PEDIATRIC COLLECTIONS

Obesity: Stigma, Trends, and Interventions

FEATURES

- Stigma Experienced by Children and Adolescents With Obesity
- The Role of the Pediatrician in Primary Prevention of Obesity
- Cost-Effectiveness of a Clinical Childhood Obesity Intervention

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TABLE OF CONTENTS

1  Introduction

2  'Words Can Heal or Do Harm': Policy Addresses Ways to Reduce Weight Stigma
   AAP News • Original Publication • November-20-2017

4  Stigma Experienced by Children and Adolescents With Obesity
   From the American Academy of Pediatrics • Original Publication • December-1-2017

15 The Role of Children’s Movies Weighs Heavily in the Tackling and Fumbling of Obesogenic Issues
    Journals Blog • Original Publication • November-23-2017

16 Obesogenic Behavior and Weight-Based Stigma in Popular Children’s Movies, 2012 to 2015
    Article • Original Publication • December-1-2017

Trends/Characteristics

24 Study: Public Health Efforts Fail to Make Dent in Childhood Obesity
    AAP News • Original Publication • February-26-2018
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Type</th>
<th>Publication Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>Epidemic Childhood Obesity: Not Yet the End of the Beginning</td>
<td>Commentary • Original Publication • February-1-2018</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Prevalence of Obesity and Severe Obesity in US Children, 1999–2016</td>
<td>Article • Original Publication • March-1-2018</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Young Children With Severe Obesity: Who Are They and What Might We Do Differently to Help Them</td>
<td>Journals Blog • Original Publication • March-1-2018</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Characteristics of Children 2 to 5 Years of Age With Severe Obesity</td>
<td>Article • Original Publication • March-1-2018</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Racial and Ethnic Disparities in Early Childhood Obesity</td>
<td>Article • Original Publication • January-1-2018</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Intervention/Prevention</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>The Role of the Pediatrician in Primary Prevention of Obesity</td>
<td>From the American Academy of Pediatrics • Original Publication • July-1-2015</td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>How to Prevent Obesity Without Encouraging Eating Disorders</td>
<td>AAP News • Original Publication • August-22-2016</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>Preventing Obesity and Eating Disorders in Adolescents</td>
<td>From the American Academy of Pediatrics • Original Publication • August-1-2016</td>
<td></td>
</tr>
<tr>
<td>103</td>
<td>An Integrated Clinic-Community Partnership for Child Obesity Treatment: A Randomized Pilot Trial</td>
<td>Article • Original Publication • January-1-2018</td>
<td></td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

117  A Home Visiting Parenting Program and Child Obesity: A Randomized Trial

   Article • Original Publication • February-1-2018

127  A Tailored Family-Based Obesity Intervention: A Randomized Trial

   Article • Original Publication • August-1-2015

136  Cost-Effectiveness of a Clinical Childhood Obesity Intervention

   Article • Original Publication • November-1-2017
Obesity is one of the defining health challenges of our generation. Studies project that, if current trends continue, more than 50% of the US population will have obesity within the next 20 years. Alarmingly, severe obesity appears to be increasing in prevalence faster than overweight or "routine" obesity. Illness associated with obesity, such as diabetes, cardiovascular disease, steatohepatitis, and sleep apnea, is experiencing a commensurate increase in prevalence and severity. The obesity health crisis threatens to overwhelm our health care system, shorten life expectancy for the first time in recorded history, and reduce quality of life for millions. The most successful and cost-effective approaches to this epidemic involve the prevention and treatment of pediatric obesity. Additionally, obesity is affected by a myriad of factors, including individual genetics, personal behaviors, family habits, school and community programs, state and federal policy, and environmental factors.

The American Academy of Pediatrics (AAP) and the AAP Section on Obesity approach obesity by suggesting policies to prevent and treat obesity. Additionally, they provide support to pediatric obesity specialists, pediatricians who serve as practice and community leaders in the fight against pediatric obesity, and general pediatricians who encounter patients with overweight, obesity, and severe obesity.

The AAP Section on Obesity is grateful to the AAP for compiling this collection on obesity topics that cover policies and principles that seek to reduce obesity and its impact on our nation’s health. Obesity is one of the most complicated disease processes pediatricians deal with. It is a disease that is brought about by a myriad of causes and a disease that affects nearly every organ system in the body. This collection will give you easy access to topics that help you manage this challenging disease.

—Christopher F. Bolling, MD, FAAP, Chairperson
AAP Section on Obesity
‘Words Can Heal or Do Harm’: Policy Addresses Ways to Reduce Weight Stigma

Stephen J. Pont, MD, MPH, FAAP and Rebecca Puhl, PhD

“Fat Bias Starts Early and Takes a Serious Toll” (New York Times, Aug. 21, 2017)
“High School Senior Bullied for Her Weight Commits Suicide” (US Weekly, Dec. 2, 2016)
“Fat Shaming Can Lead to a Host of Health Problems” (CBS News, Jan. 31, 2017)
“Obesity, Bias and Stigma in the Doctor’s Office” (Huffington Post, Nov. 2, 2016)

Obesity is highlighted frequently in news media, but headlines increasingly are focusing on the societal stigma that many people face because of their weight. The phenomenon of weight stigma is real and has been documented by decades of research.

Unfortunately, this stigma extends to children and adolescents. Body weight has become one of the most common reasons that youths are teased, bullied and victimized. The harm these experiences cause for children’s health provides an important opportunity for pediatric health professionals to help address this problem.

