Contributions of Built Environment to Childhood Obesity

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ABSTRACT
As childhood obesity has reached epidemic proportions, it is critical to devise interventions that target the root causes of obesity and its risk factors. The two main components of childhood obesity are physical inactivity and improper nutrition, and it is becoming increasingly evident that the built environment can determine the level of exposure to these risk factors. Through a multidisciplinary literature review, we investigated the association between various built environment attributes and childhood obesity. We found that neighborhood features such as walkability/bikeability, mixed land use, accessible destinations, and transit increase resident physical activity; also that access to high-caloric foods and convenience stores increases risk of overweight and obesity, whereas the presence of neighborhood supermarkets and farmers’ markets is associated with lower childhood body mass index and overweight status. It is evident that a child’s built environment impacts his access to nutritious foods and physical activity. In order for children, as well as adults, to prevent onset of overweight or obesity, they need safe places to be active and local markets that offer affordable, healthy food options. Interventions that are designed to provide safe, walkable neighborhoods with access to necessary destinations will be effective in combating the epidemic of obesity. Mt Sinai J Med 78:49–57, 2011. © 2011 Mount Sinai School of Medicine

Key Words: built environment, childhood, nutrition, obesity, physical activity.

Physicians, parents, and policymakers alike are concerned about the increasing rates of overweight and obesity in the US population, particularly among children. Recent data from the National Health and Nutrition Examination Survey show that the current prevalence of obesity and overweight for adults is approximately 68%. Over the last 3 decades, the number of obese children aged 6–11 years has tripled, and the prevalence has doubled for preschool

The rising rates of childhood obesity parallel the emergence of type 2 diabetes in children. Excess weight during childhood not only has concurrent effects, but is also associated with health problems in adulthood. The situation has become so alarming that obesity is predicted to shorten life expectancy of the average American 2 to 5 years by mid-century unless aggressive efforts are made to slow this major public health epidemic.
children and adolescents (Table 1). Health risks associated with childhood obesity include type 2 diabetes, coronary heart disease, asthma, and others that are linked to psychosocial disorders. In fact, the rising rates of childhood obesity parallel the emergence of type 2 diabetes in children. Excess weight during childhood not only has concurrent effects, but is also associated with health problems in adulthood. The situation has become so alarming that obesity is predicted to shorten life expectancy of the average American 2 to 5 years by mid-century unless aggressive efforts are made to slow this major public health epidemic. Even with physicians educating their patients about the benefits of a balanced diet and regular exercise, the increasing obesity trend has not abated. As more research has focused on the environmental factors that impact health outcomes, it has become increasingly evident that there is an important relationship between community design and health.

Up until the recent decade, research has mainly focused on the nutritional aspects of this epidemic, but now increased attention is being given to Americans’ low levels of physical activity. It is widely recognized that the design of cities and communities can promote or inhibit physical activity in children and adults. Due to the protective benefits of physical activity, it is recommended that adults engage in at least 150 minutes of moderate-intensity aerobic activity—such as brisk walking—each week, and children get at least 60 minutes of aerobic activity every day. However, most Americans fail to follow these guidelines.

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In the September 2003 issue of the American Journal of Public Health, experts from a number of disciplines contributed groundbreaking research recognizing the emerging field of built environment and health. Now, growing numbers of health professionals, urban planners, community leaders, policymakers, and others are working to build healthy communities that promote physical and mental well-being. In fact, the American Academy of Pediatrics issued a policy statement calling for a multidisciplinary approach to designing communities to promote active lifestyles among children. A PubMed literature search demonstrates the increasing trend of publications in the arena of “built environment and health” (Figure 1). These academic contributions elucidate the ways in which the design of our homes, schools, workplaces, neighborhoods, cities, and transportation systems—our built environment—impact health outcomes. In one example, a major study in Atlanta, Georgia, found that walkable neighborhoods confer significant health benefits to local residents.

