



Florida's Pregnancy-Associated Mortality Review 2014 Update

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Summary

Florida's Pregnancy-Associated Mortality Review (PAMR) is an ongoing surveillance process that involves data collection and examination of maternal deaths to promote evidence-based actions for individual behavioral changes, health care system improvements, and prevention of pregnancy-related deaths (PRDs). [For additional details about the PAMR team and process, please refer to Appendix 2]

The 2014 data update report provides an overview and comparisons of PRD data and trends for Florida between the years 2005 and 2014. Distributions of PRDs are shown by race/ethnicity, age, BMI, timing of deaths, pregnancy outcome, type of delivery and cause of death, and, when applicable, pregnancy-related mortality ratios (PRMRs).

In 2014, the data linkage process identified 145 pregnancy-associated Florida resident deaths from January 1, 2014, to December 31, 2014. The PAMR case selection committee determined that 43 of these pregnancy-associated deaths in 2014 were most likely to be pregnancy-related. Upon full team review of the 43 death cases, the PAMR committee found 35 (81.4%) of these deaths to actually be pregnancy-related.

The PRMR in Florida in 2014 was 16.0 per 100,000 live births. Although the 2014 PRMR was lower than the ratio in 2013 (26.2 per 100,000 live births), the trend for the period 2005-2014 was not statistically significant.

For 2014:

- Of the 35 PRDs
 - 13.2% were non-Hispanic White women
 - 29.3% were non-Hispanic Black women
 - 8.1% were Hispanic women
 - 26.7% were non-Hispanic other Races women
- The leading pregnancy-related causes of death in 2014 were hemorrhage (20.0%) and cardiomyopathy (17.1%)
- Of the 35 PRDs, 68.6% occurred during the postpartum period
 - 45.7% of postpartum PRDs occurred prior to hospital discharge
 - 22.9% of postpartum PRDs occurred after hospital discharge
- PRDs by outcome of pregnancy
 - 57.1% after a live birth delivery
 - 14.3% after a stillbirth
 - 11.4% after an ectopic pregnancy

- 8.6% during or after an emergency delivery
- 5.7% while still pregnant (undelivered)
- 2.9% after a miscarriage/abortion
- In 2014, 28 PRDs occurred during or after delivery
 - (20) 57.1% had cesarean as a delivery method
 - 17.1% were planned cesarean deliveries
 - 40.0% were unplanned cesarean deliveries
- In 2014, (24) 68.6% of PRDs were women who were overweight or obese according to body mass index classifications

The leading recommendations in 2014 were:

- Facilities should institute system level obstetric hemorrhage protocols, including a mass blood transfusion protocol
- It is important to stabilize a patient with influenza and upper respiratory symptoms prior to delivery due to the inflammatory process in the lungs
- Providers, especially emergency room providers, should consider the importance of complete clinical picture in suspected preeclamptic patients

The Department of Health (Department) collaborates with diverse public and private organizations to pursue multifaceted approaches to moving recommendations into tangible actions. As a result of the leading causes of death:

- In fiscal year 2014/15, the Department contracted the Florida Perinatal Quality Collaborative (FPQC) to implement Obstetric Hemorrhage Initiative (OHI) addressing the leading cause of pregnancy-related death
- The Department is currently contracting with the FPQC to implement a Hypertension in Pregnancy (HIO) initiative

Next Steps:

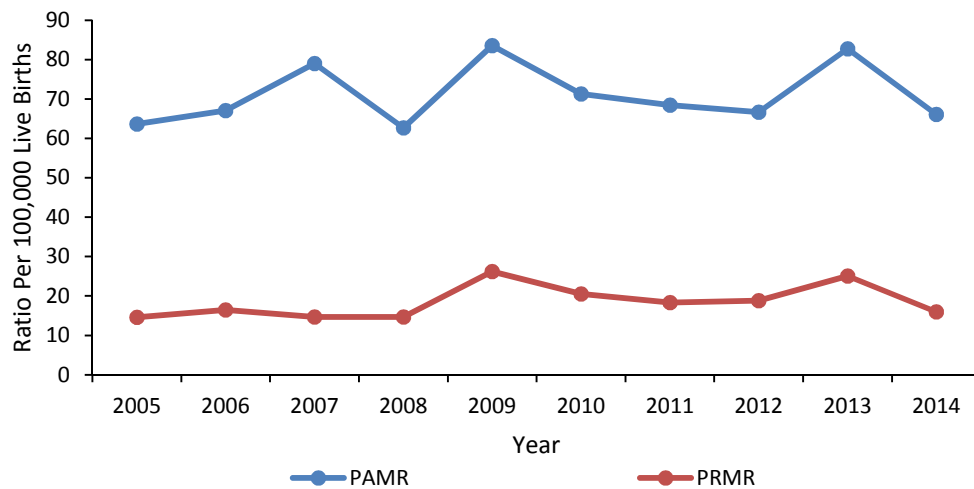
- Ongoing surveillance
- Urgent messages
- Ongoing building of partnership

Pregnancy-Related Mortality Findings — Florida, 2014

Pregnancy-Associated and Related Deaths

A *pregnancy-associated death (PAD)* is a death of a woman from any cause, while she is pregnant or within one year of termination of pregnancy, regardless of the duration and site of the pregnancy. A *pregnancy-related death (PRD)* is a death of a woman directly attributed to pregnancy and/or childbirth. PRDs are subsets of pregnancy-associated deaths [For PAMR processes see Appendix 2]. Florida's pregnancy-associated mortality ratios (PAMR) and pregnancy-related mortality ratios (PRMR) are shown in Figure 1.

Figure 1. Pregnancy-Associated Mortality Ratios and Pregnancy-Related Mortality Ratios, Florida 2005-2014



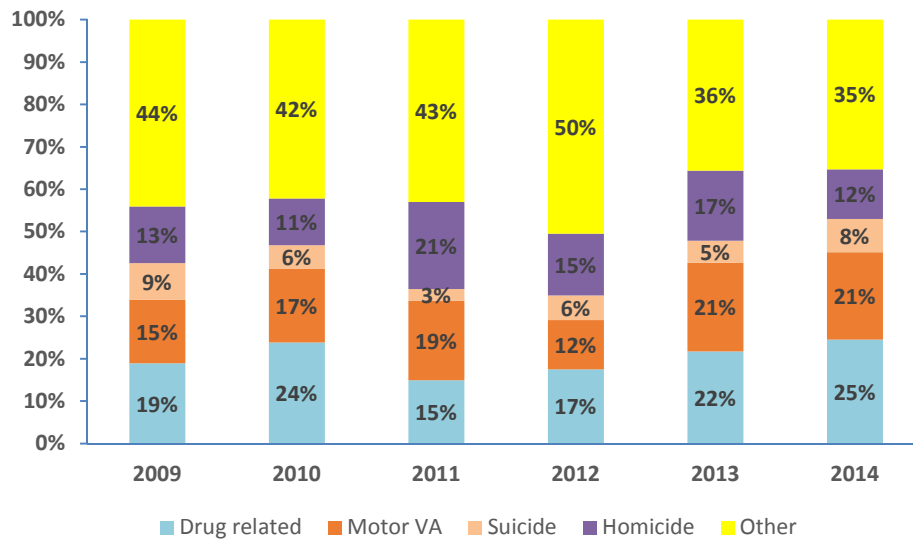
Year	# PAD	#PRD	%PRD	Year	# PAD	#PRD	%PRD
2005	144	33	22.9	2010	153	44	28.8
2006	159	39	24.5	2011	146	39	26.7
2007	189	35	18.5	2012	142	40	28.2
2008	145	34	23.4	2013	178	54	30.3
2009	185	58	31.4	2014	145	35	24.1

- The total number of PADs in Florida ranged from 142 to 189 per year between 2005 and 2014. The number of PADs in 2014 was 145.
- The proportion of PADs that were pregnancy-related ranged from 18.5% to 31.4% between 2005 and 2014. In 2014, 24.1% of PADs were determined to be PRDs by the Florida PAMR Committee.