The new AAP policy statement Stigma Experienced by Children and Adolescents With Obesity addresses a timely but often neglected issue affecting the quality of life of children with obesity. The statement, from the AAP Section on Obesity and The Obesity Society, is available at https://doi.org/10.1542/peds.2017-3034 and will be published in the December issue of Pediatrics.

Weight stigma often is propagated and tolerated in society because of beliefs that stigma and shame will motivate people to lose weight. However, rather than motivate positive change, this stigma contributes to behaviors such as binge eating, social isolation, avoidance of health care services, decreased physical activity and increased weight gain, which worsen obesity and create additional barriers to healthy behavior change.

Furthermore, experiences of weight stigma also dramatically impair quality of life, especially for youths who are vulnerable to weight-based bullying and victimization.

Health care professionals continue to seek effective strategies and resources to prevent and treat obesity; however, they also frequently exhibit weight bias and stigmatizing behaviors.

Dr. Pont, a lead author of the policy, is past chair of the AAP Section on Obesity Executive Committee. Dr. Puhl, also a lead author, is a fellow of The Obesity Society.
The stigmatization of people with obesity is widespread and causes harm. Weight stigma is often propagated and tolerated in society because of beliefs that stigma and shame will motivate people to lose weight. However, rather than motivating positive change, this stigma contributes to behaviors such as binge eating, social isolation, avoidance of health care services, decreased physical activity, and increased weight gain, which worsen obesity and create additional barriers to healthy behavior change. Furthermore, experiences of weight stigma also dramatically impair quality of life, especially for youth. Health care professionals continue to seek effective strategies and resources to address the obesity epidemic; however, they also frequently exhibit weight bias and stigmatizing behaviors. This policy statement seeks to raise awareness regarding the prevalence and negative effects of weight stigma on pediatric patients and their families and provides 6 clinical practice and 4 advocacy recommendations regarding the role of pediatricians in addressing weight stigma. In summary, these recommendations include improving the clinical setting by modeling best practices for nonbiased behaviors and language; using empathetic and empowering counseling techniques, such as motivational interviewing, and addressing weight stigma and bullying in the clinic visit; advocating for inclusion of training and education about weight stigma in medical schools, residency programs, and continuing medical education programs; and empowering families to be advocates to address weight stigma in the home environment and school setting.

More children in the United States suffer from obesity than from any other chronic condition, with one-third of US children and youth having overweight or obesity and 17% of children 2 to 19 years of age having obesity. In some pediatric populations, such as children living in economically challenged communities, as many as two-thirds of children have overweight or obesity. Although some promising signs suggest the prevalence of obesity may be stabilizing, rates remain unacceptably high,
The Role of Children’s Movies Weighs Heavily in the Tackling and Fumbling of Obesogenic Issues

Lewis First, MD, MA, Editor in Chief, Pediatrics

The media’s influence both positively and negatively on children is a frequent topic of study in our journal and others. This week, we add to that evidence-base with a study by Howard et al. (10.1542/peds.2017-2126) looking at the prevalence of obesity-promoting behaviors or stigma as displayed in recent popular children’s movies. The authors looked at the 31 top-grossing films from 2012-2015 and for each ten-minute segment of a film, raters identified and described what was being eaten, the activity and whether there was weight-related dialogue being observed in a film. The results are concerning to us and will likely be to you as well. 100% of the films studied had obesity-promoting content involving unhealthy foods, larger than recommended portion sizes, plenty of sugar-sweetened beverages being drunk, and more weigh-based stigma such as verbal insults about someone being overweight or obese. Even more concerning was that these findings were not isolated ones in each of the 31 films, but occurred repeatedly in each.

Do you talk about films seen by your patients with your patients? Do you tell them to focus on the healthy and unhealthy behaviors being observed and then share their thoughts on these behaviors with their families or with you? Perhaps this study will trigger increased awareness of what our children are being exposed to in films and lead to better preventive strategies starting with what they choose to snack on when they do go to the movies. We certainly know the influence of smoking and other risk-taking behaviors depicted in films viewed by teens, but this study now opens the door to additional themes we might not have thought about before thanks to the information one should digest first by reading this study and then sharing what you learn with your patients-especially those who are at risk for becoming increasingly overweight or obese.
Obesogenic Behavior and Weight-Based Stigma in Popular Children’s Movies, 2012 to 2015

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BACKGROUND: Obesity-promoting content and weight-stigmatizing messages are common in child-directed television programming and advertisements, and 1 study found similar trends in G- and PG-rated movies from 2006 to 2010. Our objective was to examine the prevalence of such content in more recent popular children’s movies.

METHODS: Raters examined 31 top-grossing G- and PG-rated movies released from 2012 to 2015. For each 10-minute segment (N = 302) and for movies as units, raters documented the presence of eating-, activity-, and weight-related content observed on-screen. To assess interrater reliability, 10 movies (32%) were coded by more than 1 rater.

RESULTS: The result of Cohen’s κ test of agreement among 3 raters was 0.65 for binary responses (good agreement). All 31 movies included obesity-promoting content; most common were unhealthy foods (87% of movies, 42% of segments), exaggerated portion sizes (71%, 29%), screen use (68%, 38%), and sugar-sweetened beverages (61%, 24%). Weight-based stigma, such as a verbal insult about body size or weight, was observed in 84% of movies and 30% of segments.

