Snack Food and Beverage Interventions in Schools

Summary Evidence Table

Abbreviations Used in This Document:

- Outcomes:
  - SSB: sugar sweetened beverage
- Measurement terms
  - BMI: body mass index
  - CI: confidence interval
  - d: day
  - serv: servings
- Other terms:
  - f/u: follow-up
  - NA: not applicable
  - NR: not reported
  - NS: not significant
  - SES: socioeconomic status

Study	Population Characteristics	Intervention Characteristics	Results
Author, Year: Alaimo, 2013 (nutrition policy only arm) **Study Design:** Other design with concurrent comparison **Suitability of Design**: Greatest **Quality of Execution**: Fair	**Study population:** 7th and 8th graders **Sample size: 18 schools** **Demographics** Age: 7th and 8th grade students Gender: 60.7% female Race/Ethnicity: 46.0% white; 24.1% African American; 19.1% Hispanic; 3.0% Native American; 7.4% Asian and Other SES: eligible for FRPL 69.6%	**Location (urbanicity):** Michigan (mixed) **Intervention activities:** competitive food policy + nutrition education + marketing Healthy food and beverage policy implemented in `a la carte lines at each school. Each school submitted a plan. Each school also implemented nutrition education and marketing. **Comparison**: no policies implemented **Study Period**: 2007-2010	**Fruit (cups/d)** Regression Coefficient: 0.17, 95% CI: 0.02, 0.32 **Vegetables (cups/d)** Regression Coefficient: -0.03; 95% CI: -0.14, 0.07 **Paper conclusions:** New USDA nutrition standards for a` la carte and vending will likely increase the healthfulness of middle school children's diets.
Author, Year: Blum, 2008 **Study Design:** Prospective cohort **Suitability of Design**: Greatest **Quality of Execution**: Fair	**Study population:** Targeted all high school students, results for 9th-11th grade **Sample size:** 2,616 **Demographics:** Age: NR Gender: 67% female Race/Ethnicity: 97.8% white SES: NR	**Location (urbanicity):** 6 counties through southern and central, Maine (mixed) **Intervention activities:** competitive foods policy Schools reduced availability of SSB and diet soda in a la carte and vending programs **Comparison**: No changes **Study Period:** Fall 2004-Spring 2005	**100% Fruit Juice Intake (serv/d)** Girls Intervention: baseline: 0.85 f/u: 0.72 Control: baseline: 0.85 f/u: 0.93 **Summary Effect: -0.21 serv/d, p<0.05** Boys Intervention: baseline: 0.68 f/u: 0.73 Control: baseline: 1.00 f/u: 1.00 **Summary Effect: 0.05 serv/d, NS** **SSB Intake (serv/d)** Girls Intervention: baseline: 0.79 f/u: 0.69 Control: baseline: 0.82 f/u: 0.70 **Summary Effect: 0.02 serv/d, NS** Boys

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			Intervention: baseline: 1.16 f/u: 1.07 Control: baseline: 1.30 f/u: 1.08 **Summary Effect: 0.13 serv/d, NS** **Milk Intake (serv/d)** Girls Intervention: baseline: 1.11 f/u: 1.14 Control: baseline: 1.44 f/u: 1.32 **Summary Effect: 0.15 serv/d, NS** Boys Intervention: baseline: 1.77 f/u: 1.96 Control: baseline: 2.10 f/u: 1.73 **Summary Effect: 0.46 serv/d, p<0.05** **Paper conclusions:** Reducing availability of SSB in schools did not result in a greater decrease in SSB consumption by intervention as compared to control subjects. The impact of reducing availability of SSB at school may be limited.
Author, Year: Cradock, 2011 **Study Design:** Repeat cross sectional **Suitability of Design**: Least **Quality of Execution**: Good	**Study population:** Targeted Boston Public High school students **Sample size:** 895 **Demographics:** Age: 9th grade: 40%; 10th grade: 29%; 11th grade: 25%; 12th grade: 7% Gender: 55% female Race/Ethnicity: Non-Hispanic White: 11%; Black/African/Cape Verdean/Caribbean: 43%;	**Location (urbanicity):** Boston, MA (urban) **Intervention activities:** Competitive foods policy Policy restricts the sale of sugar-sweetened beverages in vending and à la carte settings. The policy required that beverages sold in schools or on school grounds adhere to the Massachusetts à la Carte Food and Beverage Standards to Promote a Healthier School Environment. The	**Sugar Sweetened Beverage (serv/d)** Baseline: 1.38 Follow-up: 1.38 **Adjusted Summary Effect: - 0.30 serv/d, p<0.001** **Non-diet Soda (serv/d)** Baseline: 0.81 Follow-up: 0.63 **Adjusted Summary Effect: -0.16 serv/d, p<0.001**

