# INTERVENTION TABLE 2

**School Food & Beverage Policies**

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| **School Meal Policies - United States** | | | | | | |
| Perry, Bishop (2004)<br>Minnesota | School policy to increase fruit and vegetable consumption by adding an additional serving of fruit and/or vegetable in the lunch line and school snack cart<br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br>*Complex:*<br>1. 2 week kick-off campaign featuring life size fruit and vegetable characters on posters in cafeteria.<br>2. Monthly samplings of fruits and vegetables<br>3. Annual challenge week competition encouraging students to eat 3 servings of fruits and/ or vegetables per day during lunch.<br>4. Theater production regarding fruit and vegetable consumption<br>5. Verbal encouragement from lunch room staff | ***DESIGN:*** Group randomized trial<br>***DURATION:*** 2 years<br>***SAMPLE SIZE:*** 1,168 students in grades 1-4 in 26 elementary schools (13 intervention, 13 control)<br>***PRIMARY OUTCOME:*** Fruit and vegetable consumption<br>***MEASURES:***<br>1. Direct observation (number of fruits and vegetables consumed by students during lunch)<br>***DATA COLLECTION:*** Trained observers watched the students from a distance in the cafeteria and recorded all items eaten at lunch and their portion size. The lunch observations were processed using the Nutrition Data System.<br>***LIMITATIONS:*** Possible cross-school contamination as all schools shared same food sources and lunch menus; during the second year of the intervention, juice was added to the menu for all schools in the district, reducing the potential to observe intervention-control differences at the end of the second year | 5-10 year olds<br>***ELIGIBILITY:*** Not reported<br>***EXPOSURE/ PARTICIPATION:*** 26 schools from one large school district in the Twin Cities metropolitan area of Minnesota were exposed to the intervention (13 intervention, 13 delayed-intervention). | ***LEAD AGENCY:*** Research team<br>***THEORY/ FRAMEWORK:*** Social cognitive theory; a health behavioral planning model that emphasizes changes in social-environmental factors<br>***EVIDENCE-BASED:*** The study builds off of previous multi-component interventions focused on increasing fruit and vegetable consumption in youth, but seeks to focus largely on an environmental component.<br>***REPLICATION/ ADAPTATION:*** The study was adapted from the 5-A-Day Power Plus Program in St. Paul, MN.<br>***ADOPTION:*** Not reported<br>***IMPLEMENTATION:*** Research team developed the intervention, trained the school food staff (1-day training sessions), worked with school staff to increase the quality/quantity of fruits and vegetables served and visited weekly to support/ organize events. Monthly meetings were held during the 1st school year with the cook managers from each intervention school to discuss and share implementation issues and new ideas. The meetings were quarterly during the second year.<br>***FORMATIVE EVALUATION:*** Not reported<br>***PROCESS EVALUATION:*** Direct observations of the lunchroom, lunch line, food cart and food service staff behavior (number of fruits and vegetables students could choose on lunch line, appeal of fruits and vegetables served, verbal encouragement of food service staff, number of fruits and vegetables on snack cart). Trained observers conducted 320 observations throughout the second year of the intervention. | ***RESOURCES:***<br>1. Funding for fruits and vegetables and monthly samplings<br>2. Posters<br>3. Prizes for winners of "challenge week,"<br>4. Personnel to train food service and cook managers<br>5. Theater production resources<br>6. Funds to organize final special event<br>***FUNDING:*** National Cancer Institute<br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. Verbal encouragement by food service staff in the lunch line was significantly associated with fruit and vegetable consumption (no potatoes, no juice) at follow-up ($R^2$=0.40; regression coefficient= 0.64, p=0.001), fruit and vegetable consumption (no potatoes) at follow-up ($R^2$= 0.26; regression coefficient= 0.52, p=0.007), fruit consumption (no juice) at follow-up ($R^2$= 0.24; regression coefficient= 0.49, p=0.011) and increased consumption of fruits and vegetables (no potatoes, no juice) from baseline to follow-up (regression coefficient= 0.34).<br>2. Number of fruits and vegetables on the snack cart was associated with increased fruit and vegetable consumption from baseline to follow-up ($R^2$=0.45; regression coefficient= 0.53, p=0.001).<br>3. Intervention schools had greater verbal encouragement from food service staff than control schools (42% of observations vs. 11% of observations, p=0.01) and more fruits and vegetables that students could choose (mean= 4.37 vs. mean= 3.89, p<0.0001). |

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| Lytle, Kubik (2006); Klein, Lytle (2008);Story, Lytle (2002); Birnbaum, Lytle (2002); Lytle, Murray (2004); Lytle, Gerlach (2001); Lytle, Perry (2001); Kubik, Lytle (2003)<br><br>Minnesota | TEENS study: School policy to increase offerings & sales of fruits and vegetables (F&V) and low fat snacks<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>1. School nutrition advisory councils<br><br>*Complex:*<br>1. Classroom curriculum component using peer leaders (7th grade curriculum only)<br>2. Family newsletters included behavior coupons, tips sheets for eating more F&V and lower fat snacks | ***DESIGN:*** Group randomized trial<br><br>***DURATION:*** 1997-2000<br><br>***SAMPLE SIZE:*** 3503 students from 16 middle schools (8 control, 8 intervention) in St Paul and Minneapolis, MN; 845 environment only, 677 curriculum plus environment; 1755 control<br><br>***PRIMARY OUTCOME:*** Fruit and vegetable (F&V) consumption<br><br>***MEASURES:***<br>1. Parent surveys [random sub-sample] (food choices)<br>2. Observations of types and amounts of F&V choices offered and sold<br>3. Peer leader and student evaluation forms<br>4. Teacher interviews (perceptions of the curriculum, effectiveness of peer leaders, responsiveness of students)<br>5. Student 24-hour food recalls<br>6. Student surveys (frequency of consuming F&V during the past year, demographics) – usual F&V intake measured by a modified Behavioral Risk Factor Surveillance System (BRFSS) measure<br><br>***DATA COLLECTION:*** Lunch observations and a la cart line offerings were collected over a 5-day period at baseline and follow-up. Peer leaders completed an evaluation form at the end of the 7th grade intervention to assess their perception of being a peer leader. All other students were asked to evaluate their perceptions of the curriculum and the helpfulness of the peer leaders. Students were randomly selected for 24-hour food recall at baseline and follow-up. Student surveys were conducted in the fall of 1998 and at the end of the seventh grade intervention (Spring 1999).<br><br>***LIMITATIONS:*** No baseline data were collected from parents; data were self-reported; no data on food-choice score corresponding with changes in overall fat intake; possible insufficient power to detect differences within exposure groups; no assessment of separate contributions of classroom and family components; modified BRFSS for estimating F&V consumption was not validated on this population; the food choice score is a non-validated instrument; some students were not exposed to the classroom curriculum at all due to scheduling | Urban, 11-18 year olds<br><br>68.7% White, 10.4% African American, 6.9% Asians or Pacific Islanders, 5.6% multi-racial, 8.5% other racial/ethnic groups, 19.8% lower-income (sample)<br><br>***ELIGIBILITY:*** Schools were included if they were within a 30 mi. radius of Minneapolis/St Paul, had 20% of students qualified for free/reduced price lunch, had 7th & 8th grades in same building and had at least 30 students per grade. Parental consent was required.<br><br>***EXPOSURE/ PARTICIPATION:*** 48.5% of eligible schools participated in the intervention; attendance logs tracked participation in peer leader training; number of behavioral coupons returned used to measure family participation | ***LEAD AGENCY:*** TEENS research team<br><br>***THEORY/ FRAMEWORK:*** Social Cognitive Theory & Trans-theoretical Model<br><br>***EVIDENCE-BASED:*** Study builds off of previously successful multi-component interventions, but focuses on the less studied 7th & 8th graders<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** School nutrition advisory councils formed to develop and implement the intervention.<br><br>***IMPLEMENTATION:*** TEENS research team trained peer leaders to assist the teachers with the classroom curriculum. Teachers attended a one-day training session. Peer leaders led small group discussions, conducted hands-on activities, organized food preparation, and facilitated group decision making and problem solving. Classroom teachers also monitored all peer-led activities and were responsible for the program organization, class management, and program content. The 7th grade curriculum involved ten 45-minute classroom sessions. Advisory Councils worked with school food service to discuss school-level policy to increase offerings and sales of F&V.<br><br>***FORMATIVE EVALUATION:*** Assessment of school food service staff; phone surveys with parents and teens; school principals interviews; direct observations of the extent and diversity of foods available; focus groups with adolescents from target population.<br><br>***PROCESS EVALUATION:*** School lunch observation (types and amount of F&V); classroom observation (fidelity) conducted for 4 of the classroom sessions; teacher rating (degree of implementation); school nutrition advisory council meeting logs | ***RESOURCES:***<br>1. Peer leader manuals, training<br>2. Newsletters<br>3. Behavioral coupons<br>4. Videos, audio tapes, low-fat snacks, and comic strips for classroom activities<br>5. Funds to increase availability of fruits and vegetables and changes to low-fat snack offerings<br><br>***FUNDING:*** National Cancer Institute (intervention), Minnesota Obesity Center and University of Minnesota (evaluation)<br><br>***STRATEGIES:*** TEENS 7th grade curriculum has been placed on a website for wide dissemination. | ***NUTRITION:***<br>*End of year 1:*<br>1. After year one, there was an increase of about one full serving daily in fruit and vegetable consumption for peer leaders ($p<0.012$).<br>2. After year one, there was a half of one serving daily increase in fruit and vegetable consumption in curriculum + environment change group ($p=0.058$).<br>3. After year one, there was an increase in usual food choice score (higher score equals lower fat consumption) among peer leaders (from 5.90 to 6.54, $p=0.002$) and students exposed to the curriculum and environment change (from 5.68 to 6.32, $p<0.001$)<br><br>*End of year 2 (follow-up):*<br>4. The positive effect in F&V consumption seen after 1 year of intervention was not maintained at follow up. The only significant effect was seen for usual food choice score (non-validated instrument). A greater level of intervention exposure resulted in a statistically significant higher food choice score (omnibus test $p= 0.01$).<br><br>***ENVIRONMENT CHANGE:***<br>5. The differences in healthier items offered in the a la carte line between the intervention and control schools was significant ($p=0.04$).<br><br>***OTHER:***<br>6. Parents of intervention children reported being more likely to select lower fat choices compared to parents of control children (mean = 4.73 vs. 4.26, $p=0.01$). |

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| Reynolds, Franklin (2000); Reynolds, Franklin (2000); Reynolds, Raczynski (1998); Harrington, Binkley (1997)<br><br>Alabama | High 5 program -<br><br>School policy to modify school lunches to increase fruit and vegetable (F&V) consumption by offering at least 10 F&V servings per week, modifying recipes to meet 5 A Day guidelines, offering salad bar or pre-plated salads<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br><br>*Complex:*<br>1. Classroom component- 14-lesson curriculum taught by 9 Curriculum Coordinators<br>2. Parent component- Kick-Off Night for parents; Freggie book (homework assignments, skill-building materials); Newsletter to parents<br>3. Food cues in the lunchroom to highlight fruits and vegetables<br>4. High 5 days – students challenged to eat 5 servings of F&V that day | ***DESIGN:*** Group randomized trial<br><br>***DURATION:*** 12-24 months<br><br>***SAMPLE SIZE:*** 3,396 participants from 28 elementary schools in 3 districts; 1,698 student/ parent pairs<br><br>***PRIMARY OUTCOME:*** Fruit and vegetable (F&V) consumption<br><br>***MEASURES:***<br>1. 24-hour diet recall interviews using Nutrition Data System<br>2. Cafeteria observations of F&V consumption<br>3. Student surveys to assess knowledge, stages of change, asking skills, outcome expectancies, perceived self-efficacy and social norms<br>4. Parent questionnaire using Health Habits and History Questionnaire<br><br>***DATA COLLECTION:*** 4 measurements taken at baseline, follow-up 1 (after the intervention), and follow-up 2 (one year after the intervention completion). Data were collected from students using 3 different assessment teams. Children's dietary behaviors were measured across 7 days using 24-hour dietary recall. Interviews were conducted via telephone on Saturday and Sunday to collect data from Friday and Saturday. Students were randomly assigned to the day of the interview. The data was entered into the Nutrition Data System on lap top computers. Research assistants observed the students' trays, and lunches brought from home and recorded the type and quantity of fruits and vegetables selected. Researchers recorded the amount of waste left for each fruit and vegetable selected. Students brought home parent surveys to be completed by the parents.<br><br>***LIMITATIONS:*** 24-hour dietary recalls were self-reported; completion of the more effortful family-intervention activities was low; problems were encountered with the accurate completion of the food-frequency assessment by parents | 50% Parents<br><br>50% 5-10 year olds<br><br>Students were<br><br>83% European American<br><br>16% African-American<br><br>1% other race/ ethnicity (sample)<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** 2,456 third grade students participated in the intervention activities; 24% of participants attended the Kick-Off Nights; 74% of the 100 food service workers attended the training | ***LEAD AGENCY:*** Researchers and school staff<br><br>***THEORY/ FRAMEWORK:*** Social Cognitive Theory<br><br>***EVIDENCE-BASED:*** Study builds off of previous theory-based interventions that combine classroom curriculum, school environment and families.<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** Curriculum Coordinators & teachers delivered the 3-day/wk curriculum. A Kick-Off Night was held at the school for parents who were encouraged to complete the Freggie Book with children. On High 5 Days, parents were alerted via a newsletter and asked to encourage everyone in the family to eat 5 servings of fruits and vegetables themselves. Food service personnel implemented the cafeteria intervention component.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** School cafeteria rated monthly completion of the intervention activities; each classroom coordinator completed a checklist and a diary of the activities conducted | ***RESOURCES:***<br>1. Curriculum lessons<br>2. Resources for the Kick-Off Night<br>3. Freggie Books prizes for drawings<br>4. Food service calendars<br>5. Star Rating certificates<br>6. Curriculum Coordinators<br>7. Newsletter to parents<br>8. Promotional materials<br>9. Food cues<br>10. Fruits and vegetables for the school lunches<br><br>***FUNDING:*** The intervention and evaluation were funded by the National Cancer Institute.<br><br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. There was higher reported fruit and vegetable intake in intervention vs. control at follow-up 1 and follow-up 2 (follow-up 1= 3.96 vs. 2.28 servings, $p<0.0001$; follow-up 2= 3.20 vs. 2.21, $p<0.0001$).<br>2. There was higher reported fruit intake alone (follow-up 1= 1.71 vs. 0.83, $p<0.0001$; follow-up 2= 1.21 vs. 0.65, $p<0.0001$) and vegetable intake alone (follow-up 1= 1.84 vs. 1.15, $p<0.0001$; follow-up 2= 1.60 vs. 1.25, $p<0.009$) in the intervention vs. control group.<br>3. Intervention effects on fruit and vegetable consumption were not obtained in the cafeteria observations.<br>4. At follow-up 1 and 2, after adjusting for baseline levels, the intervention students had a smaller percentage of calories coming from total fat (follow-up 1= 30.93 vs. 33.37, $p<0.003$; follow-up 2= 31.56 vs. 33.23, $p<0.0402$) and saturated fat (follow-up 1= 11.07 vs. 12.00, $p<0.009$; follow-up 2= 11.49 vs. 12.24, $p<0.0249$) but had higher levels of calories coming from carbohydrates, fiber, folate, β carotene and vitamin C (data not shown) compared to the control students.<br>5. There was a higher combined fruit and vegetable consumption in the intervention vs control group at follow-up 1 (4.23 vs. 3.94, $p<0.0366$). The only significant difference between conditions was for vegetable consumption (2.38 vs. 2.21, $p<0.0359$).<br>6. There were no differences between conditions for parent consumption at follow-up 2 (p=ns).<br><br>***ENVIRONMENT CHANGE:***<br>7. In the intervention cafeteria at follow-up 1, a mean of 3.5 servings of fruits and vegetables were offered to students, a mean of 3.6 High 5 posters were exhibited, and a mean of 4.4 food labels were displayed. |

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| Perry, Bishop (1998); Story, Mays (2000)<br><br>Minnesota | 5-a-Day Power Plus - School policy to increase fruit and vegetable (F&V) consumption by increasing the variety and choice of fruits and vegetables served and offering an additional fruit choice on days when baked or frozen desserts are served<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>1. Classroom curricula including sixteen, 40-45 minute classroom sessions, twice a week for 8 weeks (skill building, problem solving activities, snack preparation, taste testing and stories)<br>2. Point of Purchase promotions for fruits and vegetables at food service areas<br>3. Incentives for students who ate 2 or more servings of F&V at school<br>4. Family activity packets & snack packs<br>5. Local producer provided some fruits and vegetables for use in classroom taste testing, home snack packs and school lunch. They also provided a 30 minute presentation on fruits and vegetables to each of the 5th grade intervention classrooms. | ***DESIGN:*** Group randomized trial<br><br>***DURATION:*** 12-24 months<br><br>***SAMPLE SIZE:*** 1,750 students in grades 4-5 from 20 schools (10 intervention, 10 control)<br><br>***PRIMARY OUTCOME:*** Fruit and vegetable consumption<br><br>***MEASURES:***<br>1. 24-hour food-recall<br>2. Lunchroom observations (participation, dose, fidelity)<br>3. Parent phone survey (F&V consumption)<br>4. Health behavior questionnaire (HBQ) (F&V consumption, demographics)<br>5. School file reviews (student demographics)<br>6. Principals' surveys (additional nutrition related curricula)<br>7. Food service supervisors' surveys (events influencing F&V consumption)<br><br>***DATA COLLECTION:*** 24 hour recalls were collected at baseline from a random sample of 34 students per school. Lunch observations were completed by trained observers on the same sample of 34 students. Parents of the students who completed the 24 hour food recall completed a 15 min. telephone survey (within 2 months of the school survey). All students completed the HBQ at baseline and follow up.<br><br>***LIMITATIONS:*** Curriculum delivered at same time as DARE and individual standardized tests | Urban<br><br>Lower income<br><br>5-10 year olds<br><br>48% White, 25.2% Asian American, 19.1% African American, 6.4% Hispanic, 1.3% Native American (evaluation sample)<br><br>More than 60% of the students received free or reduced-cost school lunches (evaluation sample)<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** 1,750 fourth-grade students enrolled in the 20 participating inner-city public schools received the intervention; training sessions were attended by 100% of the teachers; training sessions for cooks were attended by 2/3 of the cooks. | ***LEAD AGENCY:*** Research team<br><br>***THEORY/ FRAMEWORK:*** Social Learning Theory<br><br>***EVIDENCE-BASED:*** Study built off of previously effective school-based, multi-component interventions.<br><br>***REPLICATION/ ADAPTATION:*** Study built on the conceptual categories used in the process evaluation for the CATCH study.<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** School teachers attended a 1-day training session and implemented grades 4-5 curriculum of 16 sessions. Food service attended a 2-hour training session and implemented lunch changes and prepared snack packs to take home.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** All teachers were observed twice (once during a taste testing session, and once during a lesson session) during each 8 week program. They also filled out questionnaires regarding their self efficacy teaching the classroom curricula and food service changes. An observation based process evaluation method was used to assess the food service intervention implementation. Direct observation was used to assess student participation and school food environment changes. | ***RESOURCES:***<br>1. Incentives/ prizes<br>2. Funds for F&V<br>3. Point of purchase strategies<br>4. Funds for theater production and events<br>5. Cost of substitute teachers during teacher trainings<br>6. Funds for food service staff for training<br>7. Curriculum<br><br>***FUNDING:*** National Cancer Institute<br><br>***STRATEGIES:*** The school district has provided Power Plus for all fourth grade teachers for the 3 years since the study ended (179 classes, 4,763 students). | ***NUTRITION:***<br>1. Observations showed that there was a higher intake of F&V (mean difference= 0.47 servings, $p<0.0001$) and fruit alone (mean difference= 0.30 servings, $p<0.0001$) in the intervention schools compared to the control schools.<br>2. Observations showed no difference between the intervention and control schools in percent of calories consumed from fat and saturated fat.<br>3. There was a significant intervention effect observed among girls for vegetable consumption at lunch (change= 0.26 servings, $p<.05$) but not among boys (change= 0.04 servings).<br>4. Vitamin A and C intake were also found to be higher in intervention vs. control schools, due only to effects among girls (change = 13.73 mg, $p<0.001$).<br>5. Higher intake of F&V per 1000 kcal (mean difference= 0.41 servings, $p=0.02$), servings of fruit (mean difference= 0.62 servings, $p=0.02$), servings of fruit/per 1000 kcal (mean difference= 0.05 servings, $p=0.02$) and decrease in percentage of kcal from total fat (mean difference= -1.81, $p=0.02$) were reported in the intervention group.<br>6. There was a significant and favorable intervention effect reported among girls for vitamin C consumption (mean difference= 27.73, $p=0.02$), but no effect among boys.<br><br>***ENVIRONMENT CHANGE:***<br>7. Intervention schools offered more F&V choices and F&V promotions compared to control schools. |

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| Bartholomew, Jowers (2006)<br>Texas | School food policies to reduce high-fat food choices.<br>*Phase 1:* Food service increased the frequency of days offering at least one lower-fat entrée (<30% of energy from fat).<br>*Phase 2:* Food service staff reduced the available high-fat entrée choices from three down to two each day.<br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br>*Complex:* Not reported | ***DESIGN:*** Group randomized trial<br>***DURATION:*** 6-12 months<br>***SAMPLE SIZE:*** 1,298 students from 2 central Texas elementary schools<br>***PRIMARY OUTCOME:*** Dietary consumption<br>***MEASURES:***<br>1. Sales report provided by food service directors completed daily (dietary selection [proxy for consumption])<br>***DATA COLLECTION:*** Food service staff collected daily sales reports.<br>***LIMITATIONS:*** Aggregate data prevents analyses at the student level; data limited to food selection, not consumption; only 2 schools used for study | Lower income<br>Hispanic<br>5-10 year olds<br>Intervention school – 73.4% Hispanic, 18.9% White, 6.1% African American and 1.6% other; 73.9% free or reduced-price lunch (entire school)<br>Control school – 63.5% Hispanic, 28.3% White, 6.7% African American and 1.3% other; 60% free or reduced-price lunch (entire school)<br>***ELIGIBILITY:*** Not reported<br>***EXPOSURE/ PARTICIPATION:*** All students from the two elementary schools were exposed to the school lunch changes. | ***LEAD AGENCY:*** Foodservice director and staff and the research team<br>***THEORY/ FRAMEWORK:*** Not reported<br>***EVIDENCE-BASED:*** Not reported<br>***REPLICATION/ ADAPTATION:*** Not reported<br>***ADOPTION:*** Not reported<br>***IMPLEMENTATION:*** The food service director, his staff, and a dietitian determined the fat content in each of the existing entrees in the school lunch. The food service staff and the research team worked together to implement the plan. Food service staff was asked to reduce the available high-fat entrée choices from three down to two each day, while maintaining the availability of moderate and low fat entrees.<br>***FORMATIVE EVALUATION:*** Not reported<br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Dietitian<br>2. Resources for determining fat content of existing entrees<br>***FUNDING:*** Texas Dept. of State and Health Services and the CDC Cooperative Agreement<br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. No significant differences were seen in entree selection during phase 1 between intervention and control schools. Low fat entrée selection was 15.4% in the intervention group vs. 11.3% in the control group (F=3.20 p=0.07), moderate fat entrée selection was 16.2% in the intervention group vs. 18.6% in the control group (F=0.11, p>0.10) and high fat entrée selection was 80.2% in the intervention group vs. 86.4% in the control group (F=2.74, p=0.10)<br>2. In phase 2, there was a significant difference seen in entrée selection between intervention and control schools. Low fat entrée selection was 32.1% intervention vs. 13.8% control (F=71.06 p<.01), moderate fat entrée selection was 26.4% intervention vs. 7.5% control (F=34.77, p<0.01) and high fat entrée selection was 70.4% intervention vs. 86.9% control (F=67.22, p<0.01)<br>***ENVIRONMENT CHANGE:***<br>3. Of the 207 intervention entrees observed during phase 1, 32.4% were low-fat, 19.8% were moderate-fat, and 47.8% were high-fat. In the control group 15% were low-fat, 22.2% were moderate-fat, and 62.8% were high-fat entrees.<br>4. In the intervention group 112 entrees were analyzed. Of the 112 intervention entrees analyzed during phase 2, 28.6% were low-fat, 21.4% were moderate-fat, and 50% were high-fat entrees. In the control group 26.5% were low-fat, 15.7% were moderate-fat, and 57.8% were high-fat entrees. |

