

# Obesity Prevention Policies in U.S. States and Localities: Lessons from the Field

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Published online: 18 June 2013  
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**Abstract** Obesity is a complex problem requiring large-scale, population-based solutions. Public policy strategies have been identified as critical tools in obesity prevention efforts as they can benefit all who are exposed rather than simply changing individual behaviors one at a time. This paper reviews the peer-reviewed scientific U.S.-based literature published between January 2012 and March 2013 to examine the influence of state laws and local policies on changes to school and other environments, individual activity and nutrition-related behaviors, and obesity and weight outcomes. Virtually all recent studies have focused on policies directed at the school environment and, across-the-board, the evidence was mixed. Most studies were cross-sectional, focused on policy implementation in schools and other settings rather than impacts on individual behaviors or obesity. Opportunities exist for impact studies focusing on a broader spectrum of policies as well as for continued policy actions at all levels of government.

**Keywords** Obesity · Public policy · State and local governments · Policy impact · Prevention

## Introduction

Obesity rates in the U.S. have more than tripled over the past three decades although several recent reports provide encouraging data suggesting that rates have stalled and, in some cases, even started to trend downward [1–3]. There are both direct and indirect costs associated with obesity. Direct costs include the medical costs associated with obesity; in 2005 alone, over \$190 billion was spent in the U.S.

on obesity-related annual medical care spending [4]. And, recent estimates suggest that if obesity trends continue on their current path, annual medical costs attributable to obesity could rise by \$48 to \$66 billion per year by 2030 [5]. The indirect costs include, but are not limited to, absenteeism, disability, premature mortality, workers' compensation, higher transportation costs, and psychological suffering [6, 7] and, for children, social costs include bullying and less involvement in social activities such as organized sports.

Because obesity is a complex, multi-faceted problem, there is no one simple solution [8]. Recognizing the complex web of influences associated with obesity, numerous recent authoritative reports and studies issued by the federal government, the Institute of Medicine (IOM), advocates, and others have consistently pointed to the need for broad, population-based strategies for preventing obesity and overweight [8–18]. Increasingly, the public health community is calling for a systems-based approach to obesity prevention that recognizes the policy, environmental, and individual level factors that affect behavior and outcomes [8, 14, 19]. In 2012, the IOM recommended that concerted action be taken across and within five environments (physical activity (PA), food and beverage, marketing and messaging, healthcare and worksites, and schools) and all sectors of society (including government, business and industry, schools, child care, urban planning, recreation, transportation, media, public health, agriculture, communities, and the home) in order for obesity prevention efforts to truly be successful [14].

Population-based approaches to obesity that have been recommended and/or pursued in the United States are due, in part, to the lessons that the public health community learned from efforts to reduce tobacco use. There, the most effective interventions for reducing smoking rates were broad-based public policies, including taxation and smoke-free air laws [20, 21]. And, these public policies were primarily enacted at the state and local government levels. With smoke-free air

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laws, in particular, policy making was bottom-up—that is; policies were first enacted by local governments and eventually diffused to the state level [22, 23].

As complicated of a public health problem as tobacco is, in many ways, obesity is far more complex in that it affects multiple environments, involves multiple industries and sectors, and affects both energy intake and expenditure. Thus, obesity prevention solutions need to be wide-reaching. As such, public policy strategies have been at the forefront of obesity prevention efforts in recent years as they can benefit all who are exposed rather than simply changing individual behaviors one at a time [24]. For purposes of this review, public policies” are defined as formal, legally-binding measures adopted by legislative and administrative units of government. Public policies include legislative, regulatory, and case law (i.e., court decisions) and are adopted or enacted by all levels of government—federal, state, local, and school district. Many governments also adopt “informal” policies that are never codified into law such as guidance documents, interpretations of formal laws, non-codified policies, or policies that operate “in practice” but are never formally codified into law. This review focuses on formal, obesity-related public policies that are or have been considered by state, local (county and municipal), and school district governments throughout the United States. While several obesity-related public policies also exist at the federal level such as the Healthy, Hunger-Free Kids Act, the Supplemental Nutrition Assistance Program Education (SNAP-Ed) program, Safe Routes to School funding, the goal for this review was to examine the broad range of policy strategies that state, local, and/or school districts have adopted and implemented in recent years and highlight areas where policy opportunities and continued research on the impact of such policies is needed. Public policies at the state, local or school district levels include enacted state legislation; local ordinances, zoning codes, and land use laws; promulgated state and local regulations or rules; executive orders; school board policies; and school district superintendent regulations.

In recent years, state and local governments have considered and, in some cases, adopted a range of obesity-related public policies. Several sources track the status of legislation and/or regulations introduced and/or adopted across the states including: the Yale Rudd Center for Food Policy & Obesity (<http://www.yalerruddcenter.org/legislation/>), the Centers for Disease Control and Prevention’s Chronic Disease State Policy Tracking System (<http://apps.nccd.cdc.gov/CDPHPPolicySearch/Default.aspx#>), and the National Conference of State Legislatures (<http://www.ncsl.org/issues-research/health/childhood-obesity-2012.aspx>). While there is no readily available comprehensive source for local policies, the Prevention Institute’s ENACT local policy database (<http://eatbettermovemore.org/sa/policies/index.php>) provides examples of a range of obesity-related policies enacted by local

governments throughout the U.S. And policies officially adopted by school districts nationwide are not currently catalogued in a publicly accessible database but summary data on wellness and related policies adopted by school districts nationwide is available from the Robert Wood Johnson Foundation-supported Bridging the Gap Program at the University of Illinois at Chicago ([http://www.bridgingthegapresearch.org/research/district\\_wellness\\_policies/](http://www.bridgingthegapresearch.org/research/district_wellness_policies/)).

Table 1 lists the range of key public policy strategies identified in the peer-reviewed scientific literature or based on policies that have been attempted in recent years by state, local, and/or school district governments [18, 25–27, 28•, 29•, 30–37]. The policy tracking sources identified above also highlight the range of policy strategies that have been attempted in recent years—with many failing to be enacted by state or local governments (e.g., enacting excise taxes on sugary drinks). This review summarizes the recent literature to examine the influence of public policy strategies that have been enacted and implemented in the United States.

