

Florida's Pregnancy-Associated Mortality Review 2011 Update



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Summary

Reduction of maternal death is a national and state priority. Florida's Pregnancy-Associated Mortality Review (PAMR) is an ongoing system of surveillance that collects and analyzes information related to maternal deaths in order to promote system improvements through evidence-based actions aimed at preventing future untimely deaths.

In 2012, the PAMR case selection process identified 146 pregnancy-associated deaths occurring to residents of Florida from January 1, 2011 to December 31, 2011.

The PAMR case selection committee identified that 51 of these pregnancy-associated deaths that occurred in 2011 were most likely to be pregnancy-related. Upon full team review of the 51 death cases, the PAMR committee found 38 (74.5%) of these deaths to actually be pregnancy-related.

The pregnancy-related mortality ratio (PRMR) in Florida in 2011 was 17.8 per 100,000 live births. Although the 2011 PRMR ratio is lower than the 2010 ratio of 20.5 per 100,000 live births, the trend for the period 1999-2011 was not statistically significant.

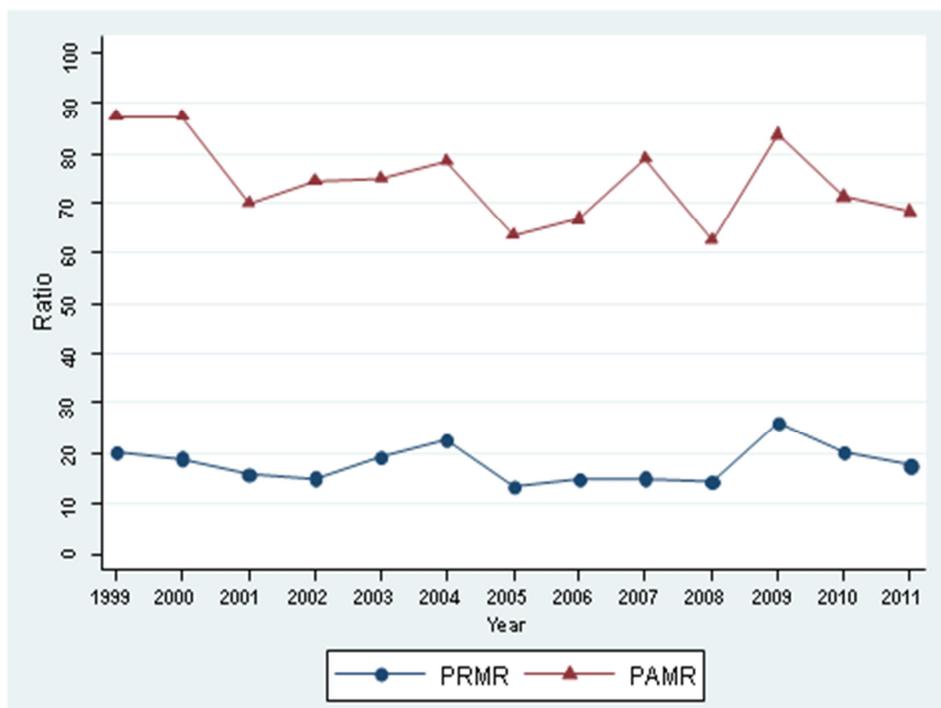
Notable for 2011:

- The leading pregnancy-related causes of death in 2011 were hemorrhage (18.4%) and hypertensive disorders (15.8).
- In 2011, 68.4% of the pregnancy-related deaths occurred during the postpartum period, of which 42.1% of all deaths occurred postpartum prior to discharge and 26.3% occurred after hospital discharge.
- Sixty-three (63) percent of the pregnancy-related deaths occurred after a live birth delivery, 15.8% died while still pregnant (prior to a delivery), 10.5% died after an emergency delivery, 7.9% after an ectopic pregnancy, and 2.6% occurred after a stillbirth.
- Of women who died during or after delivery, 78% had cesarean as a delivery method. Of these women, 33% were planned cesarean deliveries and 67% were unplanned cesarean deliveries.
- In 2011, more than half (65%) of women whose deaths were pregnancy-related had overweight or obese body mass index classifications.

Pregnancy-Related Mortality Findings — Florida, 2011

Florida’s pregnancy-associated mortality ratios and pregnancy-related mortality ratios are shown in Figure 1. Pregnancy-related deaths are a subset of pregnancy-associated deaths (For PAMR process see Appendix 1). Although there was a decrease in the pregnancy-associated and pregnancy-related mortality ratios in 2011 compared with 2010, the declining trend for the period 1999-2011 was not statistically significant.