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| Burgess-Champouxt, Chan (2007)<br><br>Minnesota | School policies to increase consumption of whole-grain foods by replacing refined-grain products with whole-grain products in school cafeterias<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>1. 5 lesson classroom curriculum consisting of 45 minute weekly lessons to improve knowledge and self-efficacy to identify and choose whole-grain foods<br>2. Family component: Weekly parent newsletters<br>3. Bakery and grocery store tours; "whole grain day" at a local milling museum | ***DESIGN:*** Non-randomized trial<br><br>***DURATION:*** < 6 months<br><br>***SAMPLE SIZE:*** 300 fourth and fifth grade students and parents from 2 suburban elementary schools in Minneapolis (Exposed =67 parent/child pairs, Unexposed=83 parent/child pairs)<br><br>***PRIMARY OUTCOME:*** Whole-grain consumption<br><br>***MEASURES:***<br>1. Direct observation of students' lunches<br>2. Student Questionnaire (knowledge, usual food choice, availability and self-efficacy)<br>3. Parent Questionnaire (frequency of whole-grain intake, availability of whole-grain foods in the home, role-modeling)<br><br>***DATA COLLECTION:*** Lunch meal observations were conducted by trained intervention staff at baseline and post-intervention. Meal observers recorded the amount of each food served at the beginning of lunch and subtracted the measured amounts remaining on the tray at the end of lunch. Meal observation and menu data were analyzed using the Nutrition Data System for research software version 2005.<br><br>***LIMITATIONS:*** Data are insufficient to de-confound the experimental effect from any school-by-time component of variance (due to only one intervention and control school); limited generalizability; short duration of program; possible selection bias; possible potential observer error (observers weren't blinded) | 5-10 year olds<br><br>Parents<br><br>Intervention group– 6.4% Hispanic, 3.2% Asian, 17.5% Black, 47.6% White, 9.5% American Indian, 23.8% other<br><br>Control group – 6.1% Hispanic, 6.1% Asian, 4.9% Black, 75.6% White, 6.1% American Indian, 7.3% other<br><br>***ELIGIBILITY:***<br>5th grade band students excluded due to scheduling conflicts<br><br>***EXPOSURE/ PARTICIPATION:***<br>All 4th and 5th grade students from the intervention school were exposed to the intervention. Participation was measured for the family events and classroom components. 94% children participated in lessons and completed the workbook. | ***LEAD AGENCY:***<br>Researchers and school staff<br><br>***THEORY/ FRAMEWORK:*** Social Cognitive Theory<br><br>***EVIDENCE-BASED:***<br>Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:***<br>Trained research assistants implemented the classroom curriculum and food service staff modified the school lunches to include more whole grains. A teacher and/or principal attended each of the classroom lessons to provide disciplinary assistance as needed. Food service staff took a 1-hour training session to learn about menu modifications.<br><br>***FORMATIVE EVALUATION:*** Focus group discussions, pilot-tested lessons with 5th graders from another school, taste-tested new products before modifying menus<br><br>***PROCESS EVALUATION:*** Site visits conducted 2-3 times/week by researchers and quality control logs completed | ***RESOURCES:***<br>1. Personnel to train food service staff<br>2. Incentives ($10-50 for participation)<br>3. Curriculum workbooks<br>4. Flash cards<br>5. Treasure maps<br>6. Newsletters<br>7. Funding to offset additional costs associated with menu changes<br>8. Nutritionist to modify menu<br>9. Funds for whole-grain products<br>10. Funding for events<br><br>***FUNDING:*** Allen Foundation<br><br>***STRATEGIES:*** Not applicable – pilot efficacy study | ***NUTRITION:***<br>1. Consumption of whole grains increased by about 1 serving ($p<0.0001$) and refined-grains decreased by about 1 serving ($p<0.001$) for intervention vs. control children.<br>2. Compared to control schools, intervention schools had higher changes in dietary fiber (1.3g vs. -0.4g, $p=0.001$), riboflavin (0.03mg vs. -0.06mg, $p=0.03$), and iron (0.4mg vs. -0.4mg, $p=0.04$). There were no significant differences found for energy, thiamin, or folate.<br>3. Self-reported parent intake of refined-grain decreased in intervention vs. control parents (-0.3 vs. 0.1, $p<0.01$).<br><br>***ENVIRONMENT CHANGE:***<br>4. There was greater availability of whole-grain foods in student lunches in intervention vs. control schools: 1.05 mean serving increase vs. 0.09 mean serving increase ($p<0.0001$).<br><br>***OTHER:***<br>5. Pre/post changes in role-modeling (mean increase = 2.2 for intervention vs. 0.6 for control, $p<0.001$) and enabling behaviors (mean increase = 2.8 for intervention vs. 1.3 for control, $p<0.05$) were significantly greater for the intervention school than for the control school. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Nucci, Stuhldreher, (2003)<br><br>West Virginia and Pennsylvania | School nutrition policies to improve dietary intake – implementation of the West Virginia standards for school nutrition (WVSNS - details of the intervention not reported)<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Before and after study, with comparison group<br><br>***DURATION:*** > 2 years<br><br>***SAMPLE SIZE:*** 239 sixth grade students in West Virginia (baseline; n=98, after intervention; n=71) and Pennsylvania (control; n=70)<br><br>***PRIMARY OUTCOME:*** Dietary intake: <30 % of calories from fat; <10 % of calories from saturated fat; <100 mg of cholesterol; <6 gram of fiber; <1.100 mg of sodium<br><br>***MEASURES:***<br>1. 24 hour dietary recalls (dietary consumption)<br>2. Food observations during school lunch (dietary consumption)<br><br>***DATA COLLECTION:*** Researchers observed lunch trays during lunch. Trays were labeled at the beginning of the serving line and researchers examined the trays after lunch to record the amounts consumed. An observation was performed for every student at least once. Data from the observations were compared with the dietary recall of that same lunch to assess the quality of the recall. Dietary data were analyzed using Nutritionist IV software. The term "before cohort" refers to dietary intake data collected from students prior to standard implementation. The term "after cohort" refers to dietary intake data collected from students during the time period the WVSNS were in place.<br><br>***LIMITATIONS:*** The specific influence of other foods eaten during the day on nutrient intake was not assessed; the time period for the intervention to be implemented may not have provided sufficient time for students to adapt to the changes | Lower income<br><br>11-13 year olds<br><br>70% of students in the communities received free or reduced-price meals<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** Participation in the program by school and staff measured by available data from students (over 90%) | ***LEAD AGENCY:*** Research team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** Not reported<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Tracked implementation of action points in school action plans | ***RESOURCES:*** Not reported<br><br>***FUNDING:*** Child Nutrition Foundation (Hubert Humphrey Research Grant)<br><br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. There were lower levels of cholesterol in the WV after cohort (from 76.2±31.9mg to 54.0±20.0mg, p<0.001 males; from 61.1±56.0mg to 37.0±29.0mg, p<0.01 females), and females in the after cohort consumed lower mean sodium (from 1245.3±527.4mg to 812.0±392.0mg, p<0.001).<br>2. Mean total fat reported as the percentage of calories, decreased in the WV after cohort (from 39.5±8.3% to 33.6±7.3%, p<0.001 males; and from 37.2±9.3% to 31.6±9.3%, p<0.05 females).<br>3. There were no differences in the percentage of calories from saturated fat between the two time periods.<br>4. Compared to the PA unexposed cohort, the WV after cohort had lower mean levels of protein (26.0±8.0g vs. 29.0±7.0g, p<0.01 males; 18.0±9.0g vs. 25.0±8.0g, p<0.01 females) and calories (547.0±164.0 vs. 662.0±122.0, p<0.001 males; 377.0±159.0 vs. 607.0±179.0, p<0.001 females).<br>5. There were noticeable decreases among the WV after cohort for iron, zinc and fiber, and among females for vitamin B6 and calcium (data not shown).<br>6. Higher mean values for thiamin, calcium, and iron were observed among the PA cohort compared to the WV after cohort. Mean zinc intakes were higher for the PA cohort among females (data not shown).<br><br>***UNINTENDED NEGATIVE EFFECTS:***<br>7. The percentage of students in the WV after cohort that met the standard for vitamins and minerals (except vitamin C) dropped.<br>8. Fewer than 25% of the WV after cohort met the standards for vitamin A, thiamin, vitamin B6, calcium, iron and zinc. The frequency of those compliant for these nutrients dropped and this decrease was disturbing, especially for iron (34% to 7%), zinc (22% to 3%) and thiamin (62% to 20%).<br>9. Caloric intake was lower for the WV after cohort and was less than the standard. |

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| Slusser, Cumberland (2007)<br><br>California | School policy to increase access to healthy food options in schools through introduction of a salad bar<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>1. Field trips to a farmers' market and/or a farm<br><br>*Complex:*<br>1. Children's artwork displayed in the cafeteria to advertise the program<br>2. All-school assembly to teach proper etiquette of serving salad and picking a well-balanced lunch | ***DESIGN:*** Before and after<br><br>***DURATION:*** > 24 months<br><br>***SAMPLE SIZE:*** 337 children from three Los Angeles Unified School District elementary schools<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. 24-hour food recalls (fruit and vegetable consumption)<br><br>***DATA COLLECTION:*** Face-to-face interviews, using food prompts, in the morning or afternoon during the school day. Students asked about the 24 hours prior to the time of the interview. Interviews were conducted over a one-week period in each school during the same fruit and vegetable growing season. Post-intervention interviews were 2 months or more after the introduction of the salad bar menu option.<br><br>***LIMITATIONS:*** There was a 2 year gap between the pre-and post-intervention data collection; some researchers identify limitations of the 24-hour food recall as a dietary assessment tool | Urban<br><br>Lower income<br><br>7-11 year olds<br><br>Approximately 25% Hispanic, 34.4% African American, 37.5% Asian, 1% Other, and 2.1% Unknown (sample)<br><br>All of the children in the 3 schools were eligible to participate in the free or reduced-price lunch program<br><br>***ELIGIBILITY:***<br>Participation criteria included:<br>1. Children attending the 2nd to 5th grade<br>2. Attendance at one of the three LAUSD elementary schools participating in the salad bar pilot program<br>3. School must have data from 1998 study (prior to salad bar lunch program)<br><br>***EXPOSURE/ PARTICIPATION:***<br>All students from the 3 schools were exposed to the lunch salad bar. | ***LEAD AGENCY:*** The research team<br><br>***THEORY/ FRAMEWORK:***<br>Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:***<br>The teachers taught children about the salad bar in a school assembly and implemented the educational components of the intervention. The cafeteria manager prepared fruits and vegetables that were perceived as culturally acceptable to the student population they served. The salad bar also had food items that contained protein, dairy, and grain. Children who chose the salad bar for lunch were required to have four different food groups on their trays in order for the food services to meet the USDA's "Lunch Guidelines for hot or salad bar lunches." This rule was enforced by food service staff who supervised the salad bars daily during lunch period. Children could chose the salad bar or hot lunch during the lunch period, and those who chose the salad bar could go back for seconds while those eating hot lunch could not.<br><br>***FORMATIVE EVALUATION:***<br>Not reported<br><br>***PROCESS EVALUATION:***<br>Not reported | ***RESOURCES:***<br>1. Cost associated with salad bar<br>2. Resources for school assembly and field trips<br>3. Children's artwork to promote the program<br><br>***FUNDING:*** The Joseph Drown Foundation & UC Davis<br><br>***STRATEGIES:***<br>LAUSD school board voted positively on an Obesity Prevention Motion in 2003 that includes recommending fruit and vegetable bars as a modification of the hot lunch program. | ***NUTRITION:***<br>1. Frequency of fruit and vegetable consumption increased between 1998 and 2000 (from a mean [SD] of 2.97 [2.0] to 4.09 [2.7], $p<0.0001$).<br>2. Frequency of fruit and vegetable consumption increased significantly in 2000, compared with 1998, when age and gender were analyzed separately ($p<0.01$ and $p<0.0001$, respectively; mean frequency not reported).<br>3. The increase in frequency of fruits and vegetables consumed was almost completely related (84%) to an increase during lunch.<br>4. Significantly lower mean daily intakes of energy (1607 kcal vs. 1804 kcal, $p=0.03$), cholesterol (202 mg vs. 251 mg, $p=0.02$), saturated fat (19 g vs. 26 g, $p<0.0001$) and mean percentage energy from fat intake (31% vs. 33%, $p=0.03$) in the children in the year 2000 sample compared with children in the year 1998 sample. |

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| Gleason, Suitor (2003)<br><br>United States | Access to healthy lunch options at school: National School Lunch Program (NSLP)<br><br>**OTHER INTERVENTION COMPONENTS:**<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | **DESIGN:** Cross-sectional study<br><br>**DURATION:** Not applicable<br><br>**SAMPLE SIZE:** 1,680 students, ages six to eighteen; independently drawn from the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII), nationally representative sample<br><br>**PRIMARY OUTCOME:** Dietary intake<br><br>**MEASURES:**<br>1. Continuing Survey of Food Intakes by Individuals (CSFII) measured dietary intake and foods obtained from the school cafeteria<br><br>**DATA COLLECTION:** Dietary intakes of all sample members were collected by the CSFII on 2 nonconsecutive days during the survey year, using in-person 24-hour dietary recalls.<br><br>**LIMITATIONS:** The CSFII has no information on foods students selected from the cafeteria but did not consume; potential bias due to self selection and possibility that NSLP participants are different than nonparticipants because of food preference (controlled for by using fixed effects models); NSLP participants and nonparticipants differ on: income, ethnicity, gender and age (controlled for these variables in the analysis) | 6-18 year olds<br><br>NSLP participants: 60% non-Hispanic White, 18% non-Hispanic Black, 17% Hispanic, 5% Other, 47% lower-income (≤185% of poverty)<br><br>NSLP non-participants: 74% non-Hispanic White, 12% non-Hispanic Black, 10% Hispanic, 4% Other, 32% lower-income<br><br>**ELIGIBILITY:** For the subsample analyzed, eligible children were non-institutionalized, attending schools offering the NSLP, and had reported at least 2 days of dietary intake information. Students with missing information (66) were excluded from the fixed effects model.<br><br>**EXPOSURE/ PARTICIPATION:** Not applicable | **LEAD AGENCY:** The research team for the current analysis; CSFII investigators for the initial data collection<br><br>**THEORY/ FRAMEWORK:** Not reported<br><br>**EVIDENCE-BASED:** Not reported<br><br>**REPLICATION/ ADAPTATION:** Not applicable<br><br>**ADOPTION:** Not applicable<br><br>**IMPLEMENTATION:** Not applicable<br><br>**FORMATIVE EVALUATION:** Not reported<br><br>**PROCESS EVALUATION:** Not reported | **RESOURCES:** Not applicable<br><br>**FUNDING:** The evaluation was conducted under contract for the Food and Nutrition Service (FNS) of the USDA. CSFII Survey funding not reported.<br><br>**STRATEGIES:** Not applicable | **NUTRITION:**<br>*Ordinary Least Squares Model*<br>1. After controlling for demographic characteristics, NSLP participants consumed an average of 30% of the Recommended Energy Allowance (REA) at lunch, compared with 26% among nonparticipants ($p<0.01$). This difference persisted over the remainder of the day: the 24-hour food energy of participants (94% of the REA) exceeded that of nonparticipants (88%).<br>2. After controlling for demographic characteristics, NSLP participants consumed an average of 30% of the Recommended Energy Allowance (REA) at lunch, compared with 26% among nonparticipants ($p<0.01$). This difference persisted over the remainder of the day: the 24-hour food energy of participants (94% of the REA) exceeded that of nonparticipants (88%).<br>3. NSLP participants had significantly larger mean lunchtime and 24-hour intakes of sodium (lunch 1117 vs. 901 mg, $p<0.01$; 24 hour 3377 vs. 3065, $p<0.01$), cholesterol (lunch 67 vs. 46 mg, $p<0.01$; 24 hour 225 vs. 205 mg, $p<0.05$) and lunchtime fiber intake (4.8 vs. 4.0 g, $p<0.01$) than nonparticipants.<br>4. After controlling for demographic characteristics, NSLP participants who ate school lunches consumed more fat and protein than nonparticipants. However, participants' consumption of carbohydrates--added sugars in particular--was lower than that of nonparticipants. Over 24 hours, participants consumed an average of 34% of calories from total fat and 13% from saturated fat; in contrast, nonparticipants consumed 32% and 12% of calories from total and saturated fat, respectively ($p<0.01$ for both).<br>5. Participants' regression adjusted mean intake of added sugars contributed 17% of their 24 hour food energy, compared with 20% for nonparticipants. Thus, even though NSLP participants' food energy intake was higher than that of nonparticipants, their mean absolute intake of added sugars was lower (22 versus 24 teaspoons).<br><br>*Fixed Effects Model (controlled for selection bias, N=1614)*<br>6. Unlike the ordinary least squares results, the fixed effect results showed that NSLP participation was not significantly related to children's intakes of food energy, sodium and cholesterol. However, both models found that participation led to a significant increase in dietary fat intake and a significant decrease in children's intake of added sugars.<br>7. NSLP participation had a significant positive impact on the intake of 6 vitamins and minerals, both at lunchtime and over 24 hours (data not shown). |

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| **School Meal Policies - International** | | | | | | |
| Haerens, Deforche (2006); Haerens, De Bourdeauduij (2007); Haerens, De Bourdeauduij (2007); Haerens, Cerin (2007); Haerens, Cerin (2008); Haerens, Deforche (2006)<br><br>Belgium | School policy to increase healthy food choices by:<br>1. Offering fruit for dessert during lunch<br>2. Offering water for free through drinking fountains<br>3. Selling fruit at school for a very low price or for free at least once a week<br>4. Pricing water lower than soft drinks<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>1. Physical activity (PA) component to increase levels of moderate to vigorous physical activity (MVPA) to at least 60 min/day. Activities included PA during breaks using varied content to reach all students, provision of extra sports materials, encouragement of active transportation to school, and a computer-tailored PA classroom lesson.<br><br>*Complex:*<br>1. Computer-tailored classroom lesson on fat and fruit intake<br>2. Parent component including interactive meeting on healthy living, newsletters/ school paper 3 times/yr and adult computer-tailored intervention for fat intake and PA | ***DESIGN:*** Group randomized trial<br><br>***DURATION:*** 2 school years<br><br>***SAMPLE SIZE:*** 2434 seventh and eighth grade students in 15 schools (5 schools= parent component; 5 schools= no parent component; 5 schools= no intervention); 2287 students included in 2 year sample<br><br>***PRIMARY OUTCOME:*** Overweight/obesity (Body Mass Index[BMI])<br><br>***MEASURES:***<br>1. BMI- Height and weight<br>2. Flemish PA questionnaire (FPAQ).<br>3. Accelerometers (N= 258)<br>4. PA diary (activities done without accelerometer)<br>5. Self administered questionnaire (fat intake)<br>6. Food frequency questionnaires (fruit, water, soft drink intake)<br>7. Implementation questionnaire (implementation of the intervention activities)<br><br>***DATA COLLECTION:*** Students completed the questionnaires once a year. BMI was measured at baseline, 1 year, and 2 years. A subsample of students wore the accelerometer for four weekdays and two weekend days. Students recorded their activities in the diary. One workgroup member from each intervention school completed the implementation questionnaire at the end of the 2 year intervention.<br><br>***LIMITATIONS:*** Self-reported data; high attrition rate (25%); risk for clustering of outcome variables within schools due to randomization at the school level; schools not matched on key characteristics resulting in a gender disparity across conditions; accelerometers only used in a subsample of 7th graders; not possible to determine which component of the intervention had significant effects | 11-18 year olds<br><br>68% lower income (evaluation sample)<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** All children in the 10 intervention schools were exposed to the healthy eating and physical activity policies; all children in the 5 intervention with parent schools were exposed to the parent component. | ***LEAD AGENCY:*** Research team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** The study builds off previous successful interventions that targeted the environment and computer-tailored physical activity interventions. The current study combines these two approaches.<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** The research team developed the intervention (including the intervention manual). In year one the research team led a work group composed of school staff that helped to guide the intervention delivery. The school staff made changes to the food environment, physical activity environment, and led the parent component.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Computers<br>2. CD-ROM for the adult computer intervention<br>3. Sports materials (jump ropes, balls etc.)<br>4. Funds for subsidizing fruit and water<br>5. Materials for meetings with parents<br>6. Newsletters for parents<br><br>***FUNDING:*** Federal Flemish government funds<br><br>***STRATEGIES:*** Not reported | ***OVERWEIGHT/OBESITY:***<br>*After Two Years*<br>1. For all analyses, variance at the school level was not significant (all z< 1.59).<br>2. For girls there was a significantly lower increase in BMI (from 20.23 ± 3.95 to 21.34 ± 3.83) in the intervention with parent group compared to control (from 19.12 ± 3.50 to 20.78 ± 3.66), F=12.52, p<0.05.<br>3. For girls there was a significantly lower increase in BMI z score (from 0.24 ± 1.11 to 0.24 ± 1.06) in the intervention with parent group, compared to control (from -0.03 ± 1.05 to 0.14 ± 1.00), F=8.61, p<0.05.<br>4. In addition, there was a significantly lower increase in BMI z score (from 0.24 ± 1.11 to 0.24 ± 1.06) in the intervention with parent group, compared to intervention no parent group (from 0.28 ± 0.97 to 0.35 ± 0.96), F= 2.68, p=0.05.<br>5. In boys, no significant positive intervention effects were found.<br>6. BMI z-score increased significantly more in schools with low levels of implementation, when compared with schools with medium (F=5.03, p<0.05) and high (F=2.80, p<0.05) levels of implementation. After 2 years of the intervention, BMI z-score increased with 0.12 units in the schools with low levels of implementation and with 0.06 and 0.09 units, respectively, in schools with medium and high levels of implementation.<br><br>***NUTRITION:***<br>*After One Year*<br>7. The intervention was not effective in increasing self reported fruit intake and water consumption or decreasing soft drink consumption.<br>8. Fat intake decreased significantly more in girls in the intervention with parent group, compared to the intervention no parent group (F=6.1, p<0.05) and control group (F=17.3, p<0.001).<br>9. Percentage of energy from fat also decreased significantly more in girls in the intervention with parent group, compared to the intervention no parent group (F=3.9, p<0.05) and control group (F=16.7, p<0.001).<br>10. No significant effect for fat intake or percentage of energy from fat among boys.<br><br>*After Two Years*<br>11. In year 2 for girls, decreases in fat intake were higher in the intervention groups (-20g/day) when compared to control group (-10g/day), F=5.8, p<0.05. Percentage of energy from fat decreased by 9% in the intervention group and 5% in the control group (F=13.3, p<0.001).<br>*(continued next page)* |

| (Continued from previous study) | | | | | | |
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| | | | | | | ***PHYSICAL ACTIVITY:***<br>12. Based on the physical activity questionnaire, the intervention with parent group increased their total physical activity by 9.0 min day-1 (95% CI: 2.9, 15.2; p=0.004) more than did the control group.<br>13. Based on the physical activity questionnaire, school related PA increased significantly in the two intervention groups (+6.4 min/day, d=0.40 with parent support group; +4.5 min/day, d=0.29 without parent support group) compared to controls (no change), p<0.05 for both.<br>14. Based on the physical activity questionnaire, girls leisure time active transportation remained stable in the no parent intervention group, while it decreased on average 4 minutes daily in the control group (F=12.1, p<0.001, d=0.28). In boys, there were no significant differences.<br>15. Based on the physical activity questionnaire, significant differences were also found between the intervention with parent group and the control group on changes in active transportation to/from school (2.1 min day-1, 95% CI: 0.6, 3.6; p=0.006) and changes in school-related sporting activities (2.1 min day-1, 95% CI: 0.5, 3.7; p=0.012). No significant differences were found between the control group and intervention with no parent group.<br>16. Based on accelerometry data, MVPA increased an average of 4 min. daily in the intervention with parent group, and decreased 7 min. daily in the control group (F=5.1, p≤ 0.05; d=0.46).<br>17. Based on accelerometer data, PA of light intensity decreased an ave. of 21 min daily in the intervention with parent group and decreased by 57 min on ave. daily in the control group (F=5.1, p≤ 0.05; d=0.54).<br>*After Two Years*<br>18. In boys, school-related physical activity increased significantly more in the intervention groups (from 18.3 ± 18.7 to 25.2 ± 21.4) compared with the control group (from 22.6 ± 14.8 to 23.8 ± 16.5), F=3.4, p<0.05.<br>19. For boys, accelerometer data revealed a trend for significant lower decreases in physical activity of light intensity in the intervention groups (-6 min/day) compared with the control group (-39 min/day), F=8.6, p<0.001.<br>20. Based on accelerometer data for boys, MVPA remained stable in the intervention group, but significantly decreased (-18 min/day) in the control group (F=3.5, p<0.08).<br>21. In girls, time spent in physical activity of light intensity decreased significantly less in the intervention groups (-2 min/day) compared with the control group (-20 min/day), F=4.6, p<0.05. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Bayer, von Kries (2009)<br>Germany | TigerKids Intervention - Provided at least 30 min/day vigorous physical activity.<br>**OTHER INTERVENTION COMPONENTS:**<br>*Multi-component:*<br>1. School policy for kindergartens to replace high energy density snack foods and sugared beverages with fruits and vegetables, water and non-sugared drinks.<br>*Complex:*<br>1. Parent materials, newsletters and "TippCards"<br>2. An internet platform with supporting information was established for teachers and families.<br>3. Teachers were provided with materials and modules for Kindergarten and a CD with songs for use in the day cares. | **DESIGN:** Group randomized trial<br>**DURATION:** 12-24 months<br>**SAMPLE SIZE:** 64 kindergartens (42= Intervention, 22= Control). 2 samples containing different children were analyzed at time intervals of 5.7±2.4 and 17.6±2.3 months after the start of the intervention. Sample 1 n=1318 (Intervention=850, Control=468); Sample 2 n=1340 (Intervention=872, Control=468)<br>**PRIMARY OUTCOMES:** Physical activity and nutrition<br>**MEASURES:**<br>1. Anthropometric measures (height and weight)<br>2. Parent Questionnaire (eating habits [consumption of fresh fruit and vegetables, water and non-sugared drinks])<br>3. Motoric testing<br>**DATA COLLECTION:** Eating habits were assessed by questions embedded in a parental questionnaire of the Bavarian Health Survey. Anthropometrics and motoric testing were carried out during the obligatory school entrance health examination offered to all children in the state of Bavaria.<br>**LIMITATIONS:** Absence of ascertainment of diet habits both before and after the intervention; motoric testing might have been a poor surrogate marker for increased physical activity | 3-6 year olds<br>**ELIGIBILITY:** Not reported<br>**EXPOSURE/ PARTICIPATION:** All children at the intervention schools were exposed to the intervention. | **LEAD AGENCY:** The research team and the schools<br>**THEORY/FRAMEWORK:** Concept of age-appropriate social learning of health promoting behavior by imitation of superiors and peers and adoption of the behavior of these role models<br>**EVIDENCE-BASED:** Not reported<br>**REPLICATION/ADAPTATION:** Not reported<br>**ADOPTION:** Not reported<br>**IMPLEMENTATION:** The researchers developed the low cost behavioral intervention for use in the kindergarten setting. The kindergarten teachers and families helped in some preparation of the materials and implemented the intervention. At the start of the intervention the teachers participated in a 2-day training workshop to learn about implementation of the TigerKids intervention. The AOK Verlag Remagen designed and produced the materials for the intervention.<br>**FORMATIVE EVALUATION:** Experts in preschool education, sport and nutrition science, and pediatrics developed and tested modules for kindergarten settings in two daycare centers.<br>**PROCESS EVALUATION:** Kindergarten staff reported on implementation of the intervention. | **RESOURCES:**<br>1. Materials, folder, and CD for Kindergarten teachers<br>2. Newsletters<br>3. TippCards<br>4. Web staff<br>5. Telephone hotline personnel<br>**FUNDING:** Bavarian Ministry of Environment, Health and Consumer Protection and the charitable Stiftung Kindergesundheit Child Health Foundation.<br>**STRATEGIES:** Not reported | **PHYSICAL ACTIVITY:**<br>1. Intervention students in the first sample had a significantly higher number of side to side jumps than the control students (24.9, 95% CI: 24.4-25.3 vs. 24.0, 95% CI: 23.4-24.6; p=0.0056).<br>**NUTRITION:**<br>2. There was a significantly higher consumption of fruits in the first sample intervention group (66.6%, 95% CI: 63.3-69.8 vs 55.7%, 95% CI: 51.0-60.3; p<0.0001) and the second sample intervention group (66.7%, 95% CI: 63.4-69.9 vs 56.3%, 95% CI: 51.6-60.9; p=0.0002) compared to the control.<br>3. There was a significantly higher consumption of vegetables in the second sample intervention group (42.7%, 95% CI:39.4-46.1 vs. 33.6%, 95% CI: 29.2-38.1; p=0.0013) compared to the control.<br>4. There was a lower consumption of high caloric drinks while watching TV observed in the sample one intervention compared to the control (60.4%, 95% CI: 56.6-64.2 vs. 47.7%, 95% CI: 42.4-52.9; p<0.0001). In sample 2, the proportion of children with a low consumption of high caloric drinks increased in the intervention group; a greater increase in the control group rendered the difference between groups non-significant. |

