EARLY CHILDHOOD OBESITY PREVENTION

RISK FACTORS FOR EARLY CHILDHOOD OBESITY

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The Need for Early Prevention

- Even the youngest children are affected
  - 10% of children < 2 years are overweight
  - 21% of children 2-5 years old are overweight or obese
- Gestation to early infancy as a critical period
- Overweight or obese children are at increased risk to become obese adults

Normal Growth of a Young Child- CDC Standards

- Based on birth data from vital statistics in Missouri and Wisconsin, data for 0-5 month old children is from the Pediatric Nutrition Surveillance System (a predominantly low-income sample), and additional data for children 2-3 months and older were collected from NHANES
- Variable rates of breastfeeding
- Overweight defined by weight-for-length ≥95th percentile if <2 years, no definition for obesity
- Overweight and obesity defined using BMI in older children

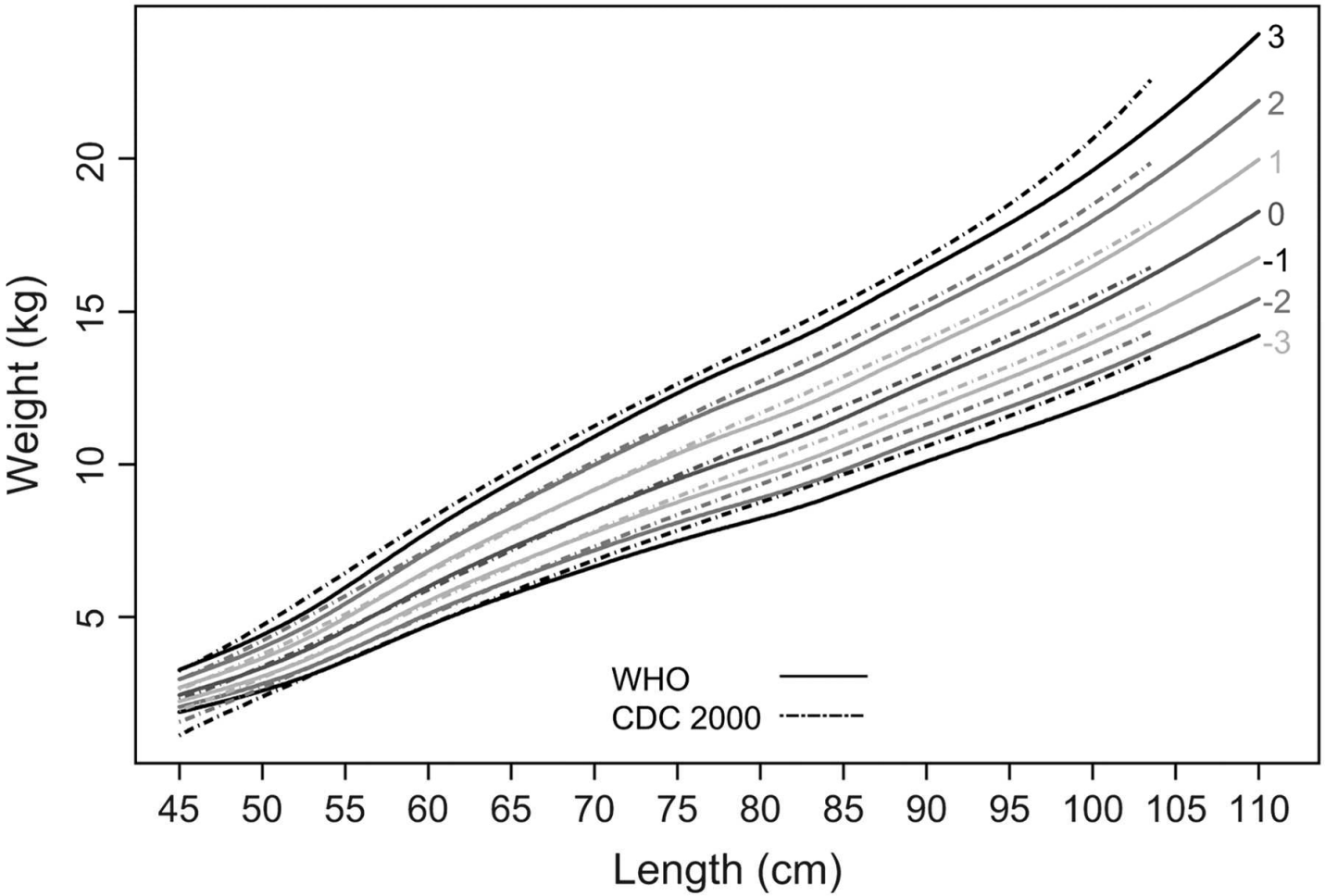
Normal Growth of a Young Child- WHO Standards