Figure 1. Pregnancy-Associated Mortality Ratios and Pregnancy-Related Mortality Ratios — Florida 1999-2011



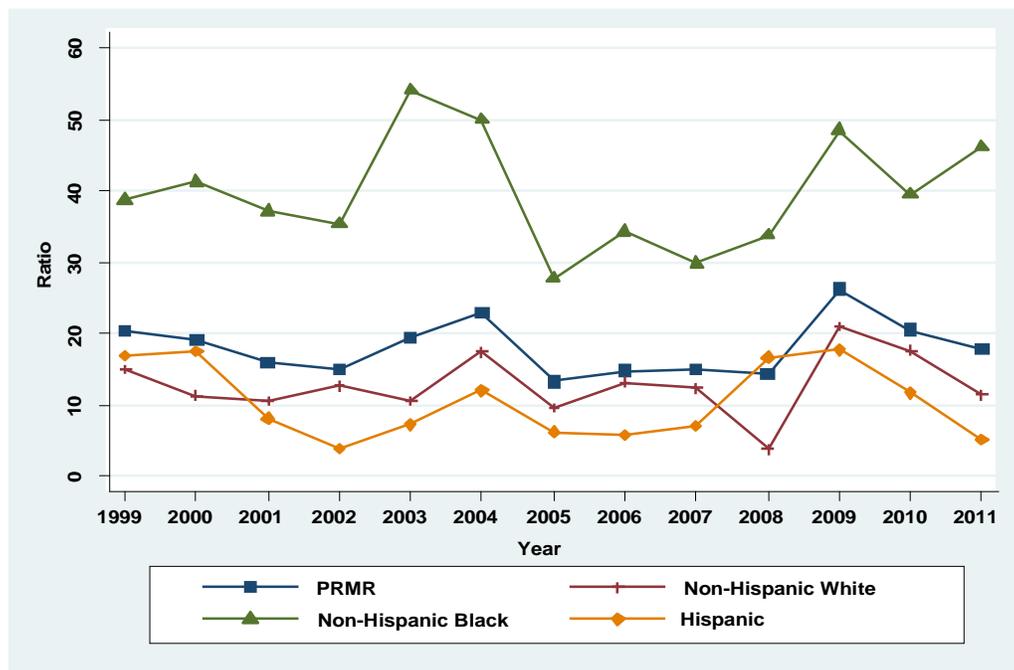
Year	# PAD*	#PRD**	Year	# PAD*	#PRD**
1999	160	40	2006	159	38
2000	178	39	2007	189	33
2001	144	33	2008	145	33
2002	153	31	2009	185	58
2003	159	41	2010	153	44
2004	171	50	2011	146	38
2005	144	30			

*PAD: Pregnancy Associated Deaths. **PRD Pregnancy-Related Deaths

Between 1999 and 2011, the PRMR fluctuated from 20.3 deaths per 100,000 live births in 1999 to a low of 13.3 deaths per 100,000 live births in 2005, increased to a high of 26.2 in 2009, and declined to 17.8 deaths per 100,000 live births in 2011 (Figure 2).

Racial and ethnic disparities continue to exist with pregnancy-related mortality in Florida. In 2011, the PRMR for non-Hispanic Black women was 46.1 per 100,000 live births. This result contrasts with 11.4 per 100,000 live births for non-Hispanic White women and 5.1 for Hispanic women (Figure 2).