Not-Pregnancy-Related Deaths

Not-Pregnancy-Related Deaths are a subset of PAD. The leading causes of maternal death in the not-pregnancy-related cases for 2009-2014, according to documentation in the death certificates, are shown in Figure 2. These are maternal deaths that were identified through the data identification process described in Appendix 2. In 2014, deaths due to cancer and other miscellaneous causes represented 35% of not-pregnancy-related cases, while drug related, motor vehicle accidents (MVA), and homicide had percentages from 12% to 25%. Suicides represented 8% of the not-pregnancy-related deaths.

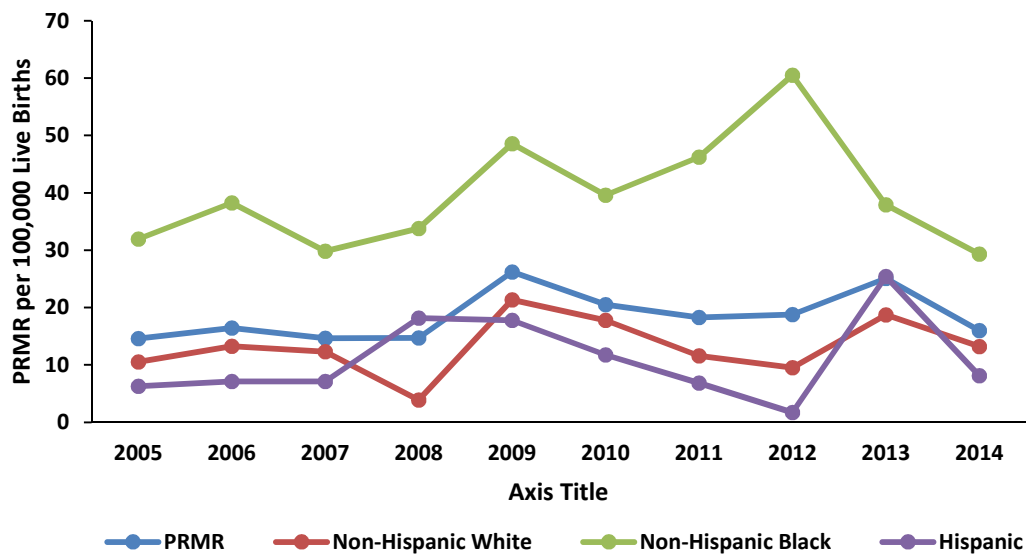
**Figure 2. Not-Pregnancy-Related Death Cases by Cause of Death
Florida, 2009-2014**



Pregnancy-Related Mortality Ratios (PRMR)

A measure of PRDs is the PRMR. The PRMR is the number of PRDs per 100,000 live births. In assessing mortality, it is customary to view mortality measures over an extended period of time to identify increasing or decreasing trends. Figure 3 displays PRMRs for Florida between 2005 and 2014 by race and Hispanic ethnicity.

**Figure 3. Pregnancy-Related Mortality Ratios (PRMRs) by Race/Ethnicity
Florida, 2005-2014**



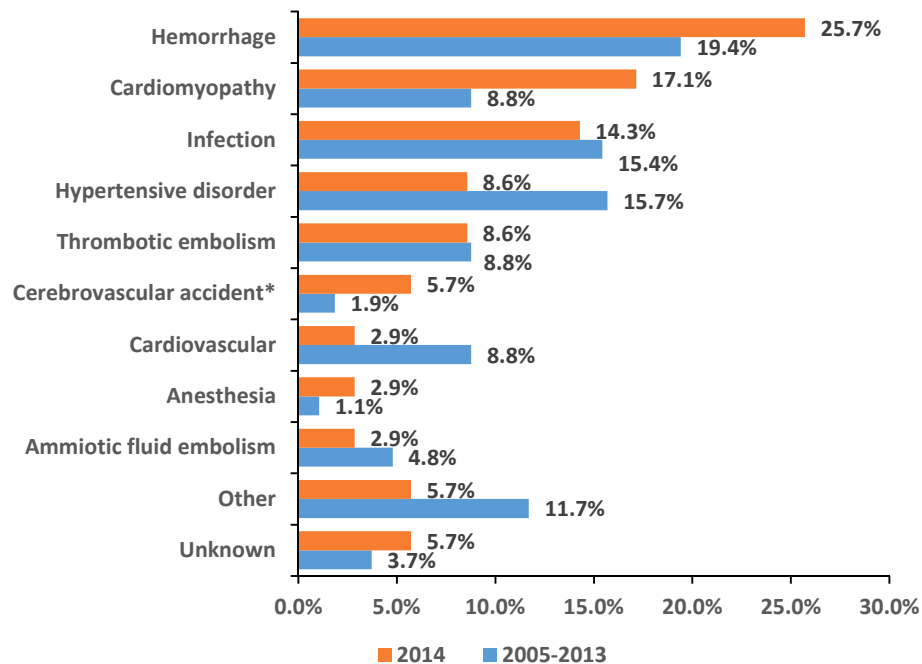
- During the period 2005-2014, the overall Florida PRMR fluctuated between 14.6 and 26.2. The Florida PRMR of 26.2 in 2009 was the highest value followed by Florida PRMR in 2013 with 25.1 maternal deaths per 100,000 live births.
- As evidenced in Figure 3, racial disparities are present and consistent with PRMR in Florida. Between 2005 and 2014, annual PRMRs among non-Hispanic Black women have been at least two times higher than the PRMRs for non-Hispanic White or Hispanic women with an all-time high in 2012 when the PRMR for non-Hispanic Black was 60.5. In 2014 the PRMR for non-Hispanic Black was 29.3 maternal deaths per 100,000 live births, 13.2 for non-Hispanic White, and 8.1 for Hispanic maternal deaths per 100,000 live births.

Cause of Pregnancy-Related Deaths

For each PRD case reviewed by the PAMR Committee, a primary cause of PRD is determined.

- In 2014, the leading causes of PRDs were hemorrhage 25.7%, cardiomyopathy 17.1%, and infection 14.3%. This is the first year that cardiomyopathy is the second cause of PRD in Florida.
- Figure 4 and Table 1 show how the percentage of deaths for cardiomyopathy, hemorrhage, and cerebrovascular accident were higher compared with the period 2005-2013. Also, Figure 4 and Table 1 show decreases in the percentage of deaths in 2014 due to cardiovascular problems, hypertensive disorders, amniotic fluid embolism and other remaining causes compared with 2005-2013.

**Figure 4. Distribution of Pregnancy-Related Causes of Death
Florida, 2005-2013 (n=376) and 2014 (n=35)**



*Cerebrovascular accident no known hypertensive disorders.

**Table 1. Distribution of Causes of Pregnancy-Related Death
Florida, 2005-2013 and 2014**

Causes of Deaths	2005-2013	2014	Change in Percentage
	N (%)		
Hemorrhage	73 (19.4)	9 (25.7)	32.5
Cardiomyopathy	33 (8.8)	6 (17.1)	94.3
Infection	58 (15.4)	5 (14.3)	-7.1
Hypertensive disorders	59 (15.7)	3 (8.6)	-45.1
Thrombotic Embolism	33 (8.8)	3 (8.6)	-2.3
Cerebrovascular accident	7 (1.9)	2 (5.7)	20.0
Cardiovascular	33 (8.8)	1 (2.9)	-67.0
Amniotic Fluid Embolism	18 (4.8)	1 (2.9)	-39.6
Anesthesia	4 (1.1)	1 (2.9)	1.6
Other remaining causes*	44 (11.7)	2 (5.7)	-51.3
Total	376**	35**	

*Other remaining causes include: hematopoietic, collagen vascular diseases, metabolic (pregnancy related or non-other pregnancy related), injury, cancer, pulmonary problems, neurologic/neurovascular problems, multiple organ/system failure, gastrointestinal disorders, and other conditions

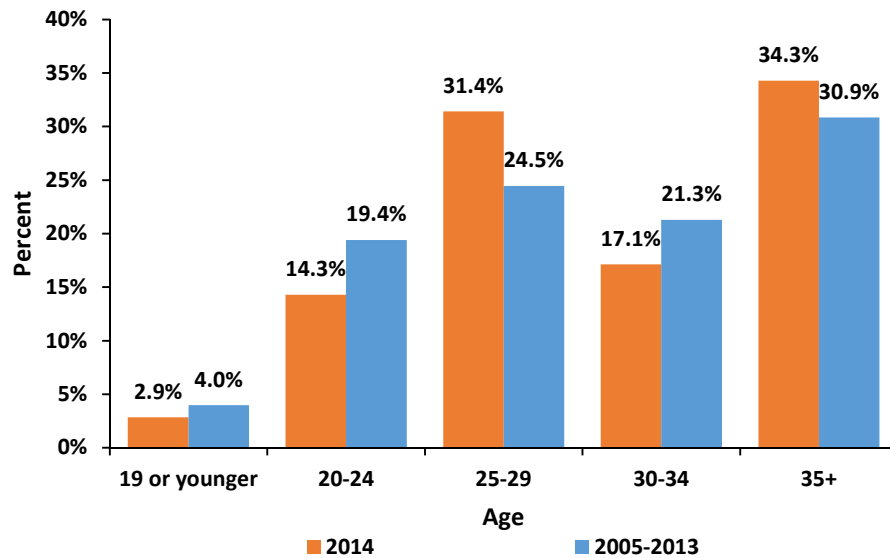
** Total includes unknowns

Pregnancy-Related Deaths by Age

Examination of age at death can point toward the presence and types of PRD protective or risk factors among age groups, such as biological effects of the aging process. PRD distribution and PRMRs by age group are shown in Figures 5a and 5b.

