



Pregnancy-Associated Mortality Review

Florida Department of Health, Bureau of Family Health Services

Pregnancy-Related Deaths Due to Infection 2005-2014

Infection in pregnancy has been rising in the United States from 10.7% during 1998-2005 compared with 13.6% during 2006-2010.¹ The higher pregnancy-related mortality ratios (PRMR) in 2009 and 2010 were driven by the 2009 H1N1 influenza pandemic, a condition embedded in the infection category that disproportionately affected pregnant women (Figure 1).²⁻³ This brief provides an overview of pregnancy related deaths (PRDs) due to infections in Florida from 2005 to 2014, and includes evidence-based recommendations intended to reduce the risk of maternal death due to infections.⁴

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 care and system improvements through evidence-based actions intended to lower risks for PRDs.⁵

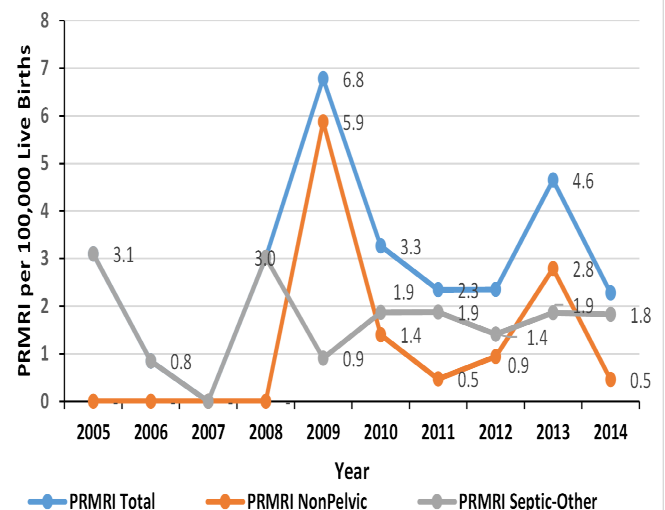
From 2005-2014, the Florida PAMR Committee classified 411 cases as PRDs. Figure 1 shows the distribution of these 411 deaths by cause of death. During this period (2005-2014), the top two leading causes of PRDs were hemorrhage (20.0%) and infection (15.3%).

Of the 411 PRDs, 63 were due to infection. The pregnancy-related mortality ratio due to infection (PRMRI) fluctuated from of 6.8 infection deaths per 100,000 live births during the year 2009 to 0.8 deaths in 2006. There were not deaths for infection in 2007. The PRMRI was 2.3 in 2014. The trend was not statistically significant for the 2005-2014 period.

Differences in PRMRI were found for maternal characteristics of race and Hispanic ethnicity, delivery type, prenatal care, body mass index (BMI), and gestational age.

The ages of the women who died from infection ranged between 17 and 45 years with a median age of 27 years. There were no statistically significant differences by age found.

Figure2. Pregnancy-Related Mortality Ratio Due to Infection (PRMRI), by Total, Non-Pelvic, Pelvic and Others, Florida 2005-2014



By race/ethnicity, 41% of women who died from infection were non-Hispanic Black, 30% were non-Hispanic White, and 29% were Hispanic and other races. Non-Hispanic Black women had a higher PRMRI of 5.4 compared with non-Hispanic White or Hispanic and non-Hispanic other races at 1.9 and 2.4 PRDs per 100,000 live births.

Infection is associated with cesarean delivery, 61% of women who died from infection had a cesarean delivery. Women who delivered by cesarean had a higher PRMRI of 3.6 compared to the PRMRI of 1.4 PRDs per 100,000 live births for women who had a vaginal delivery.

Women who had late or no prenatal care had a higher PRMRI of 4.8 compared with the women who had prenatal care during the first trimester of pregnancy at 2.0 PRDs per 100,000 live births.

Most of the women who died from infection (71%) were overweight or obese. Obese (BMI ≥ 30.0) women had a higher PRMRI of 6.6 compared with 1.4 PRDs per 100,000 live births for women with normal BMI (20-24.9).

Pregnant women who presented at the hospital with signs of infection may have a higher risk of preterm births. Women who had a gestational age of 28 weeks or less or between 29 and 36 weeks had a higher PRMRI of 84.4 and 5.2 PRDs per 100,000 live births compared with women who had a gestational age of 37 weeks or more

Figure 1. Distribution of Pregnancy-Related Causes of Death. Florida, 2005-2014 (N=411)

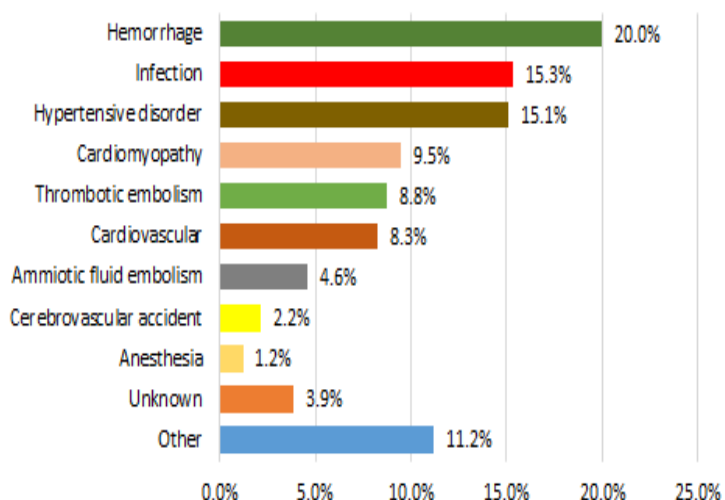


Table 1. Pregnancy-Related Mortality Ratios due to Infection: Rates per 100,000 Live Births (PRMRI) and Unadjusted Relative Ratios (RR), Florida, 2005-2014 (n=63)

