

Severe Early Childhood Obesity

I. Background

Childhood obesity continues to be an overwhelming epidemic that affects even the youngest children. About 9.7% of infants and toddlers were obese in 2009-2010 according to NHANES data. Obesity in toddlers leads to increased risk for adult obesity. This may result in a lifetime of complications such as type 2 diabetes, cardiovascular disease, sleep apnea, hypertension, hypercholesterolemia.

II. Algorithms

A. CASE

1. Height/Weight measurement is available for same day
Only actual measured height and weight, no stated or estimated values
Take the first height/weight measurement of the day
YES->2, NO->EXCLUDE
2. Height measurement > 5th percentile
YES->3, NO->EXCLUDE
3. Age (in days at time of measurement): > 365 days and < 2190 days
YES->4, NO->EXCLUDE
4. Multiple height/weight measurements
YES->5, NO->EXCLUDE
5. Calculate BMI for each height/weight measurement (see Body Mass Index Calculation).
6. Multiple BMI measurement \geq 99th percentile
YES->7, NO-> CONTROL Algorithm
7. More than 50% of BMI Measurements > 76th percentile
YES->8 NO->EXCLUDE
8. Case Exclusion Criteria (see Table 1)
YES->EXCLUDE NO->CASE

B. CONTROL

1. Age (in days) at measurement > 1460 and < 2920
Two or more measurements -> 2, less than 2 measurements -> EXCLUDE
(At least one qualifying BMI measurement must be taken @ >1460 days.)
2. All BMI Measurements are \geq 5th percentile and \leq 85th percentile
YES-> 3, NO->EXCLUDE
3. Control Exclusion Criteria (see Table 2)
YES->EXCLUDE NO->4.
4. All BMI measurement \leq 15th percentile
YES->CONTROL 2, NO->CONTROL 1

III. Body Mass Index (BMI) Calculation

The determination of the BMI-for-age percentile is according to CDC criteria or WHO criteria

1. For ages 366-729 (days), use WHO
2. For ages 730-1859, use greater of WHO or CDC.ⁱ
3. For ages 1860-2920, use CDC

A. Equation

$$\text{BMI} = \frac{\text{weight}(lb)}{(\text{height}(in))^2} * 703$$

B. CDC and WHO Criteria: BMI-for-age percentiles

1. CDC: ages 2 years to 20 years (by increments of 0.5 months).
http://www.cdc.gov/growthcharts/percentile_data_files.htm
2. WHO: ages birth to 5 years (by increments of day).
http://www.who.int/childgrowth/standards/bmi_for_age/en/index.html

C. CDC Criteria: Length/Height-for-age percentiles

1. CDC: ages birth to 20 years (by increments of 0.5 months).
http://www.cdc.gov/growthcharts/percentile_data_files.htm

IV. Covariates

- Age
- Gender
- Ethnicity
- Race
- Zip
- Insurance
- Birth Weight
- Diagnosis of ADHD (ICD-9 314 – 314.9)

Table 1: Case Exclusion Criteria

Genetic	Synonyms	Related Medications	Related Procedures	ICD9
Down Syndrome	Trisomy 21			758.0
Albright Hereditary Osteodystrophy/ Pseudohypoparathyroidism		rocaltrol		756.59
Turner's Syndrome	Mixed gonadal dysgenesis XO syndrome	premarin vivelle dot menostar climara		758.6
Prader-Willi Syndrome				759.81
Noonan's Syndrome				759.89
Bardet-Biedl				
Carpenter's Syndrome				
Alstrom Syndrome				
Endocrine	Synonyms	Related Medications	Related Procedures	ICD9
Hypothyroidism	Primary hypothyroidism Hypothyroid TSH deficiency hypothyroidism, post-ablative	levothyroxine levoxyl synthyroid	thyroidectomy radioactive iodine ablation	244.9
Growth hormone deficiency		norditropin genotropin humatrope nutropin saizen		253.3
Panhypopituitarism		hydrocortisone cortef solucortef		253.2
Adrenal Insufficiency	congenital adrenal hyperplasia Addison's disease iatrogenic adrenal insufficiency	hydrocortisone cortef solucortef		255.41
Hypothalamic obesity				259.8
Precocious puberty		lupron		259.1
Cushing syndrome	Ectopic ACTH syndrome Cushing disease			255.0
Type 1 diabetes	Type 1 diabetes, without complication Diabetes	novolog/aspart humalog/lispro lantus/glargine levemir/detemir apedria/glulisine		250.01 250.03
GastroIntestinal	Synonyms	Related Medications	Related Procedures	ICD9
Eosinophilic Esophagitis				530.13
			gastroonomy tube (g-tube)	

Table 1: Case Exclusion Criteria (cont.)

