

Weight Gain During Pregnancy and Pregnancy Outcomes Among Full-term Infants: Pregnancy Risk Assessment Monitoring System

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Purpose

To examine the association of weight gain during pregnancy with pregnancy outcomes stratifying by prepregnancy body mass index and race/ethnicity

Pregnancy outcomes

- **Small for gestational age – customized and population-based**
- **Large for gestational age – customized and population-based**

Why customized SGA/LGA?

- n Early epidemiological studies found increased neonatal mortality for infants below the 10 centile at every gestational age.
- n This led to the publishing and use of population-based infant growth curves which set the “normal” range of 2 SD from the mean at any given gestational age (between the 10-90%).
- n These cut-offs identify infants that are morbid as well as those who are constitutionally small (or large) and healthy
- n Most studies that have looked at weight gain during pregnancy and SGA/LGA have used these population-based curves to determine SGA/LGA

Studies using population-based fetal growth references

- n **DeVader S et al., Obstet & Gynecol, October 2007**
 - aOR=2.14 (95%CI 2.01-2.27) for SGA among those gaining <25 lbs compared to gaining 25-35 lbs for normal BMI
 - aOR=2.43 (95%CI 2.3-2.56) for LGA among those gaining >35 lbs compared to gaining 25-35 lbs for normal BMI
- n **Kiel WD et al., Obstet & Gynecol, October 2007**
 - SGA increased as weight gain decreased/weight loss increased among obese women
 - LGA increased as weight gain increased among obese women

What are customized growth curves?

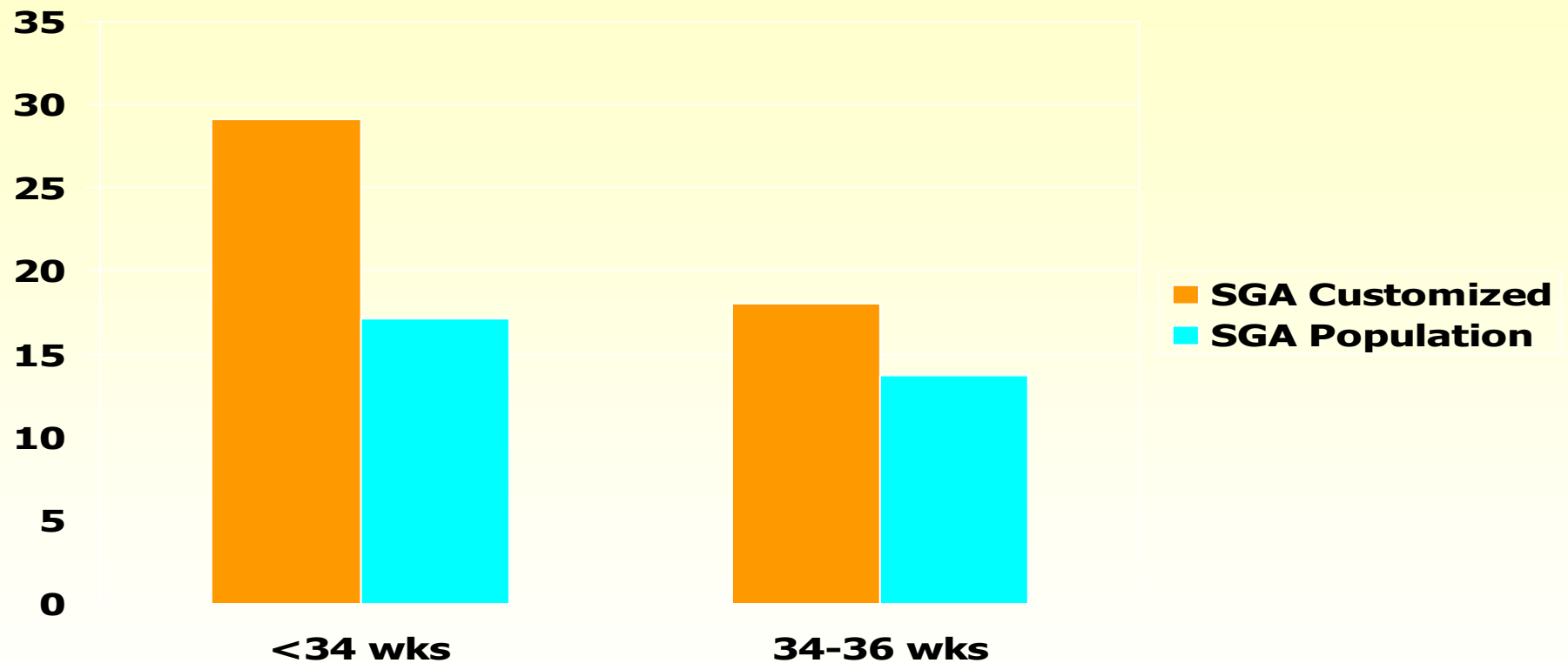
- n **Developed by J. Gardosi and others in the UK**
- n **They establish optimal growth curves with consideration of maternal factors such as race/ethnicity, parity, height, weight and infant gender**
- n **Studies have found customized optimal growth curves more accurately predicted stillbirths, neonatal deaths, neurologic morbidity, and perinatal deaths among preterm infants**
- n **Editorial in AJOG, September 2007, by Robert Resnik “One size does not fit all”**

