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## Adequacy of Prenatal Care Utilization Index and Adverse Birth Outcomes, Florida 2016

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August 2018

### Abstract

In this analysis, Florida birth records for 2016 were used to assess the relationship between the adequacy of prenatal care utilization (APNCU) index (also known as the Kotelchuck Index) and three birth outcomes; preterm birth, low birthweight, and small-for-gestational-age. Poisson regression was used to obtain adjusted risk ratios controlling for race/ethnicity, age, education, marital status, and smoking. Births in the intermediate and adequate prenatal care categories tended to have the lowest risk for poor outcomes, while births in the inadequate and adequate plus categories tended to have the highest risk for poor birth outcomes. For assessing adequacy of prenatal care data in Florida, we recommend including all levels of adequacy (inadequate, intermediate, adequate, and adequate plus) in research studies/program evaluations.

### Introduction

Prenatal care has the potential to reduce the incidence of perinatal morbidity and mortality by treating medical conditions, identifying and reducing potential risks, and helping women to address behavioral factors that contribute to poor birth outcomes. Prenatal care is more likely to be effective if women begin receiving care during the first trimester of pregnancy and continue to receive care throughout pregnancy (1).

The American Academy of Pediatrics (AAP) and American College of Obstetricians and Gynecologists (ACOG) recommend that a woman with an uncomplicated pregnancy be examined every 4 weeks for the first 28 weeks of pregnancy, every 2 to 3 weeks until 36 weeks gestation, and weekly thereafter (2). Research indicates that prenatal care is beneficial to maternal health (3, 4). Prenatal care is a useful, cost-effective way to potentially decrease the incidence of preterm birth. Preterm birth and low birthweight are leading causes of infant mortality and morbidity (4, 5). Measurement of prenatal care utilization is critical in monitoring trends and assessing the relationship between prenatal care services and pregnancy outcomes (6).

The purpose of this analysis was to examine the association between adequacy of prenatal care utilization and adverse birth outcomes (preterm birth, low birthweight, and small-for-gestational-age infants) in Florida.

## Methods

A population-based study was performed using 2016 Florida birth certificates. Poisson regression was used to calculate adjusted risk ratios (RR) using Stata/SE 15.0 to assess the relationship between adequacy of prenatal care and preterm, low birthweight and small-for-gestational-age birth outcomes. Models were controlled for race/ethnicity, age, education, marital status, smoking, and adequacy of prenatal care. Preterm labor was defined as less than 37 weeks gestation. Low birthweight was defined as birthweight of less than 2500 grams.

The assessment of the adequacy of prenatal care was made using the adequacy of prenatal care utilization (APNCU) index (also known as the Kotelchuck Index). The APNCU index is based on the gestational age of the infant, the trimester prenatal care began, and the number of prenatal care visits. The APNCU index includes the following categories:

- Adequate plus -prenatal care that begins by the 4th month and 110% or more of the recommended visits received
- Adequate -prenatal care that begins by the 4th month and 80%-109% of the recommended visits received
- Intermediate -prenatal care that begins by the 4th month and 50%-79% of the recommended visits received
- Inadequate -prenatal care that begins after the 4th month or less than 50% of the recommended visits received

## Results

In 2016, there were 225,018 births in Florida. The mean maternal age and standard deviation was 28.8 years and 5.8, respectively. Most mothers were in the age range of 24-34 years (57.2%). During this period, 10.1% of births were preterm, 8.7% were low birthweight, and 8.9% were small-for-gestational-age. Using the APNCU index for adequacy of prenatal care, 15.1% of mothers received inadequate care, 14.8% received intermediate care, 41.6% received adequate care, and 28.5% received adequate plus care (Table 1).

	Number of Births	Percentage of Births
Inadequate	29,959	15.06%
Intermediate	29,477	14.82%
Adequate	82,796	41.63%
Adequate plus	56,637	28.48%
Total*	198,869	100.00%

\*Excludes births with unknown adequacy of prenatal care status.

Among mothers who received adequate plus care, 19.1% had a preterm birth, 14.2% had a low birthweight birth, and 9.4% had small-for-gestational-age birth. Among mothers who received inadequate care, 10.5% had a preterm birth, 9.6% had a low birthweight birth, and 10.3% had a small-for-gestational-age birth (Table 2).

	Inadequate	Intermediate	Adequate	Adequate Plus
Preterm	10.51%	4.63%	4.46%	19.06%
Low birthweight	9.61%	4.70%	4.88%	14.18%
Small-for-gestational-age	10.31%	7.92%	7.91%	9.42%

For each of the three outcomes examined, ten regression models were constructed using different levels of adequacy as references (Table 3).