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| Marcus, Nuberg (2009)<br>Sweden | STOPP study-<br>Physical activity: Teachers increased non-sedentary behavior in the classroom (goal = increase physical activity by 30 min/day); toys from home that encouraged sedentary behaviors were prohibited; students were not allowed to play computer games at the after school care center for more than 30 minutes.<br>**OTHER INTERVENTION COMPONENTS:**<br>*Multi-component:*<br>School nutrition policies that included:<br>1. Offering a variety of vegetables to students prior to the main course at school meals<br>2. Substitution of white bread with whole-grain bread, or a similar product<br>3. Reduction of sugary meals and snacks<br>4. Offering lower-fat milk options in place of high-fat products<br>5. Requiring low-fat sandwich ingredients<br>*Complex:*<br>1. Dietary component: Teachers encouraged children to increase vegetable intake.<br>2. Schools were encouraged to eliminate sweets including those brought from home. Parents were encouraged to not send sweets from home.<br>3. Newsletter twice a year for parents and school staff.<br>4. School nurses received education about obesity-related problems. | **DESIGN:** Group randomized trial<br>**DURATION:** August 2001 – June 2005<br>**SAMPLE SIZE:** 2838 students (1538 exposed, 1300 unexposed) from 10 schools (5 intervention, 5 control)<br>**PRIMARY OUTCOMES:** Overweight/obesity, physical activity (PA), and nutrition<br>**MEASURES:**<br>1. Anthropometry (height and weight)<br>2. Accelerometer [n=1293] (physical activity)<br>3. 14-item parental questionnaire (frequency of food items served at home)<br>4. Children's Eating Attitude Test (ChEAT)<br>**DATA COLLECTION:** Trained research assistants measured height and weight yearly in the fall (and spring during the final year –2005). BMI was calculated and overweight and obesity were defined according to IOTF recommendations. Ten random children were chosen weekly from both conditions to wear accelerometers for 7 consecutive days on their non-dominant arm continuously. No child participated more than once. Parents completed the questionnaire at the end of the study. Teachers administered ChEAT to students prior to their completion of the project in grade 4.<br>**LIMITATIONS:** Researchers had no control over children's diets over school breaks which could have negatively impacted BMI; parental questionnaires were not validated; control schools reported taking some measures to increase healthiness of school lunches/snacks, which may have reduced differences between the two conditions; teachers' reports on the physical activity component may have been inaccurate | 6-10 year olds<br>**ELIGIBILITY:** Schools were invited to participate.<br>All assenting children were eligible for inclusion in the evaluation if they participated in at least one year of the intervention and if they participated in at least one occasion of height and weight assessment.<br>**EXPOSURE/ PARTICIPATION:** All students at the 5 intervention schools were exposed to the intervention. | **LEAD AGENCY:** The schools and researchers at the Karolinska Institute in Stockholm, Sweden and Addenbrooke's Hospital in Cambridge, UK.<br>**THEORY/FRAMEWORK:** Not reported<br>**EVIDENCE-BASED:** Not reported<br>**REPLICATION/ADAPTATION:** Not reported<br>**ADOPTION:** Not reported<br>**IMPLEMENTATION:** The intervention was developed by the researchers. The schools carried out all intervention activities. School personnel met with research staff every term to increase their awareness of the intervention.<br>**FORMATIVE EVALUATION:** Not reported<br>**PROCESS EVALUATION:** Researchers observed schools throughout the intervention and discussed deviations with school staff in an effort to make corrections. | **RESOURCES:**<br>1. Newsletter<br>2. Educational material for school nurses<br>3. Funds for healthier foods<br>**FUNDING:** Intervention activities were funded by the intervention schools. The evaluation was funded by Stockholm County Council, Swedish Council for Working Life and Social Research, Swedish Research Council, Freemasons in Stockholm Foundation for Children's Welfare and Signhild Engkvist Foundation<br>**STRATEGIES:** Not reported | **OVERWEIGHT/OBESITY:**<br>1. There was a significant difference between intervention and control with respect to prevalence of overweight & obese children in grades 2-4 and 3-4 from baseline to follow-up (difference= -6.0%, 95% CI: -10.6,-1.3%, $p<0.05$; difference=-9.2%, 95% CI: -16.9,-3.3, $p<0.01$, respectively).<br>2. For boys, the prevalence of overweight and obesity in the intervention schools was significantly reduced, whereas it increased in control schools from 2001-2005. The difference between the two groups was -7.7% (95% CI: -14.1,-1.2; $p<0.05$). No difference was found among girls.<br>3. There was an increase in the proportion of normal weight children in the intervention group, compared to the control group (2.3 vs 1.1%). The corresponding proportions of children who shifted from overweight or obese to normal weight were 14% and 7.5%, respectively ($p=0.017$).<br>**PHYSICAL ACTIVITY:**<br>4. After adjustment for cluster of schools, there were no statistically significant differences between intervention and controls for levels of total physical activity and physical activity in after school care.<br>**NUTRITION:**<br>5. Intervention families with 3rd and 4th grade children reported healthier eating habits at home compared to controls with significant differences in consumption of high-fat dairy products ($p=0.001$), sweetened cereals ($p=0.02$), sweet products ($p=0.002$) [data not shown].<br>**UNINTENDED POSITIVE RESULTS:**<br>6. Researchers observed that families from the intervention schools reported healthier eating habits, which indicated that the change in attitudes and rules at school may have facilitated parental selection of healthier foods at home. |

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| Sahota, Rudolf (2001); Sahota, Rudolf (2001)<br><br>Leeds, United Kingdom | APPLES program (Active program promoting lifestyle education in schools) Developing and implementing action plans to promote physical activity<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>1. School policies to promote healthy modification of school meals.<br>2. Development and implementation of school action plans to promote healthy eating<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Group randomized trial (delayed intervention)<br><br>***DURATION:*** September 1996 – July 1997<br><br>***SAMPLE SIZE:*** 636 students (314 intervention, 322 comparison) from 10 state primary schools in Leeds (5 intervention, 5 control)<br><br>***PRIMARY OUTCOMES:*** Overweight/obesity, physical activity (PA), and nutrition<br><br>***MEASURES:***<br>1. Growth measures (height and weight)<br>2. 24-hour food recall<br>3. 3-day food diaries<br>4. Lunch observations<br>5. Parent surveys<br>6. Teacher questionnaire (quality of the teachers' training, usefulness and appropriateness of resources, adequacy of support offered)<br>7. Focus Groups with children (knowledge and attitudes towards healthy living)<br>8. Physical activity questionnaires<br>9. Psychological measures<br>10. Monthly menu monitoring<br><br>***DATA COLLECTION:*** All measures were collected at baseline and follow-up. Teacher questionnaire and focus groups were conducted at follow-up only.<br><br>***LIMITATIONS:*** Inadequate sample size; 600 children participated but the unit size was only 5 schools in each arm; measurements of students' growth, diet, physical activity, and psychological state could not be obtained blind to the schools' intervention status; accurate dietary assessment is particularly difficult in children; 24 hour recall and 3-day diary cannot assess quantities accurately, therefore the authors relied more on the quality of food reported; reports of physical activity levels are even harder to quantify | 8-10 year olds<br><br>Lower income<br><br>The schools had 1 to 42% children from ethnic minorities and 7 to 29% entitled to free school meals, (compared with 11% and 25%, respectively, for Leeds children as a whole)<br><br>Sociodemographic measures suggested that the sample populations generally reflected the Leeds school aged population, although there was a slight bias towards more advantaged children. (representative of target population)<br><br>***ELIGIBILITY:*** Data had to be completed before they left primary school to be eligible for the study.<br><br>***EXPOSURE/ PARTICIPATION:*** All children in the 5 intervention schools were exposed to the intervention.<br><br>19 out of 20 teachers attended the training sessions. | ***LEAD AGENCY:*** Research team<br><br>***THEORY/FRAMEWORK:*** The Health Promoting Schools philosophy.<br><br>***EVIDENCE-BASED:*** Study based on similar school-based primary prevention interventions aimed at all students, which have been successful in the US.<br><br>***REPLICATION/ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** Each intervention school developed their own plan for implementing this intervention with the help of the intervention team. The intervention team was composed of a dietician, community pediatrician, health promotion specialist, psychologist, obesity physician and nutritional epidemiologist. The intervention teamed trained the teachers and provided resources and support.<br><br>***FORMATIVE EVALUATION:*** Surveys administered to all school staff and parents of year 4 and 5 students to assess the views about the importance of education on nutrition and physical activity. The questionnaires were used to develop an intervention plan.<br><br>***PROCESS EVALUATION:*** Regular staff meetings were held and monitored; surveys of packed lunches, snacks, and playground activities assessed to determine the program's progress. | ***RESOURCES:***<br>1. Dietitian<br>2. Pediatrician<br>3. Health promotion specialist<br>4. Psychologist<br>5. Nutritional epidemiologist<br>6. Funds for conducting school action plans (e.g., playground facilities)<br>7. Funds for teacher training<br><br>***FUNDING:*** The Northern and Yorkshire Region Research and Development Unit<br><br>***STRATEGIES:*** Not reported | ***OVERWEIGHT/OBESITY:***<br>1. No significant difference for overweight (weighted mean difference= -0.07, 95% CI: -0.22 to 0.08) or obese (weighted mean difference= -0.05, 95% CI: -0.22 to 0.11) between intervention and control children at follow-up.<br><br>***PHYSICAL ACTIVITY:***<br>2. No significant difference in amount of physical activity or sedentary behavior between intervention and control schools.<br><br>***NUTRITION:***<br>3. Intervention children had higher vegetable intakes than control children at follow-up (weighted mean difference= 0.3, 95% CI: 0.2 to 0.4)<br>4. Overweight intervention children had higher vegetable intakes than overweight control children at follow-up (mean difference= 0.3, 95% CI: 0.1 to 0.5), when comparing the 24-hour food recall.<br>5. Obese intervention children had higher vegetable intakes than obese control children at follow-up (mean difference = 0.3, 95% CI: -0.1 to 0.6)<br>6. Obese intervention children had lower fruit intakes than obese control children at follow-up (mean difference= -1.0, 95% CI: -1.8 to -0.2), when comparing 24 hour recall.<br>7. According to the 3-day food diaries, overweight intervention children had higher intakes of foods and drinks high in sugar than overweight control children (mean difference= 0.8, 95% CI: 0.1 to 1.6). No other differences in dietary consumption were found using the 3-day diaries. |

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| Prell, Berg (2005); Prell, Berg (2002)<br><br>Sweden | School lunch policies to increase access to healthy fish options<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br><br>*Complex:* Home economics education component included 5 classroom cooking experiences focusing on fish. | ***DESIGN:*** Group randomized trial<br><br>***DURATION:*** < 6 months<br><br>***SAMPLE SIZE:*** 228 eighth grade students from three schools in Sweden (58 school lunch [SL] only students; 87 school lunch and home economics [SL + HE] students; 83 control students)<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. Structured observations in the school cafeteria of eating behavior<br>2. 10-item fish knowledge questionnaire.<br><br>***DATA COLLECTION:*** Structured observations in the school cafeteria 5 times (once a week) when fish was served. One person observed the selected fish component on each of the students' plate and another observer observed plate waste.<br><br>***LIMITATIONS:*** Baseline differences existed between the groups; possible observer bias for food observers; high dropout rates in intervention and control group; study did not use a factorial design; intervention was of a relatively short duration; the same home economics teachers were engaged in the 2 groups and pupils in the lunch modification only group might have been subject to "spill over" | 14-18 year olds<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** The intervention was conducted among all 8th grade pupils at 3 comprehensive schools (n=390) in the Goteborg area in Sweden. | ***LEAD AGENCY:*** The research team<br><br>***THEORY/ FRAMEWORK:*** Theory of Planned Behavior<br><br>***EVIDENCE-BASED:*** Study builds off of previous school-based, behavior change focused approaches.<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** There were two intervention groups. Both consisted of modifications of the school lunch to increase the amount of fish served. One group also received additional modifications within the home economics curriculum so that more lessons dealt with fish related issues. The home economics teachers facilitated the lessons that included a visit from a fish retailer that discussed different fish species and how to fillet them, slides about cooking fish in the school kitchen and lessons on fish and nutrition. The school food personnel took part in a 1-day training session in preparing fish, and carried out the menu modifications.<br><br>***FORMATIVE EVALUATION:***<br>1. Focus groups<br>2. Questionnaires regarding the target behavior (eating fish for school lunch) measured intention, attitudes, subjective norm and descriptive norm, perceived control and underlying beliefs and evaluations<br>3. Dietary assessments: observations regarding actual fish consumption in school lunch room.<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Funds to train food personnel<br>2. Funds to make menu modifications<br>3. Fish related decorations for school lunch room<br>4. Slides for home economics class<br>5. Curriculum for the home economics class<br><br>***FUNDING:*** The KLIV at the Marketing Technology Center.<br><br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. The change in fish consumption in the School Lunch + Home Economics group from baseline to follow up (RP = 0.15, CI: 0.06-0.24) differed significantly from the control group (RP = -0.08, CI: -0.17-0.01) but not from School Lunch group (RP = 0.10, CI: -0.02 – 0.22) (i.e., the confidence interval of the School lunch + Home Economics group did not overlap the confidence interval of the control group, but did overlap the School Lunch group).<br>2. In the School Lunch + Home Economics group, the proportion of fish eaters at baseline increased from 56% to 71% at follow up, in the School Lunch group there was an increase from 59% to 69% and in the control group there was a decrease from 77% to 69%.<br>3. Changes in knowledge were also found between baseline and follow-up for the intervention groups (data not shown). |

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| Ho, Gittelsohn (2008); Rosecrans, Gittelsohn (2008); Ho, Gittelsohn (2006)<br><br>Canada | Zhiiwapenewin Akino'maagewin: Teaching to Prevent Diabetes (ZATPD) program - physical activity breaks during lessons<br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>1. Schools were encouraged to adopt policy of no soda and chips in school and review breakfast and lunch programs for nutritional content<br><br>*Complex:*<br>1. Community component: mass media (e.g., posters, flyers, local access cable, radio), cooking demos and taste tests in band offices and community events (e.g., walking challenges, family fun nights)<br>2. Recipe cards, posters, newsletters and letters; 4 family action packs sent home over the year.<br>3. Store component: Promotion of healthier alternatives through shelf labels, posters, flyers, and cooking demos or taste tests; managers encouraged to stock low-sugar, low-fat and high-fiber foods.<br>4. 16 lessons in 3rd grade and 17 lessons in 4th grade promoting healthy eating and physical activity | ***DESIGN:*** Non-randomized trial (delayed intervention)<br><br>***DURATION:*** 9 months (Sept. 2005 – June 2006)<br><br>***SAMPLE SIZE:*** 95 people from 4 First Nations sites (2 intervention, 2 comparison) The comparison sites received the intervention the following year.<br><br>***PRIMARY OUTCOMES:*** Overweight/obesity, physical activity (PA), and nutrition<br><br>***MEASURES:***<br>1. Anthropometric measurements (height and weight [body mass index], percent body fat)<br>2. Accelerometers (physical activity)<br>3. Food frequency questionnaire (dietary intake)<br>4. Adult impact questionnaire (knowledge, self-efficacy, outcome expectation, intentions for specific food-related behaviors, healthy food acquisition, food preparation)<br>5. Questionnaire to assess independent variables (age, marital status, education, employment, material style of life, household size, self-reported diabetes or impaired glucose tolerance)<br><br>***DATA COLLECTION:*** 13 trained individuals (5 community members, 3 research staff, and 5 students) collected data at baseline and follow-up. Interviews were conducted at the respondent's house or the local band or health office. Independent variables were assessed at baseline for adjustment in analyses. Trained local Ojibwe-speaking research assistants administered the impact and food frequency questionnaires. Accelerometers were used at baseline and follow-up for at least 3 days including both weekend and weekdays. Anthropometric measures were collected using a stadiometer and a scale/bioimpedence analyzer.<br><br>***LIMITATIONS:*** Non-random assignment of communities; the response rate in some communities was fairly low; respondents lost to follow-up were more likely to have diabetes, reside in comparison and remote communities and have lower knowledge scores at baseline; the availability and affordability of foods at stores of different sizes and locations varied considerably, and data from the large supermarket skewed percentages of food availability; the process data were recorded by several program assistants and were sometimes inconsistent; the intervention focused on food-related behaviors, and therefore the weakness of the physical activity component may have caused the lack of impact on activity; the intervention period was short and may have lacked ability to penetrate further into the community and have greater impact; the ZATPD training in diabetes and nutrition was inadequate; food stores differed in eagerness and willingness to participate; and only one intervention site had access to local radio and cable TV, which was minimally utilized | 100% Native American<br><br>Intervention group average age = 40.3; Control group average age = 44.7<br><br>***ELIGIBILITY:*** Communities were selected from those that responded to invitations to participate. Participants had to provide written informed consent and have both baseline and follow-up data. Pregnant women, women who had a live birth in the past 6 months, and people who had not been living in the community for the last 30 days were excluded at baseline.<br><br>***EXPOSURE/ PARTICIPATION:*** All intervention school students were exposed to the school lunch menu changes, but only 3rd and 4th grade students received the physical activity and education component.<br><br>Family pack return logs (40% completed and returned); attendance tracking (572 participated in cooking demonstrations, 122 attended kickoff feasts) | ***LEAD AGENCY:*** Researchers at Johns Hopkins Bloomberg School of Public Health<br><br>***THEORY/FRAMEWORK:*** Social cognitive theory<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ADAPTATION:*** School curriculum was based on the Sandy Lake School Diabetes Prevention program curriculum and the store component was adapted from the Apache Healthy Stores program.<br><br>Adoption: Not reported<br><br>***IMPLEMENTATION:*** Researchers developed 5 intervention phases (coordinated across each component – school, store and community), each lasting 6-10 weeks that targeted specific behaviors:<br>1. Starting the day with healthy foods and exercise<br>2. Reducing fat<br>3. Healthier beverages<br>4. Shopping wisely and including five servings of fruits and vegetables a day<br>5. Healthier snacks and daily activities<br><br>The field supervisor and project coordinator provided on-the-job support and site visits. The program assistants were local community members that received training from the research staff on nutrition, physical activity, diabetes, health education strategies, and program-specific instructions on how to implement activities. The assistants were supported by a field supervisor for the first 6 months of the intervention and then by phone and a site visit from the project coordinator. The program assistants worked with existing health and social service programs in conducting the community component. Classroom teachers conducted the school component and store owners were responsible for implementing the store component.<br>*(continued next page)* | ***RESOURCES:***<br>1. Physical activity lessons for breaks<br>2. School component resources (recipe cards, school newsletter, posters, letters, family action packs)<br>3. Resources for store component (shelf labels, posters, flyers, materials for cooking demos/ taste tests)<br>4. Posters, flyers and messages for mass media<br>5. Materials for community cooking demos or taste tests<br>6. Materials for community events (walking challenges, family fun nights)<br>7. Community program assistant, project coordinator, and field supervisor<br><br>***FUNDING:*** Canadian Institutes for Health Research (formative evaluation); an American Diabetes Association Clinical Research Award and a US-Canada Fulbright Award (intervention); an American Diabetes Association Clinical Research Award and the Canadian Institutes of Health Research (process evaluation)<br>*(continued next page)* | ***OVERWEIGHT/OBESITY:***<br>1. After adjustment for baseline values and other covariates, there was no significant difference in change in BMI between intervention and comparison groups.<br>2. On average, intervention respondents gained 1.8kg (range: -9.4, 37.5 kg) and comparison respondents gained 0.1kg (range: -15.1, 14.4kg).<br><br>***PHYSICAL ACTIVITY:***<br>3. Total activity counts decreased for both intervention and comparison, whereas minutes of sedentary activity increased for both groups. There were no significant differences in changes in minutes of light physical activity/ day, moderate physical activity/day or vigorous physical activity/day across the 2 groups even after adjustment for covariates.<br><br>***NUTRITION:***<br>4. At follow-up, intervention respondents had significantly higher healthy food acquisition scores than comparison respondents after adjustment for baseline scores and other covariates (β=0.947, p=0.003; adjusted R2= 0.4058).<br>5. There were no significant differences between groups in the healthiness of food preparation score and food intention scores. |

| (Continued from previous study) | | | | | | |
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| | | | | ***FORMATIVE EVALUATION:***<br>1. Review of the Sandy Lake Health and Diabetes Project<br>2. Survey with adult band members (sociodemographics, health history, food preparation and consumption, physical activity, and preferences for intervention methods)<br>3. Direct observations at stores and of students (eating, purchasing, activity patterns and available food selections)<br>4. Community forums (health concerns and resources)<br>5. Visits to existing elders' group activities and luncheons (appropriateness of intervention strategies)<br>6. In-depth interviews<br>7. Piloting of potential intervention strategies to groups and in public places<br>***PROCESS EVALUATION:***<br>1. Teacher interviews (lesson implementation)<br>2. Checklist form (store food stock, store poster placement)<br>3. Record of media publications and radio and cable TV spots during each phase (mass media evaluation)<br>4. Interviews with teachers, school staff, families, store owners, human services employees, and ZATPD employees (assessment of acceptability, feasibility, and sustainability) | ***STRATEGIES:*** At the end of the program, most store owners agreed to continue stocking healthier foods, and some stated they would post shelf labels and posters if given the materials. All communities expressed a willingness to continue program activities if supplied with materials, but there was no plan made for such continuation. | |

