Preventing Obesity and Its Consequences

Highlights of RAND Health Research

RAND RESEARCH AREAS
CHILDREN AND FAMILIES
EDUCATION AND THE ARTS
ENERGY AND ENVIRONMENT
HEALTH AND HEALTH CARE
INFRASTRUCTURE AND TRANSPORTATION
INTERNATIONAL AFFAIRS
LAW AND BUSINESS
NATIONAL SECURITY
POPULATION AND AGING
PUBLIC SAFETY
SCIENCE AND TECHNOLOGY
TERRORISM AND HOMELAND SECURITY

For the past two decades, obesity rates have been increasing at an alarming rate worldwide. In the United States, the Obama administration has made fighting childhood obesity a top priority. A substantial portfolio of RAND work focuses on the causes of obesity and its economic and health consequences. This research highlight summarizes some of the key studies.

Key findings:

- **Treating or preventing obesity would reduce rates of chronic disease and related health care costs, increase life expectancy, and improve birth outcomes.**
- **Residential neighborhoods affect obesity rates by providing access to healthy and unhealthy foods and opportunities for physical activity.**
- **It is not clear whether building more supermarkets in areas lacking access to healthy foods would help curb obesity.**
- **Improving school meals may not help curb childhood obesity if food outlets surrounding schools make unhealthy food easy to get.**

How Does Obesity Affect Health—and Health Spending?

Extensive research has shown that obesity increases the risk—or worsens the prognosis—for a variety of diseases, including diabetes, heart disease, cancer, and arthritis. Indeed, in 2002, RAND research showed that the health consequences of obesity are worse than those of smoking and problem drinking (Sturm, 2002). Obesity increases health care costs by 25 to 100 percent over the costs of persons of normal weight (Sturm, 2002; Andreyeva, Sturm, and Ringel, 2004). A recent RAND study showed that lowering obesity rates to their 1978 level by 2030 would decrease rates of diabetes, hypertension, and heart disease; increase longevity and years of disability-free life; and decrease Medicare and Medicaid costs (Goldman et al., 2010).

Several recent RAND studies have looked at other health implications of obesity or its treatment. Obesity has been associated with poorer breast cancer survival. RAND Health researchers found that obese women who develop breast cancer risk receive inadequate treatment with adjuvant chemotherapy—the drug doses are supposed to be adjusted for body weight but often are not adjusted adequately (Griggs et al., 2007). More recently, some of the same team found that obese women who develop invasive breast cancer are at higher risk than thinner women for invasion of the lymph nodes, which worsens the prognosis (Gillespie et al., 2010).

Researchers in the Southern California Evidence-Based Practice Center at RAND conducted an exhaustive review of how weight loss surgery affected the health of women of childbearing age. Obese women have a more difficult time getting pregnant than thinner women, have more pregnancy complications (such as gestational diabetes), and face greater risks of having babies with congenital problems. The researchers expected the surgery to have negative health consequences for infants, and possibly mothers as well, because the surgery reduces nutrient intake. Instead, they found that the women had healthier babies and a lower risk of gestational diabetes (Maggard et al., 2008).

Preventing Obesity: How Much—and What—We Eat

The basic equation underlying obesity is straightforward: People gain weight when they consume

This product is part of the RAND Corporation research brief series. RAND research briefs present policy-oriented summaries of published, peer-reviewed documents.

Corporate Headquarters
1776 Main Street
P.O. Box 2138
Santa Monica, California
90407-2138
TEL 310.393.0411
FAX 310.393.4818

more calories than they burn. RAND researchers have analyzed the role that the environment plays in what—and how much—we eat. They are also exploring how public policy could be used to alter eating habits.

Research conducted at RAND and elsewhere strongly supports the idea that the environment influences what and how much we eat. For example, Cohen and Farley (2008) argued that eating is an automatic behavior and that the amount we eat is influenced by such factors as portion size, accessibility of food, and even the number of dinner companions: An increase in any of these three factors will also increase the amount we tend to eat.

