health and Senior Services. In late 1999, the New Jersey Department of Health and Senior Services' Institutional Review Board approved the maternal mortality review process. Following the two-year pilot project, facilitation of the project was transferred to staff of the New Jersey Department of Health and Senior Services, Reproductive and Perinatal Health Services. The Central New Jersey Maternal and Child Health Consortium, Inc. continues to assist by coordinating the data abstraction process.

Prior to implementation, information regarding the new process was provided. The Central New Jersey Maternal and Child Health Consortium, Inc. developed and distributed a special issue of *Clinical Updates*, a periodic publication for healthcare professionals, which provided a history of the process of maternal mortality review in New Jersey, identified current national trends and a described the new process. The information was also provided to the other maternal and child health consortia in the state for distribution to their network of physicians and providers. The maternal child health consortia were encouraged to publish articles in their newsletters and post information on their website regarding the new process.

Three regional trainings for hospital staff were held in the southern, central and northern areas of New Jersey to outline both the new program and the implications for hospitals. During each of the training sessions, a summary of the New Jersey Maternal Mortality Review Program was provided and the new definitions of maternal death were discussed. Also discussed were the implications for reporting maternal deaths, and new review methods that included abstracting data from the medical records.

## Program Oversight

The New Jersey Maternal Mortality Review Steering Committee provides guidance and oversight for the process. The Steering Committee is comprised of representatives from the New Jersey Department of Health and Senior Services, the Maternal and Child Health Consortia, the Medical Society of New Jersey's Maternal Mortality Review Committee, and the Regional Perinatal Centers.

The first task of the Steering Committee was to develop policies to guide the review program. These policies include Confidentiality, Case Review Team Duties and Responsibilities, Identification of Cases and Deidentification of Data. Next, the Steering Committee distributed a call for nominations for the multidisciplinary Case Review Team and appointed the members of the team. During the first two years of the project, the Steering Committee met quarterly to address concerns regarding the challenge of educating healthcare professionals about the issues identified through the enhanced maternal mortality review process. The Steering Committee continues to meet annually and on an ad hoc basis.

## Case Identification

One of the objectives of revised maternal mortality review process is to improve the reporting of maternal deaths. Before the revised maternal mortality process was implemented, the New Jersey Department of Health and Senior Services received reports of maternal deaths from hospitals, medical examiners offices, and/or the State Bureau of Vital Statistics. With the new process, multiple data sources are used for case identification to ensure the completeness of information, and reduce potential underreporting. Cases are identified through the following methods:

- ◆ Direct reporting of a maternal death by a hospital, medical examiner or other personnel to the New Jersey Department of Health and Senior Services;
- ◆ The death certificate indicates the woman was pregnant within 90 days prior to death (New Jersey's death certificate includes a check box);

*Prior to implementing the revised maternal mortality review process, a study was conducted by the MCH Epidemiology Program to determine if linking multiple vital death and pregnancy outcome data sources would increase the detection of maternal deaths in New Jersey. Data sources included death certificates, birth certificates, the fetal death file, and the hospital discharge file for the years 1994-1996. Analysis was performed by AUTOMATCH using a probabilistic methodology to identify new cases were the woman was pregnant within 90 days of her death. By linking multiple data sources, the number of cases identified increased by 33%\*.*

### Potential Maternal Death Cases Identified Using a Probabilistic Match, 1994-1995

Year	Known	New	Total
1994	41	11	52
1995	27	10	37
1996	28	10	38
<b>Total</b>	96	31	127

\*Not manually verified

- ◆ 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 and Senior Services Maternal and Child Health (MCH) Epidemiology Program.

While using probabilistic methodology successfully identifies new pregnancy-associated deaths, it was discovered early on that the results of the matching process include some cases where the woman did not have an associated pregnancy event. To prevent review of non-pregnancy associated deaths, cases identified by probabilistic matching are further screened to insure the woman had a pregnancy event within the year prior to her death. This is accomplished by verifying demographic information with the birthing hospital before attempting data collection.

### ***Data Collection***

The data collection process begins with the Reproductive and Perinatal Health Services program at the New Jersey Department of Health and Senior Services, which receives reports of maternal deaths. Death certificates and autopsy reports are obtained, and the death is verified as a maternal death. A list of verified cases and death certificates is forwarded to the Central New Jersey Maternal and Child Health Consortium, Inc. As cases are reported to the Central New Jersey Maternal and Child Health Consortium, Inc, they are assigned to data abstractors. Information is collected using a standard data abstraction tool, which is an adaptation of the tool utilized by the Florida Pregnancy Associated Mortality Review program.

Data abstractors obtain data from all available sources. These include the death certificate, autopsy report, report of the medical examiner, emergency medical services, prenatal care records, and medical records from the delivery event, hospitalizations, emergency room and outpatient visits including the terminal event, and any other relevant known hospitalizations.

Upon the completion of the data abstraction, a case summary is generated following a specified format. No identifying information (patient names, addresses, dates, physician names, or hospital names) is utilized in the case summary.

Early in the implementation of the new process, it was recognized that a comprehensive history of the issues was needed to adequately identify systems issues associated with a maternal death. To obtain as much information as possible, records are reviewed from one year before the date of the pregnancy event through the date of the terminal event. In some instances, this might span a period of two years. This is a personnel intensive process, requiring the data abstractor to travel to one or more hospitals to review records. Frequently, more than one data abstractor will collect information on the same case. When this occurs, the Central New Jersey Maternal and Child Health Consortium, Inc. will synthesize the information from both data abstractors into the case summary. The time and effort invested in this process has proven to be worthwhile, and

provides much detail about the mother and the care she received before, during, and after the pregnancy event.

### ***About the NJ Maternal Mortality Review Data Abstractors***

*Data abstractors are nurses with extensive maternal and child health backgrounds, trained in medical data abstraction, and case summary development. Each Maternal and Child Health Consortia identifies qualified individuals to act as a data abstractor for deaths that occur within the consortium's region. Initially, 16 data abstractors were contracted with; currently the NJ Maternal Mortality Review has a contingent of eight data abstractors.*

*Data abstractors receive extensive training before receiving an assignment. Training includes general information about the maternal mortality review process, as well as very specific instruction regarding data collection and the development of case summaries. The first training was in March 2000, followed by yearly update training. The data abstractors also receive extensive telephone consultation from the Central New Jersey Maternal and Child Health Consortium, Inc. as needed.*

*Because doing onsite data abstraction was a new concept to maternal mortality review in New Jersey, a precedent did not exist for determining reimbursement for the data abstractor. Initially data abstractors were paid a flat per-case fee, however, the variation in case length required that a tiered payment schedule be developed based on the complexity of the case.*

### ***Case Review Team***

The Case Review Team is multidisciplinary with representation from multiple medical specialties, as well as other health and human services professionals and community representatives. To ensure continuity between old and revised maternal mortality review processes, several of the physician members affiliated with the Maternal Mortality Review Committee of the Medical Society of New Jersey are members of the Case Review Team. Membership on the Case Review Team is voluntary; members receive no monetary reimbursement. All team members are dedicated to improving the health and system of care for pregnant women in New Jersey. The Case Review Team first met in March 2000. Team members were oriented to the process and received a copy of the New Jersey Maternal Mortality Review Manual, which includes supporting materials. The current Case Review Team has 25 members, of which 75% are original members. Vacancies are filled through the nomination process.

The following disciplines are represented on the Case Review Team:

Obstetrics/Gynecology	Social Work
Maternal-Fetal Medicine	Mental Health
Obstetrical Anesthesiology	Clergy
Perinatal Pathology	Substance Abuse
Obstetrical Nursing	Family Planning
Certified Nurse Midwifery	Public Health
Medical Examiner	Minority Rights Advocacy
Critical Care Intensivist	Risk Management/Safety
Emergency Medical Services	Nutrition
Hospital/Facility Administration	

### ***Case Review Process***

In order to obtain a total picture of maternal mortality in New Jersey, the Case Review Team reviews all cases of pregnancy-associated mortality, which occur in a given year. The Case Review Team meets four times a year for an entire day, and reviews 10 to 15 maternal deaths. A brief summary of each case is presented, followed by open discussion of the case. After all issues and concerns are identified, the committee votes to determine if the death was pregnancy-related, not pregnancy related or undetermined. The purpose of the review and classification of cases is to assist the Case Review Team in identifying potential system-level issues. The Case Review Team is careful to ensure a balanced review in light of the advantages of retrospective review and analysis. When all maternal deaths for a given year are reviewed, summary data is presented to the Case Review Team, which then develops recommendations for action.



### SECTION III: FINDINGS

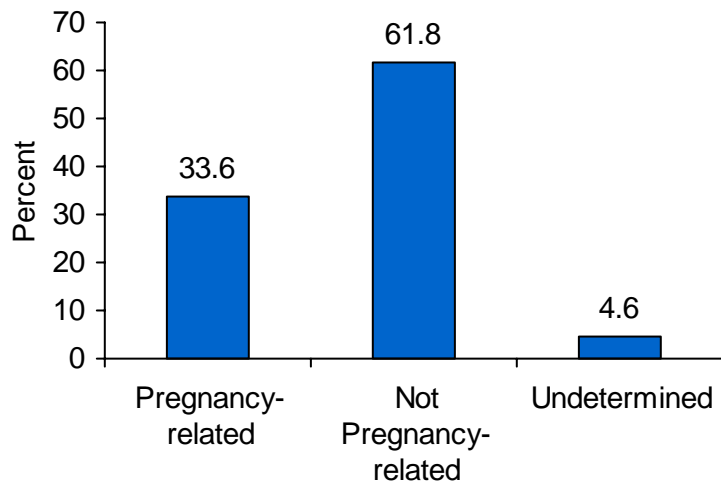
Pregnancy associated deaths occurring in 1999 were the first to be reviewed using the revised maternal mortality review process. Although the New Jersey Department of Health and Senior Services' Institutional Review Board approved the revised process, it is important to remember that the purpose of this revised review process is not research. The maternal mortality review process is also not about fault finding. The purpose of the New Jersey Maternal Mortality Review is to better understand the incidence and circumstances of pregnancy-associated deaths in New Jersey, and how the system of care for women, infants, children and families might be improved.

The findings discussed in this report include data on pregnancy-associated deaths for the three-year period 1999-2001. Because the numbers are small, results should be interpreted with caution, especially concerning the pregnancy related deaths. Rates calculated from small numbers are unstable, fluctuating erratically from year to year, and are not likely to be statistically significant.

To minimize the effects of calculating rates with small numbers, the New Jersey Maternal Mortality Review treats a pregnancy-associated death as a sentinel event and performs a case review of each identified pregnancy-associated death.

For the years 1999-2001, the Case Review Team reviewed 152 cases of pregnancy-associated death. Of these 152 pregnancy associated deaths, 51 were found to be pregnancy-related, 94 were not pregnancy-related, and seven were undetermined (Figure 3).

**Figure 3: Distribution of Pregnancy-associated Deaths, 1999-2001  
n=152**



*NOTE: In the tables and graphs in SECTION III: FINDINGS, pregnancy-associated deaths are labeled as "Total."*

#### Case Identification

- ◆ Pregnancy-related deaths were primarily identified through hospital notification (33.3%), the probabilistic match (31.4%), and the death certificate check box (23.5%) (Table 1).
- ◆ In contrast, the majority of not pregnancy-related (78.7%) and undetermined (85.7%) deaths were identified through the probabilistic match.



- ◆ The number of pregnancy-related deaths identified increased by almost a third (31.3%) by using the probabilistic methodology over the traditional methods of case identification, i.e. hospital or medical examiner notification, death certificate check box.

**Table 1: Primary Sources of Identification for Pregnancy-associated Deaths, 1999-2001**

	Pregnancy-related n=51		Not Pregnancy-related n=94		Undetermined n=7		Total n=152	
	%	(n)	%	(n)	%	(n)	%	(n)
Probabilistic Match	31.4	(16)	78.7	(74)	85.7	(6)	63.2	(96)
Death Certificate	23.5	(12)	12.8	(12)	14.3	(1)	16.4	(25)
Hospital	33.3	(17)	5.3	(5)	0.0	(0)	14.5	(22)
Medical Examiner	9.8	(5)	2.1	(2)	0.0	(0)	4.6	(7)
Other <sup>1</sup>	2.0	(1)	1.1	(1)	0.0	(0)	1.3	(2)

<sup>1</sup> Other includes an obituary and a newspaper article.

### **Data Abstraction Sources**

For the 152 pregnancy-associated deaths, data was abstracted from 775 records. Table 2 lists the type and number of records from which data was abstracted.

