

Environmental and Policy Strategies to Improve Eating, Physical Activity Behaviors, and Weight among Adolescents

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The epidemic of adolescent obesity remains 1 of the top public health concerns facing our country. Rates of adolescent obesity tripled between 1966 and 1999, rising from 4.6% to 15.5%.¹ As of 2008, adolescent obesity rates stabilized for girls at 17%, whereas boys' rates continued to rise significantly to 19.6%.¹ The fact that adolescent obesity rates continue to be so high, and are still rising for boys, should serve as a wake-up call for parents, physicians, advocates, and policy makers.

Although there are some environmental and policy strategies that have reached adolescents, many major efforts to protect youth have failed to adequately include this segment of the population. One reason adolescents have not been directly targeted by obesity prevention policy efforts is political feasibility. It is easier to convince people that protective policies are warranted when the beneficiaries are very young. In contrast, our society views adolescents as emerging adults, and gradually grants them the rights and responsibilities of adulthood. Efforts to limit access to or marketing of unhealthy foods and beverages are immediately countered with arguments that it is not sensible to consider an adolescent old enough to drive, but too young to be the target of marketing for unhealthy products.²

A second reason why there are fewer policies to protect adolescents is the belief that they need to learn to make their own nutrition decisions. The problem is that neurological, behavioral, and psychological studies reveal that adolescents are actually more likely to engage in sensation-seeking, emotion-driven, and impul-

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sive behavior than younger children because of the unique developmental changes occurring in their brains.³⁻⁵ Research suggests that the prefrontal cortex, which controls impulses and uses cognitive strategies, does not fully develop until early adulthood.³⁻⁶ Further, the emotional lability that is common among adolescents increases the risk of impulsive behavior.⁷⁻¹⁰ Finally, adolescents' high brain plasticity makes them vulnerable to negative environmental input, like marketing.^{3,6}

Many argue that providing nutrition education to adolescents leads to healthier behaviors. Unfortunately, research on the effectiveness of nutrition education has shown that while attitudes and intentions may change, actual eating behavior rarely does.¹¹ This is unsurprising in light of research on other types of teen-directed education, like sex, drug, and driver's education, which also suggest that education alone does not effectively reduce teens' risky behaviors.¹² Researchers believe that "logical reasoning" abilities reach adult levels by age 16, but psychosocial maturity does not peak until age 25, which is why many adolescents engage in risky behavior, even though they know it is unsafe or unhealthy.⁵

Table 1
Policies to improve nutrition and physical activity

	Nutrition	Physical Activity
Local School Wellness Policies	Strengthen standards for all competitive foods and beverages in schools Prohibit an "open campus" during lunch Restrict food use for fund-raising Conduct nutrition assessment with BMI screening Prohibit food marketing on school property	Increase time and quality of physical education Provide after-school intramural sports Support and promote walking/biking to and from schools by installing bike racks on campus Conduct physical activity assessment with BMI screening
City or State Action	Limit fast food and convenience stores around schools Ask convenience stores near schools to not sell unhealthy beverages and snacks to students before or after school Ask convenience stores and restaurants near schools to provide and promote competitively priced, healthy snacks and beverages Institute a sugary drink tax Set a limit on portion sizes for sugary drinks that can be sold in restaurants	Require complete streets and safety measures for safe routes to schools, libraries, and community centers Create joint use agreements so that schools can be used for physical activity Provide classes and programs specifically for adolescents at community athletic facilities
Federal	Recommend nutrition standards for all foods and beverages marketed to youth younger than age 16 Force energy drinks to follow the same labeling regulations required of other beverages	

Therefore, it is important to not only provide nutrition education, but to create policies that limit adolescent access to less healthy foods and beverages when they are not under the supervision of their parents.

There are many promising environmental policies that could help adolescents improve their nutrition and physical activity levels. This article begins with a detailed discussion of school-based nutrition and physical activity policies that are currently politically feasible, prominent in public discourse, and have substantial empirical support. Next is a discussion of the issue of food and beverage marketing directed at youth, which is currently quite controversial but of critical importance. Finally, the issue of sugary drinks is reviewed in detail because of the strong research linking these products to adolescent obesity.

SCHOOL-BASED FOOD AND BEVERAGE POLICIES

Why Adolescents Need Policies to Improve the Nutrition Environment

It is critical that advocates and policymakers do not fall into the trap of thinking that only younger children need to be protected from an unhealthy nutrition environment at school. Older children are more likely than younger children to be in the school building after school hours for extracurricular activities, providing frequent unsupervised opportunities to use their money to buy food from vending machines, fund-raisers, and school stores. Although it is reasonable to provide students with access to snacks after school to bridge the time between lunch and dinner, those snacks must positively contribute to the overall healthfulness of student diets.

School Wellness Policies

The Child Nutrition and Women, Infants, and Children Reauthorization Act of 2004 required all local education agencies participating in the United States Department of Agriculture (USDA) food programs to create a written school wellness policy by the 2006 to 2007 school year.¹³ This legislation required that the policies include goals for nutrition education and physical activity; nutrition guidelines for food provided at school; assurance that all USDA requirements for school meals are met; a plan for measuring implementation for the policy and designation of a responsible party; and the creation of a committee that includes parents, students, food service workers, school board members, school administrators, and the public.

A substantial amount of advocacy and research has emerged in response to the requirement to create school wellness policies. School-health advocates have created materials to help districts write and improve their policies.^{14,15} Researchers have developed a quantitative measure to assess policy comprehensiveness and strength, which has been used to document the relationship between policy strength and implementation.^{16,17} Further, several states have done in-depth analyses of the com-

ponents best addressed in their state policies and the predictors of actual implementation.^{18–20} Each of these efforts underlines the importance of creating strong policies and having champions at the district level to ensure implementation.

Although there have been a number of successful environmental changes achieved because of school wellness policies, one problem that has not been solved is the significant disparity between younger and older students' nutrition environments. The prevalence of unhealthy foods and beverages remains much higher in middle and high schools than elementary schools, and research has documented that student diets and body mass index (BMI) deteriorate as a consequence of a less healthy school nutrition environment.^{21–24}

There is research showing that middle and high school nutrition environments can be measurably improved if stronger nutrition standards are implemented.^{22,25,26} Unfortunately, this remains uncommon. The largest national study of school wellness policies is an ongoing effort by Bridging the Gap, which collects a representative sample of policies each year and codes them on more than 100 items.^{27,28} One of the key findings has been that there are much stronger policies at the elementary school level than the middle and high school levels.²⁷ Specifically, regulations of competitive foods and beverages are significantly more lenient in middle and high schools than in younger grades. For example, data from 2008 to 2009 indicate that 30% of elementary schools ban competitive foods from at least some locations (eg, vending machines), while only 11% of middle schools and 7% of high schools have comparably strong policies.²⁷