Figure 2. Pregnancy-Related Mortality Ratios — Florida, 2000-2011

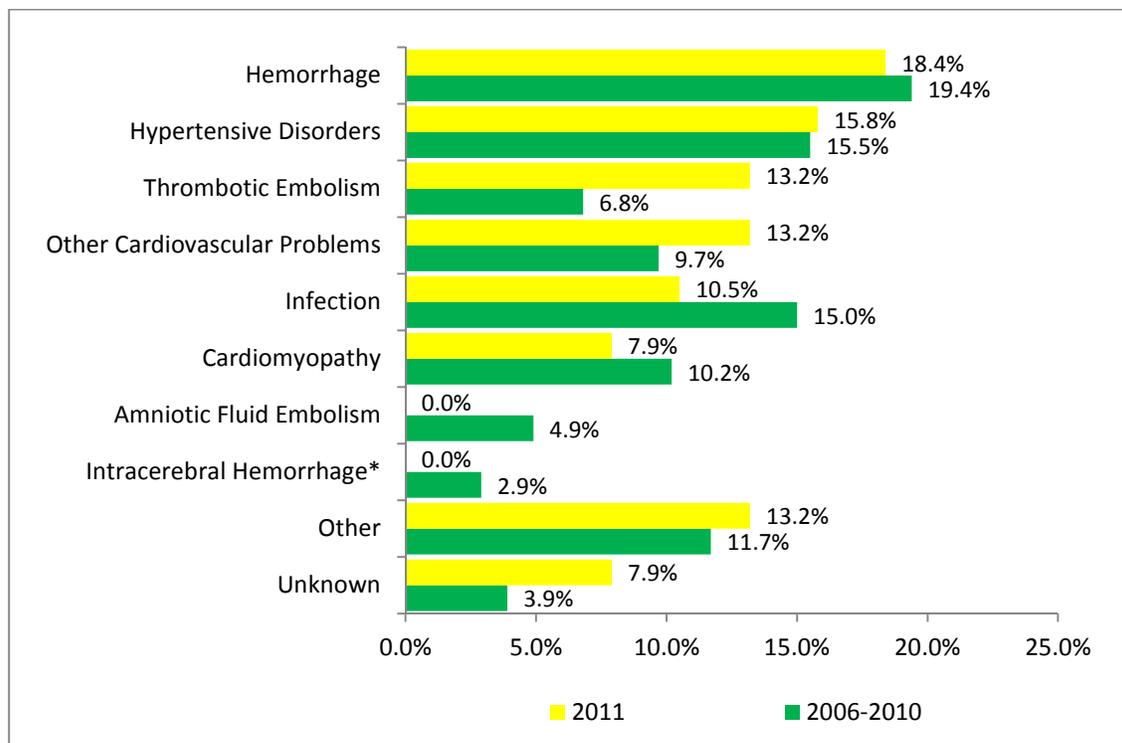


Cause of Death

The leading causes of pregnancy-related death in 2011 were hemorrhage (18.8%), hypertensive disorders (15.8%), thrombotic embolism (13.2%), and other cardiovascular problems (13.2%) (Figure 3 and Table 1). The category “other remaining causes” tied for the third leading cause and accounted for 13.2% of pregnancy-related deaths. These

“other remaining causes” of death included: respiratory failure (5.3%), high spinal/epidural (2.6%), metabolic pregnancy-related (includes diabetes mellitus) (2.6%), and neurologic/neurovascular problems (2.6%). Figure 3 and Table 1 show the percentages of deaths for unknown causes of death, thrombotic embolism, other cardiovascular problems, other remaining causes, and hypertensive disorders were higher in 2011 compared with the 5-year period of 2006-2010. Figure 3 and Table 1 show decreases in the percentage of deaths in 2011 due to infection, cardiomyopathy, and hemorrhage compared with 2006-2010.

Figure 3. Distribution of Pregnancy-Related Causes of Death Florida, 2006-2010 (n=206) and 2011 (n=38)



*Intracerebral hemorrhage (no known hypertensive disorder)

**Table 1. Distribution of Causes of Pregnancy-Related Death
Florida, 2006-2010 and 2011**

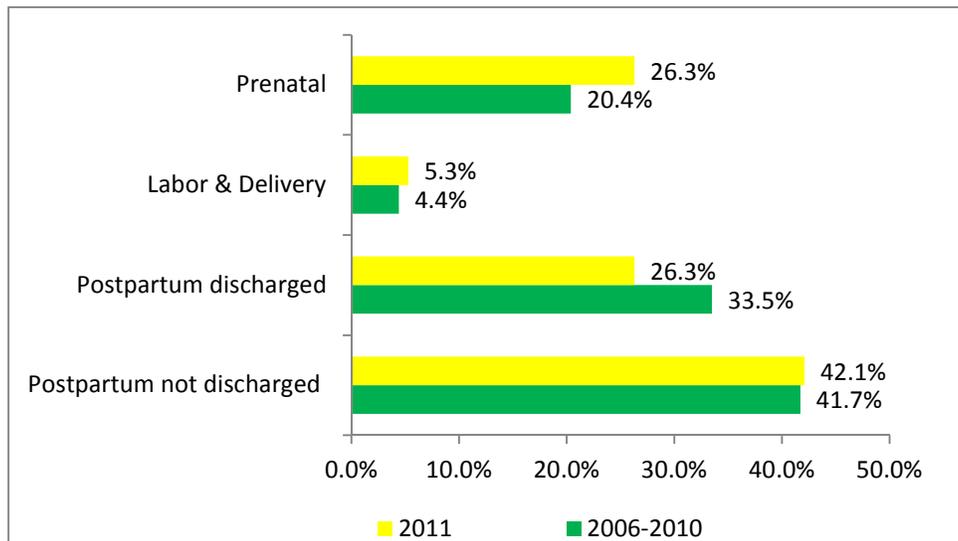
Causes	2006-2010 N (%)	2011 N (%)	Change in Percentage
Hemorrhage	40 (19.4)	7 (18.4)	-5
Hypertensive disorders	32 (15.5)	6 (15.8)	2
Thrombotic Embolism	14 (6.8)	5 (13.2)	94
Other Cardiovascular Problems	20 (9.7)	5 (13.2)	36
Infection	31 (15.0)	4 (10.5)	-30
Cardiomyopathy	21 (10.2)	3 (7.9)	-23
Amniotic Fluid Embolism	10 (4.9)	0 (0.0)	-
Intracerebral Hemorrhage (no known hypertensive disorder)	6 (2.9)	0 (0.0)	-
Others	24 (11.7)	5 (13.2)	22
Unknown	8 (3.9)	3 (7.9)	103
Total	206	38	