Study	Population Characteristics	Intervention Characteristics	Results
	Hispanic/Latino: 31%; Asian/Pacific Islander: 9%; Other/multiracial: 6% SES: 74% of Boston Public High School students qualify for free or reduced priced lunch	beverage guidelines specifically precluded the sale of soft drinks, fruit drinks (i.e., non–100% vegetable or fruit juice beverages), and sports drinks anywhere in school buildings or on school campuses and had specifications that limited other beverage serving sizes. **Comparison**: NA **Study Period**: Pretest: 2004; Posttest: 2006	**Paper conclusions**: Data from Boston youth indicate that significant reductions in sugar-sweetened beverage intake coincided with a policy change that restricted the sale of sugar-sweetened beverages in public high schools.
Author, Year: Hennessy, 2014 (data entered) **Study Design:** cross sectional with comparison group **Suitability of Design:** Least **Quality of Execution**: Fair	**Study population:** children 11-14 yrs (middle school) **Sample size:** 16,271 **Demographics:** Mean age: healthy weight (HW): 12.7 yrs; obese/overweight (O): 12.5 yrs Gender: HW: 53.2% female; O: 46.1% female Race/ethnicity: White HW: 63.6% O: 46.7% Black HW: 13.6% O: 21.1% Hispanic HW: 14.9% O: 25.1% Other HW: 8.0% O: 7.2% SES: poverty level, % federal poverty level 0-99 HW: 12.7% O: 22.3% 100-199 HW: 19.0% O: 24.9% 200-399 HW: 33.9% O: 34.8% ≥400 HW: 34.4% O: 17.9%	**Location (urbanicity):** nationwide **Intervention activities:** States were classified based the Classification of Laws Associated with School Students (CLASS) database of state codified law(s) relevant to school nutrition. States were classified as having strong or weak competitive food laws in 2005 based on strength and comprehensiveness. **Comparison:** states with no laws **Study Period:** Laws had to go into place by Dec 31, 2005; data collected from April 2007-July 2008	**Overweight/ obesity prevalence** Weak law OR:1.23 (1.1, 1.4) Strong law OR: 1.01 (0.8, 1.3) reference group: in a state with no school food law **Paper conclusions:** Children living in states with weak competitive food laws for middle schools had over a 20% higher odds of being overweight or obese than children living in states with either no or strong school competitive food laws. State-level school competitive food and beverage laws merit attention with efforts to address the childhood obesity epidemic. Attention to the specificity and requirements of these laws should also be considered.