RAND studies have also shown a link between neighborhood residence and being overweight. For example, analysis of data from a national survey showed that for whites and Latinos, higher body mass index (BMI—a measure of overweight) was strongly associated with neighborhood characteristics, such as lower socioeconomic status (SES) and the proportion of ethnic minorities living in the neighborhood (Do et al., 2007). In contrast, greater intake of fruits and vegetables and better health status were strongly associated with higher-SES neighborhoods (Dubowitz et al., 2008).

Findings such as these seem to suggest that eating more fruits and vegetables prevents obesity. However, other RAND research shows that the link between fruit and vegetable consumption and obesity is not that simple.

One group of studies has focused on the availability of fruits and vegetables and other foods in neighborhood food outlets. For example, a nationwide study found that lower prices for fruits and vegetables in neighborhood shops were associated with smaller increases in BMI from kindergarten to 5th grade in children living in those neighborhoods; lower prices for meats predicted greater increases in BMI (Sturm and Datar, 2005, 2008). Another nationwide study just released by the same research team found that regional variations in the costs of meat, milk, and fruits and vegetables affect the consumption of these foods by 5th graders: Higher local costs of all of these foods were associated with lower consumption (Sturm and Datar, 2011).

However, other research at RAND suggests that the focus on the food environment needs to widen to include another category of foods: salty snacks, cookies, candy, and sugar-sweetened beverages. The U.S. Dietary Guidelines for Americans refer to these foods as "discretionary calories" (often called "junk food") because of their low nutritional value and high caloric content. For example, a study in southeastern Louisiana found that higher neighborhood BMI was linked to the amount of shelf space in food outlets allotted to discretionary-calorie foods, not the amount allotted to fruits and vegetables (Rose et al., 2009). Likewise, a study conducted in Los Angeles (L.A.) County found that BMI was more strongly related to the discretionary calories consumed than to fruit or vegetable consumption or physical activity.

It may be easier and more appealing to promote an increase in consumption of something than a decrease; however, studies such as these suggest that the former may be far less effective in reducing weight (Cohen, Sturm, Lara, et al., 2010; Cohen, Sturm, Scott, et al., 2010). These studies also suggest that unless something is done to curb excessive consumption of discretionary calories, interventions focusing on increasing fruit and vegetable consumption will have a limited impact on obesity control.

Some research has linked the rise in obesity with the increase in the proportion of meals we eat or purchase away from home. Perhaps prompted by such findings, in 2008 the L.A. City Council passed an ordinance imposing a one-year ban on new fast-food establishments in South L.A., the neighborhood with the city's highest obesity rates (as well as the highest proportion of Latinos and the lowest SES). A RAND research team analyzed the density of food outlets throughout the city's neighborhoods and the health behaviors of their residents. They found that South L.A. actually has fewer fast-food restaurants—indeed, fewer restaurants of any kind—than West L.A., the area of the city with the lowest rate of obesity (Sturm and Cohen, 2009). South L.A. has more convenience stores and small groceries but fewer supermarkets than other areas, but South L.A. residents reported shopping at supermarkets as much as their counterparts elsewhere in the city. However, South L.A. residents did consume more discretionary calories than did their less-obese neighbors in other parts of the city.

Taxing Junk Food?

Research by Sturm and his colleagues showing a link between the costs of various foods and children's BMI suggests that raising prices may be a powerful way to discourage consumption of discretionary calories—even more powerful than lowering prices to encourage consumption of fruits and vegetables.

An obesity prevention measure that has gained some popularity is the imposition of a special tax on discretionary calories. A RAND study analyzed how taxing sugar-sweetened soda and other beverages might affect children's soda consumption and BMI (Sturm et al., 2010). This study found that existing soda taxes, which increased the price of soda by a maximum of 4 percent (about the same as taxes imposed on some discretionary food items in some states), had little, if any, effect on most populations' soda consumption or obesity rates. Yet for children already at risk of obesity, low-income children, and black children, such small increases in the price of soda *did* appear to decrease consumption, especially

among children who attended schools where soda was available. The results also suggested that to be an effective deterrent, any increase in the soda tax must be tied to immediate consumption (e.g., taxing soda purchased by children in schools) and must be substantially greater than the current low rates of taxation.