An alternative to local school wellness policies is state competitive food laws, which mandate nutrition standards. Although it is more politically complicated to achieve a state law than a local district policy, state laws are also significantly more effective in making actual changes in the cafeteria and other school settings.¹⁷ Recent work suggests that strong state competitive food laws are associated with a better BMI trajectory among middle school students.²⁹

Open Campus Policies and Fast Food Surrounding Schools

Whether a school has an “open campus” (ie, students are allowed to go off school grounds during lunch) has the potential to significantly influence student diets. Nationally, about one-fourth of high schools have open campus policies; however, the prevalence of open campus policies is higher in California, where almost 50% of schools allow students to leave during lunch. Open campus policies put students at dietary risk because fast food restaurants often cluster around schools.^{30,31} In Chicago, Illinois, there are 6 times more fast food restaurants within 1.5 km of schools, with 35% of schools having at least 1 fast food restaurant within a quarter mile and 80% within a half mile.³⁰ A study in Los Angeles, California, found similar results; 31% and 71% of high schools had at least 1 fast food restaurant within a quarter mile and a half mile, respectively.³¹

Access to fast food near school may also contribute to socioeconomic and racial health disparities.^{31–33} Research suggests that schools with higher percentages of free meals have more food retail businesses nearby,³² and fast food restaurant proximity to schools is more likely in low-income, high-commercial areas.³¹ Further, schools with higher percentages of Hispanic and black students are more likely to be surrounded by food retail operations.^{32,33} Although this is due in part to the fact that urban locations are more likely to have both fast food and Hispanic and black students, one study found that Hispanic adolescents are significantly more likely to attend schools clustered by food retail operations, regardless of location or income.³²

There is evidence that young people who attend schools or reside near fast food restaurants and convenience stores have worse diets and greater risk of obesity.^{34,35,36} One California study found that students in schools within a half mile of a fast food restaurant consumed more soda and fewer fruits and vegetables and were also more likely to be obese than students farther away.³⁷ This is not surprising, in light of a recent findings that in an average visit, adolescents purchase foods that contain between 800 and 1100 calories, typically from large and extra large French fries, soft drinks, large-sized burgers, and desserts.³⁸ Although people from all age groups go to fast food restaurants, this study also found that teens are more likely than other segments of the population to visit a fast food restaurant for an afternoon or evening snack and are more likely to order the highest-calorie, least nutritious items on the menu.³⁸

It seems that fast food restaurants are uniquely attractive to teens. Therefore, strong policies to make them less obesogenic are needed. Although closed campus policies do not prevent students from frequenting nearby restaurants before or after school, they could effectively remove at least 1 time a day when students are exposed to unhealthy choices and promote participation in the National School Lunch program instead. Cities or states can consider policies that support creating and promoting other venues for teens to meet after school and in the evenings. These might include a teen lounge in the public library, community recreation centers, or religious buildings. At the same time, some of the harm associated with fast food restaurants and convenience stores could be alleviated if they limited sales of their least healthy products to students before and after school and instead developed, promoted, and competitively priced water and healthy snacks for their adolescent customers.

Federal School Food Regulations

As part of the Healthy, Hunger Free Kids Act of 2010, the USDA was charged with updating the National School Lunch and Breakfast nutrition standards. These standards were released in January 2012 and represent a significant step forward in promoting better nutrition at school.³⁹ Notably, although the standards set different portion sizes based on age, the nutrition standards are not more lenient for high school students.

The USDA is scheduled to release updated federal competitive food regulations in 2012. This is a significant policy change because the USDA has historically provided little oversight of food and beverages sold outside the school lunch program. As stated earlier, most state and local competitive food policies are more lenient for high schools than elementary and middle schools. Although the anticipated federal regulations will likely improve the high school nutrition environment substantially, it is possible that they will still permit less healthy food to be sold to adolescents than younger children. If this occurs, state and local policies must be strengthened to compensate for this gap in protection.

SCHOOL-BASED PHYSICAL ACTIVITY POLICIES

The transition from childhood to adolescence is characterized by not only deterioration in diet quality, but less physical activity as well. One in 4 high school students does not participate in any vigorous exercise weekly.⁴⁰ Adolescent girls are less likely to be physically active than adolescent boys, and students at highest risk for obesity are the ones who are least physically active. Black and Hispanic female adolescents are less physically active and perceive more barriers to physical activities than their white peers.⁴¹ For example, although only 9% of whites reported not exercising outside because they feel unsafe in their neighborhood, 71% of blacks and 62% of Hispanic students reported this barrier.⁴² At the same time, black female adolescents also reported less social support from teachers, family, friends, and males for physical activity.⁴³ Interestingly, black female adolescents reported more enjoyment with physical education classes, but not physical activity in general, than white females, suggesting that in-school physical education is a critically important strategy to protect these adolescent girls from inactivity.⁴³

Physical Education

There are a number of hypotheses as to why physical activity drops so precipitously in adolescents, but one of the most likely reasons is that far fewer high schools offer or require physical education (PE) classes when compared with elementary and middle schools. One study found that although almost all middle schools require students to participate in PE, only 1 in 5 high schools have similar requirements.⁴⁴ Participation rates mirror the requirements; more than 90% of 8th graders participated in PE, compared to only 34% of 12th graders.⁴⁴ State-based data further support a close connection between the requirement of PE and amount of student physical activity.⁴⁵

To address this problem, the National Association for Sports and Physical Education (NASPE) recommends that all elementary schools require 150 minutes per week of PE, and middle and high schools require 225 minutes per week.⁴⁶ To date, few school districts have adopted this policy and only 1 state, Illinois, has legislation that requires PE to be offered in grades K to 12. Official policies requiring PE

are critical and have been shown to increase the likelihood of schools actually delivering the recommended number of minutes per week to students.⁴⁷

Organizations such as NASPE have been advocating for federal and state legislation to put PE back in the curriculum, but there are a number of obstacles. The most frequently cited is that schools are preoccupied with standardized test scores and consequently feel they cannot afford to take time away from classroom academic instruction.^{48,49} The research on this topic, however, is extremely clear; test scores do not suffer when students spend more time in PE.⁴⁸⁻⁵⁰ Further, there is research documenting a positive relationship between student fitness and academic achievement.⁵⁰⁻⁵³

The field of PE has moved toward a greater focus on lifetime physical activities, such as yoga, rock climbing, and weight training, in addition to the traditional volleyball and flag football.⁵⁴⁻⁵⁶ The focus on personal fitness and lifetime skills is likely to help students maintain their enjoyment and ability to stay active beyond high school and is particularly important for adolescents.^{55,56} Local and state policies that require the inclusion of lifetime skills as part of the PE curriculum are needed to ensure that these changes are implemented throughout the country.