## Methodology

This review is based on the peer-reviewed evidence published in the scientific literature between January 1, 2012 and March 1, 2013 to examine the implementation and/or impact of U.S.-based policy strategies identified in Table 1. Relevant studies were compiled through Boolean keyword searches conducted between November 2012 and March 2013 using the PubMed, Public Affairs Information Service (PAIS), and Econlit literature databases. Four specific searches were conducted, each in combination with a policy-specific set of terms (policy OR policies OR legislation OR law OR regulation OR govern\* OR ban\*):

1. Obesity OR weight OR diet OR food OR nutrition OR eating
2. Active OR activity OR “physical education” OR “physical activity”
3. Walk OR bike\* OR bicycle\* OR transport\* OR bus
4. (Food OR beverage\*) AND (tax OR taxes) AND NOT alcohol\*

The initial searches yielded 752 potentially relevant articles, including 144 duplicates, resulting in a potential universe of 608 non-duplicate articles for consideration. To be included, the study must have empirically examined a formal, public policy adopted at the state, local, and/or school district level in the United States. Simulation models, extrapolation studies, survey studies that contain data on policies reported by respondents (e.g., administrator reports of policies “in practice”), or summaries of the literature that failed to document the formal public policy(ies) studied were not included. Based on a review of the titles, abstracts and,

**Table 1** Representative examples of state and local public policy<sup>a</sup> strategies<sup>b</sup> related to obesity prevention

Policy strategy <sup>b</sup> (sorted alphabetically within environment)	Jurisdiction(s) <sup>c</sup> where policy may be adopted	Published studies of policy influence, 2012-13
<b>Child care environments</b>		
1. Nutrition standards for foods and beverages served in child care settings	S	No
2. Physical activity standards for child care settings	S	No
<b>Food and beverage environments</b>		
1. Community gardens/urban agriculture permitted uses [30]	S, L	No
2. Financial incentives to encourage development/upgrading of food outlets selling fresh fruits and vegetables and healthy food and beverage options [30]	S, L	No
3. Incentivizing food purchasing (subsidies, vouchers) [18]	S, L	No
4. Licensing restrictions on retail outlets selling certain foods and beverages [33]	L	No
5. Menu/calorie labeling [29•, 34]	S, L, SD	Yes [29•]
6. Minimum age restrictions on purchase of certain beverages (e.g., energy drinks) [33]	S, L	No
7. Nutrition standards for foods sold in public places (e.g., prohibit sale of sugary drinks in vending machines located in public parks) [18, 28•, 29•, 30, 34]	S, L, SD	No
8. Portion size restrictions [28•, 32, 33]	S, L, SD	No
9. Procurement policies (including farm-to-institution policies) [35]	S, L, SD	No
10. Restrictions on foods or beverages that can be purchased with Supplemental Nutrition Assistance (SNAP) benefits	S	No
11. Restrictions on retail food outlet (e.g., fast food outlets) density or location within a certain distance of schools [28•, 30]	L	No
12. Retail food outlet zoning/permitted uses [30]	L	No
13. Taxation and dedicated tax revenue for obesity prevention [18, 26, 28•, 29•, 33, 64••]	S, L	Yes [64••]
<b>Health care environment</b>		
1. Insurance (including Medicaid) coverage for weight management counseling and programming	S	No
<b>Messaging and marketing environment</b>		
1. Healthy food marketing and promotion [36]	S, L, SD	No
2. Toy ban in children's restaurant meals [29•]	L	No
<b>Physical activity environment</b>		
1. Complete streets policies [18]	S, L	No
2. Joint use agreements between schools, communities, and/or recreation programs [25, 30, 34]	L, SD	No
3. Point-of-decision prompts [25]	S, L, SD	No
4. Street-scale and community-scale land use design and development [18, 28•, 30, 34, 37]	L	No
5. Transportation and recreational trail networks [37]	S, L	No
<b>School Environments</b>		
1. BMI screening and assessment in schools [28•, 29•]	S, SD	Yes [49, 62]
2. Competitive food and beverage restrictions	S, SD	Yes [49, 51, 52, 53•, 54••, 55, 57, 58•, 59]
3. Farm-to-school policies	S, SD	Yes [61]
4. Healthy food marketing on school property [36]	S, SD	No
5. Nutrition education in schools [29•]	S, SD	Yes [49]
6. Physical education teacher and physical educator qualifications [18]	S, SD	Yes [49]
7. Physical education, recess, and physical activity in schools [18, 25, 28•, 29•, 39]	S, SD	Yes [38, 39, 41•, 42, 44–46, 47•, 48, 49]
8. Prohibit “open campuses” at schools [28•]	S, SD	No
9. Prohibit use of “food as a reward” in schools	S, SD	Yes [56]
10. Restrictions on food marketing/advertising on school property, vehicles [28•, 31, 36]	S, L	Yes [49, 60]
11. Safe routes to school programs, funding, and infrastructure [28•, 30, 34, 37]	S, L, SD	Yes [40, 43]

**Table 1** (continued)

Policy strategy <sup>b</sup> (sorted alphabetically within environment)	Jurisdiction(s) <sup>c</sup> where policy may be adopted	Published studies of policy influence, 2012–13
12. School food service director qualifications	S, SD	Yes [49]
13. School siting policies [25]	S, SD	No
14. School wellness policies [28•, 34, 36]	S, SD	Yes [28•, 55, 63]
15. Strategies to improve the school meal environment	S, SD	Yes [49]

<sup>a</sup> “Policy” is defined to include formal, legally-binding measures adopted by legislative and administrative units of government at the state, local (county and municipal), and school district levels. “Policy” includes legislation, regulations or rules, ordinances, school board policies, school district superintendent regulations, and tax policies.

<sup>b</sup> The included strategies were identified in peer-reviewed literature published in scientific journals or through on-line policy tracking databases. Although not exhaustive, the list is intended to be representative of the broad range of state and local obesity prevention-related policy strategies.