Planting Supermarkets in Food Deserts?

The term "food desert" has been coined to describe areas of the developed world—such as South L.A.—that lack access to affordable healthy foods. The White House Task Force on Child Obesity has proposed spending $400 million to build more food outlets in some areas. A recent RAND study examined whether access to supermarkets will help prevent obesity. Research has shown that frequently eating foods not prepared at home, especially fast food, is linked to weight gain. A 2009 study of people living in Los Angeles explored whether car ownership moderates the effect of living in an area with a high concentration of restaurants or fast-food outlets (Inagami et al., 2009). The researchers hypothesized that car ownership should enable people who live in neighborhoods with many restaurants or fast-food outlets but few supermarkets to leave the neighborhood and go to supermarkets to purchase the ingredients to make healthy meals at home, whereas those without cars would be relegated to eating locally available fast food. As expected, people living among high concentrations of fast-food outlets had higher BMIs than people living in areas with no fast-food outlets. Among people living in areas with many outlets, car ownership was indeed associated with a lower BMI.

Making Better School Meals?

Because children spend much of their day in school and eat one to two meals daily in or near school, the role of school meals in obesity has become the focus of much attention. Research has already influenced changes in policies dictating the contents of school lunches and breakfasts. A related concern is whether "competitive foods" offered in schools (for example, foods available in vending machines), which are often junk food, are associated with obesity.

Whether foods eaten in or around school promote obesity is not clear. For example, a 2008 study found that only 26 percent of 5th graders who had access to soft drinks in schools actually drank them (Fernandes, 2008). Likewise, Datar and Nicosia (2009) found that competitive foods in schools did not significantly affect either children's BMI or their overall consumption of healthy and unhealthy foods. Of course, banning sales of junk food and sodas in schools would not ensure that students did not have access to empty calories. Sturm (2008) found that schools with a greater proportion of Latino and black students were more likely to be surrounded by convenience stores, restaurants, liquor stores, and other stores selling snack foods. Nevertheless, many municipalities have banned or are considering banning competitive foods from schools in their attempt to prevent obesity.

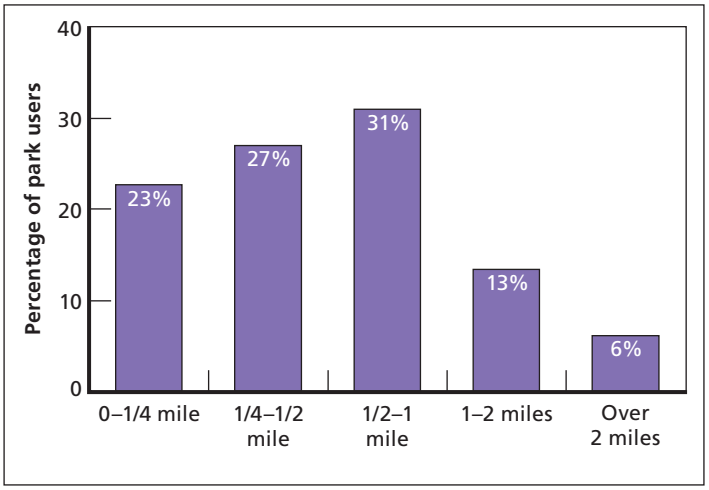
Paving the Way for More Physical Activity

Another focus of RAND research has been identifying factors in the environment, especially in residential neighborhoods, that influence people's participation in physical activity and determining the most cost-effective ways to increase calories burned.