There are obstacles to stronger PE policies. In addition to concerns about taking time away from classroom instruction, districts are also wary of the costs of a high quality PE program. NASPE recommends hiring only PE teachers who are trained and certified and requiring that PE classes have appropriate teacher to student ratios. A potentially more affordable way to improve a district's PE program is using resources, such as SPARK (Sports, Play, and Active Recreation for Kids), which have been developed to train PE teachers to make the most of the time they have with students.⁵⁷

Promoting Structured Physical Activity Outside of Physical Education

Extramural sports provide another school-based opportunity for adolescents to be physically active. High schools have more organized school sports teams than elementary or middle schools; however, these teams are usually selective and therefore only help the most talented athletes. One policy option to remedy this is to offer additional intramural sports for all students. One study found that students in schools offering numerous intramural sports had substantially more physical activity per week than students in schools offering only a few intramural sports.⁵⁸

Safe Routes to School

Encouraging students to walk or bike to and from school is another physical activity promotion strategy that is gaining national momentum. There has been

a well-documented decrease in the number of students walking or biking to school today compared to a generation ago.⁵⁹ Some of this decrease may be attributable to children living farther from their schools, but the rate of walking for students who live within a mile of school has decreased from 89% to 35%.⁵⁹ There is also evidence that as students get older they are less likely to walk or bike to school, with 1 study reporting that 20% of 8th graders walked or biked to school compared to fewer than 7% of 12th graders.⁴⁴

Advocates can work with the national Safe Routes to School (SRTS) initiative, which provides federal funding for infrastructure, education, encouragement, and enforcement measures for safe walking and bicycling routes to school.⁵⁹ In 2010, the SRTS provided \$821 million to all 50 states, reaching more than 10,400 schools and potentially 4.8 million children.⁵⁹ Funds are most used for safety measures like improving sidewalks and calming traffic near schools.⁵⁹ Strategies to promote walking and biking to school can be included in district wellness policies, as well as city and state policies that address transportation. The SRTS Local Policy Guide provides many examples of how advocates have worked to promote active student transportation in their communities.⁶⁰ Once schools are accessible, communities can build on this by creating safe routes from schools to other buildings such as libraries and community centers.

Joint Use Agreements

Another policy option to increase physical activity is encouraging school buildings to remain open and available for community activities, such as basketball in the gym or soccer on the playing fields. Currently, only 29% of schools open up their facilities outside normal school hours.⁶¹ School districts are frequently concerned about costs, vandalism, security, and liability in case of injury. Joint use agreements have been widely recommended as a way to address these concerns.⁶² This formal agreement between schools and another government entity allows schools to share or even fully allocate the costs and responsibilities of opening their facilities. ChangeLab Solutions offers guidance to creating and implementing joint use agreements.⁶² This solution is particularly appealing to low-income and minority neighborhoods, where there are often fewer facilities for physical activity.⁶² One study found that opening up school facilities increased the number of children who played and were physically active after school by 84%.⁶³

School wellness policies can address participation in joint use agreements, as well as other community programs aimed at adolescents, such as Girls on the Run.⁶⁴ Another school policy is to remove food as a fund-raiser and suggest creative fund-raisers, such as bike-a-thons, fun runs, or organized walks where students get sponsors. These fund-raisers provide all students (not just the athletes) with opportunities to be physically active, while also contributing to an important cause.

Measuring Body Mass Index in Schools

Measuring student body mass index (BMI) is associated with 2 distinct policies: BMI surveillance and BMI screening.⁶⁵ BMI surveillance refers to the practice at the state or district level of tracking student BMI in the aggregate and assessing changes in the population as a whole. The American Heart Association, the American Academy of Pediatrics, and the Centers for Disease Control and Prevention support this practice as an appropriate way to monitor trends in childhood obesity rates. More than a dozen states have legislation that requires districts to track BMI and report the data back to the state government for surveillance. The effort put into tracking BMI has illuminated the slow but steady progress in reducing childhood obesity in Arkansas, Mississippi, and New York City.^{66–68}

BMI screening is a different and more controversial policy than surveillance. Screening involves measuring BMI in school and then notifying parents about their child's weight status, usually by sending a health information packet home. The rationale is that some parents may not realize that their children are overweight; therefore, school systems should screen for obesity, just as they screen for vision or hearing problems, to help inform parents of a potential health risk. Although there is some evidence that parents of overweight children are well aware of the problem,⁶⁹ other studies suggest that many parents do not realize that their children are overweight.⁷⁰ One explanation may be that families who live in communities with particularly high rates of obesity find it more difficult to assess their child's status because it is not dissimilar from their peers. Some data suggest that sending BMI screening feedback to parents may increase parental awareness of their child's health.⁷⁰

An argument in favor of using BMI for screening is that it is relatively easy and inexpensive to measure reliably. When examining large numbers of people, BMI tracks closely with percent body fat; however, like all screening measures, BMI produces both false positives and false negatives. BMI false positives are most likely to occur with children who are very muscular. BMI false negatives occur when a child is not overweight but consumes a very poor diet and is not physically active and therefore is still at increased risk of health problems in the future.

An argument against screening for only BMI is that it may send a negative and misleading message to adolescents that weight should be the primary, and sole, concern in regard to health. This could undermine efforts to emphasize a healthy lifestyle of moderate physical activity and a healthy diet and promote unhealthy attempts to lose weight through extreme dieting, laxatives, and other dangerous weight-loss tactics. One study found that parents with overweight children who were concerned about their children's weight (after receiving information about

their child's health status) were very likely to plan weight-control strategies for their children, but were not more likely to adopt the preventive lifestyle behaviors described in the health education materials.⁷¹

Similarly, BMI surveillance may foster negative body image and preoccupation with weight, particularly among female adolescents. Given that an estimated 60% of female adolescents and 30% of male adolescents report body dissatisfaction, this is a serious concern.⁷² Body dissatisfaction increases the risk of disordered eating, depression, and other psychological and physiological damage. Perceived pressure from parents, peers, and society are the main source of body dissatisfaction among adolescents⁷² and thus a BMI report may cause greater body dissatisfaction among overweight children, and potentially even among healthy weight children. Research confirms that overweight children have lower self-esteem than children of healthy weight and further found that the self-esteem of these children significantly decreased after a school BMI report.⁷³

To increase the likelihood that BMI reporting leads to productive family and individual behavior changes, it should always be combined with a comprehensive assessment of dietary quality and fitness level. Completing a 24-hour food recall assessment and a standardized, comprehensive physical fitness assessment would provide more detailed and useful information. Specific feedback could be provided to the family about what dietary changes would be most important (eg, remove sugary drinks, increase fiber through more fruits and vegetables), rather than a general suggestion to eat more healthfully. Similarly, there are several components to fitness, including strength, cardiovascular health, and flexibility. By assessing each of these, students could learn what their personal fitness strengths and weaknesses are and receive tailored recommendations on how to improve. This strategy would also prevent the problem of false positive BMI scores for muscular adolescent athletes. Ideally, a school wellness policy could require that this type of multicomponent assessment be done through schools so that all youth would be able to access this information.