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| Parker, Fox (2001)<br><br>England | School policies to increase consumption of healthy foods by:<br>1. Increasing the availability of fresh fruit by a minimum of 50%<br>2. Increasing the availability of vegetables and salad by a minimum of 50%<br>3. Increasing the availability of high fiber bread by 100%<br>4. Increasing the availability of non fried potatoes by a minimum of 66%<br>5. Increasing the availability of non cream cakes by a minimum of 50%<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>1. School food groups provided a forum for initiating positive changes in the food provision and eating environment within the school<br>2. Promotion of healthier foods (e.g., photo menu board to promote healthier combinations of foods, entertainment in lunch line)<br>3. Peer-related and curriculum activities-targeting drama in workshops and/or lessons on food and health | ***DESIGN:*** Non-randomized trial<br><br>***DURATION:*** 12-24 months<br><br>***SAMPLE SIZE:*** 2669 students from three schools (school 1 & 3= intervention, school 2= control)<br>Exposed=1972<br>Unexposed=679<br><br>***PRIMARY OUTCOME:*** Dietary consumption meeting dietary standards<br><br>***MEASURES:***<br>1. Food production sheets with numbers of portions of foods produced from each head cook<br>2. Observations of foods consumed by food categories (fruit, vegetable, high fiber bread, etc.)<br><br>***DATA COLLECTION:*** Food production sheets collected from each head cook over one 8-week monitoring portions per term, per school. Food observations were done over 4 lunch-times per school within each 8-week monitoring period. The uptake of school meals from schools' catering were recorded as the mean number of pupils observed over lunch-times. This occurred once at the end of each 8-week monitoring period. Monitoring took place over the entire 2 years of the study; however the methods used for both the interventions and monitoring were not validated.<br><br>***LIMITATIONS:*** Food production data were self-reported; study design did not involve evaluation of individual interventions | Lower income<br><br>11-18 year olds<br><br>Intervention schools represent the highest (38%) & lowest (19%) proportion of Free School Meal Entitlement (FSME) pupils. Control school had FSME enrollment midway between intervention schools (23%).<br><br>***ELIGIBILITY:***<br>Schools were chosen to reflect the socio-economic and ethnic profile of Peterborough's urban area using free school meal entitlement as a measure of socio-economic status of the surrounding area.<br><br>***EXPOSURE/ PARTICIPATION:***<br>All children from the 2 intervention secondary schools in Peterborough were exposed to the intervention. | ***LEAD AGENCY:***<br>Research team from the city health clinic, North Peterborough Primary Care Trust<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:***<br>Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:***<br>School food groups consisting of staff, caterers, and health professionals, provided a forum for initiating positive changes in these areas: establishment of communication networks, pupil involvement, food availability and eating environment. A liaison teacher at each school identified a clear priority order for implementing the interventions.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. School Food Groups<br>2. Funds for healthy foods<br>3. Photo menu boards<br>4. Supplies for food-tasting workshops<br>5. Supplies for education lessons<br>6. Supplies for competitions<br>7. Supplies for a parents evening<br>8. Equipment and foods purchased for launch and continuation of fast food area for healthier options<br>9. Supplies for the production and performance of "The Food Show"<br><br>***FUNDING:***<br>Evaluation funded the Anglia and Oxford Regional Health Authority.<br><br>***STRATEGIES:*** Not reported | ***ENVIRONMENT CHANGE:***<br>1. Proportion of high fiber bread offering increased in School 1 from 18% of all bread to 36% (95% CI: 12 to 37) and in School 3 from 10% to 28% (95% CI: 7 to 34).<br>2. A jacket potato bar was introduced as a fast food area for healthier options in School 1 and a salad "cart" was introduced in School 3.<br><br>***NUTRITION:***<br>3. The dietary target for fruit (50% increase) was achieved in School 1 during monitoring periods 2 & 3 (12.5 & 13.8 pupils respectively), but was not sustained. Target was not attained at any point in School 3, with a statistically significant change in the wrong direction at period 5 ($p<0.01$).<br>4. School 1 achieved the dietary target (50% increase) for vegetable and salad consumption during the final period, with 15.3 pupils ($p<0.01$). School 2 had a significant increase at period 2 with 10 pupils ($p<0.001$), but showed a decline thereafter, although still significantly higher ($p<0.01$) at the end of the study.<br>5. In School 3, the high fiber bread dietary target (100% increase) was reached in period 1 (26.3% of pupils) and sustained for the duration of the study ($p<0.05$). The proportion of high-fiber bread consumed in School 1 varied from 39.8% to 12.6% between periods 2 and 4, to 37.6% at the end of the study.<br>6. In School 1, a significant negative change in non-fried potato consumption occurred at period 1 with a fall to 2% ($p<0.01$), but the target of a 66% increase was exceeded during period 3 with the proportion rising to 14.2% (coinciding with the launch of the filled jacket potato station). This level of consumption was not sustained but remained higher than at baseline. School 3 showed a change in the wrong direction from period 1 onwards, the proportion of only 1.1% becoming significant by period 5 ($p<0.001$).<br>7. School 3 achieved the target (50% increase) for the consumption of non-cream cakes during periods two and three with 59.4% ($p<0.01$) and 57.4%, respectively, but this was not sustained. School 1 showed a negative change up to period three, with a marked rise to 45.3% by period five (not significant). |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Ask, Hernes (2006)<br>Norway | School policy to increase healthy eating by providing a daily breakfast (low fat milk, orange juice, whole grain bread, different spreads with fish, meat and cheese and a fruit) at school.<br>**OTHER INTERVENTION COMPONENTS:**<br>*Multi-component:* Not reported<br>*Complex:*<br>1. Students offered a food supplement consisting of vitamins, minerals and omega-3 fatty acids<br>2. Presentation for parents on the importance of breakfast and a packed lunch<br>3. Students trained to use a data program to evaluate their own diet (month 1 and 4) | **DESIGN:** Group randomized trial<br>**DURATION:** 4 months<br>**SAMPLE SIZE:** 54 students in tenth grade (26 intervention, 28 control) in a secondary school in rural Norway<br>**PRIMARY OUTCOME:** Overweight/obesity and nutrition<br>**MEASURES:**<br>1. Height and weight (body mass index -BMI)<br>2. Blood sample (hemoglobin concentration)<br>3. Food Frequency Questionnaire (FFQ) (frequency of intake of 27 food items commonly used in the Norwegian diet; weekly intake of breakfast, lunch, dinner, evening meal, snack meals).<br>4. Healthy Eating Index (healthy eating behavior)<br>5. Questionnaire 2 (evaluation of the class environment, students' own performance, school satisfaction) – [validated tool]<br>6. Teachers ratings of social behavior (i.e., school attention and punctuality)<br>**DATA COLLECTION:** Height and weight were measured with standard equipment by the school nurse before and after the study. Children's BMI was categorized as overweight or obese based on definitions outlined in Cole et al., 2000. A blood sample was drawn for hemoglobin concentration measurements before and after the study. The children completed both questionnaires at baseline and 1 week after the intervention. Eleven food items from the FFQ were chosen to calculate a healthy eating index. Teachers rated social behavior at the beginning and end of the intervention.<br>**LIMITATIONS:** Short time period and small sample size prevented detection of small to medium improvements; sample comprised of students with previously documented problems related to social behavior which limits generalizability; insufficient training provided for the implementer that may have decreased implementation fidelity; FFQ was not validated | Rural<br>15 year olds<br>Intervention: 15 males, 11 females<br>Control: 14 males, 14 females (evaluation sample)<br>**ELIGIBILITY:** Informed written consent was obtained from all parents and students.<br>**EXPOSURE/ PARTICIPATION:** During the intervention, almost all intervention students had breakfast everyday at school. | **LEAD AGENCY:** The researchers and the schools<br>**THEORY/ FRAMEWORK:** Not reported<br>**EVIDENCE-BASED:** Not reported<br>**REPLICATION/ ADAPTATION:** Not reported<br>**ADOPTION:** Not reported<br>**IMPLEMENTATION:** Donations from private food industry corporations provided the food for breakfasts. A conscientious objector working at the school was responsible for preparation and serving breakfast. Control students were not given breakfast but received the same information about the importance of a healthy diet.<br>**FORMATIVE EVALUATION:** Not reported<br>**PROCESS EVALUATION:** Not reported | **RESOURCES:**<br>1. Food for breakfasts<br>2. Personnel to prepare and serve the breakfasts<br>3. Data program for student diet evaluation<br>4. Materials for parent presentation<br>**FUNDING:** Mollers AS, Mills, TINE BA, COOP Lista and Young Enterprises and West-Agder provided food and the food supplements; The National Association for Nutrition and Health provided their Data program "Mat pa data" for free to the school.<br>**STRATEGIES:** Not applicable – pilot study | **OVERWEIGHT/OBESITY:**<br>1. After the intervention period, weight and BMI increased significantly in control group males' (from median 67kg to 70kg for weight, $p<0.01$; and from median 21.7kg/m$^2$ to 22.4kg/m$^2$ for BMI, $p<0.05$) and in control group females (from median 59kg to 61 kg for weight, $p<0.01$; and from median 21.6kg/m$^2$ to 22.1kg/m$^2$ for BMI, $p<0.05$)<br>2. There was also a significant increase in weight in the intervention group males from baseline to post-intervention [from median 73kg (range= 55-109) to 73kg (range= 57-111), $p<0.05$], but not in females.<br>3. BMI did not change significantly in the intervention group.<br>**NUTRITION:**<br>4. The healthy eating index increased significantly in male students in the intervention group (from median score of 69 to 85, $p<0.01$) but not for girls in either group. There was a non-significant increase in healthy eating index scores of males in the control group.<br>**OTHER:**<br>5. At baseline, 54% of intervention students and 43% of control students had breakfast every day. During the intervention period almost all students in the intervention group had daily breakfast at school. However, one week post-intervention these students went back to the breakfast habits from before the intervention.<br>6. From pre-intervention to one week post-intervention, reported intake of lunch every day in the intervention group increased from 52 to 54% and from 81 to 86% in the control group. The increase in lunch frequency was statistically significant in the control group ($p<0.01$) post-intervention, while there was a non-significant increase in the intervention group.:<br>7. Teachers reported improvement in school attention and social behavior among intervention group students; not statistically significant due to limited reporting by teachers.<br>8. School performance as measured by time spent doing homework did not increase as a result of the intervention. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Shemilt, Mugford (2004); Shemilt, Harvey (2004)<br><br>England | School breakfast club to provide a healthy breakfast to children before school<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br><br>*Complex:* Not reported | ***DESIGN:*** Group randomized trial and an observational analysis<br><br>***DURATION:*** 2 years<br><br>***SAMPLE SIZE:*** 6076 students (3673 intervention, 2369 control) from thirty primary and secondary schools<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. A Life, Health, and School Questionnaire (sociodemographic information, food and eating, general health, self-image, educational factors and peer and family relationships).<br>2. Strengths and Difficulties Questionnaire (child/ adolescent behaviors, emotions, and relationships)<br>3. Trail Making Test (child concentration)<br>4. Family Questionnaire (children's involvement in school-based activities, access to child care, parental employment, recent uptake of medical services, parental/caregiver emotional stress [Rutter 1970])<br>5. School survey (financial and organizational arrangements for breakfast clubs)<br>6. School-level data (attendance, punctuality, attainment, ethnicity and free school meal status of each child)<br><br>***DATA COLLECTION:*** A set of baseline measures were collected during Spring 2000. First follow-up measures were collected during Summer 2000 (at ~3 months) and second follow-up measures during Spring 2001 (at ~12 months). The school survey was mailed to a key contact at each participating school during the 1999/2000 school year. School staff were trained in the administration of the measurement instruments. Teachers completed the Strengths and Difficulties Questionnaire for each primary-aged student while secondary-aged students completed a self-report version. The trial was intended to have 2 follow-up points, but contamination between the study arms was so marked by the second follow-up that the authors decided to treat the data as observational (cohort study) and investigated the effects of individual breakfast club attendance after adjustment for potential confounders.<br><br>***LIMITATIONS:*** Short evaluation timeframe; impossible to compare 2 consistent, homogenous groups due to contamination between the study arms; lack of continuous breakfast club provision in the intervention group | Lower-income<br><br>5-18 year olds<br><br>76% lower-income (evaluation sample)<br><br>***ELIGIBILITY:*** Primary and secondary schools serving deprived communities which had no pre-existing breakfast club provision and were willing to conform to the Department of Health requirements for the program were included. Schools serving only special educational needs students and those proposing clubs that would take place off the school site were excluded.<br><br>***EXPOSURE/ PARTICIPATION:*** Breakfast clubs were implemented in primary and secondary schools serving deprived areas across England. More than 2/3 of the intervention schools did not operate breakfast clubs continuously between baseline and 2nd follow-up. | ***LEAD AGENCY:*** The Department of Health (DOH), the schools, and the researchers<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** In Spring 1999, the United Kingdom (UK) Department of Health dedicated new funding to support the expansion of breakfast clubs into schools serving deprived areas across England.<br><br>***IMPLEMENTATION:*** Not reported<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Funds for healthy breakfast foods<br>2. Personnel to prepare and serve the breakfasts<br><br>***FUNDING:*** United Kingdom Department of Health National Health Service Executive (financial and material support for evaluation)<br><br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. (N=596) Observational analysis at 1 year showed a higher proportion of primary-aged breakfast club attendees who reported eating fruit for breakfast in comparison to non-attendees (14% vs. 8%; Adjusted Odds Ratio (AOR) = 10.04; 95%CI: 2.09, 48.18).<br><br>***COSTS:***<br>2. Mean estimated total cost including costs associated with all resource inputs used to implement and maintain the breakfast club for 2 years was £9494 for a primary school-based club and £9728 for a secondary school-based club.<br>3. During the course of the initiative, 45% of breakfast clubs secured additional funding from sources other than the Department of Health pilot initiative.<br><br>***RELATED CONSEQUENCES:***<br>4. (N=758 and 754, respectively) Using intention to treat analysis, fewer secondary-aged students in the intervention group reported having skipped 1+ classes on at least 1 day within the last month (9% vs 16% AOR=0.47, 95%CI: 0.24-0.92) and having skipped at least 1 day of school within the last month (5% vs 14%, AOR=0.49, 95%CI: 0.25, 0.99) compared to students in the control group at second follow-up. Results were not significant using observational analysis.<br>5. (N=446 and 412, respectively) Using observational analysis, a higher proportion of primary-aged students who attended breakfast club had borderline or abnormal conduct (29% vs 10%,AOR=3.93, 95%CI: 1.75, 8.82) and total difficulties scores (35% vs. 14%, AOR= 2.15, 95% CI: 1.02, 4.52) compared to non-attendees.<br>6. (N=305) Using observational analysis, a higher proportion of secondary-aged students who attended breakfast club had borderline or abnormal prosocial scores compared to non-attendees (41% vs 30%, AOR=2.68, 95%CI: 1.08, 6.61) |

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| Horne, Tapper (2004)<br><br>London, England | School policy to increase fruit and vegetable (F&V) consumption by providing fruits and vegetables to all children at lunchtime, and fruits to five to seven year olds at snack time<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>1. Curriculum component- Six 6-min peer modeling videos featuring "Food Dudes"<br>2. Letters from Food Dudes read to children to provide encouragement and praise<br>3. Two home packs distributed to children (information for parents and charts for children to record F&V consumed at home)<br>4. Incentives for eating/tasting fruits and vegetables (e.g., hand stamps, stickers) | ***DESIGN:*** Non-randomized trial<br><br>***DURATION:*** < 6 months<br><br>***SAMPLE SIZE:*** 749 children at 2 inner-city London schools (1 intervention, 1 control)<br><br>***PRIMARY OUTCOME:*** Fruit and vegetable consumption<br><br>***MEASURES:***<br>1. Parent Interviews (children's consumption of F&V at home). Parents used food recall diaries to aid their recall<br>2. Lunch observations (visual estimate and rate amount of F&V consumed by each child during lunch each day)<br>3. Snack observations of snack consumption<br><br>***DATA COLLECTION:*** Intervention schools data collection was conducted at baseline (12 days), during the intervention phase (16 days), and follow-up (4 months). Control school data collection was conducted at the same intervals. The research team conducted interviews with children's parents and used a 24-hour food recall to report the data. Parents used food diaries to aid their recall. Observers visually estimated and rated on a 5-point scale (0, 25, 50, 75, or 100%) the amount of fruits and vegetables each child consumed during lunch each day. During snacks, observers weighed each child's fruit before and after snack time on a daily basis for each child in the five to seven year old age group.<br><br>***LIMITATIONS:*** Possibility that high levels of vegetable consumption were due to the stickers placed on children's name badges; sample size for the parental 24-hour food recall was small for statistical purposes; assessment of food portions in the 24-hour food recall was difficult, particularly when dealing with a variety of ethnically diverse cooking; over the 4 month maintenance period procedures in the intervention group were not always implemented consistently, or by all teachers | Lower income 5-11 year olds<br><br>Intervention school – 85% racial/ ethnic populations and 67% free-meal entitlement<br><br>Control school – 80% racial/ ethnic populations and 46% free-meal entitlement<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** All 364 students from the intervention school were exposed to school lunch changes. | ***LEAD AGENCY:*** Research team and school staff<br><br>***THEORY/ FRAMEWORK:*** Social Cognitive Theory<br><br>***EVIDENCE-BASED:*** Based on successful studies that have targeted taste exposure, modeling and rewards<br><br>***REPLICATION/ ADAPTATION:*** Adapted from study conducted by Lowe, et al (2004)<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** The research team planned the intervention and the school staff implemented the intervention.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Funds for additional fruits and vegetables<br>2. Food Dude videos<br>3. Rewards for eating F&V<br>4. Letters from Food Dude<br>5. Home packs with info and charts<br>6. Badges<br>7. Wall charts<br><br>***FUNDING:*** Dept. of Health; Dept. for Education and Employment; the Dept. of Environment, Food, and Rural Affairs; and the Food Standards Agency<br><br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. Mean F&V consumption at lunch for 5-7 year olds increased from baseline to the intervention (from 20% to 69% for fruit, t=14.37[59], p<0.002; from 35% to 55% for vegetables, t=6.67[59], p<0.002) and from baseline to follow-up (from 20% to 56% for fruit, t=9.27[59], p<0.002; from 35% to 53% for vegetables, t=6.40[59], p<0.002).<br>2. Mean F&V consumption at lunch for 7-11 year olds increased from baseline to the intervention (from 47% to 86% for fruit, t=12.00[87], p<0.002; from 51% to 74% for vegetables, t=9.59[87], p<0.002) and from baseline to follow-up (from 47% to 65% for fruit, t=4.73[87], p<0.002; from 51% to 63% for vegetables, t=4.67[87], p<0.002).<br>3. Children who ate the least during baseline showed the largest increases in F&V consumption (from 4% at baseline to 68% at intervention to 48% at follow-up for fruit, from 11% at baseline to 48% at intervention to 43% at follow-up for vegetables).<br>4. Consumption of F&V at snack time for 5- 7 year olds was significantly higher at intervention than at baseline and follow-up, but there was no difference between baseline and follow-up levels.<br>5. There were significant increases in F&V consumption during the weekday at home for the intervention group compared to the control group (from 2.13 at baseline to 2.31 at intervention in the intervention school compared to a shift from 1.93 to 1.39 in the control school, p<0.05).<br>6. Vegetable consumption decreased at lunch for 5-7 (from 16% to 6%, t=-5.86[76], p<0.002; baseline to follow-up = 16% to 10%, t=-3.26[76], p<0.002) and from baseline 2 compared to baseline 1 in 7-11 year old controls (36% to 20%, t=-9.36[128], p<0.002; baseline to follow-up = 36% to 23%, t=-6.07[128], p<0.002). Fruit consumption decreased among 7-11 year olds between baseline and follow-up (from 20% to 9%, t=-1.33[128], p<0.002). Control children that ate the most during baseline showed the largest decreases in F&V consumption (from 90% at baseline to 47% at intervention to 13% at follow-up for fruits, from 92% at baseline to 64% at intervention to 55% at follow-up for vegetables). |

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| Gatenby (2007)<br>United Kingdom | Provision of free healthy school meals to primary school children adhering to the Caroline Walker Trust (CWT) nutritional guidelines:<br>≤21.1g total fat<br>≤6.8 g saturated fat<br>≥74.3g carbohydrate<br>≤16.3g sugar<br>≥8.5g fiber<br>≥8.5 g protein<br>≥ 3.5 mg iron<br>≥193 mg calcium<br>≥150 µg vitamin A<br>≥ 60 µg folate<br>≥11 mg vitamin C<br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br>*Complex:*<br>Not reported | ***DESIGN:*** Non-randomized trial (analysis post-intervention only)<br>***DURATION:*** Not reported<br>***SAMPLE SIZE:*** Sixty-four children (32 intervention, 32 control) aged nine to ten years from two schools in England<br>***PRIMARY OUTCOME:*** Dietary consumption<br>***MEASURES:***<br>1. Portions and food weight (average portion size [estimate of dietary intake], average food weight)<br>2. Digital camera (photographs of children's lunch choice)<br>3. School reports on recipes and cooking methods for food menu items (nutrient intake [e.g., fat, energy, protein, calcium, sodium])<br>4. Assessment of foods provided (conformance to the CWT guidelines; difference between food provided and consumed)<br>***DATA COLLECTION:*** Data collection took place during May and June 2005 during five days (five consecutive lunch periods). Before food service began each day, 10 weights of each food were recorded to obtain an average. Foods that appeared on more than 1 day were only measured on the 1st day. Recipes and cooking methods for all foods on the menu were obtained from the school to obtain an assessment of nutrient intake. During lunch service, children were identified as they approached the assessment station and their lunch choice was photographed before and after the meal. Food waste was also weighed and recorded. Study data was analyzed using WISP nutrient analysis package.<br>***LIMITATIONS:*** Small sample size; study unable to assess differences between gender intakes; dining staff were aware of the study and could have potentially altered the children's behavior; children exchanged food with one another changing the dietary content they consumed from what was recorded; salad bar available in the Hull school which may have increased food/nutrient intake; portion sizes were variable and no standard could be set between the 2 schools; nutrient database was limited; limited generalizability | Lower-income<br>5-10 year olds<br>10.9% students eligible for free school meals in the intervention group; 10% eligible for free school meals in control group (evaluation sample)<br>Over 50% of the population in the area of Hull lives in neighborhoods among the 20% most deprived in England.<br>***ELIGIBILITY:*** Largest schools in local area matched based on percentages of children eligible for free school meals and key stage 2 exam averages. Consent required from teachers and parents. All children in year 5 who stayed for school meals everyday of the week were invited to participate.<br>***EXPOSURE/ PARTICIPATION:*** Approximately 20,500 children attended primary and special schools in Hull City and were provided free healthy school meals. | ***LEAD AGENCY:*** Hull City Council, Hull school staff and caterers<br>***THEORY/ FRAMEWORK:*** Not reported<br>***EVIDENCE-BASED:*** Not reported<br>***REPLICATION/ ADAPTATION:*** Not reported<br>***ADOPTION:*** Hull City Council applied to the Secretary for Education in 2004 for the power to provide free healthy school meals to all children attending primary and special schools, meeting the CWT nutritional guidelines in an attempt to reduce health inequalities.<br>***IMPLEMENTATION:*** The Food Health Education Team at the Univ. of Hull, the Eat Well Do Well Team at Hull City Council and Hull school staff at developed the intervention. The catering company worked with nutritionists to provide balanced lunch menus. The control school provided lunches by using their own in-house catering which followed the standard nutritional guidelines.<br>***FORMATIVE EVALUATION:*** Not reported<br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Foods that meet new CWT nutritional guidelines<br>2. Revised balanced menus<br>3. Personnel (Nutritionist, Head Teachers, food providers/ cafeteria staff)<br>***FUNDING:*** Hull City Council<br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. Intervention school students had significantly lower mean intakes of protein (16.3g vs. 18.4g, p=0.02), energy (1.92 MJ vs. 2.74MJ, p<0.001), fat (20.6g vs. 29.3g, p<0.001), sugars (19g vs. 27.3g, p<0.001), carbohydrates (54.6g vs. 79.6g, p<0.001), and starch (27.4g vs 45.2g, p<0.001) than control school students. Intervention school students also consumed less saturated fat (6g vs 27.6g) than control school students but the difference was not significant.<br>2. The mean intake of calcium (221mg vs. 193mg, p=0.026) was significantly greater for intervention than control school students.<br>3. The mean intake of fiber (2.6g vs. 3.3g, p=0.001), sodium (624mg vs. 776mg, p<0.001), iron (1.79mg vs. 2.25mg, p<0.001), zinc (1.34mg vs. 1.69mg, p<0.001), folate (35.3µg vs. 49.5µg, p<0.01) and magnesium (42mg vs. 51.2mg, p<0.01) were significantly less for intervention students compared to control students.<br>4. Intervention school students mean consumption of carbohydrates (54.6g), energy (1.92MJ), sugars (19g), fiber (2.6g), sodium (624mg), iron (1.79mg), zinc (1.34mg), folate (35.3µg), vitamin C (10mg), magnesium (42mg), and manganese (0.43mg) did not meet CWT recommended levels of consumption.<br>5. Control school students mean consumption of fat (29.3g), saturated fat (27.6g), sugars (27.3g), fiber (3.3g), sodium (776mg), iron (2.25mg), zinc (1.69mg), folate (35.3µg), magnesium (51.2mg), manganese (0.44mg), and selenium did not meet CWT recommended levels of consumption<br>6. Across both the schools, only mean intakes of calcium (intervention 221mg, control 193mg) and vitamin A (intervention 254µg, control 301µg) met the CWT recommended guidelines. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Nelson, Lowes (2007)<br><br>England | 2001 National Nutritional Standards requiring secondary schools to offer at least 2 items from each of the following food groups:<br>Starchy foods – at least 1 not cooked in oil<br><br>1 portion of fruit<br><br>1 portion of vegetables (excluding potatoes)<br><br>Fish at least 2 times per week<br><br>Red meat at least 3 times per week (and alternatives for vegetarians)<br><br>Primary school guidelines:<br><br>≤ 3 times per week of starchy foods cooked in oil<br><br>Fruit-based desserts at least 2 times per week<br><br>Meat at least twice (rather than 3 times) per week<br><br>Fish at least once (rather than 2 times) per week<br><br>Caterers encouraged to provide:<br><br>Free drinking water<br><br>Drinking milk<br><br>Hot food, especially during the cold months<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Prospective cross-sectional study<br><br>***DURATION:*** > 24 months<br><br>***SAMPLE SIZE:*** *1997:* 1456 students aged four to eighteen years (743 from primary schools, 713 from secondary schools) across the United Kingdom from the 1997 National Diet and Nutrition Survey (NDNS) data.<br><br>*2004/2005:* 5695 students from 79 secondary schools and 7058 students from 151 primary schools in England<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. 1997 NDNS (dietary intake, child health)<br>2. Direct observation of school lunch food offerings and student lunch choices<br>3. Telephone surveys with school head cook or catering manager (catering practices, contract arrangements, school food policies)<br>4. Household income and free school meal eligibility<br><br>***DATA COLLECTION:*** Data regarding children's health and school meal consumption was used from the 1997 NDNS survey. The researchers compared this data with data on food choice that was directly observed in secondary and primary schools in 2004 and 2005, respectively. Telephone interviews were conducted with food service managers in 2004/2005 to assess catering practices and other food policies (context for the analysis).<br><br>***LIMITATIONS:*** Cannot determine causality due to cross-sectional study design; methodological differences existed between surveys collected during different years; 1997 NDNS survey used self-reported data; catering staff were aware of the presence of observers in the dining room and may have chosen to serve healthier foods on observation days | 4-18 year olds<br><br>Nationally representative sample of primary and secondary schools<br><br>***ELIGIBILITY:***<br>Students who reported they were "unwell with eating affected" or were dieting to lose weight were excluded from the study.<br><br>***EXPOSURE/ PARTICIPATION:***<br>All primary and secondary school children in England were exposed to the school lunch changes as a result of the 2001 National Nutritional Standards. | ***LEAD AGENCY:***<br>The Department for Education and Skills (DfES), the schools and the researchers<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:***<br>Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not applicable<br><br>***ADOPTION:*** Not applicable<br><br>***IMPLEMENTATION:***<br>Not applicable<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>Not applicable<br><br>***FUNDING:***<br>The work was funded through salaries paid by the authors' host institutions or companies. There was no additional funding.<br><br>***STRATEGIES:*** Not applicable | ***NUTRITION:***<br>1. In primary schools in 1997, students reported lower consumption of vegetables and salads, chips and potatoes cooked with fat, and pasta and other cereals than was observed directly in 2005.<br>2. In 1997, primary school students also reported higher consumption of soft drinks, milk and milk products, butter and margarine, sugar, preserves and confectionery and snacks than was observed directly in 2005.<br>3. In secondary schools in 1997, students reported lower consumption of higher-fat main dishes, chips and other potatoes cooked with fat, pasta and other cereals than was observed directly in 2004.<br>4. In secondary schools in 1997, students reported higher consumption of vegetables and salads, sugar, preserves and confectionery, and savory snacks than was observed in 2004. |

