

# Influence of Competitive Food and Beverage Policies on Children's Diets and Childhood Obesity

Healthy Eating  
Research

Bridging the Gap

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## Abstract

Competitive foods is a term used to describe foods and beverages that generally compete with school meal programs. These foods and beverages are sold through vending machines, à la carte cafeteria lines, school stores and other venues. They are commonly referred to as snacks or “junk” foods, and they are often high in fat, cholesterol, calories, sugar and/or salt. Many schools also sell a variety of unhealthy drinks to students, including high-fat milks and sugar-sweetened beverages (SSBs) such as soda, sports drinks and high-calorie fruit drinks.

The influence of policies related to the sale of competitive foods is worth examining because the foods and drinks available in school have a significant effect on children's diets and their weight. Given the high rates of obesity among children and adolescents nationwide, it is important to understand how competitive foods and beverages are sold and consumed by students in school, as well as to identify effective strategies for improving the nutritional quality of those products.



This research review examines the emerging evidence about the influence of competitive food and beverage policies on children's diets and childhood obesity. The research clearly shows a need for comprehensive policies that govern the sale and consumption of these foods and beverages in the school environment.

## Introduction

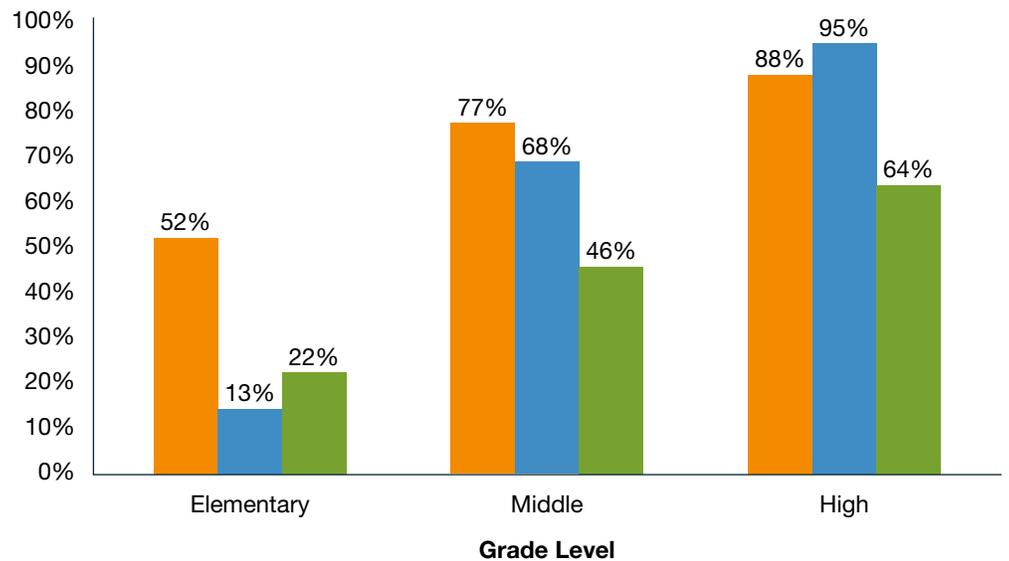
More than 23 million children and adolescents in the United States—nearly one in three young people—are obese or overweight.<sup>1</sup> The foods and beverages available in schools have a significant impact on children's diets and their weight. Children spend the majority of their waking

hours in school for at least nine months of the year; hence schools are one potentially important setting for influencing the foods and beverages that they have access to on a regular basis.<sup>2</sup> In fact, more than 35 percent of children's and adolescents' daily energy intake occurs at school.<sup>3</sup>



**FIGURE 1****Percentage of U.S. Public School Students Nationwide with Access to Competitive Food and/or Beverage Venues by Grade Level, School Year 2009–10**

- À La Carte Lines in the Cafeteria
- Vending Machines
- School Stores/ Snack Bars

**% of Public School Students Nationwide**

Source: Bridging the Gap; see: Turner et al.,<sup>7</sup> and Johnston et al., forthcoming<sup>8</sup>

Outside of the school meal programs, snack foods and beverages are readily available for sale at school from venues such as vending machines, school stores, snack bars, canteens, à la carte lines in the cafeteria and fundraisers.<sup>4,6</sup> In elementary schools, foods and beverages also are frequently served in classroom parties. As of school year 2009–10, 55 percent of all public elementary school students were in a school that did not limit sugary items for classroom birthday parties.<sup>7</sup> Collectively, the snacks and beverages sold or served outside of school meal programs are known as competitive foods and beverages because they compete with school meals for students' spending.

The majority of public school students in the United States, particularly at the middle and high school levels, have access to competitive foods and beverages (see Figure 1).<sup>7,8</sup> In spite of voluntary agreements by snack and beverage manufacturers to remove energy-dense, low-nutrient foods and beverages from schools,<sup>9,10</sup> the majority of public school students still have ready access to foods that are high in fat,

calories, sugar and/or salt, and offer minimal nutritional value. Many schools also sell a variety of unhealthy drinks to students, including high-fat milks and sugar-sweetened beverages (SSBs) such as soda, sports drinks and high-calorie fruit drinks (see Figure 2).<sup>6-8,11-15</sup>

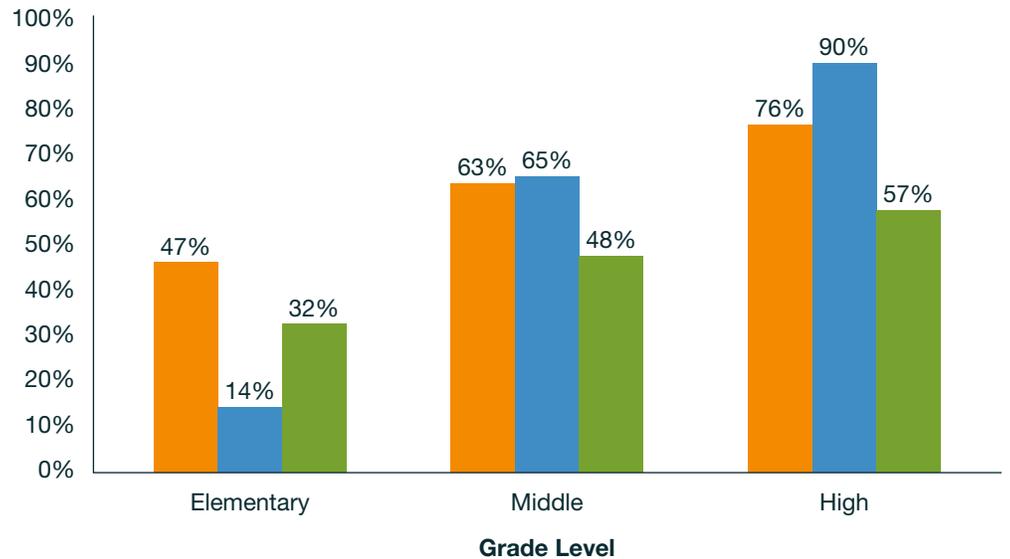
In recognition of the obesity epidemic and the need to increase children's access to nutritious foods and beverages at school, states, school districts and schools nationwide are changing policies to create a healthier school environment.<sup>6,16-36</sup> The impetus behind much of the policy action was the Child Nutrition and WIC Reauthorization Act of 2004 (hereafter referred to as the "Act"; P.L. 108-265) which required that all local education agencies (i.e., school districts) participating in the National School Lunch Program (NSLP) and other federal child nutrition programs adopt and implement a wellness policy by the first day of school year 2006–07.<sup>37</sup> Among other things, the Act required that local education agencies develop guidelines for all foods and beverages sold outside of the school meal

**FIGURE 2**

**Percentage of U.S. Public School Students Nationwide with Access to Unhealthy Foods and Beverages in Competitive Venues by Grade Level, School Year 2009–10**

- Sweet/Salty/High Fat Snacks
- SSBs
- 2% or Whole Milk

**% of Public School Students Nationwide**



Source: Bridging the Gap; see: Turner et al.,<sup>7</sup> and Johnston et al., forthcoming<sup>8</sup>

programs (i.e., competitive foods and beverages) during the school day. However, many of these wellness policies are weak, particularly with regards to competitive food and beverage standards at the middle and high school levels.<sup>16,17</sup> Further, many districts that have established a wellness policy have not yet implemented its provisions, especially those related to competitive foods and beverages.<sup>38</sup>

At the state level, a number of states enacted or strengthened their laws related to competitive foods and beverages in the mid- to late-2000s to provide guidance and promote uniformity across districts working to implement their wellness policies.<sup>18-23</sup> With the passage of the Healthy, Hunger-Free Kids Act of 2010 (P.L. 111-296), Congress reauthorized the wellness policy requirement and, for the first time, required the U.S.