POLICIES TO LIMIT FOOD MARKETING TO YOUTH

Recent data on the changes in marketing trends over the past several years suggest that the food industry is shifting its strategy away from marketing on child-targeted television (ie, shows with an audience of $\geq 35\%$ children aged 2–11) to adolescent-targeted shows. Although advertising to children peaked in 2004 and has since declined, the number of food and beverage advertisements targeting adolescents has steadily increased and showed a sharp 11% rise from 2007 to 2008.⁷⁴ In 2010, \$948 million was spent on the marketing of sugary drinks and energy drinks, and adolescents saw 50% more advertisements than younger children.⁷⁵ To better reach adolescents, food and beverage companies are increasingly turning to social media and other online marketing strategies.

Our Youth Are “Children” Until Age 15

The food industry is fiercely protecting its ability to market to adolescents. One strategy was to create a self-regulatory body through the Better Business Bureau called the Children's Food and Beverage Advertising Initiative (CFBAI) that sets nutrition standards for marketing to children younger than age 12.⁷⁶ When the federal interagency working group suggested in 2011 that children up to age 17 should be considered a protected group,⁷⁷ the CFBAI responded:

“We allow adolescents, but not children, to drive, hold jobs, pay taxes, get married and enlist in the services (at age 17 with permission) and we sometimes hold them criminally liable for their actions. Though adolescents' brains continue to develop throughout the second decade of life, their cognitive capacities are far more advanced than those of children.”⁷⁸

The flaw in the logic of this argument is that we do not allow 12-, 13-, 14-, or even 15-year-olds to do any of the activities listed (drive, pay taxes, get married, or enlist in the armed services). A far more reasonable cut-off for marketing to youth is younger than 16 years, not younger than 12 years. Furthermore, the argument that adolescent brain development is more advanced than that of children is irrelevant—the question should be whether adolescents have cognitive capacities comparable to adults. Here, the answer is clear: Compared to adults, adolescents are more apt to engage in high-risk behavior and seek immediate gratification,^{3,79,80} which makes them more vulnerable to marketing.

If the food industry is unwilling to extend protection to children between 12 and 15 years, alternative strategies are needed to protect this group. Federal regulation is unlikely, but middle and high schools can set policies to eliminate all food and beverage marketing from campus. Parents can protest teen-directed marketing practices and demand greater regulation of social media and other online sites that target adolescents. The voices of physicians are especially important in these efforts because they can speak to the unique vulnerabilities of young adolescents and argue that this is an important health issue.

THE UNIQUE PROBLEM OF SUGARY DRINKS

When it comes to unhealthy foods and beverages, sugary drinks are in a class by themselves. Regular soft drinks represent the single largest source of added sugar in the American diet⁸¹ and the consumption of these and other sugar-sweetened beverages is associated with poor overall nutrition, rising obesity rates, and a heightened risk for diabetes.^{82–85} Adolescent consumption of sugary drinks is a serious problem; sugary drinks represent the greatest single source of calories for adolescents, making them a clear target for calorie reduction efforts.⁸⁶

A combination of many strategies is needed to break adolescents of the habit of drinking sugary beverages. Physicians who work with adolescents have the opportunity to educate their patients about the low nutritional value and high caloric nature of these beverages and encourage consumption of water and low-fat milk instead. Further, physicians are trustworthy advocates for strong policies to protect teens from excess exposure to sugary drinks. These policies can include local school wellness policies, state and federal competitive food regulations, and local or state policies to restrict the sale or serving size of sugary beverages in public venues.

Industry Self-Regulation of Beverages Sold in Schools

In 2004, the American Beverage Association (ABA) entered into an agreement with The Alliance for a Healthier Generation to follow specific nutrition standards for beverages sold in schools. Elementary and middle schools were supposed to receive only 100% juice and water. The high school standards required that 50% of nonmilk beverages were water and no- or low-calorie options, although up to 50% of the beverages could remain the same as they were before.⁸⁷

In 2010, the ABA announced that this program was a tremendous success, resulting in excellent compliance by bottlers and an 88% decrease in the number of calories shipped to schools.⁸⁷ A closer look at the results presented in the ABA's final report, however, paints a less impressive picture.⁸⁷ Although elementary schools are only supposed to have juice and water, a full 57% of the beverages still being sold in 2010 are noncompliant, including a substantial amount of diet sports drinks and carbonated drinks. The high school standards are significantly more lenient, so even though schools are compliant, 69% of the beverages they are offering do not meet the elementary/middle school standards.⁸⁷

Although the beverage industry touts this program as evidence of the power of self-regulation, the national data likely overestimate the effect of this program because they include districts that are now compelled by state law to limit what is sold in their schools. For a true test of the effectiveness of self-regulation, one would need to combine the data from all of the states and cities that have legislation prohibiting the sale of sugary drinks in schools and compare them to districts in states with no legislation.

Sports Drinks

Although purchases of full-calorie soda have been decreasing over the past few years, the consumption of sports drinks has increased.⁸⁸ Sports drinks have similar amounts of sugar and calories as soft drinks, but are perceived as healthy. One study of adolescents found that unlike soda consumption, sports drink consumption was correlated with consumption of healthy foods, suggesting that sports drinks are considered part of a healthy diet.⁸⁹ Another study found that

27% of parents believed sports drinks were healthy for children, and 40% believed Gatorade was healthy.⁷⁵

Efforts to market sports drinks to adolescents are extensive and effective. In 2010, companies used a variety of social media to promote sports drinks and featured many famous athletes.⁷⁵ Ads for Gatorade were among the top 5 most viewed ads by youth in 2010.⁷⁵ Marketing emphasizes the health halo of these products, evidenced by the finding that 40% of ads for sports drinks feature nutrition-related claims.⁷⁵ The beverage industry is invested in maintaining a healthy image so that it can justify why these sugary drinks are still available in high schools.

The ABA explains that sports drinks are needed in high schools because [they] “provide a functional benefit necessary for students to add energy and absorb fluids efficiently . . . the calories contained in sports drinks, largely through carbohydrates, are needed to fuel working muscles of active students.”⁸⁷ This position is countered by the American Academy of Pediatrics, who state that “water, not sports or energy drinks” should be the principal source of hydration for adolescents, and regular consumption of sports drinks should be “avoided or restricted” to “a specific and limited function for child and adolescent athletes.”⁹⁰ They go on to explain that sports drinks should only be used when there is a need for rapid replenishment of carbohydrates and/or electrolytes . . . during prolonged, vigorous sports participation or other intense physical activity.⁹⁰ In light of the data presented earlier that this level of physical activity is not occurring in school, there is no justification for providing these products in this setting.