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| Veugelers, Fitzgerald (2005)<br><br>Nova Scotia, Canada | School healthy eating policies that offer healthier menu alternatives to reduce obesity and overweight (Group 2).<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported<br><br>Note: Policies for the Annapolis Valley Health Promoting Schools Program not reported | ***DESIGN:*** Cross-sectional study<br><br>***DURATION:*** Not applicable<br><br>***SAMPLE SIZE:*** 5,139 fifth graders from 282 schools, assigned to three groups; Group 1-no nutrition program (199 schools), Group 2 nutrition policies or practices that offer healthy menu alternatives (73 schools), Group 3 schools participating in the Annapolis Valley Health Promoting Schools Program (AVHPSP)<br><br>***PRIMARY OUTCOME:*** Overweight/obesity<br><br>***MEASURES:***<br>1. Height and weight<br>2. Harvard Youth Adolescent Food Frequency Questionnaire (YAQ)<br>3. Survey of physical and sedentary activities<br><br>***DATA COLLECTION:*** Not reported<br><br>***LIMITATIONS:*** Self-reported data; analyses were not weighted; bias by indication: schools with higher obesity rates (at baseline) are more likely to initiate programs and that may have masked possible benefits of school programs | 5-10 year olds<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** Not applicable | ***LEAD AGENCY:*** CLASS Research Team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not applicable<br><br>***ADOPTION:*** Not applicable<br><br>***IMPLEMENTATION:*** Not applicable<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Not applicable<br><br>***FUNDING:*** Evaluation funded by the Canadian Population Health Initiative and a Canadian Institutes of Health Research<br><br>***STRATEGIES:*** Not applicable | ***OVERWEIGHT/OBESITY:***<br>1. AVHPSP students had lower rates of overweight and obesity (17.9% overweight compared to 32.8% in control and 34.2% in the nutrition policy group; and 4.1% obese compared with 9.9% in the control and 10.4% in the nutrition policy group; no p-values provided).<br>2. Rates of overweight and obesity among AVHPSP students were significantly lower than rates among students from schools without a nutrition program (obesity OR=0.41, 95% CI: 0.32-0.53; overweight OR=0.28, 95% CI: 0.14-0.57; no p-values provided).<br><br>***NUTRITION:***<br>3. AVHPSP students had higher consumption of fruits and vegetables (6.7 mean servings compared to 5.7 in control and 5.8 in the nutrition policy group), less calorie intake from fat (29.4% compared to 30.3% control and 30.3% nutrition policy) and higher dietary quality index scores (64.5 compared to 62.3 control and 62.1 nutrition policy).<br>4. Students from AVHPSP schools reported more consumption of fruits and vegetables (OR=1.23, 95% CI: 1.07-1.40), better dietary quality (OR=1.29, 95% CI: 1.11-1.50) and less fat intake (OR=0.36, 95% CI: 0.11-1.13; p=ns) than students from schools without a nutrition program (not all p-values provided). However, the decrease in fat intake was not statistically significant.<br><br>***PHYSICAL ACTIVITY:***<br>5. AVHPSP students reported more participation in physical activity (not statistically significant). |

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| **Competitive Food Policies-United States** | | | | | | |
| Foster, Sherman (2008)<br><br>Pennsylvania | Food policies implemented in schools: beverages limited to 100% juice, water and low fat milk; snacks allowed (per serving):<br><7 g of total fat<br><2 g of saturated fat<br><360 mg of sodium<br><15 g of sugar<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>1. Nutrition education: 50 hours per student per year<br>2. Social marketing: incentives, messages<br>3. Family outreach: education through meetings, events, workshops and challenges (<2 hours per day of TV and video, >1 hour of physical activity per day, >5 fruits and vegetables per day. | ***DESIGN:*** Group randomized trial<br><br>***DURATION:*** 2 years<br><br>***SAMPLE SIZE:*** 844 students (479 exposed, 365 unexposed) in grades 4-6 from 10 middle schools in the school district of Philadelphia<br><br>***PRIMARY OUTCOME:*** Overweight/ obesity<br><br>***MEASURES:***<br>1. Body Mass Index (BMI) z-scores<br>2. Youth/Adolescent Nutrition and Physical Activity questionnaires<br>3. Body Dissatisfaction subscale of the Eating Disorder Inventory-2 (body image)<br><br>***DATA COLLECTION:*** BMI z scores and percentiles were calculated after students' heights and weights were measured. Students self-administered the Youth/Adolescent Nutrition and Physical Activity questionnaires.<br><br>***LIMITATIONS:*** Small number of schools limited capacity to create equivalent groups, self-report measures of healthy eating and activity. It is possible that the groups differed on unmeasured characteristics that were related to the outcome | Urban<br><br>Lower income<br><br>5-13 year olds<br><br>Intervention group: 44.33% Black, 22.43% Hispanic, 17.09% Asian, 10.68% White, 5.47% other (evaluation sample)<br><br>Control group: 46.83% Black, 27.67% Asian, 14.17% White, 5.83% Hispanic, 5.50 other (evaluation sample)<br><br>***ELIGIBILITY:*** Schools had to have >50% of students eligible for free or reduced priced meals<br><br>Students that provided written parental consent were included. Students that were not available for follow-up were excluded from sample.<br><br>***EXPOSURE/ PARTICIPATION:*** 83.3% of eligible schools chose to participate in the intervention; 69.5% ± 15.4% of eligible students within those schools participated in the intervention. | ***LEAD AGENCY:*** Food Trust and Research Team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** A task force was set up which established committees to make recommendations based on Centers for Disease Control and Prevention (CDC) guidelines to the Food Service Division; schools established Nutrition Advisory Groups. These groups developed plans for school environment changes.<br><br>***IMPLEMENTATION:*** The lead agency developed and delivered the intervention. Nutrition Advisory Groups led the assessment (CDC School Health Index) and action plan (e.g., limiting use of food as reward/ punishment/ fundraising, promote active recess, serve breakfast in classrooms). Teachers and support staff participated in an average of 10.4 ± 2.9 and 8.4 ± 2.2 hours of training, respectively, during the 1st and 2nd years of the intervention. The trained school staff implemented the intervention components. Teachers and support staff provided an average of 48.0 ± 27.1 and 44.0 ± 18.3 hours of nutrition education during each year of the intervention.<br><br>***FORMATIVE EVALUATION:*** School self-assessment by school Nutrition Advisory Groups (food environment) which proposed strategies for change.<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Personnel (school staff, research staff)<br>2. Funds for training<br>3. Curricula and supporting materials<br>4. Incentives (e.g. prizes for raffles)<br><br>***FUNDING:*** CDC and United States Department of Agriculture through the Pennsylvania Nutrition Education Program as part of Food Stamp Nutrition Education<br><br>***STRATEGIES:*** Not reported | ***OVERWEIGHT/OBESITY:***<br>1. After 2 years, significantly fewer children in the intervention schools (7.5%) became overweight compared to the control schools (14.9%). After controlling for gender, race/ethnicity and age, the predicted odds of incidence of overweight were ~33% lower for the intervention group (odds ratio [OR]= 0.67, 95% CI: 0.47 – 0.96; p<0.05).<br>2. There were no differences between intervention and control schools for obesity incidence. After collapsing the overweight and obese weight categories, the predicted odds of incidence of overweight or obesity were ~15% lower for the intervention group (OR: 0.85, 95% CI: 0.74 – 0.99; p<0.05).<br>3. After 2 years, the predicted odds of overweight prevalence were 35% lower for the intervention group (adjusted OR: 0.65; 95%CI: 0.54 to 0.79; p<0.0001). There were no differences between intervention and control schools for obesity prevalence.<br>4. After controlling for gender, age and baseline prevalence, Black students in the intervention schools were 41% less likely to be overweight than those in the control schools after 2 years (OR: 0.59, 95% CI: 0.38 – 0.92; p<0.05).<br>5. The predicted odds of remission of overweight or obesity were ~32% higher for the intervention group compared to control group (OR: 1.32, 95% CI: 1.09 – 1.60; p<0.01).<br><br>***SCREEN TIME:***<br>6. After controlling for gender, race/ethnicity, age and baseline television watching, weekday television watching was 5% lower in the intervention group than in the control group (OR: 0.95; 95% CI: 0.93 to 0.97; p<.0001) after 2 years.<br><br>***PHYSICAL ACTIVITY:***<br>7. After controlling for gender, race/ethnicity, age and baseline inactivity, inactivity was 4% lower in the intervention group than in the control group (OR: 0.96; 95% CI: 0.94 to 0.99; p<.01) after 2 years.<br>8. Decreases in self reported amounts of physical activity were reported by students at intervention and control schools, with no differences between the two groups.<br><br>***NUTRITION:***<br>9. Decreases in self reported amounts of the consumption of energy, fat and fruit/vegetables were reported by students at intervention and control schools, with no differences between the two groups. |

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| French, Story (2004); Fulkerson, French (2004)<br><br>Minnesota | Trying Alternative Cafeteria Options in Schools (TACOS), school policy to increase the availability of lower fat a la carte foods in secondary school cafeterias.<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>1. Student groups, assisted by a full-time TACOS Promotions Coordinator, implemented school promotional activities highlighting lower-fat foods available in the a la carte areas (i.e. taste tests, student choice self-assessments, media campaigns). | ***DESIGN:*** Group randomized trial<br><br>***DURATION:***2 school years<br><br>***SAMPLE SIZE:*** Estimated 35,000 children from 20 secondary schools in Minneapolis-St. Paul metro area (enrollment 812-3157, average 1731 students, 10 intervention, 10 control).<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. Electronic a la carte sales data (% of lower fat a la carte foods sold).<br>2. School food service revenue (% of lower fat a la carte foods sold)<br>3. Student survey (food choices, attitudes, perceived norms regarding lower/ higher-fat foods, perceptions of school food environment, use of cafeteria and vending machines, demographics).<br><br>***DATA COLLECTION:*** Student surveys were given to a sample of 75 students per school during 1 semester in 2000-2002 (75% response rate). Lower fat food choices measured the frequency previous day consumption.<br><br>***LIMITATIONS:*** Using school level data for analysis of promotions limited power. Not all schools had enough time or money to implement TACOS | Suburban<br><br>Lower income<br><br>14-18 year olds<br><br>Schools predominantly suburban, with average 14% non-white students and 9% eligible for free/reduced price lunch (evaluation sample).<br><br>***ELIGIBILITY:***<br>Schools had to have an a la carte area, a food service director and principal willing to participate, have computerized sales data available to researchers, allow a survey to be mailed to students, and allow students to collaborate on school-wide promotional activities. Only 1 school per district was included in the study to avoid contamination.<br><br>***EXPOSURE/ PARTICIPATION:***<br>Of the 25 eligible schools, 20 agreed to participate in the intervention (80%). | ***LEAD AGENCY:*** TACOS staff<br><br>***THEORY/ FRAMEWORK:***<br>Social learning theory<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:***<br>TACOS staff worked with the food service staff on implementation and documentation of food items, worked with student groups to train students for promotional activities and to be liaisons with food service staff, and worked with faculty advisors to conduct the peer promotions. Graduate assistants were trained by the Promotions Coordinator to conduct/ facilitate promotions and collect process evaluation data.<br><br>***FORMATIVE EVALUATION:***<br>Not reported<br><br>***PROCESS EVALUATION:***<br>Quarterly meetings between research and food service staff (review progress toward goals), TACOS staff visits to schools every 3 weeks (% low-fat a la carte products in a la carte areas), lunch register observations (accurate keying of food items), data form (promotion, implementation), student survey (student exposure) | ***RESOURCES:***<br>1. TACOS staff<br>2. Promotions Coordinator<br>3. Resources for adding lower fat a la carte items<br>4. Faculty advisors<br>5. Peer promotional materials<br>6. Student group incentives ($100-300)<br><br>***FUNDING:***<br>National Institutes of Health and the Centers for Disease Control and Prevention<br><br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. (n=75) No intervention-related differences in student-reported food choices data on any of the following variables: ratio of lower-fat to higher-fat food choices, added fats score, fruit and vegetable score.<br><br>***FOOD SALES:***<br>2. No significant differences from baseline to follow-up in the intervention group for any of the food service revenue variables examined.<br>3. Intervention schools showed a higher mean percentage of sales of lower-fat foods in Yr 1 (27.5% vs. 19.6%, p=0.096) and Yr 2 (33.6% vs. 22.1%, p=0.042) than control schools.<br>4. Intervention schools showed a steeper rate of increase in percentage of sales of lower-fat foods in Yr 1 (10% increase in intervention, compared to 2.8% decrease in control, p=0.002). Yr 2 did not differ significantly (2.0% vs. 1.2%, p=0.76).<br><br>***ENVIRONMENT CHANGE:***<br>5. At baseline, the mean percentage of lower-fat menu options offered in a la carte areas was similar in intervention and control schools (27.8 vs. 29.1%). After the two years, intervention schools rose to 42.0% low-fat foods while the control schools decreased to 27.7%.<br>6. 49 promotions were conducted across the 10 intervention schools during year 1 and 127 promotions were conducted during year 2.<br><br>***OTHER:***<br>7. The percentage of total promotions conducted in intervention schools was significantly associated with an increase in the percentage lower-fat food sales in Yr 1 (p=0.033), but not in Yr 2 (p=0.399). The duration of total promotions and the percentage lower-fat food sales were unrelated in Yr 1 (p=0.207), but significantly positively associated in Yr 2 (p=0.029).<br>8. In year 1, financial incentives ranged from $50 to $300 per promotion (mean $162, SD $38) and the mean amount of financial incentives per school was $418 (SD $276). In year 2, financial incentives ranged from $25 to $300 per promotion (mean $130, SD $15.8) and the average total amount of financial incentives per school was $920 (SD $320). |

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| Schwartz, Novak (2009)<br><br>Connecticut | Guidelines established by the Department of Education to provide healthier versions of snacks sold at school (e.g., beverages, salty snacks, sweet snacks). Guidelines included:<br>1. No more than 35% of calories from fat<br>2. No more than 10% calories from saturated fat<br>3. No more than 35% added sugar by weight<br>4. Limiting serving sizes<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Before and after study<br><br>***DURATION:*** 2 years<br><br>***SAMPLE SIZE:*** 996 adolescents from six different middle schools (three intervention, three control)<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. Snack Foods Eaten at School and Home Questionnaire (food intake, weight concerns and dieting); snack foods were analyzed to determine if they met criteria<br><br>***DATA COLLECTION:*** Questionnaires were completed at baseline (year 1) and follow-up (year 2), and administered by health or family consumer science teachers to all students they had in class at time of data collection. The research team conducted data analyses.<br><br>***LIMITATIONS:*** Self-reported questionnaire makes obtaining valid food intake data difficult; lack of follow-up to ensure adherence to nutritional guidelines; students did not report foods/ beverages consumed outside of school or home; lack of comprehensive, detailed assessment of body dissatisfaction and unhealthy eating behaviors; risk of Type 1 error due to multiplicity of testing | Lower income<br><br>11-13 year olds<br><br>Intervention schools: 33% eligible for free or reduced-price meals; 63.2% White, 24.6% Hispanic, 8.5% Black, 3.4% Asian American and 0.3% American Indian<br><br>Comparison schools: 37% eligible for free or reduced-price meals; 50.4% White, 23.8% Hispanic, 21.1% Black, 4.6% Asian American and 0.06% American Indian<br><br>***ELIGIBILITY:*** Application of schools to the Connecticut State Dept. of Ed to participate in the Connecticut Healthy Snack Project<br><br>***EXPOSURE/ PARTICIPATION:*** All students from the three intervention middle schools in Connecticut were exposed to the new snack guidelines. | ***LEAD AGENCY:*** Research team, school authorities<br><br>***THEORY/ FRAMEWORK:*** Social Cognitive Theory<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** Nutrition guidelines were developed by the research team, health professionals and school authorities throughout the state. The schools were responsible for implementing the policy change. Each school was able to choose its snacks and beverages within the guidelines. The only beverages that met the standards were water, milk, and 100% juice. Salty snacks that met the standards were baked chips, popcorn, and pretzels. Sweet snacks that met the standards were yogurt, granola, cereal bars, fresh or canned fruit, frozen juice bars, and reduced-fat cookies. Food services in the local schools changed the food availability at all food sources in the school<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Snack foods<br>2. Health professionals to guide development of snack guidelines<br>3. Resources for policy changes<br><br>***FUNDING:*** Connecticut State Department of Education (intervention), the Rudd Center for Food Policy and Obesity at Yale University (evaluation)<br><br>***STRATEGIES:*** Not reported | ***NUTRITION:***<br>1. Intervention schools decreased consumption of sugar sodas, teas and sports drinks from year 1 to year 2 ($\beta$ =-0.23, $p<0.05$). Comparison schools increased consumption.<br>2. Intervention schools significantly increased consumption of water and 100% juice from year 1 to year 2 ($\beta$ =0.33, $p<0.05$). No change in comparison schools.<br>3. Intervention schools consumed more chips (not baked) than comparison schools ($\beta$ =0.23, $p<0.05$). Difference was qualified by the observation that intervention schools decreased consumption of chips from year one to year two, as comparison schools increased slightly ($\beta$ =-0.30, $p<0.05$).<br>4. Intervention schools increased consumption of baked chips, pretzels, popcorn and crackers from year 1 to year 2 ($\beta$ =0.29, $p<0.05$). No change in comparison schools.<br>5. Intervention schools increased consumption of fruit, chewy fruit snacks, yogurt, granola bars, popsicles, and frozen fruit bars from year 1 to year 2 ($\beta$ =0.15, $p<0.05$). No change in comparison schools.<br>6. No changes in reported snack and beverage consumption at home among either group, except for sugary drinks which increased from year 1 to year 2 in both groups ($\beta$=0.19, $p<0.05$), with a greater increase in the comparison schools ($\beta$=-0.18, $p<0.05$). |

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| Cullen, Thompson (2005)<br><br>Texas | Portion size of snack bar items available to students (e.g., sweetened beverages, high-fat, salty and sweet foods)<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Cross-sectional study<br><br>***DURATION:*** Not applicable<br><br>***SAMPLE SIZE:*** 24,427 students from 23 middle schools in Houston<br><br>***PRIMARY OUTCOME:*** Potential energy savings from portion-size reductions in food items<br><br>***MEASURES:***<br>1. Monthly aggregate sales data (foods and beverages sold)<br>2. Mean kilocalorie savings per student per day with the reduced portion sizes were calculated<br><br>***DATA COLLECTION:*** The research team obtained monthly aggregate sales data for the 2001-02 school-year. Foods/beverages were divided into 10 categories and kilocalories were assigned to each category: 12-, 16-, and 20-oz sweetened beverages, french fries, ice cream, candy, small and large packages of high-fat/high-salt foods such as chips, and small and large high-fat/high-sugar desserts such as cakes or cookies. The researchers then assigned new variables for two largest sized beverages, large high-fat/high-salt foods, and high-fat/high-sugar desserts by substituting the kcal for a 12-oz beverage or small package of the same foods for the large portion size. Total daily sales, % of total sales, and kcal content were calculated for each item. The new reduced kcal variables were then subtracted from the large portion kilocalories to obtain energy savings for each category.<br><br>***LIMITATIONS:*** The sales data represented all food and beverage items sold during the school year, but the number of transactions was not identified, nor the number of non-student purchases; kilocalorie content of the food groups was based on an average for the items in the group; no descriptive data on the students, including BMI, were available; total dietary intake was not measured, so the impact of the policy change on total daily intake could not be assessed | Lower income<br><br>11 - 13 year olds<br><br>91% lower income<br><br>7 schools were predominantly African American, 10 Hispanic, and 6 mixed ethnicity (evaluation sample)<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** Not applicable | ***LEAD AGENCY:*** Research team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not applicable<br><br>***ADOPTION:*** Not applicable<br><br>***IMPLEMENTATION:*** Not applicable<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Not applicable<br><br>***FUNDING:*** USDA Economic Research Service and USDA Agricultural Research Service under a cooperative agreement<br><br>***STRATEGIES:*** Not applicable | ***NUTRITION:***<br>1. 379 high-fat/high-salt snacks and sweetened beverage items were sold daily in the snack bars. This represented a daily average of 111 kcal sold per student over the 180-day school year. Kilocalories per day per student were reduced to 63 when the reduced portion sizes were substituted for the full size. This represents a savings of 47 kcal/day/student.<br>2. Over a 180-day school year, an energy deficit equivalent to about 2lb could occur if students replaced the large portion-sized snacks and beverages with the smaller sizes on a one-to-one basis, did not buy multiple small bags or small drinks, did not consume additional other foods and beverages and did not change physical activity levels. |