Timing of Death

Figure 4 displays pregnancy-related deaths by timing of death: prenatal, labor and delivery, or postpartum for the 5-year period of 2006-2010 compared with single-year data from 2011. In 2011, 68.4% of the deaths occurred during the postpartum period, which is defined as one year after delivery. Forty-three (43) percent of all deaths occurred postpartum prior to discharge from the delivery hospital and 26.3% occurred

postpartum after hospital discharge. Seven women who died during the first six-weeks were discharged from the hospital after delivery in 2011; these seven women died from hypertensive disorder, thrombotic embolism, cardiomyopathy, other cardiovascular problems, infection, other cause, and unknown. For those women who were not discharged and died during the postpartum period (16), the most common causes of death were hemorrhage (25.0%), hypertensive disorders (18.8%), and thrombotic embolism (18.8%).

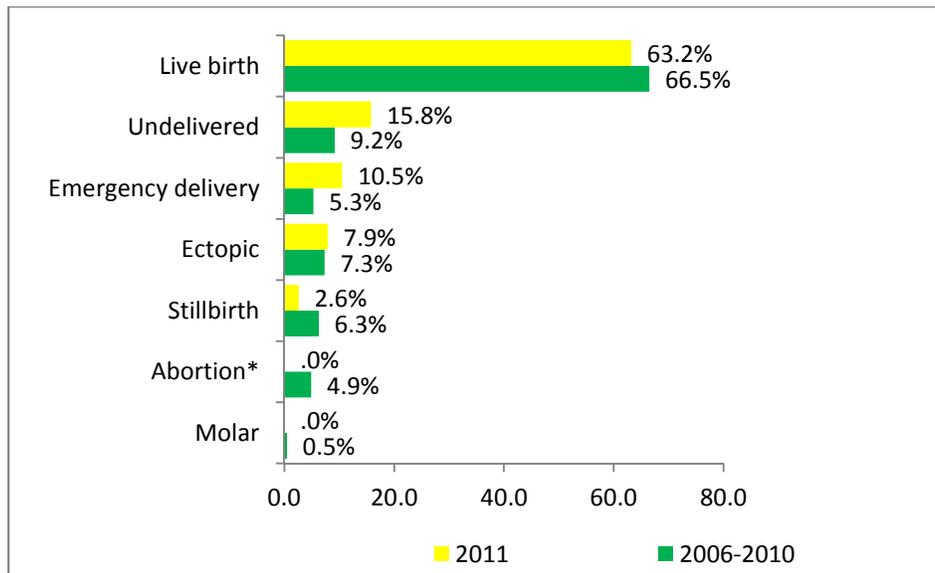
Figure 4. Distribution of Pregnancy-Related Deaths by Timing of Death Florida, 2006-2010 (n=206) and 2011 (n=38)



Pregnancy Outcome

Figure 5 shows the pregnancy-related deaths by outcome of pregnancy. In 2011, 63.2% occurred after a live birth, and 10.5% were emergency cesarean deliveries to save the infant. In 2011, there were 73 surviving children of mothers who died from pregnancy-related deaths.

