

# The Use of the New World Health Organization Growth Standards to Identify Trends and Determinants of Overweight in WIC Infants and Children

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## Background

Childhood obesity is a worldwide epidemic. In the US, 24.4% of children are overweight or at risk of overweight. Tools for the adequate diagnosis, treatment and prevention of childhood obesity are needed. The WIC program, reaching half of all pregnant women and their infants in the US, and providing follow-up until the child is five years of age, provides an ideal avenue to effectively address the problem of childhood obesity. A child's obesity status is determined by calculating his/her Body Mass Index (BMI) ( $\text{weight (kg)}/\text{height}^2 (\text{m}^2)$ ) and comparing it to an age- and sex-specific reference distribution. If a child's BMI is above the 95th percentile of that distribution, the child is considered overweight. If the BMI is between the 85th and the 95th percentiles, the child is considered at risk of overweight. Currently, in the US, the reference used for children's BMI is the set of charts known as the Centers for Disease Control and Prevention (CDC) growth charts. These charts were constructed using nationally representative data collected from 1963 to 1994. Most of the children whose anthropometric measurements contributed to the construction of the charts were formula-fed as infants, and this is not in line with feeding recommendations for optimal growth. Furthermore, the measurements were not done frequently enough to capture the rapid changes in growth that occur in the first year of life. Because of these and other technical deficiencies in the charts, the World Health Organization (WHO) issued new growth charts in 2006. These were constructed with data from children who were provided with conditions that allowed for optimal growth (they had optimal nutrition, an optimal environment, and optimal healthcare). There was frequent follow-up of the children to collect growth data, and appropriate statistical techniques were used to construct the WHO standards from these data. The objectives of this study were to determine if, and at what ages, the WHO growth charts identify a larger number of overweight children compared to the CDC children, using data from Massachusetts WIC participants. Another objective was to examine the risk factors associated with child overweight when growth status is assessed using the new WHO standards.

## Methods

The data were collected from participants in the Massachusetts WIC program from September 2001 to October 2006. The anthropometric measurements were done every 6 months during the participants' certification visits. These are reported to the Centers for Disease Control and Prevention (CDC) as part of the state's participation in the Pregnancy and Pediatric Nutrition Surveillance Systems (PNSS and PedNSS), from which the data were extracted. Information on socio-demographic characteristics and breastfeeding was also extracted. The age- and sex-specific BMI percentiles of children were based on their directly measured height and weight and the two growth charts (WHO and CDC). Data analysis was done using SAS version 9.1.3. The data were cleaned to exclude implausible values, according to PedNSS and PNSS edits. Consistency between a child's data for consecutive visits was also checked. All of the data were used for descriptive statistics. To examine prevalence estimates and risk factors for overweight, a dataset with one randomly chosen visit per child was used.

## Findings

Our sample included 143,787 children who collectively had 392,927 WIC visits between the ages of 2 and 5 years. The mothers had a mean age of 26 years. About 35% of them had not completed high school, 46% had a high school diploma, and the rest had at least some college training. Pre-pregnancy, 5% were underweight, 25% were overweight, and 22% were obese. About half (51%) of the children are males. 9% of the children had a low birth weight, and another 9% had a high birth weight. The racial/ethnic distribution is as follows: 43% of the children are Caucasian, 19% are African-American, 32% are Hispanic, and 6% are Asian/Hawaiian/Pacific Islanders. Of those with breastfeeding information (about half of the sample), 65% of the children were breastfed at some point, and the average duration of any breastfeeding among those who breastfed was 17 weeks. When using the CDC charts, 44% of the children were classified as overweight or at risk of overweight at least once during the 3 years of follow-up in WIC, and that proportion goes up to 53% if using the WHO charts. This and all the subsequent comparisons are statistically significant with p-values less than 0.0001. The prevalence of overweight at any given time point was 17% when using the CDC cutoffs and 24% when using the WHO cut-offs. The prevalence of overweight or at risk of overweight when using the CDC charts is 34%, and when using the WHO charts it is 42%. The difference between the prevalence estimates using the two charts is larger when the children are younger. The estimate for the percentage of overweight children in the 24-27 months of age group doubles from 12.6% when using the CDC cutoffs to 25.3% when using the WHO

cutoffs. The same is true when looking at the estimate of overweight or at risk of overweight: in the 24-27 months group, it increases from 28% using the CDC charts to 45% when using the WHO charts. On average, using the WHO charts detects overweight 1.3 months earlier than when using the CDC charts. In a logistic regression model controlling for birth weight and child age, significant predictors of child overweight (defined using the WHO cutoffs) include: maternal pre-pregnancy weight (obese vs. normal OR=1.81 (1.72-1.91)), Hispanic ethnicity (OR=1.50 (1.43-1.56, ref=non-Hispanic), maternal education (some college vs. less than high school graduate (HS), OR=0.80, 0.75-0.85, HS vs. less than HS OR=0.90, 0.86-0.94) and child sex (OR=0.89, 0.85-0.93, ref=male). Using the WHO charts will result in a higher estimated prevalence of childhood overweight and allow for earlier diagnosis, thus making earlier intervention possible.