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| Vecchiarelli, Takayanagi (2006)<br><br>California | Los Angeles Unified School District (LAUSD) school nutrition policy banning sales of soft drinks and foods of limited nutritional value/junk foods through vending machines and direct sales throughout the school day.<br><br>Beverage guidelines: healthy beverages = fruit drinks with ≥ 50% fruit juice, drinking water, milk, and electrolyte replacement beverages<br><br>Snack food guidelines: ≤ 35% of total calories from fat, ≤ 10% of total calories from saturated fat, ≤ 35% added sugar, and ≤ 600 mg of sodium per serving<br><br>Serving sizes for snacks: 1.5 oz for snacks and sweets, 2 oz for cookies/ cereal bars and 3 oz for bakery items or frozen desserts.<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Cross-sectional study<br><br>***DURATION:*** Not applicable: on-going policies that went into effect in 2004<br><br>***SAMPLE SIZE:*** 399 students from 12th grade language arts classes from two Los Angeles United School District high schools<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. 45-question, pre-tested survey (consumption of fruits, vegetables, and junk food at home and at school; student perception of change in their dietary behaviors as a result of the nutrition policies; knowledge of LAUSD nutrition policies; attitudes toward the LAUSD nutrition policies; and attitudes toward the school nutrition environment)<br><br>***DATA COLLECTION:*** The research team developed and pre-tested the survey. An item-consistency reliability analysis test was conducted for the 4 subscales in the 45 questions using Cronbach's alpha. This survey was administered to students by a trained member of the research team. Students were also asked to write in comments regarding the policies. The research team analyzed and reported results.<br><br>***LIMITATIONS:*** Reliance on students' self-report and possibility of discrepancies between the reports and actual consumption | Lower income<br><br>14-18 year olds<br><br>School 1: 4033 students; 26.0% free/reduced meals<br><br>School 2: 4758 students; 75.0% free/reduced meals<br><br>33.8% Hispanic, 31.7% White, 9.3% Asian, 6.2% African American, 2.3% Pacific Islander, 9% multiracial and 7.7% other (evaluation sample)<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** Not applicable | ***LEAD AGENCY:*** Los Angeles Unified School District (LAUSD)<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not applicable<br><br>***ADOPTION:*** Not applicable<br><br>***IMPLEMENTATION:*** Not applicable<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Not applicable<br><br>***FUNDING:*** Not reported<br><br>***STRATEGIES:*** Not applicable | ***NUTRITION:***<br>1. A significant difference was found for the students' perceived impact of the healthy beverage resolution between school and home/outside of school environment ($\chi^2[1]=20.59$, $p<0.001$) showing that 55.5% of all students reported that the policy impacted the beverages they drank at school whereas only 16.2% of all students reported the policy impacted the beverages they drank at home/outside of school.<br>2. More of the students who reported an impact of the soda ban stated they consumed fewer of the prohibited beverages compared to the students who perceived the policy had no impact at school (72% vs. 39.8%; $\chi^2[2]=48.311$, $p<0.001$), and at home/outside of school (56.1% vs. 16.0%; $\chi^2[2]=67.779$, $p<0.001$).<br>3. Significantly more female students who identified an impact of the soda ban at home/outside of school indicated they drank fewer of the banned items at home/outside of school than males students in the same group (67.6% vs. 41.4%; $\chi^2[2]=6.402$, $p=0.041$).<br>4. A significant difference was found in students' perceptions of the impact of the junk food ban between school and home/outside of school environment ($\chi^2[1]= 30.073$, $p<0.001$). Over one half of all students (52.6%) reported that the policy had an impact on the snacks they ate at school, whereas only 20.2% of them reported that the policy had impact on the snacks they ate at home/outside of school.<br>5. More of the students who reported an impact of the junk food ban said they consumed fewer of the banned snacks compared to the students who reported no policy impact at school (80.5% vs. 31.7%; $\chi^2[2]=100.520$, $p<0.001$), and at home/outside of school (57.5% vs. 14.6%; $\chi^2[2]=86.347$, $p<0.001$).<br>6. Those students who perceived an impact form the junk food ban paid more attention to what they ate compared to the students who did not perceive any impact at school ($\chi^2[2]= 14.285$, $p=0.001$) and at home/outside of school ($\chi^2[2]= 68.981$, $p<0.001$).<br>7. Within the group who did not perceive an impact from the junk food ban, significantly fewer males paid attention to what they ate compared to female students ($\chi^2[2]= 6.563$, $p=0.038$), and more male students indicated they ate more of the banned snacks at school compared to their female counterparts within the group ($\chi^2[2]=6.077$, $p=0.048$). |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Neumark-Sztainer, French (2005)<br><br>Minnesota | School food environment and policies (e.g., vending machines, open/closed lunch policies)<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Cross-sectional study<br><br>***DURATION:*** Not applicable<br><br>***SAMPLE SIZE:*** 1088 adolescents from 20 high schools in Minneapolis/St. Paul metro area<br><br>***PRIMARY OUTCOME:***Dietary consumption<br><br>***MEASURES:***<br>1. School surveys (food policies and practices)<br>2. Vending machine sales data<br>3. Student surveys (lunch patterns, fast-food consumption, and vending machine usage).<br><br>***DATA COLLECTION:*** Principals and food service directors completed surveys to collect data on school food policies and practices from the previous school year. Data on vending machine availability and hours of operation were collected through site visits by trained research staff. Data on adolescent school lunch patterns and vending machine practices were collected by surveys mailed to their homes. The research team conducted data analyses.<br><br>***LIMITATIONS:*** The data are not generalizable to other areas and populations; survey data were self-reported; the wording of questions on the student survey limited some of the conclusions drawn | Lower income<br><br>14-18 year olds<br><br>84.3% White, 4.6% Asian American, 2.5% Hispanic, 2.4% Black and 6.2% American Indian/other; 9% eligible for free or reduced price school lunch (evaluation sample)<br><br>***ELIGIBILITY:***All schools participated in the TACOS (Trying Alternative Cafeteria Options in Schools) study.<br><br>Students must have completed the survey and received parental consent.<br><br>***EXPOSURE/ PARTICIPATION:***<br>Not applicable | ***LEAD AGENCY:***<br>Research team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:***<br>Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not applicable<br><br>***ADOPTION:*** Not applicable<br><br>***IMPLEMENTATION:***<br>Not applicable<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>Not applicable<br><br>***FUNDING:***<br>National Institutes of Health and the CDC (evaluation)<br><br>***STRATEGIES:*** Not applicable | ***NUTRITION:***<br>1. Students at schools with open campus policies during lunchtime were significantly more likely to eat lunch at a fast food restaurant (0.7 days/week vs. 0.2 days/week, $p<0.001$) or a convenience store (0.3 days/week vs. 0.1 days/week, $p<0.001$) than students at schools with closed campus policies.<br>2. There were no significant differences for eating from the main lunch line, eating a la carte foods, or bringing lunch from home between students at school with open campus policies vs. closed campus policies.<br>3. Having a school policy about the types of foods sold in vending machines was inversely associated with frequency of student snack food purchases from vending machines. In schools with policies, students reported making snack food purchases an average of 0.5 days/week compared to an average of 0.9 days/week in schools without policies ($p<0.001$).<br>4. Student snack food purchases from vending machines were significantly more frequent among students from schools with a greater number of machines (1.1 days/week for 3-6+ machines, 0.8 days/week for 1-2 machines and 0.4 days/week for 0 machines, $p<0.001$).<br>5. Policies regarding hours of operation of machines were not associated with snack food purchases in the 16 schools that had snack machines.<br>6. Student soft drink purchases from vending machines were not significantly associated with the number of soft drink vending machines, but were significantly lower in schools in which machines were turned off during lunchtime (1.4 days/week) compared to schools where they were not turned off (1.9 days/week), $p<0.043$.<br><br>***OTHER:***<br>7. About two-thirds of the schools had closed campus policies during lunch time (68.4%, n=13 schools) and 3 (15.8%) of the schools had polices regarding the types of food that could be sold in vending machines. |

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| **Comprehensive School Food Policies-United States** | | | | | | |
| Harrell, Davy (2005)<br>Mississippi | School food environment modifications to add fresh fruits and vegetables as healthy options for students in school cafeteria and include healthier options in vending machines.<br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br>*Complex:*<br>1. Classroom educational sessions regarding cardiovascular risks during one science class per month.<br>2. Parent's night to educate the parents about heart healthy lifestyles<br>3. Poster contest | ***DESIGN:*** Non-randomized trial<br>***DURATION:*** Less than 6 months<br>***SAMPLE SIZE:*** 205 fifth graders from two middle schools in Mississippi (1 intervention with 112 students, 1 control with 93 students)<br>***PRIMARY OUTCOME:*** Overweight/obesity and dietary consumption<br>***MEASURES:***<br>1. Anthropometric measures (height and weight [body mass index], waist circumference and bioelectrical impedance analysis)<br>2. Physiological markers (blood pressure, blood glucose and blood lipids)<br>3. 24-hour dietary recall (food intake)<br>4. Child Dietary Fat Questionnaire (parents report of child's fat and cholesterol intake)<br>5. Know Your Body Questionnaire (health knowledge)<br>6. Administrative Interview (food service operations and practices, nutrition education and promotion practices, open campus lunch)<br>***DATA COLLECTION:*** Food service managers provided researchers with menus to assist children in recalling their meals. School administration and food service directors discussed nutrition content of meals and vending machine options. Sampled children were measured and weighed by trained field staff.<br>***LIMITATIONS:*** The intervention and control school differed in the exact distribution of children among racial groups | Rural<br>Lower income<br>5-10 year olds (5th grade)<br>Intervention school – 70% eligible for free or reduced-cost breakfast and lunch<br>Control school – 81% eligible for free or reduced-cost breakfast and lunch<br>***ELIGIBILITY:*** Parental consent<br>***EXPOSURE/ PARTICIPATION:*** All students at the intervention middle school were exposed to the school-wide changes. Only the 5th graders received the classroom education and parent night activities; Parents of 35 children attended the parent's night. | ***LEAD AGENCY:*** Research team<br>***THEORY/ FRAMEWORK:*** Not reported<br>***EVIDENCE-BASED:*** Not reported<br>***REPLICATION/ ADAPTATION:*** Not reported<br>***ADOPTION:*** Not reported<br>***IMPLEMENTATION:*** The research team met with school administration and food service director regarding the nutritional content of the meals served in the lunchroom and vending machine. The medical team and science teachers at the intervention school developed materials and incorporated the educational sessions into their monthly lesson plans and tests. Sessions were instructed by the various team members including a pediatrician, pharmacist, exercise physiologist and registered dietician.<br>***FORMATIVE EVALUATION:*** A multidisciplinary medical team consisting of dietitians, physicians, pharmacists and exercise physiologists was formed through the medical center. The team met with the administration of school district and intervention school to perform a needs assessment for the intervention school, and to outline intervention strategies.<br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Plastic food models<br>2. Health care personnel to deliver classroom component<br>3. Prizes for poster contest<br>4. Materials for parent evening<br>5. Funds for additional fruits and vegetables<br>***FUNDING:*** Financial support was provided by Pfizer Pharmaceuticals<br>***STRATEGIES:*** Not reported | ***OVERWEIGHT/OBESITY:***<br>1. There was a change in BMI from baseline to follow-up in the intervention (from 22.7±5.4 to 22.7±5.6 kg/m$^2$) and control groups (from 23.0±7.8 to 21.8±7.5 kg/m$^2$), with control group BMI significantly lower at follow-up ($p<0.05$).<br>2. Waist circumference increased in both the intervention (from 73±14 to 75±14cm) and control groups (from 72±16 to 73±17cm) from baseline to follow-up, but the difference between the two groups was not significant.<br>3. There was a decrease in the percentage of body fat from baseline to follow-up in the intervention (from 27%±12% to 26%±11%) and control groups (from 28%±13% to 24%±12%), with a significant difference between the 2 groups at follow-up ($p<0.05$).<br>***NUTRITION:***<br>4. A significant reduction in reported mean energy intake was noted in both intervention (from 1811 ± 697 kcal to 1749 ± 615 kcal) and control groups (2046 ± 767 to 1892 ± 695) over time ($p<0.0001$).<br>5. As a result of the intervention, there was a small but significant increase in vegetable intake in the intervention compared with the control group (+0.1 servings vs. -0.2 servings, $p<0.05$). No changes in fruit consumption were detected.<br>6. As a result of the intervention, there was a significant decrease in soft drink consumption in the intervention as compared with the control group (-2 fl. oz. vs. +1.3 fl. oz., $p<0.05$).<br>***OTHER:***<br>7. Systolic blood pressure and cholesterol levels decreased over time (data not shown). |

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| Blum, Davee (2007); Blum, Davee (2008); Davee, Blum (2005)<br><br>Maine | School policy to provide low-fat, low-sugar (LFLS), and portion-controlled vending and a la carte items: food items ≤ 30% of total fat calories and ≤ 35% sugar; beverages nonfat or 1% low-fat milk, 100% juice, and water; portion sizes limited to 12oz. beverages (excluding water), 3oz. frozen desserts, 3oz. bakery items, 2oz. cookies, 1.25oz. snacks.<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>1. School committee promoted changes (e.g., taste-testing of healthier foods, banners encouraging F&V consumption, visual demonstrations of the amounts of sugar & fat in foods).<br>2. Cafeteria modified recipes to lower portion size of cookies or replace butter with apple sauce to reduce fat content and increased fresh fruit and vegetable (F&V) availability. | ***DESIGN:*** Non-randomized trial<br><br>***DURATION:*** 1 school year<br><br>***SAMPLE SIZE:*** 456 students (235 exposed, 221 unexposed) from 7 high schools (3 control, 4 intervention)<br><br>***PRIMARY OUTCOME:*** Proportion of a la carte/vending items meeting LFLS guidelines<br><br>***MEASURES:***<br>1. School observations (# items offered as a la carte items, info on # of vending machines, # items offered in machines, nutritional info for each item)<br>2. Food frequency questionnaire (FFQ) for beverage consumption<br><br>***DATA COLLECTION:*** Observations were made at each school on 5 consecutive scheduled, non-randomly selected days at baseline and follow-up by observers trained by the project team. The FFQ was given to a convenience sample of students at baseline and follow-up.<br><br>***LIMITATIONS:*** Convenience sample and a small sample size; self report of FFQ; FFQ didn't differentiate between school-based and overall consumption of beverages; one school couldn't find a provider to stock LFLS foods. Non-randomized design | 14-18 year olds<br><br>97.8% White, 32.9% lower income exposed, 20% lower-income unexposed (sample)<br><br>50 Maine school districts expressed interest in the program after hearing about it.<br><br>***ELIGIBILITY:***<br>Schools expressed interest, had to be participants in National School Lunch Program, offer an a la carte program, and have at least 1 snack and 1 beverage vending machine accessible to students.<br><br>***EXPOSURE/ PARTICIPATION:***<br>All students from the 4 intervention high schools received the intervention. School enrollment was 855 ± 422 students for the intervention schools. | ***LEAD AGENCY:*** Project team (from the U. Southern Maine) and Maine Bureau of Health<br><br>***THEORY/ FRAMEWORK:***<br>Not reported<br><br>***EVIDENCE-BASED:***<br>Study built off previous studies that had implemented environmental changes to increase availability of low-fat items in all school food sources<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:***<br>The Maine Bureau of Health developed the intervention. The project team set LFLS guidelines and worked with schools, food service personnel and food industry to help implement the guidelines. Strategies used to implement guidelines included: monetary stipends, a committee at each school to promote change, visits by research personnel to food suppliers to identify LFLS items, increased F&V availability.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:***<br>Compliance was monitored throughout the school year. | ***RESOURCES:***<br>1. Project team (coordinator, dietitian, research assistant, trained project specialist)<br>2. Incentives for schools ($1500/ year)<br>3. School liaison<br>4. Promotional materials<br>5. Funds for additional fruits and vegetables<br><br>***FUNDING:*** Centers for Disease Control and Prevention's Nutrition and Physical Activity Program to Prevent Obesity and Other Chronic Diseases<br><br>***STRATEGIES:*** A model vending and an a la carte nutrition policy was developed by each school. | ***NUTRITION:***<br>1. Sugar sweetened beverage (SSB) consumption was reduced for intervention and control girls (-0.1 and -0.12 servings/ day, respectively; F=53.69, p=0.001) and boys (-0.09 and -0.22 servings/day, respectively; F=22.87, p=0.001) from pre- to post-intervention.<br>2. Diet soda consumption decreased for intervention girls (-0.06 servings/day), but increased for control girls (+0.05, p=0.01). No significant effects seen for boys.<br>3. Milk consumption increased for intervention girls and boys (+0.03 servings/day for girls, +0.09 servings/day for boys) and decreased for control girls and boys (-0.12 servings/day for girls, -0.37 servings/day for boys; girls F=33.38, p=0.001; boys: F=10.37, p=0.001).<br>4. Juice consumption decreased for intervention girls and increased for control girls (-0.13 and +0.8 servings/day, respectively; F=23.50 p=0.001). Juice consumption increased for both intervention and control boys (+0.05 and no change, respectively; F=24.91, p=0.001).<br><br>***ENVIRONMENT CHANGE:***<br>5. For a la carte items, changes from baseline to follow-up for items meeting LFLS and portion criteria were significantly greater (p<0.05) in intervention schools than control schools (40.5±6.9% vs. 0.8±2.0%, respectively).<br>6. For snack vending machine items, changes from baseline to follow-up for items meeting LFLS and portion criteria were significantly greater (p<0.05) in intervention schools than control schools (22.1±14.5% vs. -5.8±5.1%, respectively).<br>7. For beverage vending machine items, changes from baseline to follow-up for items meeting LFLS guidelines was greater (p<0.05) in intervention schools than control schools (50.9±18.8% vs. 10.5±6.5%, respectively). The difference was not significant when portion criteria were applied.<br><br>***UNINTENDED POSITIVE AND NEGATIVE EFFECTS:***<br>8. A much larger decrease in the availability of sugar-sweetened beverages (SSB) was observed in the intervention (40.5%) versus the control schools (9.4%) from baseline to follow-up. There were also much larger increases in the availability of milk (11.5%) and juice (29.9%) in the intervention schools as compared to the control schools (milk, 1.6% and juice, 4.3%).<br>9. By decreasing availability of SSB and diet soda, availability of milk and juice in the intervention schools increased. In 2 of the schools, students and faculty had adverse reactions to the a la carte program, specifically the removal of certain items, the perceived lack of food/beverage choices, and smaller portion sizes with similar costs. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Wojcicki, Heyman (2006)<br>California | Improved nutrition standards for school food service in the San Francisco Unified School District (SFUSD):<br>Beverages: plain water, 100% fruit juice, no soda, caffeine or artificial sweeteners, 1% or fat free milk with no bovine growth hormone, max size 12 fl. Oz.<br>Food items: <30% calories from fat; <10% calories from saturated plus trans fat; <35% sugar by weight; >5% of basic nutrients in snacks; portion size limits on snacks, desserts<br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br>*Complex:* Not reported | ***DESIGN:*** Before and after study<br>***DURATION:*** 12-24 months<br>***SAMPLE SIZE:*** Estimated sample size=59,000. The nutrition policy changes took effect in all public elementary, middle and high schools in the SFUSD at the beginning of the 2003-04 school year. At Aptos Middle School (first school to implement policy changes) there were 859 students.<br>***PRIMARY OUTCOME:*** Federally subsidized school lunch program participation<br>***MEASURES:***<br>1. Monthly school lunch revenue data<br>2. Student enrollment and eligibility for the free/ reduced school lunch data from the SFUSD website was used to compare changes in revenue and participation with changes in demographics of schools<br>3. District-wide survey to assess student eating practices<br>***DATA COLLECTION:*** School revenue and lunch participation data from 2002-03 (before nutritional changes) was compared with data from 2003-04 (after changes) at both the individual school level (Aptos Middle School) and the district. District-wide surveys were filled out in 1-3 classes per grade level in each school, depending on school size. The SFUSD Research, Accountability, and Planning Department designed and administered the survey, and completed preliminary analysis of the data.<br>***LIMITATIONS:*** Statistical tests were not used to make comparisons. It is unclear whether changes in the nutrient quality and types of foods provided by the nutrition service led to increased participation in the program, or if these increases were due to other reasons like increased eligibility for free/ reduced price lunches | 5-18 year olds<br>859 students from the Aptos middle school were 21.2% African American, 34.9% Asian American, and 23.4% Latino (demographics not reported for the whole school district)<br>***ELIGIBILITY:*** Not reported<br>***EXPOSURE/ PARTICIPATION:*** All students in the San Francisco Unified School District were exposed to the school nutrition policy (n=59,000). | ***LEAD AGENCY:*** SFUSD<br>***THEORY/ FRAMEWORK:*** Not reported<br>***EVIDENCE-BASED:*** Not reported<br>***REPLICATION/ ADAPTATION:*** Not reported<br>***ADOPTION:*** A task force on nutrition and physical activity in public schools was created, including parents, students, doctors, members of board of education, who met monthly for a year to develop policies that could be recommended.<br>***IMPLEMENTATION:*** Student Nutrition Services (SNS) implemented the changes in the schools.<br>***FORMATIVE EVALUATION:***<br>1. Parent groups met with SNS to discuss food distribution and school meal finances, before meeting with the SFUSD Board of Education.<br>2. At Aptos Middle School, students were informally polled on their food choices by teachers and their input was relayed to the SFUSD Nutrition Committee.<br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Personnel on the task force<br>2. Nutrition committee<br>3. Board of education<br>4. New food items/ ingredients to meet standards<br>***FUNDING:*** The San Francisco Unified School District funded the changes in nutrition policy. The evaluation was funded by a National Institutes of Health grant and a Robert Wood Johnson Foundation grant.<br>***STRATEGIES:*** Not reported | ***SCHOOL LUNCH PARTICIPATION:***<br>1. Overall participation in the federally subsidized free lunch program increased dramatically at both middle and high schools in the 2003-2004 school years. 67.5% of high schools showed an increase in participation, while only 15% showed a decrease. Student participation increased by a mean of 640 individual lunch meals per school.<br>2. Increases in participation in the free lunch program may be explained, to some extent, by the increase in the percentage of students eligible for free lunches from the 2002-2003 to the 2003-2004 school year (mean increase: 7.2%).<br>3. While participation in the reduced-price and paid lunch program decreased in the 2003-2004 school year (50% and 47.5% of schools, respectively) overall participation in the lunch program (paid, free and reduced price) increased, with 55% of schools demonstrating increases in sales.<br>4. Changes led to a decrease in the number of students participating in a la carte / snack bar program.<br>***SALES:***<br>5. A total mean increase in sales of $1,706 for the 40 schools in the SFUSD was directly related to the overall increase in students' participation in the federal lunch program (free, reduced, and paid).<br>6. Only 5.1% of schools showed an increase in a la carte/ snack bar sales and schools lost an average of $13,155 in a la carte/snack bar sales.<br>7. At the time of this article, profits had not been tabulated for the 2003-2004 school year, and thus the effects of the menu changes on overall profits were unclear. |