Figure 5. Distribution of Pregnancy-Related Deaths by Pregnancy Outcome Florida, 2006-2010 (n=206) and 2011 (n=38)



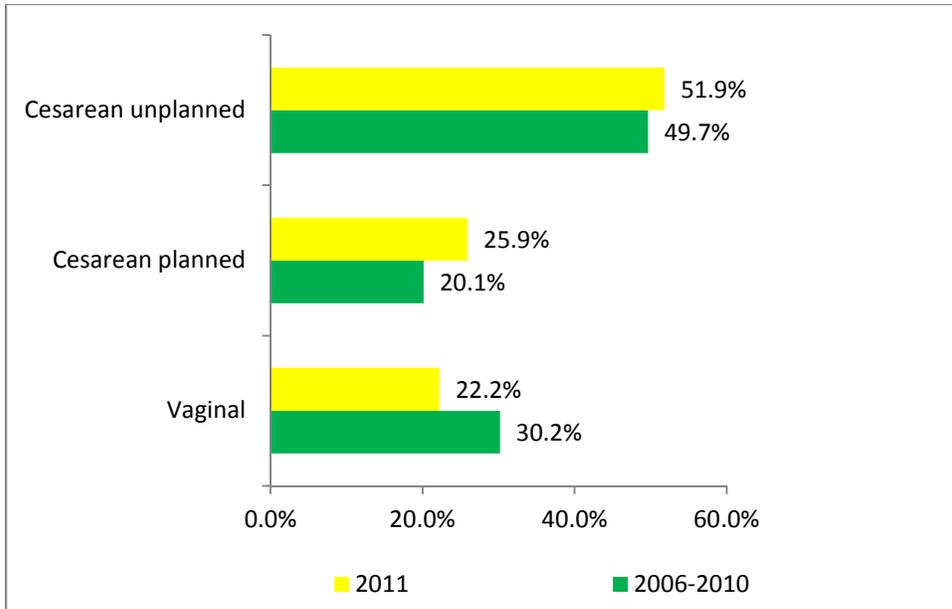
* Abortion includes spontaneous and elective abortions.

Type of Delivery

Figure 6 shows the percentage of women in 2011 who died during labor and delivery or postpartum by type of delivery. During 2011, the majority (77.8%) of these deliveries were cesarean deliveries. Of the 21 women who died after cesarean delivery, seven (33.3%) were planned cesarean deliveries and the remaining 14 (66.7%) were unplanned cesarean deliveries that may have been performed to save maternal and/or fetal life.

There was a non-significant increase in the percentage of deaths in women who had cesarean deliveries in 2011 (77.8%) compared to 2006-2010 (69.8%). A significant increase in the percentage of women having cesarean deliveries was observed when compared to all live births by type of delivery. Thirty seven (37.3) percent of live births were cesarean deliveries during 2006-2011 compared with 38.1% in 2011.

**Figure 6. Distribution of Pregnancy-Related Deaths by Type of Delivery
Florida, 2006-2010 (n=164), 2011 (n=28)**

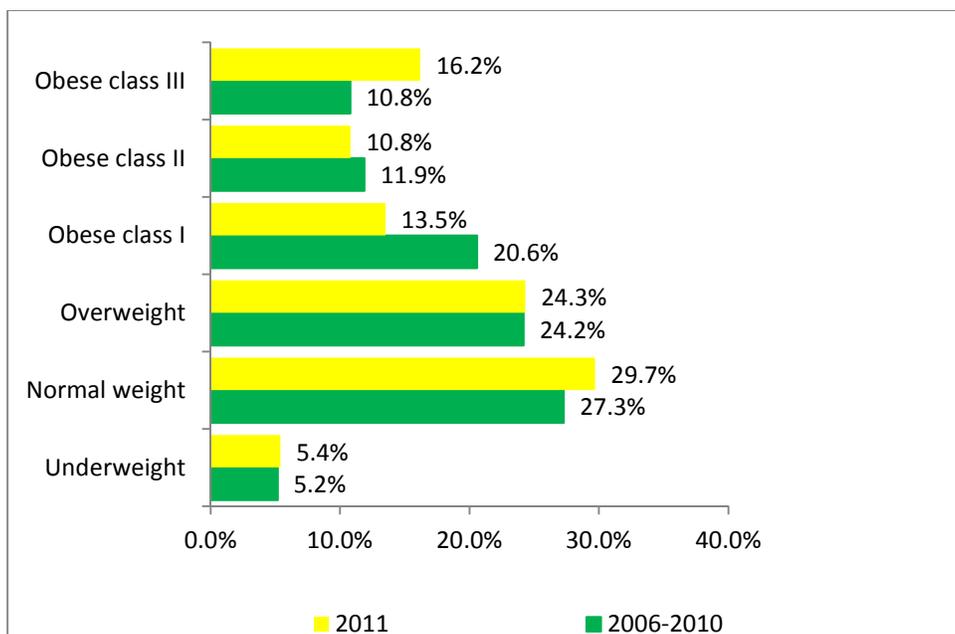


Maternal Body Mass Index (BMI)