- Recommended by the CDC for use in children 0-24 months old
- Includes BMI curves
- Includes children breastfed for 12 months and predominantly for 4 months
- 2nd and 98th percentiles suggested as the cutoffs for concerns of abnormal growth

Normal Growth of a Young Child- Differences between the Curves

- Accounts for differences and slowed growth among breastfed infants between 3-18 months as compared to formula fed infants
- Fewer young children classified as underweight
- More likely to identify formula-fed infants growing too rapidly

Comparison of the WHO and CDC Weight-for-Length Z-score Curves for Boys



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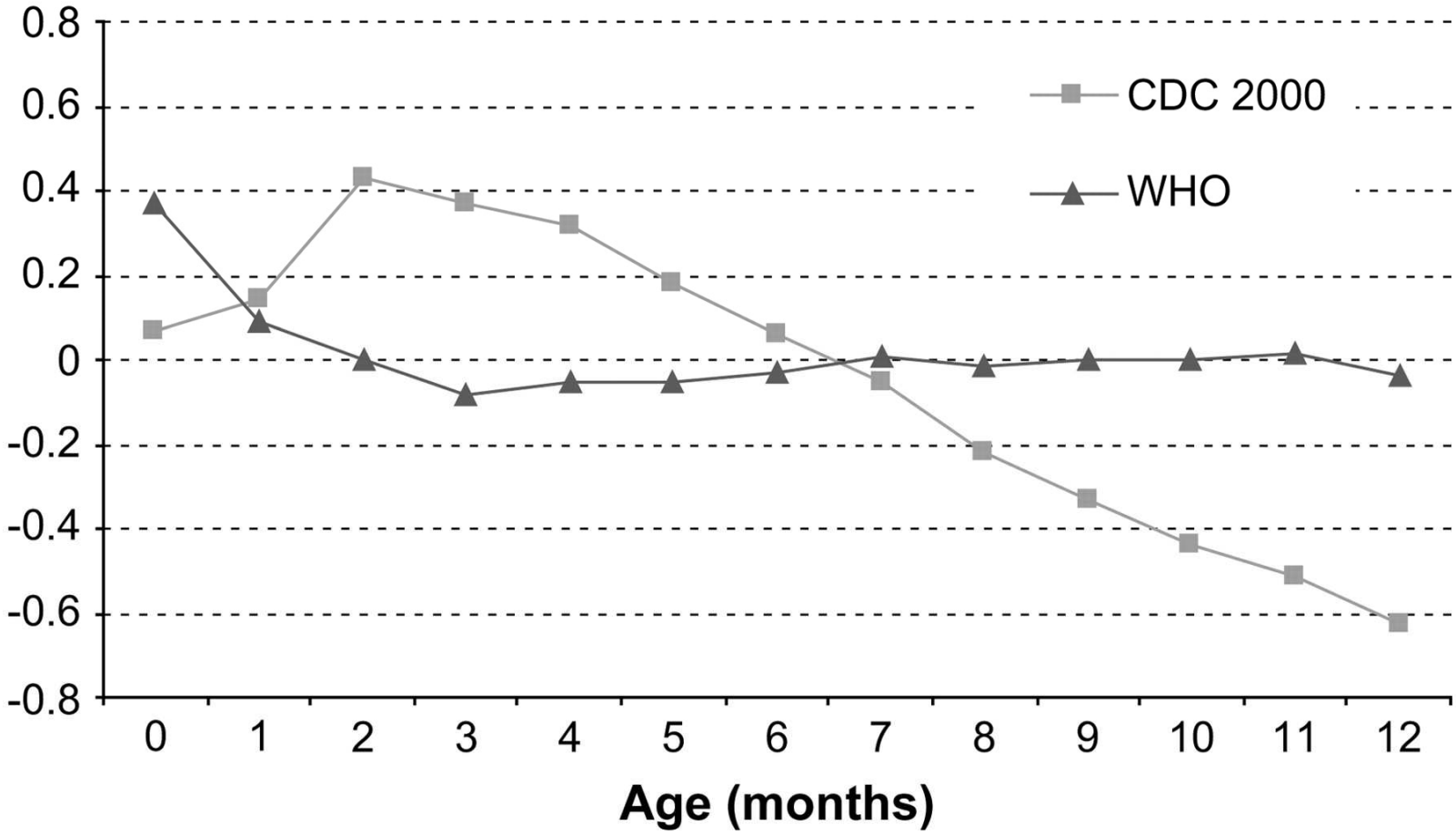
Mean Weight-for-Age Z-scores of Healthy Breast-fed Infants Relative to the WHO Standard and the CDC Chart



