Assessing Prenatal Risk Screening and Severe Maternal Morbidity in Florida 2010-2014

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Background

Since 1998, several pregnancy recommendations and pregnancy care actions have been implemented in Florida based on the findings of Florida's Pregnancy Associated Mortality Review (PAMR) team. Most of the recommendations are related to the care of women during pregnancy, delivery, and the postpartum period. Some recommendations are related to preconception or interconception care, a time of prevention and preparation for a future pregnancy without complications [1].

The Florida Healthy Start Program was signed into law in June 1991. Healthy Start is a program designed to prevent adverse birth and infant health outcomes through the provision of health education; medical, psychosocial and social service referrals; and care coordination services. Healthy Start program services are provided in each of Florida's 67 counties [2]. In the same year, the Florida Prenatal Risk Screening was developed by the Florida Department of Health and is used by the Healthy Start program to identify women at-risk of poor maternal and child health outcomes [3]. Risk factors on the screen include: age, race, marital status, education, weight, domestic violence, sexual abuse, tobacco or alcohol use, unwanted pregnancy, first pregnancy, previous pregnancy problems or loss of a baby, maternal illness, and late entry into prenatal care [3]. Florida law mandates that all women in Florida are offered prenatal risk screening at their first prenatal visit. A score on the screen of 6 or more indicates the pregnant woman is at-risk for a poor birth outcome and, with her consent, her provider may refer her to Healthy Start for care coordination.

Severe maternal morbidity (SMM) is associated with a high rate of preventability, like that of maternal mortality [4]. It is also considered a near miss for maternal mortality [4]. SMM affected more than 65,000 women in the United States in 2016 [5]. SMM includes unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman's health [6]. To identify delivery hospitalizations with SMM, the Centers for Disease Control and Prevention (CDC) uses administrative hospital discharge data and International Classification of Diseases (ICD), 9th Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes [6].

The purpose of this study was to determine the association between Florida's prenatal risk screening score and SMM in women residing in Florida who had a singleton live birth between 2010-2014, and identify other factors associated with SMM.

Methods

For this study, a linked data file of Florida prenatal risk screening data, hospital discharge data, and live birth certificates were used for the period 2010-2014. The prenatal risk screening instrument has 21 questions to be filled out by the provider to determine the total screening score. If the score is 6 or more, the patient is referred to Healthy Start for services. The patient can accept or decline services. Hospital discharge data from Florida's Agency for Health Care Administration was used to calculate obstetric complications and estimate SMM rates using ICD-9-CM diagnosis and procedure codes and we included the 25 conditions used by Callaghan [7]. The prenatal risk screening data, hospital discharge data, and birth certificates were linked to get demographic and social characteristics. The outcome measure was SMM from the hospital discharge data and the predictor measure was the prenatal risk score classified in three categories of risk screening score: less than 6, 6-9, and 10 or more.

Other covariates were included in the model as confounders. From the birth certificate: mother's age, race/ethnicity, education, hypertension, diabetes, and payer-source. The Institutional Review Board approved this research. All statistical analysis was completed using STATA/SE version 14.2

Results

Between 2010 and 2014, there were 982,167 delivery hospitalizations in Florida. Of these deliveries, 99.7% (979,669) were linked to births records and 99% (972,128) were identified as delivery hospitalizations based on ICD-9 V27 code; 746,846 records were linked to the prenatal screening file representing 76% of all delivery hospitalizations. After selecting only singleton births, the final linked file used for this study had 722,912 records, 74% of all delivery hospitalizations.

The overall SMM rate for Florida between 2010 and 2014 was 152.4 per 10,000 delivery hospitalizations. The trend analysis shows a statistically significant increase with an annual percentage change of 2.9. The trend analysis graphic is depicted in Figure 1.

The leading condition of severe morbidity per 10,000 hospitalizations was blood transfusion with a SMM rate of 100.3. Other leading conditions were heart failure (9.2), operation on heart and