Though there is a substantial body of literature on neighborhood effects on adult obesity and related risks, such research on childhood obesity is quite limited. However, as Glanz and Sallis describe in their investigation on the potential role of the built environment in promoting childhood obesity, it is reasonable to expect that findings from adult studies can justify the presence of similar associations in pediatric populations. In fact, children are even more vulnerable to the adverse effects of their environment, suggesting that improvements to neighborhood conditions in conjunction with other preventive programs are promising strategies to reduce childhood obesity.

### ROLE OF BUILT ENVIRONMENT IN CHILDHOOD OBESITY

The United States has invested significant resources to educate children about the importance of good nutrition and being active, yet we have seen limited success with this strategy. It is now commonly recognized that we must make health-promoting changes to the environments in which children live, learn, eat, and play. There is strong evidence to show
that long-term solutions to the childhood obesity epidemic can be achieved by modifying the built environment to increase children’s physical activity and access to healthful foods, and reduce their access to unhealthy foods.\textsuperscript{17} Although there are a number of complex issues associated with obesity, research indicates that prevention programs should focus on improving environmental conditions that put children at risk for poor diets, physical inactivity, and sedentary behavior.

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\textbf{NUTRITION}

The availability, accessibility, and cultural acceptability of food affect the health of the surrounding community. People with better access to supermarkets and limited access to convenience stores are more likely to have healthier diets and lower levels of obesity.\textsuperscript{19}

\textbf{Schools}

In the United States, >55 million children are enrolled in elementary or secondary schools and on average spend >6 hours at school each day.\textsuperscript{20} The school nutrition environment plays a significant role in a child’s diet, as most children eat at least 1 meal per day at school, as well as snacks. Although schools offer students at least some healthy food choices, the presence of many unhealthy options means that few children consume balanced meals.

Research also suggests that youth with limited access to fast-food restaurants near their schools have a lower risk of obesity.\textsuperscript{21} One study found that among ninth-graders, the presence of a fast-food restaurant within a tenth of a mile—about 530 feet—of a school is associated with a \(\geq 5.2\%\) increase in obesity rates. There was no effect found for restaurants one-quarter or one-half mile away from the school.\textsuperscript{22} Therefore, policies that restrict access to fast food near schools could have significant impacts on childhood obesity.

\textbf{Community}

Lower–socioeconomic status neighborhoods are at higher risk, as these communities often have limited access to recreational facilities and food stores with healthful, affordable options—though the neighborhoods themselves may be designed in ways that promote physically active transportation. Availability of supermarkets is associated with lower adolescent body mass index (BMI; a standard measure of weight to height used as an indicator of overweight and obesity) and overweight status.\textsuperscript{23} Morland \textit{et al.} found that poorer neighborhoods have 3\times fewer supermarkets than wealthier neighborhoods but contain more fast-food restaurants and convenience stores, which constrains residents’ ability to access healthy food locally.\textsuperscript{21} A high density of fast-food restaurants, convenience stores, and bars, along with concentrated media marketing, all promote unhealthful food choices and hinder good nutrition.\textsuperscript{25}

Neighborhoods that have access to community gardens can promote both physical activity and DOI:10.1002/MSJ
healthful eating for residents. Not only do community gardens generate fresh, locally grown produce, they provide an opportunity to engage in physical activity. In turn, this can reduce the cost of transporting healthful foods to markets. School-aged children can gain multiple benefits from being involved in gardening with their family or at school. In an effort to address elevated childhood-obesity rates and the overindustrialized food system, Mayor Antonio Villaraigosa of Los Angeles, California, established the Food Policy Task Force (http://goodfoodla.org). The group recently endorsed the creation of a regional food system that would give low-income residents access to healthy foods. Among the key recommendations are getting Electronic Benefits Transfer cards (California’s version of the national Supplemental Nutrition Assistance Program) accepted at all farmers’ markets in Los Angeles County and encouraging city and county institutions to buy more local food.