Transplant/Cancer/ Rheumatoid	Synonyms	Related Medications	Related Procedures	ICD9
s/p Liver transplantation				V42.7
s/p Bone marrow transplantation	acute rejection	hydrocortisone		V42.81
s/p kidney transplantation	Graft vs host disease	prednisone		V42.0
s/p heart transplantation		dexamethasone		V42.1
Acute rejection		cortisone		996.8*
juvenile rheumatoid arthritis		prednisolone		714.3*
Inflammatory Bowel Disease	Crohn's disease Ulcerative Colitis	methylprednisolone triamcinolone		555.9 556.9
Cancer	Obesity due to cancer	Solucortef		191.1
Malignant neoplasm of brain				191*
Hodgkin's disease				201*
Malignant neoplasms of lymphoid and hisiocytic tissue				202*
Multiple myeloma and immunoproliferative neoplasm				203*
Lymphoid leukemia				204*
Myeloid leukemia				205*
Monocytic leukemia				206*
Other specified Leukemia				207*
Leukemia of unspecified cell type				208*
Histiocytosis	Langerhans cell histiocytosis			277.89
Edema	Synonyms	Related Medications	Related Procedures	ICD9
Congestive heart failure				428.0
Edema	Anasarca			782.3
Nephrotic syndrome		(steroid)		581.9
End Stage Renal disease			dialysis	585.6
		aripiprazole (Abilify)		
		clozapine (Clozaril)		
		olanzapine (Zyprexa)		
		quetiapine (Seroquel)		
		paliperidone (Invega)		
		ziprasidone (Geodon)		
		risperdal (risperidone)		

Table 1: Case Exclusion Criteria (cont.)

Continuous or Frequent Steroids		Steroids
		> 2 weeks of continuous steroid therapy OR > 3 separate courses totaling over 28 total days in the last 6 months

Table 2: Control Exclusion Criteria

Genetic	Synonyms	Related Medications	Related Procedures	ICD9
Marfan's				759.82
Russell-Silver Syndrome	Silver-Russell Syndrome Chromosome 7-Related Russell-Silver Syndrome Chromosome 11p15.5-Related Russell-Silver Syndrome			759.89
Skeletal Dysplasia	CHST3-Related Skeletal Dysplasia Hypochondroplasia Thanatophoric Dysplasia Achondroplasia Chondrodystrophy achondrogenesis acrodystosis acromesomelic dysplasia atelosteogenesis diastrophic dysplasia chondrodysplasia punctata Osteogenesis Imperfecta			756.4 756.5* 756.9 755.24 755.34
Robins Syndrome				756.0
Roberts Syndrome				755.69
Dermatoglyphic anomalies				757.2
Hyperthyroidism	Thyrotoxicosis	Methimazole PTU	Thyroidectomy	243 242.9
Respiratory				
Cystic Fibrosis				277.0*

Table 2: Control Exclusion Criteria (cont.)

GastroIntestinal				
Other specified intestinal malabsorption	Intestinal malabsorption Other and unspecified postsurgical nonabsorption Short bowel syndrome Protein Losing enteropathy		Gtube TPN -central line	275.49 262 263.2 263.8
Inappropriate diet and eating habits				V69.1
Protein deficiency anemia				281.4
Other and unspecified disorders of eating				307.5* 307.1
Failure to thrive	Other symptoms concerning nutrition, metabolism, and development			783*
Eosinophilic Esophagitis				530.13
Infectious Disease				
HIV	AIDS			042 V08 795.71
Medications				
		Adderall Ritalin Methylphenidate Concerta Methylin Metadate Methylin Periactin Cyproheptadine		

ⁱ Only 3 cases occurred (out of 9743 BMI measurements) where WHO BMI was >99th percentile and the CDC measurement was < 99th percentile. Both criteria are used because approximately 18% of all BMI measurements are after 5 years and 25% of BMI measurements are before 2 years.