pericardium (7.8), disseminate intravascular coagulation (7.4), and hysterectomy (7.3) – data not shown. The adjusted risk ratios presented in Table 1 show that women who had a risk screening score of 6-9 were significantly more likely to experience SMM (aRR:1.2, CI:1.1-1.2) than women with a screening score of less than 6. Women who had a risk screening score of 10 or more, were almost twice as likely to experience SMM (aRR:1.5, CI:1.4-1.6) than women with a screening score of less than 6. By demographic or health characteristics, higher SMM ratios were found in non-Hispanic black women when compared with non-Hispanic white women (aRR:1.7, CI:1.7-1.8); women 35 or older compared with women 18-34 (aRR:1.4, CI:1.3-1.5); women with Medicaid or Medicare (aRR:1.2, CI:1.2-1.3) compared with women with private insurance; women with chronic (aRR:1.8, CI:1.7-2.1) or gestational hypertension (aRR:2.4, CI:2.3-2.6) compared with women without hypertension; and women with chronic diabetes (aRR:1.5, CI:1.3-1.7) compared with women without diabetes. When examining for interaction effects among independent variables, prenatal risk score (6 or more vs. less than 6) and SMM, significant associations were identified with race/ethnicity and maternal age. Hispanic and non-Hispanic white women with a risk score of 6 or more experienced higher risk of SMM (aRR:1.5, CI:1.4-1.7) and (aRR:1.4, CI:1.3-1.5) than Hispanic and non-Hispanic white women who had a risk score of less than 6 (Figure 2). Likewise, women ages 35 or more and 18-34 with a risk score of 6 or more were more likely to experience SMM (aRR:1.4, CI:1.3-1.6) and (aRR:1.2, CI:1.1-1.3), than women in the same two age groups with risk scores less than 6 (Figure 3).

Discussion

Women in Florida with prenatal screen scores of 6 to 9 and 10 or more were more likely to have SMM at delivery than women with a score of less than 6. Women who score 6 or more on the prenatal screen are offered Healthy Start services including care coordination, health/social program referrals, and other social support services to reduce adverse birth outcomes [3]. The Healthy Start program also includes home visitation services by a nurse, social worker, early childhood educator, and other trained professionals or trained paraprofessionals during pregnancy [8]. Acceptance of these services is not required, but those who do accept receive a series of services tailored to their individual health and social needs. Most pregnant women are seen repeatedly by doctors or other health care providers during their pregnancy. These visits create an opportunity for the detection of risk factors and subsequent appropriate interventions [9]. Research shows that when pregnant women's health and needs are addressed, the chances of SMM decrease.

Women who were non-Hispanic black, either 35 or older, on Medicaid-Medicare, presented chronic or gestational hypertension, or presented chronic diabetes were associated with a high probability of SMM. These variables are included in the prenatal risk screen. In 2008, a newly designed prenatal risk screen was implemented. The Florida Department of Health, in collaboration with other perinatal health professionals, invested two years developing the revised screening criteria [10]. Every year, the Department's Maternal and Child Health Section performs a prenatal screen evaluation to ensure the performance of the prenatal screening is maintained and to assess the possibility of improving screening performance. Depending on the results, a decision is made as to whether revisions to improve the screening are warranted. Between 2009 and 2017, there was no analytical evidence that modifications would yield substantial improvement to the prenatal screen [11].

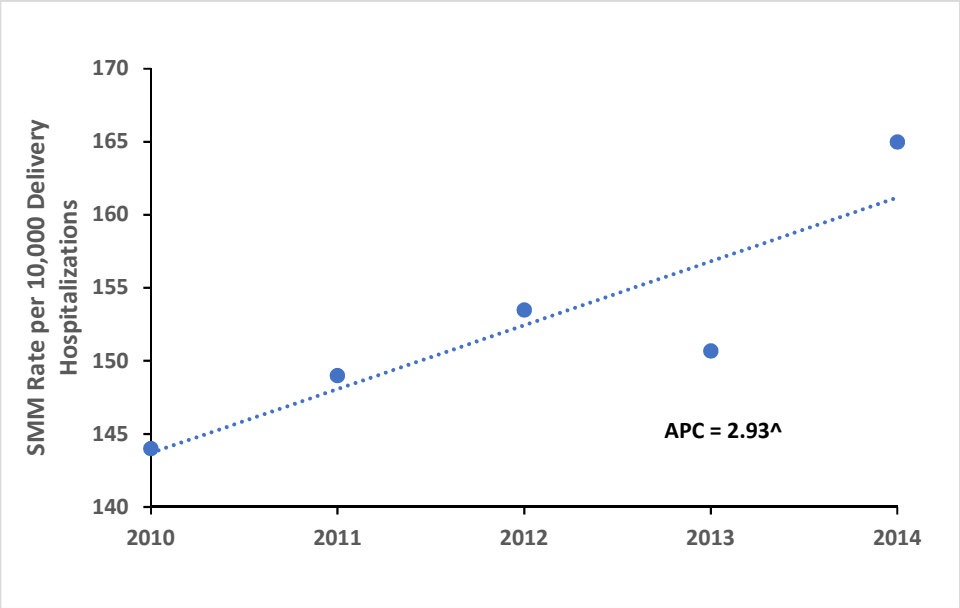
The interaction results presented in Figures 2 and 3 show there is a significant risk of SMM for non-Hispanic white and Hispanic women when comparing prenatal risk scores of 6-10 with scores less than 6. The result for non-Hispanic black women where the comparison between the two risk scores and SMM interaction was not significant shows how black women are at high-risk of SMM, with low or high prenatal risk scores. Our finding where black women are at risk of SMM regardless of the prenatal risk score may be attributed to inherent racial bias in the provision of healthcare services, showing the importance of insuring access to quality healthcare to reduce racial disparities. The New York Times Magazine article, "*Why America's Black Mothers and Babies are in a Life or Death Crisis"* says: "societal racism is further expressed in a pervasive, longstanding racial bias in healthcare-including the dismissal of legitimate concerns and symptoms-that can help explain poor birth outcomes even in the case of black women with the most advantages." [12]. The study *Quality of Care and Disparities in Obstetrics* found that quality improvement efforts targeting the lowest-performing hospitals could lower the SMM rates and narrow the black-white morbidity gap [13].