In 2011, 64.8% of women who experienced a pregnancy-related death were overweight (BMI 25-29.9), obese class I (BMI 30-34.9), obese class II (BMI 35-39.9), or obese class III (BMI of 40 or more) categories (Figure 7). In comparison, 46.8% of all Florida women having a live birth in 2011 were classified to be overweight or obese [1].

Figure 7 presents BMI category distributions for the year 2011 and the period 2006-2010. A non-significant increase was observed in women who died and were in the obese class III category from 10.8% during 2006-2010 to 16.2% in 2011. This difference was not observed in the obese class III category for all women giving births in 2011 according to birth certificate data [1].

**Figure 7. Distribution of Pregnancy-Related Deaths by BMI
Florida, 2006-2010 (n= 206) and 2011 (n= 38)**



PAMR Identified Issues and Recommendations for 28 Pregnancy-Related Deaths

After reviewing pregnancy-related death cases, the PAMR committee identifies relevant issues related to the death and makes recommendations on efforts to promote systems improvements. PAMR committee-identified issues and recommendations are placed into four prevention categories: Clinical Factors, System Factors, Individual and Community Factors, and Death Review Factors. The following narrative outlines issues and recommendations made by the PAMR committee in 2011 by the four prevention categories, followed by PAMR team issues and recommendations related to four specific causes of death; hemorrhage, hypertensive disorders, thrombotic embolism, and infection.

Clinical Factors

Clinical factors relates to services provided by the entire health care system.

Issues

1. Incomplete patient assessments:
 - Lack of thorough assessments of the cardiac, pulmonary, and vascular systems during pregnancy and/or after delivery
 - Lack of vigilance in monitoring vital sign trends and lack of appreciation for significance of abnormal values
2. Inadequate documentation in the medical chart
3. Lack of coordination and follow-up, particularly of high-risk women
4. Deficient communication between staff and patients
5. Lack of association between a change in a patient's mental status and a potential deteriorating medical condition
6. Lack of patient education in preconception, pregnancy, or postpartum time periods

Clinical Recommendations

- Patient and partner should receive preconception or interconception health education regarding risk of pregnancy with chronic illness.
- Providers should raise awareness of the importance of postpartum (interconception) management of diabetes.
- Providers should be aware of the significance of tachycardia, increasing agitation, and confusion (hypoxia).
- Providers should perform thorough cardiac and respiratory assessments at each prenatal visit which include complete documentation.
- Providers should be aware of subtle signs and symptoms or changes indicating physical decline.

- Providers should consider using graphic tools for documenting vital signs that serve as a quick alert to potential changes in health status such as the Modified Early Obstetric Warning System implemented in the United Kingdom [2].
- Providers should monitor fluid overload in an underweight patient.
- Providers should be mindful to document reasoning or justification for treatments.
- Providers should be educated on the management of second trimester uterine evacuation and considerations for cerclage.
- Midwives should transfer care of high risk pregnant women to higher level of care per current guidelines.
- Providers should be aware of the importance of appropriate level of care for high risk pregnant woman and provide care coordination, including a delivery plan at a tertiary facility if indicated.
- Providers should be knowledgeable of the appropriate criteria for inducing labor and the associated risks involved.
- Providers should thoroughly consider the medical necessity of cesarean delivery weighing benefits versus risks.
- Providers should improve postpartum care coordination particularly for a woman with history of chronic illness.

System Factors

A lack of policies and procedures may lend itself to deficient quality of care, which potentially can affect a woman's health outcome.

Issues

1. Barriers to accessing care: lack of insurance, provider shortage, transportation
2. Lack of standardized policies and procedures

System Recommendations

- Hospitals should improve linkage and coordination of care between tertiary centers and smaller hospitals.
- Health care providers should be aware of the importance of a full trauma team for suspected high risk delivery and how to implement massive transfusion protocols.
- Hospitals should be aware of the barriers with electronic medical records for viewing, monitoring, and tracking vital signs, as well as fluid input and output, particularly across units, such as antenatal, labor and delivery, and postpartum.