Energy Drinks

Energy drinks are one of the most concerning additions to the sugary drink environment. As the name implies, energy drinks are marketed as a method to stay alert and thus are appealing to and often used by adolescents, who are often chronically sleep-deprived. Similar to sports drinks, consumption of energy drinks has rapidly increased in the past 10 years. From 2005 to 2006, energy drink sales increased by more than 50% and have continued to increase over the years, with a 15% increase between 2008 and 2010.^{91–93}

Adolescents are among the most targeted and frequent consumers of energy drinks.⁹⁴ According to 1 survey, approximately 30% of adolescents reported consumption of energy drinks, while another study found that almost 1 in 2 adolescents regularly consumed energy drinks.^{95,96} Adolescents list sports performance, peer group pressure, and attractive packaging as the top reasons for consuming energy drinks.⁹⁷ The growth in consumption is undoubtedly linked to the growth in marketing; in 2010, energy drinks had the second highest advertising expenditure among nonalcoholic drinks, totaling to \$164 million.⁷⁵ Also in 2010, the

most viewed television advertisements among adolescents were those for 5-Hour Energy.⁷⁵

Other strategies used to market energy drinks include sponsorships of music and other events frequented by adolescents and the use of celebrities and extreme sports to promote their products.⁹⁸

Most energy drink companies claim a health benefit from their products, despite minimal evidence supporting these claims.⁹⁹ Because of their classification as natural dietary supplements, energy drink manufacturers are not held to the same government regulation standards as are other beverage manufacturers. Companies do not need FDA approval; instead, the company is responsible for determining that the product is reasonably safe, but they do not need to list nutrition facts or ingredient amounts.¹⁰⁰ One major concern is that there is no caffeine limit for sports drinks as there is for soft drinks.¹⁰⁰ Companies exploit the lack of limits by putting large amounts of caffeine in their products; Monster Energy, Red Bull, and Rockstar surpass the FDA caffeine limit for soft drinks by 170%, and Spike Shooter exceeds the limit by 600%.¹⁰¹ Disappointingly, one-half of all energy drinks do not even reveal their caffeine content (as they are exempt from labeling regulations), so the amount of caffeine is completely unknown to the consumer.⁹³

Although caffeine is safe in moderation, there is reason to worry that the high concentrations of caffeine in energy drinks pose a health risk for adolescents. One study found that 40% of teenagers who consumed caffeine exceeded recommended limits.¹⁰² Excess caffeine can cause health problems like nausea, palpitations, insomnia, anxiety, dehydration, and irritability,¹⁰³ and large doses of caffeine can cause seizures, muscle spasms, myocardial arrhythmias, vomiting, and fertility problems.^{102,104} Among children and adolescents, regular caffeine consumption has been associated with depression and difficulty in concentrating.^{97,105} There is a greater risk of serious cardiovascular, renal, neurologic, and psychiatric side effects when energy drinks are consumed with alcohol.^{103,106}

Policies to Reduce Sugary Drink Consumption

There are various regulatory changes that are needed regarding energy drinks, including requiring full disclosure of ingredients and caffeine content, and requiring warning labels about possible negative health effects. Policies requiring ID for the purchase of these beverages should also be considered to limit consumption of energy drinks by adolescents.

One policy to reduce consumption of all sugary drinks, including not only energy and sports drinks, but also soft drinks, fruit drinks, and sweetened teas, is to tax them. This strategy is controversial, but also has the potential to be the most effective policy to reduce adolescent consumption. Taxes on both tobacco

and alcohol have shown that increasing the price of these goods reduces levels of consumption.^{107–109} For cigarettes, taxes have been found to have the most profound effect on consumption among children. Several economic studies have shown that a 10% increase in the real price of cigarettes reduces consumption in the general population by between 3% to 5%, but by between 6% to 7% among children.¹¹⁰ These findings suggest that taxing sugary drinks could be particularly effective at combating obesity among young people. In addition to affecting consumption, the revenue raised by a sugary drink tax could be used to support nutrition or other health-related initiatives, such as healthier school lunch programs. The revenue that could be generated is significant. An estimate generated by the Rudd Center for Food Policy and Obesity Revenue Calculator reveals that introducing a national sales tax of 1 cent per ounce for sugar-sweetened beverages would raise \$13 billion in 2013.¹¹¹

CONCLUSION

Although adolescents have more advanced logical reasoning abilities than younger children, they are a vulnerable segment of the population that needs to be protected from obesogenic environments. If obesity were caused by lack of knowledge or faulty reasoning, one could argue that adolescents need to learn and use skills to protect their health. However, there is abundant evidence that obesity is not caused by lack of knowledge, lack of reasoning ability, or failure of personal responsibility.¹¹² Obesity is caused largely by an environment that promotes poor diet and physical inactivity,¹¹³ and most adults have difficulty maintaining a healthy weight. To expect adolescents to overcome the current environment is unreasonable.

Our society must be restructured to promote, rather than hinder, healthful diets and physical activity. There are a number of public places where adolescents study and play, and in each, there are opportunities to create an environment that promotes good nutrition and physical activity. School wellness policies are a powerful, yet underused, tool to improve our nation's high schools. Local policies can state that competitive foods must be healthy, vending machines cannot sell sugary drinks, and fund-raisers should support increased physical activity instead of promoting sweets. Local wellness policies can also state that physical education classes need to help adolescents learn lifetime physical activity skills, and schools must provide ample opportunities for students to practice these skills.

In addition to local school wellness policies, city and state governments are important partners. The best progress to date in changing school food and measurably changing BMI trajectories has occurred because states have passed strong legislation, or cities have adopted strong policies to make changes such as limiting consumption of sugary drinks and requiring competitive foods to meet nutrition standards.

Federal government policy changes are fewer and farther between, but have tremendous effect. As the USDA works to improve the regulations for all of the government food programs, the voices of physicians are welcome. The national debate on food marketing to children will likely emerge again, and when it does, advocates need to stand up for the protection of adolescents.

Physicians are a critical part of the solution to childhood obesity in the United States. Parents and the general public trust physicians to prioritize childhood safety and well-being; this makes members of the health care system extremely powerful advocates. Physicians can work as individuals or part of a professional organization and connect with other advocacy groups to form coalitions. Many states have already created such alliances and would welcome the opportunity to work with local physicians. There are political and economic challenges to changing policies at the local, state, and federal level. A collaborative effort that engages everyone who cares about adolescent health is needed to overcome the obstacles and create an environment where adolescents can thrive.