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| Cullen, Watson (2009)<br>Texas | 2004 Texas Public School Nutrition Policy - effective beginning in the 2004-2005 school year, restricting portion sizes of high-fat and sugar snacks to < 200 kilocalories per serving package and sweetened beverages to 12 ounces or less, limits the fat content of milk offered to 1% or less, provides guidelines for the fat content of foods served, and sets limits on the frequency of serving high-fat vegetables such as french fries<br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br>*Complex:*<br>Not reported | ***DESIGN:*** Before and after study<br>***DURATION:*** 2 school years<br>***SAMPLE SIZE:*** 47 schools in 11 school districts throughout Texas, including 23 schools with snack bar sales.<br>***PRIMARY OUTCOME:*** Food items served and snack bar sales<br>***MEASURES:***<br>1. Daily food production records for the National School Lunch Program (NSLP)<br>2. Point of sale data for snack bars<br>3. Daily portions served per student<br>***DATA COLLECTION:*** Researchers requested daily production records for NSLP meals and point of sale data for snack bar items for the 2003-04 (prepolicy) and 2004-05 (postpolicy) school years from 5 schools in each district (2 elementary, 2 middle, 1 high). Daily portions served per student for all schools were aggregated over the month. Final data for analysis included the daily average food-specific portions served per student for all months. Data were aggregated annually by summing the total food-specific items sold and dividing that total by 180 school days.<br>***LIMITATIONS:*** School districts included in the study may have been more amenable to making policy changes; results may not be generalizable to all of Texas or other parts of the country, however there were no significant differences in district size, student ethnicity, and % of students eligible for free /reduced price lunches among districts that sent data, those that did not, and state district averages; data on served or sold food items may not represent individual student lunch consumption; only a small number of schools provided snack bar sales data, limiting the ability to detect significant differences; no data were collected for any other year | Lower income<br>5-18 year olds<br>The school districts were 51% eligible for free or reduced-price lunch, 12% Black, 31% Hispanic, 56% White and 1% other<br>***ELIGIBILITY:***<br>Researchers invited 5 schools in each district to participate (2 elementary, 2 middle, 1 high); 29 districts initially agreed to participate, but only 11 districts (with a total of 49 schools) sent adequate food production data; 2 schools were excluded because 2004-2005 data were not provided.<br>***EXPOSURE/ PARTICIPATION:***<br>The TX statewide policy has the potential to impact 4.7 million children in 1,238 school districts. | ***LEAD AGENCY:*** The research team from the Agricultural Research Service/ United States Department of Agriculture and Children's Nutrition Research Center of Baylor College<br>***THEORY/ FRAMEWORK:*** Not reported<br>***EVIDENCE-BASED:*** Not reported<br>***REPLICATION/ ADAPTATION:*** Not reported<br>***ADOPTION:*** Not reported<br>***IMPLEMENTATION:*** State Department of Agriculture informed schools about the policy, an unfunded mandate. Schools were responsible for carrying out the school lunch changes.<br>***FORMATIVE EVALUATION:*** Not reported<br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Funds to provide lower fat and calorie food options<br>***FUNDING:*** Robert Wood Johnson Foundation and in part by federal funds from the United States Department of Agriculture, Agriculture Research Service (evaluation). Funding not reported for the intervention<br>***STRATEGIES:*** Implementation of the policy is monitored during periodic school food service reviews. | ***ENVIRONMENT CHANGE:***<br>1. There was a significant difference between school years for servings of high-fat vegetables ($p<0.001$). Regardless of school and district size, fewer portions of high-fat vegetables per student were served during 2004-05 (0.46 servings) than during 2003-04 (0.68).<br>2. Regardless of school year or district size, secondary schools reported serving more portions of high-fat vegetables per student (0.80 and 0.54 servings) than did primary schools (0.49 and 0.36 servings). The reduction was greater in schools located in larger districts (0.71-0.38 servings, $p<0.001$) than in schools in smaller districts (0.65-0.55 servings; $p=0.011$).<br>3. There were no significant differences for regular or non-fried vegetables for any analyses.<br>4. There was a significant district size main effect for milk ($p=0.030$). Schools in the smaller districts served more milk (1.31 servings in both years) than did larger districts (0.83 and 1.02 servings).<br>5. There was no significant improvement in fruit servings between years, but there was a significant ($p=0.001$) school-level main effect for average daily servings of fruit served per student. Regardless of district size, primary schools reported serving more portions of fruit per student both school years (0.73 and 0.74 servings) than did secondary schools (0.40 and 0.45 servings).<br>6. 75% of the elementary schools offered french fries 3 or fewer times per week during 2003-2004; this increased to 89% in 2004-2005. Forty-two percent of the middle schools offered french fries 3 or fewer times per week during 2003-2004; this increased to 62% during 2004-2005.<br>***FOOD SALES:***<br>7. The sale of large bags of chips decreased postpolicy (2004-2005) from 9.6 to 0.2 servings ($p=0.006$), whereas the sale of baked chips increased from 15.3 to 23.6 servings per day postpolicy ($p=0.048$).<br>8. There was a non-significant decrease in candy sales from 12.8 to 1.1 servings per day, and there were no significant changes in sales of dessert foods or ice cream. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Cullen, Hartstein (2007); Hartstein, Cullen (2008)<br><br>California, North Carolina, Texas | School food environment modifications to improve healthy food and beverage choices in vending machines, a la carte areas and cafeterias. Goal to reduce all regular chips serving size bags to ≤1.5 oz, increase of lower-fat chip offerings by 25%, increase fruit and vegetable menu items ≥ 3/day, increase fruit and vegetable variety to ≥10 different items, increase lower fat entrees to ≥2 per week; offer 20oz. sized bottled water, limit sweetened beverages to ≤12 oz., turn off soda machines during meals<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Before and after study<br><br>***DURATION:*** < 6 months<br><br>***SAMPLE SIZE:*** 6,248 students from 6 middle schools in NC, TX, CA<br><br>***PRIMARY OUTCOME:*** Healthy food and beverage availability<br><br>***MEASURES:***<br>1. Food sales records<br>2. Questionnaires (achievement of food service goals)<br>3. Focus groups with students (feedback on study changes)<br>4. Interviews with principals and foodservice staff (feedback on study change)<br><br>***DATA COLLECTION:*** Sales records were collected at baseline and every week for 6 weeks. Six follow-up focus groups were conducted with 6th grade students (ages 11-14), as were interventions with foodservice directors, managers and principals at each school to obtain feedback on study changes. Researchers collected and analyzed the data.<br><br>***LIMITATIONS:*** No determination on whether students bought double servings or bought other snack foods; no data available on foods brought from home; no data on individual consumption obtained to measure impact on student intake; used student attendance as approximation of number of students who purchased a la carte items; lacked power to detect significant differences in sales among schools; limited generalizability | Lower income<br><br>African American<br><br>Hispanic<br><br>*California:* School 1 – 91% Hispanic, 7% African American, 1% White and 1% other; 97% free and reduced price meals<br><br>School 2 – 48% Hispanic, 48% White, 1% Native American and 4% other; 55% free and reduced price meals<br><br>*North Carolina:* School 1 – 50% African American, 25% Native American, 23% White, 1% Hispanic and 1% other; 75% free and reduced price meals<br><br>School 2 – 49% African American, 49% White, 1% Native American, <1% Hispanic and <1% other; 57% free and reduced price meals<br><br>*Texas:* School 1 – 88% African American, 10% Hispanic, 1% other and <1% White; 93% free and reduced price meals<br><br>School 2 – 98% Hispanic, 1% White, <1% African American and <1% other; 94% free and reduced price meals<br><br>***ELIGIBILITY:*** Schools must have at least 50% ethnic minority student population and at least a 50% student population eligible for free/ reduced price meals.<br><br>***EXPOSURE/ PARTICIPATION:***<br>Not reported | ***LEAD AGENCY:***<br>School foodservice staff<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:***<br>Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:***<br>The research team collaborated with the schools' food service staff to implement school food changes. All food service workers were trained on the changes and to enlist support for the intervention.<br><br>***FORMATIVE EVALUATION:***<br>Eleven focus groups and interviews with district administrators at participating schools (13 potential policy goals)<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. Information sheet on foodservice changes for teachers<br>2. Dietitians<br>3. Foodservice staff<br>4. $3,000 compensation for each school to implement changes<br>5. NuMenu nutrient standard meal planning system<br><br>***FUNDING:***<br>National Institute of Diabetes and Digestive and Kidney Diseases and the United States Department of Agriculture<br><br>***STRATEGIES:*** Not applicable – pilot study | ***ENVIRONMENT CHANGE:***<br>1. At baseline, 1 school met 1 intervention goal (offering reduced fat chips as 25% of their snack chips). At follow-up all goals (see intervention components) were met by 5 schools with 1 school meeting all but one goal (offering reduced-fat chips).<br>2. Across the 6 schools the total NSLP (National Student Lunch Program) fruits and vegetables (F&V) served increased from 1.10 to 1.42 servings. Vegetable servings increased from 0.65 to 0.79, and fruit servings increased from 0.23 to 0.42.<br><br>***SALES:***<br>3. There were significant changes in nutrient sales per student, with an increase in % kcal from protein ($p<0.05$) and ounces of water ($p<0.01$), and decrease in sales of sweetened beverages ($p<0.01$), and regular chips ($p<0.05$) across all 6 schools.<br>4. There was a significant reduction in kcal density per item sold ($p<0.01$). The 2nd TX school showed a reduction in kcal density from 277 to 216. Reductions at other schools were more modest (1 to 12 kcal per item sold). The 2nd CA school increased kcal density by 9 kcal per item sold.<br>5. There were no changes in fat or % fat per item sold.<br>6. Large-sized drinks and chips were eliminated from a la carte lines in all schools. Overall, ounces of sweetened beverages and chips sold declined by 29% and 16%, respectively; ounces of water sold increased (51%); and sales of low-fat/ reduced-fat chips increased (775%).<br>7. There was no significant change in number of kilocalories sold per student from week 1 to week 6. However, the 2 Texas schools showed small but important savings of 31 and 24 kcal per student per day. |

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| Grainger, Senauer (2007)<br><br>Minnesota | School cafeteria modifications, which removed high-fat foods and snacks from the school cafeteria, eliminated soft drinks from vending machines and introduced home-made nutritionally-rich foods.<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br><br>*Complex:* Construction of a new food service kitchen and lunchroom area | ***DESIGN:*** Time series study<br><br>***DURATION:*** > 24 months<br><br>***SAMPLE SIZE:*** 890 high school students<br><br>***PRIMARY OUTCOME:*** Students dietary intake<br><br>***MEASURES:***<br>1. Point-of sale (POS) reports from a random sample of students<br>2. National School Lunch Program (NSLP) and a la carte item prices from food service (expenditures, value of foods purchased)<br>3. School district office files (student demographics)<br>4. Relative Healthiness Index (RHI) which was based on ratings of school dietitian, the dietitian developed index (RHI-DDI) (nutritional ratings of foods)<br>5. USDA's Healthy Eating Index (RHI-HEI) (nutritional ratings of foods)<br><br>***DATA COLLECTION:*** Using student IDs from Nov. 2002-04 and April 2003-05 with 2002 treated as baseline, daily sales data on food item numbers and quantity purchased by each student informed the point of sale reports. The RHI-DDI and RHI-HEI indices were used to rate the quality of students' school meal and a la carte purchases, respectively, over a 10-day period. The authors (from the University of Minnesota) analyzed the data.<br><br>***LIMITATIONS:*** No assessment of what students actually consumed (except for plate observations), no control group, limiting claims of causality, only limited information was available on the NSLP meals | Lower income<br><br>14-18 years old<br><br>6.9% of students received free or reduced-price meals; 84.2% White, 7.2% Black, 5.0% Asian, 2.8% Hispanic and 0.8% Asian (evaluation sample)<br><br>***ELIGIBILITY:*** Data was calculated/ analyzed only for students purchasing one or more a la carte items on at least 10 days during a given month.<br><br>***EXPOSURE/ PARTICIPATION:*** The school food policy was implemented in all school cafeterias in the Hopkins School District (most innovations at the high school), which served about 9,000 students daily. | ***LEAD AGENCY:*** The school district<br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** School district hired a new food service director who helped design and implement the program. Certain cafeteria windows served only food free of trans-fats, high in fiber and low in sugar. The Pepsi vending contract was canceled. Vending machines were purchased from Pepsi and restocked with water/100% juice. Foods were cooked from scratch, and flatware was used instead of disposable trays. The high school also switched to low-fat salad dressings/cheese, and whole wheat breads/pizza crusts. More vegetables were offered in dishes and as toppings. A closed campus policy prevented competition from nearby fast food outlets.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:***<br>1. New food ingredients<br>2. Purchase of vending machines and products<br>3. Funds for construction of the food service kitchen and lunchroom area<br>4. Food service director<br><br>***FUNDING:*** McKnight Foundation and the school district<br><br>***STRATEGIES:*** The program demonstrated its financial viability and is able to operate on a revenue-neutral basis, not requiring a subsidy from the school district. | ***COST:***<br>1. Prices increased due to preparing foods from scratch and providing more fresh fruits and vegetables. The price at Hopkins High School of the NSLP meal was $2.05 in 2002-03, $2.30 in 2003-04, and $2.50 in 2004-05.<br>2. Capital expenditure to start the program was large, but variable costs such as labor did not increase substantially due to efficiency gains. These gains were a result of the food service director's experience in the private sector which led him to focus on increasing efficiency and productivity in the kitchens.<br><br>***NUTRITION:***<br>3. Both nutritional quality indexes increased, suggesting that students made healthier food choices over time. In November 2002, the average RHI-DDI was -1.237, which improved to 2.571 by April 2005. Likewise, the mean RHI-HEI increased from 23.062 to 27.656.<br>4. The linear time trend variable was positive and significant ($p<0.01$) in every regression analysis suggesting that there was an improvement in students' diets over time and that these improvements were associated with changes implemented by the school district.<br>5. Based on random effects regression, females were more likely to make healthier food choices than white males (random effects RHI-HEI = 3.95769 [0.64318], $p<0.01$; random effects RHI-DDI = 2.13771 [0.34937], $p<0.01$). However, males had greater improvement in the healthiness of their choices than females over time (random effects RHI-HEI = 0.65722 [0.15577], $p<0.01$; random effects RHI-DDI = 0.30392 [0.07738], $p<0.01$).<br>6. There was no significant effect on healthier food choices among students who received a free or reduced-price NSLP meal. This result is encouraging because it means that poorer students who received assistance buying lunch were able to make food choices that were as healthy as other students.<br>7. Racial/ethnic students saw a positive trend in making healthier choices, but the healthiness of their choices improved less dramatically than that of white students. |

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| Cullen, Watson (2006); Cullen, Watson (2008)<br><br>Texas | Texas Public School Nutrition Policy:<br><br>Restriction of portion sizes of high-fat and sugar snacks, sweetened beverages (≤12oz), and fat content (≤28g fat per serving no more than 2x per week) of all foods served at school. Also sets limits on the frequency of serving high-fat vegetables (French fries) to 3oz per serving no more than 3x per week. (Year 3)<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>1. Local school district policy removing snack chips, candy, and many desserts from all district middle school snack bars and removing vending machines from all district middle school cafeterias. (Year 2)<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Before and after study<br><br>***DURATION:*** 3 years<br><br>***SAMPLE SIZE:*** 2,790 students in sixth to eighth grade in 3 middle schools<br><br>***PRIMARY OUTCOME:*** Dietary consumption<br><br>***MEASURES:***<br>1. Food records (self-reported food intake)<br>2. Electronic data of daily snack bar food sales<br><br>***DATA COLLECTION:*** Data collected at 3 periods: baseline (prior to nutrition policy), 1 year after policy, and 2 years after policy. Records were completed by students in cafeteria, immediately after eating lunch. Data collectors showed the students how to record the foods. Data were entered into Nutrition data system to obtain average daily lunch consumption of nutrients and servings of fruit, vegetables, milk, candy etc. for the total meal and the % from each meal source. Cafeteria workers entered data into Point Of Service purchase machines which provided an electronic data file of daily snack bar food sales. The research team (trained data collectors) collected lunch food records and took data from the point of service machines for analysis.<br><br>***LIMITATIONS:*** Self-reported food records; convenience sample; sample may not have captured the usual dietary patterns that are represented by the daily sales record; sales data entered by cafeteria staff making it possible for inaccurate data entries; the research team was unable to ascertain if or which students provided multiple assessments; limited generalizability | Lower income<br><br>11-18 year olds<br><br>47% eligible for free/ reduced price lunch; 61% Hispanic, 34% White, 3% African American, 2% Asian/other (evaluation sample)<br><br>***ELIGIBILITY:*** Students who agreed to complete food records.<br><br>***EXPOSURE/ PARTICIPATION:*** All Texas public school children were exposed to the statewide Texas Public School Nutrition Policy (unfunded mandate). | ***LEAD AGENCY:*** State government of Texas and schools<br><br>***THEORY/ FRAMEWORK:*** Social Cognitive Theory<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** The food service director in the schools implemented local policy changes for the 2002-03 school-year.<br><br>***IMPLEMENTATION:*** The local food service director implemented the local district policy and the state government implemented the Texas Public School Nutrition Policy statewide. Year 1 (2001-2002): No restrictions/nutrition policies in existence. Principals determined the number of beverage and snack vending machines in school. Year 2 (2002-2003): Introduction of local policy change removing unhealthy foods from district snack bars and removing vending machines from the cafeterias. Year 3 (2005-2006): Texas School Nutrition Policy restricting portion sizes for food, limiting fat content and frequency of serving certain items in effect for 2 years.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Not reported<br><br>***FUNDING:*** USDA Economic Research Service, the USDA-Agricultural Research Service, and the National Cancer Institute<br><br>***STRATEGIES:*** Not reported; however, the policy was not rescinded. | ***ENVIRONMENT CHANGE:***<br>*Before nutrition policy:*<br>1. The number of vending machines increased from 21 at baseline to 42 during year 1. There was an increase in the number of candy and snack chips available in the vending machines.<br><br>*After nutrition policy:*<br>2. Total vending machines in schools dropped from 42 during year 1 to 23 during year 2 and the percentage of schools dispensing beverages decreased from 83 to 61%.<br><br>***NUTRITION:***<br>*After nutrition policy:*<br>3. Intake of daily energy (from 2646kJ to 2990kJ), protein (from 22.2g to 28.2g), fiber (from 3.7g to 5.1g), vitamin A (from 151RE to 220RE ), vitamin C (from 13.9mg to 26.9mg), and calcium (from 292mg to 454mg) were significantly higher in year 3 than year 1 ($p<0.05$).<br>4. More milk (from 2.44oz to 6.54oz) and vegetables (from 0.29 servings to 0.89 servings) and less sweetened beverages (from 5.43oz to 1.49oz), soft drinks (from 4.76oz to 0.11oz) and snack chips (from 0.21 servings to 0.04 servings) were consumed per day in year 3 than during year 1 ($p<0.05$).<br>5. Comparing year 3 to year 1, more servings of regular vegetables (99% vs. 83%) and milk (99% vs. 88%) were consumed from the NSLP meal and fewer dessert foods (15% vs. 24%), soft drinks (0% vs. 5%) and snack chips (4% vs. 10%) were consumed from the NSLP meal ($p<0.025$).<br>6. Comparing year 3 to year 1, the snack bar provided more sweetened beverages (61% vs. 13%), candy (52% vs. 24%) and dessert foods (20% vs. 7%), and fewer high-fat vegetables (1% vs. 24%), milk (1% vs. 9%) and snack chips (1% vs. 41%), $p<0.025$.<br>7. The vending machines provided fewer sweetened beverages (19% vs. 72%), soft drinks (11% vs. 80%), candy (5% vs. 39%), dessert foods (0% vs. 22%) and snack chips (6% vs. 31%) in year 3 than year 1 ($p<0.025$). However, more of these items were brought from home in year 3 (chips 90%, soft drinks 66%, dessert foods 64%, candy 40%; $p<0.025$).<br>8. There were fewer differences in overall consumption between Yr 2 and 3, indicating that the local policy made a difference.<br><br>***UNINTENDED POSITIVE EFFECT:***<br>9. The total number of students enrolled in the NSLP program increased about 200 per school (~20%) from year 1 to year 3. |

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| Ritenbaugh, Teufel-Shone (2003); Teufel, Ritenbaugh (1998)<br><br>New Mexico | Zuni Diabetes Prevention Program included school policies to:<br><br>Replace sugary soft drinks with diet beverages in school vending machines; ban unhealthy snacks and sugary beverages from the wellness center; increase fruits and vegetables (F&V) and decrease fat in school lunches; provide palatable water in 5 gallon water coolers<br><br>**OTHER INTERVENTION COMPONENTS:**<br>*Multi-component:*<br>1. Creation of youth fitness center open during lunch and after school; new exercise equipment and climbing wall; sponsored classes, tournaments, and other activities.<br><br>*Complex:*<br>1. Diabetes prevention curriculum: 9 weeks of physical education (PE) class devoted to orientation to wellness center and diabetes prevention; biology and food service class learning units; new elective on diabetes prevention.<br>2. Posters, school announcements and radio PSAs<br>3. Social network component: Efforts to develop 3 supportive social networks; Teen Task Force (6-12 youth) | **DESIGN:** Time series<br><br>**DURATION:** 4 years<br><br>**SAMPLE SIZE:** Average of 125 Native American juniors and seniors (at each interval) from 2 high schools. 38 Anglo youth from another high school were used as comparison.<br><br>**PRIMARY OUTCOME:** Nutrition, use of wellness center, plasma glucose and insulin levels<br><br>**MEASURES:**<br>1. Biological measures (plasma insulin and glucose levels)<br>2. Family history of diabetes<br>3. Body composition (height, weight)<br>4. In-school soft drink vending machine sales<br><br>**DATA COLLECTION:** Biological measures were drawn after an 8hr fast and 30 minutes after a 75g glucose load (OGTT), with the 75th percentile used for outcome measure comparisons. Family history was asked at the time of the OGTT. Body composition was collected using a stadiometer and beam balance. Three cross sectional evaluations of biological markers were conducted in Yr 0 (baseline), Yr 1.5, and Yr 3. Sales were tracked over the 4 years of the intervention.<br><br>**LIMITATIONS:** Impact evaluation in year 3 is based on OGTTs from 44% of participants; factors predisposing youth to volunteer for study may also bias outcome; intervention effects cannot be extrapolated to represent all Zuni high school youth | 14-18 year olds<br><br>100% Native American<br><br>**ELIGIBILITY:** Enrollment as a high school student at Zuni high school, parental consent for 16-18 yr olds, student assent. Students aged <16 years were excluded from invasive evaluation measurements and 7 youth with elevated fasting glucose levels were excluded from analyses.<br><br>**EXPOSURE/ PARTICIPATION:** All students in the high school classes of 1999 and 2000 were exposed to the intervention. | **LEAD AGENCY:** Pueblo of Zuni, the Zuni Public School District and the University of Arizona<br>**THEORY/ FRAMEWORK:** Not reported<br><br>**EVIDENCE-BASED:** Not reported<br><br>**REPLICATION/ ADAPTATION:** Not reported<br><br>**ADOPTION:** The lead agencies included several members of the community and the reservation. Over the course of 6 years (1991-97), these groups developed the intervention.<br><br>**IMPLEMENTATION:** Members of the various lead agencies and the reservation implemented the intervention. Teachers and researchers developed course specific diabetes education units. Fitness center staff were trained on use of equipment, first aid, and as certified instructors. The Teen Task Force was trained during the 1st 6 months of employment and helped to collect data, planned events and monitored activities for the center. Food service personnel completed a 3 hour workshop on healthy recipes and were given a list of alternative food vendors.<br><br>**FORMATIVE EVALUATION:**<br>1. Focus groups with high school youth (understanding of healthy eating, diabetes, PA)<br>2. Interviews with high school faculty, staff, and administrators (current biology, PE, and health requirements; strengths/limitations of the school lunch program)<br>3. 24-hr dietary recalls from high-school aged youth to assess food choices/serving sizes<br>4. Questionnaire for youth (knowledge and attitudes about the existing wellness center and other facilities)<br><br>**PROCESS EVALUATION:** Program progress reports were provided periodically at faculty meetings. | **RESOURCES:**<br>1. Space/ funds for fitness center<br>2. Director and staff for the fitness center<br>3. Wages for Teen Task Force members<br>4. Purified water coolers<br>5. Food service training packet<br>6. Healthy recipes<br>7. Diabetes prevention curriculum<br>8. Posters and time on local radio station for promotion<br><br>**FUNDING:** National Institutes of Health, University of Arizona<br><br>**STRATEGIES:** Not reported | **NUTRITION:**<br>1. By year 3 the 400 students of Zuni high school were consuming virtually no sugared soft drinks at school (down from 800 12-ounce cans/ week/400 students).<br>2. Environmental change accounted for a decrease in consumption of sugared soft drinks of about 4.8 ounces/day/student.<br><br>**FACILITY USE:**<br>3. Increased use of the wellness facility over the first 3 years of operation. 8.5% of the total high school student population used the wellness center per day in Yr 1, while 28% used it daily in Yr 3.<br><br>**OTHER:**<br>4. Fasting glucose levels varied little over the 3 years, with levels for most youth well within the normal range.<br>5. The fasting insulin levels for Zuni females and males showed a significant downward trend over 3 years both at the median (Coeff= -12, p=0.03 females, Coeff= -18, p=0.000 males) and at the 75th percentile (Coeff= -27, p<0.05 females, Coeff= -39, p<0.001 males). By Year 3, neither Zuni males nor females were different from the appropriate Anglo comparison group.<br>6. 30-min insulin levels for Zuni females and males showed downward trends at both the median (Coeff= -261, p<0.001 females, Coeff= -135, p=0.05 males) and the 75th percentiles (Coeff= -260, p<0.001 females, Coeff= -342, p<0.001 males) over the 3 years. However, at year 3 levels for Zuni females remained higher than Anglo girls. In year 3 Zuni males were not different from the Anglo males. |

