

Editorial

Adolescent Obesity: Towards Evidence-Based Policy and Environmental Solutions

Adolescent obesity is one of the major global health challenges of the 21st century. In the United States, the prevalence of obesity (body mass index [BMI] >95th percentile) among adolescents aged 12–19 years quadrupled from 1966 to 2003–2006 (from 4.6% to 17.6%) [1,2]. Currently one in three (34.9%) U.S. adolescents are overweight or obese (BMI >85th percentile) [2]. The prevalence of adolescent obesity is highest among black, Hispanic, and American Indian youth and among youth from lower-income households [3,4]. Overweight causes adverse health, social, and emotional outcomes and increases adolescents' risk of disability and premature death as adults. Of great concern is the increasing prevalence of type 2 diabetes among adolescents, which is associated with obesity and becomes more common after age 10 years. Two million adolescents (or one in six overweight adolescents) have prediabetes [5]. Metabolic and physiologic abnormalities associated with obesity in adolescence (e.g., hypertension, dyslipidemias, orthopedic problems, type 2 diabetes) tend to track into adulthood along with the condition of obesity itself. Obesity during adolescence is the single best predictor of adult obesity [6]. Dietz and Gortmaker [7] identified three critical periods in childhood for the development of obesity: the prenatal period, the period of adiposity rebound, and adolescence. These critical periods highlight not only the importance of the adolescent stage but also the necessity of applying a life-course approach to the prevention of obesity.

Although a wide range of behavioral, genetic, biological, and environmental factors contribute to the development of obesity, energy imbalance resulting from limited physical activity and excess energy intake are considered the most important factors. Wang et al [8] found that U.S. children and adolescents experienced an average “energy gap” (i.e., surplus of energy intake over energy expenditure) of 165 calories per day over the period from the 1988 and 1994 NHANES to the 1999–2002 NHANES surveys, leading to an excess 10 pounds of body weight for all adolescents, 1 pound per year, on average. Overweight adolescents consumed an average of 700–1000 more calories per day, which resulted in an average weight gain of 58 extra pounds beyond that associated with normal growth, almost 6 pounds per year.

The U.K. Foresight report [9] has framed obesity as an imbalance in energy caused by a complex multifaceted system of determinants in which no single influence dominates. The investigators concluded that at the heart of the issue of excess weight lies a biological system struggling to cope in a fast-changing world in which the pace of technological revolution has outstripped human evolution. Biologically based preferences for energy-dense foods and energy-conserving activities were adaptive in environments with periodic food shortages, but not in today's world. Adolescents today live in a society that has changed drastically in the past few decades during which obesity has increased so dramatically. In the past three to four decades, there have been major societal changes affecting physical activity, such as increased opportunities for sedentary recreation and fewer opportunities for active transport, with physical activity being engineered out of adolescents' daily routines [10]. Only 8% of middle schools and 2% of high schools provide daily physical education or its equivalent [11], and there has been a significant decrease in the number of youth who walk or bike to school [12]. In addition, adolescents are spending more sedentary time using electronic media, such as television, computer games, and the Internet [13]. Environments that make it difficult for youth to be active are believed to be partially responsible for the low prevalence of adolescents meeting the recommended 60 minutes per day of moderate-to-vigorous physical activity—less than 10% of adolescents as measured by objective accelerometers in a national sample [14].

At the same time, cumulative changes in adolescents' food environments have increased the marketing, availability, appeal, affordability, and consumption of foods and beverages that are low in nutrients but high in fat, sugar, and calories. Few adolescents eat the amounts of fruits, vegetables, whole grains, and calcium-rich foods as recommended in the Dietary Guidelines for Americans, and many consume excess calories, sugar, total and saturated fats, and sodium. Middle and high schools frequently sell high-calorie, low-nutrition beverages and foods in vending machines and a la carte in the cafeteria [15]. In addition, an increasing number of adolescents living in underserved communities do not

have access to food stores that stock and sell affordable healthy foods. Over the past few decades, the cost of high-calorie, low-nutrition foods has decreased whereas the cost of more healthful foods such as fruits and vegetables has increased [16].

In short, the consistent rise in the prevalence of obesity among children and adolescents since the 1970s reflects the cumulative effects of these changes in the external environment and underscores the need to identify and modify the environmental influences that could help to alter both energy intake and energy expenditure at the population level. Huang and Glass [17] point out that shifting the population distribution of obesity will require interventions and strategies that include targeting food environments and physical activity environments, especially among groups most at risk for obesity. McKinnon et al [18] similarly emphasize the importance of public policies as a tool to alter the built and food environment to improve population-level diet and physical activity behaviors. There is growing recognition that environmental and policy approaches can affect large populations, can reach traditionally underserved populations, are likely to have long-term or permanent effects, and can augment and support educational and behavior change interventions to make them more effective. According to the Institute of Medicine [19], the U.S. Surgeon General [20], and the World Health Organization [21], environmental and policy interventions must be at the center of efforts to reverse the rise in childhood obesity. In the long term, these environmental and policy changes may not only reduce health and disability costs but may also produce a healthier and more environmentally sustainable society [9].

