Young Children; a Sentinel Population for Associations Between Food Insecurity and Obesity?

John Cook, PhD, MA Ed
Boston University School of Medicine
Department of Pediatrics

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Research on Food Security and Obesity Among Children is Inconclusive

“Although a few studies have found that children living in food-insecure households are more likely to be obese than children who are food secure, most studies have found no evidence of a direct relationship.”

In What Sense can Young Children be Considered a “Sentinel Population” for Obesity?

1. Could surveillance of a sentinel population of young children yield useful information about the prevalence or incidence of obesity:
   - Among the overall population of young children?
   - Among particular subpopulations of young children?
   - Among particular SES, race/ethnicity subpopulations?
   - Among adolescents?
   - Among children all ages?
   - Among Adults?
Sentinel Surveillance

- A surveillance system in which a pre-arranged sample of reporting sources agrees to report all cases of one or more notifiable conditions.

- Monitoring rate of occurrence of specific conditions to assess the stability or change in health levels of a population.

- The study of disease rates in a specific cohort, geographic area, population subgroup, etc., to estimate trends in the larger population.

- The “canaries in the coal mine”; monitoring disease rates in a particularly vulnerable sub-population to detect notable change before it impacts the general population.
What is a Sentinel Population?

- A subpopulation in which occurrence of a disease can be indicative of or predict rates in the general population.

- A subpopulation that may be especially vulnerable to a disease and experience higher disease rates before the general population (the “canaries in the coal mine”)

- A subpopulation in which occurrence of or exposure to disease at one age or life-cycle phase reliably predicts occurrence of disease at later ages or life-cycle phases.
How Might Young Children be a Sentinel Population for Obesity?

- If young children were especially vulnerable to onset of obesity;
  - Because of high rates of exposure to environmental factors that put them at high risk, or
  - Because of special biological characteristics that put them at high risk.

- If obesity in young children was indicative of obesity later in life (later childhood, adolescence, adulthood)
Obesity* by Age and Race/Ethnicity
NHANES 2007-2008

*Gender – and age-specific BMI ≥ the 95th percentile
Adapted from Ogden et al. JAMA. 2010;303:242.
Prevalence of Obesity* Among 2-5 Year Old U.S. Children

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>1971-74 NHANES I</td>
<td>5</td>
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<tr>
<td>1976-1980 NHANES II</td>
<td>5</td>
</tr>
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<td>1999-2000 NHANES</td>
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<tr>
<td>2007-2008 NHANES</td>
<td>10.4</td>
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</tbody>
</table>

*Gender- and age-specific BMI ≥ the 95th percentile
Adapted from Ogden et al. JAMA. 2002;288:1728 and JAMA. 2010;303:242
Figure 6. Prevalence of obesity* and overweight† among children aged 2–5 years, by race and ethnicity

* Defined as ≥95th percentile BMI-for-age according to the 2000 CDC Growth Charts.
† Defined as >85th to <95th percentile BMI-for-age according to the 2000 CDC Growth Charts.
Source: 2008 National PedNSS Data Table 8D. Available at http://www.cdc.gov/pednss/pednss_tables/tables_numeric.htm.
Figure 7. Trends in prevalence of obesity* among children aged 2–5 years, by race and ethnicity

*Defined as ≥85th percentile BMI-for-age according to the 2000 CDC Growth Charts.
Source: 2008 National PedNSS Data Table 18D. Available at http://www.cdc.gov/pednss/pednss_tables/tables_numeric.htm.
Table 20D
2009 Pediatric Nutrition Surveillance
National
Summary of Trends in Growth Indicators by Age
Children Aged < 5 Years *(2)*

<table>
<thead>
<tr>
<th></th>
<th>Short Stature (4)</th>
<th>Underweight (5)</th>
<th>Obese (5)</th>
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<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>%</td>
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<tr>
<td></td>
<td>&lt;5th</td>
<td>&lt;5th</td>
<td>&gt;95th</td>
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<td>2000</td>
<td>1,000,547</td>
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“A child or adolescent with a high BMI percentile on the CDC BMI-for-age growth charts has a high risk of being overweight or obese at 35 y of age, and this risk increases with age.”