CONCLUSIONS: Children’s movies include much obesogenic and weight-stigmatizing content. These messages are not shown in isolated incidences; rather, they often appear on-screen multiple times throughout the entire movie. Future research should explore these trends over time, and their effects.

WHAT’S KNOWN ON THIS SUBJECT: Screen time is associated with obesity. Media impacts children’s behaviors in many health-related domains, including tobacco use, alcohol use, and sexual activity. The authors of a study of movies from several years ago found that obesogenic behaviors and weight stigma were often depicted simultaneously.

WHAT THIS STUDY ADDS: In this study, we show that obesogenic and obesity-stigmatizing content continues to be highly prevalent in recent top-grossing children’s movies. We also provide a framework to investigate trends in the prevalence of obesogenic and stigmatizing content in children’s movies over time.


Asheley Cockrell Skinner, PhD, Sophie N. Ravanbakht, BA, Joseph A. Skelton, MD, MS, Eliana M. Perrin, MD, MPH, Sarah C. Armstrong, MD

OBJECTIVES: To provide updated prevalence data on obesity trends among US children and adolescents aged 2 to 19 years from a nationally representative sample.

METHODS: We used the NHANES for years 1999 to 2016. Weight status was determined by using measured height and weight from the physical examination component of the NHANES to calculate age- and sex-specific BMI. We report the prevalence estimates of overweight and obesity (class I, class II, and class III) by 2-year NHANES cycles and compared cycles by using adjusted Wald tests and linear trends by using ordinary least squares regression.

RESULTS: White and Asian American children have significantly lower rates of obesity than African American children, Hispanic children, or children of other races. We report a positive linear trend for all definitions of overweight and obesity among children 2–19 years old, most prominently among adolescents. Children aged 2 to 5 years showed a sharp increase in obesity prevalence from 2015 to 2016 compared with the previous cycle.

CONCLUSIONS: Despite previous reports that obesity in children and adolescents has remained stable or decreased in recent years, we found no evidence of a decline in obesity prevalence at any age. In contrast, we report a significant increase in severe obesity among children aged 2 to 5 years since the 2013–2014 cycle, a trend that continued upward for many subgroups.

WHAT’S KNOWN ON THIS SUBJECT: The US prevalence of child and adolescent obesity has been increasing for 4 decades. Some reports reveal stabilization across the population and decreases among young children aged 2 to 5 years, although severe obesity has increased, with adverse health effects.

WHAT THIS STUDY ADDS: We detail the prevalence of obesity and severe obesity by age and race and/or ethnicity, including Asian American youth, in a nationally representative sample. Despite significant public health initiatives, obesity and severe obesity continue to increase, with a sharp increase being noted in preschool-aged children.
version 15.0 (StataCorp, College Station, TX).

Readers should use the following information as guidance when interpreting our findings. We present results from multiple significance tests but do not make any adjustments for multiple testing, which reduces the chance of a type II error but increases the chance of a type I error. Readers should consider the chance for both type I and type II errors. To reduce the chance of a type I error (indicating as significant a relationship that does not exist), we present all ad hoc significance tests but do not make subgroup analyses should be considered more carefully. We have provided sample sizes throughout the tables to assist readers in their assessments.

**RESULTS**

**Prevalence**

Table 1 presents the prevalence of overweight and all classes of obesity by demographic characteristics in the most recent NHANES cycle, 2015–2016. Non-Hispanic African American and Hispanic children had higher prevalence rates of overweight and all classes of obesity compared with other races. Asian American children had markedly lower rates of overweight and all classes of obesity. The prevalence of overweight and obesity increased with age, with 41.5% of 16- to 19-year-old adolescents having obesity and 4.5% meeting criteria for class III obesity.


Table 2 shows the prevalence of overweight and all classes of obesity by ordinal 2-year cycles (1999–2016) for females, males, and both sexes. A positive linear trend is significant for overweight (P = .003), class I obesity (P = .008), class II obesity (P = .019), and class III obesity (P < .001) for both sexes, with all ages combined. The increasing linear trend from 1999 to 2016 is most apparent among Hispanic females (Table 3). Similar to those of females, there are large increases in overweight and class II obesity among Hispanic males (Table 4). All 95% CIs are included in Supplemental Tables 5–9.

### Differences From the Last Cycle

There are few differences in the prevalence of overweight and all classes of obesity since the last NHANES cycle, 2013–2014 and 2016–2016. One exception is a sharp increase in the prevalence of class I obesity among 2- to 5-year-olds, particularly in young males. Another notable increase is for overweight, from 36% to 48%, in among older adolescent females. There were no other significant changes from the 2013–2014 and 2015–2016 cycles for any of the race and/or