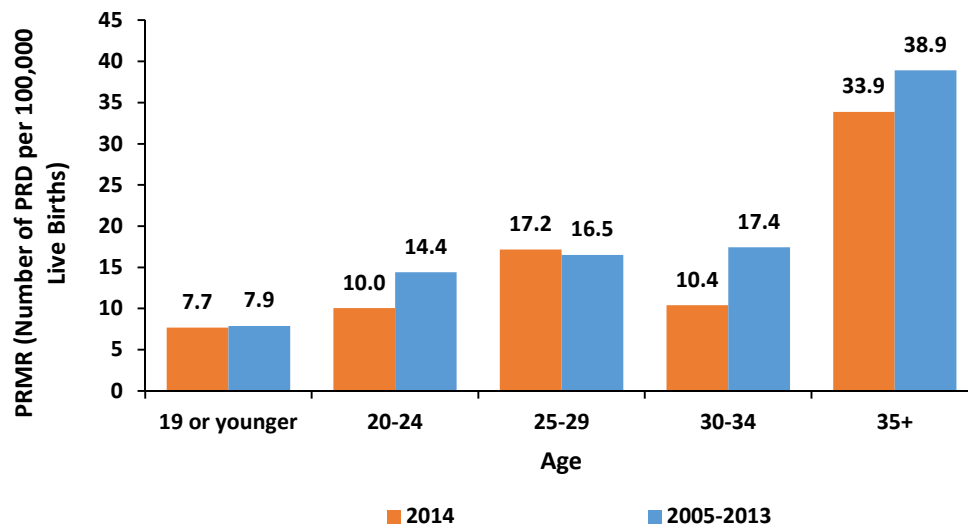
- In 2014, the highest percentage of maternal deaths (34.3%) occurred in women 35 years old and older. In contrast, fewer young mothers (less than 25 years old) died in 2014 compared with 2005-2013 (17.2% vs. 25.6% respectively). (Figure 5a)

**Figure 5a. Distribution of Pregnancy-Related Deaths by Age
Florida, 2005-2013 (n=376) and 2014 (n=35)**



- In 2014, the PRMR of women 35 years or more (33.9) was almost 2 times the PRMR of women less than 25 years (17.7). (Figure 5b)

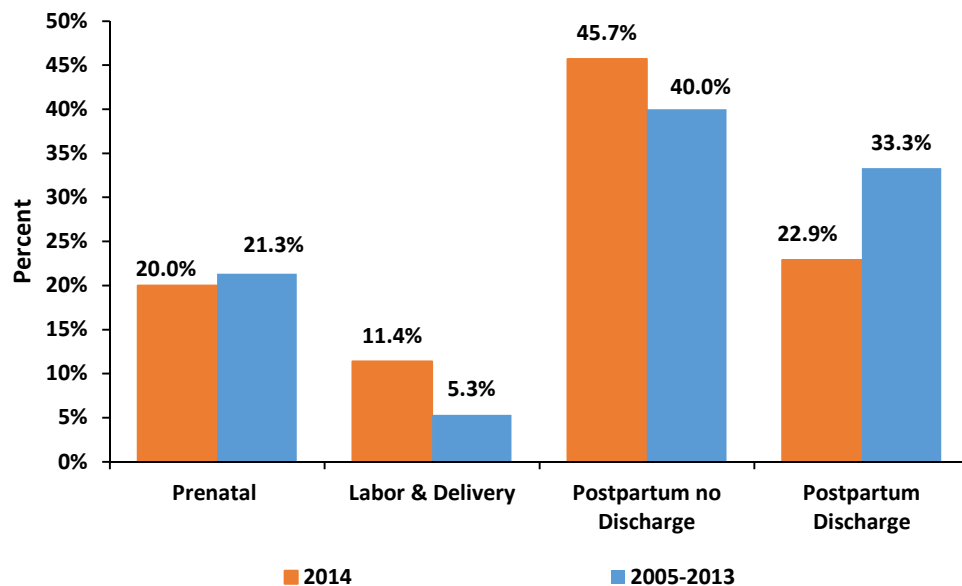
**Figure 5b. Pregnancy-Related Mortality Ratios (PRMRs) by Age
Florida, 2005-2013 and 2014**



Pregnancy-Related Deaths by Timing of Death

The PAMR process classifies timing of death for PRDs into categories defined by the three perinatal periods in which PRDs can occur: prenatal, labor and delivery, and postpartum. The postpartum period is divided into two subcategories: Postpartum not discharged from the hospital and postpartum discharged from hospital. [See Appendix 1 for detailed definitions]. PRDs by timing of death between 2005-2013 and 2014 are shown in Figure 6.

**Figure 6. Distribution of Pregnancy-Related Deaths by Timing of Death
Florida, 2005-2013 (n=376) and 2014 (n=35)**



- In 2014, a majority of PRDs (68.6%) occurred during the postpartum period. There are differences between the causes of death in the postpartum period by hospital discharge status.
 - Of the postpartum PRD cases who were not discharged from the hospital, the PRD causes were: hypertensive disorders, hemorrhage, infection, cardiovascular problems, other remaining causes, and amniotic fluid embolism.
 - Of the women who died after hospital discharge: the PRDs that occurred during the first six weeks postpartum were due to infection, hypertensive disorders, and other remaining causes. For women who died after six-

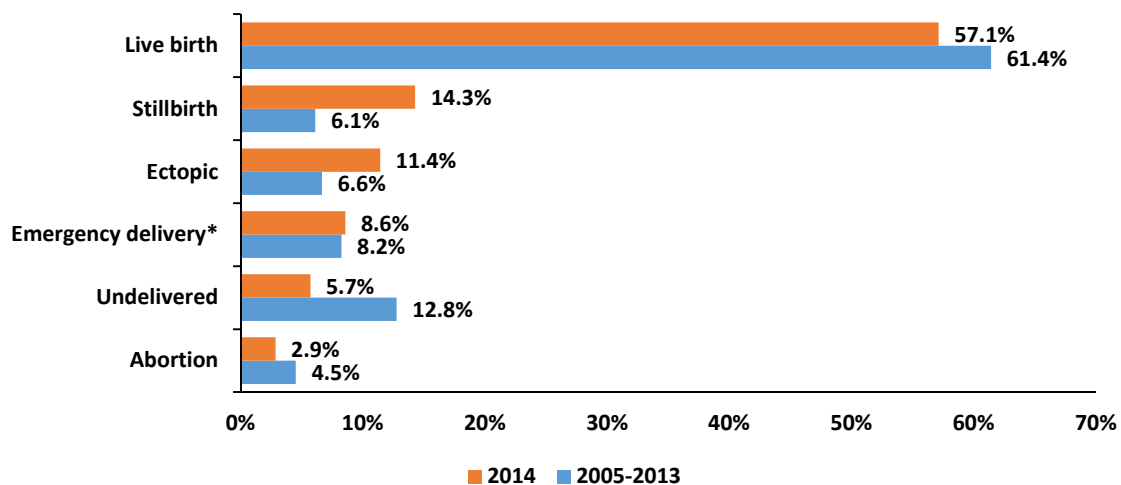
weeks postpartum and were discharged from the hospital, the causes of deaths were cardiomyopathy and other remaining causes.