Groom KM et al. , AJOG, September 2007

- n Retrospective observational study 17,855 nulliparous women delivering 1992-1999 Auckland, New Zealand**
- n Singleton pregnancies, excluded congenital anomalies, diabetes, chronic hypertension, renal disease and autoimmune conditions**
- n Objective to compare the proportion of infants classified as SGA by customized and population birthweight centiles delivering at <34, 34-36, and 37+ weeks**
- n Customized on gestational age, maternal height, weight, parity, ethnicity, and fetal gender**

Percent of births identified as SGA by <34 weeks gestation and by 34-36 weeks gestation

Groom KM et al. , AJOG, September 2007

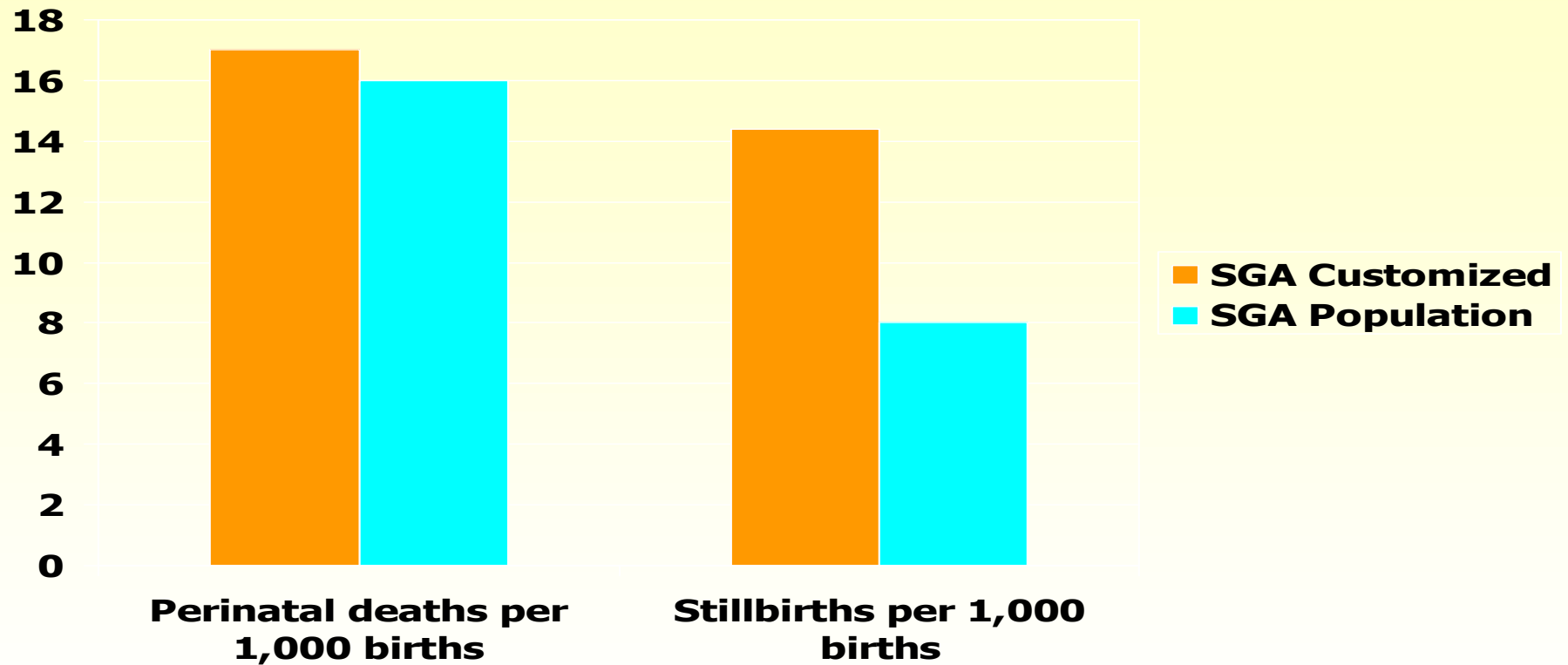