Surveying parks around Los Angeles, Cohen (2008) found that people who lived within a mile of a park were more likely to use the park and to get exercise, either within the park itself or from walking between the park and home (see figure). A study of urban adolescent girls nationwide found that city schools and school playgrounds accounted for nearly half of the available sites for physical activity. Yet more than half were locked on the weekends, especially those in older, nonwhite, lower-SES neighborhoods. The BMIs of girls residing in areas with inaccessible school playgrounds were significantly higher than the BMIs of girls who lived in areas with open playgrounds (Scott et al., 2007). This study also found that girls who lived within a half mile of a commercial facility for physical activity (such as a dance studio or a youth organization) had higher levels of nonschool physical activity than girls who did not live near such facilities (Dowda et al., 2007).

Recently, a group of RAND researchers systematically reviewed studies assessing the benefits and costs of measures to improve physical activity. Encouragingly, they found that community- and school-based programs were among the most cost-effective and showed the greatest promise for reaching more people (Wu et al., 2011).

Most Park Users Live Within One Mile of the Park



Putting It All Together: A Comprehensive Community-Based Approach

A comprehensive school-based program to prevent obesity is under way in the Los Angeles Unified School District. In partnership with the community and the district, RAND Health researchers have implemented a program called Students for Nutrition and eXercise (SNaX), which is based on the extensive research on what causes and might help prevent obesity. Equally importantly, SNaX is based on the outcomes of a series of focus groups among parents, students, community representatives, and school personnel aimed at identifying perceptions of the barriers to healthy eating and physical activity. Not surprisingly, these focus groups named many of the same factors that have been studied by RAND researchers: diets rich in fast foods, proximity of schools to fast-food outlets and convenience stores, too many after-school snacks, too little physical activity in schools, and limited access to safe areas for exercise outside of school hours. Elements of this ongoing program include healthier and better-tasting school meals, displays of nutrition information in school cafeterias, hands-on nutrition education, a peer advocacy program, increased access to parks and school yards, and parental education and involvement (Goh et al., 2009).

Looking Forward

As these RAND studies highlight, the contributions of specific kinds of food outlets and eating habits to obesity remain unclear. However, studies are examining the potential for changes in the food environment, food intake, and exercise to prevent and control obesity. For example, in addition to the multipronged SNaX study, several studies are examining how improving access to parks and other facilities might affect teens' likelihood of exercising and weight management. Another study is examining whether the opening of a full-service grocery store in a low-income, predominantly black neighborhood in Pittsburgh will influence residents' food purchasing habits and diet. The results of these studies will be vital in shaping policies to prevent and treat obesity. ■

This research highlight summarizes RAND Health research reported in the following publications:

Andreyeva T, Sturm R, and Ringel JS, "Moderate and Severe Obesity Have Large Differences in Health Care Costs," *Obesity Research*, Vol. 12, No. 12, December 2004, pp. 1936–1943 (http://www.rand.org/pubs/external_publications/EP20041222.html).

Cohen DA, "Obesity and the Built Environment: Changes in Environmental Cues Cause Energy Imbalances," *International Journal of Obesity*, Vol. 32, Supplement 7, December 2008, pp. S137–142 (http://www.rand.org/pubs/external_publications/EP20081225.html).

Cohen D and Farley TA, "Eating as an Automatic Behavior," *Preventing Chronic Disease*, Vol. 5, No. 1, January 2008 (http://www.rand.org/pubs/reprints/RP1326.html).

Cohen DA, Sturm R, Lara M, Gilbert M, and Gee S, "Discretionary Calorie Intake a Priority for Obesity Prevention: Results of Rapid Participatory Approaches in Low-Income US Communities," *Journal of Public Health*, September 2010, Vol. 32, No. 3, pp. 379–386 (http://www.rand.org/pubs/external_publications/EP20100096.html).