Individual and Community Factors

It has been established that a woman's health prior to her pregnancy can greatly affect the birth outcome, as well as the woman's health status after birth. Some deaths may be associated with a woman's personal decision regarding her health and her care. It is important that healthcare providers enable women to make informed decisions.

Community factors encompass non-medical issues that have an underlying causal role in the death, such as reasons which hindered a woman or her family from recognizing a health problem or seeking care once a problem was recognized.

Issues

1. Women presenting in pregnancy with pre-existing medical conditions, such as hypertension, obesity, diabetes, and asthma
2. Lack of documentation of patient education and counseling regarding a woman's risk factors
3. Lack of patient knowledge regarding the association of a woman's health status to potential pregnancy complications

4. Women and their partners may not be fully aware of the implications of symptoms signifying a complication

Individual/Community Recommendations

- Women of reproductive age should have preconception or interconception health information on risks of multiple cesarean deliveries.
- Women with chronic health problems should receive family planning recommendations advising about serious complications of pregnancy.
- All postpartum women who require more pain medication than recommended for increased pain should call the provider.
- Pregnant patients should seek medical assistance for persistent headache.
- It is recommended to identify community resources to assist with childcare or home health follow-up.

Death Review Factors

The PAMR process relies on information from death certificates and autopsy reports for the identification and evaluation of pregnancy-related deaths.

Issues

1. Lack of autopsy on unexplained or inconclusive deaths
2. Death certificates not always completed accurately
3. Missing prenatal records in hospital charts

Death Review Recommendations

- Women who die with an unknown cause of death should be referred to Medical Examiner for potential autopsy.
- Health care providers should communicate with the Medical Examiner when an unexpected death occurs.
- PAMR abstractors should record entire electrophoresis report for sickle cell trait.

Recommendations Related to Specific Causes of Death

Hemorrhage

In 2011, seven pregnancy-related deaths were due to hemorrhage. Of these seven women, three had ruptured ectopic pregnancies, one had placenta accreta, one had uterine atony, one had uterine bleeding, and one had uterine laceration.

Clinical Recommendations

- Ectopic pregnancy should be suspected in women of reproductive age presenting with abdominal pain.
- Patients who survive an ectopic pregnancy should be warned of subsequent ectopic risk.
- Women with ruptured ectopic pregnancy may need volume resuscitation along with advanced cardiovascular life support (ACLS).

Hypertensive Disorders

Six pregnancy-related deaths were due to hypertensive disorders. Five of these women had a cerebrovascular hemorrhage associated with pre-eclampsia, eclampsia, and/or hypertension; and one had encephalopathy.

Clinical Recommendations

- Providers should know symptoms of preeclampsia and provide appropriate treatment in a timely manner.
- Providers should treat increased blood pressure during labor immediately per the American Congress of Obstetricians and Gynecologists (ACOG) guidelines.
- Providers should provide more aggressive management of postpartum hypertension.

Thrombotic Embolism

In 2011, all five embolism deaths were thrombotic, [includes pulmonary, not otherwise specified (NOS)].

Clinical Recommendations

- Patients should be educated to seek care for postpartum symptoms specifically when they have pain in their legs.
- Providers should use ACOG guidelines for management of thrombophilia and consult with a maternal and fetal medicine specialist (MFM) or hematologist for complicated cases beyond the scope of the guidelines.

Infection

Four women died from infection. Of these four, two had peritonitis, one had generalized septicemia and one had non-pelvic infection (pneumonia).

System Recommendations

- Providers should provide empiric antiviral treatment in patients with respiratory symptoms.

Other Conditions

For the five women who died from other conditions, the causes of death included two from respiratory failure during or after anesthesia, one from high spinal/epidural, one metabolic, and one from neurologic/neurovascular problems.

Conclusion

Florida has been actively conducting ongoing surveillance of maternal mortality cases since 1996. To date, over 2,000 pregnancy-associated cases have been reviewed by a multidisciplinary team of maternal child specialists in the PAMR project.

This 2011 report shows the consistent disparity in pregnancy-related deaths between non-Hispanic Black and non-Hispanic White women. Non-Hispanic Black women were four times as likely to have a pregnancy-related death compared to non-Hispanic White women.