**Table 2: Data Sources for Pregnancy-associated Deaths, 1999-2001**

	Number Records
Death Certificate	151
Inpatient Medical Record	137
Labor and Delivery Record	103
Autopsy Report	88
Prenatal Care Record	72
Toxicology Report	68
Emergency Room Record	68
Outpatient Record	42
Report of Investigation of Medical Examiner	24
EMS Record	18
Law Enforcement Record	2
Rehabilitation Center Record	1
Non-obstetric Provider Record	1

**Pregnancy-related Mortality Ratio**

*NOTE: The pregnancy-related mortality ratio, as presented in this report, is based on the classification of pregnancy-associated deaths identified and reviewed through the New Jersey Maternal Mortality Review. These rates are not the official statistics on maternal deaths reported to the National Center for Health Statistics (NCHS). Information on maternal deaths provided to the NCHS by the New Jersey Center for Health Statistics is based solely on vital statistics reporting and may not include any matching of data. As such, cases may be missed causing an underreporting of maternal deaths, resulting in the reporting of lower rates by the NCHS than presented in this report.*

Black, non-Hispanic and Hispanic women are more likely to die from a pregnancy-related cause than White, non-Hispanic women (Table 3).

- ◆ For the period 1999-2001, Black, non-Hispanic women were three times more likely, and Hispanic women twice as likely, to die from a pregnancy-related cause than White, non-Hispanic women.
- ◆ The Black, non-Hispanic to White, non-Hispanic mortality ratio for this period is 3.1 to 1, and the Hispanic to White, non-Hispanic ratio 1.9 to 1.
- ◆ The ratios noted above for New Jersey are neither age nor race adjusted.

**Table 3 : New Jersey Pregnancy-related Mortality Ratio (Maternal Mortality Rate)<sup>1</sup> 1999-2001**

	New Jersey	Risk Ratio	United States <sup>2</sup>
Total <sup>3</sup>	14.8		11.5
White, non-Hispanic	9.7	1.0	7.3
Black, non-Hispanic	30.5	3.1	29.6
Hispanic	18.1	1.9	11.3
Asian/PI	7.7	0.8	11.3

<sup>1</sup> Per 100,000 live births.

<sup>2</sup> 1991-1997 combined. Source: CDC: Pregnancy-Related Deaths Among Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native Women— United States, 1991-1997.

<sup>3</sup> Race/ethnicity categories used are White, non-Hispanic, Black, non-Hispanic, Asian/Pacific Islander (Asian/PI), and Other. Hispanic is defined as being of Mexican, Puerto Rican, Cuban, Central/South American, or other Hispanic ethnicity, regardless of race. Asian/PI includes persons of Chinese, Japanese, Hawaiian, Filipino, Asian Indian, Korean, Samoan, Vietnamese, Guamanian, or other Asian and Pacific Islander descent not reported as Hispanic. This race/ethnicity classification system is consistent with that used by the New Jersey Center for Health Statistics.

The following are some important notes regarding pregnancy-related mortality ratios and some cautions regarding their interpretation:

- ◆ The maternal mortality rate, or pregnancy-related mortality rate, is more accurately described as a pregnancy-related mortality ratio with the denominator as the number of live births, not the total number of pregnancies.

- ◆ The pregnancy-related mortality ratio for race/ethnicity is based on information from the death certificate (numerator) and live births (denominator) as reported by the New Jersey Center for Health Statistics. Race/ethnicity information reported on the death certificate is completed by the funeral director as reported by the family or other informant, or based on observation. Studies have shown that inaccurately coded race/ethnicity information results in over reporting of white and black deaths, and underreporting for other racial/ethnic groups.
- ◆ The CDC National Pregnancy Mortality Surveillance System uses the pregnancy-associated death and pregnancy-related death definitions; however some states continue to define maternal death using time frames such as 42 days to 90 days.

### **Pregnancy Outcome**

- ◆ The most frequent pregnancy outcome associated with pregnancy-associated deaths was live birth (67.8%) (Table 4).
- ◆ Women who died from a pregnancy-related death had more live births than women who died a not pregnancy-related or undetermined death (74.5% v. 64.9% and 57.1%).
- ◆ The majority of terminations of pregnancy were to women who died from a not pregnancy-related (22.3%) or undetermined (28.6%) death.

**Table 4: Distribution of Pregnancy-associated Deaths by Birth Outcome, 1999-2001**

	Pregnancy-related (n=51)		Not Pregnancy-related (n=94)		Undetermined (n=7)		Total (n=152)	
	%	(n)	%	(n)	%	(n)	%	(n)
Live birth	74.5	(38)	64.9	(61)	57.1	(4)	67.8	(103)
Pregnant at death	7.8	(4)	6.4	(6)	14.3	(1)	7.2	(11)
Ectopic	7.8	(4)	2.1	(2)	0.0	(0)	3.9	(6)
Stillbirth	5.9	(3)	2.1	(2)	0.0	(0)	3.3	(5)
Termination of pregnancy <sup>1</sup>	3.9	(2)	22.3	(21)	28.6	(2)	16.4	(25)
Unknown	0.0	(0)	2.1	(2)	0.0	(0)	1.3	(2)

<sup>1</sup>Termination of pregnancy includes spontaneous and induced abortions.

**Pregnancy Event to Death Interval**

- ◆ The majority of pregnancy-related deaths occurred while the woman was pregnant or within 42 days postpartum (84.3%) (Table 5). The median interval between the pregnancy-related pregnancy event and death was 9 days, with a range of 0-134 days.
- ◆ In contrast to the pregnancy-related deaths, the majority of not pregnancy-related deaths (79.7%) occurred from 43 to 365 days after the pregnancy event. The median interval between the not pregnancy-related event and death was 189 days, with a range of 0-364 days.

**Table 5: Distribution of Pregnancy-associated Deaths by Number of Days Between Index Pregnancy<sup>1</sup> and Death, 1999-2001**

	Pregnancy-related n=51		Not Pregnancy-related n=94		Undetermined n=7		Total n=152	
	%	(n)	%	(n)	%	(n)	%	(n)
Pregnant at Death	29.4	(15)	7.4	(7)	14.3	(1)	15.1	(23)
1-42 days Postpartum	54.9	(28)	12.8	(12)	28.6	(2)	27.6	(42)
43-90 days Postpartum	2.0	(1)	10.6	(10)	14.3	(1)	7.9	(12)
91-365 days Postpartum	13.7	(7)	69.1	(65)	42.9	(3)	49.3	(75)

<sup>1</sup> Index Pregnancy is the pregnancy event

### Pregnancy-related Cause of Death

Based on cause of death information from the death certificate, the leading causes of pregnancy-related deaths were embolism (19.6%), hemorrhage (13.7%), infection (13.7%), intracranial hemorrhage (13.7%), and heart disease (13.7%) (Table 6). These findings are consistent with CDC's Pregnancy Mortality Surveillance System, which, for the years 1991 – 1999, reports the leading cause of pregnancy-related mortality as embolism (19.6%) followed by hemorrhage (17.2%) (Chang, et al., 2003). The leading causes of pregnancy-related death were the same for all races; however, the distribution differed by race. White, non-Hispanic women were more likely to die from heart disease and intracranial hemorrhage. The leading causes of death for Black, non-Hispanic women were hemorrhage followed by infection and embolism. For Hispanic women the leading causes were infection followed by hemorrhage and embolism. Pregnancy-related deaths of Asian/Pacific Islander and Other race women were due to embolism and heart disease.

**Table 6: Cause of Pregnancy-related Death by Race, 1999-2001**

Cause of Death	White, nH n=18		Black, nH n=17		Hispanic n=12		Asian/PI n=2		Other, nH n=2		All Races n=51	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Embolism <sup>1</sup>	11.1	(2)	17.6	(3)	16.7	(2)	100.0	(2)	50.0	(1)	19.6	(10)
Hemorrhage <sup>2</sup>	5.6	(1)	23.5	(4)	16.7	(2)	0.0	(0)	0.0	(0)	13.7	(7)
Infection <sup>3</sup>	5.6	(1)	17.6	(3)	25.0	(3)	0.0	(0)	0.0	(0)	13.7	(7)
Intracranial Hemorrhage	22.2	(4)	11.8	(2)	8.3	(1)	0.0	(0)	0.0	(0)	13.7	(7)
Heart Disease <sup>4</sup>	27.8	(5)	5.9	(1)	0.0	(0)	0.0	(0)	50.0	(1)	13.7	(7)
PIH/Pre-eclampsia	11.1	(2)	5.9	(1)	0.0	(0)	0.0	(0)	0.0	(0)	5.9	(3)
Suicide	11.1	(2)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	3.9	(2)
Substance Use/Abuse	0.0	(0)	5.9	(1)	0.0	(0)	0.0	(0)	0.0	(0)	2.0	(1)
Other <sup>5</sup>	5.6	(1)	11.8	(2)	33.3	(4)	0.0	(0)	0.0	(0)	13.7	(7)

<sup>1</sup>Embolism includes: amniotic fluid embolism (2), pulmonary embolism (8).

<sup>2</sup>Hemorrhage includes: ruptured ectopic pregnancy (3), abruptio/accrete (3), other (1).

<sup>3</sup>Infection includes: complication of termination of pregnancy (2), complication of C-section (1), sepsis (3), pneumonia (1).

<sup>4</sup>Heart Disease includes: cardiomyopathy (2), acute myocardial infarction (2), other (3).

<sup>5</sup>Other includes: hypoxic event (2), end stage renal disease (1), lupus (1), adult respiratory distress syndrome (1), anoxic brain injury (1), sudden death of unexplained origin (1).

**Not Pregnancy-related and Undetermined Cause of Death**

The leading causes of death for the remaining cases, which includes not pregnancy-related and undetermined deaths, were cancer (17.8%), accidents (15.8%), substance use/abuse (13.9%), infection (13.9%) and heart disease (11.9%) (Table 7). As with the pregnancy-related deaths, the distribution of leading causes of not pregnancy-related death differed by race. White, non-Hispanic women were more likely to die from substance use/abuse (30.3%), which was the leading cause of not pregnancy-related death for this group. The leading cause of death for Black, non-Hispanic women was heart disease (17.1%). Cancer was the leading cause of death for Hispanic women (22.7%).

**Table 7: Cause of Not Pregnancy-related and Undetermined Deaths by Race, 1999-2001**

Cause of Death	White, nH (n=33)		Black, nH (n=41)		Hispanic (n=22)		Asian/PI (n=5)		Other, nH (n=0)		All Races (n=101)	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Malignant Neoplasm <sup>1</sup>	24.2	(8)	12.2	(5)	22.7	(5)	0.0	(0)	0.0	(0)	17.8	(18)
Accidents	12.1	(4)	14.6	(6)	13.6	(3)	60.0	(3)	0.0	(0)	15.8	(16)
Substance Use/Abuse <sup>2</sup>	30.3	(10)	7.3	(3)	4.5	(1)	0.0	(0)	0.0	(0)	13.9	(14)
Infection <sup>3</sup>	15.2	(5)	12.2	(5)	13.6	(3)	20.0	(1)	0.0	(0)	13.9	(14)
Heart Disease <sup>4</sup>	9.1	(3)	17.1	(7)	9.1	(2)	0.0	(0)	0.0	(0)	11.9	(12)
Homicide	3.0	(1)	9.8	(4)	9.1	(2)	0.0	(0)	0.0	(0)	6.9	(7)
Intracranial Hemorrhage	3.0	(1)	9.8	(4)	4.5	(1)	0.0	(0)	0.0	(0)	5.9	(6)
Embolism, Pulmonary	0.0	(0)	4.9	(2)	0.0	(0)	0.0	(0)	0.0	(0)	2.0	(2)
Suicide	0.0	(0)	0.0	(0)	4.5	(1)	20.0	(1)	0.0	(0)	2.0	(2)
Hemorrhage	3.0	(1)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	1.0	(1)
Other <sup>5</sup>	0.0	(0)	12.2	(5)	18.2	(4)	0.0	(0)	0.0	(0)	8.9	(9)

<sup>1</sup> Malignant Neoplasm includes: breast (4), lung (2), adenocarcinoma (2), gastric (2), lymphoma (2), bone (1), colon (1), liver (1), metastatic primary unknown (1), signet cell of appendix (1), metastatic cytosarcoma phylloides (1).

<sup>2</sup> Substance Use/Abuse includes: illicit drugs (12), alcohol (2).

<sup>3</sup> Infection includes: HIV (6), sepsis (3), pneumonia (4), meningitis (1).