<sup>c</sup> Focus for this review was on jurisdictions with public policy making authority at the state (S), local (L; includes county or municipal), and school district (SD) levels, not including the federal level.

where necessary, full-text papers, 27 relevant articles were identified for inclusion. Although the review predominantly included quantitative studies that provided inferential statistics to enable assessment of policy impact or association, where relevant, review studies describing specific policy impacts (e.g., state taxes on carbonated beverages) or qualitative studies examining policy implementation (e.g., implementation of state physical education (PE) mandates) were also included. In the following section, all quantitative findings reported reflect adjusted multivariate regression results unless otherwise noted.

## Results

As noted in Table 1 (column 3), with the exception of a few studies reporting the influence of menu labeling policies or tax policies, virtually all studies published between January 1, 2012 and March 1, 2013 have focused on the school environment.

### Focus on School Environments

The recent literature primarily focused on the influence of PE and PA-related policies as well as snack food and beverage policies. No recent studies examined the influence of child care-related laws or policies, likely due to the rather recent policy focus on child care settings.

#### *Focus on School-Based PE and PA-related Policies and Their Impacts*

Twelve studies (two qualitative, one review, one observational, and eight quantitative studies) examined the implementation and/or influence of PE and PA-related policies. Nearly all of the studies were cross-sectional and none were longitudinal. The majority of the studies focused on school-

level implementation of state and/or district level policies [38–40, 41•, 42–46], followed by studies of the relationship between the policies and student PA [41•, 47•], or youth obesity [48, 49].

*Policy Implementation Studies* Two qualitative studies and one review study examined PA policy-related implementation and/or associated barriers. Carlson and colleagues conducted qualitative interviews with state-level PE coordinators in 12 (of 16) states with laws specifying minutes (or percent time) of PA or PE in schools to understand implementation, monitoring, and enforcement [39]. State coordinators were uncertain regarding school-level policy implementation but reported providing technical assistance, resources, and trainings to schools to facilitate implementation. All coordinators reported developing self-reported checklists for schools/districts to use for voluntary or required implementation reporting, and only two coordinators conducted site visits or worked directly with the schools on implementation efforts. Amis and colleagues qualitatively assessed school-level implementation of laws enacted in Mississippi (2 laws) and Tennessee (1 law) that focused on increasing PA among high school students, primarily through changes to PE requirements [38]. In seven of the eight high schools studied, implementation was avoided altogether and avoided until the second and third years in the eighth school. Four key implementation barriers were reported: standardized testing priorities, focus on varsity sports in lieu of PE, resource constraints, and a policy-centric environment (one principal reported being subject to 50 new policies in one year) that made it necessary to prioritize or focus on certain policies over others [38]. And, Robertson-Wilson and colleagues’ review identified five studies that examined the implementation and/or influence of state laws in Arkansas, California, Texas, and North Carolina [41•]. Specific changes associated with implementation of the

various state laws included changes in school-level PA policies and/or practices (e.g., classroom energizers, PA during recess, prohibitions on using PA as punishment such as withholding recess); meeting or exceeding recommendations for 30 minutes of daily or 135 minutes of weekly PA in school; or percent PE time spent in moderate-to-vigorous PA.

Five quantitative studies empirically examined the implementation of PE-related policies. Four of the studies focused on elementary school environments [40, 42–44] and one focused on all grade levels—elementary, middle, and high school levels [45]. One observational study also focused on policy implementation across grade levels [46].

Three studies examined policies governing PE time in school and generally found that such laws and policies were associated with more PE time being provided in school settings [42, 45, 46]. The first study, conducted by Slater and colleagues, used three data sets compiled by Bridging the Gap researchers at the University of Illinois at Chicago: (1) cross-sectional, nationally-representative elementary school data compiled through annual mail-back surveys of elementary school principals [50], (2) objectively measured school district wellness and related policies for all districts surrounding the elementary schools, and (3) primary legal research of state laws nationwide. They found that the odds of elementary schools providing 150 minutes of PE per week as recommended by the National Association for Sport and Physical Education (NASPE) were greater in states (OR=2.8, 95 % CI=1.3–5.7) or school districts (OR=2.4, 95 % CI=1.3–4.3) with laws and policies, respectively, that required this amount of PE time [42]. Using cross-sectional school-level data from the School Health Policies and Practices Study (SHPPS) and state law data from the National Cancer Institute's (NCI) Physical Education and Recess State Policy Classification System (PERSPCS; available at <http://class.cancer.gov>), Perna and colleagues found that elementary schools offered 27 and 40 minutes more PE per week in states with specific PE time requirements as compared to schools in states with non-specific or no time requirement laws, respectively [45]. They also found that middle schools offered 60 more minutes of PE per week in states with specific time requirements as compared to states with nonspecific or no time requirement laws and found no association between state laws governing high school PE time and school-level practices. In bivariate analyses conducted by Lafleur and colleagues, a district level policy change in Los Angeles, California was associated with increased PE class duration (from 27.6 to 37.4 minutes per class) among high income elementary schools and a decrease in the percentage of low income middle schools with PE classes of greater than 45 students (from 50 % to 20 %) [46].

Two studies addressed PA outside of PE at the elementary levels [42, 44]. Slater and colleagues (described above) found that elementary school provision of 20 minutes of daily recess was greater in states with laws addressing daily recess as compared to states that do not address daily recess (OR=1.8, 95 % CI=1.2–2.8) [42]. Interestingly, they also found an inverse relationship between the provision of 150 minutes of weekly PE and 20 minutes of daily recess. Holt and colleagues examined elementary school-level implementation of a district-level PA policy requiring 20 minutes of daily PA [44]. While overall implementation of the policy was low (ranging from 4 % to 40 %), moderate-to-vigorous PA during the school day increased significantly when teachers employed curriculum-based lessons such as Take 10!<sup>®</sup> lessons (59.92±20.38 minutes) or walk/run periods (51.56±18.67 minutes) as compared to days when students engaged in other movement-based activities.