Cohen DA, Sturm R, Scott M, Farley TA, and Bluthenthal R, "Not Enough Fruit and Vegetables or Too Many Cookies, Candies, Salty Snacks, and Soft Drinks?" *Public Health Reports*, Vol 125, No. 1, January–February 2010, pp. 88–95 (http://www.rand.org/pubs/external_publications/EP20100070.html).

Datar A and Nicosia N, *Junk Foods in School and Childhood Obesity: Much Ado About Nothing?* Santa Monica, Calif.: RAND Corporation, WR-672, 2009 (http://www.rand.org/pubs/working_papers/WR672.html).

Do DP, Dubowitz T, Bird CE, Lurie N, Escarce JJ, and Finch BK, "Neighborhood Context and Ethnicity Differences in Body Mass Index: A Multilevel Analysis Using the NHANES III Survey (1988–1994)," *Economics and Human Biology*, Vol. 5, No. 2, July 2007, pp. 179–203 (http://www.rand.org/pubs/external_publications/EP20070714.html).

Dowda M, McKenzie TL, Cohen DA, Scott MM, Evenson KR, Bedimo-Rung AL, Voorhees CC, and Almeida MJCA, "Commercial Venues as Supports for Physical Activity in Adolescent Girls," *Preventive Medicine*, Vol. 45, No. 2–3, August–September 2007, pp. 163–168 (http://www.rand.org/pubs/external_publications/EP20070809.html).

Dubowitz T, Heron M, Bird CE, Lurie N, Finch BK, Basurto-Dávila R, Hale L, and Escarce JJ, "Neighborhood Socioeconomic Status and Fruit and Vegetable Intake Among Whites, Blacks, and Mexican Americans in the United States," *American Journal of Clinical Nutrition*, Vol. 87, No. 6, June 2008, pp. 1883–1891 (http://www.rand.org/pubs/external_publications/EP20080614.html).

Fernandes MM, "The Effect of Soft Drink Availability in Elementary Schools on Consumption," *Journal of the American Dietetic Association*, Vol. 108, No. 9, September 2008, pp. 1445–1452 (http://www.rand.org/pubs/external_publications/EP20080911.html).

Gillespie E, Sorbero M, Hanauer D, Sabel M, Herrmann E, Weiser L, Jagielski C, and Griggs J, "Obesity and Angiolymphatic Invasion in Primary Breast Cancer," *Annals of Surgical Oncology*, Vol. 17, No. 3, March 2010, pp. 752–759 (http://www.rand.org/pubs/external_publications/EP20100301.html).

Goh YY, Bogart L, Sipple-Asher B, Uyeda K, Hawes-Dawson J, Olarita-Dhungana J, Ryan GW, and Schuster MA, "Using Community-Based Participatory Research to Identify Potential Interventions to Overcome Barriers to Adolescents' Healthy Eating and Physical Activity," *Journal of Behavioral Medicine*, Vol. 32, 2009, pp. 491–502 (http://www.rand.org/pubs/external_publications/EP20090018.html).

Goldman D, Michaud P-C, Lakdawalla D, Zheng Y, Gailey A, and Vaynman I, "The Fiscal Consequences of Trends in Population Health," *National Tax Journal*, Vol. 63, No. 2, June 2010, pp. 307–330.

Griggs JJ, Culakova E, Sorbero MES, van Ryn M, Poniewierski MS, Wolff DA, Crawford J, Dale DC, and Lyman GH, "Effect of Patient Socioeconomic Status and Body Mass Index on the Quality of Breast Cancer Adjuvant Chemotherapy," *Journal of Clinical Oncology*, Vol. 25, No. 3, January 20, 2007, pp. 277–284 (http://www.rand.org/pubs/external_publications/EP20070116.html).

Inagami S, Cohen DA, Brown AF, and Asch SM, "Body Mass Index, Neighborhood Fast Food and Restaurant Concentration, and Car Ownership," *Journal of Urban Health*, Vol. 86, No. 5, September 2009, pp. 683–695 (http://www.rand.org/pubs/external_publications/EP20090931.html).