Department of Agriculture (USDA) to promulgate nationwide competitive food and beverage standards and wellness policy regulations.

The following research review summarizes 33 peer-reviewed, U.S.-based studies published in the scientific literature from 2005 through November 2011 that examine the relationship between competitive food- and/or beverage-related policies, children’s diets and childhood obesity. All included studies are listed in Table 1. The review also identifies the policy implications of the published studies and identifies areas for future research. The findings are critical for informing the development and implementation of school policies at all levels that aim to prevent obesity and improve children’s diets.

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## Methodology

This research review was based on peer-reviewed scientific literature published between 2005 and November 2011. Boolean keyword searches were conducted in PubMed, CINAHL, EconLit, PsychLit, EMBASE, ERIC, PAIS, Google Scholar, and the references of the resultant literature to identify studies that examined the influence of competitive food- and/or beverage-related policies on competitive food and/or beverage availability, access, consumption, and/or weight or body mass index (BMI) outcomes. In order to be included, the studies must have been conducted in the United States, published in the English language, and explicitly stated in the study abstract and/or methods that some type of competitive food/beverage-related “policy” was the independent variable of interest. For purposes of this review, “policy” was defined broadly to include formal, written laws, rules, regulations or standards developed by state legislatures, state administrative agencies (e.g., Departments of Education), district school boards or district administrators (including the congressionally-mandated school district wellness policies) and/or school administrators related to competitive items sold or served during the school day.

Although important in their own right, several studies were excluded from the review for the following reasons:

1. They examined changes to some aspect of the school food environment but they did not specifically use the term “policy” in their abstract or study methods.
2. The study examined a wide range of policies but did not differentiate the impact of the food/beverage policies, specifically, from other policies (e.g., nutrition education, physical education).
3. They were surveys or audits of competitive food and/or beverage availability, purchasing and/or consumption but they did not study the impact of a specific policy(ies) on availability, purchasing, consumption, etc.
4. The study focused exclusively on school meal programs without examining the impact of competitive food and/or beverage policies on changes to meal participation or changes in à la carte purchasing.
5. The study was a pilot or intervention study with the policy change only occurring in a limited number of schools.
6. The study was a systematic review or review of the literature (although such studies were reviewed to identify possible studies for inclusion in this review).

### Summary of Included Studies

Using these criteria, 33 papers were selected for inclusion. Most of the studies were conducted between 2002 (baseline year pre-policy) and 2008 (post-policy timeframe). The included studies examined a combination of objectively measured policies (23 papers) and self-reported policies (10 papers). Six of the self-reported policy studies were large, nationally representative studies using data from national surveys such as the Centers for Disease Control and Prevention’s (CDC) School Health Policies and Programs Study (SHPPS) or the National Center for Education Statistics’ (NCES) Early Childhood Longitudinal Survey-Kindergarten (ECLS-K) cohort survey. Most of the studies relating policy to BMI used self-reported height and weight to calculate BMI rather than objectively measured BMI.

The included studies were conducted across the country. They covered the following states: Arkansas, California, Colorado, Indiana, Maine, Minnesota, Pennsylvania, Texas, Utah and Washington. Twelve district-level studies were also conducted in large metropolitan areas including Boston, Los Angeles, Minneapolis-St. Paul, New York City and San Francisco. Two studies examined the impact of both state and district policies and six were school-level studies.

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## Key Research Results

### Competitive Food and Beverage Policies Influence the School Food Environment and Student Purchases

- Policies that prohibit or restrict unhealthy snack foods and beverages, such as soda and other SSBs, 2%/whole milk, candy and chips, are associated with less access to and consumption and purchasing of these items and increased availability of healthier options.<sup>39-50</sup>
- The influence of competitive food and beverage policies on food and beverage availability and/or consumption is almost immediate (in some cases as soon as a few months following implementation).<sup>40,41,43,44,46-49,51-59</sup>
- Only two peer-reviewed studies have examined the impact of competitive food and beverage policies on school revenues. Both studies found that food service revenues do not decrease. They also found that revenues increase when schools restrict students' access to unhealthy snack foods and beverages. This is primarily due to increased participation in school meal programs, following restrictions on competitive foods and beverages.<sup>41,60</sup>
- Congressionally-mandated wellness policies have primarily been associated with changes in competitive food and beverage availability.<sup>51,53,54,61,62</sup> One study found that strong wellness policies did not significantly affect competitive food sales or NSLP participation.<sup>57</sup>

### Such Policies Impact Students' Diets and Possibly Even Their Weight

- Policies that restrict snack food and beverage offerings and place limits on fats, sugars, calories and portion sizes of such products are effective at reducing children's caloric intake.<sup>48,49,52,63</sup>
- Policies that allow schools to offer snack foods and beverages that are high in fat, sugar and calories are

associated with increased availability and consumption of these items and/or lower consumption of healthier options.<sup>39,64,65</sup>

- Literature is emerging on the relationship of competitive food and beverage policies with obesity and BMI.<sup>45,56,66-69</sup> Most of these studies point to consistent results—policies that allow junk foods in schools are associated with increased BMI; while policies that prohibit or restrict junk foods in schools are associated with lower proportions of overweight or obese students or lower rates of increase in student BMI.

### To Be Effective, Policies Must Be Comprehensive

- Policies that only apply to some venues but not all (e.g., apply to à la carte lines or vending machines, but not school stores) are not as effective as comprehensive policies that apply to all venues.<sup>47,48</sup>
- Comprehensive policies are key to reducing students' access to and consumption of SSBs in schools.<sup>59,70,71</sup> Policies that restrict only soda, but allow sports drinks and other SSBs, do not reduce SSB availability or consumption.<sup>70,71</sup>
- School food and beverage policies are but one component of child and adolescent food and beverage environments.<sup>47-49,55,59,70</sup> While one study found that school-based policies can affect children's total consumption of SSBs, both in and out of school,<sup>59</sup> most studies show that school-based policies did not translate into positive or negative dietary changes at home or after school.<sup>47-49,55,70</sup>
- Little scientific research has examined the influence of fundraising policies on competitive food and beverage availability, consumption or BMI.<sup>67,72</sup>

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## Studies Supporting Key Research Results

### **Policies that prohibit or restrict unhealthy snack foods and beverages, such as soda and other SSBs, 2%/whole milk, candy and chips, are associated with less access to and consumption and purchasing of these items and increased availability of healthier options.<sup>39-50</sup>**

Studies conducted nationwide;<sup>39,45</sup> and statewide in Arkansas,<sup>42</sup> California<sup>41,43,44</sup> and Connecticut;<sup>40</sup> as well as numerous districts and schools in Texas;<sup>46-49</sup> and in the Minneapolis-St. Paul metropolitan area<sup>50</sup> indicate that policies that prohibit or restrict access to unhealthy snack foods and beverages are resulting in real reductions in the availability of these items as well as increased availability of healthier options.