The loss of a woman due to pregnancy is a loss to a family, community, state, and nation. A Healthy People 2020 objective is to reduce the rate of maternal mortality to 11.4 maternal deaths per 100,000 live births [4]. Florida's pregnancy-related ratio from 1999-2011 averaged 18 deaths per 100,000 live births; therefore, much work is still needed to meet the Healthy People objective.

Appendix 1

Case Selection for PAMR Team Review

Every year, the PAMR process begins with collecting data for all reported deaths that are associated with pregnancy. The Florida Department of Health (DOH) has implemented a process of data linkages to maximize the identification of pregnancy-associated deaths. This enhanced surveillance system fosters improved case identification when compared with a more limited process using Vital Statistics alone.

A pregnancy-associated death is defined as a death to a woman during pregnancy or up to one year after the pregnancy ends, regardless of the cause of death. Cases are included in the listing of pregnancy-associated deaths if any of the following four criteria are met:

- 1) The response on the death certificate is “yes” to the question: “If female, was she pregnant in the past year?”
- 2) The cause of death diagnosis code (International Classification of Diseases or ICD-10 code) indicates a death classified as being due to “Pregnancy, Childbirth, and the Puerperium (Chapter XV O00-O09).”
- 3) There is a matching birth or fetal death record within 365 days prior to the woman’s death.
- 4) There is a matching Prenatal Risk Screen (Florida’s universal prenatal screening tool used to identify and assess pregnant women at risk for adverse birth outcomes) within 365 days prior to the woman’s death.

The PAMR case selection committee is comprised of an obstetrician, a nurse, and an epidemiologist. The case selection team reviews cases by cause and time of death in relation to the course of pregnancy to categorize the deaths as pregnancy-related, possibly pregnancy-related, or not pregnancy-related.

A pregnancy-related death (PRD) is a pregnancy-associated death which resulted from 1) complications of the pregnancy itself; 2) the chain of events initiated by the pregnancy that led to death; or 3) aggravation of an unrelated condition by the physiologic or pharmacologic effects of the pregnancy that subsequently caused death. A possible PRD is a pregnancy-associated death where determination of the death could not be conclusively classified as either related or not related to the pregnancy. Pregnancy-associated deaths due to a cause deemed unrelated to pregnancy are classified as not pregnancy-related.

Approximately 15 cases are chosen by the selection team each quarter for record abstraction and subsequent PAMR team review. Abstraction and review preference is given to case deaths categorized as pregnancy-related. If there are fewer than 15 pregnancy-related deaths in a given quarter to review, a random selection of the “possibly pregnancy-related” and “not pregnancy-related” cases is conducted until a total of 15 cases have been obtained. Table 2 depicts the characteristics of cases that were not selected for team review by the committee.

**Table 2. 2011 PAMR Data on Non-Selected Cases
(n = 92)**

Classification at Selection

Pregnancy-Related = 0
Possibly Pregnancy-Related = 0
Not Related = 92

PAMR Selection

ICD-10 codes = 27
Prenatal screen = 21
Pregnancy check box = 33
Birth/Fetal death certificate = 70

Age

< 16 = 0
16 – 19 = 12
20 – 24 = 25
25 – 29 = 21
30 – 34 = 14
35 – 39 = 12
> 39 = 8

Race / Ethnicity

White Non-Hispanic = 48
Black Non-Hispanic = 33
Hispanic = 11
Other (specify) = 0

Marital Status

Married = 20
Separated = 3
Divorced = 7
Widowed = 2
Never married = 60

Place of Birth

Florida = 56
Other U.S. = 22
Outside U.S. = 14

Education Level

8th or less = 1
HS, no diploma = 25
HS diploma or GED = 35
College, no diploma = 13
College with degree = 18

Leading Causes of Death:

Accidental drug overdose = 26
Motor vehicle accident = 19
Homicide = 12
Cancer = 21
Suicide = 6
Other miscellaneous = 18

ME Referred = 68

Autopsy = 68

References

- [1] Florida CHARTS <http://www.floridacharts.com/charts/chart.aspx>
- [2] Singh, S., McGlennan, A., England, A., Simons, R. (2012) A validation study of the CEMACH recommended modified early obstetric warning system (MEOWS). Journal of the Association of Anaesthetists of Great Britain and Ireland. 67, 12-18.
doi:10.1111/j.1365-2044.2011.06896.x
- [3] Centers for Disease Control and Prevention. Ectopic Pregnancy Mortality – Florida, 2009-2010. MMWR 2012; 61:106-109.
- [4] Healthy People 2020, Maternal Infant, and Child Health, MICH-5. Available at:
<http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=26>

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