Characteristics	Deaths	PRMRI	RR (95%CI)
Age			
<25	20	2.6	Ref.
25-34	31	2.7	1.0 (0.6-1.8)
35 +	12	3.6	1.4 (0.7-2.8)
Race			
Non-Hispanic White	19	1.9	Ref.
Non-Hispanic Black	26	5.4	2.8* (1.6-5.1)
Hispanic and other	18	2.4	1.2 (0.7-2.4)
Marital Status			
Married	34	2.9	Ref.
Not married	27	2.6	1.1 (0.7-1.8)
Mode of Delivery¹			
Vaginal	19	1.4	Ref.
Cesarean	30	3.6	2.7* (1.5-4.7)
Prenatal Care Initiation²			
First trimester	32	2.0	Ref.
Second-third or none	21	4.8	2.4* (1.4-4.2)
Body Mass Index Categories			
Underweight (BMI <20)	2	1.9	1.4 (0.3-6.3)
Normal (BMI 20-24.9)	14	1.4	Ref.
Overweight (BMI 25-29.9)	16	3.1	2.2* (1.1-4.7)
Obese (BMI ≥ 30)	29	6.6	4.9* (2.6-9.3)
Gestational Age (Wks)			
28 or less	20	84.4	70.4* (38.7-128.1)
29-36	15	5.2	4.3* (2.3-8.3)
37 or more	23	1.2	Ref.

1/ Excluded seven undelivered and four emergency cesarean deliveries . 2/ Excluded three women who died during the first trimester. *Statistically significant (p<0.05). Note: Missing information was not included .

Overall characteristics of women at increased risk of PRDs due to infection were (see Table 1):

- Non-Hispanic Black
- Second or third trimester entry to care, or no prenatal care
- Obese (BMI ≥ 30)

Infection is associated with:

- Cesarean deliveries
- Preterm births

References:

1. Creanga, A., Berg, C.J., Syverson, C., Seed, K., Bruce, F.C., Callaghan, W.M. (2015). Pregnancy-related mortality in the United States, 2006-2010. *Obstet Gynecol*, 125(1):5-12.
2. Centers for Disease Control and Prevention (CDC). (2011). Maternal and infant outcomes among severely ill pregnant and postpartum women with 2009 pandemic influenza A (H1N1) - United States, April 2009-August 2010. *MMWR Morb Mortal Wkly Rep.*, 60(35), 1193-6.
3. Creanga A, Johnson T, Graitcer S, et al. (2010) Severity of 2009 Pandemic Influenza A (H1N1) Virus Infection in Pregnant Women. *Obstet Gynecol*, 115 (4):717-726.
4. Bauer M, Lorenz R, Bauer S, et al. (2015). Maternal Deaths Due to Sepsis in the State of Michigan, 1999-2006. *Obstet Gynecol*, 126(4):747-752.
5. Burch, D., Noell, D., Washington, H., Delke, I. (2012). Pregnancy-Associated Mortality Review. The Florida Experience. *Seminars in Perinatology*. 36(1): 31-36.

Ninety four percent of PRDs due to infection occurred during the first two days of the postpartum period. Forty one percent of the deaths were classified as non-pelvic infection (ex: pneumonia) and 40% were due to generalize septicemia/septic shock, septic abortion (Ab) (Table 2).

Florida PAMR Committee Infection Recommendations for Actions:

Since 2013 the PAMR Committee has assessed the preventability of maternal deaths. Forty seven of PRD due to infection were deemed to be preventable while 60% had factors that definitely contributed. With the right treatment and knowledge/skills/assessment, 46% of the PRDs due to infection may have been prevented. Factors that definitely contributed were personal decisions (31%) and knowledge/skills/assessments (23%). The Florida PAMR Committee identified the following recommendations as opportunities to reduce the risk of PRDs due to infection.

Clinical Factors - Recommendations for Clinicians:

- It is important to treat promptly any pregnant woman who presents with influenza like illness
- It is important to perform a thorough assessment including evaluation of vital signs prior to discharge
- Septic abortion requires rapid intervention

System Factors -

- Establish standards for assessment and treatment of patients suspected of having H1N1
- Facilities should have admission and treatment protocols to stabilize a pregnant or postpartum woman with positive sepsis screen

Individual and Community Factors -

- Every pregnant woman should have a flu shot
- Pregnant women should receive education about seeking care with signs and symptoms of illness including fever and shortness of breath
- Pregnant women should seek care for persistent fever

Table 2. Pregnancy-Related Deaths Due to Infection by Causes, Florida, 2005-2014 (n=63)

Causes	Prenatal	Postpartum	Total Deaths (%)
Chorioamnionitis/Antepartum Infection	0	2	2 (3.2%)
Postpartum Pelvic Infection	0	6	6 (9.5%)
Generalized Septicemia/Septic Shock, Septic Abortion	3	22	25 (39.7%)
Peritonitis	0	3	3 (4.8%)
Nonpelvic Infection (ex: Pneumonia)	1	25	26 (41.3%)
Other	0	1	1 (1.6%)
Total Deaths Due to Infection	4	59	63 (100%)