PHYSICAL ACTIVITY

Communities that have low-density development patterns, poor street connectivity, and a lack of destinations within safe walking distance adversely impact health behaviors, which in turn contributes to obesity and other chronic illnesses. Several studies have found higher rates of adult obesity in sprawling communities. Urban sprawl is characterized by areas in which homes are far from community amenities, and often the only route to reach destinations is a busy, high-speed arterial roadway that is unsafe for walking or biking (Figure 2). Driving is commonly the only way to access essential goods and services in sprawling areas, whereas communities that are more compactly developed provide residents the opportunity to walk and engage in regular, utilitarian physical activity. The more time people spend in automobiles, the less time they spend engaging in physical activity, and the more difficult it becomes to maintain a healthy weight.

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Evaluations of the relationship between the built environment, travel patterns, and obesity show that each additional hour spent in a car per day is associated with a 6% increase in the likelihood of obesity, whereas any additional kilometer walked per day is associated with a 4.8% decrease. The first national study to establish a direct association between community design and the health of local residents found that people living in sprawling counties are likely to have higher BMIs. There is also a direct relationship between sprawl and hypertension.

The disappearance of physical activity from the daily lives of American adults and children is a complex problem. However, there is growing evidence demonstrating that the presence of sidewalks, safe intersections, walkable communities, accessible destinations, appealing green spaces, and public transit can improve population activity levels and related health outcomes. Neighborhoods that include a mix of residential, commercial, retail, and recreational destinations frequently result in more resident physical activity and less overweight and obesity. Walking for utilitarian purposes is consistently found to be more prevalent in dense, mixed-use neighborhoods when compared with lower-density, exclusively residential neighborhoods. People who live in more walkable neighborhoods (with mixed use, connected streets, high residential density, and pedestrian-oriented retail) tend to walk and bike more for transportation (also known as “active transportation”), have lower BMIs, drive less, and emit less air pollution than people living in less-walkable neighborhoods. High-quality public transportation and transit-oriented development (Figure 3) impact health beyond physical activity rates, as they reduce

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traffic-related injuries, benefit mental health, improve access to healthy food and medical care, and increase affordability, which decreases financial stress on lower-income households.32

School-Related Transportation

Many communities developed after World War II have limited access to safe places to walk, bike, or play, and as a consequence, children and adolescents are less physically active than they were a generation ago. For example, the number of students aged 5 to 18 years who walk or bike to school declined from 42% in 1969 to 13% in 2001.37 Today, approximately 44% of kids commute to school by car (Figure 4), due in large part to a lack of neighborhood sidewalks and concerns about distance and traffic safety.38 The decline in active transportation to school has notably coincided with the increasing rates of childhood obesity. Elementary and middle school aged youth who walk to and from school are more physically active overall than those who commute by automobile.39

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Table 2. Recommendations for Health Professionals in Addressing Childhood Obesity.

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<th>Recommendation</th>
<th>Suggested Courses of Action</th>
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| Provide access to safe and nutritious food at school. | • Offer technical assistance and expertise to local parent-teacher associations in order to promote a healthy school-nutrition environment.  
• Provide support to local schools in developing a robust nutrition-education program.  
• Provide support for community gardens or programs that link local farmers with schools, ensuring that school meals are healthier.  
• Establish healthcare facilities as models for healthy eating by closing down fast-food outlets in hospitals and other care centers.  
• Advocate for the use of zoning laws to require certain types of destinations be located within walking distance of most residences, and to limit the number of convenience stores and fast-food restaurants. |
| Encourage healthy eating habits. | • Focus on health instead of weight to encourage children to make healthier choices.  
• Take time during patient visits to discuss the importance of a healthy diet.  
• Educate parents about what constitutes a healthy diet and the importance of providing children with nutritious meals.  
• Conduct BMI or height-to-weight screenings and educate parents about the significance of these measurements. |
| Promote Safe Routes to School (SRTS). | • Support the reauthorization of the Surface Transportation Act so it provides substantial financial support for walking, bicycling, public-transit infrastructure, and programs such as SRTS.  
• Work with community groups or schools to organize a SRTS program in the local community. |
| Ensure that communities are designed or repurposed with healthy living as a clear goal. | • Urge your local planning and transportation department to establish project-review guidelines that incorporate Complete Streets principles, which consider the needs of all users, including children.  
• Promote safe access to parks and recreational facilities.  
• Incorporate health items in public comments for projects. |
| Encourage agencies to evaluate the impacts to human health when considering policies and regulations. | • Spread the word that funds marked for highway development would be better spent to improve the quality of life of millions of Americans if used to make communities more walkable and bikeable.  
• Encourage the integration of Health Impact Assessments (HIA) in local decision-making and provide technical assistance in the development process. A HIA incorporates quantitative and qualitative methods to anticipate the potential health-related consequences of a policy, project, or program. |