Study	Population Characteristics	Intervention Characteristics	Results
Jones, 2009 (uses same data and outcomes as Taber, 2012) **Study Design:** post only with comparison **Suitability of Design:** Least **Quality of Execution**: Fair	**Study population:** 5th grade students **Sample size:** 10,719 children **Demographics:** Mean age: 9-13 yr olds Gender: NR Race/ethnicity: NR SES: NR	**Location (urbanicity):** nationwide **Intervention activities:** examined availability of different beverages and purchase of sweetened beverages at school and overall consumption of beverages. **Comparison**: SSB available vs SSB not available **Study Period:** 2003-2004	**SSB Consumption** Consumed < 1 SSB/d (available and purchased) OR: 2.97, p<0.001 Consumer 1 or more SSB/d (available and purchased) OR: 3.25, p<0.001 **Paper conclusions:** A policy of availability of sweetened beverages makes an independent contribution to children's purchase and consumption of sweetened beverages in the 5th grade year.
Author, Year: Palakshappa **Study Design:** repeat cross-sectional **Suitability of Design:** Least **Quality of Execution**: Fair	**Study population:** children 10-17 yrs (elementary, middle and high school) **Sample size:** 40,177 **Demographics:** Mean age: 13.6 yrs Gender: 48.85% female Race/ethnicity: White 67.5%; Black 15.9%, Hispanic 19.6%; other 16.7% SES: 0-99% FPL 18.6% 100-199% FPL 20.8% 200-399% FPL 29.5% 400% or greater FPL 31.1% Other: public school 90%; private school 10%	**Location (urbanicity):** nationwide **Intervention activities:** Examined 2010 laws using the Classification of Laws Associated with School Students, which grades the strength of state laws (none, weak, or strong). The authors examined the association between the strength of laws and weight. **Comparison:** NA **Study Period:** 2003-2007 trend analysis; 2011 post test	**Obesity Prevalence** **Elementary School** 4 or more strong laws OR: 0.57 (0.34, 0.97) 2-3 strong laws OR: 0.57 (0.36, 0.90) **Middle and High School** 4 or more strong laws: No change 2-3 strong laws: No change reference group: in a state with no school laws or only 1 non-competitive food & beverage law **Paper conclusions**: Although further research is needed to determine the causal effect of these laws, this study suggests that strong state laws limiting the sale and advertising of unhealthy

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			foods and beverages in schools are associated with decreased obesity rates.
Author, Year Schwartz, 2009 **Study Design:** Repeat cross-sectional with control **Suitability of Design**: Moderate **Quality of Execution**: Good	**Study population:** middle school students **Sample size:** Pre n=501, Post n=495 **Demographics (Intervention/Comparison):** Age: middle school students; Gender: NR Race/Ethnicity: Black I: 8.5%; C: 21.1% White I: 63.2%; C: 50.4%; Asian American I: 3.4%; C: 4.6%; American Indian I: 0.3%; C:0.06%; Hispanic I: 24.6%; C:23.8% SES: Eligible free/reduced lunch I: 33.0%; C: 37.0%	**Location (urbanicity):** State of Connecticut (mixed) **Intervention activities:** Competitive foods policy **Intervention activities**: middle schools adhered to snack guidelines for foods sold at school during school day (i.e., cafeteria a la carte, vending, and fundraisers) **Study Period**: Pretest: Spring 2006, Posttest: Spring 2007 **Comparison**: usual snacks.	**Sweet drinks (4-point scale score)** Intervention: baseline: 1.95, f/u: 1.80 Control: baseline: 2.0, f/u: 2.1 **Summary Effect: -0.25** **Sweet Snacks (4-point scale score)** Intervention: baseline: 2.0, f/u: 1.9 Control: baseline: 1.9, f/u: 1.9 **Summary Effect: -0.10** **Salty Snacks (4-point scale score)** Intervention: baseline: 2.6, f/u: 2.4 Control: baseline: 2.4, f/u: 2.5 **Summary Effect: -0.20** **100% fruit juice and bottled water combined (4-point scale score** Intervention: baseline: 1.9, f/u: 2.4 Control: baseline: 2.0, f/u: 2.1 **Summary Effect: 0.40** **Paper conclusions**: this study provides support for removing foods that do not meet nutrition standards from schools as a public health policy intervention. Overall, students in the intervention schools ate snacks of higher nutritional value at school than students in the comparison schools.