<sup>4</sup> Heart Disease includes: arrhythmia (5), other (7).

<sup>5</sup> Other includes: Acute pancreatitis (1), sickle cell (1), hepatitis B (1), ARDS (1), diabetes (1), asthma (1), seizure (1), tracheal stricture (1), lactic acidosis (1).

### **Classification of Cause of Death by Case Review Team**

An important function of the New Jersey Maternal Mortality Review Case Review Team is to determine the cause of death, which may or may not be reflected appropriately on the death certificate. After thoroughly discussing the case, and classifying the death as pregnancy-related, not pregnancy-related or undetermined, the Case Review Team renders an opinion as to the accuracy of the cause of death as listed on the death certificate. If the Case Review Team does not agree with the cause of death listed on the death certificate, a determination of an accurate cause of death is made based on the expertise of committee members.

Of the 152 cases reviewed for the period 1999-2001, the Case Review Team agreed upon a different cause of death than recorded on the death certificate in 31 (20.4%) of pregnancy-associated cases. Half of the re-classified cases were pregnancy-related (48.4%; n=15) and half were not pregnancy-related or undetermined cases (51.6%; n=16). The Case Review Team cause of death re-classifications were of three types:

- Cause of death could not be determined;
- General classification the same (i.e. infection, disease of heart), but specific cause of death different; or
- General classification and specific cause of death were different.

Of the 31 cases re-classified, the Case Review Team could not determine a cause of death for eight deaths (25.8%) or the Case Review Team agreed with the general classification, but disagreed with the specific cause of death in nine (29.0%) of the deaths. In 41.2% (n=14) of the 31 re-classified deaths, the Case Review Team did not agree with the general classification or the specific cause of death.

Re-classification of cause of death by the Case Review Team resulted in shifts between categories, but did not significantly change the rank order of the cause of death. Cause of death ranking for pregnancy-related deaths did not change. For not pregnancy-related and undetermined deaths malignant neoplasm continued to be the leading cause of death, however infection and accidents became the second leading causes of death, followed by substance use/abuse. Table 8 compares the changes (highlighted in blue) to cause of death ranking for pregnancy-associated deaths as determined by the Case Review Team. Cause of death reclassification for over twenty percent of the pregnancy-associated deaths reviewed supports the general belief that the death certificate does not always accurately reflect the cause of death in pregnancy-associated deaths.

**Table 8: Changes to Cause of Death Ranking for Pregnancy-associated Deaths Based on Case Review, 1999-2001  
n=152**

Cause of Death	Pregnancy-related n=51				Not Pregnancy-related and Undetermined n=101			
	Death Certificate		Case Review		Death Certificate		Case Review	
	%	(n)	%	(n)	%	(n)	%	(n)
Embolism	19.6	(10)	21.6	(11)	2.0	(2)	1.0	(1)
Hemorrhage	13.7	(7)	13.7	(7)	1.0	(1)	0.0	(0)
Infection	13.7	(7)	11.8	(6)	13.9	(14)	16.8	(17)
Intracranial Hemorrhage	13.7	(7)	11.8	(6)	5.9	(6)	5.0	(5)
Heart Disease	13.7	(7)	11.8	(6)	11.9	(12)	9.9	(10)
PIH/Pre-eclampsia	5.9	(3)	7.8	(4)	0.0	(0)	0.0	(0)
Suicide	3.9	(2)	3.9	(2)	2.0	(2)	2.0	(2)
Substance Use/Abuse	2.0	(1)	2.0	(1)	13.9	(14)	11.9	(12)
Malignant Neoplasm	0.0	(0)	0.0	(0)	17.8	(18)	18.8	(19)
Accidents	0.0	(0)	0.0	(0)	15.8	(16)	16.8	(17)
Homicide	0.0	(0)	0.0	(0)	6.9	(7)	6.9	(7)
Other	13.7	(7)	7.8	(4)	8.9	(9)	6.9	(7)
Undetermined	0.0	(0)	7.8	(4)	0.0	(0)	4.0	(4)



### Characteristics of Pregnancy-associated Deaths

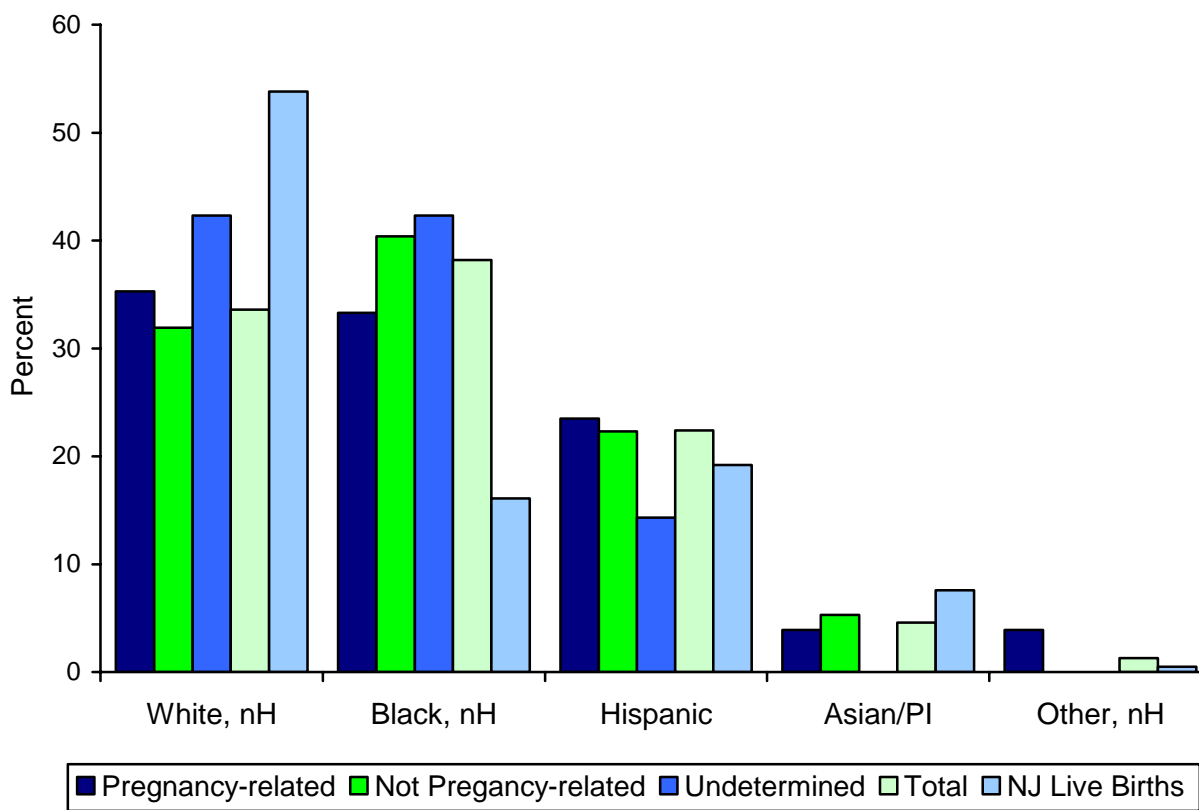
NOTE: Findings from the 152 pregnancy-associated deaths reviewed for the period 1999-2001 are compared to the New Jersey live birth population when data are available for that population group. Unless otherwise noted, the source of the New Jersey live birth statistics is: New Jersey Department of Health and Senior Services, Center for Health Statistics, New Jersey Health Statistics Report, Natality Chapter for years 1999, 2000 and 2001.

#### Race:

Black, non-Hispanic and Hispanic women were over represented in pregnancy-related deaths (Figure 4).

- ◆ Black, non-Hispanic women had 17 (33.3%) pregnancy-related deaths, but accounted for only 16.1% of New Jersey live births.
- ◆ In contrast, there were 18 (35.3%) pregnancy-related deaths to White, non-Hispanic women, who accounted for 53.8% of live births during the same period.
- ◆ There were 12 (23.5%) pregnancy-related deaths among Hispanic women, who accounted for 19.2% of live births.

**Figure 4: Distribution of Pregnancy-associated Deaths by Race/Ethnicity, 1999-2001  
n=152**



**Age:**

- ◆ The median age for pregnancy associated deaths at the time of death was 30.0, comparable to the median age of the New Jersey live birth population of 30.3 (Table 9).
- ◆ Women who died from a pregnancy-related death were slightly older than the remainder of the pregnancy-associated population or the general population of New Jersey live births.

**Table 9: Age at Death for Pregnancy-associated Deaths, 1999-2001**

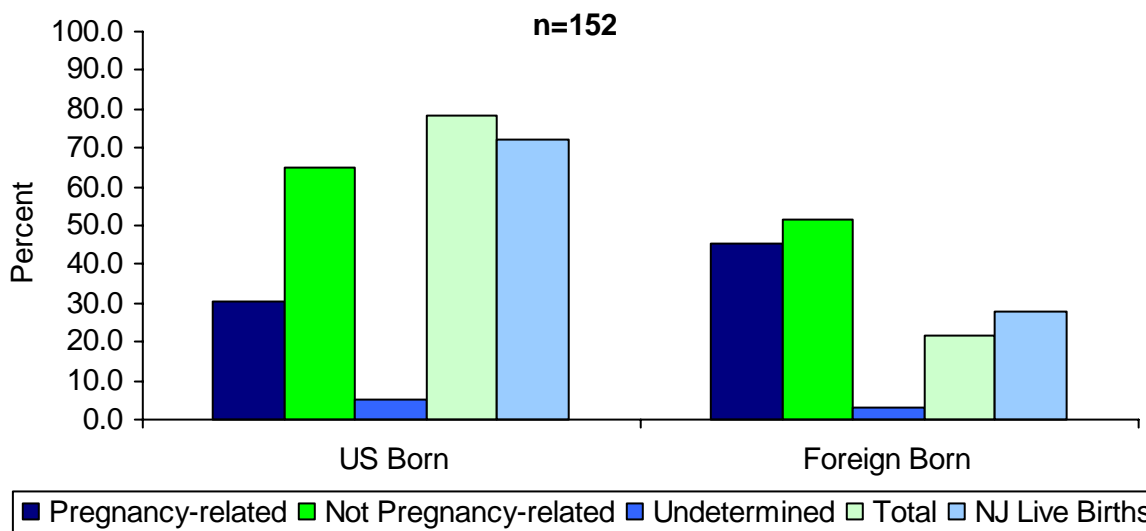
	Pregnancy-related (n=51)		Not Pregnancy-related (n=94)		Undetermined (n=7)		Total (n=152)		NJ Live Births <sup>1</sup> (n=345,070)	
Mean Age	31.5		29.5		26.9		30.0		30.3	
Age	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
11-14	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	0.1	(435)
15-19	5.9	(3)	8.5	(8)	42.9	(3)	9.2	(14)	6.9	(23,904)
20-24	13.7	(7)	20.2	(19)	0.0	(0)	17.1	(26)	16.5	(56,820)
25-29	9.8	(5)	18.1	(17)	14.3	(1)	15.1	(23)	24.8	(85,584)
30-34	33.3	(17)	28.7	(27)	28.6	(2)	30.3	(46)	31.2	(107,720)
35-39	29.4	(15)	17.0	(16)	14.3	(1)	21.1	(32)	16.9	(58,319)
40-44	7.8	(4)	6.4	(6)	0.0	(0)	6.6	(10)	3.4	(11,625)
45+	0.0	(0)	1.1	(1)	0.0	(0)	0.7	(1)	0.2	(663)

<sup>1</sup> Records with age not stated not included in count.

**Place of Birth:**

- ◆ The majority of pregnancy-associated deaths (78.3%; n=119) were to women born within the United States. This is slightly higher than the percent of New Jersey live births to US Born women (Figure 5).
- ◆ Foreign born women were more likely to die from a pregnancy-related death than women born in the United States (45.5%; n=15 v. 30.3%; n=36).
- ◆ The percent of foreign born women who died from a pregnancy-related death (45.5%; n=15) was higher than the percent of foreign born women in the New Jersey live birth population (27.6%). In contrast, the percent of US born women who died from a pregnancy-related death (30.3%; n=36) was lower than US born women in the New Jersey live birth population (72.4%).