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Risk Factors

- Prenatal
- Perinatal
- Early infant growth
- Breastfeeding
- Supplemental Feeding
- Sleep
- Screen time
- Physical Activity
- Childcare setting

Prenatal- Appropriate Gestational Weight Gain

Prepregnancy body mass index	Appropriate weight gain (pounds)
<18.5	28-40
18.5-24.9	25-35
25.0-29.9	15-25
30 or more	11-20

Prenatal – Gestational Weight Gain

- Excess gestational weight gain appears related to a child's future risk of being overweight
  - Related to delivering a large-for-gestational age infant
  - Associated with childhood obesity independently of being LGA
    - Women with higher weight gain had children more likely to be obese at age 3 years (OR 3.77 and 4.35 respectively) than women with less weight gain)

Prenatal

- Maternal smoking
  - Meta-analysis of about 80,000 children
  - Children whose mothers smoked during pregnancy more likely to be overweight (adjusted OR 1.50, 95% CI: 1.36, 1.65)
- Pregestational maternal obesity
  - Young adults whose mothers were obese prepregnancy are more likely to be obese (RR 6.35)
- Gestational diabetes
  - Suggestion of a relationship to future obesity however not consistent and unclear if mediated through birth weight
- High levels of stress
- Food insecurity

Perinatal-Birth Weight

- Association between birth weight and obesity in infancy and childhood
- Increase in birth weight associated with obesity at age 7 years in a sample of about 8000 children (OR 1.05, 95% CI: 1.03, 1.07 for each additional 100 grams)

Early infant growth

- Early childhood weight gain can influence future obesity risk
- Rate of weight gain in the first six months of life is related to overweight risk at age 4 (OR 1.37, 95% CI: 1.23, 1.53 per 100 grams/month)
- Weight gain in first week of life related to adult overweight status (OR 1.28, 95% CI: 1.08, 1.52 per 100 gram gain)
- Preterm infants fed high calorie formula in order to encourage weight gain are more likely to develop insulin resistance by adolescence

Breastfeeding

- Numerous studies suggest a relationship between breastfeeding and decreased risk of later obesity
- Meta-analysis of 9 studies with >69,000 children
  - Breastfeeding reduced risk of obesity (adjusted OR 0.78, 95% CI: 0.71, 0.85)
- More recent meta-analysis of 298,900 children
  - Breast fed children less like to be obese than formula fed (OR 0.87, 95% CI, 0.85, 0.89)
- Duration may be important
  - Protective effect greater for subjects breastfed for at least 2 months than overall breastfed sample
  - Further decrease in risk for each additional month of breastfeeding (OR 0.96, 95% CI 0.94, 0.98)

Breastfeeding

- Potential explanations
  - Endocrine responses to breast milk vs. formula may cause different fat deposition
  - Breast milk may create exposure to different tastes and less pickiness later on
  - Learning to regulate satiety and food intake
    - Infants fed exclusively at the breast for first 6 months half as like to empty a bottle or cup in later infancy as compared to those exclusively bottle-fed
  - Breastfeeding as a marker of a healthier mom or better SES
    - Adjustment for these characteristics still yields similar results

Supplemental Feeding: Solid Foods

- AAP recommendations are that children exclusively breastfeed for at least 4 months but preferably 6 months
- Recent study showing that 10.9% of infants <4 months eat supplemental foods
- Mixed evidence in the relationship between timing of solid foods and solid foods and obesity
- Not much investigation into which type of solid food is appropriate

Supplemental Feeding: Solid Foods

- Study of about 200 children
  - Weaning before 4 months associated with higher 7 month and 14 month weight z-score and higher increase in weight z-score between 8 weeks and 14 months, after adjustment for duration of any breastfeeding
- In contrast, other observational studies have shown no effect

Supplemental Feeding: Solid Foods

- Randomized trial of 147 infants
  - Began solid foods at either 3-4 months or 6 months
  - No differences in energy intake, growth or body composition between groups at 3, 6, or 12 months

Supplemental Feeding: Sweet Beverages

- 7% of infants between 4-6 months consume 100% fruit juice on any given day, 61% by 2 years old
- <1% of infants between 4-6 months consume non-juice sweet beverages, 38% by 2 years old
- AAP recommends not introducing juice to infants <6 months and maximum of 4-6 oz/day for 1-6 year olds
- AAP recommended limited other sweet beverages