| TABLE 1 Prevalence of Overweight and Obesity Among Children and Adolescents, 2015–2016 |
|-----------------------------------------------|------------------------------------------------------------------------------|
| Total Overweight                             | Class I Obesity                                                              |
| Class II Obesity                             | Class III Obesity                                                            |
| Total                                          | n = 3340                                                                 | n = 1213                                                                 |
| Age                                           | n = 652                                                                      | n = 213                                                                    |
| 2–5 y                                         | n = 73                                                                      |
| 6–8 y                                         | —                                                                           | —                                                                         |
| 9–11 y                                        | —                                                                           | —                                                                         |
| 12–15 y                                       | —                                                                           | —                                                                         |
| 16–19 y                                       | —                                                                           | —                                                                         |
| Sex                                            | —                                                                           | —                                                                         |
| Female                                        | —                                                                           | —                                                                         |
| Male                                          | —                                                                           | —                                                                         |
| Race                                          | —                                                                           | —                                                                         |
| White                                         | —                                                                           | —                                                                         |
| African American                              | —                                                                           | —                                                                         |
| Hispanic                                      | —                                                                           | —                                                                         |
| Asian                                         | —                                                                           | —                                                                         |
| Other                                         | —                                                                           | —                                                                         |
| Prevalence of overweight                      | 31.9 to 38.4                                                                  | 15.8 to 21.2                                                               |
| Prevalence of class I obesity                 | 6.0                                                                          | 4.5                                                                       |
| Prevalence of class II obesity                | 1.9                                                                          | 1.0                                                                       |
| Prevalence of class III obesity               | .059                                                                         | .087                                                                      |
| Age                                            | 35.1                                                                         | 18.5                                                                      |
| Prevalence of overweight (% 95% CI)           | .005                                                                         | .006                                                                      |
| Prevalence of class I obesity (% 95% CI)       | 13.7                                                                         | 0.2                                                                       |
| Prevalence of class II obesity (% 95% CI)      | .329                                                                         | 0.006                                                                    |
| Prevalence of class III obesity (% 95% CI)     | 1.8                                                                          | 0.2                                                                       |
| Sex                                            | 95% CI                                                                       | 95% CI                                                                    |
| Female                                        | 17.5                                                                         | 13.3 to 21.2                                                               |
| Male                                          | 9.1                                                                          | 5.5                                                                       |
| Race                                          | 3.8                                                                          | 0.0                                                                       |
| White                                         | 2.8                                                                          | 0.0                                                                       |
| African American                              | .9                                                                          | 0.0                                                                       |
| Hispanic                                      | 6.0                                                                          | 0.0                                                                       |
| Asian                                         | 3.9                                                                          | 0.0                                                                       |
| Other                                         | 4.9                                                                          | 0.0                                                                       |

—, not applicable.
Characteristics of Children 2 to 5 Years of Age With Severe Obesity

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BACKGROUND AND OBJECTIVES: As a distinct group, 2- to 5-year-olds with severe obesity (SO) have not been extensively described. As a part of the Expert Exchange Workgroup on Childhood Obesity, nationally-representative data were examined to better characterize children with SO.

METHODS: Children ages 2 to 5 (N = 7028) from NHANES (1999–2014) were classified as having normal weight, overweight, obesity, or SO (BMI ≥120% of 95th percentile). Sociodemographics, birth characteristics, screen time, total energy, and Healthy Eating Index 2010 scores were evaluated. Multinomial logistic and linear regressions were conducted, with normal weight as the referent.

RESULTS: The prevalence of SO was 2.1%. Children with SO had higher (unadjusted) odds of being a racial and/or ethnic minority (African American: odds ratio [OR]: 1.7; Hispanic: OR: 2.3). They were from households with lower educational attainment (OR: 2.4), that were single-parent headed (OR: 2.0), and that were in poverty (OR: 2.1). Having never been breastfed was associated with increased odds of obesity (OR: 1.5) and higher odds of SO (OR: 1.9). Odds of >4 hours of screen time were 1.5 and 2.0 for children with obesity and SO. Energy intake and Healthy Eating Index 2010 scores were not significantly different in children with SO.

CONCLUSIONS: Children ages 2 to 5 with SO appear to be more likely to be of a racial and/or ethnic minority and have greater disparities in social determinants of health than their peers and are more than twice as likely to engage in double the recommended screen time limit.

WHAT’S KNOWN ON THIS SUBJECT: Preschool-aged children with severe obesity are a group with high risk of future comorbidity; however, they are poorly characterized as a distinct group.

WHAT THIS STUDY ADDS: In this study using nationally representative data, preschool-aged children with severe obesity were found to have greater disparities in social determinants of health and a particularly high level of screen time use compared with their peers.
OBJECTIVES: The prevalence of childhood obesity is significantly higher among racial and/or ethnic minority children in the United States. It is unclear to what extent well-established obesity risk factors in infancy and preschool explain these disparities. Our objective was to decompose racial and/or ethnic disparities in children’s weight status according to contributing socioeconomic and behavioral risk factors.

METHODS: We used nationally representative data from ~10,700 children in the Early Childhood Longitudinal Study Birth Cohort who were followed from age 9 months through kindergarten entry. We assessed the contribution of socioeconomic factors and maternal, infancy, and early childhood obesity risk factors to racial and/or ethnic disparities in children’s BMI z scores by using Blinder-Oaxaca decomposition analyses.

RESULTS: The prevalence of risk factors varied significantly by race and/or ethnicity. African American children had the highest prevalence of risk factors, whereas Asian children had the lowest prevalence. The major contributor to the BMI z score gap was the rate of infant weight gain during the first 9 months of life, which was a strong predictor of BMI z score at kindergarten entry. The rate of infant weight gain accounted for between 14.9% and 70.5% of explained disparities between white children and their racial and/or ethnic minority peers. Gaps in socioeconomic status were another important contributor that explained disparities, especially those between white and Hispanic children. Early childhood risk factors, such as fruit and vegetable consumption and television viewing, played less important roles in explaining racial and/or ethnic differences in children’s BMI z scores.