- One cross-sectional study using nationwide self-report data from the 2006 SHPPS conducted by the CDC found that elementary schools in states that prohibit junk food sales in vending machines and school stores offered significantly less junk food than schools located in states that neither required nor recommended prohibiting junk food sales (13% compared with 37%, respectively). Likewise, middle schools located in states banning junk food sales through vending machines were significantly less likely to allow such sales than were schools located in states that only recommended banning such items (71% in states allowing versus 87% in states banning).<sup>39</sup>
- Another study examined the relationship between changes to state-reported competitive food and beverage policies based on the 2000 and 2006 waves of SHPPS and adolescent soda consumption using data from CDC's Youth Risk Behavior Survey (YRBS). The study found that state policy changes for concession stands were associated with 0.09 fewer servings of soda daily and those targeting parties were associated with 0.07 fewer servings of soda daily. Soda consumption was markedly lower (0.19 fewer servings per day) for non-Hispanic Black adolescents located in a state that strengthened its concession stand policy between 2000 and 2006.<sup>45</sup>
- In 2008, five years after implementation of Arkansas' legislation on competitive foods, the state saw a significant decline in the availability of whole milk, soda, fruit drinks and non-chocolate candies; and students were less likely to have vending machines available during lunch and to have access to sodas in vending machines. Conversely, schools were more likely to require healthy options at student parties and at concession stands as well as to offer skim or non-fat milk options in the cafeterias.<sup>42</sup>
- A number of studies have examined the impact of California's food (SB 12) and beverage (SB 965) standards.<sup>41,43,44</sup> One study found that the majority of high schools met the beverage requirements one year following implementation and that compliance with beverage standards was easier to achieve than was compliance with the food standards. Compliance was greatest in food service (à la carte) venues followed by school stores and vending machines.<sup>43</sup> Another California study conducted in schools throughout the state found that approximately one year after the initial implementation of the standards, the availability of compliant foods and beverages increased while the availability of non-compliant items, particularly chips, candy, soda and other SSBs declined.<sup>41</sup> A third study, conducted in 19 schools located in six communities participating in the California Endowment's Healthy Eating, Active Communities (HEAC) program, found universal school-level adherence to the standards regardless of location of sale or grade level. For example, overall food adherence increased from 23.3 percent in 2005 to 67.1 percent in 2008 (the year following required full implementation of the food standards) and overall beverage adherence increased from 50.3 percent in 2005 to 77.8 percent in 2008 (prior to the required full implementation date for the beverage standards).<sup>44</sup>
- Connecticut was somewhat unique in that rather than mandating that all schools or districts adhere to the state's nutrition standards, beginning in school year 2006–07 they provided a monetary incentive to school districts that voluntarily chose to participate in the state's Healthy Food Certification (HFC) Program which included restrictions on portion sizes, fats, sugars and

sodium. Less than one year following implementation of the program, HFC districts had a significantly greater decline in unhealthy à la carte snack offerings at the elementary and high school levels compared with districts that did not participate in the HFC.<sup>40</sup>

- Three studies<sup>46,48,49</sup> examined the impact of the Texas 2004 policy that restricted portion sizes of high-fat and high-sugar snacks, limited milk fat to 1% or less, prohibited SSBs in vending machines, prohibited snack machines during lunch hours, set guidelines for fat content of food served and set limits on the frequency of serving high-fat vegetables at the elementary and middle school levels. One study, conducted in 47 schools in 11 districts during school year 2004–05 found that cafeteria servings of high-fat vegetables (e.g., french fries) and snack bar sales of large bags of chips declined across all grade levels while snack bar sales of baked chips significantly increased following implementation of the law. Larger districts were more likely to implement the state law than were smaller districts.<sup>46</sup> Two additional studies examined the impact of the state law during school year 2005–06. The first study, conducted in three middle schools in southeast Texas, found that lunchtime consumption of vegetables, milk and several nutrients increased and consumption of SSBs and snack chips declined.<sup>49</sup> The second study, conducted in one low socioeconomic status (SES) school and one middle SES school in southeast Texas, found that the middle SES school had fewer SSBs and greater reductions in nutrients consumed from snack bars than the low SES school. However, students at the middle SES school brought more high-fat vegetables, SSBs and chips from home compared with students at the low SES school.<sup>48</sup> Finally, one additional study, conducted in three middle schools located in one school district in Harris County, Texas, examined the impact of the district policy, effective at the beginning of school year 2002–03, which removed chips, candy, sweet desserts and SSBs from snack bars and removed vending machines from cafeterias. In the school year immediately following policy implementation, there was a decline in consumption of soft drinks, snacks, chips and candy from snack bars but an increase in chip and candy consumption from vending machines (which were only removed from cafeterias).<sup>47</sup>

- A study of 1,088 high school students randomly sampled from 20 high schools in Minneapolis-St. Paul, Minnesota, found that student snack food and beverage purchasing was significantly lower in schools with school-reported vending machine restrictions.<sup>50</sup>

**The influence of competitive food and beverage policies on food and beverage availability and/or consumption is almost immediate (in some cases as soon as a few months following implementation).**<sup>40,41,43,44,46-49,51-59</sup>

- The evidence to date indicates that school food policies are rapidly changing the school food environment and consumption and purchasing behaviors. Most of the studies examined the impact of these policies within one year following policy implementation and all found positive effects.<sup>40,43,46-49,51-56</sup>
- Furthermore, studies conducted more than one year after the policy was implemented continue to see effects of the policy on the school food environment and eating behaviors.<sup>41,42,44,58,59,61,63,69</sup> This suggests that school food policy changes can make an immediate difference in the school food environment, which, if coupled with changes at home and in other social settings, could lead to sustained changes in children's eating behaviors.

**Only two peer-reviewed studies have examined the impact of competitive food and beverage policies on school revenues. Both studies found that food service revenues do not decrease. They also found that revenues increase when schools restrict students' access to unhealthy snack foods and beverages. This is primarily due to increased participation in school meal programs, following restrictions on competitive foods and beverages.**<sup>41,60</sup>

Fear of decreased revenue is one of the main concerns expressed by food service directors and school boards when considering stronger competitive food and beverage standards. There are no data to suggest lost revenue, and in fact, the studies that have been done have found that revenues actually increased overall.

- In a study conducted in one middle school located in the San Francisco Unified School District (SFUSD), food service revenue substantially increased in the year following implementation of the district nutrition standards. Prior to policy implementation, the school food service reported a revenue loss of \$1,000 in the final month prior to policy implementation; after the policy change, the school food service generated more than \$2,000 in revenue in one month due to increased participation in the school lunch program.<sup>60</sup>
- In a study to examine the statewide impact of the California nutrition and beverage standards, competitive food revenues declined by more than 5 percent and à la carte sales declined in 60 percent of the schools studied; however, these revenue declines were offset by increased sale of school meals. As a result, all of the schools studied experienced an increase in total revenues (including both meal participation and competitive food and beverage sales) following adoption of the state standards.<sup>41</sup>

**Congressionally-mandated wellness policies have primarily been associated with changes in competitive food and beverage availability.<sup>51,53,54,61,62</sup> One study found that strong wellness policies did not significantly affect competitive food sales or NSLP participation.<sup>57</sup>**

Four statewide studies<sup>51,53,61,62</sup> and two district-level studies<sup>54,57</sup> examined the relationship between the Congressionally-mandated wellness policies (which were required to be in place by beginning of the 2006–07 school year) and the availability of unhealthy and/or healthy food options. The studies found that wellness policies do affect the types of foods offered in schools.

