Assessment of the 2017 Florida Current Prenatal Risk Screening Implemented in 2013 Linked to Birth Records

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Introduction and Background

Enacted in June 1991 and implemented in April 1992, Florida's Healthy Start initiative includes Florida Department of Health (DOH) universal prenatal and infant risk screening to identify pregnant women and infants at risk for adverse birth, health and developmental outcomes. Section 383.14(a), Florida Statute states: "The department shall develop a multilevel screening process that includes a risk assessment instrument to identify women at risk for a preterm birth or other high-risk condition."

The original prenatal risk screen instrument was developed in 1991 by the Florida Department of Health in collaboration with the Healthy Start Advisory Committee, which included representatives from Florida's county health departments, universities, the legislature and the private health care sector. The prenatal risk screen was designed to identify pregnant women at a higher risk for having an adverse birth outcome, including preterm birth and low birth weight, so that those women could be targeted for intervention and risk-reduction services. The prenatal risk screening criteria were revised in 1994 and, although the design of the screening form was changed in the interim, the screening criteria were not revised again until July 2008. The 2008 revisions were made in conjunction with a newly designed prenatal risk screening form.

The revised screening criteria implemented in 2008 were developed over a period of two years with the goal of improving the accuracy, ease of use and acceptability of the prenatal risk screening. Department of Health staff in collaboration with perinatal health professionals and experts from Florida's county health departments, Healthy Start coalitions, and universities were involved in developing the revised screening criteria. Extensive reviews of the research literature and analysis of available data were also conducted.

The purpose of this analysis is to assess the performance of the prenatal screening in its ability to accurately detect high-risk pregnancies and to determine if substantial improvement in screening performance could be achieved by changing the screening criteria.

Methods

The data used in this analysis were 2017 Florida resident singleton birth records linked to prenatal screening records for the period April 1, 2016 to December 31, 2017. Multiple births were excluded from the analysis because they tend to have risk factors for low birthweight and preterm birth that are different from the risk factors for singleton births. There were 252,986 prenatal screening records for the period April 2016-December 2017. The screening records were unduplicated so that each woman was represented by only one record in the data file, as some women may be screened more than once

during a pregnancy or may be pregnant more than once in a single year. When more than one screening record was detected for the same woman, the record with the earliest screening date was selected. Screening records were then linked to birth records in two ways. The first linking process used the mother's Social Security number to link the records. The second linking process used the first five letters of the mother's first name and the birth date to link the records. The linked records were checked for invalid time spans between the screening date and birth date. Time spans of less than 1 day and more than 280 days were excluded.

After both linking processes were completed and exclusions for invalid time spans and multiple births were made, there were 106,754 prenatal screening records linked to 2017 singleton births. Approximately 49% of singleton births could be linked to prenatal screening records. Some of the prenatal screening records did not link to birth records because the pregnancies did not end with live births. In some cases, live births may have occurred in another state if the pregnant woman relocated after the screening, but before the birth. Also, some prenatal screening records did not link to birth records due to a failure of the linking process. With the data available for this analysis, it is not possible to determine what proportions of the non-linked records are attributable to each of these factors.

All statistical analysis was performed using Stata 14. Multifactorial generalized linear model (GLM) regression was used to examine the association between adverse birth outcomes (AO) and each of the screening factors. AO were defined as births at less than 37 weeks gestation and births weighing less than 2500 grams. GLM techniques were also used to construct an optimal screening criterion that could be compared to the performance of the current criteria by using GLM results to compute the probability of AO for every woman in the data set. All screening factors were used to compute these probabilities, and women with the highest computed probability of AO were classified as positive. Comparatively, the current screening criteria is based only on scored screening factors and women are classified positive using a simple additive point system. The positive percentage for the current screening was 25%, so this was used as the cutoff for the optimal screening. Thus, the top 25% of the women, based on the computed probability of AO, were classified as positive on the optimal screening. Since the positive percentage was identical for the current and optimal screenings, the performance of the two screenings could be directly compared.

Results

Table 1 shows the percentage of AO for all screening factors on the prenatal screening form. The scored factors are used in computing the risk screening score. The number of points for each factor is also shown in Table 1. A score of six or more is classified as a positive screening. The unscored factors are used for assessment purposes but are not used in computing the screening score.

The AO percentage for all women in the analysis is 10.8%. Factor-specific AO percentages are generally higher than the overall AO percentage of 10.8%. For example, the AO percentage for the "Low birth weight previous birth outcome" factor is 27.4% and for the "Smoked in the last month" factor the AO percentage is 16.7%.