- Infection and cardiomyopathy were the two common causes of PRD cases not discharged from the hospital and PRD cases discharged who died during the first six weeks postpartum.

Pregnancy-Related Deaths by Pregnancy Outcome

In the PAMR process, pregnancy outcomes are classified as live birth, emergency delivery, undelivered, ectopic, abortion, and still birth. [See Appendix 1 for detailed pregnancy outcome definitions]. Figure 7 shows PRDs by outcome of pregnancy.

Figure 7. Distribution of Pregnancy-Related Deaths by Pregnancy Outcome Florida, 2005-2013 (n=376) and 2014 (n=35)



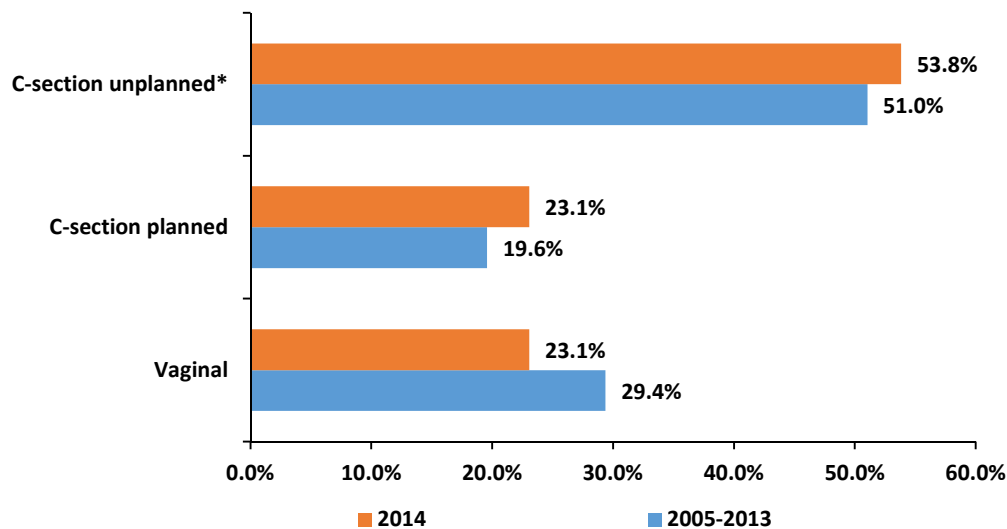
*There were 3 emergency deliveries in 2014 of which 2 were live births and 1 stillbirth.

- In 2014, the majority (57.1%) of PRDs occurred after a live birth and 14.3% were stillbirths.
- In 2014, there were 53 surviving children of mothers who died of PRDs.

Pregnancy-Related Deaths by Type of Delivery

Type of delivery is classified by PAMR as vaginal or cesarean section (C-section). C-section deliveries are further defined as planned and unplanned. [See Appendix 1 for type of delivery definitions]. Figure 8 illustrates the PRD distribution by type of delivery for the women who died during the labor/delivery or postpartum period.

**Figure 8. Distribution of Pregnancy-Related Deaths by Delivery Type
Florida, 2005-2013 (n=286), 2014 (n=26)**



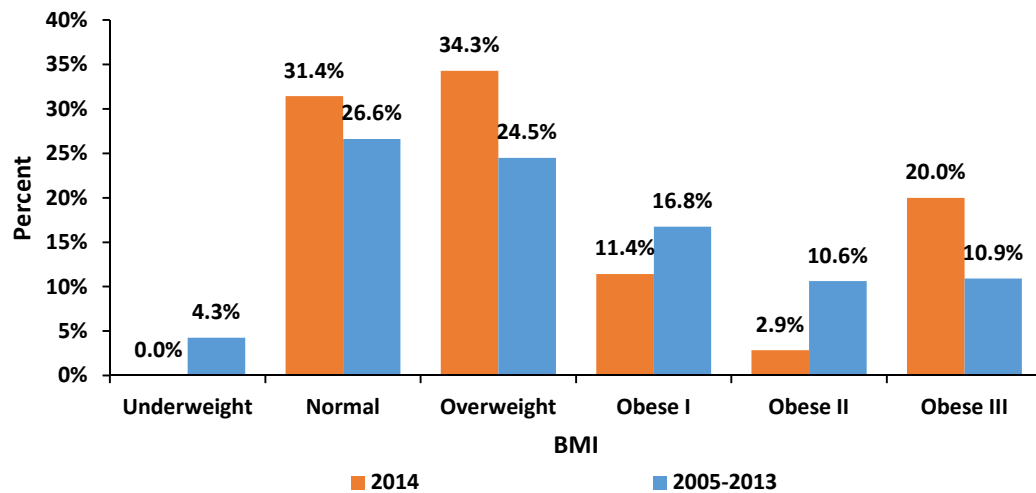
*Of 24 (53.8%) unplanned C-sections 3 (21.4%) were emergency deliveries.

- In 2014, 76.9% of PRD cases that occurred during the labor/delivery or postpartum period were by C-section. In comparison, 37.1% of all live births in Florida were C-section deliveries in 2014 (not shown in figure) [1].
- Nearly 54% of the C-sections among the PRD cases that occurred in 2014 were unplanned C-section deliveries.

Pregnancy-Related Death by Pre-Pregnancy Body Mass Index

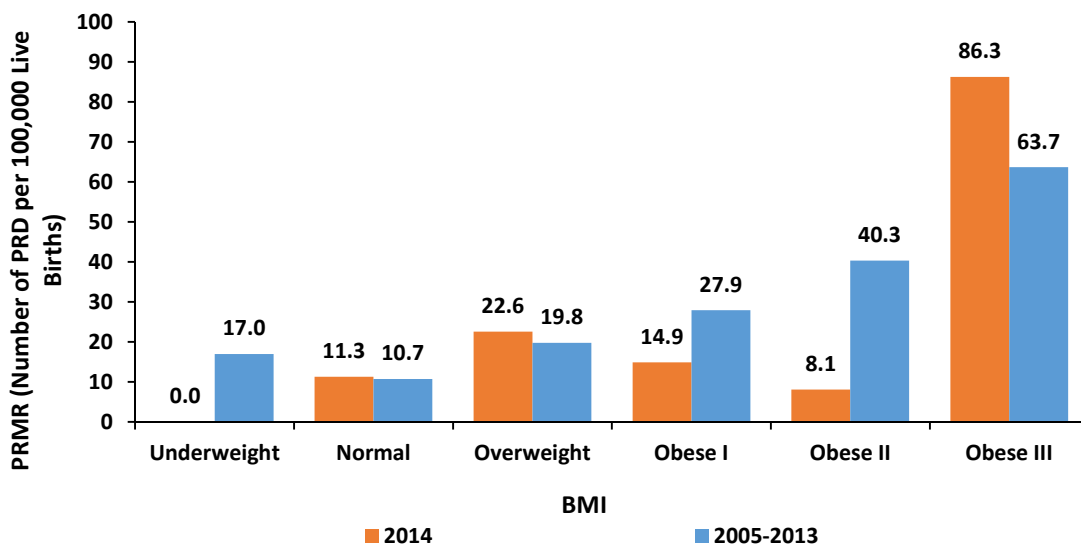
Body Mass Index (BMI) is a calculated measure of the relative percentage of body fat based on height and weight. PAMR uses the following BMI categories to examine associations between weight before pregnancy and PRD: underweight, normal weight, overweight, obese (Class I, Class II, and Class III). [See Appendix 1 for detailed definitions of BMI calculation and BMI categories.] Distributions of PRDs and PRMRs by BMI category are shown in Figures 9a and 9b, respectively.

**Figure 9a. Distribution of Pregnancy-Related Deaths by Pre-Pregnancy BMI
Florida, 2005-2013 (n=376) and 2014 (n=35)**



- In 2014, 68.6% of women who experienced a PRD were in the overweight/obese pre-pregnancy BMI (Figure 9a). Comparably during the same year, a lesser percentage (50.7%) of all Florida women who had a live birth were in the overweight/obese pre-pregnancy category (not shown in figure) [1].