- In Colorado, there was an increase in low-income, rural elementary schools that offered fresh fruit daily at lunch (0.80 choices in 2005 compared with 1.15 choices in 2007) and that used skinless poultry in lunch meals (27% in 2005 compared with 59% in 2007).<sup>62</sup>
- A study in Indiana compared changes in public high school-reported junk food availability and policies prior to wellness policy implementation (February–March 2006) with post-wellness policy implementation (April–May 2007). Bivariate results indicated that high schools offered fewer chocolate candies (from 63% to 39%); other candies (from 59% to 39%); higher-fat cookies, crackers, cakes, pastries and other baked goods (from 79% to 53%); and SSBs (from 83% to 63%) following implementation of the wellness policies in districts throughout the state. At the same time, principals reported a significant increase in the number of schools prohibiting junk food sales (from 29% to 68%).<sup>53</sup>
- A cross-sectional study conducted during the 2007–08 school year in Washington state found that stronger SSB restrictions included in district wellness policies were associated with less SSB exposure ( $\beta=-9.50$ ,  $p<.01$ ).<sup>51</sup> However, the same study did not find that stronger SSB policies affected in-school SSB consumption, only exposure to them.
- A cross-sectional study conducted between November 2008 and January 2009 examined district-level experiences implementing the wellness policies in Pennsylvania. The study found that the majority of districts perceived the nutritional quality of à la carte offerings to be much healthier and the nutritional quality of items sold or served in vending machines, classroom parties and fundraisers to be somewhat to much healthier than before the policies were in place.<sup>61</sup>
- One study examined the impact of the nutrition standards in wellness policies on food offerings and purchases in three public high schools located in one district. It found significant reductions in the offering (from 48% to 30%) and purchase (from 83% to 47%) of foods that have minimal nutrient value (such as fried and high-fat foods). The same study found the wellness policy to be associated with a significant increase (from 18% to 48%) in offerings of foods that are rich in nutrients for the calories they provide and are generally lower in fat (e.g., proteins, some dairy products and certain fruits and vegetables).<sup>54</sup>
- A study conducted in 24 schools located in 16 districts in an unnamed Midwestern state examined the change in NSLP participation and competitive food sales in school

year 2005–06 (before wellness policy implementation) with school year 2007–08 (after wellness policy implementation). The study did not find significant changes in NSLP participation or competitive food sales in districts reporting to have stronger wellness policies.<sup>57</sup>

**Policies that restrict snack food and beverage offerings and place limits on fats, sugars, calories and portion sizes of such products are effective at reducing children’s caloric intake.**<sup>48,49,52,63</sup>

- When New York City public schools removed whole milk and switched from low-fat to fat-free chocolate milk during school year 2005–06, there was a 25 percent reduction in annual calories available from milk and an 81 percent reduction in available fat from milk.<sup>63</sup>
- The Texas Public School Nutrition Policy was associated with a significant decline in the percent of middle school student energy consumed from fat,<sup>49</sup> kilocalories from vending machine purchases<sup>48</sup> and energy density from foods and beverages.<sup>52</sup> Two of the studies found that the impact of the Texas policy varied by school SES. In one study, reductions in energy density for foods *only* were greatest for high and moderate SES schools but declines in energy density for foods *and* beverages were greatest for moderate and low SES schools.<sup>52</sup> In contrast, another study found that the amount of kilocalories consumed from vending machine purchases was greater for middle SES schools compared with low SES schools.<sup>48</sup>

**Policies that allow schools to offer snack foods and beverages that are high in fat, sugar and calories are associated with increased availability and consumption of these items and/or lower consumption of healthier options.**<sup>39,64,65</sup>

Two cross-sectional analyses conducted using school administrator- and student-reported data from the nationally representative ECLS-K study examined differences in consumption and purchases by elementary school students in schools that allow access to unhealthy options compared with students in schools that do not allow access to such options.

- One study found that children in schools that allow access to snack foods were significantly less likely to occasionally consume fruits than were students enrolled in schools that did restrict access to snack foods.<sup>64</sup>
- Using the same data source, another study found that elementary school students in schools that allowed access to SSBs were three times more likely to consume SSBs occasionally or frequently and were five times more likely to purchase at least one SSB in school during the past week compared with students in schools that did not allow SSB access.<sup>65</sup>

Similarly, a nationally representative cross-sectional study using school- and state-reported data from the 2006 SHPPS found that elementary schools in states that prohibit junk food sales in vending machines and school stores offered significantly less junk food than schools in states that neither prohibited nor recommended prohibiting junk food sales. The results for middle schools were similar although the differences were most significant for states that prohibited such sales versus states that recommended prohibiting such sales.<sup>39</sup>

**Literature is emerging on the relationship of competitive food and beverage policies on obesity and BMI.**<sup>45,56,66-69</sup> **Most of these studies point to consistent results—policies that allow junk foods in schools are associated with increased BMI; while policies that prohibit or restrict junk foods in schools are associated with lower proportions of overweight or obese students or lower rates of increase in student BMI.**

Two cross-sectional studies found that student BMI increased when schools allowed access to junk foods.

- One study linked county-level school food policy data obtained from the CDC’s SHPPS data from 2000 with BMI calculated for middle and high school students based on self-reported height and weight provided in the National Longitudinal Survey of Youth in 2000. The study found that for each 10 percent increase in the proportion of schools located in a county allowing

access to junk food, student BMI increased by nearly 1 percent.<sup>66</sup> Notably, the effect of the school food policies on student BMI was mitigated by parental BMI—school food policies had no effect on BMI for children of normal weight parents but, for students with overweight parents, a 10 percent increase in junk food access was associated with a more than 2 percent increase in student BMI.<sup>66</sup>

- A study of food policies and practices in middle schools also found that BMI (calculated from 8th grade student self-reported height and weight) increased 10 percentage points for every additional unhealthy food practice that was permitted in the school.<sup>67</sup>

In contrast, obesity outcomes appear to be better for students located in states, districts and/or schools that prohibit or restrict junk food sales.

- One study conducted in two urban and two rural middle and high schools located in one Great Plains state found a lower proportion (-0.18 lower) of overweight or obese students (based on self-reported height and weight) in schools that prohibit the sale of à la carte junk food during school meals.<sup>68</sup>
- Another study analyzed the effects of the Los Angeles Unified School District (LAUSD) policy and the statewide California food and beverage standards. The study found a significantly lower rate of increase in BMI among 5th graders in LAUSD and, in the rest of California, a significantly lower rate of increase in BMI among 5th grade boys and 7th graders overall following implementation of the district and statewide standards, respectively.<sup>69</sup> The LAUSD and California findings were based on objectively measured height and weight obtained through Fitnessgram.

One nationally representative study to examine the impact of state competitive food and beverage policy changes between 2000 and 2006 did not find an association between state policy changes and student BMI in those states. That study was based on state-reported policies obtained from SHPPS and self-reported BMI obtained from YRBS.<sup>45</sup>

**Policies that only apply to some venues but not all (e.g., apply to à la carte lines or vending machines, but not school stores) are not as effective as comprehensive policies that apply to all venues.**<sup>47,48</sup>

- One statewide study<sup>48</sup> and one district-level study<sup>47</sup> conducted in Texas found that reductions in sales and/or purchasing of unhealthy options from one venue (e.g., vending machines) may be offset by increases in sales and/or purchasing of such items from other venues (e.g., school stores). These findings highlight the need for comprehensive restrictions that affect all locations of sale of competitive foods and beverages.

**Comprehensive policies are key to reducing students' access to and consumption of SSBs in schools.**<sup>59,70,71</sup> **Policies that restrict only soda, but allow sports drinks and other SSBs, do not reduce SSB availability or consumption.**<sup>70,71</sup>

Three recent studies found that comprehensive SSB policies are critical to reducing SSB availability and consumption in schools.

- One study examined the impact of the Boston Public School SSB policy adopted in June 2004 that prohibited the sale of soft drinks, <100% juice drinks and sports drinks in schools and on campus and specified serving size limits for other beverages. Nearly two years following the policy adoption, Boston high school student self-reported daily soda consumption declined by 0.16 servings, daily consumption of other SSBs declined by 0.14 servings and total SSB consumption declined by 0.30 servings per day.<sup>59</sup>
- Similarly, a nationally representative study conducted using ECLS-K data found that public middle school students located in states with bans on SSBs (as of the beginning of school year 2006–07), reported significantly less access and weekly purchasing of SSBs (prevalence difference of 14.9 and 7.3, respectively) compared with students in states with a soda-only or no beverage restrictions. Unlike the Boston study, however,

neither the SSB or soda-only policy affected students' overall (in- and out-of-school) SSB consumption.<sup>70</sup>

- Both the ECLS-K study<sup>70</sup> and a study conducted in Maine public high schools participating in federal meal programs<sup>71</sup> found that soda-only policies reduced soda consumption and/or sales but did not affect the sale or consumption of other SSBs.