CONCLUSIONS: Differences in rapid infant weight gain contribute substantially to racial and/or ethnic disparities in obesity during early childhood. Interventions implemented early in life to target this risk factor could help curb widening racial and/or ethnic disparities in early childhood obesity.
How to Prevent Obesity Without Encouraging Eating Disorders

Neville H. Golden, MD, FAAP

Many eating disorders (EDs) programs have noted a marked increase in the number of teens who previously were obese or overweight presenting with frank eating disorders. In their attempt to lose weight, these adolescents may have resorted to unhealthy and unsustainable methods such as skipping meals or using diet pills or laxatives.

Even though their weight now is in the normal range, these individuals have medical and psychologic findings similar to those with classic anorexia nervosa. They may present to the pediatrician with severe bradycardia or orthostasis, signs of medical instability.

A new AAP clinical report addresses the interaction between obesity prevention and EDs in teenagers. It also provides pediatricians with evidence-informed tools to identify behaviors that predispose to both obesity and EDs and guidance on messaging.

The report Preventing Obesity and Eating Disorders in Adolescents, from the AAP Committee on Nutrition, Committee on Adolescence and Section on Obesity, is available at http://pediatrics.aappublications.org/content/early/2016/08/18/peds.2016-1649 and will be published in the September issue of Pediatrics.

BEHAVIORS LINKED TO WEIGHT PROBLEMS

While most adolescents who develop an eating disorder were not previously overweight, some teens may develop an eating disorder as they try to lose weight.

Research has shown that certain behaviors such as dieting, weight talk and weight teasing predispose to both obesity and EDs in teens, while frequent family meals are protective of both conditions.

Research has shown that frequent family meals protect against obesity and eating disorders in teens. A new AAP clinical report recommends that families eat together as a way to model healthy food choices.

Dieting, defined as caloric restriction with the goal of weight loss, was associated with a twofold increased risk of becoming overweight and a 1.5-fold increased risk of binge eating five years later in a large prospective study of healthy teens (Neumark-Sztainer DR, et al. Am J Prev Med. 2007;33:359-369).

Another study found that normal weight girls who dieted in ninth grade were three times more likely to be overweight in 12th grade compared with non-dieters (Stice E, et al. J Consult Clin Psychol. 1999;67:967-974).

Dr. Golden is lead author of the clinical report and a member of the AAP Committee on Nutrition.
 Obesity and eating disorders (EDs) are both prevalent in adolescents. There are concerns that obesity prevention efforts may lead to the development of an ED. Most adolescents who develop an ED did not have obesity previously, but some teenagers, in an attempt to lose weight, may develop an ED. This clinical report addresses the interaction between obesity prevention and EDs in teenagers, provides the pediatrician with evidence-informed tools to identify behaviors that predispose to both obesity and EDs, and provides guidance about obesity and ED prevention messages. The focus should be on a healthy lifestyle rather than on weight. Evidence suggests that obesity prevention and treatment, if conducted correctly, do not predispose to EDs.

INTRODUCTION

The prevalence of childhood obesity has increased dramatically over the past few decades in the United States and other countries, and obesity during adolescence is associated with significant medical morbidity during adulthood.1 Eating disorders (EDs) are the third most common chronic condition in adolescents, after obesity and asthma.2 Most adolescents who develop an ED did not have obesity previously, but some adolescents may misinterpret what “healthy eating” is and engage in unhealthy behaviors, such as skipping meals or using fad diets in an attempt to “be healthier,” the result of which could be the development of an ED.3 Messages from pediatricians addressing obesity and reviewing constructive ways to manage weight can be safely and supportively incorporated into health care visits. Avoiding certain weight-based language and using motivational interviewing (MI) techniques may improve communication and promote successful outcomes when providing weight-management counseling.4

This clinical report complements existing American Academy of Pediatrics (AAP) reports on EDs5 and obesity prevention.6 The aim is to address the interaction between obesity prevention and EDs in teenagers and to stress that obesity prevention does not promote the development
An Integrated Clinic-Community Partnership for Child Obesity Treatment: A Randomized Pilot Trial

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BACKGROUND AND OBJECTIVES: Effective treatment of childhood obesity remains elusive. Integration of clinical and community systems may achieve effective and sustainable treatment. However, the feasibility and effectiveness of this integrated model are unknown.

METHODS: We conducted a randomized clinical trial among children aged 5 to 11 presenting for obesity treatment. We randomized participants to clinical care or clinical care plus community-based programming at a local parks and recreation facility. Primary outcomes were the change in child BMI at 6 months and the intensity of the program in treatment hours. Secondary outcomes included health behaviors, fitness, attrition, and quality of life.

RESULTS: We enrolled 97 children with obesity, and retention at 6 months was 70%. Participants had a mean age of 9.1 years and a mean baseline BMI z score of 2.28, and 70% were living in poverty. Intervention participants achieved more treatment hours than controls (11.4 vs 4.4, SD: 15.3 and 1.6, respectively). We did not observe differences in child BMI z score or percent of the 95th percentile at 6 months. Intervention participants had significantly greater improvements in physical activity (P = .010) and quality of life (P = .008).

CONCLUSIONS: An integrated clinic-community model of child obesity treatment is feasible to deliver in a low-income and racially diverse population. As compared with multidisciplinary treatment, the integrated model provides more treatment hours, improves physical activity, and increases quality of life. Parks and recreation departments hold significant promise as a partner agency to deliver child obesity treatment.