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References

- Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999–2000. *JAMA*. 2002;288(14):1728–1732
- The Legal Pulse. Five Questions for CFBAI's Elaine Kolish on Self Regulation of Advertising. *Washington Legal Foundation Advocate for Freedom and Justice*. 2011
- Pechmann C, Levine L, Loughlin S, Leslie F. Impulsive and self-conscious: adolescents' vulnerability to advertising and promotion. *American Marketing Association*. 2005;24(2):202–221
- Byrnes JP. The development of decision-making. *J Adolesc Health*. 2002;31:208–215
- Steinberg L. Risk taking in adolescents - new perspective from brain and behavioral science. *Curr Dir Psychol Sci*. 2007;16(2):55–59
- Johnson SB, Blum RW, Giedd JN. Adolescent maturity and the brain: the promise and pitfalls of neuroscience research in adolescent health policy. *J Adolesc Health*. 2009;45:216–221
- Tercyak K, Goldman P, Smith A, Audrain J. Interacting effects of depression and tobacco advertising receptivity on adolescent smoking. *J Pediatr Psychol*. 2002;27(2):145–154
- Whalen C, Jamner L, Henker B, Delfino R. Smoking and moods in adolescents with depressive and aggressive dispositions: evidence from surveys and electronic diaries. *Health Psychol*. 2001;20(2):99–111
- Tice DM, Bratslavsky E, Baumeister RF. Emotional distress regulation takes precedence over impulse control: if you feel bad, do it! *J Pers Soc Psychol*. 2001;80(1):53–67
- Shiv B, Fedorikhin A. Heart and mind in conflict: the interplay of affect and cognition in consumer decision making. *J Consum Res*. 1999;26(3):278–293
- Carson DE. Changes in obesity-related food behavior: A nutrition education intervention to change attitudes and other factors associated with food-related intentions in adolescents: an application of the theory of planned behavior. 2011. *Dissertation Abstracts International: Section B: The Sciences and Engineering*. 2011;71(8-B)
- Steinberg L. Risk-taking in adolescence: what changes and why. *Ann N Y Acad Sci*. 2004;1021:51–58
- United States House of Representatives. Child Nutrition and WIC Reauthorization Act of 2004. Vol 108-4981. Washington, D.C.; 2004
- Action for Healthy Kids. Wellness Policy Tool. 2011. Available at: <http://www.actionforhealthykids.org/for-schools/wellness-policy-tool/>. Accessed April 6, 2012
- National Alliance for Nutrition and Activity. Model School Wellness Policies. 2005. Available at: <http://www.schoolwellnesspolicies.org/>. Accessed April 6, 2012
- Schwartz MB, Lund AE, Grow HM, et al. A comprehensive coding system to measure the quality of school wellness policies. *J Am Diet Assoc*. 2009;109(7):1256–1262
- Schwartz MB, Henderson KE, Falbe J, et al. Strength and comprehensiveness of district school wellness policies predict policy implementation at the school level. *J School Health*. 2012;82(6):262–267
- Belansky ES, Cutforth N, Delong E, et al. Early effects of the federally mandated Local Wellness Policy on school nutrition environments appear modest in Colorado's rural, low-income elementary schools. *J Am Diet Assoc*. 2010;110(11):1712–1717
- Probart C, McDonnell ET, Jomaa L, Fekete V. Lessons from Pennsylvania's mixed response to federal school wellness law. *Health Aff (Millwood)*. 2010;29(3):447–453
- Kubik MY, Lytle LA, Farbaksh K. School and district wellness councils and availability of low-nutrient, energy-dense vending fare in Minnesota middle and high schools. *J Am Diet Assoc*. 2011;111(1):150–155
- Kubik MY, Lytle LA, Hannan PJ, Perry CL, Story M. The association of the school food environment with dietary behaviors of young adolescents. *Am J Public Health*. 2003;93(7):1168–1173
- Cullen KW, Watson K, Zakeri I. Improvements in middle school student dietary intake after implementation of the Texas Public School Nutrition Policy. *Am J Public Health*. 2008;98(1):111–117
- Cullen KW, Eagan J, Baranowski T, Owens E, de Moor C. Effect of a la carte and snack bar foods at school on children's lunchtime intake of fruits and vegetables. *J Am Diet Assoc*. 2000;100(12):1482–1486
- Kubik MY, Lytle LA, Story M. Schoolwide food practices are associated with body mass index in middle school students. *Arch Pediatr Adolesc Med*. 2005;159(12):1111–1114
- Cullen KW, Watson KB. The impact of the Texas public school nutrition policy on student food selection and sales in Texas. *Am J Public Health*. 2009;99(4):706–712
- Schwartz MB, Novak SA, Fiore SS. The impact of removing snacks of low nutritional value from middle schools. *Health Educ Behav*. 2009;36(6):999–1011
- Chiqui JF, Schneider L, Chaloupka FJ, et al. *School District Wellness Policies: Evaluating Progress and Potential for Improving Children's Health Three Years after the Federal Mandate*. School Years 2006–07, 2007–08 and 2008–09. Chicago, IL: Bridging the Gap Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago; 2010
- Turner L, Chaloupka FJ, Sandoval A. *School Policies and Practices for Improving Children's Health: National Elementary School Survey Results: School Years 2006–07 through 2009–10*. Chicago, IL: Bridging the Gap Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago; 2012
- Taber DR, Chiqui JR, Perna FM, Powell LM, Chaloupka FJ. Weight status among adolescents in states that govern competitive food nutrition content. *Pediatrics*. 2012;130(3)
- Austin SB, Melly SJ, Sanchez BN, Patel A, Buka S, Gortmaker SL. Clustering of fast-food restaurants around schools: a novel application of spatial statistics to the study of food environments. *Am J Public Health*. 2005;95:1575–1581
- Simon PA, Kwan D, Angelescu A, Shih M, Fielding JE. Proximity of fast food restaurants to schools: do neighborhood income and type of school matter? *Prev Med*. 2008;47(3):284–288
- Sturm R. Disparities in the food environment surrounding US middle and high schools. *Public Health*. 2008;122(7):681–690
- Kwate NO, Loh JM. Separate and unequal: the influence of neighborhood and school characteristics on spatial proximity between fast food and schools. *Prev Med*. 2010;51(2):153–156
- Davis B, Carpenter C. Proximity of fast-food restaurants to schools and adolescent obesity. Disparities in the food environment surrounding US middle and high schools. *Am J Public Health*. 2009;99(3):505–510