- In model one, mothers with inadequate, intermediate, or adequate care were significantly less likely to have an adverse birth outcome compared to mothers with adequate plus care.
- In model two, mothers with inadequate or adequate plus care were significantly more likely to have an adverse birth outcome compared to mothers with adequate care while mothers with intermediate care were significantly less likely to have a low birthweight birth or small-for-gestational-age birth compared to mothers with adequate care.
- In model three, mothers with inadequate or adequate plus care were significantly more likely to have an adverse birth outcome compared to mothers with intermediate care while mothers with adequate care were significantly more likely to have a low birthweight birth or small-for-gestational age birth compared to mothers with intermediate care.
- In model four, mothers with adequate plus care were significantly more likely to have an adverse birth outcome compared with mothers with inadequate care. Mothers with intermediate or adequate care were significantly less likely to have an adverse birth outcome compared to mothers with inadequate care.
- In model five, mothers with inadequate or adequate plus care were significantly more likely to have an adverse birth outcome compared with mothers with intermediate or adequate care.
- In model six, mothers with intermediate care were significantly less likely to have an adverse birth outcome compared to mothers with adequate or adequate plus care. Mothers with inadequate care were significantly less likely to have a preterm or low birthweight birth compared to mothers with adequate or adequate plus care.
- In model seven, mothers with adequate or adequate plus care were significantly more likely to have an adverse birth outcome compared to mothers with inadequate care or intermediate.
- In model eight, mothers with inadequate or adequate plus care were significantly more likely to have an adverse birth outcome compared to mothers with intermediate or adequate care.
- In model nine, mothers with intermediate or adequate care were significantly less likely to have an adverse birth outcome compared to mothers with inadequate or adequate plus care.
- In model ten, mothers with inadequate or intermediate care were significantly less likely to have an adverse birth outcome compared with mothers with adequate or adequate plus care.

Table 3: Adjusted Risk Ratios for Adverse Birth Outcome Models						
Models*	Preterm Birth		Low Birthweight		Small-for-Gestational-Age	
	ARR <sup>i</sup>	95% CI <sup>ii</sup>	ARR	95% CI	ARR	95% CI
1 Inadequate Intermediate Adequate (reference=Adequate plus)	0.49	(0.47-0.51)	0.56	(0.53-0.58)	0.89	(0.85-0.94)
	0.24	(0.22-0.25)	0.31	(0.29-0.33)	0.77	(0.73-0.81)
	0.23	(0.22-0.24)	0.34	(0.33-0.35)	0.82	(0.79-0.85)
2 Inadequate Intermediate Adequate plus (reference=Adequate)	2.13	(2.02-2.24)	1.64	(1.56-1.73)	1.09	(1.04-1.14)
	1.02	(0.96-1.09)	0.91	(0.86-0.98)	0.94	(0.89-0.99)
	4.34	(4.18-4.51)	2.95	(2.84-3.07)	1.21	(1.17-1.26)
3 Inadequate Adequate Adequate plus (reference=Intermediate)	2.08	(1.94-2.22)	1.79	(1.68-1.92)	1.16	(1.09-1.22)
	0.98	(0.91-1.04)	1.09	(1.03-1.17)	1.06	(1.01-1.12)
	4.24	(4.00-4.50)	3.23	(3.04-3.43)	1.29	(1.23-1.36)
4 Intermediate Adequate Adequate plus (reference=Inadequate)	0.48	(0.45-0.51)	0.56	(0.52-0.60)	0.87	(0.82-0.92)
	0.47	(0.45-0.49)	0.61	(0.58-0.64)	0.92	(0.88-0.96)
	2.04	(1.95-2.13)	1.80	(1.72-1.88)	1.12	(1.07-1.17)
5 Inadequate Adequate plus (reference= Intermediate or adequate)	2.11	(2.02-2.22)	1.68	(1.60-1.76)	1.10	(1.06-1.15)
	4.31	(4.17-4.47)	3.02	(2.91-3.13)	1.23	(1.19-1.28)
6 Inadequate Intermediate (reference=Adequate or adequate plus)	0.91	(0.88-0.95)	0.93	(0.89-0.97)	1.00	(0.96-1.04)
	0.44	(0.41-0.46)	0.51	(0.48-0.54)	0.86	(0.83-0.91)
7 Adequate or adequate plus (reference=Inadequate or intermediate)	1.47	(1.42-1.53)	1.37	(1.32-1.43)	1.07	(1.03-1.11)
8 Inadequate or adequate plus (reference=Intermediate or adequate)	3.55	(3.43-3.67)	2.53	(2.44-2.62)	1.19	(1.15-1.22)
9 Intermediate or adequate (reference=Inadequate or adequate plus)	0.28	(0.27-0.29)	0.40	(0.38-0.41)	0.84	(0.82-0.87)
10 Inadequate or intermediate (reference=Adequate or adequate plus)	0.68	(0.65-0.70)	0.73	(0.70-0.76)	0.94	(0.90-0.97)

\*Adjusted for race/ethnicity, age, education, marital status, and smoking.

<sup>i</sup>AAR = Adjusted Risk Ratio

<sup>ii</sup> CI = Confidence Interval

## Discussion

Mothers who receive inadequate or adequate plus prenatal care differ from women who receive adequate or intermediate prenatal care. Women with adequate plus prenatal care are at higher risk for having an adverse birth outcome, therefore they would be expected to receive a higher number of prenatal visits compared with women with less risk. Additionally, women with inadequate prenatal care are also at higher risk for an adverse birth outcome, mostly due to an insufficient number of prenatal care visits that would allow the physician to evaluate obstetric and non-obstetric conditions during pregnancy. For a clear view of adequacy of prenatal care data in Florida, we recommend including all levels of adequacy (inadequate, intermediate, adequate, and adequate plus) in research studies/program evaluations.

## References:

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