WHAT'S KNOWN ON THIS SUBJECT: Childhood obesity treatment guidelines are challenging to deliver in real-world settings. Integrated clinic-community partnerships may increase the intensity of treatment, yet little is known about the feasibility and effectiveness of these integrated models.

WHAT THIS STUDY ADDS: When compared with clinical obesity treatment alone, an integrated clinic-community model, delivered at a parks and recreation facility, is engaging among a low-income, racially diverse population and is associated with improvements in physical activity and quality of life.
We observed an unexpected significant increase in sugar-sweetened beverage consumption in the intervention group. Potential explanations include increased consumption of sports beverages or sugary drinks because of increased physical activity or increased usage of vending machines with sugar-sweetened beverages located on-site at the parks and recreation facility. Recall bias could also explain this observation, because Bull City Fit provides nutrition education, and intervention parents might have monitored and reported their drink consumption more closely.

There are several limitations to our study. The initial exclusion of monolingual Spanish-speaking families, because of limited study resources, excluded a large proportion of the catchment population of interest. This exclusion made recruitment unfeasible, but the addition of resources later during the recruitment phase allowed us to include Spanish-speaking families. However, deviating from the initial protocol may have affected study outcomes. The adaptation of our trial highlights the importance of designing interventions to meet the linguistic and cultural needs of the population of interest. This is necessary not only for the generalizability of study outcomes but also to ensure that treatment interventions are appropriate for and inclusive of the population being served.

Because Bull City Fit primarily serves a low-income and diverse population, the curricula were designed to be flexible, engaging for all ages, and relatively unstructured. For example, attendance expectations discussed at enrollment were adaptable to each family’s individual schedule. This flexibility is a strength in terms of inclusivity, but the lack of structure and accountability is also a limitation. Incorporating personalized text messaging boosted attendance, and additional structured accountability measures should be considered in the future to improve intensity.

Although a randomized controlled trial design was a strength, another limitation was the relatively high drop-out among participants randomly assigned to the control group who wanted access to the intervention (n = 7).

We are building on our work from this pilot through a larger study recently funded by the American Heart Association to evaluate the implementation of the integrated model in diverse community settings. This randomized controlled clinical trial (n = 350) will compare the clinic-community integrated model with standard primary care obesity treatment over a 12-month period. This design will expand our sample size and duration of the intervention and will incorporate the texting protocol and the inclusion of monolingual Spanish-speakers to enhance recruitment and reduce dropout. Enrollment is expected to begin in January 2018.

**CONCLUSIONS**

In this study, we demonstrate the feasibility of delivering an integrated clinic-community partnership for child obesity treatment, delivered at a parks and recreation facility. The integrated model leads to greater engagement than clinical care alone and results...
# Supplemental Information

## SUPPLEMENTAL TABLE 4 Treatment Arms

<table>
<thead>
<tr>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Lifestyles Only</td>
<td>Healthy Lifestyles: same as control</td>
</tr>
<tr>
<td>Baseline visit (2 h)</td>
<td>Bull City Fit</td>
</tr>
<tr>
<td>Introduction to the program</td>
<td></td>
</tr>
<tr>
<td>Baseline laboratories, measurements</td>
<td></td>
</tr>
<tr>
<td>Medical evaluation: detailed history, examination, treatment goals</td>
<td>Different activities each session, led by trained staff and volunteers. Most staff are undergraduate students (paid through undergraduate work-study program in partnership with Healthy Lifestyles)</td>
</tr>
<tr>
<td>Physical therapy evaluation: history, fitness and physical functioning, fitness goals</td>
<td>Types of activities offered (on average)</td>
</tr>
<tr>
<td>Second visit (~1 h at 2 wk–1 mo)</td>
<td></td>
</tr>
<tr>
<td>Medical evaluation: review laboratories, review goals, decide treatment approach</td>
<td></td>
</tr>
<tr>
<td>Registered dietitian evaluation: detailed history, nutrition goals</td>
<td></td>
</tr>
<tr>
<td>Monthly visits for 1 y (~1 h) with multidisciplinary team, individualized for each patient</td>
<td></td>
</tr>
<tr>
<td>Medical provider + registered dietitian, physical therapist, mental health counselor</td>
<td></td>
</tr>
<tr>
<td>All participants had at least 2 h of clinical treatment from the baseline enrollment visit, and up to 6 additional hours if all 6 recommended monthly visits were attended</td>
<td></td>
</tr>
<tr>
<td>Clinical sessions could be more frequently than monthly on an individual basis if recommended by the medical team or desired by the family</td>
<td></td>
</tr>
<tr>
<td>Additional visits at least every 1 y, with shorter intervals as needed</td>
<td>GARDENING: 1 D/WK DURING THE SUMMER MONTHS</td>
</tr>
</tbody>
</table>

All members of multidisciplinary treatment team are trained in motivational interviewing.

Study visits conducted at baseline, 3-mo visit (10–16 wk), and 6-mo visit (23–29 wk).

Healthy Lifestyles: healthy lifestyles only

Children aged 0–22 y with a BMI ≥95th percentile are referred by their primary care provider.

All family and/or household members of the Healthy Lifestyles patient are invited to attend. At least 1 parent or guardian must be on-site per session.

Free, unlimited access.

Introduction to the program

Open Monday–Thursday from 6–8 pm and Saturday–Sunday from 1–3 pm.