Study	Population Characteristics	Intervention Characteristics	Results
Author, Year: Taber, 2012a (Weight Status Among Adolescents in States That Govern Competitive Food Nutrition Content) **Study Design:** Before-After **Suitability of Design**: Least **Quality of Execution**: Fair	**Study population:** 5th and 8th grade studies in 40 states within the Early Childhood Longitudinal Study – Kindergarten Class **Sample size:** 6,300 **Demographics** Age: 5th and 8th grade students Gender: 49.8% female Race/Ethnicity: 58.9% White; 11.9% Black; 18.5% Hispanic; 10.7% other SES: 58.9% White; 11.9% Black; 18.5% Hispanic; 10.7% other SES: NR Overweight: 40.1% 5th grade; 37.4% 8th grade; Obese:22.3% 5th grade; 20.3% 8th grade	**Location (urbanicity):** 40 US states (mixed) **Intervention activities**: competitive foods policy Examined state competitive food laws using the Classification of Laws Associated with School Students criteria. States were classified as having weak or strong laws. **Study Period:** 2003-2006 **Comparison**: NA	**Obesity prevalence (%)** Beta coefficient weak laws: -0.8, p=0.40 Beta coefficient strong laws: 0.0, p=0.94 **Overweight prevalence (%)** Beta coefficient weak laws: -4.5, p = 0.001 Beta coefficient strong laws: -2.8, p = 0.04 **BMI Z-score** Beta coefficient weak laws: -0.39, p=0.001 Beta coefficient strong laws: -0.10, p=0.36 **Paper conclusions**: Laws that regulate competitive food nutrition content may reduce adolescent BMI change if they are comprehensive, contain strong language, and are enacted across grade levels.
Author, Year: Taber, 2012b (Banning All Sugar-Sweetened Beverages in Middle Schools) **Study Design:** Other Design with Concurrent Comparison **Suitability of Design**: Greatest	**Study population:** 5th and 8th grade studies in 40 states within the Early Childhood Longitudinal Study – Kindergarten Class **Sample size:** 6,900 **Demographics** Age: 5th and 8th grade students Gender: 49.9% female Race/Ethnicity: 58.8% White; 12.0% Black; 18.4% Hispanic; 10.9% other SES: 18.8% below poverty line	**Location (urbanicity):** 40 US states (mixed) **Intervention activities:** competitive foods policy States were classified based on limiting all SSB or soda 1. ban all SSB: policy limiting the availability of soda and other SSBs (only allowing milk, water, and 100% juice in school) 2. ban soda: policy prohibiting soda but no policy limiting the availability of other SSBs (allowing milk, water,	**Daily consumption SSB** Prevalence Difference for schools that ban soda: 2.3, 95% CI: -1.4, 6.0 Prevalence Difference for schools that ban all SSB: 5.7, 95% CI: 0.6, 11.1 **Paper conclusions:** Daily consumption of SSB was more prevalent in states that banned all SSB than in states with a soda ban.

Study	Population Characteristics	Intervention Characteristics	Results
Quality of Execution: Fair		energy drinks, and electrolyte replacement beverages **Comparison**: NA **Study Period**: spring 2004-spring 2007	
Author, Year: Taber, 2012c (Differences in Nutrient Intake Associated With State Laws Regarding Fat, Sugar, and Caloric Content of Competitive Foods) **Study Design:** post-only with comparison **Suitability of Design:** Least **Quality of Execution**: Good	**Study population:** high school students **Sample size:** 680 **Demographics:** Intervention Mean age: 15.0 years Gender: 55.8% female Race/ethnicity: 11.7% White, 1.0% Black, 76.6% Hispanic, 10.8% other SES: NR Control Mean age: 15.2 years Gender: 51.2% female Race/ethnicity: 43.5% White, 33.8% Black, 14.7% Hispanic, 8.1% other SES: NR	**Location (urbanicity):** California and national (urban, suburban, rural) **Intervention activities:** California State Senate Bill 12, which required several nutrition standards for competitive foods at all grade levels, including limiting calories, fat, saturated fat, and sugar content of snacks sold in vending machines, schools stores, and cafeterias, and California State Senate Bill 965, which banned the sale of soda and other sweetened beverages in high schools. **Comparison:** 14 states with weak or no laws on competitive foods **Study Period:** February – May 2010	**Caloric Intake (kcals/d):** California: 1629.6 kcals/d Other states: 1787.3 kcals/d **Adjusted difference: -157.8 kcals/d** **Total Sugar Intake (g/d):** California: 96.5 g/d Other states: 114.4 g/d **Adjusted difference: -17.9 g/d** **Total Fat Intake (g):** California: 60.9 g/d Other states: 67.1 g/d **Adjusted difference; -6.2 g/d**
Author, Year: Taber, 2015 The association between state bans on soda only and adolescent substitution with	**Study population:** 9th-12th grade students **Sample size:** 8,696 **Demographics:** Mean age: 9th grade 26.6%; 10th grade 25.4%;	**Location (urbanicity):** 27 states **Intervention activities:** Student data on consumption of various SSBs and in-school access to vending machines that sold SSBs were obtained from the National Youth Physical Activity and Nutrition Study	**Servings soda/week** Soda allowed (vending): 5.2 serv/wk, NS Soda banned (vending): 5.4 serv/wk, NS **Paper conclusions:** We found that students tended to consume more sports drinks, energy drinks, coffee/tea, and other SSBs if they resided in a state that

