

Summary of Healthy Start Infant Screening Analysis

In 1991, the Florida Legislature enacted the Healthy Start legislation. Part of Healthy Start is a universal prenatal and infant screening process to identify pregnant women and infants at increased risk for adverse birth outcomes and infant health problems. As stated in the statute: “A risk factor analysis using the department’s designated risk assessment instrument shall also be conducted as part of the medical screening process upon the birth of a child and submitted to the department’s Office of Vital Statistics for recording and other purposes provided for in this chapter.” (Title XXIX, S. 383.14, (1), (b), F.S.). The infant risk screening criteria were developed, in 1991, by a multidisciplinary advisory committee that included epidemiologists, nurses, physicians, social workers, hospital administrators, researchers and policy and program representatives from key infant and child health care providers.

The Healthy Start infant risk screen was designed to identify infants who are at increased risk of death at age 28 to 364 days. This is also known as postneonatal death. Infant deaths that occur before the 28th day of life would benefit minimally from Healthy Start since there would be only a short time in which to receive and benefit from Healthy Start services. For this reason, the screening criteria was developed using postneonatal death as the outcome of interest.

When the screening was developed in 1992, the percentage of infants classified as positive was 14%, and 48% percent of the postneonatal deaths occurred among the 14% of the infants that were positive on the screening. This is also known as a 14% positive rate and 48% sensitivity. In the years since the screening was implemented, the Florida Department of Health has periodically reviewed and assessed the performance of the screening and has found essentially the same level of positive rate and sensitivity. The purpose of this analysis is to assess the performance of the screening with more recent data, and quantify the relationship between the screening factors and

birth outcomes. Another objective is to estimate the extent to which improvement might be made by revising the screening criteria.

In March 2004 a new Florida birth certificate was implemented. The new birth record includes more information than the old birth record which raises the possibility that the new information could be used to improve the Healthy Start infant screening. Currently, the infant screening is based on 10 items from the birth record and because the screening criteria were developed before the birth record was revised, these 10 items do not include any of the new items on the birth record.

In this analysis birth records linked to infant death records were used to evaluate all of the items on the birth record that might be associated with post neonatal death (infant death at age 28 to 364 days). This was done for births in the years 2005 through 2008 resulting in a total of 747,628 birth records available for the analysis. Births where the parents declined the infant screening were excluded.

Logistic regression was used to estimate the probability of post neonatal death based on the birth record data. The estimated probability was then used as a screening criterion. The results for this screening criterion are in the second column of Table 1 below. The results of the current screening criterion are in the first column for comparison.

The formula generated by the logistic regression procedure is too complex to be used as a screening tool so the formula was simplified to a screening score that could be calculated without a computer and used as a screening criterion. This scoring method uses 10 items from the birth record and assigns each item a number of points between 1 and 4. A total score of 4 or more points is considered positive. The results for this screening criterion are in the third column of Table 1. Both the logistic and simplified logistic criteria are much higher in terms of sensitivity compared to the current criteria, while the positive percent is essentially the same for all three criteria ranging from 15.1% to 15.9%. The sensitivity means that, for the current screening, 54.7% of the post neonatal deaths occur within the 15.9% of births that are positive on the screening. The sensitivity

is higher for the two logistic based screenings where the sensitivity is 64.4% and 65.3% for the simplified logistic and logistic criteria respectively. The slightly lower sensitivity for the simplified logistic screening is due in part to the lower positive percentage of 14.9% compared to the positive percentage of 15.1% for the logistic screening criteria.

A list of the 10 items in the simplified logistic criteria with the corresponding risk scoring points is given in Table 2 with the percentage positive and post neonatal death rate for each of the 10 items. For example the first item, birthweight < 2000 grams, occurs in 3.3% of the births and for infants with this characteristic the post neonatal death rate is 29.2 per 1,000 births. This is a very high post neonatal death rate so 4 points are added to the risk score for these infants which make them positive on the screening without any of the other risk factors. In contrast, the “Mother unmarried” item occurs in 47.5% of the births and infants with this characteristic have a post neonatal death rate of 3.8 per 1,000 births. This is a higher rate than the overall rate of 2.72 (Table 3), but is not extremely high so births with this characteristic are assigned 1 point on the risk score. Since a score of 4 or more is classified as positive on the screening, births with the “Mother unmarried” factor would not be classified as positive unless there were other factors that resulted in a total risk score of 4 or more.

The simplified logistic screening criterion correlates well with increasing rates of post neonatal death. The graph below shows that post neonatal death rates increase sharply as the risk score increases.

In an effort to assess the potential effect of changing the screening criteria, all of the birth records in the analysis were classified as either positive or negative using the simplified logistic criteria. Birth records were also classified as either positive or negative based on the current screening criteria so all of the birth records fall into one of four categories: 1) both screens are positive 2) both screens are negative 3) the simplified logistic screen is positive and the current screen is negative or 4) the simplified logistic screen is negative and the current screen is positive. For analysis purposes only the last 2 categories are of interest. In the other 2 categories changing

the screening criteria would have no effect since both screenings agree on the screening result. In Table 3 the number of births in each of the 4 categories is shown with the corresponding post neonatal death rates. The first 2 rows are the categories of interest. For the 55,806 births classified as negative with the current screening and positive with the simplified logistic screening, the neonatal death rate is 5.20 per 1000 births. This is substantially higher than the overall rate of 2.72 so in these cases the positive classification from the simplified logistic screening is preferable to the negative classification from the current screening. In contrast, for the 62,804 births in the opposite situation, where the current screening is positive and the simplified logistic screening is negative, the rate is 1.48. This is substantially lower than the overall rate of 2.72 so here again the classification of the simplified logistic screening is preferable to the result from the current screening.