Supplemental Feeding: Sweet Beverages

- Limited evidence but perhaps a link with childhood obesity
- Study of 1-4 year old WIC participants
  - Among at risk or overweight children at baseline, more daily fruit juice intake at baseline was related to greater increases in BMI z score over an up to 48 month follow-up
- Study of 2-3 year old WIC participants
  - Among children with BMI ≥ 85th percentile, at least 1 baseline sweet drink (including juice)/day associated with increased odds of BMI≥95th percentile 1 year later

Supplemental Feeding: Sweet Beverages

- Longitudinal study of 170 5 year old girls
  - Greater sweet beverage intake (at least 2/day) at 5 years had greater adiposity from 5-15 years compared to those with less
  - No adiposity differences by juice intake

Sleep

- Low sleep duration is emerging as a risk factor for childhood obesity
- Meta-analysis of children < 10 years found that those with shorter duration were more likely to be overweight or obese than those with longer duration (OR 1.51, 95 % CI: 1.20, 1.92)

Sleep

- Taveras et al.
  - Study of 915 children
  - Infant sleep of <12 hour/day (assessed at 6 months, 1 year, 2 years) associated with increased odds of overweight at 3 years (OR 2.04, 95% CI: 1.07, 3.91)
- Reilly et al.
  - Sleep duration at 30 months associated with obesity at age 7 years (n=5943)
  - Compared to those sleeping >12 hours/day, children sleeping <10.5 hours/day (OR 1.45, 95% CI: 1.10, 1.89) and 10.5-10.9 hours/day (OR 1.35, 95% CI: 1.02, 1.79) were more likely to be obese

Screen Time

- Approximately 90% of children regularly watch television, DVDs, or videos by age 2
- Two-thirds of a national sample of 3 year olds watch about 3 hours/day of television with 5 more hours of background television daily
- 33% of children under 6 years have television in their bedrooms
- In general, studies in children have suggested a relationship between screen viewing and adiposity
- Less data on the relationship in younger ages

Screen Time

- Evaluation of 2761 1-5 year olds enrolled in WIC
- After adjustment for child's age, sex, parent education, and race/ethnicity, those watching more TV/video game had higher odds of being overweight or obese (OR 1.06, 95% CI: 1.01, 1.15) for each additional hour of screen time
- Children with TV in bedroom more likely to be overweight or obese(OR 1.31, 95% CI: 1.01, 1.69)

Screen Time

- Evaluation of 8550 four year old children
- Maternal report of television and DVD/video watching time
- No statistically significant relationship with preschooler obesity after adjustment for other factors

Screen Time

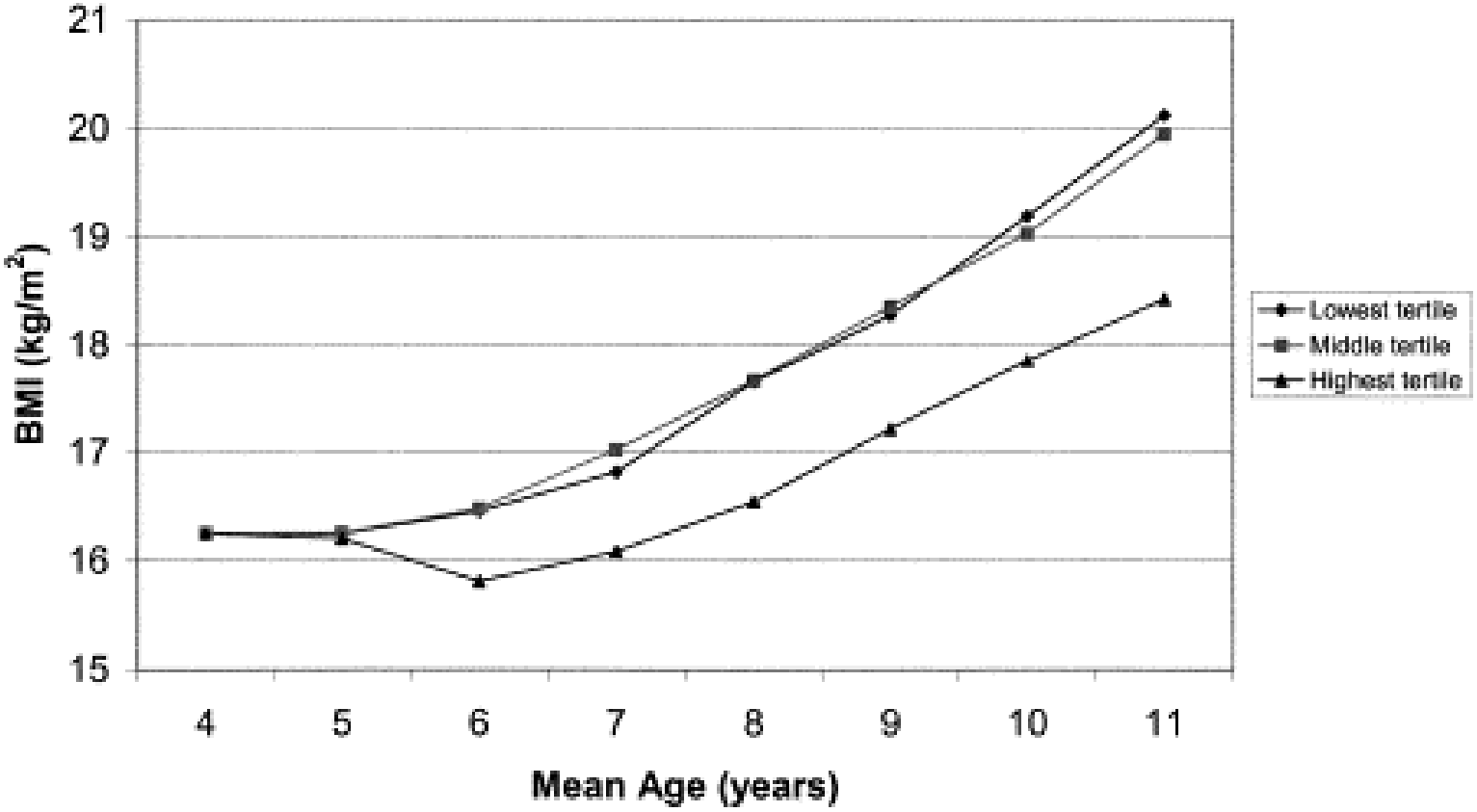
- Randomized controlled intervention of 70 4-7 year old children with a BMI above 75%
- Received intervention to reduced television and computer use
- Followed for 6 years
- Intervention group had greater decreases in screen time
- Both groups had decrease in BMI Z (intervention -0.24, control -0.13)