Likewise, there is significant risk of SMM for women 18-34 and 35 or more when comparing risk scores for these two groups (6 or more vs. less than 6). Women under 18 are at risk for experiencing SMM regardless of whether they have low or high-risk screening scores. Evidence shows younger mothers have poor access to antenatal and delivery care than older women [14].

This study has the following limitations: The ICD-9-CM could be subject to underestimating the prevalence of SMM. Some hospital discharge records could not be linked to birth records and some hospital birth records could not be linked to prenatal screening records, which leads to underestimations for all variables. Therefore, these findings may not be generalizable to all women screened.

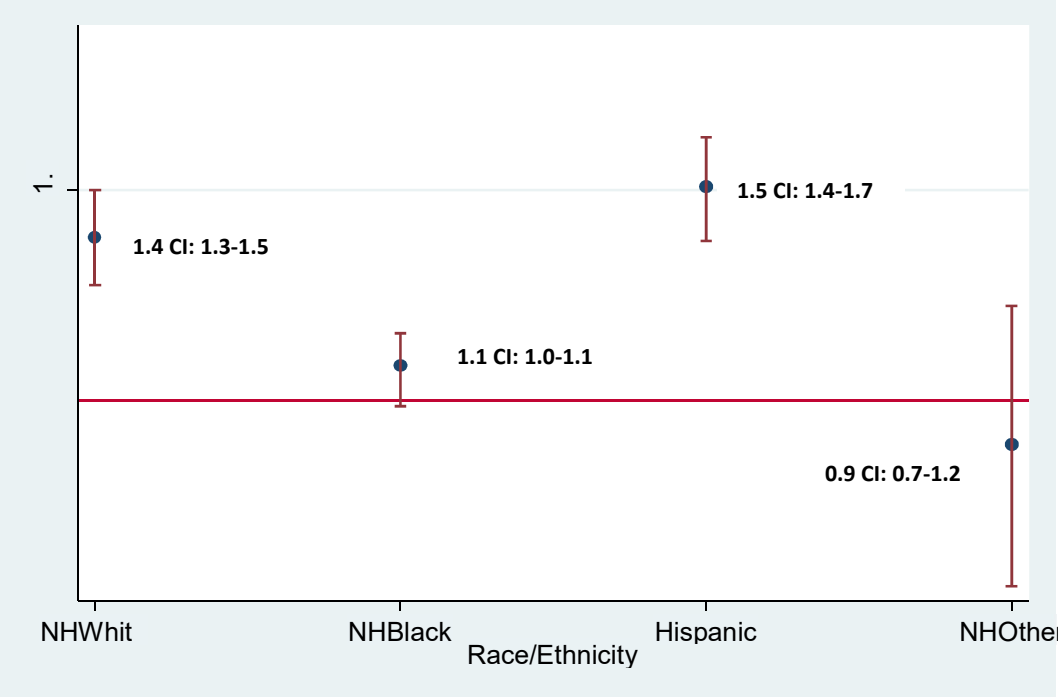
There are two public health implications related with this study. First, the study demonstrates that prenatal risk screening results can be used to predict maternal morbidity. Second, providers should explain to their pregnant patients how their maternal health conditions can impact their pregnancy outcomes and postpartum maternal health.