**Figure 5: Distribution of Pregnancy-associated Deaths by Place of Birth, 1999-2001**



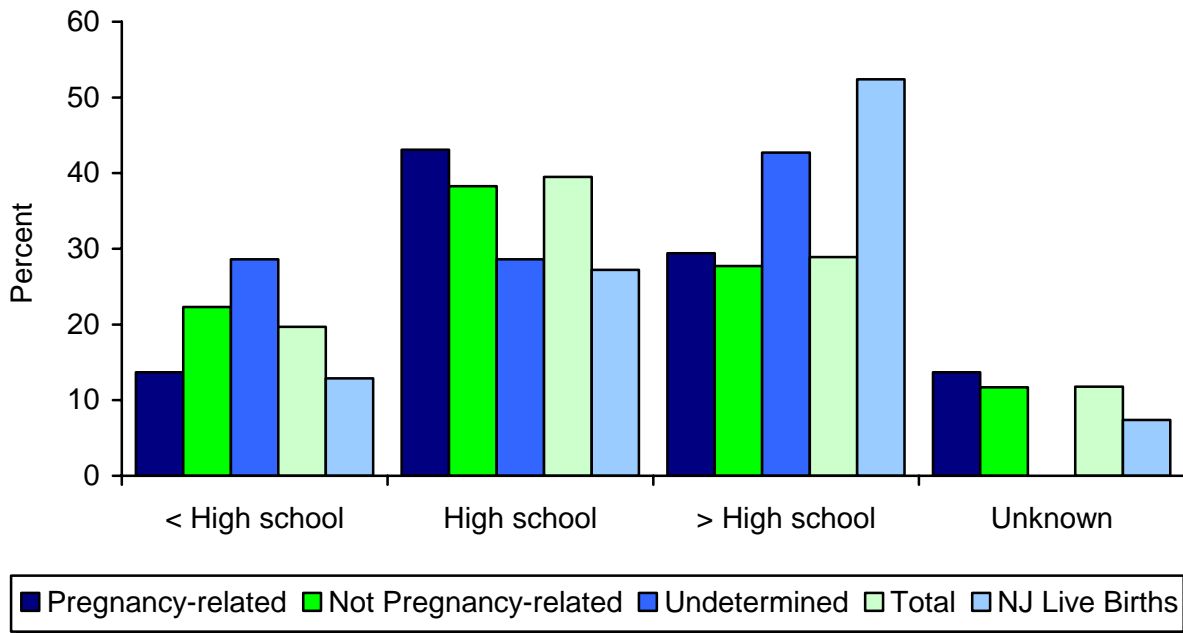
Source for NJ live births: Electronic Birth Certificate database as analyzed and reported by the New Jersey Department of Health and Senior Services, Division of Family Health Services, MCH Epidemiology Program.

US born is defined as having been born in one of the 50 States, the District of Columbia, Puerto Rico, the Virgin Islands or Guam.

**Education:**

- ◆ In general, women who died from a pregnancy-associated death had less education than the general New Jersey live birth population. Of the New Jersey live birth population, 52.4% had education beyond high school compared to only 28.9% (n=44) of the pregnancy-associated deaths (Figure 6).
- ◆ Women who died from a pregnancy-related death were more likely to have a high school education than women who died from a not pregnancy-related or undetermined death (43.1%; n=22 v. 38.3%; n=36 and 28.6%; n=2).

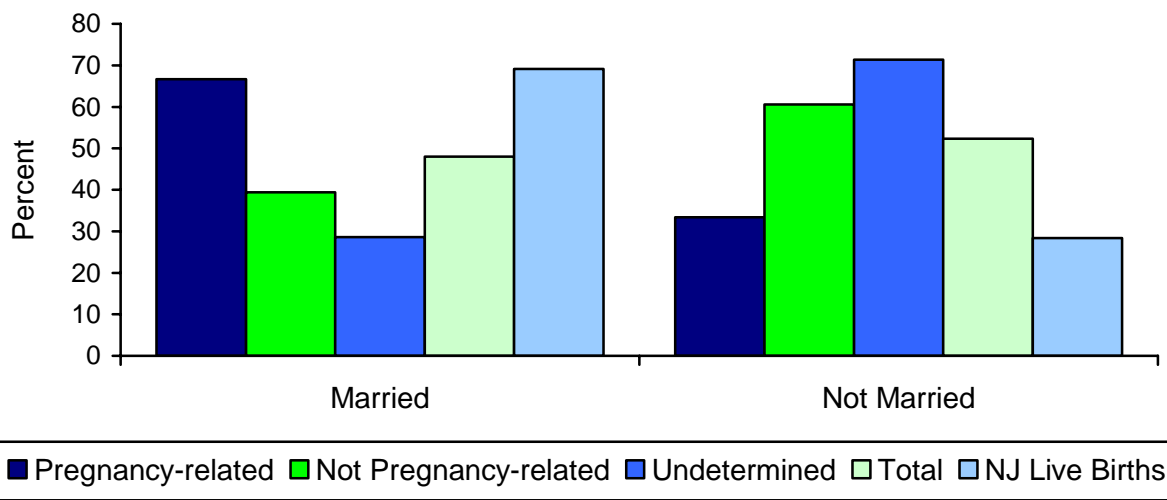
**Figure 6: Distribution of Pregnancy-associated Deaths by Education, 1999-2001  
n=152**



**Marital Status:**

- ◆ Women who died from a pregnancy-related death were more likely to be married than women who died from a not pregnancy-related or undetermined death (66.7%; n=34 v. 39.4%; n=37 and 28.6%; n=2) (Figure 7).
- ◆ Women who died from a pregnancy-associated death were less likely to be married than women in the New Jersey live birth population (48.0%; n=73 v. 69.1%).

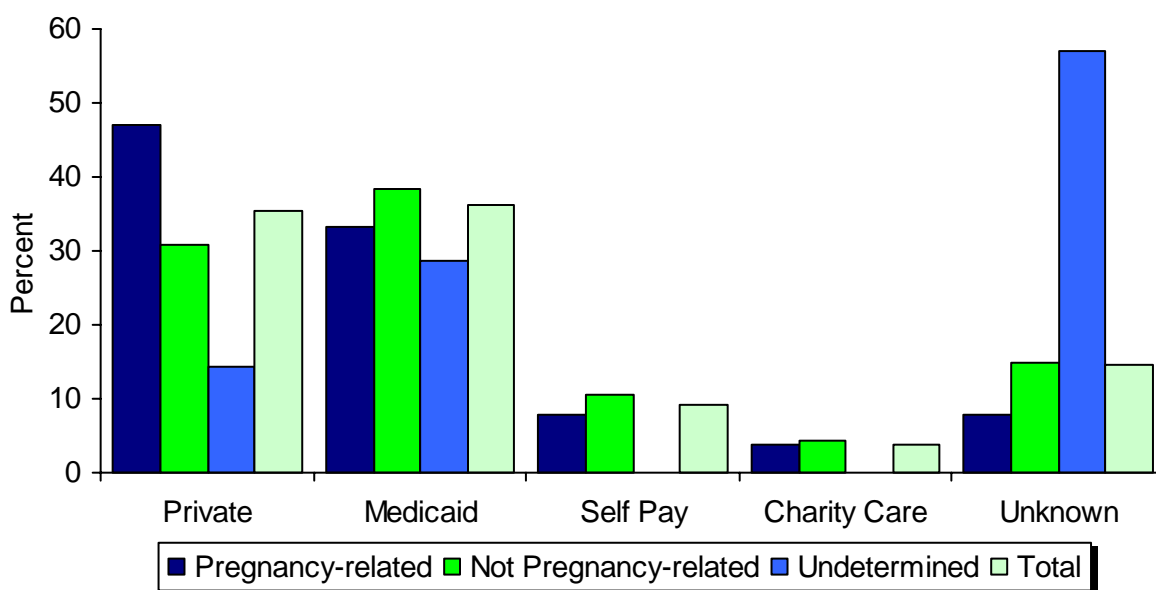
**Figure 7: Distribution of Pregnancy-associated Deaths by Marital Status, 1999-2001  
n=152**



**Insurance Status at Death:**

- ◆ Of women who died from a pregnancy-associated death, 71.7% (n=109) had private or Medicaid insurance at the time of death (Figure 8).
- ◆ Women who died from a pregnancy-related death were more likely to have private insurance than women who died from a not pregnancy-related or undetermined death (47.1%; n=24 v. 30.9%; n=29 and 14.3%; n=1).

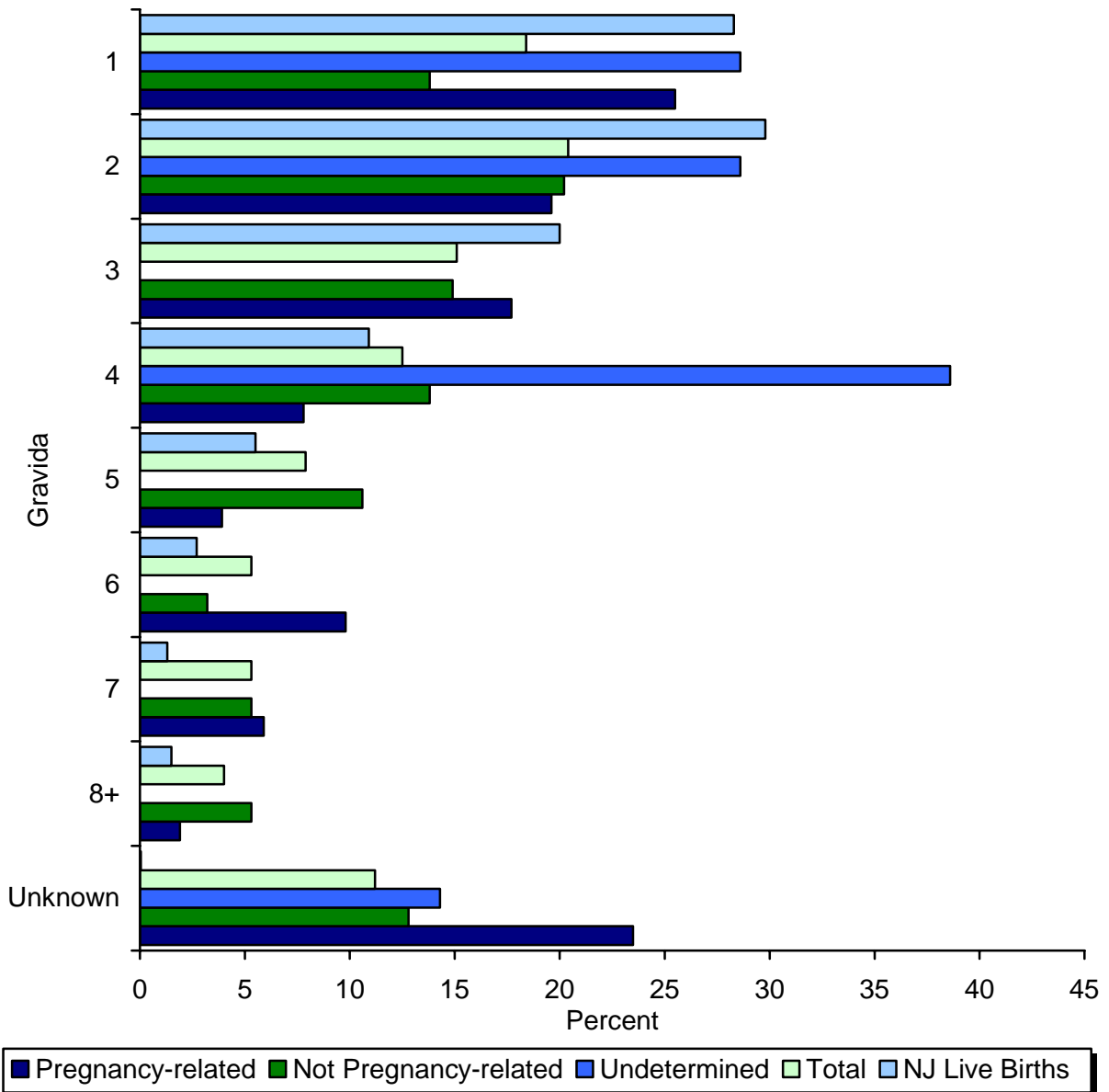
**Figure 8: Distribution of Pregnancy-associated Deaths by Insurance Status at Death, 1999-2001  
n=152**



**Gravid Status:**

- ◆ Information on gravid status was available for only 135 of the 152 cases reviewed (Figure 9).
- ◆ Almost two thirds (62.7%; n=32) of pregnancy-related deaths were gravida 3 or less, with a median gravida of 3.
- ◆ Compared to the NJ Live Birth population, women who died from a pregnancy-associated death had a higher median gravida, 3 versus 2.