**School food and beverage policies are but one component of child and adolescent food and beverage environments.**<sup>47-49,55,59,70</sup> **While one study found that school-based policies can affect children's total consumption of SSBs, both in and out of school,<sup>59</sup> most studies show that school-based policies did not translate into positive or negative dietary changes at home or after school.**<sup>47-49,55,70</sup>

Schools are but one part of the broader social environment that affect children's and adolescents' access to food.<sup>2,73</sup> Consequently, the few studies to examine the impact of restrictions on in-school food access on overall consumption of unhealthy options concluded that the effects of school policies are limited to the school setting. Some theorize that when foods are restricted in the school setting, students may compensate by eating more of those foods out of school, while others believe that if dietary behavior improves in school, it will lead to further improvement out of school. It appears neither of these changes occurs consistently.

- In one study, conducted in early 2005 using a convenience sample of two high schools located in northwest Los Angeles following implementation of food and beverage standards, significantly more students perceived that the school-based ban on soda significantly affected their in-school consumption (55.5%), while only 16.2 percent perceived that it affected their home or out-of-school consumption. Similarly, the same study found that students perceived the junk food ban to affect their in-school consumption of snacks (52.6%) significantly more than it affected their at home or out-of-school consumption (20.2%).<sup>55</sup>

- A nationally representative study conducted using ECLS-K found that state laws banning SSBs in schools did not affect overall SSB consumption among 8th grade students.<sup>70</sup>

- Three studies conducted in Texas middle schools found that while policies reduced in-school access and/or consumption of SSBs and/or snack foods, there was a significant increase in such items brought from home.<sup>47-49</sup> Although the results of these studies point to the need to restrict what students are allowed to bring from home, implementation of such a policy might prove challenging. Instead, efforts could be directed towards effective educational and awareness programs to educate students and families about the importance of healthy eating to learning and overall health. It also points to the need for multi-level initiatives across communities and states. Such comprehensive efforts are essential to reinforce the practices that children are seeing in the school environment.

- In contrast, one recent study conducted in Boston Public Schools found that within two years of implementing a district-wide ban on SSBs, total (in- and out-of-school) SSB consumption declined by 0.30 servings per day.<sup>59</sup>

Notably, with the exception of the LAUSD/California study,<sup>69</sup> the aforementioned studies were all based on self-reported height and weight which has been shown to be less accurate than objectively measured height and weight when computing BMI.<sup>74</sup> Additional research is needed to examine the impact of competitive food and beverage policies on objectively measured BMI.

**Little scientific research has examined the influence of fundraising policies on competitive food and beverage availability, consumption or BMI.**<sup>67,72</sup>

Two cross-sectional studies examined the influence of restrictions on foods sold through school fundraisers in middle schools located in the Minneapolis-St. Paul metropolitan area.

- The first study, conducted in 2000, examined the impact of school-wide food policies and practices (including in-school fundraising and classroom incentives and rewards) on BMI (based on self-reported height and weight) of 3,088 8th grade students located in 16 middle schools. The study found that BMI increased by 0.10 BMI units for each additional food practice permitted in the school.<sup>67</sup>
- The second study, conducted in 2006, specifically focused on fundraising policies at 45 middle schools

and 71 high schools. Here the authors found healthful fundraising policies to be associated with healthful fundraising practices in middle school classrooms (68% of the time), school-wide (58% of the time), and for sports and clubs (56% of the time). The concordance between healthful fundraising policies and practices at the high school level was significantly lower: 33 percent, 32 percent, and 15 percent, for classrooms, school-wide, and sports and clubs, respectively.<sup>72</sup>

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## Conclusions and Policy Implications

The best evidence available indicates that policies on snack foods and beverages sold in school impact children's diets and their risk for obesity. Strong policies that prohibit or restrict the sale of unhealthy competitive foods and drinks in schools are associated with lower proportions of overweight or obese students, or lower rates of increase in student BMI. Such policies also may boost participation in school meal programs and increase food service revenues.

Research also suggests that when schools provide easy access to unhealthy snack foods and beverages, students consume more of them. Overall, student BMI tends to be higher in schools that sell unhealthy items in competitive venues. Because the school food environment affects the dietary behaviors and weight outcomes of millions of students across the country, implementing strong policies that support healthy eating could lead to sustained changes that would help reverse the childhood obesity epidemic, particularly if those changes were reinforced in environments outside of the school setting.

The federal government and many states, school districts and schools across the country have begun changing policies to create a healthier school environment. The following is a short summary of those efforts, including policy implications based on the findings reported in this review.

### At the Federal Level

As required by the Healthy, Hunger-Free Kids Act of 2010, the USDA is working to update national nutrition standards for competitive foods and beverages for the first time since 1979. The findings documented in this review can help inform USDA in its efforts to develop strong, comprehensive competitive food and beverage standards for all schools across the country.

### At the State Level

In the mid- to late-2000s, a number of states enacted or strengthened their competitive food and beverage laws to provide guidance and promote uniformity across districts working to implement their wellness policies. Findings from this review can help inform policy-makers about effective strategies for restricting or removing unhealthy foods from schools. These results also show that such policies have an almost immediate effect on improving students' diets. Increasing awareness of the link between strong policies and healthier behaviors is one strategy for motivating key decision-makers to support policy changes.

## At the District and School Level

While most districts do have a wellness policy that addresses competitive foods, many of those policies do not include guidelines for all competitive venues, nor do they align with current nutritional recommendations. Among districts that have established a wellness policy, many have not yet implemented its provisions, especially those related to

competitive foods and beverages. The findings presented in this review suggest that districts and schools should continue to strengthen their own nutritional guidelines for competitive products, in order to help students consume a healthier diet. Implementing strong policies for competitive foods also may help districts and schools build revenue, through increased participation in school meal programs.

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## Future Research Needs

- Longitudinal studies are needed to examine whether state and district school food policies have a long-term sustained impact on child and adolescent food and beverage consumption behaviors.
- Additional studies are needed to examine the impact of school food policies on BMI and weight outcomes with emphasis on studies using measured height and weight.
- More peer-reviewed studies are needed to document the impact of school food policies, particularly those related to competitive foods and beverages, on food service revenues and school meal participation.
- Additional ecological studies are needed to examine the combined impact of school, home, and other non-school/home environments on children's and adolescents' consumption behaviors and weight outcomes. If changes in the school setting are masked by unhealthy practices out of school, any positive impacts seen during the school day may be lost.
- Ongoing studies of the impact of school district wellness policies on student in-school food and beverage consumption and weight are needed, particularly since the policies have now been in effect for more than six years.

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**TABLE 1**

**Summary of Studies\* that Examined the Influence of State and/or District Policies\*\* on Competitive Food and/or Beverage Availability and/or Consumption, Weight and/or Revenues by Policy Level and Grade Level Examined for Implementation (in Author(s), Year order)**

#	Reference	Policy Jurisdiction and Grade Levels Examined	Study Participants/ Location	Study Design	Policy Measure(s) of Interest	Outcome Measure(s) of Interest	Time Frame for Policy and Baseline/ Outcome Measure(s), as appropriate	Summary of Relevant Results
1	Anderson and Butcher, 2006 <sup>56</sup>	School MS HS	Nationally representative sample of 451 public schools from 180 counties in 41 states (SHPPS) linked to 3,482 individuals in 426 counties located in 39 states (NLSY97)	Cross-sectional	Junk food availability Pouring rights contracts Soda/snack advertising allowed at school or school events based on self-reported data from SHPPS school principals	BMI (based on self-reported height and weight from NLSY97)	Policy: 2000 Outcome: 2000	10% increase in the proportion of schools in county allowing access to junk food is associated with a nearly 1 percent (0.90 percent) increase in student BMI. However, the effect is mitigated by parental BMI. No effect of school food policy for children of normal weight parents. For students with overweight parents, 10 percentage point increase associated with >2 percent increase in student BMI.
2	Belansky et al., 2010 <sup>62</sup>	District ES	45 low-income, rural districts in Colorado	Pre-/post-	School-level policies and practices reported by principals and food service directors after the wellness policies took effect	Principal- and food service director-reported change in school nutrition environment	Policy: 2006 Pre data: 2005 Post data: 2007	Increase in schools with policy requiring healthy items in classroom parties. Increase in daily fresh fruit offerings at lunch and increase in percent of schools using skinless poultry.
3	Coffield et al., 2011 <sup>56</sup>	District HS	30 Utah school districts (out of 40)	Cross-sectional	Wellness policies (competitive food and nutrition practices and education were examined as a sub-component and are reported for this analysis)	Probability of overweight, obese, or severely obese for gender/age (based on self-reported height and weight)	Policy: 2006 Outcome: 2007-2008	2.5% lower odds of adolescent overweight or obesity and 3.4% lower odds of severe obesity.
4	Cradock et al., 2011 <sup>59</sup>	District HS	Boston public high schools (participants: 2,033 students participating in the Boston Youth Survey)	Pre-/post-	Boston public schools SSB policy that prohibited sale of soft drinks, <100% juice drinks, and sports drinks in school/on campus and specified serving size limits for other beverages	High school student self-reported soda and SSB consumption	Policy: June 2004 Pre: Feb-April 2004 Post: Feb-April 2006	Significant decline in consumption of soda (-0.16 servings), other SSBs (-0.14 servings), and total SSBs (-0.30 servings).