**Figure 9b. Pregnancy-Related Mortality Ratios (PRMRs) by Pre-Pregnancy BMI
Florida, 2005-2013 (n=376) and 2014 (n=35)**



- As shown in Figure 9b, PRD cases with higher pre-pregnancy BMIs had higher PRMRs. In 2014, the PRMR was 11.3 maternal deaths per 100,000 live births with normal weight pre-pregnancy BMIs versus 22.6 with overweight and 14.9, 8.1, and 86.3 obese Class I, Class II, and Class III pre-pregnancy BMIs, respectively.

PAMR Identified Issues and Recommendations for PRDs, 2014

After reviewing PRD cases, the PAMR Committee identifies relevant issues related to the death and makes recommendations to promote system improvements. The PAMR Committee's identified issues and recommendations are placed into four prevention categories: Clinical Factors, System Factors, Individual/Community Factors, and Death Review Factors. The following narrative outlines how the issues and recommendations were made by the PAMR Committee in 2014 by the four prevention categories. A consistent message that has been established is 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.

Clinical Factors (Health Care Services, Practice, Protocols, and Care Coordination)

Clinical factors relate to services delivered by all health care providers and include actions involving diagnosis, treatment, and communication.

Issues

Contributing factors identified in review of 2014 pregnancy-related deaths included:

- Delay of Treatment: 22%
- Lack of Treatment: 22%
- Lack of Diagnosis: 19%
- Delay of Diagnosis: 11%
- Communication/Documentation: 7%
- Knowledge/Skills/Assessment: 7%
- Prevention-Patient Education Preconception/Pregnancy/Postpartum: 7%
- Care Coordination-Referrals, Transfers, Follow-up: 4%

Clinical Recommendations

- Providers should stress the importance of thorough consideration of the medical necessity of a primary cesarean delivery.
- Providers should be aware of the importance of cardiac screening in obese and/or hypertensive patients.
- A delivery care plan is important for high risk women with the potential for hemorrhage and those women who have chronic cardiac conditions.
- It is important to determine early diagnosis and treatment of preeclampsia.
- It is important to determine early recognition of vital sign changes which may indicate hemorrhage.
- Providers should coordinate timely care and services to pregnant women with acute and chronic conditions.
- Providers should consider early transfer of a patient to a higher level of care facility when indicated.
- Staff debriefing should occur in sudden maternal deaths.
- Providers should be aware that septic abortion requires rapid intervention.
- Providers should consider antepartum prophylaxis with Acetylsalicylic acid (ASA) in patients with high proteinuria.
- It is important to utilize an echocardiogram (ECHO) for women with shortness of breath in pregnancy.

System Factors (Health Care Management, Reimbursement and Access)

System factors relate to system level processes involving policies, barriers to access health insurance, nursing knowledge, or infrastructure.

Issues

Contributing factors mentioned in review of 2014 pregnancy-related deaths included:

- Barriers to Accessing Health Care Insurance, Provider Shortage, Transportation: 50%
- Lack of Care Coordination: 50%

System Recommendations

- Patients should be seen by a pulmonary specialist if they have pulmonary concerns.

- Facilities should institute obstetric hemorrhage and hypertension protocols.
- Labor and delivery facilities should institute a training team to improve health assessment skills and team coordination.
- Facilities should know the importance of the obstetric component of an evaluation in the emergency department during the immediate postpartum period.
- It is recommended that women with severe co-morbidities during the prenatal and interconception periods have access to ongoing health care and a medical home; ongoing care is essential for management of severe chronic diseases.
- Patients with sickle cell crisis should remain hospitalized for aggressive management and supportive treatment in pregnancy.
- Medical records should be accessible to all medical providers to provide continuity of care.

Individual/Community Factors

Individual/Community factors relate to non-medical issues that have an underlying causal role in the death. For example, these can include barriers to recognizing a symptom or personal decisions about seeking care or following a medical recommendation.

Issues

Contributing factors mentioned in review of 2014 pregnancy-related deaths included:

- Significant Co-Morbidity: 53%
- Personal Decisions (Example: Delayed Seeking Care): 32%
- Substance Abuse/Use: 5%
- Missing prenatal visits 5%
- Financial Barriers: 5%

Individual/Community Recommendations

- All providers should provide preconception/interconception counseling and education to all child bearing age women. Education and counseling should include healthy weight and any risk factor identified.
- All providers should discuss a reproductive life plan with any woman who has a severe chronic disease where pregnancy may endanger the woman's life.

- It is important that medical providers fully inform pregnant women about their risk factors and document provision of education.
- Women with severe co-morbidities should have access to long-acting reversible contraceptives.
- Healthy Start should be alert and able to identify intimate partner violence issues.
- Patients should be educated to notify their providers if they are unable to continue recommended treatment, including prescription medications (i.e. blood pressure medicine).
- High risk women choosing to leave against medical advice should be educated and counseled appropriately.

Death Review Factors.

The PAMR process relies on information from death certificates and autopsy reports for the identification and evaluation of PRDs.

Issues

- Death certificate accuracy
- PAMR abstraction process
- Lack of autopsy for sudden, unexplained, or inconclusive cause of death

Death Review Recommendations

- All maternal deaths with multiple complications should have an autopsy.
- It is important to have an autopsy for an unexplained death in a pregnant woman in order to determine the cause of death.
- The Medical Examiner should discuss the option of partial autopsy with family to encourage consent in an effort to determine cause of death.
- It is important to include a note in abstraction documents when patient is transferred from one hospital to another.

Committee Recommendations Related to the Leading Causes of Death

Also outlined are the PAMR Committee's identified recommendations related to the five leading causes of PRD for the year 2014: hemorrhage, cardiomyopathy, infection, hypertensive disorders, and thrombotic embolism.

Hemorrhage

Clinical Recommendations

- Labor and delivery triage nurse should identify and document a woman at risk of hemorrhage.
- Early recognition of placenta accreta is important.
- Providers should consider the risk of abnormal ectopic pregnancy with bicornuate uterus and stress access to early ultrasound images.
- Postpartum instructions should include how to identify when bleeding is too much and what to do.

System Recommendations

- Facilities should institute system level obstetric hemorrhage protocols, including a mass blood transfusion protocol.
- Facilities should develop a delivery care plan for high risk women with the potential for hemorrhage.

Individual/Community Recommendations

- Pregnant women with abdominal pain should seek care promptly.
- Postpartum women should call their provider or go to the emergency room when bleeding more than recommended in postpartum instructions.

Cardiomyopathy

Clinical Recommendations

- It is important to consider development of protocol for intravenous opioid and pain management patients with cardiomyopathy.

Infection

Clinical Recommendations

- It is important to stabilize a patient with influenza and upper respiratory symptoms prior to delivery due to the inflammatory process in the lungs.
- The American Congress of Obstetricians and Gynecologists (ACOG) should support providers messaging that women with co-morbidities and influenza in pregnancy are prone to complications.
- Pregnant women with upper respiratory symptoms and multiple emergency room visits should be admitted and managed.

- It is important to give Tamiflu and supportive treatment immediately with respiratory influenza symptoms in pregnant women.
- It is important to follow ACOG guidelines for treatment of flu and not rely on a positive flu swab.

System Recommendations

- Facilities should have a standard protocol on admission to stabilize a patient with a positive sepsis screen.

Individual/Community Recommendations

- It is necessary to increase the awareness of the importance of pregnant women and their families to receive the flu vaccination due to the increased morbidity and mortality of pregnant women who are infected with the flu virus.
- ACOG and the Department of Health should promote public messaging on the importance of the flu vaccine for pregnant women and their families.
- Pregnant women should seek care during pregnancy for persistent fever.

Hypertensive Disorders

Clinical Recommendations

- Early delivery and hospitalization is recommended for consideration for poorly controlled hypertension.
- Low dose of aspirin is recommended prenatally for patients with chronic hypertension.
- Providers, especially emergency room providers, should consider the importance of a complete clinical picture in suspected postpartum preeclamptic patients.

System Recommendations

- Facilities should adopt Hypertension in Pregnancy protocols for preeclampsia.

Thrombotic Embolism

Clinical Recommendations

- Providers should conduct a thromboembolism risk assessment and have knowledge of the guidelines for treatment in pregnancy.
- Providers should take into consideration chemical thrombo-prophylaxis in patients with multiple co-morbidities and high proteinuria.