The 2005 Institute of Medicine report, *Preventing Childhood Obesity: Health in the Balance* [19] concluded that environmental and policy influences are potentially the most powerful—but currently least well understood—strategies for addressing child and adolescent obesity. At present, relatively little is known about the most effective and feasible policy initiatives to modify children's food and physical activity environments. The need to find the most effective population-level obesity prevention strategies is among the most profound challenges in public health today [17]. It is widely acknowledged that we need to identify obesity prevention strategies that are feasible and effective and then work with public health practitioners, schools, community coalitions and policymakers at all levels to implement these approaches [22]. A recent survey of state health department chronic disease directors found that nearly half reported that they did not believe that they had adequate quality research to help them construct effective obesity prevention and reduction strategies in their states [23]. They emphasized the need for additional research to identify evidence-based interventions and “best practice” guidelines for programs. Given the importance of finding and implementing effective public health strategies for addressing child and adolescent obesity overall and in high-risk populations, systematic “solution-oriented” and fast-track policy and environmental research is needed [22,24].

To fill critical gaps in research, an increasing number of funders have placed a high priority on funding research to identify key policy and environmental determinants of rising youth obesity trends and to find effective and sustainable policy and environmental solutions to reverse these trends, with a special focus on the populations and communities at highest risk. To increase their impact and speed of discovering and applying evidence-based interventions, the Centers for Disease Control and Prevention, National Institutes of Health, and Robert Wood Johnson Foundation (RWJF) recently joined forces to launch a National Collaborative on Childhood Obesity Research (NCCOR). Through NCCOR (<http://www.nccor.org>), they will work collectively to improve the efficiency and effectiveness of childhood obesity studies—evaluating new and existing prevention approaches, rapidly assessing promising policy changes, and speeding the application of interventions that work.

The articles in this supplement are based on research funded by the RWJF, which has invested significantly in research programs and evaluations addressing both sides of the energy balance equation, with the aim of providing key decision and policy makers with evidence to guide and accelerate effective action to reverse the rise in childhood obesity [22,25]. RWJF's research initiatives, the largest of which are described below, are designed to inform action and create change and have generated a large number of peer-reviewed publications, as well as numerous policy-relevant research briefs and syntheses, monographs, and journal supplements.

- *Active Living Research (ALR)* and *Healthy Eating Research (HER)* support investigator-initiated research to identify and evaluate policies and environmental approaches that have the greatest potential to reverse the nation's rising levels of childhood obesity, especially among children ages 3–18 at highest risk for obesity on the basis of income, race/ethnicity or location. Both programs support studies and analyses of school, local, state and federal policies, including “rapid response” studies of naturally occurring policy and environmental changes (so-called “natural experiments”) that are taking place in states, communities and schools across the country. The shared core goals of ALR and HER are as follows: 1) to establish a strong research base regarding policy and environmental factors that influence (either healthy eating or physical activity) and body weight in children and adolescents, as well as effective policy and environmental strategies for reversing the childhood obesity epidemic; 2) to build a vibrant, multidisciplinary field of research and a diverse network of researchers; and 3) to ensure that findings are rapidly synthesized and communicated to inform policy debates, public health action, and advocacy and to guide the development of effective solutions. More information on ALR and HER, as well as policy-relevant research briefs and syntheses, monographs and journal supplements, can be found on their

respective Web sites (www.activelivingresearch.org and www.healthyeatingresearch.org).

- With a primary focus on adolescents, *Bridging the Gap* has created a national school- and community-based surveillance system to annually assess the impact of school, community, state and national policies, programs, and other environmental influences on diet, physical activity, and self-reported BMI among nationally representative cross-sectional samples of 8th, 10th, and 12th graders [25]. Results are summarized and synthesized in annual monographs that can be found on the relevant Web sites (www.bridgingthegapresearch.org and www.impactteen.org).
- A grant to the Yale University Rudd Center for Food Policy and Obesity supports strategic food marketing research, including “quick strike” studies on policies and practices related to food advertising and marketing aimed at children and adolescents (www.yaleruddcenter.org).

Growing findings from these initiatives and research funded by other agencies have shown that adolescents are especially vulnerable to unhealthy food and physical activity environments, at a time when lifelong health behaviors are being established. Thus, this supplement to the *Journal of Adolescent Health* focuses on adolescent obesity and the need for evidence-based policy and environmental solutions. The purpose of the supplement is to highlight recent findings from *Healthy Eating Research* grantees, *Active Living Research* grantees, *Bridging the Gap*, and *The Rudd Center* that illustrate the breadth and depth of research related to adolescent obesity prevention and its relevance for informing policy changes.