\*Studies published in peer-reviewed literature between 2005 and November 2011.

\*\*Unless otherwise noted, policies were objectively measured or based on “policy on the books.”  
As noted in the table, some studies were based on administrator or other official self-reported “policies” which often may be considered “policies in practice.”

#	Reference	Policy Jurisdiction and Grade Levels Examined	Study Participants/ Location	Study Design	Policy Measure(s) of Interest	Outcome Measure(s) of Interest	Time Frame for Policy and Baseline/ Outcome Measure(s), as appropriate	Summary of Relevant Results
5	Cullen and Watson, 2009 <sup>46</sup>	State All	Texas (47 schools in 11 districts)	Pre-/post-	Texas Public School Nutrition Policy	Objectively measured changes in food sold/ served following implementation of the policy	Policy: 2004 Pre: school year 2003-04 Post: school year 2004-05	Less cafeteria servings of high-fat vegetables (e.g., French fries) at all grade levels. Snack bar sales of large bags of chips declined and baked chip sales significantly increased. Larger districts more likely to implement policy changes than smaller districts
6	Cullen, Watson, and Fithian, 2009 <sup>48</sup>	State MS	Texas (1 middle SES school and 1 low SES school located in one district in SE Texas)	Pre-/post-	Texas Public School Nutrition Policy	Student self-reported food and beverage lunch consumption by school SES	Policy: 2004 Pre: school year 2001-02 Post: school year 2005-06	Middle SES school saw higher rates of consumption of protein and milk, fewer sweetened beverages, greater reductions in nutrients consumed from snack bars and a greater percentage of total kilocalories and iron, calcium, sodium obtained from vending machine purchases compared to low SES school. More high fat vegetables, sweetened beverages, and chips were brought from home in the middle SES school.  Regardless of SES, significant increase in percentage of fruit and juice, high fat vegetables, and milk consumption from NSLP and significant reduction in soft drinks consumed from NSLP. The percentage of sweetened beverages and dessert foods consumed from snack bar increased post-policy for both schools.  Overall, more soft drinks consumed from home post-policy
7	Cullen, Watson, Zakeri, 2008 <sup>49</sup>	State MS	Southeast Texas (three middle schools)	Pre-/post-	Texas Public School Nutrition Policy	Changes in lunchtime food purchases and consumption based on student self-report lunch records	Policy: 2004 Pre: school year 2001-02 Post: school year 2005-06	Lunchtime consumption of vegetables, milk, and several nutrients (protein fiber, vitamins A and C, calcium, and sodium) increased. Consumption of sweetened beverages and snack chips declined. Percentage of energy from fat declined. Less sweetened beverages, candy, chips, and dessert foods were purchased and consumed at school but more of these items were brought from home and purchased from the snack bar.
8	Cullen, Watson, Zakeri, & Ralston, 2006 <sup>47</sup>	District MS	Houston, Texas (Three middle schools located in 1 school district in Harris County, TX)	Pre-/post-	District policy to remove chips, candy, sweet desserts and sweetened beverages from snack bars and remove vending machines from cafeterias	Change in food and beverage consumption based on student self-report lunch records	Policy: school year 2002-03 Pre: school year 2001-02 Post: school year 2002-03	Increase in certain vitamins and nutrients. Decline in consumption of soft drinks, snack chips, and candy from snack bar but increased snack chip and candy consumption from vending machines. Doubling of number of vending machines located outside of cafeteria. Significantly higher SSB and soft drink consumption brought from home/other sources.
9	Dority, McGarvey, and Kennedy, 2010 <sup>68</sup>	School MS & HS (7 <sup>th</sup> & 10 <sup>th</sup> )	1 Great Plains State; 2 urban and 2 rural schools	Pre-/post-	School administrator-reported prohibition on junk food sales à la carte; restricting junk food sales and providing nutritional information	Weight outcomes (based on self-reported height and weight obtained from the Socially Constituted Food Consumption of Adolescents Survey)	Policy: not specified Pre: 2005-06 Post: 2006-07	Lower proportion of overweight or obese students in schools that prohibit à la carte junk food sales at meals

#	Reference	Policy Jurisdiction and Grade Levels Examined	Study Participants/ Location	Study Design	Policy Measure(s) of Interest	Outcome Measure(s) of Interest	Time Frame for Policy and Baseline/ Outcome Measure(s), as appropriate	Summary of Relevant Results
10	Effects of..., 2010 <sup>63</sup>	District All	New York City public schools	Pre-/post-	Removing whole milk and switching from low-fat to fat-free chocolate milk in all cafeterias in New York City public schools	Changes in milk purchasing, calories and fat consumption based on analysis of milk purchasing data	Policy: Full implementation by FY 06 Pre: FY 04 Post: FY 09	One-percent increase in milk purchases by the district. Significant reductions in annual calories available from milk in available fat from milk.
11	Gonzalez, Jones, and Frongillo, 2009 <sup>64</sup>	School ES	Nationally representative sample of 10,285 5 <sup>th</sup> grade students attending 2065 elementary schools; data obtained from ECLS-K cohort	Cross-sectional	School administrator report of snack food restrictions (no snack items available) vs. not restricted (at least 1 item available)	Student-reported fruit and vegetable consumption	Time frames not specified	Children in schools with restricted snack availability had significantly higher frequency of fruit and vegetable consumption than children in schools without restricted snack availability.
12	Johnson et al., 2009 <sup>51</sup>	District MS	9,151 students in 64 middle schools in 28 districts in Washington state	Cross-sectional	School district SSB policies included in their wellness policies	Student-reported exposure to SSBs and SSB consumption	Policy: school year 2006-07 Outcome: school year 2007-08	Stronger SSB policy was associated with less SSB exposure.
13	Jones, Gonzalez, and Frongillo, 2009 <sup>65</sup>	School ES	Nationally representative sample; 10,719 children aged 9-13 years and 2,065 elementary schools in the ECLS-K cohort	Cross-sectional	School administrator-reported policy on beverage availability	Children's self-reported purchase and school administrator-reported total weekly and daily consumption of sweetened beverages	Policy: school year 2003-04 Outcome: school year 2003-04	Children in schools with policy allowing SSBs were three times more likely to consume sweetened beverages occasionally/frequently. Children in schools with a policy allowing sweetened beverages were five times more likely to purchase at least one sweetened beverage at school in the past week.
14	Kubik et al., 2009 <sup>72</sup>	School MS HS	45 middle schools and 71 high schools in Minneapolis/St. Paul, MN metropolitan area	Cross-sectional	School principal-reported fundraising policies	Healthful fundraising practices in classroom, school-wide and sports/club-related fundraisers (i.e., do not use chocolate, candy and other high-fat baked goods as part of fundraising practice(s)).	Policy: 2006 Outcome: 2006	At the middle school level, 68%, 58%, and 56% of the schools had healthful practices if they had a healthful fundraising policy in the classroom, school-wide, or for sports/clubs, respectively. The concordance between healthful policies and practices at the high school level was significantly lower: 33%, 32%, and 15%, respectively.
15	Kubik, Lytle, and Story, 2005 <sup>67</sup>	School MS (8 <sup>th</sup> grade)	3,088 8 <sup>th</sup> grade students in 16 middle schools in the Minneapolis-St. Paul metro area	Cross-sectional	School-wide food policies and practices including in-school fundraising and classroom incentives/rewards	Self-reported height and weight (used to calculate BMI)	Policy: 2000 Outcome: 2000	BMI increased .10 units for every additional food practice permitted in the school.