System Recommendations

- Facilities should have a standardized risk assessment for deep vein thrombosis prophylaxis, both mechanical and pharmacological.

Assessing Preventability of Maternal Deaths in Florida in 2014

In 2014, the Florida PAMR Committee initiated the assessment of preventability of PRDs. After a series of discussions with the PAMR preventability work group and mirroring the California PAMR process, [2] two new columns were included in the PAMR review form. First, the PAMR Committee reached consensus on whether the death appeared to have been preventable and to what degree the death was preventable with the following question: *If specific actions had been implemented, to what degree would these actions have changed the woman's trajectory and led to her survival?* There were three possible answers to this question:

- Strong: A case with a strong chance for an altered outcome would likely have factor(s) identified that definitely contributed to the death (e.g., misdiagnosis, wrong drug, or particular patient action) so that if the correct diagnosis had been made (or correct drug given or patient action had been different), the fatal course would have been reversed. For a strong chance to alter outcome, there are often obvious deficiencies for which there are clear alternative action(s) that can be identified retrospectively. The alternative actions would likely target precipitating conditions or actions that either set in motion a cascade of unsuccessful 'catch-up' or 'salvage' actions, or were critical tipping points after which little could have been done.
- Possible: A case with some chance for an altered outcome would have fewer or weaker contributing factors and fewer or less specific quality improvement areas identified. These cases may parallel cases of women with similar conditions who survived; in that there may be a multitude of factors and actions that *could* have been reversed. However in these cases, it would have required actions that were beyond what could feasibly be accomplished in that setting or required an uncommon synchronization of corrective actions to have occurred. So while there is usually *something* that could have been done to have improved care and possibly reversed the fatal trajectory, the specific actions and their impact is less clear.
- None: A case with no chance to alter outcome has no clear point of prevention or intervention identified. In such cases, no intervenable risks were presented and there were no instances where improved care or alternative actions might have changed the outcome.

Second, for each PRD case, the PAMR Committee would identify whether health care providers, facility, or patient/community factors contributed to the death with the following question: *Do the factors identified in the improvement categories contribute to the maternal death?* This question has two choices to select (when the factor did not contribute to the death, the question should be left blank).

- Definitely: In the reviewer's best judgment, the factor was present and definitely contributed to the cause of death.
- Probably: In the reviewer's best judgment, the factor was present and probably contributed to the cause of death.

These assessments of preventability are based on PAMR Committee review and represent the first year of collecting these factors. The Florida PAMR Committee members are optimistic that this information will help to focus the PAMR Committee recommendations.

Results

Overall, in 2014, 51.4% of PRDs had a strong chance to alter the outcome and prevent the maternal death, and 20.0% had at least a possible chance to alter the outcome.

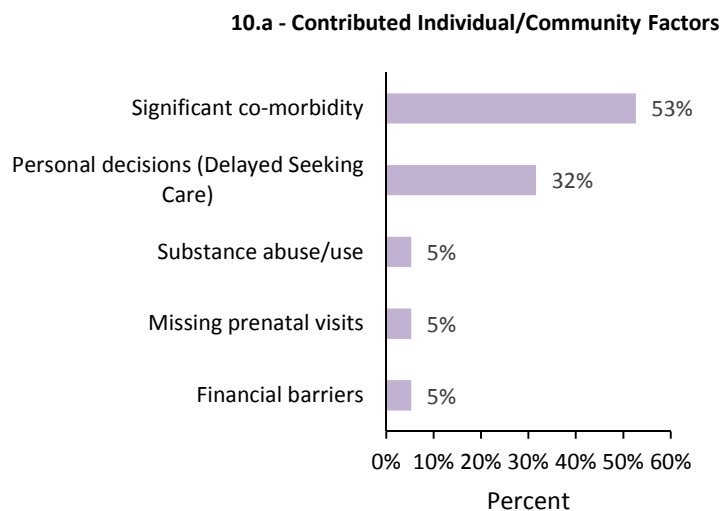
Table 2. Pregnancy-Related Death and Preventability, Florida 2014 (n=35)

Cause of PRDs	PRDs with Chance to Alter Outcome				Total	% Strong Chance to Alter Outcome
	Strong	Possible	None	N/I		
Hemorrhage	7	0	0	2	9	77.8%
<i>Intrauterine</i>	5	0	0	1	6	83.3%
<i>Ectopic</i>	2	0	0	1	3	66.7%
Cardiomyopathy	2	1	0	3	6	33.3%
Infection	2	3	0	0	5	40.0%
Hypertensive disorder	2	0	0	1	3	66.7%
Thrombotic embolism	2	1	0	0	3	66.7%
Amniotic fluid embolism	0	0	0	1	1	0.0%
Other	1	0	0	1	2	50.0%
Anesthesia	0	1	0	0	1	0.0%
Cardiovascular	1	0	0	0	1	100.0%
Cerebrovascular accident	0	1	0	1	2	0.0%
Unknown	1	0	0	1	2	50.0%
Total	18	7	0	10	35	51.4%

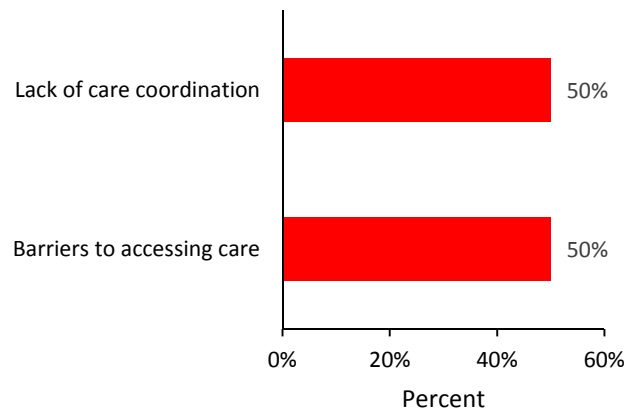
The leading causes of death showed variation (Table 2). Intrauterine hemorrhage had 83.3% strong chance to alter the outcome, hypertensive disorders, and thrombotic embolism both had 66.7% strong chance to alter the outcome, while infection and cardiomyopathy had 40.0% and 33.3%, respectively.

For 2014 PRDs, the Florida PAMR Committee identified definite and possible factors that could have contributed to the maternal deaths. These factors were identified by Individual/Community Factors, System Facility Factors, and Clinical Factors. Each patient may have had multiple contributing factors. By individual/community the factors that definitely contributed were significant co-morbidities, personal decisions, substance abuse, missing prenatal visits, and financial barriers. Systems issues were related to lack of care coordination and barriers to accessing care insurance/provider shortage/transportation. Clinical factors were delay of treatment, lack of treatment, lack of diagnosis, delay of diagnosis, knowledge/skill assessment, communication/documentation, prevention-patient education, and care coordination-referrals (Figures 10.a, 10.b and 10.c).

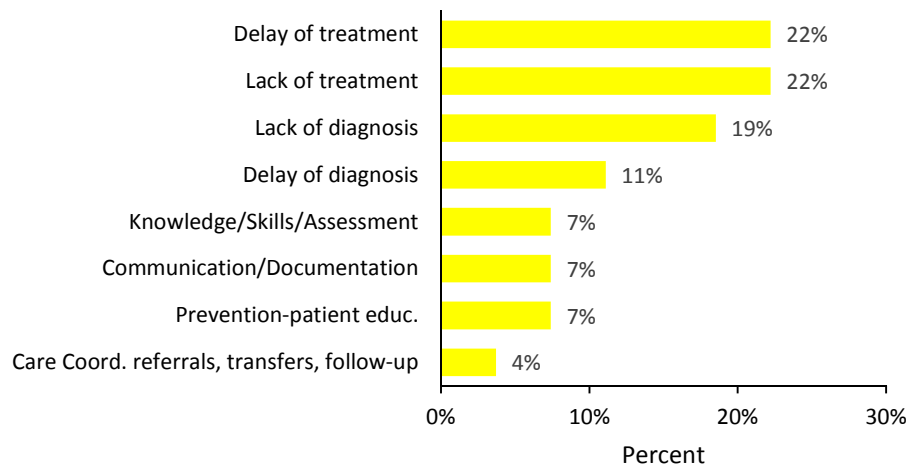
Figures 10a, 10b, and 10c. Contributed Factors among Pregnancy-Related Deaths, Individual and Community Factors (10.a), System Factors (10.b) and Clinical Factors (10.c), Florida, 2014



10.b - Contributed System Factors



10.c - Contributed Clinical Factors



By cause of death, hemorrhage (intrauterine and ectopic), hypertensive disorder, and thrombotic embolism had the higher percentage of contributing factors (67% for each), followed by women who died from infection (60%). There was only one PRD in this timeframe with cardiovascular problems (Table 3).