Table 2 shows the adjusted risk ratios of AO for all screening factors. For example, women who had an education level less than high school (the first factor in Table 2) were 1.1 times more likely to have an AO when compared to women who had education levels of high school or more. This is after adjusting for the influence of associations between this factor and all the other factors in the table.

Table 3 compares the performance of the optimal screening with the performance of the current screening. The positive percentage for both screenings is very close at 25.2% for the current screening and 25.4% for the optimal screening. Since the positive percentages are very close, the sensitivity of the two screens can be directly compared without adjusting for differences in the positive percentages. The sensitivity of the current and optimal screening is 41.5% and 43.9%, respectively. This indicates that the optimal screening is not substantially more sensitive than the current screen. Although some

unscored factors are associated with relatively high percentages of AO, they may not improve the accuracy of predicting AO in the context of the scored factors. After the risk of AO is assessed using the scored factors, the information provided by the unscored factors may be highly correlated with the scored factors to the point where the unscored factors do not increase the predictive power of the screening.

Discussion

The purpose of this analysis was to assess the performance of the prenatal screening and determine if substantial improvement in screening performance could be achieved by modifying the screening criteria. Additionally, this analysis quantified the relationship between the factors on the prenatal screening form and the risk of adverse birth outcomes, including preterm birth and/or low birth weight.

In summary, the current prenatal screen has a sensitivity of 41.5%, meaning that 41.5% of preterm and low birth weight births were classified as positive on the screening. This is consistent with the results of an analysis performed in 2010 entitled: “Healthy Start Prenatal Screening: Sensitivity and Positive Rate Compared for the Revised 2008 Prenatal Screening Criteria Versus the 1994 Prenatal Screening Criteria” which is available at: http://www.floridahealth.gov/programs-and-services/childrens-health/healthy-start/healthy-start-docs/hsprenatalscreen-whitepaper-2010.pdf

The results of this analysis indicate that including all prenatal screening factors and changing the risk scoring system would not result in substantial improvement of the sensitivity of the screening. This is evident from the small improvement in the sensitivity of the optimal screening compared to the sensitivity of the current screening (43.9% versus 41.5%, respectively).

Some previous prenatal screening analyses have been successful in improving the predictability of the screening criteria. In 2006, a similar analysis was done which concluded that the screening could be substantially improved by adding risk factors and changing the scoring system. This led to a statewide effort to revise the screening and a revised prenatal screening was implemented in 2008. Thus, the Department continues to perform this analysis on an annual basis to ensure performance of the screening is maintained and to assess the potential for improvement. A decision to revise the screening in the future would be based upon strong analytic evidence that proposed modifications would yield substantial improvement in the ability of the screening to detect true high-risk pregnancies. While all efforts are made to ensure that revisions improve the screening, when a new screening is implemented it will not be known if it is an improvement until the screening has been in use for at least a year and has been evaluated as described in this paper.

Limitations

One potential limitation of this analysis is the accuracy of the linking between prenatal screening and birth records. Another limitation is the accuracy of the birth record data. If the data on the birth record used to classify the births as preterm or low birth weight are incorrect, then infants could be incorrectly classified regarding low weight or preterm births.

Table 1. Percentage of Adverse[1] Birth Outcomes for Factors on Florida's Prenatal Screening Based on 106,754 Prenatal Screening in 2017 Linked to Births