Figueras F et al. , Arch. Dis Child. Fetal Neonatal Ed., 2007; 92;277-280

- n Retrospective observational study 15,464 nulliparous women delivering university hospital in Barcelona, Spain**
- n Objective to compare perinatal death and morbidity among infants classified as SGA by customized and population birthweight centiles**
- n Customized by ethnicity, maternal height and weight, parity, infant gestational age at birth, and fetal sex**
- n Singleton births, excluded congenital anomalies and births < 25 weeks gestation**

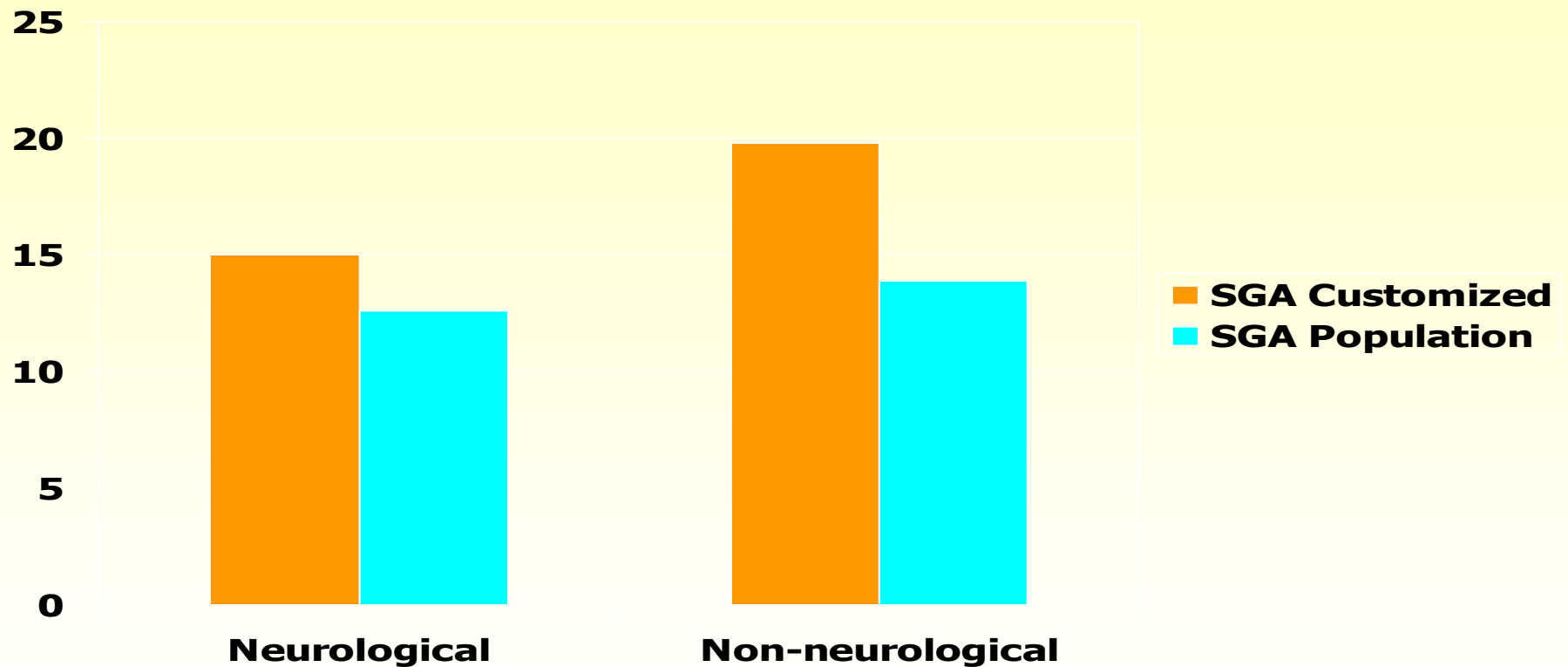
Perinatal death rate and stillbirth rate for births identified as SGA by customized and population-based methods