Finally, two studies reported on the influence of state laws and/or district policies on school-level active transport to school policies and practices using the Bridging the Gap data [40, 43]. Chriqui and colleagues found that state laws requiring crossing guards around schools were associated with reduced odds of principal-reported barriers to walking/biking to school (OR=0.38, 95 % CI=0.22, 0.58), increased odds of allowing students to bike to school (OR=2.70, 95 % CI=1.71–4.27), and reduced odds of zero students walking to school (OR=0.32, 95 % CI=0.17, 0.61) [40]. In the second study, Turner and colleagues assessed whether elementary school walking school bus programs were more common in states or districts with safe routes to school-related policies [43]. Consistent with the Chriqui et al. study, they found that walking school bus programs were more commonly employed by elementary schools located in states with laws requiring crossing guards around schools (OR=2.72, 95 % CI=1.37, 5.38). They also found that walking school bus programs were more common in districts with safe routes to school-related requirements included in their wellness policies (OR=2.14, 95 % CI=1.08, 4.22).

*Association with PA Levels* The results of studies examining the association between policies and youth PA levels were mixed. Sanchez-Vaznaugh and colleagues assessed the influence of district-level compliance with a California law requiring a minimum of 200 minutes of PE every 10 days for students in grades 1–6 on student physical fitness levels obtained from California's FITNESSGRAM data [47]. They found that students in policy-compliant districts were 29 percent more likely to be physically fit than students in noncompliant districts (OR=1.29, 95 % CI=1.03, 1.61). Kim found no relationship between the overall strength of state laws nationwide as obtained from NCI's PERSPCS with self-reported individual-level, cross-sectional data on the number of days that youth aged 10–17 were engaged in 20 minutes of

vigorous PA per week as obtained from the NSCH in 2003 and 2007 [48]. Yet, Robertson-Wilson and colleagues' review included two Texas studies that reported that students spent at least 50 percent of their PE class time in moderate-to-vigorous activity following implementation of state PE-related laws [41•].

*Association with Youth Obesity* The two studies to examine the relationship between state PE and recess-related laws on youth obesity reported mixed results. Both analyses linked data on state laws obtained from the NCI's PERSPCS [48, 49] with individual-level, cross-sectional data for 10–17 year olds obtained from the NSCH. Riis and colleagues found that the odds of youth obesity was higher in states: (1) with stronger laws governing assessment of health-related fitness at the elementary and middle school levels and recess time requirements for elementary schools; and (2) whose laws were strengthened between 2003 and 2006 for physical educator staff qualifications (at the elementary and middle school levels) and PE curriculum standards (across all three grade levels) [49]. Although these findings seem contradictory to the goals of the policies, the authors concluded that states with larger youth obesity problems enacted stronger PE-related laws. Kim did not find any association between the overall PERSPCS policy scores at the state level and individual level youth obesity [48].

#### *Focus on Snack Food and Beverage Policies*

Nine studies examined the influence of state laws and/or district policies focused on restricting the availability of snack foods and beverages in schools. Six of the studies were quasi-experimental (pre-/post-) [49, 51, 52, 53•, 54••, 55]; with the remaining three studies examining cross-sectional associations between policies and the outcomes of interest [56, 57, 58•]. The studies examined policy influences on changes to the snack food and beverage environment, school meal participation rates and revenues, student consumption and weight-related outcomes.

*Association with Snack Food and Beverage Environments* Four studies examined policy impacts on objectively measured or administrator-reported changes to the snack food and beverage environments in schools, collectively reporting mixed results. Han-Markey and colleagues examined the impact of the Ann Arbor Public Schools' 2005 local wellness policy (including new beverage guidelines) on changes to vending machine and snack food and beverage availability between 2003 and 2007 [51]. While vending machine availability remained constant over time, vending machine content changed—regular soda was entirely eliminated and juice

drink availability reduced and both regular soda and juice drinks were replaced by water, diet soda, and sports drinks [51]. The contents of food vending machines also changed—chocolate, biscuits and salami were less available while granola trail mix was more available [51]. However, Wall and colleagues found no association between local wellness policy strength and school administrator-reported implementation of snack food and beverage standards in districts located in three states—California, Iowa and Pennsylvania—based on data collected before (2005) and immediately after (2007) the required implementation date for the wellness policies (beginning of school year 2006–07) [55]. Turner and colleagues, using the Bridging the Gap data described earlier, found that district wellness policies that prohibit the use of food as a reward were significantly associated with elementary school administrators nationwide reporting that the school does not use food as a reward for academic performance (OR=1.71, 95 % CI=1.09-2.67) or good behavior (OR=1.66, 95 % CI=1.03-2.41) [56]. Finally, another study by Turner and colleagues examined the collective association between state and/or district-level fundraising restrictions on in-school fundraising practices at elementary schools nationwide, also using the Bridging the Gap data [57]. They found that elementary schools were significantly more likely to limit what was sold through fundraisers if the school was located in a state and a district with a law and policy, respectively, containing fundraising restrictions (OR=2.78, 95 % CI=1.89-4.10) or located in a district-only with specific and required fundraising restrictions (OR=2.02, 95 % CI=1.08-3.77) regardless of the state law in this area.

*Influence on of Snack Food and Beverage Policies on School Revenues* Two studies examined the influence of policy-related changes to snack food and beverage availability on school revenues. Han-Markey and colleagues found that district beverage policy changes in Ann Arbor, Michigan were associated with a 39 % reduction in beverage revenues between 2003 and 2007 (following a 2005 policy change) that was attributed more to reduced vending machine operating hours than to changes to the vending machine contents [51]. Peart and colleagues examined changes to school meal and à la carte revenues in 56 California high schools between school year 2006–07 and school year 2007–2008, the years prior to and immediately following implementation of state-wide snack food and beverage restrictions, respectively. Overall meal revenues significantly increased from \$0.70 to \$0.86 per student per day, mainly due to a significant increase in full-priced meal participation rates (increasing by 20 % for lunch and 30 % for breakfast); while à la carte revenues were associated with a non-significant decrease from \$0.45 to \$0.37 per student per day [52].