**Figure 9: Gravid Status of Pregnancy-associated Deaths, 1999-2001  
n=152**



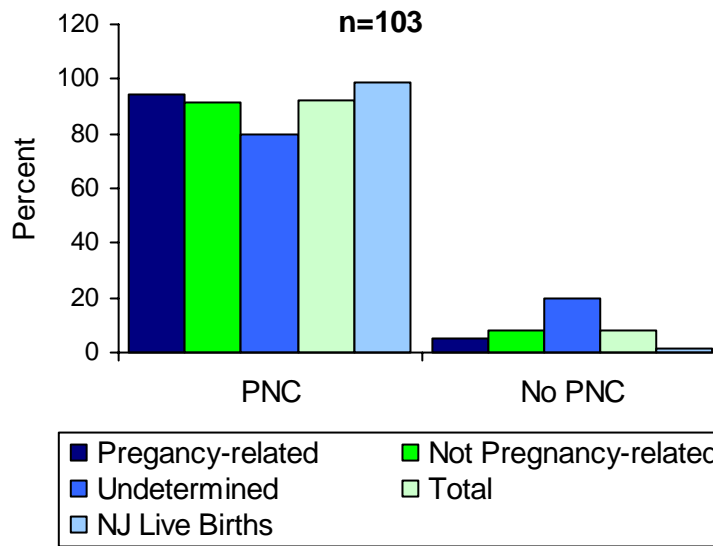
Source for NJ Live Births: New Jersey Department of Health and Senior Services, Bureau of Vital Statistics, MCHEBC Files for years 1999-2001.

NOTE: Terminations of pregnancy and ectopic pregnancies were excluded when analyzing prenatal care data because these cases generally do not have prenatal care in the traditional sense. Unknowns were also not included in the analysis.

**Prenatal Care Received:**

- ◆ Women who died from a pregnancy-associated death were less likely to have received prenatal care than the New Jersey live birth population (92.2%; n=95 v. 98.6%) (Figure 10).
- ◆ Women who died from a pregnancy-related death were more likely to have received prenatal care than women who died from a not pregnancy-related or undetermined death (94.7%; n=36 v. 91.7%; n=55 and 80.0%; n=4).

**Figure 10: Distribution of Pregnancy-associated Deaths by PNC Received, 1999-2001**  
n=103



**Initiation of Prenatal Care:**

- ◆ Of the 95 women known to have received prenatal care, information on the gestational week when prenatal care was initiated was available for only 76 of the cases.
- ◆ Women who died from a pregnancy-related death initiated prenatal care a little earlier than women who died a not pregnancy-related or undetermined death. The median gestational age for initiation of prenatal care for each category of death is shown in Table 10.

**Table 10: Median Gestational Age at Initiation of Prenatal Care, 1999-2001**  
n=76

	Week Gestation
Pregnancy-related	9.2
Not Pregnancy-related	11.0
Undetermined	11.0
Total	10.0

**Trimester at Initiation of Prenatal Care:**

- ◆ In New Jersey, 81.4%% of the live birth population received prenatal care in the first trimester. In contrast, only 65.8% of women who died from a pregnancy-associated death received prenatal care in the first trimester (Table 11).
- ◆ Women who died from a pregnancy-related death were more likely to have entered prenatal care in the first trimester than women who died from a not pregnancy-related or undetermined death (80.0% v. 55.8% and 66.7%).
- ◆ The percent of women who died from a pregnancy-related death who had entered prenatal care in the first trimester was approximately the same as the percent of New Jersey live birth population entering prenatal care in the first trimester (80.0 v. 81.4%).

**Table 11: Distribution of Pregnancy-associated Deaths by Trimester at Initiation of Prenatal Care, 1999-2001<sup>1</sup>**

	Pregnancy-related n=30		Not Pregnancy-related n=43		Undetermined n=3		Total n=76		NJ Live Births n=316,654	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
1 <sup>st</sup> Trimester	80.0	(24)	55.8	(24)	66.7	(2)	65.8	(50)	81.4	(257,741)
2 <sup>nd</sup> Trimester	16.7	(5)	23.3	(10)	0.0	(0)	19.7	(15)	14.9	(47,039)
3 <sup>rd</sup> Trimester	3.3	(1)	20.9	(9)	33.3	(1)	14.5	(11)	3.7	(11,874)

<sup>1</sup>First trimester is defined as less than 13 weeks gestation; second trimester is defined as between 13 and 24 weeks gestation; and third trimester is defined as greater than 24 weeks gestation.

**Number of Prenatal Visits:**

- ◆ Information on the number of visits was available for 83 of the pregnancy-associated deaths.
- ◆ The median number of visits for pregnancy-associated deaths was 8.0 with a range of 1 to 23 (Table 12).

**Table 12: Number of Prenatal Visits for Pregnancy-associated Death, 1999-2001**

	Pregnancy-related (n=31)	Not Pregnancy-related (n=49)	Undetermined (n=3)	Total (n=83)	NJ Live Births <sup>1</sup> (n=334,738)
Median	8.0	8.0	7.0	8.0	11.0
Range	1-19	1-23	2-8	1-23	1-49

<sup>1</sup> Records with unknown number of prenatal visits not included in count.



**Method of Delivery:**

- ◆ Women who died a pregnancy-associated death were twice as likely to be delivered by cesarean section than the New Jersey live birth population (47.3% v. 27.8%) (Table 13).
- ◆ Women who died from a pregnancy-related death were more likely to have a caesarian section (56.1%) than women who died from a not pregnancy-related cause (41.3%).

**Table 13 : Distribution of Pregnancy-associated Deaths by Method of Delivery, 1999-2001**

	Pregnancy-related		Not Pregnancy-related		Undetermined		Total <sup>1</sup>		NJ Live Births <sup>2</sup>	
	n=41		n=63		n=4		n=108		n=329,403	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Vaginal	39.0	(16)	54.0	(34)	50.0	(2)	48.1	(52)	68.5	(225,753)
VBAC	4.9	(2)	4.8	(3)	0.0	(0)	4.6	(5)	3.6	(11,952)
Primary C-section	34.1	(14)	28.6	(18)	25.0	(1)	30.6	(33)	17.4	(57,413)
Repeat C-section	22.0	(9)	12.7	(8)	25.0	(1)	16.7	(18)	10.4	(34,285)

<sup>1</sup> Number of women who delivered a live born or still birth.

<sup>2</sup> Records with unknown method of delivery not included in count.

**Anesthesia during Delivery:**

- ◆ The majority of women who died from a pregnancy-associated death and had any anesthesia were delivered by methods other than inhalation anesthesia (67.6%) (Table 14).
- ◆ Women who died from a pregnancy-related death were more likely to have inhalation anesthesia during delivery than women who died from a not pregnancy-related death (19.5% v. 11.1%).
- ◆ Women who died from a pregnancy-associated death were more likely to have inhalation anesthesia than the New Jersey live birth population (13.9% v. 2.2%).

**Table 14: Distribution of Pregnancy-associated Deaths by Anesthesia Given During Delivery, 1999-2001**

	Pregnancy-related n=41		Not Pregnancy-related n=63		Undetermined n=4		Total <sup>1</sup> n=108		NJ Live Births <sup>2,3,4</sup> (n=334,717)	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Inhalation	19.5	(8)	11.1	(7)	0.0	(0)	13.9	(15)	2.2	(7,341)
Regional	51.2	(21)	55.6	(35)	75.0	(3)	54.6	(59)	69.9	(234,099)
Local	4.9	(2)	14.3	(9)	0.0	(0)	10.2	(11)	25.0	(83,738)
Narcotic Only	2.4	(1)	3.2	(2)	0.0	(0)	2.8	(3)	-----	
None	14.6	(6)	12.7	(8)	25.0	(1)	13.9	(15)	11.7	(39,063)
Unknown	7.3	(3)	3.2	(2)	0.0	(0)	4.6	(5)	-----	

<sup>1</sup> Number of women who delivered a live birth or still born.

<sup>2</sup> Source: NJ Department of Health and Senior Services, Electronic Birth Certificate database, 1999-2001.

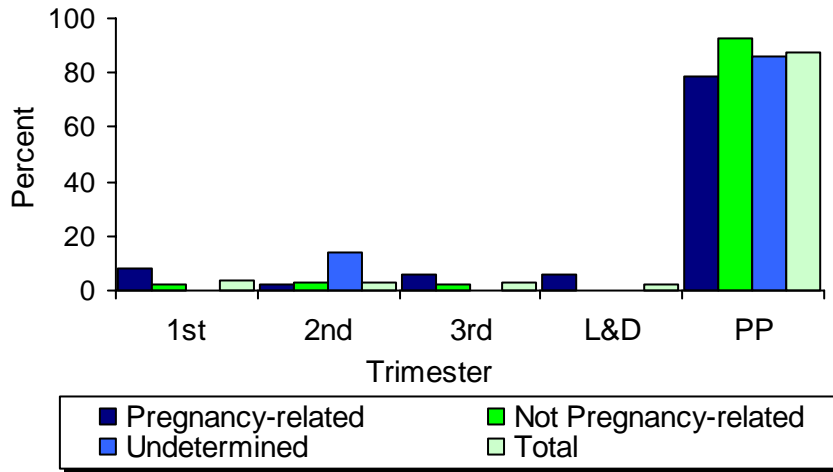
<sup>3</sup> Records with unknown anesthesia not included in count.

<sup>4</sup> Information collected through the Electronic Birth Certificate allows for more than one response to the question regarding type of anesthesia during delivery, therefore totals of all categories of anesthesia is greater than the number of live births used for analysis.

**Stage of Pregnancy at Death:**

- ◆ 87.5% (n=133) of pregnancy-associated deaths occurred in the postpartum period (Figure 11).
- ◆ All deaths that occurred during labor and delivery were pregnancy-related deaths (100.0%; n=3).

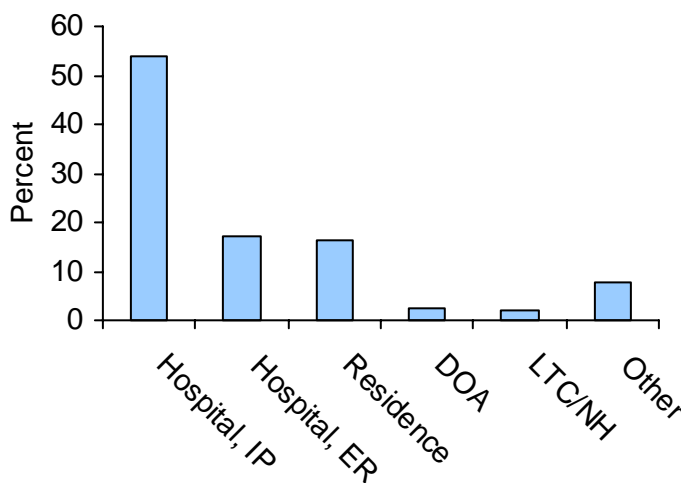
**Figure 11: Distribution of Pregnancy-associated Deaths by Stage of Pregnancy at Time of Death, 1999-2001**  
n=152



**Place of Death:**

- ◆ Almost three-quarters (71.1%; n=108) of pregnancy-associated deaths occurred in a hospital, either as an inpatient or in the emergency department (Figure 12).
- ◆ A pregnancy-related death was more likely to occur in a hospital than a not pregnancy-related death (86.3%; n=44 v. 63.8%; n=60).

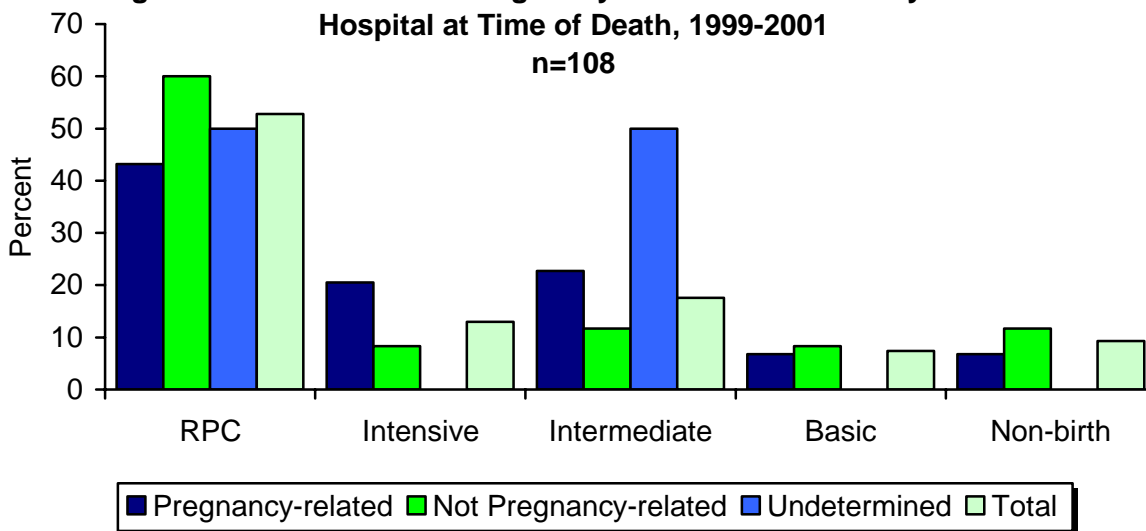
**Figure 12: Distribution of Pregnancy-associated Deaths by Place of Death**  
n=152



**Level of Hospital at Death:**

- ◆ For pregnancy-associated deaths that occurred in a hospital, (52.8%; n=57) occurred at a Regional Perinatal Center (Figure 13).
- ◆ A not pregnancy-related death was more likely to occur at a Regional Perinatal Center than a pregnancy-related death (60.0%; n=36 v. 43.2%; n=19).
- ◆ A pregnancy-related death was more likely to occur at an intermediate or intensive level hospital than a not pregnancy-related death (43.2%; n=19 v. 20.0%; n=12).