Figure 1. Severe maternal morbidity trend analysis, Florida 2010-2014



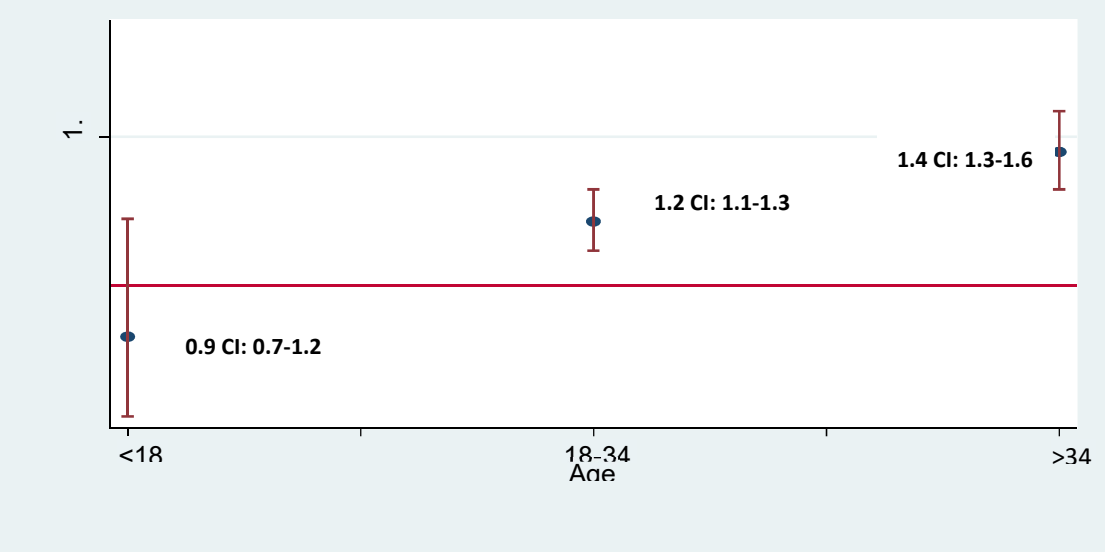
^ p <=0.05

Figure 2. Stratum-specific adjusted risk ratios for the prenatal risk screening score and the SMM among women in different race/ethnicity groups, Florida 2010-2014



Adjusted for race/ethnicity, age, education, hypertension, diabetes and payer source.

Figure 3. Stratum-specific adjusted risk ratios for the prenatal risk screening score and the SMM among women in different age groups, Florida 2010-2014



Adjusted for race/ethnicity, age, education, hypertension, diabetes and payer source.

Table 1. Crude and adjusted risk ratios of severe maternal morbidity by prenatal risk screening, demographic and health characteristic, Florida 2010-2012

Characteristics	Crude Risk Ratio (95% C.I.)	Adjusted Risk Ratio (95% C.I.)
Screening Score		
Less than 6	Ref.	Ref.
6-9	1.6 (1.5-1.7)*	1.2 (1.1-1.2)*
10 and More	2.4 (2.2-2.5)*	1.5 (1.4-1.6)*
Race/Ethnicity		
Non-Hispanic White	Ref.	Ref.
Non-Hispanic Black	2.1 (2.1-2.3)*	1.7 (1.7-1.8)*
Hispanic	1.3 (1.2-1.4)*	1.3 (1.2-1.3)*
Non-Hispanic Other	1.2 (1.1-1.4)*	1.2 (1.1-1.4)*
Age		
Less than 18 Years	1.3 (1.1-1.4)*	0.9 (0.8-1.1)
18-34 Years	Ref.	Ref.
35 Years or Older	1.4 (1.3-1.4)*	1.4 (1.3-1.5)*
Education		
Less than High School Diploma	1.1 (1.1-1.2)*	1.1 (1.0-1.1)*
High School Diploma	Ref.	Ref.
Greater than High School Diploma	0.8 (0.8-0.8)*	0.9 (0.9-1.0)*
Hypertension		
None	Ref.	Ref.
Chronic	2.4 (2.2-2.7)*	1.8 (1.7-2.1)*
Gestational	2.6 (2.4-2.7)*	2.4 (2.3-2.6)*
Diabetes		
None	Ref.	Ref.
Chronic	2.1 (1.8-2.4)*	1.5 (1.3-1.7)*
Gestational	1.2 (1.1-1.3)*	1.1 (1.0-1.2)
Payer Source		
Medicaid-Medicare	1.4 (1.4-1.5)*	1.2 (1.1-1.3)*
Commercial	Ref	Ref.
Self-Pay	1.2 (1.0-1.3)*	1.0 (0.9-1.2)
Other	1.3 (1.1-1.4)*	1.3 (1.2-1.5)*

Adjusted for race/ethnicity, age, education, hypertension, diabetes and payer source. *p<0.05

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