*Association with Student Intake and Consumption* Three studies examined the influence of state snack food and/or beverage laws nationwide on changes to secondary school student intake. Using longitudinal data from the Early Childhood Longitudinal Study-Kindergarten cohort (ECLS-K) and Bridging the Gap state law data, Taber and colleagues found that state laws that banned all sugar-sweetened beverages (SSBs) were associated with reduced in-school access (prevalence difference= $-14.9$ ) and purchasing (prevalence difference= $-7.3$ ) but not overall (in- and out-of-school) consumption of SSBs among 8th grade students attending public middle schools in 40 states nationwide [53•]. The study also found that in-school access and purchasing of SSBs was similar in states that only banned soda (66.6 % and 28.9 %, respectively) and states with no beverage restrictions (66.6 % and 26.0 %, respectively). Using cross-sectional data from the National Youth Physical Activity and Nutrition Study (NYPANS) and Bridging the Gap state law data, another study led by Taber found that California high school students who were exposed to the state's strong snack food and beverage state law consumed 157.8 fewer calories per school day than high school students located in 14 states without such laws [58•]. Finally, Huang and Kiesel examined the effect of a Connecticut-mandated ban on soft drinks in schools on out-of-school soft drink purchasing using data from the Nielsen Homescan household-level purchasing both before and after implementation of the Connecticut ban [59]. Bivariate analyses indicated that households with school-aged children purchased 90 fewer ounces of soft drinks post-ban but the regression results were mixed perhaps due, in part, to the use of households with school-aged children as a proxy for school-aged student purchasing behaviors.

*Association with Obesity Rates* Only two studies examined the influence of state snack food and beverage laws on child and/or youth obesity rates. Riis and colleagues examined the cross-sectional association between obesity prevalence among youth aged 10–17 in 2007 as obtained from the NSCH and the strength of state snack food and beverage laws as obtained from the NCI's School Nutrition Environment State Policy Classification System (SNESPCS; available at <http://class.cancer.gov>) [49]. They found that the odds of obesity prevalence was 4 % and 3 % higher among elementary school students located in states with stronger policy scores governing the sale of snack foods and beverages, respectively, in venues other than à la carte settings and vending machines or policies governing food and beverage fundraisers. As noted in the PA-related discussion above, the authors speculated that states with larger obesity problems were more likely to enact stronger laws in this area which contributed to the

positive (rather than inverse) relationship between policy strength and the odds of childhood obesity.

In the second study, Taber and colleagues examined the influence of snack food and beverage laws in 40 states on changes in student BMI between 5th and 8th grade using longitudinal data from ECLS-K and state law data from Bridging the Gap [54••]. Students exposed to strong snack food and beverage laws in 5th grade gained 0.25 fewer BMI units and were less likely to remain overweight or obese over time than students in states without such laws. Students also gained fewer BMI units over time when exposed to consistently strong laws between 5th and 8th grades. Students exposed to weaker laws between 5th and 8th grades had similar weight gain as those not exposed to strong laws in either 5th or 8th grades.

#### *Focus on Other School-based Policies*

Five studies assessed the influence of state laws and/or district policies on additional changes to school environments. Polacsek and colleagues' examined implementation of a statewide law banning food and beverage marketing in Maine high schools [60]. Noncompliant marketing of foods and beverages was found in 85 % of the high schools studied, with an average of 12 instances of noncompliant marketing per school, with most noncompliance occurring in athletic areas and teachers' lounges. Forty-five percent of noncompliant marketing was attributable to major beverage manufacturers. The study authors concluded that voluntary compliance by the beverage industry has not been effective at ensuring full implementation of the state law. Relatedly, Riis and colleagues' study to examine the association of state school-based laws and youth obesity did not find any cross-sectional associations between state laws governing school food-related marketing and advertising and youth obesity [49].

Schneider and colleagues examined the influence of state farm-to-school-related laws on elementary school farm-to-school program (FTSP) existence using the cross-sectional elementary school survey and annual state law data compiled by Bridging the Gap [61]. They found that FTSPs were 2.4 times more likely to operate in states with a farm to school law (and marginally significantly more likely once controlling for year—OR=1.72, 95 % CI=0.91-3.24).

Also using the Bridging the Gap data, Sandoval and colleagues found that elementary school-reported BMI measurement was two times more likely in states with laws addressing BMI measurement (but not influenced by district policies) [62]. While Riis and colleagues' cross-sectional study found that state laws (compiled as part of the NCI SNESPCS) addressing BMI screening at the elementary and middle school levels were positively and significantly associated with higher rates of youth obesity (as compiled through the

NSCH), suggesting that states with higher obesity rates were more likely to enact laws to monitor the problem [49].

And, Schwartz and colleagues examined school-level implementation of written school wellness policies adopted by 151 Connecticut public school districts in the year immediately prior to (2005–2006) and immediately following (2006–2007) the required wellness policy implementation date [63]. They found that school-level implementation was more likely in districts with stronger, more comprehensive wellness policies.

### Non-School Policies

Of all of the studies published between January 2012 and March 2013, only two addressed state and/or local policy influences outside of the school environment, although both were review studies [29•, 64••]. Gearhardt and colleagues reported mixed results regarding the impact of menu labeling policies in New York City and Seattle as part of a broader review of public policy strategies to address obesity [29•]. While the observational studies included in their review reported no impact of the policies on chain-restaurant purchasing patterns post-policy implementation in either city, two additional New York studies reported reductions in calories ordered or purchased post-policy implementation.

Finally, a review study conducted by Powell and colleagues reported mixed results of the impact of existing small, state-level sales taxes on carbonated beverages on adult and youth obesity or weight outcomes based on five studies published in 2010 or 2011 [64••]. They noted that one study found small but significant associations between existing state soda sales taxes and adult obesity; while other studies found no or limited associations between such taxes and child or adolescent weight outcomes—with only one study finding significant associations between higher sales taxes and less weight gain, particularly among overweight children. Currently no state has enacted sizeable and specific excise taxes on the order of those recommended by the public health community (e.g., 1-cent per liquid ounce) [65]; thus, no study has been able to examine impact of such a tax in practice [64••].