**Figure 13: Distribution of Pregnancy-associated Deaths by Level of Hospital at Time of Death, 1999-2001**  
n=108



**Completion of Autopsy:**

- ◆ An autopsy was performed in 59.2% of the pregnancy-associated deaths (Table 15).
- ◆ Over three-quarters of autopsies were done by the medical examiner (78.9%; n=71); the remainder were done by a hospital or private pathologist (21.1%; n=19).

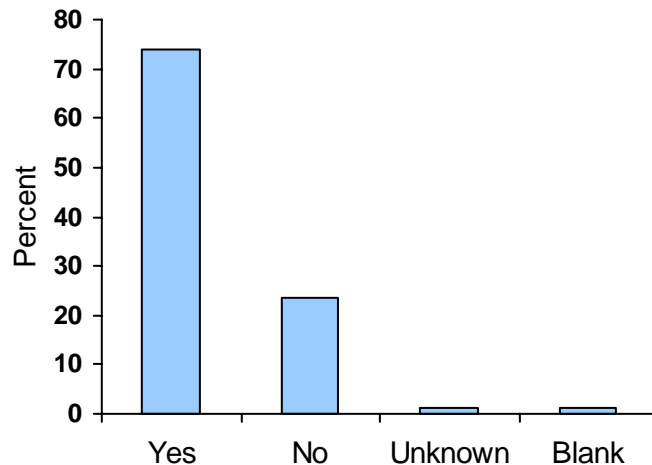
**Table 15: Distribution of Pregnancy-associated Deaths by Completion of Autopsy, 1999-2001**

	Pregnancy-related n=51		Not Pregnancy-related n=94		Undetermined n=7		Total n=152	
	%	(n)	%	(n)	%	(n)	%	(n)
Autopsy	64.7	(33)	54.3	(51)	85.7	(6)	59.2	(90)
No Autopsy	35.3	(18)	45.7	(43)	14.3	(1)	40.8	(62)

**Utilization of the Pregnancy Check Box on the Death Certificate:**

The New Jersey Certificate of Death captured information on a decedent’s pregnancy status by having the certifier indicate by a “Yes” or “No” response if the women was pregnant “...at death, or any time 90 days prior to death” (Item 27). In half (n=77) of the pregnancy-associated deaths, the woman was pregnant in the 90 day period prior to her death. However, the pregnancy check box on the death certificate was checked “No” for 23.4% (n=18) of the pregnancy-associated deaths, one death certificate had “Unknown” noted, and for one case this question was left blank. The inaccuracy of utilization of the pregnancy check box for these pregnancy-associated deaths reinforces the belief that maternal deaths are underreported (Figure 14).

**Figure 14: Utilization of Pregnancy Check Box for Pregnancy-associated Deaths Occurring within 90 days of Index Pregnancy, 1999-2001  
n=77**



## Medical, Psychological and Social Issues

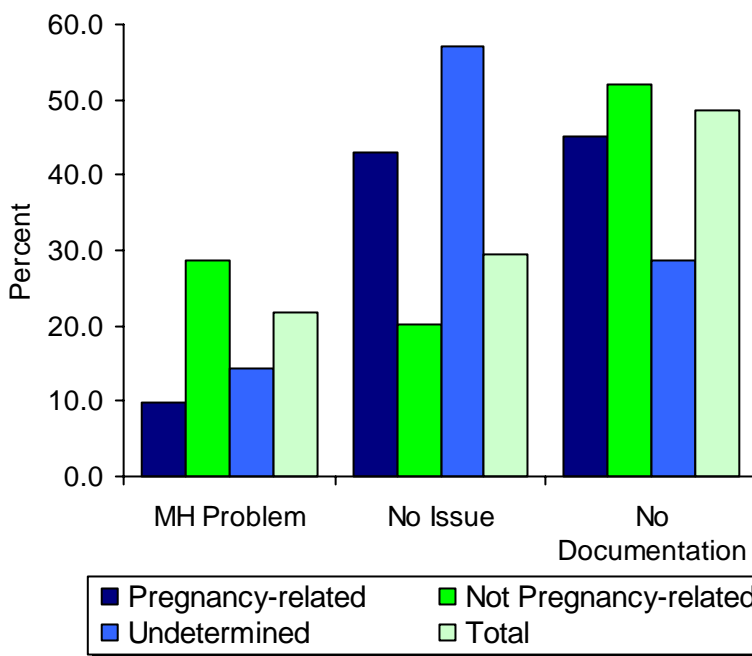
Following a thorough discussion of a pregnancy-associated death, the Case Review Team identifies medical, psychological and social issues present in a case, as well as service delivery issues. Issues are identified which may influence the system of care for mothers, infants, children and families, and which may or may not have directly contributed to the maternal death.

### Mental Health:

Mental health information, either prior to pregnancy, or in the prenatal or postpartum period, was available for approximately half (48.7%; n=74) of pregnancy-associated deaths (Figure 15).

- ◆ 21.7% (n=33) of women who died from a pregnancy-associated death had a documented mental health problem.
- ◆ Women who died from a not pregnancy-related cause were more likely to have a mental health problem than women who died from a pregnancy-related cause (28.7%; n=27 v. 9.8%; n=5).
- ◆ 36.4% (n=12) of women who experienced a mental health problem during pregnancy or the postpartum period had no documented prior history of mental health problems.

**Figure 15: Distribution of Pregnancy-associated Deaths by Presence of a Mental Health Problem, 1999-2001**



### Medical History:

- ◆ Of the pregnancy-associated deaths, 61.2% had at least one medical condition prior to the index pregnancy (Table 16).
- ◆ The average number of pre-existing medical conditions was 1.6; range of 1 to 8.
- ◆ Women who died from a pregnancy-related death were less likely to have a medical condition than women who died from a not pregnancy-related or undetermined death. Fifty-one percent (n=26) of pregnancy-related deaths, 63.8% (n=60) of the not pregnancy-related deaths, and all undetermined deaths had a medical condition pre-dating the index pregnancy.
- ◆ No prior medical history was found in 43.1% (n=22) of women who died from a pregnancy-related death.

**Table 16: Distribution of Medical Conditions Prior to the Index Pregnancy, 1999-2001 <sup>1</sup>**

	Pregnancy-related n=51		Not pregnancy-related n=94		Undetermined n=7		Total n=152	
	%	(n)	%	(n)	%	(n)	%	(n)
Asthma	11.8	(6)	18.1	(17)	42.9	(3)	17.1	(26)
Mental Health Disorder	5.9	(3)	20.2	(19)	14.3	(1)	15.1	(23)
Chronic Hypertension	7.8	(4)	10.6	(10)	14.3	(1)	9.9	(15)
Seizure Disorder	7.8	(4)	5.3	(5)	14.3	(1)	6.6	(10)
AIDS/HIV	0.0	(0)	8.5	(8)	0.0	(0)	5.3	(8)
Cancer	3.9	(2)	6.4	(6)	0.0	(0)	5.3	(8)
Heart Disease	2.0	(1)	4.3	(4)	28.6	(2)	4.6	(7)
Anemia	2.0	(1)	5.3	(5)	0.0	(0)	3.9	(6)
Diabetes Mellitus	2.0	(1)	5.3	(5)	0.0	(0)	3.9	(6)
Vaginal Infection/STD	5.9	(3)	3.2	(3)	0.0	(0)	3.9	(6)
Hepatitis	0.0	(0)	5.3	(5)	14.3	(1)	3.9	(6)
Thyroid Disorder	2.0	(1)	5.3	(5)	0.0	(0)	3.9	(6)
Lupus	2.0	(1)	4.3	(4)	0.0	(0)	3.3	(5)
Urinary Disorder	5.9	(3)	2.1	(2)	0.0	(0)	3.3	(5)
Migraine Headaches	7.8	(4)	1.1	(1)	0.0	(0)	3.3	(5)
Musculoskeletal Disorder	2.0	(1)	3.2	(3)	14.3	(1)	3.3	(5)
Gastrointestinal Disorder	2.0	(1)	2.1	(2)	14.3	(1)	2.6	(4)
Cholecystitis	3.9	(2)	2.1	(2)	0.0	(0)	2.6	(4)
Hematologic Disorder	2.0	(1)	3.2	(3)	0.0	(0)	2.6	(4)
Recurrent UTI	2.0	(1)	3.2	(3)	0.0	(0)	2.6	(4)
Pancreatitis	0.0	(0)	3.2	(3)	0.0	(0)	2.0	(3)
Gynecologic Disorder	3.9	(2)	1.1	(1)	0.0	(0)	2.0	(3)
Neurologic Disorder	2.0	(1)	2.1	(2)	0.0	(0)	2.0	(3)
Sickle Cell Disease	2.0	(1)	2.1	(2)	0.0	(0)	2.0	(3)
Thrombophlebitis	3.9	(2)	1.1	(1)	0.0	(0)	2.0	(3)
Respiratory Disorder	3.9	(2)	0.0	(0)	0.0	(0)	1.3	(2)
CVA	2.0	(1)	1.1	(1)	0.0	(0)	1.3	(2)
Peripheral Vascular Disorder	2.0	(1)	0.0	(0)	0.0	(0)	0.7	(1)
No Prior Medical History	43.1	(22)	25.5	(24)	0.0	(0)	30.3	(46)
Unknown	5.9	(3)	10.6	(10)	0.0	(0)	8.6	(13)

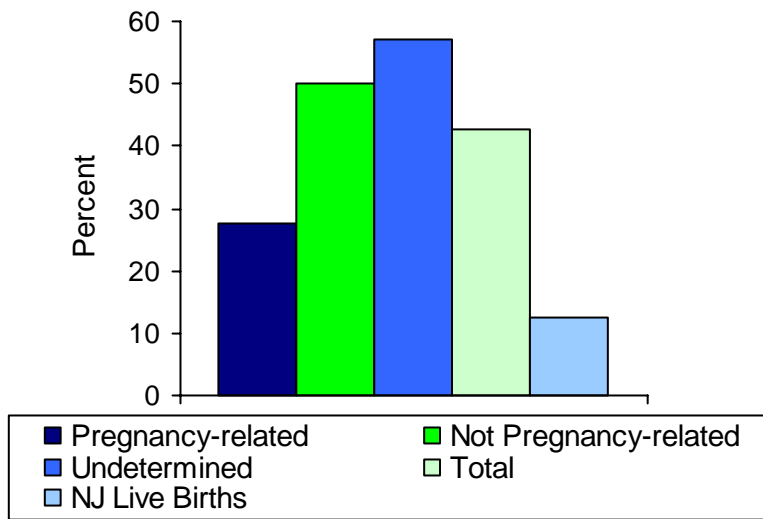
<sup>1</sup> A pregnancy-associated death may have more than one prior medical condition.