Maggard MA, Yermilov I, Li Z, Maglione M, Newberry S, Suttorp M, Hilton L, Santry HP, Morton JM, Livingston EH, and Shekelle PG, "Pregnancy and Fertility Following Bariatric Surgery: A Systematic Review," *Journal of the American Medical Association*, Vol. 300, No. 19, November 19, 2008, pp. 2286–2296 (http://www.rand.org/pubs/external_publications/EP20081112.html).

Rose D, Hutchinson PL, Bodor JN, Swalm CM, Farley TA, Cohen DA, and Rice JC, "Neighborhood Food Environments and Body Mass Index: The Importance of In-Store Contents," *American Journal of Preventive Medicine*, Vol. 37, No. 3, September 2009, pp. 214–219 (http://www.rand.org/pubs/external_publications/EP20090928.html).

Scott MM, Cohen DA, Evenson KR, Elder J, Catellier D, Ashwood JS, and Overton A, "Weekend Schoolyard Accessibility, Physical Activity, and Obesity: The Trial of Activity in Adolescent Girls (TAAG) Study," *Preventive Medicine*, Vol. 44, No. 5, May 2007, pp. 398–403 (http://www.rand.org/pubs/external_publications/EP20070517.html).

Sturm R, "The Effects of Obesity, Smoking, and Drinking on Medical Problems and Costs," *Health Affairs*, Vol. 21, No. 1, February/March 2002, pp. 245–253 (http://www.rand.org/pubs/reprints/RP1003.html).

Sturm R, "Stemming the Global Obesity Epidemic: What Can We Learn from Data About Social and Economic Trends?" *Public Health*, Vol. 122, No. 8, August 2008, pp. 739–746 (http://www.rand.org/pubs/external_publications/EP20080826.html).

Sturm R and Cohen DA, "Zoning for Health? The Year-Old Ban on New Fast-Food Restaurants in South LA," *Health Affairs*, Vol. 26, No. 6, November–December 2009, pp. w1088–1097 (http://www.rand.org/pubs/external_publications/EP20091017.html).

Sturm R and Datar A, "Body Mass Index in Elementary School Children, Metropolitan Area Food Prices and Food Outlet Density," *Public Health*, Vol. 119, No. 12, December 2005, pp. 1059–1068 (http://www.rand.org/pubs/external_publications/EP20051213.html).

Sturm R and Datar A, "Food Prices and Weight Gain During Elementary School: 5-Year Update," *Public Health*, Vol. 122, No. 11, November 2008, pp. 1140–1143 (http://www.rand.org/pubs/external_publications/EP20081107.html).

Sturm R and Datar A, "Regional Price Differences and Food Consumption Frequency Among Elementary School Children," *Public Health*, Vol. 125, No. 3, March 2011, pp. 136–141 (http://www.rand.org/pubs/external_publications/EP20110034.html).

Sturm R, Powell LM, Chriqui JF, and Chaloupka FJ, "Soda Taxes, Soft Drink Consumption, and Children's Body Mass Index," *Health Affairs*, Vol. 29, No. 5, May 2010, pp. 1052–1058 (http://www.rand.org/pubs/external_publications/EP20100032.html).

Wu S, Cohen D, Shi Y, Pearson M, and Sturm R, "Economic Analysis of Physical Activity Interventions," *American Journal of Preventive Medicine*, Vol. 40, No. 2, February 2011, pp. 149–158 (http://www.rand.org/pubs/external_publications/EP20110010.html).

Abstracts of all RAND Health publications and full text of many research documents can be found on the RAND Health website at www.rand.org/health. This research highlight was written by Sydne Newberry. The RAND Corporation is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors. **RAND**® is a registered trademark.

RAND Offices
Santa Monica, CA • Washington, DC • Pittsburgh, PA • New Orleans, LA/Jackson, MS • Boston, MA • Doha, QA • Abu Dhabi, AE • Cambridge, UK • Brussels, BE

RB-9508 (2011)