Study	Population Characteristics	Intervention Characteristics	Results
other sugar sweetened beverages: a cross-sectional study **Study Design:** post-only with comparison **Suitability of Design:** Least **Quality of Execution**: Good	11th grade 24.6%; 12th grade 23.4% Gender: 49.5% female Race/ethnicity: White 58.1%; Black 14.9%; Hispanic 18.4%; Other 8.6% SES: Overweight/Obese: overweight 18.1% obese 19.2%	(NYPANS). Student data were linked to state laws regarding the sale of soda in school. **Comparison:** NA **Study Period:** 2010	only banned soda in schools. Interestingly, SSB consumption was not elevated if both schools and states took action to reduce SSB access – i.e., states banned soda and schools did not offer vending machines.
Author, Year: Terry McElrath, 2015 **Study Design:** Cross-sectional with comparison **Suitability of Design:** Least **Quality of Execution**: Fair	**Study population:** high school students **Sample size:** 7,877 **Demographics:** Mean age: NR Gender: 51.5% female Race/ethnicity: 59.5% white, 10.2% black, 13.9% Hispanic, 13.1% other SES: mixed	**Location (urbanicity):** mixed **Intervention activities: state level** competitive food policy **Comparison:** district level competitive food policy **Study Period:** 2010-12	**Paper conclusions**: These analyses indicate state policy focused on regular soda strongly affected school soda availability, and worked through changes in school availability to decrease soda consumption among African American students, but not the overall population.
Author, Year: Wordell, 2012 **Study Design:** Post only with comparison **Suitability of Design**: Least **Quality of Execution**: Fair	**Study population:** 7th and 8th graders **Sample size:** 2,000 **Demographics** Age: 7th and 8th grade students Gender: 49% female Race/Ethnicity: >90% white SES: FRPL: I; 2 schools, 71.3% and 46.2%	**Location (urbanicity):** mid-sized city in Washington state, US (NR) **Intervention activities:** competitive foods policy Schools allowed only bottled water in vending machines, only milk and fruit on à la carte menus, and offered a seasonal fruit and vegetable bar.	**Fruit (serv/wk)** OR In school: 1.1, p=0.56 OR Out of school: 0.94, p=0.58 **Vegetables (serv/wk)** OR In school: 1.1, p=0.56 OR Out of school: 0.94, p=0.58 **Milk (serv/wk)** OR In school: 0.97, p=0.77 OR Out of school: 1.2, p = 0.04

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	C: 2 schools, 81.1% and 37.6%	**Comparison**: school district wellness policy (both intervention and control groups) eliminated sugared beverages and only allowed 100% juice products and flavored non-energy-providing water; competitive à la carte items limited to 250 kcal and 9 g fat. **Study Period**: fall 07/08 thru 08/09 and 09/10 school years	**Sweet drinks (serv/wk)** OR In school: 0.87, p=0.77 OR Out of school: 0.94, p=0.64 **Any juice (serv/wk)** OR In school: 0.73, p=0.02 OR Out of school: 0.82, p=0.10 **Chips (serv/wk)** OR In school: 0.9, p=0.41 OR Out of school: 1.2, p=0.29 **Candy (serv/wk)** OR In school: 1.0, p=0.88 OR Out of school: 1.0, p=0.96 **Pastries (serv/wk)** OR In school: 0.4, p=0.00 OR Out of school: 1.4, p = 0.06 **Paper conclusions:** Overall, there was a positive, though modest, association between a modified school food environment and student food behavior in and outside of school.