**Substance Use/Abuse:**

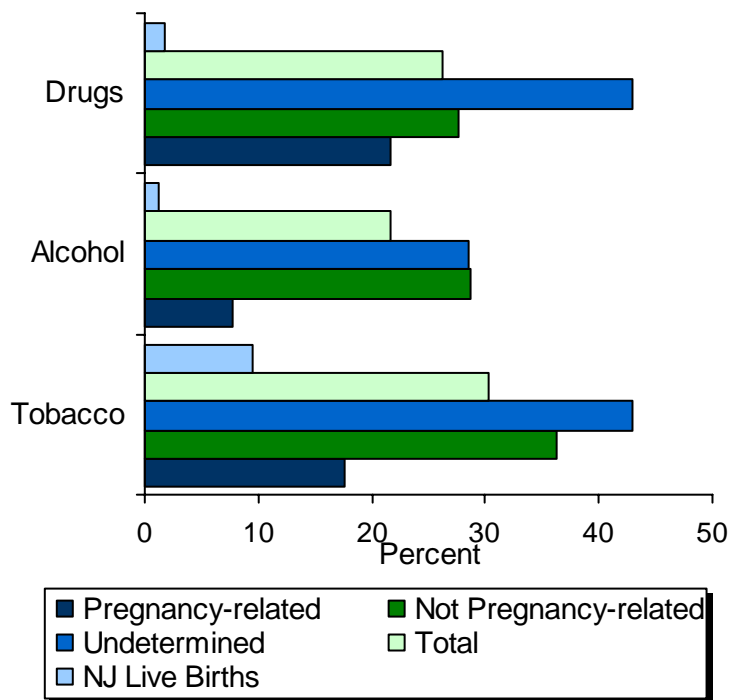
Information on use of tobacco, alcohol, or illicit drugs was available for 90% of pregnancy-associated deaths (Figures 15 and 16).

- ◆ Of women who died from a pregnancy-associated death, 42.8% (n=65) had a history of substance use/abuse, of which 60.0% (n=39) were multiple substance use/abuse.
- ◆ Women who died from a pregnancy-related death were less likely to have a history of substance use/abuse (27.5%; n=14) than women who died from a not pregnancy-related (50.0%; n=47) or undetermined (57.1%; n=4) death.
- ◆ Compared to New Jersey live birth population, women who died from a pregnancy-associated death were 4.1 times more likely to have a history of substance use/abuse (42.8% v. 10.4%).
- ◆ Women who died from a not pregnancy-related or undetermined death were more likely to use/abuse alcohol and tobacco than women who died from a pregnancy-related death.
- ◆ Illicit drug use/abuse was approximately the same for women who died a pregnancy-related or not pregnancy-related death; women who died an undetermined death used illicit drugs at a slightly higher rate.

**Figure 15: Distribution of Pregnancy-associated Deaths by Substance Use/Abuse, 1999-2001**



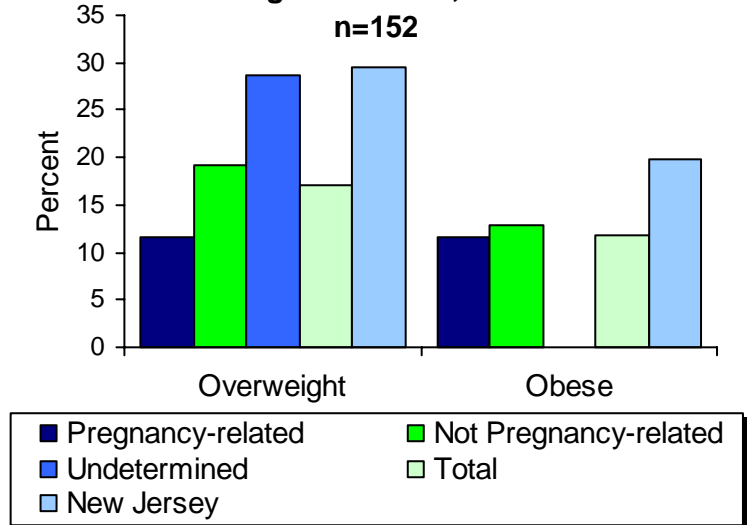
**Figure 16: Distribution of Pregnancy-associated Deaths by Type of Substance Use/Abuse, 1999-2001**



**Nutrition:**

- ◆ There was documentation on nutritional status for only 79 (52.0%) of the 152 pregnancy-associated deaths (Figure 17).
- ◆ Pregravid weight and height information was not available for 61 (40.1%) of the 152 pregnancy-associated deaths.
- ◆ A documented referral for nutritional assessment during the prenatal period was present for only 7 of 26 pregnancy-associated deaths for which the Case Review Team identified a nutritional problem (other than obesity) that warranted a nutrition referral.
- ◆ Forty-four (28.9%) of pregnancy-associated deaths were to women who were overweight (BMI 25.0-19.9) or obese (BMI >=30).
- ◆ Compared to female adults in New Jersey for 2001, a smaller percent of pregnancy-associated deaths were overweight or obese. In 2001, 29.5% of adult females in New Jersey were overweight and 19.9% obese (Behavioral Risk Factor Surveillance System, (BRFSS)).

**Figure 17: Distribution of Pregnancy-associated Deaths That Were Overweight or Obese, 1999-2001**



**Social Issues:**

In general, detailed social status information was not available to the Case Review Team. Prenatal care records transmitted to the hospital and filed in the medical record contained little to no documentation regarding social factors. Documentation of social factors was also frequently missing from inpatient and emergency department medical records. Social work consult notes, when documented as done, were often not filed with the medical record.

- ◆ Documentation of family planning issues, such as method of contraception and education provided was present in only 7.9% (n=12) of the cases reviewed.
- ◆ Twelve (7.9%) of pregnancy-associated deaths were to women with a documented communication barrier (the woman did not speak English; the majority were women whose primary language was Spanish). Of the twelve cases with a documented communication problem, one-third (33.3%; n=4) were women who died from a pregnancy-related death.
- ◆ Twenty-seven (17.8%) of women who died a pregnancy-associated death had no documented support system.



- ◆ Domestic violence was noted in 5.3% (n=8) of pregnancy-associated deaths; there was no documentation of domestic violence screening in 82.2% (n=125) of the 152 pregnancy-associated deaths reviewed.
- ◆ Six (3.9%) of the women who died a pregnancy-associated death were homeless or living in public shelter; 2.6% (n=4) were incarcerated.
- ◆ Transportation was not an issue for 34.2% (n=52) of the pregnancy-associated deaths; information on 65.1% (n=99) was not available.
- ◆ Information on environmental or occupational hazards was not available in 94.1% (n=143) of pregnancy-associated deaths.
- ◆ Twenty-two (14.3%) of women who died a pregnancy-associated death were non-compliant with antenatal or diagnostic testing or taking prescriptions as ordered.

**Provision or Design of Services:**

- ◆ A lack of care coordination was evident in 15.8% (n=24) of the pregnancy-associated deaths.
- ◆ There was a delay in or failure to accurately diagnose and/or implement appropriate treatment in 11.8% (n=18) of the pregnancy-associated deaths.
- ◆ Ten (6.6%) of pregnancy-associated deaths either had no social work follow-up when needed, or a social work consult was ordered but never done.
- ◆ In 5.3% (n=8) of the pregnancy-associated deaths, a home visit was warranted, but no referral was made.
- ◆ In 3.9% (n=6) of pregnancy-associated deaths, no bereavement support services were provided for family and/or remaining children.
- ◆ In three (2.0%) of the pregnancy-associated deaths, referral to a maternal fetal medicine specialist was warranted, but not made.

### **SECTION III: RECOMMENDATIONS**

The ultimate outcome of a pregnancy-associated maternal mortality review is to improve care for women, infants, children and families, and prevent maternal deaths, by promoting improvements to the system of care. After completing a comprehensive review of individual cases, the New Jersey Maternal Mortality Review Case Review Team reviews their findings and makes recommendations for systems improvements.

Recommendations are classified using the Spectrum of Prevention, a framework of strategies to address public health problems from a comprehensive perspective (Contra Costa Health Services, 2005). The Spectrum of Prevention model includes seven strategies:

- Influencing policy and legislation
- Mobilizing neighborhoods and communities
- Changing organizational practices
- Fostering coalitions and networks
- Education Providers
- Promoting community education
- Strengthening individual knowledge and skills.

The recommendations that follow are strategies that the Case Review Team has identified as approaches to the problems identified during the review of maternal deaths for the period 1999 to 2001. These recommendations are not prioritized; the New Jersey Maternal Mortality Case Review Team believes that each provider and/or agency should act on these recommendations within the parameters of their organization. Most important to remember, a multidisciplinary approach was used in making these recommendations and it will take a multidisciplinary approach to implement these recommendations.

## **Issue: Mental Health Services for Pregnant Women**

There were several concerns raised about mental health issues, specifically concerning women with diagnosed mental health disorders and the management of these problems during pregnancy and postpartum. These women have several specific needs requiring close attention, which were not clearly met in the cases reviewed.

### ***Changing organizational practices:***

- ◆ Women with mental health issues with concomitant substance use and/or medical complications should receive case management services.

### ***Educating providers:***

- ◆ Women maintained on psychotropic medications, which are discontinued during pregnancy, should have another support mechanism instituted, such as psychotherapy or an alternative medication.
- ◆ All pregnant and/or postpartum women should be screened for postpartum depression.
- ◆ Women with a history of mental illness are at greater risk for postpartum depression and other mental health issues and should be closely monitored during the pregnancy and postpartum periods, even if they have been asymptomatic immediately prior to the pregnancy.
- ◆ Providers of care to pregnant women should receive education on the management of women with diagnosed mental health disorders and the management of these women during pregnancy and postpartum.

### ***Promoting community education:***

- ◆ The community in general, and agencies and organizations providing care to women, should receive education and information on postpartum depression.

### ***Strengthening individual knowledge and skills:***

- ◆ All women of child bearing age should be given information about postpartum depression, which should be reinforced at each encounter.
- ◆ Family members should be provided with information on postpartum depression and depression in general, such as symptoms to look for, how to identify suicidal tendencies, and who to contact if help is needed.

## **Issue: Follow-up for High Risk Pregnant Women**

Several of the pregnancy-associated deaths involved women with complex mental health/medical issues, issues with insurance coverage, issues with substance use/abuse and social concerns. There were several cases where the woman stopped taking her medication, or did not follow-up with her diabetic regime because of a lack of resources. Often, the pregnant woman was seen multiple times in an Emergency Department prior to her death.

### ***Changing organization practices:***

- ◆ Pregnant women seen in the Emergency Department, especially when a high risk situation is present (substance use/abuse; chronic medical condition; mental health issue) should be referred to social work/case management for follow-up and outreach.
- ◆ High risk pregnant women with complex medical and/or psychosocial issues should have case coordination and/or referral to public health nursing or home care services.

### ***Fostering coalitions and networks:***

- ◆ Tertiary care agencies should improve interagency linkages with local health departments and maternal and child health consortia as resources for follow-up and outreach for high risk pregnancy women.

## **Issue: Breast Examination during Pregnancy**

Several of the pregnancy-associated deaths were due to breast cancer. In most cases, there was no documentation that any form of breast examination was done during the prenatal period, nor was there documentation that mammography was done. In one case, the woman had a history of breast cancer. Although it is recognized that physical changes during the prenatal and postpartum period make breast examination more difficult, the Case Review Team believes not performing a clinical breast examination, and encouraging the woman to continue self breast examination, throughout the prenatal and postpartum period is a missed opportunity. This is especially important given the incidence of cancer in women of child bearing age seen by the Case Review Team during review of pregnancy-associated deaths.

### ***Educating providers:***

- ◆ Providers of care to women of child bearing age should receive education on the importance of continuing breast examination throughout the prenatal and postpartum period.

### ***Promoting community education:***

- ◆ Consumer education programs should emphasize the importance of the need for self-breast examination and clinical breast examinations during pregnancy and postpartum.

### ***Strengthening individual knowledge and skills:***

- ◆ All women need to continue self-breast exams and have a regular breast exam by their provider during pregnancy and the postpartum period.

## **Issue: Co-management of Pregnant Woman with an Acute or Chronic Condition**

In several cases, the woman developed symptoms that were indicative of a medical problem, but was not referred to a specialist. In other cases the woman had symptoms that appeared to be indicative of a medical problem, however were actually related to pregnancy. Additionally, in many cases the woman had one or more chronic conditions, which predated the pregnancy.

### ***Changing organization practices:***

- ◆ When a pregnant woman presents to the Emergency Department with symptoms that appear unrelated to the pregnancy, a consult with the obstetrics on-call physician or resident should be considered to rule out any possibility that symptoms are pregnancy-related.
- ◆ Women who present to the obstetrician with symptoms indicating an acute medical condition, or with symptoms that would be considered abnormal regardless of pregnancy status, should be referred to the appropriate specialist for diagnosis and treatment recommendations.
- ◆ If a woman, regardless of her pregnancy status, gives a history of having a chronic illness, the obstetrics/gynecology provider should collaborate with the appropriate medial specialist so the patient receives appropriate follow-up by her primary physician or a consultant.