Table 3. Pregnancy-Related Death by Likelihood Factors Contributed and Cause of Death, Florida 2014 (n=35)

Cause of PRD	Factors that Contributed			Total	% Definitely Factor Contributed
	Definitely	Possible	N/I		
Hemorrhage	6	1	2	9	66.7%
<i>Intrauterine</i>	4	1	1	6	66.7%
<i>Ectopic</i>	2	0	1	3	66.7%
Cardiomyopathy	1	0	5	6	16.7%
Infection	3	2	0	5	60.0%
Hypertensive disorder	2	0	1	3	66.7%
Thrombotic embolism	2	1	0	3	66.7%
Cerebrovascular accident	0	1	1	2	0.0%
Other	1	0	1	2	50.0%
Cardiovascular	1	0	0	1	100.0%
Amniotic fluid embolism	0	0	1	1	0.0%
Anesthesia	0	1	0	1	0.0%
Unknown	1	0	1	2	50.0%
Total	17	6	12	35	48.6%

Conclusion

The death of a woman due to pregnancy is a loss to the family, community, state, and nation. Florida has been actively conducting ongoing surveillance of maternal mortality cases since 1996. To date, over 2,400 pregnancy-associated cases have been reviewed by a multidisciplinary PAMR Committee of maternal child specialists. Each de-identified case is carefully and respectfully considered by the committee before issues are identified and recommendations are made.

The 2014 report shows the consistent disparity in pregnancy-related deaths between non-Hispanic Black and non-Hispanic White women. Non-Hispanic Black women were two times as likely to have a pregnancy-related death compared to non-Hispanic White women.

The Healthy People goal for 2020 is to reduce the rate of maternal mortality to 11.4 maternal deaths per 100,000 live births [3]. Florida's pregnancy-related ratio from 1999-2014 averaged 18.0 deaths per 100,000 live births, therefore much work is still needed to meet the Healthy People goal.

Recommendations to Action

Florida's PAMR findings and recommendations are proposed to improve risk factors among individuals, communities, clinical and health care systems not only to reduce maternal deaths but to consequently improve maternal morbidity. The Department collaborates with diverse public and private organizations to pursue multifaceted approaches to moving recommendations into tangible actions.

Individual/Community, Clinical and System

Beginning in 2011, the Department, in partnership with the Florida Perinatal Quality Collaborative (FPQC), and the March of Dimes established a perinatal health care quality initiative to reduce non-medically indicated deliveries <39 weeks gestation (NMID).

The Department, the FPQC, and the March of Dimes joined with the national Collaborative Improvement and Innovation Network (CoIIN), sponsored by the Health Resources and Services Administration (HRSA), to focus on reducing early elective deliveries (EED). Primary activities included the development of a hospital toolkit to assist hospitals in reducing their rates of non-medically indicated deliveries of less than 39 weeks (NMID), grand hospital rounds and consultations, provider education and data support to 55 participating Florida hospitals.

The Department, the FPQC, and the March of Dimes coordinated with the Florida Association of Healthy Start Coalitions to lead an effort in educating pregnant women in the community on NMID by offering provider education packets and e-bulletins. Data provided by the FPQC indicates Florida's NMID rate decreased by 15% between 2010 and 2013.

Clinical and System

In fiscal year 2014/15, the Department contracted with the FPQC to implement the Obstetric Hemorrhage Initiative (OHI) addressing the leading cause of maternal death by providing an evidence-based toolkit to hospital participants and support for implementation of evidence-based guidelines. A highlighted activity in the hospital toolkit is interdisciplinary simulation drills designed to improve response times and treatment

approaches in an obstetric hemorrhage event. Participating hospitals seek to improve their risk assessment rates, as well as diagnosis and treatment approaches. The OHI is ongoing and the FPQC continues to offer technical support and self-assessment tools to hospitals pursuing this quality improvement initiative.

Individual/Community, Clinical and System

The Department is currently contracting with the FPQC to implement a Hypertension in Pregnancy (HIP) initiative. The HIP initiative is a quality improvement effort to address the second leading cause of maternal mortality and morbidity in the state from 2005-2013. A primary focus is the development of a toolkit to guide hospital participants in implementation and evaluation of quality improvement processes related to prevention, diagnosis and treatment of hypertensive disorders in pregnancy.

Individual/Community

A reoccurring recommendation from Florida's PAMR committee is the importance of women achieving optimal health and control of chronic diseases prior to pregnancy. Florida's Healthy Start Program, administered by the Department statewide, provides support services for pregnant women, infants and children to age three. In 2014, the Department added interconception care services (ICC) as a core component to the Healthy Start program. ICC services are provided to women who have had a pregnancy and are at high risk of having a poor birth outcome for a subsequent pregnancy. Reasons for a high-risk determination could be a previous fetal or infant loss; a low birth weight or pre-term baby; a chronic disease; such as hypertension, obesity or diabetes, previous pre-eclampsia or eclampsia, previous gestational diabetes; substance use or abuse; depression; or any other condition that could result in a poor birth outcome.

In August 2014, the Department, in partnership with the national Association of Maternal and Child Health Programs, was selected as a participant in the Every Mother Initiative Action Learning Collaborative. The collaborative is designed to support and improve maternal mortality reviews and translation of recommendations into actions by facilitating peer-to-peer maternal mortality site visits between selected states and implementing a community-driven project while applying sustainable approaches to screening, prevention, treatment, and promotion of healthy behaviors. The collaborative included the Department partnering with REACHUP, INC., a community based non-profit to raise

awareness of preconception health and to expand the Preconception Peer Educator (PPE) program in historically black colleges and universities. The PPE program trains students to educate their peers and raise awareness of infant mortality, maternal mortality, health disparities, healthy behaviors and encourages participants to engage in community awareness events.

Clinical

A PAMR Action Subcommittee was formed in September 2015 to focus on fine tuning and rapidly and widely distributing PAMR recommendation messaging to professional, clinical and community organizations through multiple communication venues. The first Urgent Maternal Mortality Message was developed and reviewed by the PAMR committee at large. The topic focused on important messages to providers regarding placental disorders and associated risk of hemorrhage, a leading cause of pregnancy-related death in Florida (Appendix 4).

The mixture of these efforts highlights the PAMR emphasis on actively improving maternal outcomes through the evaluation of maternal mortality cases, the development of expert recommendations, and the innovative translation of recommendations into effective actions.

Appendix 1 - Definitions

- *Body Mass Index (BMI)* - is a calculated measure of the relative percentage of body fat based on height and weight.
 - *Formula for BMI calculation:* $BMI = (\text{weight (pounds)}/\text{height (inches)}^2) \times 703$
 - *BMI Classifications and Value Ranges for Adults (ages 20 or older)*
 - Underweight: BMI <18.5
 - Normal Weight: BMI 18.5 - 24.9
 - Overweight: BMI 25.0 - 29.9
 - Obese Class I: BMI 30.0 - 34.9
 - Obese Class II: BMI 35.0 - 39.9
 - Obese Class III: BMI 40.0 or more
- *Pregnancy-associated death* - a death of a woman from any cause, while she is pregnant or within one year of termination of pregnancy, regardless of the duration and site of pregnancy.
- *Pregnancy-associated mortality ratio (PRMR)* - number of pregnancy-related deaths per 100,000 live births; a measure of maternal mortality.
- *Pregnancy-related death* - a death of a woman that is directly attributed to pregnancy and/or childbirth.
- *Pregnancy outcome*
 - *Abortion* - A procedure to end a pregnancy. Medicinal and surgical methods are used to remove an embryo or fetus and placenta from the uterus [2].
 - *Ectopic* – Occurs when the fertilized egg grows in an abnormal place outside the uterus, usually in the fallopian tubes [4].
 - *Emergency delivery* – An unplanned, emergency cesarean delivery (C-section) due to deteriorating maternal or fetal status. The outcome could be a live birth or fetal death/stillbirth [5].
 - *Postmortem/perimortem cesarean section:* – An unplanned, emergency cesarean delivery (C-section) that is conducted shortly after a maternal death or during the maternal death process [6].
 - *Live birth* – The complete expulsion or extraction from the mother of a product of human conception that shows evidence of life after expulsion/extraction [5].
 - *Molar* – (also known as hydatidiform mole) A noncancerous (benign) tumor that develops in the uterus. A molar pregnancy starts when an egg is

fertilized, but instead of continuing to the stages of a viable pregnancy, the placenta develops into an abnormal mass of cysts [7].