Physical Activity

- Some cross-sectional studies demonstrate that overweight children have lower physical activity levels than non-overweight children but the relationship is not consistent

- Overweight may be the cause or result of lower levels of physical activity

Physical Activity



Body mass index from ages 4 to 11 years, according to tertile of yearly activity. Adjusted for child's sex, baseline age and BMI, hours of TV watched per day (tertiles), mean percentage of calories from fat (<34 vs ≥34%), total energy intake, and education level and baseline BMI of both parents. Source Moore et al. 2003.

Physical Activity

- Reilly et al. evaluated the effect of a PA intervention on preschool-aged children as compared to control
  - No differences in BMI change, PA after 6 months
- Mo-suwan et al. delivered a PA intervention to 4 year old children as compared to control
  - No differences in BMI change overall after 30 weeks
  - Suggestion of a sex difference with girls having more response

Childcare Setting

- Provides nutrition and physical activity for a substantial portion of the day for many children
- State regulations governing childcare do not meet recommend standards for nutrition and physical activity (ex. minimizing screen time, sweet beverages) and the regulations differ by type of childcare
- The different forms of childcare may have different effects on risk of overweight or obesity

Childcare Setting

- Study of 1138 children
- Evaluated childcare attendance from birth to 6 months and different types of child care (center, someone else's home, child's own home by non-parent)
- Overall time spent in childcare associated with measures of overweight and obesity at 1 and 3 years old
- Center and home care not associated with outcomes but care in someone else's home had increase in outcomes

Childcare Setting

- Examined 12,354 children
- No relationship between formal childcare and overweight
- Children in informal childcare (care by a relative, friend, or non-registered nanny) between 9 months and 3 years have an increased risk of overweight at 3 years when compared to being cared for by only a parent (RR 1.15, 95% CI: 1.04-1.27)
  - Relationship remained in the highest SES group and grandparent providing care subgroups
  - Associations weaker when adjusting for breastfeeding duration and age at introduction of solids

Childcare Setting

- Suggestions of a relationship between childcare and childhood overweight
- Children in childcare may have different practices related to breastfeeding and introduction to solid foods
- Lack of guidelines for health activity and nutrition particularly in informal childcare settings

Conclusions

- Childhood obesity is a significant problem
- Potential targets for early childhood prevention exist
- Physicians should council mothers during pregnancy about weight gain and smoking in particular
- Pediatricians should use WHO growth curves and closely monitor for excessive weight gain
- Encouraging breastfeeding, minimal sweet drinks, minimal screen time, adequate sleep, and investigating practices in the childcare setting may be beneficial

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