### ***Educating providers:***

- ◆ Internal medicine providers should receive education on the recognition, management and referral of women presenting with obstetric problems and/or complications.

### **Issue: Asthma in the Pregnant Woman**

Asthma was the most frequently reported chronic condition in the medical history of the pregnancy-associated deaths. In most cases, women do not develop asthma during the pregnancy, but present with a long-standing history of asthma. Pulmonary symptoms which initially present during pregnancy are more likely to be related to a serious pregnancy-related illness. The obstetrician may be inclined to refer the pregnant woman with new onset asthma-like symptoms to a primary care provider for diagnosis and treatment. However, this course of action may result in a missed pregnancy-related diagnosis.

#### ***Changing organization practices:***

- ◆ If a woman, with no prior history of asthma, presents to the obstetrician with new-onset pulmonary symptoms, a referral should be made to a maternal fetal medicine specialist and/or pulmonologist for initial diagnosis and treatment.
- ◆ The National Institutes of Health Clinical Practice Guidelines, “Guidelines for the Diagnosis and Management of Asthma” should be utilized when managing a pregnant woman with asthma.

### **Issue: Evaluation of Abdominal Pain in Women of Childbearing Age**

In a number of cases, the woman presented to the Emergency Department with a complaint of abdominal pain, was evaluated and discharged home. Frequently, a pregnancy screening test, such as human chorionic gonadotropin (hCG) was not done as part of the workup and evaluation. In some of these cases, the women later died as a result of rupture of an ectopic pregnancy.

#### ***Changing organization practices:***

- ◆ Any woman of child bearing age with severe abdominal pain should be treated as an ectopic pregnancy until this diagnosis is ruled out.
- ◆ Any woman who presents to the Emergency Department with a complaint of abdominal pain and/or vaginal bleeding should be screened for pregnancy.

### **Issue: Screening and Follow-up of HIV Status in the Pregnant Woman**

In several cases, the woman refused HIV testing, or information on HIV status was not documented. The woman was subsequently found to have a diagnosis of AIDS that in most cases was present prior to the index pregnancy. Additionally, once the diagnosis was known, there was no follow-up for the infant.

#### ***Changing organization practices:***

- ◆ Documentation that HIV testing was offered and education provided, including recommendations for appropriate medication, and the reason the patient refused same, should be included in the prenatal and labor and delivery records.
- ◆ Documentation of HIV status should be included in the medical and prenatal care records of all women of child-bearing age.
- ◆ Refusal of HIV testing by a pregnant woman should initiate further investigation, such as review of old medical or prenatal care records, to determine HIV status.
- ◆ In any case where the woman presents for labor and delivery, and HIV status is unknown or the mother did not receive prenatal care, rapid HIV testing should be done with consent. The “Standard of Care for Women who Present in Labor with Unknown HIV Serostatus” as developed by the New Jersey Department of Health and Senior Services should be used to guide evaluation and management of these women.
- ◆ Any infant born to a woman with HIV should receive follow-up for evaluation of HIV status and appropriate treatment.

### **Issue: Management of the Incarcerated Pregnant Woman**

Several of the women who died a pregnancy-associated death were incarcerated in a correctional facility at some point during their pregnancy. There was no information available regarding if prenatal care or treatment for substance abuse services were received or during the period of incarceration.

#### ***Changing organization practices:***

- ◆ A process for coordination of care for incarcerated pregnant women between the obstetrician and the correctional facility system should be established.
- ◆ All pregnant women incarcerated for an extended period of time should be referred for and receive prenatal care.
- ◆ All incarcerated pregnant women with complex medical problems should be referred for care coordination and follow-up by the appropriate medical specialist.

#### ***Strengthening individual knowledge and skills:***

- ◆ Any woman who received prenatal care while incarcerated should be provided with a record of her prenatal care, i.e. prenatal care card, to ensure appropriate prenatal care referral following release.



### **Issue: Need for Medically Trained Interpreters**

In several cases where the woman's primary language was not English, medical and prior pregnancy history was missing or inadequate. The Case Review Team identified a language barrier, and the lack of an appropriate interpreter as a major impediment in obtaining a thorough medical, prior pregnancy and prenatal history.

#### ***Changing organization practices:***

- ◆ Medically trained interpreters or interpreter telephones should be available to, and used by, health care providers when caring for a non-English speaking woman who is pregnant and presents for prenatal care or labor and delivery, or to the Emergency/Outpatient Department or as an inpatient.

#### ***Promoting community education:***

- ◆ Consumer education regarding pregnancy and issues relevant to the pregnant woman for women whose primary language is not English should stress the importance of having a family member or friend who can interpret for them accompany them to all provider visits, or the need to request an appropriate interpreter at all provider encounters.

### **Issue: Automobile Restraint Use during Pregnancy**

Several of the pregnancy-associated deaths occurred while the pregnant woman was the driver or a passenger of an automobile. In several cases, it was unknown if the woman was wearing a seatbelt. In cases where seatbelt usage was known, either the woman was not wearing a seatbelt or was using the seatbelt incorrectly.

#### ***Strengthening individual knowledge and skills:***

- ◆ All pregnant women should receive education on the need to use seatbelts during pregnancy and safe seatbelt use.

### **Issue: Availability of Prenatal Care Record**

There were many cases in which a prenatal care record was not included as part of the permanent medical record. It was presumed by the Case Review Team that in most of these cases, the prenatal record was not available to the provider at the time of delivery. When the prenatal care record was available, the last weeks of the pregnancy were excluded as the record is sent to the hospital at 34-36 weeks (on average). If the pregnancy-associated death occurred at less than 34 weeks, the prenatal care record is not required to be available per N.J.A.C. 8:43G-19.2(d).

#### ***Changing organization practices:***

- ◆ The prenatal care record should be available to the health care provider whenever a pregnant woman, regardless of gestational age, presents to the Emergency Department or is admitted to the hospital through labor and delivery or as an inpatient.
- ◆ Following submission to the obstetric unit, in accordance with N.J.A.C. 8:43G-19.2(d), the prenatal record should be updated weekly, or at the least, updates should be faxed to the obstetric unit at the time of admission.

#### ***Strengthening individual knowledge and skills:***

- ◆ All pregnant women should be provided with a copy of their prenatal care history, i.e. prenatal history card, and educated regarding the need to carry the card with them at all times and present to the provider at each encounter.

### **Issue: Accurate Completion of Death Certificate**

The Case Review Team identified two major issues related to information provided by the individual certifying the pregnancy-associated death. In several of the cases, the cause of death sequence was reported inaccurately, or the immediate cause of death was not specific enough, i.e. cardiac arrest. The second major issue was incorrect completion of the pregnancy check box that indicates whether the woman was pregnant within ninety days of her death.

#### ***Educating providers:***

- ◆ Training on accurate completion of the death certificate should be provided to physicians, residents and other health care providers responsible for completing cause of death and pregnancy checkbox information on the death certificate. This should include the importance of the death certificate as the source for State and national mortality data.

## **Issue: Inaccurate, Incomplete or Absent Autopsy**

The Case Review Team identified several issues regarding the completion of an autopsy and death scene investigation in a pregnancy-associated death. Autopsies were not done, were of insufficient detail, or lacked specific testing. Although it was rarely documented if an autopsy was requested or advised by the health care provider, and the outcome of this request, in a few cases, it was documented that the reason an autopsy was not done was family refusal. In some cases, an autopsy was not done despite the fact that the death was of a suspicious nature. The Report of the Investigation of the Medical Examiner often did not include prenatal and/or postpartum information. These factors impacted on the ability of the medical examiner to make an informed decision as to cause of death, as well as to the relationship of the cause of death to the pregnancy.

### ***Changing organization practices:***

- ◆ All hospitals should adopt a policy that the family of any patient with a pregnancy-associated death is offered and advised of the need for an autopsy.
- ◆ Any pregnancy-associated death of a suspicious nature should have an autopsy.
- ◆ Guidelines should be developed for death scene investigation of a maternal death.
- ◆ A care pathway should be developed for managing a pregnancy-associated death.

### ***Educating providers:***

- ◆ Provide education and training to obstetricians regarding the importance of obtaining an autopsy in a pregnancy-associated death, and how to guide the family decision-making process and obtain permission for an autopsy.

## **Issue: Substance Use/Abuse Treatment in Pregnant Women**

Illicit substance use/abuse was found to be higher in the pregnancy-associated deaths reviewed than in the general New Jersey live birth population. The Case Review Team identified several cases in which either the woman was not referred for substance use/abuse treatment, or was in an inappropriate level of care, i.e. outpatient versus inpatient. In the area of tobacco use, rarely was there any documented intervention, such as referral to a smoking cessation program, in the medical record.

### ***Influencing policy and legislation:***

- ◆ The ongoing issue of inadequate treatment slots for women needing substance abuse treatment needs to be addressed as a priority issue.
- ◆ Substance abuse treatment programs should be primarily outpatient programs.
- ◆ The pregnant woman should be accepted to a substance abuse treatment program regardless of the presence of a complex medical history.

### ***Changing organization practices:***

- ◆ Child care services should be available to women attending an outpatient substance use/abuse treatment program.

### ***Strengthening individual knowledge and skills:***

- ◆ All women of child-bearing age should receive educational materials on maternal and fetal risks of substance use/abuse.

## **Issue: Domestic Violence**

Little information was available to the Case Review Team regarding the impact of domestic violence on pregnancy-associated mortality. The majority of cases reviewed had no documentation that domestic violence was or was not present in the case.

### ***Changing organization practices:***

- ◆ All pregnant women should be screened for domestic violence at least once each trimester using an evidenced-based screening tool.

### ***Educating providers:***

- ◆ Education should be provided to providers and other professionals regarding screening and referral for victims of domestic violence.

### ***Strengthening individual knowledge and skills:***

- ◆ All pregnant women should receive education before, during and after pregnancy regarding domestic violence.

## **Issue: Racial Disparity**

Despite improvement in the maternal mortality death rate, a racial disparity still exists. Through its *Black Infants Better Survival* initiative, New Jersey has identified Black infant mortality as a major public health issue and implemented programs to address the problem. This initiative serves as a model to address the maternal mortality racial disparity.

### ***Influencing policy and legislation:***

- ◆ Funding should be provided, through State and Federal grant funds, to support research into the cause and prevention of maternal mortality with a focus on decreasing the racial disparity.

### ***Fostering coalitions and networks:***

- ◆ The *Black Infants Better Survival* initiative should be expanded to include interventions that address the prevention of maternal deaths to Black women.

## References

1. Centers for Disease Control and Prevention. Maternal Mortality – United States, 1982-1996. *MMWR* 1998; 47(34): 705-7.
2. Hoyert DL, Danel I, Tully P. Maternal Mortality, United States and Canada, 1982-1997. *Birth* 27:1 March 2000:4-11.
3. Centers for Disease Control and Prevention. Pregnancy-Related Deaths Among Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native Women – United States, 1991-1997. *MMRW* 2001;50(18):361-364.
4. Centers for Disease Control and Prevention. State-Specific Maternal Mortality Among Black and White Women – United States, 1987-1996. *MMRW* June 18, 1999; 48(23), 492-496.
5. World Health Organization. Maternal Mortality in 2000: Estimates developed by WHO, UNICEF, UNFPA. 2004, 22-26.
6. Dye, TD, Gordon, H, Held, B., Tolliver, NJ, Holmes AP. (1993). Retrospective maternal mortality case ascertainment in West Virginia, 1985 to 1989. *American Journal of Obstetrics and Gynecology*, 168(5), 1640-1641.
7. Horon, IL & Cheng, D. (2001). Enhanced surveillance for pregnancy-associated mortality – Maryland, 1993-1998. *Journal of the American Medical Association*. 285(11), 1455-1459.
8. Centers for Disease Control and Prevention. Perspectives in Disease Prevention and Health Promotion Maternal Mortality: Pilot Surveillance in Seven States. *MMRW*, November 29, 1985; 34(47), 709-711.
9. Centers for Disease Control and Prevention. Pregnancy-Related Mortality – Georgia, 1990-1992. *MMRW*, February 10, 1995, 44(05), 93-96.
10. Ziskin, L., Gregory, M., & Kreitzer, M. (1979). Improved Surveillance of Maternal Deaths. *International Journal of Gynecology and Obstetrics*. 16, 281-286.
11. Centers for Disease Control and Prevention. Pregnancy-Related Mortality Surveillance – United States, 1991-1999. *MMWR*, February 21, 2003, 52(SS02), 1-8.
12. Contra Costa Health Services. Available at:  
<http://www.cchealth.org/topics/prevention/spectrum.php>.