### Conclusions

State and school district governments, in particular, have been at the forefront of enacting obesity-related policy interventions in the United States. While the range of policy options available to state, local and school district governments is vast (see Table 1), virtually all of the policy implementation and/or impact studies published between January 1, 2012 and March 1, 2013 focused on policies affecting school environments. Furthermore, most of the studies were cross-sectional

and they primarily reported on policy implementation rather than impacts on physical activity behaviors, food intake, and/or obesity-related outcomes. As Robertson-Wilson and colleagues note, policy reforms are natural experiments and, although “...implementation is important, studying policy impact is critical to ensure desired outcomes are realized” [41•]. Clearly, more work is needed—both in terms of examining the influence of state and local natural policy experiments affecting non-school environments but, more importantly, studying impacts beyond policy implementation. Without data on the actual policy impacts, it will be difficult to convince policy makers in other jurisdictions (whether at the federal, state or local levels) to adopt such policies. Given that policymakers often look to other jurisdictions when considering enactment of new policies, particularly public health policies, data on policy impacts are critical to facilitate the diffusion and adoption of such policies nationwide [23, 66].

**Acknowledgments** Support for this review was provided by the Robert Wood Johnson Foundation-supported Bridging the Gap Program at the University of Illinois at Chicago (PI: Frank Chaloupka) and grants R01DK089096 from the National Institute of Digestive Diseases and Kidney Disorders, National Institutes of Health (NIH) (PI: Jamie Chriqui) and R01CA158035 from the National Cancer Institute, NIH (PI: Jamie Chriqui). I also would like to acknowledge the research assistance provided by Christina Sansone and Yuka Asada.

### Compliance with Ethics Guidelines

**Conflict of Interest** Jamie F. Chriqui has been a consultant for Washington University, University of Minnesota, Danya International; and has been employed with University of Illinois at Chicago. She has also received honoraria from the NIH, USDA, Global Policy Solutions, Fund for Philadelphia, ICF Macro International, Johns Hopkins Global Center on Childhood Obesity. She has received payment for manuscript preparation from Healthy Eating Research at the University of Minnesota for a research synthesis on competitive food and beverage policies. She has received travel/accommodations expenses covered or reimbursed from the American Psychological Association, Institute of Medicine, NIH, and Colgate Palmolive (for the International Association of Dental Research Annual meeting presentation)

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

### References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Katz DL. Childhood obesity trends in 2013: mind, matter, and message. *Child Obes.* 2013;9:1–2.
2. Ogden, CL, Carroll, MD, Kit, BK, et al. Prevalence of obesity in the United States, 2009–2010. <http://www.cdc.gov/nchs/data/databriefs/db82.htm>. Accessed 22 Mar. 2013.