#	Reference	Policy Jurisdiction and Grade Levels Examined	Study Participants/ Location	Study Design	Policy Measure(s) of Interest	Outcome Measure(s) of Interest	Time Frame for Policy and Baseline/ Outcome Measure(s), as appropriate	Summary of Relevant Results
16	Kubik, Wall, et al., 2010 <sup>39</sup>	State and District All	Nationally representative sample of 563 public elementary, middle and high schools located in 198 districts and 39 states that were included in the 2006 SHPPS	Cross-sectional	State and district official-reported policies related to junk food in vending machines and school stores	Less junk food in school vending machines and school stores	Policy: 2006 Outcome: 2006	Elementary schools in states that prohibit junk food sales in vending machines and school stores offered significantly less junk food than schools in states that neither required prohibiting or recommending prohibiting junk food sales.  Middle schools in states that prohibit junk food sales in vending machines and school stores offered significantly less junk food than schools in states that recommended prohibiting junk food sales.  District policies were not associated with school practices. However, these data were collected in 2006 prior to the required implementation of the wellness policy requirement.
17	Litchfield et al., 2011 <sup>57</sup>	District All	24 schools in 16 districts located in one Midwestern state	Pre-/post-	Wellness policies reported by district and school officials	Objectively measured change in NSLP participation and competitive food sales	Policy: school year 2006-07 Pre: school year 2005-06 Post: school year 2007-08	No significant change in NSLP participation or competitive food sales in districts with stronger policies.
18	Long, Henderson, and Schwartz, 2010 <sup>40</sup>	State All	151 school districts participating in the NSLP in Connecticut	Pre-/post-	Connecticut Nutrition Standards for Schools Participating in Connecticut's Healthy Food Certification Program	Changes in NSLP participation and availability of unhealthy foods sold through à la carte snacks in elementary, middle and high schools	Policy: beginning school year 2006-07 Pre: Spring 2006 Post: Spring 2007	All schools participating in the study (HFC and non-HFC) showed a decline in the number of unhealthy à la carte snacks offered from baseline to follow-up; however, HFC districts had a significantly greater decline in unhealthy à la carte snack offerings at the elementary and high school levels. HFC participation had a positive or neutral effect on NSLP participation.
19	Mendoza, Watson, and Cullen, 2010 <sup>52</sup>	State MS	3 middle schools in Southeast Texas	Pre-/post-	Texas Public School Nutrition Policy	Children's energy density: Energy density-1: (kcal/g) for energy of foods only Energy density-2: (kcal/g) for energy of foods and beverages	Policy: 2004 Pre: school year 2001-02 Post: school year 2005-06	Significant decline in energy density-1; reductions were greatest for high- and moderate-SES schools. Energy density-2 significantly declined across the three schools but was only significantly lower at moderate and low SES schools.
20	Neumark-Sztainer et al., 2005 <sup>50</sup>	School HS	Random sample of 1,088 high school students from 20 high schools in Minneapolis-St. Paul, Minnesota	Cross-sectional	Principal- and food service director-reported school food policies	Student lunch patterns and vending machine purchases	Time frame not specified	Open campus policies were associated with significantly more students eating lunch at a fast food restaurant. Student snack food and beverage purchasing was significantly lower in schools with vending machine restrictions.

#	Reference	Policy Jurisdiction and Grade Levels Examined	Study Participants/ Location	Study Design	Policy Measure(s) of Interest	Outcome Measure(s) of Interest	Time Frame for Policy and Baseline/ Outcome Measure(s), as appropriate	Summary of Relevant Results
21	Phillips et al., 2010 <sup>42</sup>	State All	Public school districts (223 pre-/ and 183 post-) and public schools (811 pre- and 832 post-) in Arkansas	Cross-sectional (compare district and school level responses statewide at time 1 and time 2 but not a panel design)	Arkansas Act 1220 of 2003 and associated implementation regulations	Offering healthy/ unhealthy foods and beverages, food and beverage vending machine accessibility and contents	Policy: 2003 Outcome time 1: 2004 Outcome time 2: 2008	Significant decline in whole milk, increase in low-fat or skim milk offered in cafeterias. Significant increase in requirements that healthy food options be provided at student parties, after school and at concession stands. Significant increase in prohibition on sale of food items for fundraisers by student groups. Significant decline in soda, fruit drinks, and non-fat candy sold through vending machines. Significant increase in sale of low-fat snacks through vending machines such as crackers and chips at the MS/HS levels.
22	Probart et al., 2010 <sup>91</sup>	District All	Pennsylvania; Superintendents of 499 school districts sponsoring school meal programs (responses received from 368)	Cross-sectional	Wellness policies	Superintendent perception of changes to the nutritional quality of foods sold/served outside of school meals	Policy: school year 2006-07 Outcome: November 2008-January 2009	Majority of districts perceived that the nutritional quality of à la carte F&B is much healthier and that the nutritional quality of F&B sold/served in vending machines, classroom parties, and fundraisers is somewhat/much healthier.
23	Samuels et al., 2009 <sup>43</sup>	State HS	California; representative sample of 56 public high schools	Cross-sectional	California statewide nutrition standards (SB 12 and SB 965)	Objectively measured adherence to statewide school food and beverage standards	Policy: 2005 but full implementation of food standards by July 2007 and beverage standards by July 2009 (for all grades) (full implementation by 2009 not measured herein) Outcome: Spring 2008	Majority of high schools met the state beverage requirement, with the greatest compliance in food service, followed by school stores and vending machines. No school was 100% adherent to food standards; however, three schools completely eliminated competitive foods and beverages following the legislation. Overall, majority of the schools adhered to the food standards, with overall adherence ranging from 32.1% to 90%, with highest adherences in food stores followed by school stores and vending machines. Adherence to beverage standards more common than food standards.
24	Samuels et al., 2010 <sup>44</sup>	State All	California: 19 schools located in 6 communities participating in the California Endowment's Health Eating, Active Communities Program (HEAC)	Pre-/post-	Adherence to statewide school food and beverage standards	School-level adherence to state competitive food and beverage standards	Policy: 2005 but full implementation of food standards by July 2007 and beverage standards by July 2009 (for all grades) (full implementation by 2009 not measured herein) Pre: 2005 Post: 2008	Universal increased adherence to competitive food and beverage standards overall, by location of sale, and by school level. For example, overall food adherence increased from 23.3% at baseline to 67.1% at follow-up. Similarly, overall beverage adherence increased from 50.3% at baseline to 77.8% at follow-up.

