Childhood Obesity Prevalence Methodology

Introduction

Childhood obesity is becoming an epidemic in the United States. CDC estimated 16.9% of children and adolescents aged 2-19 years are obese in 2007-2008, about three times the prevalence in 1980 [1]. Obese children are facing increased risk of developing cardiovascular disease, hypertension, dyslipidemia, and type 2 diabetes in the later stage of their life [2]. This project represents one of the first efforts to map the childhood obesity epidemic for the entire United States. We modeled the prevalence of childhood obesity by demographic risk factors of age, sex, race, education, poverty using Bayesian hierarchical regression models and data from the National Health and Nutrition Examination Survey (NHANES) [3]. We then applied the model results to zip code level demographics to estimate prevalence of childhood obesity in small geographic areas and by gender and race/ethnicity groups.

Method

Definition of Childhood Obesity

Body mass index (BMI) is a used to determine childhood obesity. It is calculated using a child's weight and height. Because the body composition of children varies as they age and varies between boys and girls, a child's weight status is determined using an age- and sex-specific percentile for BMI rather than the BMI categories used for adults. In this work, obesity is defined as a BMI at or above the 95th percentile [4] for children of the same age and sex, with the percentile value obtained from the 2000 CDC Growth Charts [5]. For example, BMI greater than 18 for a 5 year old boy would be considered obesity; while, for a 17 year old boy, BMI needs to be greater than 28.5 to be classified as obesity. In this project, we confined our target population to all children age 5 – 17.

Model variables

Sex, age, ethnicity, education attainment by the head of the household, and poverty status were selected as predictor variables in the models. All data came from NHANES. We pooled NHANES data for three periods (2003-04, 2005-06, 2007-08) to increase sample size for better modeling results.

Bayesian Hierarchical Models
A Bayesian hierarchical logistic regression model for the risk of childhood obesity was fit using WinBUGS 1.4.3. The regression model adjusted for demographic risk factors, e.g. poverty status, highest level of education attained, ethnicity, sex, and age. The model shows that Black and Hispanic children have higher prevalence of obesity than whites, that children who live in poverty have a higher prevalence of obesity than those who do not, and that families with low education attainment (of head of household) have a higher risk of obesity than children whose parents have high education attainment.

**Prevalence estimates at zip codes and other geographies**

Prevalence of childhood obesity was then estimated for zip codes by major demographic category (gender and race/ethnicity), using the fitted model equation and zip code level Census 2000 dataset of sex, age, ethnicity, education and poverty.

We also developed crosswalk tables between zip codes and higher-level geographical areas, such as MSAs and states. We then calculated prevalence estimates for the higher-level geographical areas from the zip-code prevalence, using Equation 1:

\[ PV = \frac{\sum p_{v_i} w_i}{\sum w_i} \]  

(1)

\( PV \): Prevalence of childhood obesity in a high-level geographical area, e.g., state

\( p_{v_i} \): Prevalence of childhood obesity in zip code \( i \) within the high-level geographical area

\( w_i \): Weights (e.g., population of children age 5-17) for zip code \( i \) relative to other zip codes within the high-level geographical area

**Mapping**

The Index legends reflect natural groupings inherent in the data. The natural-breaks (Jenks) method identifies break points by creating the breaks that best group similar values and maximizes the differences between levels [8].

**Notes**

   [http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.htm](http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.htm)  
   (accessed May, 2011).