3. Robert Wood Johnson Foundation. Declining childhood obesity rates—where are we seeing the most progress? <http://www.rwjf.org/enresearch-publications/find-rwjf-research/2012/09/declining-childhood-obesity-rates.html>. Accessed 22 Mar. 2013.
4. Cawley J, Meyerhoefer C. The medical care costs of obesity: an instrumental variables approach. *J Health Econ*. 2012;31:219–30.
5. Wang YC, McPherson K, Marsh T, et al. Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet*. 2011;378:815–25.
6. Trogdon JG, Finkelstein EA, Hylands T, et al. Indirect costs of obesity: a review of the current literature. *Obes Rev*. 2008;9:489–500.
7. Hammond RA, Levine R. The economic impact of obesity in the United States. *Diabetes Metab Syndr Obes*. 2010;3:285–95.
8. Huang TT, Drewnoski A, Kumanyika S, et al. A systems-oriented multilevel framework for addressing obesity in the 21st century. *Prev Chronic Dis*. 2009;6:A82.
9. White House Task Force on Childhood Obesity. Solving the Problem of Childhood Obesity within a Generation—Report to the President. <http://www.letsmove.gov/white-house-task-force-childhood-obesity-report-president>. Accessed 1 June 2010.
10. Institute of Medicine. Preventing childhood obesity: health in the balance. Washington, D.C.: The National Academies Press; 2005.
11. Institute of Medicine. Local government actions to prevent childhood obesity. Washington, D.C.: The National Academies Press; 2009.
12. Institute of Medicine Committee on Nutrition Standards for Foods in Schools. Nutrition standards for food in schools: leading the way toward healthier youth. Washington, D.C.: The National Academies Press; 2007.
13. Institute of Medicine Committee on Nutrition Standards for National School Lunch and Breakfast Programs. School meals: building blocks for healthy children. Washington, D.C.: The National Academies Press; 2010.
14. Institute of Medicine Committee to Accelerate Progress in Obesity Prevention. Accelerating progress in obesity prevention: solving the weight of the nation. Washington, DC: The National Academies Press; 2012.
15. Institute of Medicine. Progress in preventing childhood obesity: how do we measure up? Washington, DC: The National Academies Press; 2006.
16. US Department of Health and Human Services. The surgeon general's vision for a healthy and fit nation. <http://www.surgeongeneral.gov/initiatives/healthy-fit-nation/obesityvision2010.pdf>. Accessed 1 Mar. 2013.
17. National Prevention Council. National prevention strategy. <http://www.surgeongeneral.gov/initiatives/prevention/strategy/index.html>. Accessed 1 July 2011.
18. Mozaffarian D, Afshin A, Benowitz NL, et al. Population approaches to improve diet, physical activity, and smoking habits: a scientific statement from the American Heart Association. *Circulation*. 2012;126:1514–63.
19. Gortmaker SL, Swinburn BA, Levy D, et al. Changing the future of obesity: science, policy, and action. *Lancet*. 2011;378:838–47.
20. Chaloupka FJ, Powell LM, Chiqui JF. Sugar-sweetened beverages and obesity: the potential impact of public policies. *J Pol Anal Manag*. 2011;30:645–55.
21. Institute of Medicine. Ending the tobacco problem: a blueprint for the nation. Washington, D.C.: The National Academies Press; 2007.
22. Chiqui JF, Frosh MM, Brownson RC, et al. Measuring policy and legislative change. In: Stillman F, Clark PI, Trochim W, editors. Evaluating ASSIST: a blueprint for understanding state-level tobacco control. Bethesda, MD: National Cancer Institute; 2006.
23. Shipan CR, Volden C. Bottom-up federalism: the diffusion of antimoking policies from U.S. cities to states. *Am J Polit Sci*. 2006;50:825–43.
24. Eyler A. Promoting physical activity through policy. *Res Dig*. 2011;12:1–9.
25. Bassett DR, Fitzhugh EC, Heath GW, et al. Estimated energy expenditures for school-based policies and active living. *Am J Prev Med*. 2013;44:108–13.
26. Novak NL, Brownell KD. Taxation as prevention and as a treatment for obesity: the case of sugar-sweetened beverages. *Curr Pharm Des*. 2011;17:1218–22.
27. Novak NL, Brownell KD. Role of policy and government in the obesity epidemic. *Circulation*. 2012;126:2345–52.
28. • Schwartz MB. Environmental and policy strategies to improve eating, physical activity behaviors, and weight among adolescents. *Adolesc Med State Art Rev*. 2012;23:589–609. *This paper provides a thorough review of obesity-related environmental and policy strategies.*
29. • Gearhardt AN, Bragg MA, Pearl RL, et al. Obesity and public policy. *Annu Rev Clin Psychol*. 2012;8:405–30. *This review summarizes key prevention, treatment, and policy approaches for addressing obesity and discusses the role that federal, state and local governments can play in addressing the problem.*
30. Lindholm R. Combating childhood obesity: a survey of laws affecting the built environments of low-income and minority children. *Rev Environ Health*. 2011;26:155–67.
31. Pomeranz JL. The wheels on the bus go "buy buy buy": school bus advertising laws. *Am J Public Health*. 2012;102:1638–43.
32. Pomeranz JL, Brownell KD. Portion sizes and beyond—government's legal authority to regulate food-industry practices. *N Engl J Med*. 2012;367:1383–5.
33. Pomeranz JL. Advanced policy options to regulate sugar-sweetened beverages to support public health. *J Public Health Policy*. 2012;33:75–88.
34. Brennan L, Castro S, Brownson RC, et al. Accelerating evidence reviews and broadening evidence standards to identify effective, promising, and emerging policy and environmental strategies for prevention of childhood obesity. *Annu Rev Public Health*. 2011;32:199–223.
35. Kimmons J, Wood M, Villarante JC, et al. Adopting healthy and sustainable food service guidelines: emerging evidence from implementation at the United States Federal Government, New York City, Los Angeles County, and Kaiser Permanente. *Adv Nutr*. 2012;3:746–8.
36. Kraak VI, Story M, Wartella EA. Government and school progress to promote a healthful diet to American children and adolescents: a comprehensive review of the available evidence. *Am J Prev Med*. 2012;42:250–62.
37. Fenton M. Community design and policies for free-range children: creating environments that support routine physical activity. *Child Obes*. 2012;8:44–51.
38. Amis JM, Wright PM, Dyson B, et al. Implementing childhood obesity policy in a new educational environment: the cases of Mississippi and Tennessee. *Am J Public Health*. 2012;102:1406–13.
39. Carlson JA, Sallis JF, Chiqui JF, et al. State policies about physical activity minutes in physical education or during school. *J Sch Health*. 2013;83:150–6.
40. Chiqui JF, Taber DR, Slater SJ, et al. The impact of state safe routes to school-related laws on active travel to school policies and practices in U.S. elementary schools. *Health Place*. 2012;18:8–15.
41. • Robertson-Wilson JE, Dargavel MD, Bryden PJ, et al. Physical activity policies and legislation in schools: a systematic review. *Am J Prev Med*. 2012;43:643–9. *This is one of the few systematic reviews to examine the impact of school-based physical activity policies and suggests that such policies are particularly useful for increasing levels of physical activity.*
42. Slater SJ, Nicholson L, Chiqui J, et al. 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;166:311–6.
43. Turner, L, Chiqui, J, Chaloupka, F. Walking school bus programs in U.S. public elementary schools. *J Phys Act Health*. 2012; Sep 18. [Epub ahead of print].