5. Laska MN, Hearst MO, Forsyth A, Pasch KE, Lytle L. Neighbourhood food environments: are they associated with adolescent dietary intake, food purchases and weight status? *Public Health Nutr.* 2010;13(11):1757–1763
6. Galvez MP, Hong L, Choi E, Liao L, Godbold J, Brenner B. Childhood obesity and neighborhood food-store availability in an inner-city community. *Acad Pediatr.* 2009;9(5):339–343
7. Davis B, Carpenter C. Proximity of fast-food restaurants to schools and adolescent obesity. *Am J Public Health.* 2009;99:505–510
8. Harris JL, Schwartz MB, Brownell KD. *Fast Food FACTS*. New Haven, CT: Yale Rudd Center for Food Policy and Obesity; 2010
9. Food and Nutrition Service. Nutrition standards in the national school lunch and school breakfast programs. In: USDA, ed. Vol 77. Washington, D.C.: Federal Register; 2012:4088–4167
10. Eaton DK, Kann L, Kinchen S, et al. *Youth Risk Behavior Surveillance - United States, 2009*. Center for Disease Control and Prevention- Department of Health and Human Services; June 4, 2009
11. Kubik MY, Lytle L, Fulkerson JA. Fruits, vegetables, and football: Findings from focus groups with alternative high school students regarding eating and physical activity. *J Adolesc Health.* 2005;36(6):494–500
12. Fahlman MM, Hall HL, Lock R. Ethnic and socioeconomic comparisons of fitness, activity levels, and barriers to exercise in high school females. *J Sch Health.* 2006;76(1):12–17
13. Grieser M, Neumark-Sztainer DR, Saksvig BI, Lee J, Felton GM, Kubik M. Black, Hispanic, and white girls' perceptions of environmental and social support and enjoyment of physical activity. *J Sch Health.* 2008;78(6):314–320
14. Johnston LD, Delva J, OMalley PM. Sports participation and physical education in American secondary schools: current levels and racial/ethnic and socioeconomic disparities. *Am J Prev Med.* 2007;33(4 Suppl):S195–208
15. Agazzi H, Armstrong K, Bradley-Klug KL. BMI and physical activity among at-risk sixth- and ninth-grade students, Hillsborough County, Florida, 2005–2006. *Prev Chronic Dis.* 2010;7(3):1–9
16. Activity NAFSA. Physical Education Guidelines. 2012. Available at: <http://www.aahperd.org/naspe/standards/nationalGuidelines/PEguidelines.cfm>. Accessed July 3, 2012
17. Slater SJ, Nicholson L, Chriqui J, Turner L, Chaloupka F. The impact of state laws and district policies on physical education and recess practices in a nationally representative sample of US public elementary schools. *Arch Pediatr Adolesc Med.* 2012;166(4):311–316
18. Trost SG, Mars H. Why we should not cut P.E. *Edu Leadership.* 2009/2010;67(4):60–65
19. Trost SG. *Active Education: Physical Education, Physical Activity and Academic Performance*. Available at: <http://www.activelivingresearch.org/activeeducation>. Accessed November 8, 2012
20. Sallis JF, McKenzie TL, Kolody B, Lewis M, Marshall S, Rosengard P. Effects of health-related physical education on academic achievement - SPARK. *Res Q Exerc Sport.* 1999;70(2):127–134
21. Chomitz VR, Slining MM, McGowan RJ, Mitchell SE, Dawon GF, Hacker KA. Is there a relationship between physical fitness and academic achievement? Positive results from public school children in the northeastern United States. *J Sch Health.* 2009;79(1):30–37
22. Grissom JB. Physical fitness and academic achievement. *J Exerc Physiol.* 2005;8(1):11–25
23. Kwak L, Kremers SP, Bergman P, Ruiz JR, Rizzo NS, Sjostrom M. Associations between physical activity, fitness, and academic achievement. *J Pediatr.* 2009;155:914–918
24. Virgilio, SJ. The changing face of physical education. *Curriculum Rev.* 2009;48(7)
25. Schachter R. The new phys ed. *Instructor.* 2011;120(6):39–42
26. Warner L. A place for healthy risk-taking. *Edu Leadership.* 2009/2010;67(4)
27. McKenzie TL, Sallis JF, Rosengard P. Beyond the stucco tower: design, development, and dissemination of the SPARK physical education programs. *Quest.* 2009;61:114–127
28. Fuller D, Sabiston C, Karp I, Barnett T, O'Loughlin J. School sports opportunities influence physical activity in secondary school and beyond. *J Sch Health.* 2011;81(8):449–454
29. National Center for Safe Routes to School. *How Children Get to School: School Travel Patterns From 1969 to 2009*. 2011. Available at: <http://www.saferoutesinfo.org/program-tools/NHTS-school-travel-1969-2009>. Accessed October 3, 2012
30. Cowan D, Hubsmith D, Ping R. *Safe Routes to School Local Policy Guide*. 2011. Available at: www.saferoutespartnership.org/sites/default/files/pdf/local_policy_guide_2011.pdf. Accessed November 5, 2012
31. *Healthy People 2020- Physical Activity Objectives*. Washington, DC: U. S. Department of Health and Human Services; 2010
32. Kappagoda M, Ogilvie RS. *Playing Smart: Maximizing the Potential of School and Community Property through Joint Agreements*. Available at: http://americanindianhealthyteaching.unc.edu/wp-content/uploads/2011/05/Playing_Smart-National_Joint_Use_Toolkit_FINAL_20120309.pdf. Accessed November 8, 2012
33. Farley TA, Meriwether RA, Baker ET, Watkins LT, Johnson CC, Webber LS. Safe play spaces to promote physical activity in inner-city children: results from a pilot study of an environmental intervention. *Am J Public Health.* 2007;97(9):1625–1631
34. Girls on the Run. 2012. Available at: <http://www.girlsontherun.org/>. Accessed August, 2012
35. American Heart Association. *Policy Position Statement of Body Mass Index (BMI) Surveillance and Assessment in Schools*; 2009
36. *Assessment of Childhood and Adolescent Obesity in Arkansas: Year Four (Fall 2006-Spring 2007)*. Little Rock, AR: Arkansas Center for Health Improvement; 2007
37. *Year Three Report- Assessing the Impact of the Mississippi Healthy Students Act*. Jackson, MS: Center for Mississippi Health Policy; 2012. Available at: <http://www.mshealthpolicy.com/assessing-the-impact-of-the-mississippi-healthy-students-act-on-childhood-obesity-2/>. Accessed November 8, 2012
38. New York City Obesity Task Force. *Reversing the Epidemic: The New York City Obesity Task Force Plan to Prevent and Control Obesity*. New York: NY, Office of the Mayor; 2012
39. Neumark-Sztainer DR, Friend SE, Flattum CF, et al. New moves-preventing weight-related problems in adolescent girls a group-randomized study. *Am J Prev Med.* 2010;39(5):421–432
40. Chomitz VR, Collins J, Kim J, Kramer E, McGowan RJ. Promoting healthy weight among elementary school children via a health report card approach. *Arch Pediatr Adolesc Med.* 2003;157:765–772
41. Ikeda JP, Crawford PB, Woodward-Lopez G. BMI screening in schools: helpful or harmful? *Health Educ Res.* 2006;21(6):761–769
42. Presnell K, Bearman SK, Stice E. Risk factors for body dissatisfaction in adolescent boys and girls: a prospective study. *Int J Eat Disord.* 2004;36(4):389–401
43. Hesketh K, Wake M, Waters E. Body mass index and parent-reported self-esteem in elementary school children: evidence for a causal relationship. *Int J Obes Relat Metab Disord.* 2004;28(10):1233–1237
44. Harris JL, Weinberg ME, Schwartz MB, Ross C, Ostroff J, Brownell KD. *Trends in Television Food Advertising- Progress in Reducing Unhealthy Marketing to Young People?* New Haven, CT: Yale Rudd Center; 2010
45. Harris JL, Schwartz MB, Brownell KD, et al. *Sugary Drinks FACTS: Food Advertising to Children and Teens Score*. Rudd Center for Food Policy and Obesity. New Haven, CT: Yale University; 2011
46. Better Business Bureau Children's Food and Beverage Advertising Initiative. *Food and Beverage Products That Meet Participants' Approved Nutrition Standards*; 2011
47. Interagency Working Group. *Preliminary Proposed Nutrition Principles to Guide Industry Self-Regulatory Efforts*; 2011
48. Better Business Bureau Children's Food and Beverage Advertising Initiative. *General Comments and Comments on the Proposed Nutrition Principles and Marketing Definitions*; 2011
49. Steinberg L. Risk taking in adolescence: new perspectives from brain and behavioral science. *Cur Dir Psychol Sci.* 2007;16(2):55–59
50. Pollay RW, Siddarth S, Siegel M, et al. The last straw? Cigarette advertising and realized market shares among youths and adults, 1979–1993. *J Market.* 1996;60(April):1–16
51. Welsh JA, Sharma AJ, Grellinger L, Vos MB. Consumption of added sugars is decreasing in the United States. *Am J Clin Nutr.* 2011;94(3):726–734
52. Babey S, Jones M, Yu H, Goldstein H. *Bubbling Over: Soda Consumption and Its Link to Obesity in California*. Los Angeles, CA: UCLA Center for Health Policy Research and California Center for Public Health Advocacy; 2009