Up to 312 h of programming over 6 mo is possible (2 h per session, 8 sessions offered per wk).

Baseline visit (2 h)

Participants must first attend a 1-h orientation session, offered several times per mo, before attending regular sessions.

Registered dietitian evaluation: detailed history, nutrition goals

Nutrition and/or cooking classes (for both children and parents, along with parent-specific cooking classes): 1 d/wk

Peer support groups: 1 d/wk

Active games (tag, relay races, handball, sharks and minnows, etc): 6 d/wk

Yoga: 1 d/wk

Sports (soccer, basketball, etc): 6 d/wk

Swimming (pool on-site, lessons offered): 2 d/wk

Gardening: 1 d/wk during the summer months

Parents and guardians can participate in activities with children or exercise on own.

Parents and guardians can participate in activities with children or exercise on own.
BACKGROUND: Young children living in historically marginalized families are at risk for becoming adolescents with obesity and subsequently adults with increased obesity-related morbidities. These risks are particularly acute for Hispanic children. We hypothesized that the prevention-focused, socioecological approach of the “Minding the Baby” (MTB) home visiting program might decrease the rate of childhood overweight and obesity early in life.

METHODS: This study is a prospective longitudinal cohort study in which we include data collected during 2 phases of the MTB randomized controlled trial. First-time, young mothers who lived in medically underserved communities were invited to participate in the MTB program. Data were collected on demographics, maternal mental health, and anthropometrics of 158 children from birth to 2 years.

RESULTS: More children in the intervention group had a healthy BMI at 2 years. The rate of obesity was significantly higher \( (P < .01) \) in the control group (19.7%) compared with the intervention group (3.3%) at this age. Among Hispanic families, children in the MTB intervention were less likely to have overweight or obesity (odds ratio = 0.32; 95% confidence interval: 0.13–0.78).

CONCLUSIONS: Using the MTB program, we significantly lowered the rate of obesity among 2-year-old children living in low-socioeconomic-status communities. In addition, children of Hispanic mothers were less likely to have overweight or obesity at 2 years. Given the high and disproportionate national prevalence of Hispanic young children with overweight and obesity and the increased costs of obesity-related morbidities, these findings have important clinical, research, and policy implications.

WHAT'S KNOWN ON THIS SUBJECT: Although overall obesity rates have plateaued nationwide, there is a widening racial and/or ethnic disparity in childhood overweight and obesity, particularly among Hispanic children early in life. There are few programs that address obesity in this age group.

WHAT THIS STUDY ADDS: Children living in families who received a 27-month parenting home visiting intervention were significantly less likely to be obese at 2 years of life. Hispanic children in the intervention families were also less likely to have a BMI >85%.

no major medical illness in the mother. In the current study cohort, we included 158 children (92 intervention and 66 control) from both phases of the RCT with complete anthropometric data collected at 24 months of age (see Fig 1). Additional details of design, recruitment, and retention procedures are available in the report on the pilot study findings and the efficacy trial.

**Procedures**

The MTB program provided home visiting by a master’s-prepared social worker and pediatric nurse weekly from the third trimester of pregnancy until the child’s first birthday and biweekly through the child’s second birthday. The home visits were typically 1 hour in duration, but this varied according to the dyad’s life circumstances. The clinician pairs were varied between families and CHCs to reduce threats to internal validity. They received weekly supervision and participated in team case presentations to ensure fidelity. During the 2 phases, there were 2 nurses and 5 part-time social workers at various points in time. Further details on the manualized MTB program have been published previously. Research ethics approval was obtained through the university and CHCs.

**Measures**

**Main Exposure**

The main exposures in this study were the group status (intervention or control) and race and/or ethnicity. At the time of consent, all participants were pregnant women who self-reported their race and/or ethnicity after random assignment.

**Potential Covariates**

We considered several early life risk factors known to be associated with childhood obesity as potential covariates: maternal mental health, rapid infant weight gain, and feeding other than exclusive breastfeeding. In this study, mothers in both groups met with research staff to complete questionnaires at 24 months and a semistructured interview prenatally and at 24 months to assess maternal mental health, including depressive symptoms (Center for Epidemiologic Studies Depression Scale), parenting stress (Parenting Stress Index), posttraumatic stress symptoms (Mississippi Scale), and maternal RF (Pregnancy Interview and Parent Development Interview). Details on the instruments, reliability, and validity have been reported elsewhere. Rapid infant weight gain was defined as a change in weight-for-age z score >0.67 SD on the basis of World Health Organization growth data (between birth and age 12 months), which is interpreted clinically as crossing centile lines on a growth chart. Data were collected on weeks of exclusive breastfeeding.

**Outcome Measures**

The primary outcome is the prevalence of overweight (≥85th percentile) or obesity (≥95th percentile) in children at 2 years, which was assessed by using the Centers for Disease Control and Prevention reference data, adjusting for age and sex (z score). Weight and height data at birth, 12 months, and 24 months were collected via medical chart review.

**Families Without Complete Data**

There were 75 families excluded from this study because of a combination of dropout from MTB and incomplete anthropometric growth data in the children’s medical charts at 24 months. There was no difference in the number of families in the intervention and control groups among those excluded. There were no significant differences in any demographic variables between included and excluded families (see Supplemental Table 4).