Figueras F et al. , Arch. Dis Child. Fetal Neonatal Ed., 2007; 92;277-280



Neurological and non-neurological morbidity rates per 1,000 births identified as SGA by customized and population-based methods

Figueras F et al. , Arch. Dis Child. Fetal Neonatal Ed., 2007; 92;277-280



Unanswered questions

- n After refining the measurement of SGA so that constitutionally small, healthy infants are not included, what level of low weight gain is associated with fetal growth restriction?
- n After refining the measurement of LGA so that constitutionally large, healthy infants are not included, what level of high weight gain is associated with excess fetal growth?

Data: Pregnancy Risk Assessment Monitoring System (PRAMS)

- n PRAMS is a state-based surveillance system of new mothers and it addresses a variety of health topics**
- n Questionnaires are mailed 2-3 months after delivery with telephone follow up**

Data

- n **Questionnaires are linked to birth certificates**
- n **The data are weighted to be representative of all mothers delivering a live infant in each state**
- n **Include data from approximately 27 states with a response rate of 70% or higher**
- n **Include data from 2000-2005**
- n **Sample size estimated at 230,000**

Analysis of singleton full-term infants

Weight gain during pregnancy

- Source birth certificate
- 5 lb increments (0-4, 5-9...50+)

n Outcomes

- Small for gestational age – customized and population-based
- Large for gestational age – customized and population-based

Customized SGA/LGA

- n **Multiple regression analysis – fit a model of predicting optimal infant weight with variables of maternal parity, race/ethnicity, height, and infant gender and gestational age for infants at 280 days gestation.**
- n **Frank P Hadlock developed a national in utero fetal weight standard with ultrasound imaging, this formula is used to predict fetal growth**
- n **Proportional equation, percent of fetal growth at a given gestational age**
- n **10% and 90% of proportion growth are also estimated**

Analysis

- n Exclusions: women with infants with known congenital anomalies
- n Stratified by prepregnancy BMI and race/ethnicity (if possible)
- n Crude and adjusted odds ratios and 95% confidence intervals for SGA and LGA outcomes
 - **Weight gain 15-25 pounds will be the reference group**
 - **Adjusted for hypertension, diabetes, smoking**

Distribution of prepregnancy BMI

IOM	NHBLI
< 19.8	<18.5
19.8-26.0	18.5-24.9
>26.0-29.0	25.0-29.9
29.0+	30.0+

Distribution of prepregnancy BMI

IOM	PRAMS sample	
< 19.8	14.3%	
19.8-26.0	48.0%	
>26.0-29.0	11.8%	
29.0+	20.8%	
Unknown	5.2%	

Race/ethnicity

White	55.3%, n= 133,360
Black	18.0%, n=43,385
Hispanic	13.5%, n=32,561
Other	12.8%, n=30,820

Limitations

- n Prepregnancy BMI self-reported
- n Weight gain during pregnancy taken from birth certificate
- n Gestational age may or may not be based on early ultrasound, the gold standard
- n Maternal complications are under-reported

Strengths

- n Population-based
- n Large sample size allows for stratification by prepregnancy BMI and race/ethnicity
- n New information on SGA and low weight gain
- n New information on LGA and excessive weight gain