Abbreviations: BMI, body mass index.

only 27% of people living in less-walkable neighborhoods achieve these goals.32 Children lacking access to sidewalks or paths, parks, playgrounds, or recreational centers have 20%–45% higher odds of becoming obese or overweight compared with children who have regular access to such amenities.17 Programs such as Safe Routes to School (SRTS) have proven to be effective in providing children the opportunity to walk or bike safely to school.12 In California, schools participating in the Safe Routes to School program increased the number of students walking to school by 38%.43

One of the key determinants of whether children walk or bike to school is their parents’ perception of the transportation route between home and school. Perceived safety from traffic and crime is associated with higher rates of children walking and bicycling to school. A survey in Melbourne, Australia, found that children whose parents believed they had to cross several roads to get to play areas were 40%–60% less likely than other children to walk or bicycle to school or parks at least 3 times per week.44 Therefore, the presence of safe, convenient, and accessible facilities for walking and biking is likely to increase parents’ sense of security and children’s level of physical activity.

**Indoor Environments and Physical Activity**

When a neighborhood lacks safe places to play, children tend to spend more time being inactive indoors. Factors such as heavily trafficked streets, neighborhood crime, and graffiti are likely to prevent children from being active outdoors and instead

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promote indoor sedentary behavior. An increase in “screen time,” which includes activities such as watching television, is directly associated with child and adult obesity.45

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Among children, watching television and spending time on computers or playing video games takes away opportunities to engage in physical activity. Such sedentary behavior also impacts healthy eating habits, as children watching television are more likely to snack on junk food.46,47 Further, screen time has been linked to children getting less and poorer-quality sleep,48 which in turn is associated with a heightened risk of obesity.49

CONCLUSIONS AND RECOMMENDATIONS

It is undeniable that obesity and inactivity will increase morbidity, mortality, and attendant healthcare costs. In a report by the American Public Health Association, the national health cost associated with obesity and overweight was estimated to be approximately $142 billion. This estimation includes healthcare costs, lost wages due to illness and disability, and future earnings lost by premature death.50 The recent rapidity of increase in weight has been nothing short of astonishing. Given the gravity of this epidemic, it is essential that all possible interventions be put in place. Even though researchers have yet to prove through randomized trials that all of the aforementioned interventions aimed to decrease caloric intake and increase energy expenditure are effective, it would be imprudent to miss opportunities to implement meaningful interventions. In medicine, all treatment outcomes may not be evident, as patients can react differently to certain medication; however, treatments are still prescribed because they have the potential to alleviate the health condition. Accordingly, given the best-available evidence, we suggest that prescribing healthy changes in the environments where children live, learn, eat, and play will have lasting positive impacts.

In order for people to be more active and have healthier diets, they need access to safe places for recreation, neighborhoods that are walkable, and local markets that offer healthful, affordable food. Moving away from the norm of high-density foods and toward high-density environments requires collaboration between multiple disciplines, and calls for physicians to act as advocates for healthy communities. Table 2 shows a nonexhaustive list of some ways in which health professionals can be involved in battling childhood obesity.

DISCLOSURES

Potential conflict of interest: Nothing to report.

REFERENCES


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