Screen Question Number	Risk Factor	Risk Score Points	Number of Adverse[1] Birth Outcomes	Number of Births	Adverse[1] Birth Outcome Percentages	95% Confidence Interval	
						Lower	Upper
	Scored Factors						
1	Education less than high school	1	1,998	16,191	12.3%	11.8%	12.8%
2	Unmarried	1	7,040	58,522	12.0%	11.8%	12.3%
6	Depressed in the last month	1	711	6,338	11.2%	10.4%	12.0%
11	Race Black	3	3,931	25,887	15.2%	14.7%	15.6%
12	Used alcohol in the last month	1	711	6,338	11.2%	10.4%	12.0%
13	Smoked in the last month	1	1,413	8,456	16.7%	15.9%	17.5%
14	Unwanted pregnancy	1	1,401	9,926	14.1%	13.4%	14.8%
15	First pregnancy	2	4,039	36,744	11.0%	10.7%	11.3%
16	Stillbirth previous birth outcome	3	608	3,645	16.7%	15.5%	17.9%
16	Premature previous birth outcome	3	2,043	8,186	25.0%	24.0%	25.9%
16	Low birthweight previous birth outcome	3	1,481	5,411	27.4%	26.2%	28.6%
17	Age less than 18	1	228	2,013	11.3%	12.2%	15.0%
18	BMI less than 19.8	1	1,225	9,126	13.4%	12.7%	14.1%
18	BMI more than 35.0	2	1,800	13,754	13.1%	12.5%	13.7%
19	Pregnancy interval less than 18 months	1	1,475	13,816	10.7%	10.2%	11.2%
20	2nd trimester at first prenatal visit	1	2,611	22,008	11.9%	11.4%	12.3%
21	Illness that requires ongoing medical care	2	1,863	11,269	16.5%	15.8%	17.2%
	Un-Scored Factors						
3	Children at home younger than 5 years old	0	4,220	43,979	9.6%	9.3%	9.9%
4	Children at home with medical or special needs	0	643	4,502	14.3%	13.3%	15.3%
5	Not a good time to get pregnant	0	1,337	10,483	12.8%	12.1%	13.4%
7	In the last month, felt alone when facing problems	0	1,157	8,572	13.5%	12.8%	14.2%
8	Have received medical services or counseling	0	1,828	15,397	11.9%	11.4%	12.4%
9	In the last year, someone you know tried to hurt or threaten you	0	222	1,592	13.9%	12.2%	15.6%
10	Have troubled paying bills	0	2,035	17,108	11.9%	11.4%	12.4%
17	Age higher than 35	0	1,504	10,980	13.7%	10.7%	11.9%
No number	Medicaid payer	0	5,921	47,275	12.5%	12.2%	12.8%
	All		11,565	106,754	10.8%	10.6%	11.0%

[1]Birth weight less than 2,500 grams and/or gestational age less than 37 weeks

Table 2. Association Between Factors on Florida's Prenatal Screening and Risk of Adverse Birth Outcomes Based on 106,754 Prenatal Screening in 2017 Linked to Births

Screen Question Number	Risk Factor	Adjusted[1] Risk Ratio Adverse[2] Birth Outcome		95% Confidence Interval	
				Lower	Upper
	Scored Factors				
1	Education less than high school	1.07	*	1.01	1.12
2	Unmarried	1.07	*	1.02	1.11
6	Depressed in the last month	1.00		0.92	1.08
11	Race Black	1.48	*	1.42	1.55
12	Used alcohol in the last month	1.00			
13	Smoked in the last month	1.41	*	1.33	1.50
14	Unwanted pregnancy	1.10	*	1.04	1.17
15	First pregnancy	1.21	*	1.15	1.27
16	Stillbirth previous birth outcome	1.21	*	1.11	1.32
16	Premature previous birth outcome	2.03	*	1.91	2.17
16	Low birthweight previous birth outcome	1.60	*	1.49	1.72
17	Age less than 18	0.92		0.80	1.06
18	BMI less than 19.8	1.29	*	1.21	1.37
18	BMI more than 35.0	1.14	*	1.08	1.20
19	Pregnancy interval less than 18 months	0.99		0.94	1.05
20	2nd trimester at first prenatal visit	1.01		0.97	1.06
21	Illness that requires ongoing medical care	1.39	*	1.32	1.46
	Un-Scored Factors				
3	Children at home younger than 5 years old	0.78	*	0.75	0.82
4	Children at home with medical or special needs	1.05		0.97	1.14
5	Not a good time to get pregnant	0.94		0.89	1.01
7	In the last month, felt alone when facing problems	1.04		0.97	1.11
8	Have received medical services or counseling	1.01		0.95	1.06
9	In the last year, someone you know tried to hurt or threaten you	1.01		0.88	1.16
10	Have troubled paying bills	0.99		0.95	1.05
17	Age higher than 35	1.29	*	1.22	1.36
No number	Medicaid payer	1.11	*	1.07	1.16

* Statistically significant risk factor (alpha ≤ 0.05)

[1] Adjusted for all factors in the table

[2]Birth weight less than 2,500 grams and/or gestational age less than 37 weeks

Table 3 Florida Prenatal Screening Results Compared for Current and Optimal Screening Criteria Based on 106,754 Prenatal Screening in 2017 Linked to Births, Florida 2017

Categories	Current Screen	Optimized Screen	Optimized Minus Current
Women Screened	106,754	106,754	0
Positive Screens	26,874	27,141	267
Percent Positive	25.2%	25.4%	0.25%
AO[1] with positive screens	4,802	5,077	275
AO[1] with negative screens	6,763	6,488	-275
AO[1] sensitivity	41.5%	43.9%	2.38%

[1] Adverse Outcome: birth weight less than 2,500 grams and/or gestational age less than 37 weeks