Published in final edited form as:

JAMA Pediatr. 2013 January ; 167(1): . doi:10.1001/jamapediatrics.2013.426.

Tackling Childhood Overweight and Obesity:

Thresholds and Beyond

Dr Joyce M. Lee, MD, MPH and Dr Eduardo Villamor, MD, MPH, DrPH

Division of Pediatric Endocrinology and Child Health Evaluation and Research Unit, Division of General Pediatrics, University of Michigan, and Department of Environmental Health Sciences, Human Nutrition Program, University of Michigan School of Public Health (Dr Lee); and Department of Epidemiology, University of Michigan School of Public Health (Dr Villamor)

A large number of families seek assistance from their pediatric provider for managing their child's overweight/obese status. As they embark on weight management strategies, families often ask: "How much weight should my child lose?" Because the answer to this question depends on a child's age, sex, and stage of development, physicians may be reluctant to provide a number. However, offering a weight loss goal to families would likely be helpful for setting overall weight loss goals and for monitoring progress with weight management strategies.

In this issue, Goldschmidt et al¹ provide guidance for the physician faced with this dilemma, using a longitudinal database of overweight/obese children aged 8 to 13 years who participated in weight loss interventions at 3 different centers and had repeated measures of height and weight. They stratified children into separate sex and 2-year age groups and used linear mixed models to estimate linear growth during a 1-year period. They then calculated the minimum weight threshold that a child would need to achieve to reach the normal weight category, which is a body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) at the 85th percentile for a given age, sex, and height using the Centers for Disease Control and Prevention (CDC) growth curves.² For example, a physician examining an 8-year-old boy in the clinic with a BMI in the 90th percentile based on a height of 117 cm and a weight of 25.5 kg would first need to account for the estimated average linear growth during 1 year (+5 cm), which gives an estimated height of 122 cm by age 9 years. The weight that represents a BMI at the 85th percentile for his age, sex, and height is 27.7 kg. The physician could then subtract the current weight (25.5 kg) from this threshold (27.7 kg) and communicate to the family that limiting weight gain to approximately 2.2 kg during the next year would allow him to reach the normal weight category.

The study was limited by small sample sizes for some age and sex groups, which hinders the generalizability of the findings to all US children. As a result, Goldschmidt et al¹ compared their analyses using 2 different assumptions of baseline height and linear growth: average height and growth from their longitudinal cohort as well as the 50th percentile of height and average yearly growth in the 50th percentile based on the CDC growth curves. As seen with previous studies of linear growth, overweight/obese children were on average taller and experienced greater height gains per year than the CDC means. However, when this was translated to recommended weight-change targets for hypothetical children at the 90th, 95th, and 97th BMI percentiles, the slight differences in the estimates likely became

Conflict of Interest Disclosures: None reported.

inconsequential because physicians would likely communicate a weight range rather than a specific number.

This study quantifies what most physicians have long intuited in their practices. First, for younger children who are less overweight, even modest weight gain can lead to improvements in weight status given the dynamics of linear growth and puberty. For example, boys aged 8 to 9 years old with a BMI in the 90th percentile who limit their weight gain to 2.44 kg or boys aged 12 to 13 years old who limit their weight gain to +3.90 kg during a year will normalize their weight status. In contrast, boys with more severe cases of obesity (BMI in the 95th and 97th percentiles) must lose weight, and the amount of required weight loss is much higher for older vs younger children. For example, boys aged 12 to 13 years old must lose 5.49 kg in contrast to boys aged 8 to 9 years old who must lose 2.14 kg. Because girls experience an earlier onset of puberty and an earlier Tanner stage at which pubertal growth occurs compared with boys, they appear to have less leeway in terms of permitted weight gain or recommended weight loss at later ages. For example, girls aged 12 to 13 years with a BMI in the 90th percentile are permitted nearly half the amount of weight gain (+2.65 kg) compared with boys of the same age (+3.90 kg), and girls with a BMI in the 97th percentile must lose an additional 2.06 kg (−7.55 kg) compared with boys (−5.49 kg).

The main clinical implication of this study is that reaching a normal weight status is attainable, particularly for children who are younger and are just mildly overweight. On the basis of this observation, Goldschmidt et al¹ advocate for early identification and treatment of overweight, particularly for younger children. However, the public health implications of this targeted approach are uncertain. First, there is a lack of data on whether the benefits of intervention for obesity during childhood extend into adult life; thus, it remains to be determined whether early vs late childhood intervention is more efficacious.³ Second, there have been greater increases in the prevalence of severe obesity compared with the prevalence of mild overweight during the past 30 years. The Figure depicts the percentage of children at BMI percentiles ranging from 85th to 99th from a period before the childhood obesity epidemic (1971–1975) compared with today (2009–2010). The greatest increases in overweight/obesity prevalence have occurred at the extremes of overweight and obesity, ranging from the 95th to the 99th BMI percentiles. Given this trend, focusing on the mildly overweight instead of severely obese children is unlikely to have a substantial impact on the overall burden of obesity. Third, it is unclear whether reductions in obesity at the lower end of the spectrum (between 85th and 90th percentiles) will result in a meaningful reduction of morbidity associated with childhood obesity.