#	Reference	Policy Jurisdiction and Grade Levels Examined	Study Participants/ Location	Study Design	Policy Measure(s) of Interest	Outcome Measure(s) of Interest	Time Frame for Policy and Baseline/ Outcome Measure(s), as appropriate	Summary of Relevant Results
25	Sanchez-Vaznaugh et al., 2010 <sup>69</sup>	State and District 5 <sup>th</sup> grade (ES) and 7 <sup>th</sup> grade (MS)	Los Angeles Unified School District (LAUSD) and California statewide; separate analyses for 5 <sup>th</sup> and 7 <sup>th</sup> graders; N=5,387,819 students with 763,181 located in LAUSD	Pre-/post-	LAUSD policy and California statewide nutrition standards	Rates of change in prevalence of overweight and obese calculated based on (kg/m <sup>2</sup> ) based on objectively measured height/weight obtained through Fitnessgram	Policy: LAUSD 2004 State: 2005 but full implementation of food standards by July 2007 and beverage standards by July 2009 (for all grades) (full implementation by 2009 not measured herein) Pre: 2001-04 Post: 2004-08	Significantly lower rate of increase in overweight among 5 <sup>th</sup> graders in LAUSD. In the rest of California, there was a lower rate of increase among 5 <sup>th</sup> grade boys and 7 <sup>th</sup> graders overall.
26	Seo, 2009 <sup>53</sup>	District HS	Indiana public high school principals/food service directors (226 respondents at baseline, 150 at follow-up)	Pre-/post-	Wellness policies	Principal- or food service director-reported food availability, junk food policies	Policy: beginning school year 2006-07 Pre: Feb-Mar 2006 Post: April-May 2007	Decline in the percentage of schools offering chocolate candy; other candy; cookies, crackers, cakes, pastries and other baked goods not low in fat; and soda, sports drinks or fruit drinks not 100% juice. Increase in the number of schools prohibiting junk food from being offered.
27	Snelling and Kennard, 2009 <sup>54</sup>	District HS	3 public high schools in one county located outside of an unnamed, metropolitan area (N=4,579 students across the 3 schools)	Pre-/post-	Nutrient standards included in wellness policy	Nutritional value of foods offered and purchased	Time frame not specified	Reduction in availability and purchase of foods of minimal nutrient density. Increased offering and purchase of foods that are moderate in calories, rich in nutrients. Slight decline in offering of healthiest foods that are rich in nutrients, high in fiber, and low in fat; but increase in purchasing of such foods.
28	Taber, Chriqui, et al., 2011 <sup>70</sup>	State MS	Nationally representative sample of students enrolled in public middle schools located in 40 states based on data from ECLS-K	Cross-sectional	State laws banning all SSBs and state laws that ban only soda	Self-reported in-school SSB access and purchasing; overall SSB consumption obtained from the ECLS-K for students in 5 <sup>th</sup> grade and then again in 8 <sup>th</sup> grade	Policy: Beginning 2006-07 school year Outcome: Spring 2007	Students in states with soda-only bans reported similar SSB access and purchasing as students in states with no ban. In-school SSB access and purchasing was significantly lower (-14.9 and -7.3, respectively) in states that banned all SSBs, with a stronger effect among 8 <sup>th</sup> grade students reporting SSB access or purchasing in 5 <sup>th</sup> grade. Neither SSB nor soda-only policy significantly affected 8 <sup>th</sup> grade students' overall (in- and out-of-school) SSB consumption.
29	Taber, Stevens, et al., 2011 <sup>45</sup>	State HS	Nationally representative sample of public high school students (90,730 students from 33 states and DC) obtained from YRBS	Cross-sectional	Change in state policies (from 2000 to 2006) that required or recommended that schools prohibit junk food in vending machines, snack bars, student parties and concessions. Self-reported policy data obtained from state respondents to SHPPS	Self-reported soda consumption and BMI percentile (based on self-reported height/weight) among adolescents overall and differences by race/ethnicity. Data obtained from YRBS	Policy changes from 2000-2006 Outcomes: 2007	Policy change for concession stands were associated with 0.09 fewer servings of soda daily and policy changes targeting parties were associated with 0.07 fewer servings of soda daily. Among non-Hispanic Black adolescents, consumption of soda was 0.19 lower in states whose policy targeting concession stands changed over the study period. (No significant difference was found for policies targeting vending machines or snack bars.) Policy changes were not associated with BMI percentile for any group.

#	Reference	Policy Jurisdiction and Grade Levels Examined	Study Participants/ Location	Study Design	Policy Measure(s) of Interest	Outcome Measure(s) of Interest	Time Frame for Policy and Baseline/ Outcome Measure(s), as appropriate	Summary of Relevant Results
30	Vecchiarelli, Takayanagi, and Neumann, 2006 <sup>55</sup>	District HS	399 12 <sup>th</sup> grade students in two high schools located in Northwest Los Angeles, California	Cross-sectional	Los Angeles Unified School District Healthy Beverage Resolution and Obesity Prevention Motion Policies	Student perceived impact of policies on student dietary behaviors at school and at home (other items focused on in study but not included here)	Policy: 2004 Outcome: February-March 2005	Perceived impact of the soda ban was significantly greater for school- versus home-/out-of-school consumption. Significantly greater impact of the junk food ban on in-school consumption as compared to home- or out-of-school consumption. Students perceiving an impact of the soda and junk food bans reported that they consumed fewer of the prohibited items and paid more attention to what they drank/ate at school and at home/outside of school.
31	Whatley-Blum et al., 2011 <sup>58</sup>	State HS	Maine sample of 89 public high schools participating in federal meal programs (54 responded to survey)	Pre-/Post-	Maine ban on foods of minimal nutritional value (FMNV) at all times. Note: FMNVs include carbonated beverages (i.e., sodas).	Food service director-reported availability of soda, other SSBs, and junk food; and objectively measured inventories of food and beverages in 11 high schools	Policy: Effective July 2005 Pre: Not specified Post: September-October 2006	Significant decline in sale of regular soda through vending machines (from 17% to 4%) but not other locations (although prevalence of sales in other locations prior to the law was very low to begin with).  No statistically significant difference in sale of other SSBs or junk food from pre- to post-ban.
32	Wojcicki and Heyman, 2006 <sup>60</sup>	District MS	1 middle school located within the San Francisco Unified School District (SFUSD)	Pre-/post-	San Francisco Unified School District Nutrition Standards	Changes in school food service revenues and student participation in the school lunch program	Policy: January-March 2003 Pre: December 2002 Post: May 2003	Prior to policy implementation, school food service lost \$1000 in the final month before the policy change; two months after the policy change, school food service generated more than \$2000 in revenue in one month. The increased revenue was attributed to increased participation in the school lunch program.
33	Woodward-Lopez et al., 2010 <sup>41</sup>	State All	California: Assessment of results from 3 studies conducted in California: HEAC, School Wellness Study (SWS), and High School Study (HSS)	Pre-/post-	California statewide nutrition standards (SB 12 and SB 965)	Observational data, food service and student surveys, food and beverage sales data; School compliance; changes in offerings  Impact on dietary intake Impact on F&B sales	Policy: 2005 but full implementation of food standards by July 2007 and beverage standards by July 2009 (for all grades) Pre: 2004-07 (several studies summarized) Post: 2007-2009 (several studies summarized)	Availability of food and beverage-compliant items increased; noncompliant items decreased particularly for chips, candy, sodas, other sweetened beverages.  Less middle- and high-school students reported consuming soda and vegetables at school and more reported drinking water at school.  Sales data indicate reduction in competitive food/beverage revenue and à la carte sales; however, meal sales increased and the revenue from these sales offset the decline in competitive food and beverage sales.

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## Glossary

**HEAC:** Healthy Eating, Active Communities Study

**HSS:** High School Study

**SWS:** School Wellness Study

**SHPPS:** School Health Policies and Programs Study, Centers for Disease Control and Prevention

**NLSY97:** National Longitudinal Survey of Youth 1997 Cohort

**ECLS-K:** Early Childhood Longitudinal Survey of Youth-Kindergarten Cohort

**YRBS:** Youth Risk Behavior Survey, Centers for Disease Control and Prevention

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## About Healthy Eating Research

*Healthy Eating Research* is a national program of the Robert Wood Johnson Foundation. Technical assistance and direction are provided by the University of Minnesota School of Public Health under the direction of Mary Story, PhD, RD, program director, and Karen M. Kaphingst, MPH, deputy director. The Healthy Eating Research program supports research to identify, analyze, and evaluate environmental and policy strategies that can promote healthy eating among children and prevent childhood obesity. Special emphasis is given to research projects that benefit children and adolescents ages 3 to 18 and their families, especially in lower-income and racial and ethnic populations at highest risk for obesity.

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## About Bridging the Gap

*Bridging the Gap* is a nationally recognized research program of the Robert Wood Johnson Foundation dedicated to improving the understanding of how policies and environmental factors influence diet, physical activity and obesity among youth, as well as youth tobacco use. The program identifies and tracks information at the state, community and school levels; measures change over time; and shares findings that will help advance effective solutions for reversing the childhood obesity epidemic and preventing young people from smoking. Bridging the Gap is a joint project of the University of Illinois at Chicago's Institute for Health Research and Policy and the University of Michigan's Institute for Social Research.

For more information, visit [www.bridgingthegapresearch.org](http://www.bridgingthegapresearch.org).

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