The supplement starts with a Commentary by Risa Lavizzo-Mourey, M.D., M.B.A., President and CEO of RWJF, that was adapted from her keynote presentation at the 2008 Society for Adolescent Medicine’s annual meeting, “Adolescent Obesity: Prevention and Treatment.” [26]. Her commentary describes the scope of the adolescent obesity epidemic, its impact on health and society, and the foundation’s vision for reversing the epidemic by 2015. The paper by Brownell and colleagues [27] was based on Brownell’s distinguished Gallagher Lectureship at the 2008 annual meeting, which called for “bold action to prevent adolescent obesity.” The paper underscores the urgent need for changes in the environment and makes the case that modern conditions have created an environment that makes unhealthy behavior the “default” and adolescent obesity a predictable and inevitable consequence, and presents a framework for action for creating “optimal defaults” to promote healthier eating and physical activity.

The studies of healthy eating policies and environments in this issue deal with improving the food environment at schools, food marketing, and soda taxes. Schools can become one of the most effective partners in the fight against obesity by ensuring the environment is conducive to healthy eating and physical activity. The paper by Johnson et al [28] found that sugar-sweetened beverage (SSB) exposure in middle

schools was a significant predictor of SSB consumption during the school day. Furthermore, SSB policy was a significant predictor of SSB exposure. Terry-McElrath et al [29] examined trends in the availability of foods in 684 middle and high schools from 2004–2007 and found a decreasing trend in the availability of regular sugar and high-fat food items. Suggestive evidence was observed for a relationship between the school food environment and student BMI. Samuels et al [30] examined factors associated with implementation of California’s school nutrition standards 1 year after standards became effective. They found the majority of schools were adhering to the required beverage standards; however, none of the schools selling competitive foods were 100% adherent to the nutrient-based food standards.

Food and beverage marketing is a potent factor influencing food choices and weight status of youth [31]. Brownell et al [27] describe adolescents’ increased vulnerability to food marketing messages because of developmental concerns related to appearance, self-identity, belonging, and their reduced ability to inhibit impulsive behaviors and delayed gratification. On a related topic, Montgomery and Chester [32] provide one of the first reviews of interactive food and beverage marketing and the new media and marketing ecosystem targeting adolescents, and they recommend policy and regulatory initiatives to reduce the negative impact of the digital marketplace.

One public health measure currently being debated to help prevent obesity and as a potential measure to generate revenue for health reform efforts is taxing soft drinks [33]. Using national data from *Bridging the Gap*, Powell et al [34] examined the association between state-level grocery store and vending machine soda tax rates and adolescents’ BMI.

Active living-related papers focus on schools and parks, both of which are common settings for adolescent physical activity that can be influenced by policy. Using national data from *Bridging the Gap*, O’Malley et al [35] found that school physical education policies, and practices were not related to adolescents’ BMI, and the authors advised that increased quantity and intensity of physical education is needed to make a difference in BMI. However, more participation in intramural sports was related to lower BMIs. Barroso et al [36] evaluated a Texas state law mandating 30 minutes of daily physical activity in middle schools and found generally good adherence, even in the lowest-income areas in the state. In their study of mainly African-American adolescents, Ries et al [37] reported that park use was related to greater perceptions of park proximity, park quality, and use by friends. Craddock et al [38] found that adolescents were more physically active after school when school neighborhoods had less traffic and more destinations within walking distance. This study extends previous findings that policies related to community design and transportation are relevant for youth physical activity.

The articles in this supplement of the *Journal of Adolescent Health* demonstrate the value of research in documenting favorable trends such as healthier foods in schools

[29,30] and effective school policies providing healthier food [30] and more physical activity [36] that can be adopted by other states. The data reported here can provide guidance about how to increase use of parks by African-American adolescents [37], policy changes in schools that can reduce adolescents' sugar-sweetened beverage intake [28], and the potential for increased soda taxes to reduce consumption [34]. Other papers demonstrate the many areas in need of further research and intervention. More improvements are recommended so that physical education will contribute more to obesity prevention [35]. Adolescents appear to be particularly susceptible to food marketing [27], and marketers are using new digital-age tools to target youth [32].

This supplement contains just a sample of adolescent obesity-related research, but the research has been growing in quantity and quality as indicated by the national-level analyses and evaluations of policies. However, many questions remain, and the nature of policy and environmental research challenges investigators in the areas of study design, measurement, and analysis, so a continued focus on improving both scientific rigor and policy relevance is needed [39]. Fortunately, the National Collaborative on Childhood Obesity Research provides a structure for ensuring that the development and strengthening of policy and environmental research on youth obesity research stays at the forefront of the agendas of both public and private funders. We invite our colleagues who are practitioners, advocates, and policy makers to use these and other findings to guide their efforts to improve adolescent diet and physical activity and to help prevent adolescent obesity.

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Mary Story, Ph.D., R.D.

*Healthy Eating Research, School of Public Health
University of Minnesota, Minneapolis, Minnesota*

James F. Sallis, Ph.D.

*Active Living Research, Department of Psychology
San Diego State University, San Diego, California*

C. Tracy Orleans, Ph.D.

Robert Wood Johnson Foundation, Princeton, New Jersey

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