The risk for comorbidities rises steeply at the extremes of BMI.^{5,6} Therefore, it is possible that weight reduction efforts focused on significantly obese children (BMI 97th percentile) may have a greater influence on future morbidity compared with just mildly obese children. Finally, there is a question of whether reductions in obesity can return an individual to a normal health status. Large epidemiologic studies suggest that BMI is positively associated with adverse health outcomes even within the range considered normal.^{7–9} Furthermore, although the risk for diabetes mellitus associated with adolescent obesity can be reversed with normalization of weight during adulthood, there is evidence that the risk for cardiovascular disease persists into adulthood, even if normal weight is achieved as an adult.⁷

Progress in the fight against childhood obesity in the United States will be measured by achievement of specific BMI percentile thresholds, as set forth by the White House Task Force on Childhood Obesity (ie, goal of 5% prevalence of childhood obesity by the year 2030).¹⁰ However, the pervasive and enormous burden of childhood obesity in the United States coupled with the financial constraints of a health care system strapped by rising costs

suggest that we likely need to move beyond thresholds to determine how best to tackle this problem. The recent opportunity for comparative effectiveness research in this country provides a unique opportunity to conduct additional studies and to determine the effectiveness (long-term health benefits) and cost-effectiveness of various policy approaches for tackling the epidemic.

Acknowledgments

Funding/Support: Dr. Lee was supported by grant K08 DK082386 from the National Institute of Diabetes and Digestive and Kidney Diseases and by the Clinical Sciences Scholars Program at the University of Michigan.

References

1. Goldschmidt AB, Wilfley DE, Paluch RA, Roemmich JN, Epstein LH. Indicated prevention of adult obesity: how much weight change is necessary for normalization of weight status in children? [published online November 5, 2012]. *JAMA Pediatr.* 2013; 167(1):21–26. [PubMed: 23129001]
2. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts for the United States: methods and development. *Vital Health Stat.* 2002; 11(246):1–190.
3. Kamath CC, Vickers KS, Ehrlich A, et al. Clinical review: behavioral interventions to prevent childhood obesity: a systematic review and meta-analyses of randomized trials. *J Clin Endocrinol Metab.* 2008; 93(12):4606–4615. [PubMed: 18782880]
4. National Health and Nutrition Examination Survey. [Accessed May 27, 2012] <http://www.cdc.gov/nchs/nhanes.htm>
5. Tu W, Eckert GJ, DiMeglio LA, Yu Z, Jung J, Pratt JH. Intensified effect of adiposity on blood pressure in overweight and obese children. *Hypertension.* 2011; 58(5):818–824. [PubMed: 21968752]
6. Freedman DS, Mei Z, Srinivasan SR, Berenson GS, Dietz WH. Cardiovascular risk factors and excess adiposity among overweight children and adolescents: the Bogalusa Heart Study. *J Pediatr.* 2007; 150(1):12–17.e2.10.1016/j.jpeds2006.08.042 [PubMed: 17188605]
7. Tirosh A, Shai I, Afek A, et al. Adolescent BMI trajectory and risk of diabetes versus coronary disease. *N Engl J Med.* 2011; 364(14):1315–1325. [PubMed: 21470009]
8. Tirosh A, Shai I, Tekes-Manova D, et al. Israeli Diabetes Research Group. Normal fasting plasma glucose levels and type 2 diabetes in young men. *N Engl J Med.* 2005; 353(14):1454–1462. [PubMed: 16207847]
9. Villamor E, Cnattingius S. Interpregnancy weight change and risk of adverse pregnancy outcomes: a population-based study. *Lancet.* 2006; 368(9542):1164–1170. [PubMed: 17011943]
10. Lee JM, Lee H. Obesity reduction within a generation: the dual roles of prevention and treatment. *Obesity (Silver Spring).* 2011; 19(10):2107–2110. [PubMed: 21720442]

Figure.

The percentage of the US pediatric population aged 7 to 18 years at body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) percentiles within the overweight/obese range. The white bars represent percentages based on National Health and Nutrition Examination Survey (NHANES) data from 1971 to 1975, before the obesity epidemic in the United States, and the black bars represent percentages based on the most recent NHANES data from 2009 to 2010.⁴ The largest increases have occurred at the extremes of the BMI percentile range (95th to 99th percentiles). The percentages are weighted percentages that account for the complex survey design of the NHANES.