“A pattern of rapid weight gain during early infancy is associated with obesity not only in childhood but also in young adulthood. We propose that early infancy constitutes a critical period for the development of obesity.”

“Obese children under three years of age without obese parents are at low risk for obesity in adulthood, but among older children, obesity is an increasingly important predictor of adult obesity, regardless of whether the parents are obese. Parental obesity more than doubles the risk of adult obesity among both obese and non-obese children under 10 years of age.”


“There were significant effects of food insecurity on parental depression and parental depression in turn influenced physical health. There were also significant effects of food insecurity on parenting practices, which in turn were significantly associated with infant feeding and subsequently toddlers’ overweight.”

Perinatal Risk Factors, Birth Outcomes, and Obesity

1. Weight gain in pregnancy

- **Less than 16 lbs*:** From 1990-2006, percentage who gained less than 16 pounds increased nearly 50 percent (from 8.3 to 12.3 percent),

- **More than 40 lbs*:** From 1990-2006, percentage gaining more than 40 pounds rose 30 percent (from 16.0 to 20.7 percent).

*Term (at least 37 weeks), singleton births only.
Perinatal Risk Factors, Birth Outcomes, and Obesity

1. Weight gain in pregnancy

- **Less than 16 lbs***: associated with increased risks of intrauterine growth retardation, shortened period of gestation, low birthweight, and spontaneous preterm birth,

- **More than 40 lbs***: linked with elevated risks for the mother of gestational diabetes, long-term maternal weight retention, and other adverse maternal outcomes.

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*Term (at least 37 weeks), singleton births only. 
Perinatal Risk Factors, Birth Outcomes, and Obesity

1. Diabetes during this pregnancy:

- In 2006, diabetes during pregnancy (diagnosed both prior to and during pregnancy), was reported at a rate of 42.3 per 1,000 women, (just over 4 percent) compared with 38.5 per 1,000 in 2005.

- During the 1990s, the diabetes rate increased by an average of 3 percent per year. Between 2000 and 2006*, the pace of increase rose to 6-7 percent per year.

* In 2003 birth certificate revisions led to separate reporting of diabetes diagnosed during a pregnancy.
1. Weight gain in pregnancy

- “Increasing epidemiological evidence links low birth weight to a syndrome of metabolic changes. These adverse health conditions include increased risk of developing obesity when embryo/fetal undernutrition occurred during the first half of pregnancy.”

Young Children are at Risk for Trouble on Both Ends of the Birth Weight Spectrum

- “The term “programming” refers to the concept that an insult or stimulus applied at a critical or sensitive period may have long-term or lifetime effects on the structure or function of an organism.”
  

- “. . .evidence indicates that birth weight is directly associated with later BMI. Larger babies are at greater risk for eventual obesity . . . In contrast, after adjustment for BMI, birth weight is inversely associated with central obesity . . .”
  
So, Are Young Children a Sentinel Population for Obesity?

- Yes, but maybe not in the traditional epidemiological sense.
- Nutritional programming in the perinatal period can lead to obesity later in life.
- Too little or too much maternal weight gain in pregnancy can influence nutritional programming and obesity in offspring.
- Too rapid weight gain by LBW infants can also influence nutritional programming and obesity in offspring.
- LBW infants are at greater risk for central obesity.
- High birth weight infants are at risk for high BMI and obesity.
- Food security may influence nutritional programming.
- Additional research is needed to clarify whether and how.
Young Children Are a Sentinel Population for Obesity

- Young children seem especially vulnerable to:
  - High rates of exposure to environmental factors that put them at high risk,
  - Special biological characteristics that put them at high risk.

- Obesity in young children is predictive of obesity later in life (later childhood, adolescence, adulthood)

- A subpopulation in which occurrence of or exposure to disease at one age or life-cycle phase predicts occurrence of disease at later ages or life-cycle phases.
Thank You