3. Chen L, Appel L, Loria C, Lin P, Champagne C, Elmer P. Reduction in consumption of sugar-sweetened beverages is associated with weight loss: the PREMIER trial. *Am J Clin Nutr*. 2009;89(5):1299–1306
4. Vartanian L, Schwartz MB, Brownell KD. Effects of soft drink consumption on nutrition and health: A systematic review and meta-analysis. *Am J Public Health*. 2007;97(4):667–675
5. Malik V, Schulze M, Hu F. Intake of sugar-sweetened beverages and weight gain: a systematic review. *Am J Clin Nutr*. 2006;82(4):274–288
6. Reedy J, Krebs-Smith SM. Dietary sources of energy, solid fats, and added sugars among children and adolescents in the United States. *J Am Diet Assoc*. 2010;110(10):1477–1484
7. *Alliance School Beverage Guidelines Final Progress Report*. American Beverage Association; 2010
8. Story, M, Klein, L. *Consumption of Sports Drinks by Children and Adolescents: A Research Review*; June 2012. Available at: http://www.healthyeatingresearch.org/images/stories/her_research_briefs/RRSportsDrinkFINAL6-2012.pdf. Accessed July 3, 2012
9. Ranjit N, Evans MH, Byrd-Williams C, Evans AE, Hoelscher DM. Dietary and activity correlates of sugar-sweetened beverage consumption among adolescents. *Pediatrics*. 2010;126(4):e754–761
10. Committee on Nutrition; Council on Sports Medicine. Sports drinks and energy drinks for children and adolescents: are they appropriate? *Pediatrics*. 2011;127(6):1182–1189
11. Fuhrman E. *Rush of Energy*. Beverage Industry. 2006. Available at: <http://www.bevindustry.com/articles/rush-of-energy>. Accessed July 3, 2012
12. Dinuzio J. Wary of energy drinks in an adrenaline sport. *The New York Times*; 2012. Available at: <http://www.nytimes.com/2012/01/08/sports/pro-water-in-snowboarding-culture-heavy-on-energy-drinks.html>. Accessed November 9, 2012
13. Harris JL, Schwartz MB, Brownell KD. *Sugary Drink FACTS*. Rudd Center for Food Policy and Obesity. New Haven, CT: Yale University; 2011
14. Higgins JP, Tuttle TD, Higgins CL. Energy beverages: content and safety. *Mayo Clin Proc*. 2010;85(11):1033–1041
15. O'Dea JA. Consumption of nutritional supplements among adolescents: usage and perceived benefits. *Health Educ Res*. 2003;18(1):98–107
16. Press A. Teens Abusing energy boosting drinks, doctors fear. *Fox News*. 2006. Available at: <http://www.foxnews.com/story/0,2933,226223,00.html>. Accessed July 3, 2012
17. Luebbe AM, Bell DJ. Mountain Dew or mountain don't?: a pilot investigation of caffeine use parameters and relations to depression and anxiety symptoms in 5th and 10th-grade students. *J Sch Health*. 2009;79(8):380–387
18. Kovacic WE, Harbour PJ, Leibowitz J, Rosch JT. *Marketing Food to Children and Adolescents: A Review of Industry Expenditures, Activities, and Self-Regulation*. Washington, DC: Federal Trade Commission; 2008
19. Heneman K, Zidenberg-Cherr S. *Nutrition and Health Info Sheet: Energy Drinks*. University of California; 2007
20. US Food and Drug Administration. Overview of Dietary Supplements. 2009. Available at: <http://www.fda.gov/Food/DietarySupplements/ConsumerInformation/default.htm>. Accessed November 6, 2012
21. Center for Science in the Public Interest. Caffeine Content of Food & Drugs. 2007. Available at: <http://www.cspinet.org/new/cafcchart.htm>: table_coffees. Accessed July 3, 2012
22. Thomson B, Scheiss S. *Risk Profile: Caffeine in Energy Drinks and Energy Shots*. Available at: http://www.foodsafety.govt.nz/elibrary/industry/Risk_Profile_Caffeine-Science_Research.pdf. Accessed November 8, 2012
23. Babu KM, Church RJ, Lewander W. Energy drinks: the new eye-opener for adolescents. *Clin Pediatr Emerg Med*. 2008;9:35–42
24. Rath M. Energy drinks: what is all the hype? The dangers of energy drink consumption. *J Am Acad Nurse Pract*. 2012;24(2):70–76
25. O'Connor E. A sip into dangerous territory. *Am Psychol*. 2001;32(6). Available at: <http://www.apa.org/monitor/jun01/dangersip.aspx>
26. Wolk BJ, Ganetsky M, Babu KM. Toxicity of energy drinks. *Curr Opin Pediatr*. 2012;24(2):243–251
107. Andreyeva T, Long MW, Brownell KD. The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food. *Am J Public Health*. 2010;100(2):216–222
108. Wagenaar AC, Salois MJ, Komro KA. Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction*. 2009;104(2):179–190
109. Yen ST, Lin B-H, Smallwood DM, Andrews M. Demand for nonalcoholic beverages: the case of low-income households. *Agribusiness*. 2004;20(3):309–321
110. Chaloupka F. Macro-social influences: the effects of prices and tobacco control policies on the demand for tobacco product. *Nicotine Tob Res*. 1999;1(1):S77–81
111. Friedman RR, Brownell KD. *Sugar Sweetened Beverage Taxes: An Updated Policy Brief*. Rudd Center for Food Policy and Obesity, New Haven, CT; Yale University; 2012
112. Brownell KD, Kersh R, Ludwig DS, et al. Personal responsibility and obesity: a constructive approach to a controversial issue. *Health Affairs*. 2010;29(3):379–387
113. Brownell KD, Horgen KB. *Food Fight: The Inside Story of the Food Industry, America's Obesity Crisis, And What We Can Do About It*. New York: McGraw-Hill; 2004