- *Stillbirth* – Death of a fetus before the complete expulsion or extraction from the mother irrespective of the duration of pregnancy; the death is indicated by the fact that after expulsion or extraction, the fetus does not show any evidence of life [5].
- *Undelivered* – A woman that dies before delivering or the extraction of her fetus [5].
- *Timing of death* - perinatal period in which PRDs occur; three main classifications
 - *Prenatal PRD* – occurs between conception and birth.
 - *Labor and Delivery PRD* – occurs between the start of the delivery process and ends when the mother leaves the delivery room.
 - *Postpartum PRD* – occurs during the period after labor and delivery and up to one year after delivery or termination of pregnancy. The Postpartum PRD classification has two sub classifications:
 - *Postpartum – Not discharged from the Hospital/Health Facility PRD* – occurs in the postpartum period after delivery or termination of pregnancy and before discharge from the hospital/birth facility.
 - *Postpartum – Discharged from Hospital/Health Facility PRD* – occurs in the postpartum period after delivery/termination of pregnancy and after discharge from a hospital or health facility up to one year after the delivery/termination event.
- *Type of delivery*
 - *Cesarean* – An assisted delivery procedure where an infant or fetus is delivered through surgical incisions made in the abdomen and the uterus [8].
 - *Vaginal* – Delivery of an infant or fetus through the vaginal canal.

Appendix 2 - PAMR Case Selection Process for Committee Review

The PAMR process begins with collecting data for all Florida resident deaths that are associated with pregnancy. 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. The Florida Department of Health 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 utilized by the Bureau of Vital Statistics.

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 International Classification of Diseases (ICD) diagnosis code indicates a death classified as being due to “Pregnancy, Childbirth, and the Puerperium”.
- 3) There is a matching birth or fetal death record within 365 days prior to the woman’s death.
- 4) There is a matching Florida universal prenatal screening tool, which is used to identify and assess pregnant women at risk for adverse birth outcomes within 365 days prior to the woman’s death.

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.

Quarterly, the PAMR case selection committee composed of PAMR committee members (an obstetrician, a nurse, PAMR data manager, and a PAMR coordinator) reviews ascertained pregnancy-associated cases by cause and time of death to categorize the cases as pregnancy-related, possibly pregnancy-related, or not pregnancy-related. The

pregnancy-associated cases determined to be either pregnancy-related or possibly pregnancy-related are submitted for record abstraction and subsequent review by the full PAMR Committee. 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, case abstraction and review of “possibly pregnancy-related” and “not pregnancy-related” cases may occur.

*For additional details of the PAMR case ascertainment process, see the following:
Burch D, Noell D, Hill WC, Delke I. Pregnancy-associated mortality review: the Florida experience. *Semin Perinatol*. 2012; 36: 31-6.*

Appendix 3 – Florida Pregnancy Associated Mortality Review Members, 2015

PAMR Committee Co-Chairs

- **Kris-Tena Albers, ARNP, CMN** – Chief, Bureau of Family Health Services, Title V MCH Director, DOH
- **Anthony Gregg, MD** - Professor & Chief, Division of Maternal-Fetal Medicine/Department of Obstetrics and Gynecology/University of Florida

PAMR Coordinator

Rhonda Brown, RN, BSN - Program Administrator, Maternal & Child Health Section, DOH

PAMR Lead Abstractor

Dani Noell, ARNP, NNP, BC, MSN - PAMR Facilitator & Abstractor, DOH

PAMR Committee Review Members

Estrellita “Lo” Berry, MA, LTFP – President, REACHUP Inc.

Gene Burkett, M.D - Professor, University of Miami, Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology

Anthony Clark, MD - Medical Examiner, KWB Pathology Associates; Medical Examiner's Commission

Cheryl Clark, DrPH, RHIA - Sr. MCH Epidemiologist/Training & Research Manager, Division of Children's Medical Services, DOH

Mary Kaye Collins, CNM, MN, JD, FACNM - Assistant Professor, Nursing, Indian River State College; American College of Nurse-Midwives

Carol Cox, MD – University of Florida, Department of Obstetrics and Gynecology

Isaac Delke, MD - Professor and Medical Director, University of Florida, College of Medicine; ACOG

Christine Hackshaw, CNM, ARNP - American College of Nursing-Midwives

Nancy Hardt, MD - Professor, Obstetrics and Gynecology; Pathology/University of Florida

Karen Harris, MD, MPH - Chair, Florida District XII/ACOG (Since May 2015); President, North Florida Women's Physicians, PA

Leticia Hernandez, PhD, MS – MCH Epidemiologist, Maternal & Child Health Section, DOH

Washington Hill, MD – Emeritus

Joan Hulett, RNC Retired, Florida Chapter Association of Women's Health, Obstetric and Neonatal Nurses

Ashlee Morgan, RN, BSN – Nursing Consultant, Maternal & Child Health Section, DOH

Jane Murphy, MPA - Executive Director, Healthy Start Coalition of Hillsborough County

William Sappenfield, MD, MPH - Professor & Chair, College of Public Health, Chair Lawton and Rhea Chiles Center/University of South Florida

Robert Yelverton, MD – Chair, Florida District XII/ACOG

ACOG = American Congress of Obstetricians and Gynecologists; DOH = Florida Department of Health

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- [8] Cleveland Clinic. Types of Delivery. Available at: http://my.clevelandclinic.org/health/diseases_conditions/hic_Am_I_Pregnant/hic_Labor_and_Delivery/hic_Assisted_Delivery_Methods.

Hemorrhage is the leading cause of Pregnancy-Related maternal death in Florida. (1)

Placental disorders (including placenta previa, accreta/increta/percreta) accounted for 21% of hemorrhage related deaths > 20 weeks gestation. (1)

With the rising cesarean rate, the incidence of placenta accreta has increased. (2)

Urgent Maternal Mortality Message to Providers

Diagnosis is essential before delivery

- If placental disorder suspected, get a Maternal-Fetal Medicine consultation.
- Ultrasonography with supplemental MRI when necessary.
- No imaging modality is perfect. If you suspect an issue—transfer to tertiary facility.

Risk factors

- Discuss pregnancy and delivery risks with patient and family.
- The risk of accreta increases with repeat cesarean sections, myomectomy, presence of placenta previa, multiparity, repetitive dilation and curettages and with advanced maternal age.
- A low lying anterior placenta may be ominous with multiple prior cesarean sections.

Readiness

- Develop and discuss with the patient, family and hospital staff an individual delivery plan.
- Consider early transfer to a tertiary center for access to sufficient blood bank supply and subspecialties.
- Let patients know there is a high risk for bleeding due to placental disorders that can occur after having multiple cesarean sections.
- Contingency plan should be made for emergency delivery.

- Implementation of hemorrhage protocols in all Florida delivery hospitals is essential, and should include a massive transfusion protocol, simulation drills and hemorrhage carts. For details on implementing a hemorrhage initiative see Florida Perinatal Quality Collaborative's Toolkit. (3)

Essential elements of delivery plan

- Preoperative counseling regarding risks.
- Timing of admission and delivery: see ACOG guidelines, may vary if patient unstable.
- Consult with neonatologist regarding corticosteroid administration, if applicable.
- Place blood bank on alert for potential massive transfusion protocol.
- When delivery is scheduled, discuss timing with a multispecialty team to optimize expert surgical and anesthesia assistance.
- Do not try to remove the placenta. Hysterectomy is usually the best option.
- If you have called for help and cannot control the bleeding surgically, compress the aorta or uterine vessels while waiting for help to arrive.

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4. Florida Pregnancy Associated Mortality Review 2013 Update.