44. Holt, E, Heelan, K, Bartee, T. Evaluation of a policy to integrate physical activity into the school day. *J Phys Act Health*. 2012; Jul 10. [Epub ahead of print].
45. Perna FM, Oh A, Chiqui JF, et al. The association of state law to physical education time allocation in US public schools. *Am J Public Health*. 2012;102:1594–9.
46. Lafleur M, Strongin S, Cole BL, et al. Physical education and student activity: evaluating implementation of a new policy in Los Angeles public schools. *Ann Behav Med*. 2013;45 Suppl 1:122–30.
47. • Sanchez-Vaznaugh EV, Sanchez BN, Rosas LG, et al. Physical education policy compliance and children's physical fitness. *Am J Prev Med*. 2012;42:452–9. *This is one of the first studies to demonstrate that district-level compliance with state physical education standards can increase student fitness levels.*
48. Kim J. Are physical education-related state policies and schools' physical education requirement related to children's physical activity and obesity? *J Sch Health*. 2012;82:268–76.
49. Riis J, Grason H, Strobino D, et al. State school policies and youth obesity. *Matern Child Health J*. 2012;16 Suppl 1:S111–8.
50. Turner, L, Chaloupka, FJ, Sandoval, A. School policies and practices to improve health and prevent obesity: National elementary school survey results: school years 2006–07 through 2009–10, vol. 2. [www.bridgingthegapresearch.org](http://www.bridgingthegapresearch.org). Accessed 1 Mar. 2012.
51. Han-Markey TL, Wang L, Schlotterbeck S, et al. A public school district's vending machine policy and changes over a 4-year period: implementation of a national wellness policy. *Public Health*. 2012;126:335–7.
52. Peart T, Kao J, Crawford PB, et al. Does competitive food and beverage legislation hurt meal participation or revenues in high schools? *Child Obes*. 2012;8:339–46.
53. • Taber DR, Chiqui JF, Powell LM, et al. Banning all sugar-sweetened beverages in middle schools: reduction of in-school access and purchasing but not overall consumption. *Arch Pediatr Adolesc Med*. 2012;166:256–62. *This is the first nationwide longitudinal study to illustrate that soda-only bans do not reduce in-school consumption of sugar-sweetened beverages; in order to reduce such consumption, the policies must ban all sugar-sweetened beverages. However, sugar-sweetened beverage bans do not reduce overall consumption (in- and out-of-school).*
54. •• Taber DR, Chiqui JF, Perna FM, et al. Weight status among adolescents in states that govern competitive food nutrition content. *Pediatrics*. 2012;130:437–44. *This longitudinal study provides the first evidence that strong competitive food and beverage laws with specific standards and that are consistent across grade levels are associated with lower within-student body mass index change.*
55. Wall R, Litchfield R, Carriquiry A, et al. Local wellness policy strength and perceived implementation of school nutrition standards across three states. *Child Obes*. 2012;8:331–8.
56. Turner L, Chiqui JF, Chaloupka FJ. Food as a reward in the classroom: school district policies are associated with practices in US public elementary schools. *J Acad Nutr Diet*. 2012;112:1436–42.
57. Turner L, Chiqui JF, Chaloupka FJ. Healthier fundraising in U. S. elementary schools: associations between policies at the state, district, and school levels. *PLoS One*. 2012;7:e49890.
58. • Taber DR, Chiqui JF, Chaloupka FJ. Differences in nutrient intake associated with state laws regarding fat, sugar, and caloric content of competitive foods. *Arch Pediatr Adolesc Med*. 2012;166:452–8. *This study illustrates that students living in California, a state with strong and specific competitive food standards, consumed, on average, 157.8 less calories per day than students living in states without competitive food and beverage laws.*
59. Huang R, Kiesel K. Does limited access at school result in compensation at home? The effect of soft drink bans in schools on purchase patterns outside of schools. *Eur Rev Agric Econ*. 2012;39:797–820.
60. Polacsek M, O'Rourke K, O'Brien L, et al. Examining compliance with a statewide law banning junk food and beverage marketing in Maine schools. *Public Health Rep*. 2012;127:216–23.
61. Schneider L, Chiqui J, Nicholson L, et al. Are farm-to-school programs more common in states with farm-to-school-related laws? *J Sch Health*. 2012;82:210–6.
62. Sandoval A, Turner L, Nicholson L, et al. The relationship among state laws, district policies, and elementary school-based measurement of children's body mass index. *J Sch Health*. 2012;82:239–45.
63. Schwartz MB, Henderson KE, Falbe J, et al. Strength and comprehensiveness of district school wellness policies predict policy implementation at the school level. *J Sch Health*. 2012;82:262–7.
64. •• Powell LM, Chiqui JF, Khan T, et al. Assessing the potential effectiveness of food and beverage taxes and subsidies for improving public health: a systematic review of prices, demand and body weight outcomes. *Obes Rev*. 2013;14:110–28. *This systematic review provides the most up-to-date evidence for food prices, taxes, and subsidies on demand and weight outcomes.*
65. Brownell KD, Farley T, Willett WC, et al. The public health and economic benefits of taxing sugar-sweetened beverages. *N Engl J Med*. 2009;361:1599–605.
66. Shipan CR. The mechanisms of policy diffusion. *Am J Pol Sci*. 2008;52:840–57.
67. Chiqui, JF. Influence of competitive food and beverage policies on children's diets and childhood obesity. [www.healthyeatingresearch.org](http://www.healthyeatingresearch.org). Accessed 1 Aug. 2012.
68. US Department of Agriculture. National School Lunch Program and School Breakfast Program: nutrition standards for all foods sold in school as required by the Healthy, Hunger-Free Kids Act of 2010–Proposed Rule. *Fed Regist*. 2013;78:9530–67.
69. US Department of Health and Human Services. 2008 physical activity guidelines for Americans. Washington, D.C.: U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion; 2008.
70. Promoting Healthy as Youth Skills in Classroom and Life Act, S. 392, Udall T, 2013.
71. Physical Activity Guidelines for Americans Act, S. 531, Harkin T, 2013.

## Author's Note

As this review reveals, virtually all of the peer-reviewed scientific literature published between January 2012 and March 2013 focused on policies affecting school environments. Interestingly and in contrast to the literature from prior years [67], more studies focused on PA and PE-related policy changes as compared to other changes to the school environment. What makes this particularly noteworthy is that literature from prior years heavily influenced the enactment of federal legislation that, for the first time, provided the U.S. Department of Agriculture with the authority to establish nationwide standards governing snack foods and beverages sold in schools [68]. And, while the studies reviewed herein illustrate that existing state and school district policies can influence school PE and PA environments, they alone are not sufficient to change the rates of child and adolescent PA to meet the national recommendations of 60 minutes of daily PA [69]. Currently, there are no federal standards governing PA or PE in schools and, historically, federal PA-related guidelines have not been subject to regular scientific updates. However, two recent pieces of legislation were introduced in the United States Senate related to physical education and/or physical activity [73]. On February 27, 2013, Senator Tom Udall introduced legislation that would strengthen physical and health education by

elevating both subjects as "core subjects" as part of the Elementary and Secondary Education Act [70]. And, on March 13, 2013, U.S. Senators Tom Harkin and Roger Wicker introduced bipartisan legislation to require a 10-year cycle for review and updating of the *Physical Activity Guidelines for Americans*, with mid-course reviews to be conducted during each cycle to highlight best practices and continuing issues in the PA-related arena [71].

Finally, schools are only one piece of the complex web of influences affecting the obesogenic environment within which Americans live, work and play [14]. Thus, it is important for policy makers to start to look beyond schools by focusing on broader population-based strategies that aim to improve all aspects of society, particularly given that school-level changes alone are insufficient for addressing the obesity

problem in this country. The IOM has released two reports in recent years that specifically identify a range of policy strategies that may be considered by state, local and school district governments [11, 14]. And, once the policies are in place, the National Institutes of Health has a series of program announcements specifically seeking investigator-initiated research grant proposals that will evaluate the impact of obesity prevention-related policies and programs (<http://grants.nih.gov/grants/guide>). Clearly more research on the impact of natural policy experiments is still needed and, as Gearhardt and colleagues correctly note, "there is an insufficient base of knowledge to identify which policies will be most effective...[T]he true impact [of public policy strategies] can only be known when policies are enacted and then evaluated" [29•].