**Statistical Analysis**

We compared demographic characteristics, maternal mental
ever-rising US health care spending on obesity-related morbidities, recently, in the White House Task Force Report, “Solving the Problem of Childhood Obesity Within a Generation,” as well as in subsequent Institute of Medicine reports, the need for interventions early in life to prevent obesity has been emphasized. On the basis of our findings, we suggest that home visiting programs that focus on the whole child and on the early mother-child relationship using a socioecological approach may be in the best position to build the foundation for healthy development. Much more empirical evidence is required to confirm this hypothesis, but with our results, we suggest that this approach may be highly beneficial in lowering rates of obesity in at-risk populations.

ACKNOWLEDGMENTS

We thank Denise Webb and Tanika Simpson for their thoughtful review and editorial assistance. We also thank the CHCs and families who generously provided their time and trust in our program.

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POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

REFERENCES

OBJECTIVE: To determine whether a 2-year family-based intervention using frequent contact and limited expert involvement was effective in reducing excessive weight compared with usual care.

METHODS: Two hundred and six overweight and obese (BMI ≥85th percentile) children aged 4 to 8 years were randomized to usual care (UC) or tailored package (TP) sessions at university research rooms. UC families received personalized feedback and generalized advice regarding healthy lifestyles at baseline and 6 months. TP families attended a single multidisciplinary session to develop specific goals suitable for each family, then met with a mentor each month for 12 months, and every third month for another 12 months to discuss progress and provide support. Outcome measurements (anthropometry, questionnaires, dietary intake, accelerometry) were obtained at 0, 12, and 24 months.

RESULTS: BMI at 24 months was significantly lower in TP compared with UC children (difference, 95% confidence interval: –0.34, –0.65 to –0.02), as was BMI z score (–0.12, –0.20 to –0.04) and waist circumference (–1.5, –2.5 to –0.5 cm). TP children consumed more fruit and vegetables (P = .038) and fewer noncore foods (P = .020) than UC children, and fewer noncore foods were available in the home (P = .002). TP children were also more physically active (P = .035). No differences in parental feeding practices, parenting, quality of life, child sleep, or behavior were observed.

CONCLUSIONS: Frequent, low-dose support was effective for reducing excessive weight in predominantly mild to moderately overweight children over a 2-year period. Such initiatives could feasibly be incorporated into primary care.

WHAT’S KNOWN ON THIS SUBJECT: Although treatment programs for childhood obesity can demonstrate success, long-term outcomes have seldom been evaluated. The benefit of intervention when overweight is identified in a screening assessment and parental recognition of the problem is minimal is understudied.

WHAT THIS STUDY ADDS: A low-dose (sessions every 1–3 months), but long-term (2 years), family-based intervention was effective at reducing BMI compared with usual care in children recruited via a weight screening initiative in which many parents had been unaware their child was overweight.
Cost-Effectiveness of a Clinical Childhood Obesity Intervention

Mona Sharifi, MD, MPH, a Calvin Franz, PhD, b Christine M. Horan, MPH, c Catherine M. Giles, MPH, d Michael W. Long, ScD, d Zachary J. Ward, MPH, e Stephen C. Resch, PhD, f Richard Marshall, MD, g Steven L. Gortmaker, PhD, g Elsie M. Taveras, MD, MPH c, h

OBJECTIVES: To estimate the cost-effectiveness and population impact of the national implementation of the Study of Technology to Accelerate Research (STAR) intervention for childhood obesity.

METHODS: In the STAR cluster-randomized trial, 6- to 12-year-old children with obesity seen at pediatric practices with electronic health record (EHR)-based decision support for primary care providers and self-guided behavior-change support for parents had significantly smaller increases in BMI than children who received usual care. We used a microsimulation model of a national implementation of STAR from 2015 to 2025 among all pediatric primary care providers in the United States with fully functional EHRs to estimate cost, impact on obesity prevalence, and cost-effectiveness.

RESULTS: The expected population reach of a 10-year national implementation is ∼2 million children, with intervention costs of $119 per child and $237 per BMI unit reduced. At 10 years, assuming maintenance of effect, the intervention is expected to avert 43,000 cases and 226,000 life-years with obesity at a net cost of $4085 per case and $774 per life-year with obesity averted. Limiting implementation to large practices and using higher estimates of EHR adoption improved both cost-effectiveness and reach, whereas decreasing the maintenance of the intervention’s effect worsened the former.

CONCLUSIONS: A childhood obesity intervention with electronic decision support for clinicians and self-guided behavior-change support for parents may be more cost-effective than previous clinical interventions. Effective and efficient interventions that target children with obesity are necessary and could work in synergy with population-level prevention strategies to accelerate progress in reducing obesity prevalence.

WHAT’S KNOWN ON THIS SUBJECT: Excess health care costs attributable to obesity demand effective and efficient strategies. To facilitate appropriate resource allocation, economic evaluations can aid explicit assessments of intervention efficiency and allow for comparisons between interventions. Such analyses are lacking in pediatric obesity management.

WHAT THIS STUDY ADDS: A childhood obesity intervention involving electronic decision support in primary care improved BMI at a cost of $119 per child and $237 per BMI unit reduced. National implementation over 10 years could reach >2 million children and avert 43,000 obesity cases.

Supplemental Information

SUPPLEMENTAL FIGURE 2
Logic pathway linking the STAR intervention to change in obesity-related health care costs. Δ, change; PA, physical activity; SSB, sugar-sweetened beverages.

SUPPLEMENTAL FIGURE 3
Hierarchical representation of the target population for the national implementation of the STAR intervention.