In short, where the 2 screenings disagree, the result from simplified logistic screening is the better choice. On an annual basis, changing the screening criteria from the current criteria to the simplified logistic criteria would result in shifting an estimated 15,701 relatively low risk births out of the positive category and shifting 13,952 relatively high risk births into the positive category.

It should be noted that in this data set, 55% of the infants who were positive using the simplified logistic screening criteria had one or more of the medical factors. These are the first three factors in Table 2. In contrast, using the current screening criteria, 28% of the infants classified as positive had one or more medical factors. The medical factors are somewhat different between the simplified logistic and the current criteria. As explained above, there are more medical factors available for the simplified logistic criteria due to the addition of items to the birth record in 2004. However, this may affect the operation of the Healthy Start program since switching to the simplified logistic criteria will evidently increase the proportion of infants who screen positive with medical risk factors.

In summary, the Healthy Start Infant screening criteria currently in use could be improved by revising the risk screening criteria and including some of the new information that was added to the birth record in 2004.

Table 1

**Florida Healthy Start Infant Screening Results Compared to Outcomes
Births Screened 2005 through 2008 Linked to
Post Neonatal Deaths***

	Current Infant Screening	Logistic Regression Infant Screening	Simplified Logistic Regression Infant Screening
Infants screened	747,628	747,628	747,628
Number positive	118,572	112,724	111,574
Percent positive	15.9%	15.1%	14.9%
Sensitivity	54.7%	65.3%	64.4%
PNN rate** for positives	9.40	11.80	11.75
PNN rate** for negatives	1.47	1.11	1.14
Rate ratio - positive:negative	6.40	10.60	10.28

* Post neonatal deaths are infant deaths that occur between 28 and 364 days after birth.

** Post neonatal death rate per 1000 births.

Table 2

**Simplified Logistic Regression Screening Criteria
(Total of 4 or more points is a positive screen)**

Factor	Risk Score Points	Percent Positive**	Post Neonatal Death Rate per 1000 infants	95% Confidence Interval	
				Lower	Upper
Birthweight < 2000 grams	4	3.3%	29.2	27.1	31.4
One or more of selected Abnormal conditions*	4	7.3%	16.8	15.7	17.9
Infant transferred within 24 hours of delivery	4	0.9%	36.4	32.2	41.1
Tobacco use	1	8.9%	4.9	4.4	5.5
Father's name not present	1	10.7%	7.4	6.9	8.1
Maternal age < 18 or unknown	1	3.8%	4.7	4.0	5.6
Maternal Race Black	1	23.7%	4.9	4.6	5.3
Mother unmarried	1	47.5%	3.8	3.6	4.0
Prenatal visits < 2 or unknown	1	6.1%	6.0	5.3	6.8
Principal source of payment Medicaid	1	46.0%	3.7	3.5	3.9

* Selected abnormal conditions are:

Assisted ventilation (\geq 30 min.)

Assisted ventilation (\geq 6 hrs.)

NICU admission

Newborn given surfactant replacement therapy

Hyaline Membrane Disease/RDS

Seizure or serious neurological dysfunction

** Based on 747,628 births in 2005 - 2008 linked to infant deaths

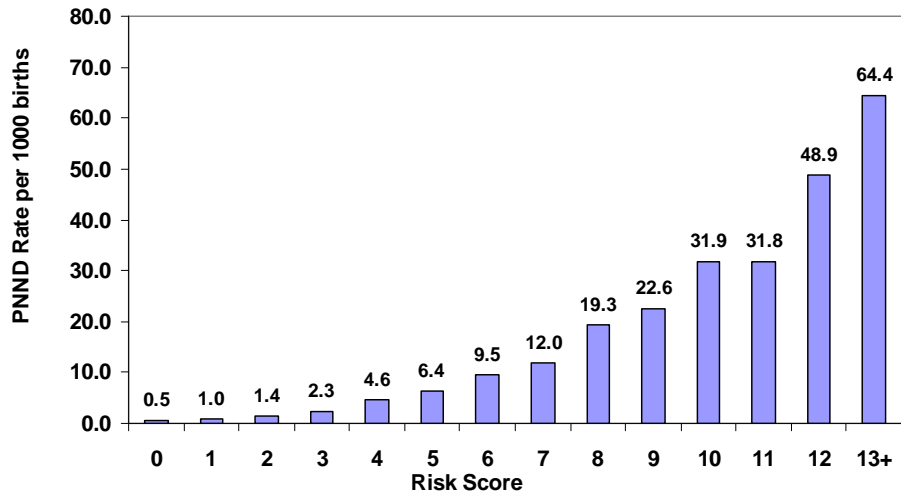
Table 3

**Florida Healthy Start Infant Screening Results
Comparison of Test Screen versus Current Screen
Births Screened 2005 through 2008 Linked to
Post Neonatal Deaths***

Current Screening Result	Simplified Logistic Regression Screening Result	Infants	Post Neonatal Deaths	Rate per 1000 infants
Negative	Positive	55806	290	5.20
Positive	Negative	62804	93	1.48
Positive	Positive	55768	1021	18.31
Negative	Negative	573250	633	1.10
Total		747628	2037	2.72

* Post neonatal deaths are infant deaths that occur between 28 and 364 days after birth.

Postneonatal Death Rate by Risk Score Using Simplified Logistic Screening Criteria



Source: Vital Statistics Birth records 2005 -2008 linked to infant death records, n = 747,628