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| Cullen, Eagan (2000) & Cullen, Zakeri (2004)<br><br>Texas | National School Lunch Program (NSLP) in elementary and middle schools<br><br>**OTHER INTERVENTION COMPONENTS:**<br>*Multi-component:*<br>1. Snack bar availability for students in middle school<br><br>*Complex:*<br>Not reported | **DESIGN:** Cohort 1: Cross-sectional study<br>Cohort 2: Prospective cohort study<br><br>**DURATION:** Cohort 1: Not applicable<br>Cohort 2: Two school years: 1998-99 & 1999-2000.<br><br>**SAMPLE SIZE:** Cohort 1: 594 students in 4th & 5th grades from one school district in S. Texas. Fourth graders (312) attended one of four elementary schools (no snack bar); all fifth graders (282) attended a single middle school (snack bar available).<br><br>Cohort 2: Total of 608 fourth and fifth grade students from same school district as cohort 1; students followed over two years.<br><br>Fourth to Fifth Grade: Fourth graders (322) at four elementary schools with NSLP advanced to fifth grade for year 2, transitioning to a single middle school where a snack bar was available in addition to NSLP.<br><br>Fifth to Sixth Grade: Fifth graders (286) at one middle school advanced to sixth grade at the same school for year 2.<br><br>**PRIMARY OUTCOME:** Dietary consumption<br><br>**MEASURES:**<br>1. Food records (# of servings, source of food)<br>2. Fruit, juice and vegetable (FJV) preference questionnaire (use of Likert scale for FJV preference allowed for adjustment for changes in preferences between grades) – Cohort 1 only<br><br>**DATA COLLECTION:** Students completed lunch food records on 5 consecutive days directly after lunch, once for cohort one and twice each year over the 2 school years for cohort 2. Cohort 1 also completed the FVJ questionnaire at the same time the lunch food records were collected.<br><br>**LIMITATIONS:** Self-reported dietary intake; lack of random assignment and no true control group; no assessment of secular events; all participants in single school district so findings may not be generalizable to all elementary and middle school students; 5th graders had higher accuracy rates than 4th graders on lunch food records; lower reliability for juice preference scale than others; no info available for 203 students from Cohort 1 who did not return consent forms | 9-11 year olds<br><br>School district students were 18% African American, 24% Mexican-American, 57% European American, 1% Asian. 24% were eligible for free and reduced lunch meals.<br><br>**ELIGIBILITY:** Parental consent forms<br><br>**EXPOSURE/ PARTICIPATION:** Fewer NSLP and home meals were consumed in middle school compared with elementary school. In middle school, 35-40% of meals were purchased exclusively from the snack bar (Cohort 2) | **LEAD AGENCY:** Baylor College of Medicine, Children's Nutrition Research Center<br><br>**THEORY/ FRAMEWORK:** Not reported<br><br>**EVIDENCE-BASED:** Not reported<br><br>**REPLICATION/ ADAPTATION:** Not reported<br><br>**ADOPTION:** Not reported<br><br>**IMPLEMENTATION:** The cafeteria managers were in charge of implementation of the NSLP meals.<br><br>**FORMATIVE EVALUATION:** Not reported<br><br>**PROCESS EVALUATION:** Not reported | **RESOURCES:** Not reported<br><br>**FUNDING:** The study evaluation was funded by K.W. Cullen and a training grant from the Cancer Research Foundation of American, the National Cancer Institute, and United States Department of Agriculture/ Agricultural Research Service.<br><br>**STRATEGIES:** Not reported | **NUTRITION:**<br>*Cohort 1:*<br>1. Compared to 4th graders (NSLP only), 5th graders (NSLP plus snack bar) consumed lower mean intakes of fruit (0.11 vs. 0.24 servings, $p<0.001$), juice (0.01 vs. 0.02 servings, $p<0.05$), total vegetables (0.47 vs. 0.54 servings, $p<0.05$) and total fruits, juices and vegetables (FJVs) (0.6 vs. 0.8 servings, $p<0.001$). There was a main effect for family education as students whose parents reported a high school education or less consumed less juice, but more regular vegetables, total vegetables and total FJVs (data not shown).<br>2. Fifth grade students who ate only snack bar meals reported significantly lower regular (0.08 vs. 0.37 servings, $p<0.001$) and total vegetable (0.37 vs. 0.61 servings, $p<0.001$) servings and total FJVs (0.40 vs. 0.82, $p<0.001$), and more high-fat vegetables (0.29 vs. 0.24 servings, $p<0.05$), compared to 5th grade students who ate the NSLP meal only.<br>3. Controlling for FJV preferences in the FJV consumption model, did not change the main effect for the grade level differences in consumption.<br><br>*Cohort 1:*<br>4. Fourth to Fifth Graders: Servings of fruits, regular vegetables, and milk decreased 33%, 42%, and 35%, respectively ($p<0.001$ for all), from year 1 to year 2 and servings of high-fat vegetables and sweetened beverages increased 68% and 62%, respectively ($p<0.001$ for both).<br>5. Fifth to Sixth Graders: High fat vegetable ($p<0.001$) and milk ($p<0.05$) consumption increased 30% and 14%, respectively, from year 1 to year 2 while consumption of regular vegetables ($p<0.05$) and sweetened beverages ($p<0.05$) decreased 10% and 12% respectively. Fruit consumption did not change.<br>6. In year 2, the fifth to sixth grade group reported significantly lower fruit (0.10 vs. 0.12 servings, $p<0.05$) and significantly higher sweetened beverage (4.3 vs. 3.4 oz, $p<0.05$) consumption compared with the fourth to fifth grade group. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Kubik, Lytle (2005)<br><br>Minnesota | School food practices including allowing food and/or beverages in the classroom, snacks and/or beverages in the hallways, food or food coupons as a reward/ incentive for students, classroom fundraising that includes food sales and school-wide fundraising included food sales<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>Not reported<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Cross-sectional study<br><br>***DURATION:*** Not applicable<br><br>***SAMPLE SIZE:*** 3,088 adolescents in Minneapolis and St. Paul<br><br>***PRIMARY OUTCOME:*** BMI<br><br>***MEASURES:***<br>1. Self-reported height and weight (Body Mass Index [BMI])<br>2. A school-wide food practices scale<br><br>***DATA COLLECTION:*** A school-wide food practices scale was developed from data from key informant interviews with school administrators (n=16) from the TEENS (Teens Eating for Energy and Nutrition at Schools) study by the research team. Higher scores on the scale indicated more food practices allowed in the school. BMI was calculated by the research team from self reported height and weight data provided by 8th grade students. Students with a BMI greater than or equal to the 95th percentile were classified as overweight. The research team conducted data analyses.<br><br>***LIMITATIONS:*** The cross-sectional design cannot determine causality; data from students and schools were self-reported; convenience sample of schools/ students may not be representative or generalizable to other populations | Urban<br><br>Lower income<br><br>11-13 year olds<br><br>14-18 year olds<br><br>30% racial/ethnic populations; 20% participated in the free or reduced-cost lunch program (evaluation sample)<br><br>***ELIGIBILITY:***<br>All 4,100 eighth grade students were eligible to participate. Those that completed the survey and provided valid self-report height and weight and were included in analyses.<br><br>Those with BMI less than or greater than 4 SD from the mean were excluded.<br><br>***EXPOSURE/ PARTICIPATION:***<br>Not applicable | ***LEAD AGENCY:***<br>Research team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:***<br>Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not applicable<br><br>***ADOPTION:*** Not applicable<br><br>***IMPLEMENTATION:***<br>Not applicable<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Not applicable<br><br>***FUNDING:***Not reported<br><br>***STRATEGIES:*** Not applicable | ***OVERWEIGHT/OBESITY:***<br>1. The school-wide food practices scale was positively associated with student's BMI. For every additional food practice allowed by a school, student BMI increased by 10% (p=0.03).<br><br>***OTHER:***<br>2. The mean number of school food practices allowed in each school was 3 (on a 1-7 scale).<br>3. The most prevalent school food practice was the use of food as a reward or incentive for students (69%) and in classroom fundraising (56%). |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Gonzalez, Jones (2009)<br><br>Not reported | School policy restricting the availability of snack foods in school<br><br>**OTHER INTERVENTION COMPONENTS:**<br>*Multi-component:* Not reported<br><br>*Complex:* Not reported | **DESIGN:** Cross-sectional study<br><br>**DURATION:** Not applicable<br><br>**SAMPLE SIZE:** 10,285 fifth grade children from 2,065 elementary schools from the Early Childhood Longitudinal Study-Kindergarten (ECLS-K) cohort data<br><br>**PRIMARY OUTCOME:** Consumption of fruits and vegetables (F&V)<br><br>**MEASURES:**<br>1. Questionnaires measured overall daily consumption of F&V in the past 7 days (green salad, carrots, potatoes [not counting French fries, fried potatoes, or potato chips], other vegetables, fruits other than fruit juice). Questions were based on those from the Youth Behavior Risk Factor Surveillance System. Validity had previously been recorded.<br>2. School administrators' self-reports of snack availability at school (school policy about restriction of snacks [e.g., chocolate candy, cookies, crackers, ice cream, non-low-fat salty snacks, low-fat or fat-free ice cream, low-fat baked goods, low-fat salty snacks] in school)<br>3. Other sociodemographic and school-related variables (gender, race/ethnicity, household income, Title 1 eligibility, and presence of 7th or 8th grade)<br><br>**DATA COLLECTION:** Children completed questionnaires as part of the ECLS-K study. Responses were coded into 2 binary indicators of whether the children reported consuming F&V during the past 7 days rarely (<1 time per day), occasionally (1-3 times/day) or frequently (>3 per day). Administrators' reports were interpreted as a statement of policy intent regarding whether snack availability was restricted (no snack items available) or unrestricted (at least 1 snack item available). The frequency of children's F&V consumption at schools with restricted and unrestricted availability of snacks was calculated.<br><br>**LIMITATIONS:** Cannot determine causality due to cross-sectional study design; dietary data collected from the children and reports of snack availability at schools are subject to measurement error and bias, however, since snack availability and dietary intake were reported by school administrators and children, respectively, it is unlikely that the observed relationships were due to reporting bias | 5-10 year olds<br><br>50% male, ~60% White, 18% Hispanic, 11% African American, and 7% Asian; 50% lived in households with an income < $50,000; ~65% attended schools that were Title 1 eligible; 35% attended schools without 7th or 8th grade (evaluation sample)<br><br>**ELIGIBILITY:** Not reported<br><br>**EXPOSURE/ PARTICIPATION:** Not applicable | **LEAD AGENCY:** Research team<br><br>**THEORY/ FRAMEWORK:** Not reported<br><br>**EVIDENCE-BASED:** Not reported<br><br>**REPLICATION/ ADAPTATION:** Not applicable<br><br>**ADOPTION:** Not applicable<br><br>**IMPLEMENTATION:** Not applicable<br><br>**FORMATIVE EVALUATION:** Not reported<br><br>**PROCESS EVALUATION:** Not reported | **RESOURCES:** Not applicable<br><br>**FUNDING:** Arnold School of Public Health at University of South Carolina and a USDA Economic Research Service grant<br><br>**STRATEGIES:** Not applicable | **NUTRITION:**<br>1. In general, children did not consume the recommended daily intake of fruits and vegetables. Nearly 40% and 61% of the children reported consuming fruits and vegetables < 1 time per day respectively. Only 9% and 16% of the children consumed fruits and vegetables > 3 times per day, respectively.<br>2. Consumption of F&V differed by schools' policies of availability of snacks. Compared to children who attended schools without restricted-snack availability, children who attended schools with restricted-snack availability had ~3% lower frequency of consumption of F&V.<br>3. After accounting for clustering by schools, there was a difference of 0.11 and 0.15 in the times/day of F&V consumption, respectively, between the children who attended schools with and without restricted-snack availability.<br>4. Compared to children in schools with restricted-snack availability, children in schools without restricted availability were 10% less likely to report consuming fruit occasionally (Coefficient=-0.110, OR=0.896, p=0.025) and 3% less likely to report consuming vegetables occasionally (Coefficient=-0.03, OR=0.97, p=0.531).<br>5. Compared to children in schools with restricted-snack availability, children in schools without restricted availability were 13% less likely to report frequent consumption of fruit (Coefficient=-0.144, OR=0.866, p=0.05) and 21% less likely to report frequent consumption of vegetables (Coefficient=-0.238, OR=0.788, p=0.001).<br>6. Type or number of snacks available did not play a significant role in defining the association between the availability of snacks and consumption of fruits and vegetables and a cluster analysis revealed no meaningful patterns among the type of snacks available (results not reported). |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Gordon, Crepinsek (2009); Gordon, Cohen (2009); Story (2009); Briefel, Wilson (2009); Condon, Crepinsek (2009); Fox, Dodd (2009); Briefel, Crepinsek (2009); Fox, Gordon (2009); Clark, Fox (2009); Gleason, Dodd (2009); Crepinsek, Gordon (2009)<br><br>United States | School Nutrition Dietary Assessment (SNDA) Study-III - National School Lunch Program (NSLP) and School Breakfast Program (SBP)<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:* Not reported<br><br>*Complex:* Not reported | ***DESIGN:*** Cross-sectional study<br><br>***DURATION:*** Not applicable<br><br>***SAMPLE SIZE:*** 2,314 students in grades 1-12 from 287 public schools. Body mass indices were collected from 2,228 children. Sample of children is nationally representative.<br><br>***PRIMARY OUTCOME:*** Food & nutrient content of meals offered & selected by children, school meal and competitive food consumption<br><br>***MEASURES:***<br>1. Weight and Height Measurements<br>2. Menu Survey (food offered in school meals)<br>3. School Food Observations (source and type of competitive foods)<br>4. Student and Parent Interviews (dietary recalls using a modified version of the Automated Multiple Pass Method software on laptop computers, 18-item USDA Food Security scale)<br>5. Staff Surveys and Checklists (foodservice operations and practices, nutrition education and promotion practices, presence of open campus policy)<br><br>***DATA COLLECTION:*** Data collection for the SNDA-III study was completed by Mathematica Policy Research, Inc. from January through June 2005. School foodservice managers completed the self-administered menu survey. The school menu information was coded using SurveyNet to link reported items to the Food and Nutrient Database for Dietary Studies. Trained field interviewers completed observation checklists. *(continued next page)* | Lower income<br><br>6-18 year olds<br><br>46% racial/ethnic populations (22% Hispanic)<br><br>29% eligible for free school meals<br><br>13% eligible for reduced price meals<br><br>18% families were food insecure (evaluation sample)<br><br>The NSLP and the SBP influence the nutritional quality of children's diets nationwide; on an average school day, more than 30 million children eat a school lunch and more than 10 million children eat a school breakfast.<br><br>***ELIGIBILITY:*** Special education students, students who were absent, students with incomplete BMI information were excluded from the sample. Consent from child's parents or guardians was required.<br><br>***EXPOSURE/ PARTICIPATION:*** Not applicable | ***LEAD AGENCY:*** The Mathematica Policy Research, Inc group<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Not reported<br><br>***REPLICATION/ ADAPTATION:*** Not applicable<br><br>***ADOPTION:*** Not applicable<br><br>***IMPLEMENTATION:*** Not applicable for this evaluation study. [NSLP and SBP administered by individual schools.]<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Not applicable<br><br>***FUNDING:*** USDA Food and Nutrition Service and the USDA Economic Research Service<br><br>***STRATEGIES:*** Not applicable | ***OVERWEIGHT/OBESITY:***<br>1. The estimated effect of usual National School Lunch Program (NSLP) participation on children's BMI was positive, although small in magnitude and not statistically significant.<br>2. Participation in the School Breakfast Program (SBP) was estimated to have a negative association with students' BMI. For every one-breakfast-per-week increase in usual SBP participation, BMI declined by 0.15 points ($p<0.05$).<br>3. The estimated effect of SBP participation on BMI z score, which standardized the BMI measure across age and sex, was negative (-0.028) and statistically significant ($p<0.05$).<br>4. Among elementary school children, offering french fries or dessert in school lunches more than once per week was associated with a significantly higher likelihood of obesity (french fries OR=2.70; $p<0.01$, dessert OR= 1.78, $p< 0.05$).<br>5. Among middle school children, the availability of low-nutrient, energy dense foods in vending machines in or near the foodservice area was associated with a higher BMI z score ($\beta$=-0.21; $p<0.05$). However, the availability of these foods for a la carte purchase in the cafeteria was associated with a lower BMI z score ($\beta$= -0.32; $p<0.01$).<br>6. Among high school aged children, none of the associations between school food environments and practices and BMI z scores or the likelihood of obesity were statistically significant.<br><br>***NUTRITION:***<br>7. Among secondary school children, NSLP participants consumed more energy at school (808 kcal vs 533 kcal, $p<0.01$) and over the entire day (2,250 kcal vs. 2,076 kcal, $p<0.01$), but consumed less energy away from school (208 kcal vs. 309 kcal, $p<0.01$).<br>8. On average, participants consumed more energy from french fries and similar potato products in elementary school and significantly less from SSB, candy, and chips/salty snacks compared with nonparticipants ($p<0.01$).<br>9. More than twice as many participants as nonparticipants consumed at least one vegetable at lunch (51% vs. 23%, $p<0.01$). The differences remained significant ($p<0.01$) even after excluding french fries and similar potato products.<br>10. School meal participation was significantly associated with more energy from low-nutrient, energy-dense foods in high school, 73 kcal more for breakfast ($p<0.01$) and 61 kcal more for lunch participation ($p<0.001$); in middle school, 38 kcal more for breakfast participation ($p<0.05$) but no difference for lunch.<br>11. Participants were significantly less likely than nonparticipants to consume desserts and snack foods at lunch (38% vs. 52%, $p<0.01$).<br>12. NSLP participants had higher intakes of calcium, sodium (high-school only), potassium, fiber, magnesium, phosphorus, vitamin C, B-6, folate and thiamin (data not shown).<br>13. Consumers of any sugar-sweetened beverages at school were significantly less likely to be participants in the NSLP or both the school lunch and breakfast programs (both $p<0.01$).<br>14. In elementary schools, NSLP participants consumed less than one third the mean amount of energy from sugar-sweetened beverages as nonparticipants (11 kcal vs 39 kcal, $p<0.01$).<br>15. Nonparticipants were more than 3 times as likely as participants (56% vs. 18%) to consume a beverage other than milk or 100% fruit juice at lunch ($p<0.01$). *(continued next page)* |

| (Continued from previous study) | | | | | | |
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| | | Elementary school children were interviewed in school about food eaten since they woke up on the interview day, and were interviewed with a parent assisting on the next day about what they ate during the rest of the target day. Older children were interviewed about what they had eaten from midnight to midnight on the day before the interview. Parents were also interviewed separately to confirm their child's recall. School food authority directors, school foodservice managers, and principals completed the brief staff surveys by telephone. The school food authority Director Survey, also conducted by telephone, obtained data on school food authority-level foodservice policies and procedures. Trained field interviewers measured the height and weight of 2,228 children using standardized equipment and procedures using a slightly modified version of a procedure developed for NHANES and other national and international surveys. Study analyses incorporate the SMI nutrient standards, the Dietary Guidelines for Americans 2005, and the Dietary Reference Intakes (DRI's).<br><br>***LIMITATIONS:*** Selection bias due to the fact that school meal participants may have differed from nonparticipants in observable and unobservable ways correlated with their weight status; the food and nutrient database looked only at foods reported as distinct food items; the analysis does not consider portion size; the relatively small sample sizes for the propensity score matching analysis of SBP participants and nonparticipants and the relatively small sample sizes for grade-level subgroups provided limited statistical power to detect significant differences between participants and nonparticipants; the representativeness of the sample could be compromised if districts, schools, or students did not participate for reasons related to the outcomes of interest; telf reported dietary intake data | | | | 16. SBP participants were more likely to drink milk (75% vs. 53%), consume 100% fruit juice or other type of fruit (63% vs. 30%), eat sweet rolls and doughnuts (17% vs. 10%) and biscuits, croissants or cornbread (10% vs. 2%) at breakfast than non-participants ($p<0.05$).<br>17. Overall, children who ate a school lunch were less likely than children who did not eat a school lunch to consume competitive foods from any source (36% versus 45%, $p<0.01$).<br>18. Attending a school without stores or snack bars selling foods or beverages was estimated to reduce sugar-sweetened beverage intake at school by 22 kcal/ school day and 28 kcal/school day among middle school and high school children, respectively ($p<0.01$).<br>19. Attending a middle school with no pouring rights contract was estimated to reduce consumption of sweetened beverages by 16 kcal/ school day ($p<0.05$) or, with a la carte but no low-nutrient, energy-dense items, by 26 kcal per school day, or with no a la carte, by 52 kcal ($p<0.001$).<br>20. Attending an elementary school that did not offer french fries (or similar potato products) at least once weekly was estimated to reduce low-nutrient, energy-dense food consumption by 43 kcal/ school day ($p<0.01$). In elementary schools that offered daily fresh fruit or raw vegetables, children consumed 36 kcal less of low-nutrient, energy-dense foods ($p<0.05$).<br>21. Results for middle school suggest that offering no low-nutrient, energy-dense foods a la carte was positively related to vegetable intake (excluding french fries) (0.12-c equivalents, $p<0.05$)<br>22. In high schools, not having an open campus policy was estimated to increase in-school consumption of vegetables (excluding french fries) by 0.06-c equivalents ($p<0.001$).<br><br>***ENVIRONMENT CHANGE:***<br>23. Significantly more schools met the standard for saturated fat in school lunches in school year 2004-2005 than in school year 1998-1999 (from 15% to 34% elementary schools, 13% to 24% secondary schools) The percentage of schools meeting the total fat standard did not change significantly over time.<br>24. Fewer school lunch menus included whole milk during school year 2004-2005 than in 1998-1999 (from 50% to 31%).<br>25. More fresh fruit was offered in 2004-2005 compared to 1998-1999 (50% vs. 41%), but availability was still limited.<br>26. Fewer school breakfasts offered whole milk in 2004-2005 compared to 1998-1999 (from 49% to 29%).<br>27. More breakfast menus offered fresh fruit (from 17% in 1998-1999 to 26% in 2004-2005).<br>28. The availability of vending machines increased dramatically from the early 1990s (SNDA-I); the percentage doubled in middle schools and increased ~25% in high schools.<br>29. One in 5 schools provided lunches that were consistent, on average, with the SMI standard for total fat (≤30% of energy), and less than one-third met the standard for saturated fat (<10% of energy). Few schools provided lunches that satisfied SMI standards (6% to 7% overall).<br>30. At least 8 in 10 schools provided breakfasts that met the SMI standard for total fat, and approx. 7 in 10 met the SMI standard for saturated fat. Nevertheless, fewer than 1 in 5 schools provided breakfasts that met all the standards. |

| Source | Intervention Components | Study Design and Execution | Reach | Adoption, Implementation and Process Evaluation | Enforcement/ Sustainability | Impacts and Outcomes |
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| Hannan, French (2002)<br><br>Location not reported | Policy to target high fat foods in schools<br><br>***OTHER INTERVENTION COMPONENTS:***<br>*Multi-component:*<br>1. School policy to raise the price of three popular high-fat food items by ~10% and lower the price of four lower fat items by ~25% for one school year<br><br>*Complex:*<br>Not reported | ***DESIGN:*** Non-comparative study<br><br>***DURATION:*** 9 months<br><br>***SAMPLE SIZE:*** 1,990 high school students from one high school<br><br>***PRIMARY OUTCOME:*** Food sales<br><br>***MEASURES:***<br>1. Sales data from targeted items (high fat: French fries, cookies, cheese sauce; lower fat: fresh fruit, low-fat cookies, low-fat cereal bars, low-fat chips)<br><br>***DATA COLLECTION:*** The cafeteria personnel were responsible for tracking the sale of the targeted foods (low fat versus high fat). Food service staff received instructions from the cook manager about accurate keying of the targeted high and low fat items.<br><br>***LIMITATIONS:*** Lack of baseline sales data under usual prices; limited number of foods included in the pricing intervention; use of a single high school setting; use of a cashless payment system that may have decreased students' reactivity to the price changes | 14-18 year olds<br><br>13% racial/ ethnic populations<br><br>8% lower income<br><br>***ELIGIBILITY:*** Not reported<br><br>***EXPOSURE/ PARTICIPATION:*** Not reported | ***LEAD AGENCY:*** Research team<br><br>***THEORY/ FRAMEWORK:*** Not reported<br><br>***EVIDENCE-BASED:*** Builds off of the success of previous studies that have increased purchases of healthy foods by lowering prices. This study examines the ability to make pricing strategies more sustainable by offsetting the lower costs of healthy foods with higher costs of unhealthy food.<br><br>***REPLICATION/ ADAPTATION:*** Not reported<br><br>***ADOPTION:*** Not reported<br><br>***IMPLEMENTATION:*** The research team designed the pricing intervention and the school cafeteria implemented it.<br><br>***FORMATIVE EVALUATION:*** Not reported<br><br>***PROCESS EVALUATION:*** Not reported | ***RESOURCES:*** Not applicable<br><br>***FUNDING:*** National Institutes of Health and the Centers for Disease Control and Prevention<br><br>***STRATEGIES:*** Not applicable | ***FOOD SALES:***<br>1. The low fat food sales averaged 13.1% of sales for the targeted foods, ranging between 10% and 16% with no consistent trend or pattern.<br>2. For individual foods, sales of fresh fruit tended to increase throughout the study period, sales of low-fat cookies and low-fat chips initially increased but then decreased and sales of the low-fat cereal bars remained stable.<br>3. High-fat foods showed a slow decline in sales.<br><br>***MODELING RESULTS:***<br>4. Total revenue for the seven targeted foods is expected to average 6.2% lower if the price elasticity for targeted high-fat foods equals -1.5, and 4.6% higher if the price elasticity for these high-fat foods equals -0.5.<br>5. Based on the model used in the study, at a price elasticity of -1.0, the revenues are expected to be down 0.8%.<br>6. According to the sensitivity analysis, the worst scenario is for an expected 7.1% loss of revenue under the model when price elasticity for low-fat foods is -1.0 and the price elasticity for high-fat foods is -1.5.<br>7. With the actual pricing strategy and the simple econometric model used, the average price elasticity for high-fat foods that would make the intervention revenue-neutral is -0.93. |

## REFERENCES


Ask, A.S., Hernes, S., Aarek, I., Johannessen, G., and Haugen, M. (2006). Changes in dietary pattern in 15 year old adolescents following a 4 month dietary intervention with school breakfast--a pilot study. *Nutrition Journal*. 5(33).

Bartholomew, J.B. and Jowers, E.M. (2006). Increasing frequency of lower-fat entrees offered at school lunch: An environmental change strategy to increase healthful selections. *Journal of the American Dietetic Association*. 106(2): 248-252.

Bayer, O., von Kries, R., Strauss, A., Mitschek, C., Toschke, A.M., Hose, A., et al. (2009). Short- and mid-term effects of a setting based prevention program to reduce obesity risk factors in children: a cluster-randomized trial. Clinical Nutrition. 28(2):122-8.

Birnbaum, A.S., Lytle, L.A., Story, M., Perry, C.L., and Murray, D.M. (2002). Are differences in exposure to a multicomponent school-based intervention associated with varying dietary outcomes in adolescents? *Health Education and Behavior*. 29(4): 427-443.

Blum, J.E., Davee, A.M., Beaudoin, C.M., Jenkins, P.L., Kaley, L.A., and Wigand, D.A. (2008). Reduced availability of sugar-sweetened beverages and diet soda has a limited impact on beverage consumption patterns in Maine high school youth. *Journal of Nutrition Education and Behavior*. 40(6): 341-347.

Blum, J.E., Davee, A.M., Devore, R.L., Beaudoin, C.M., Jenkins, P.L., Kaley, L.A., and Wigand, D.A. (2007). Implementation of low-fat, low-sugar, and portion-controlled nutrition guidelines in competitive food venues of Maine public high schools. *Journal of School Health*. 77(10): 687-693.

Briefel, R.R., Wilson, A., and Gleason, P.M. (2009). Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. *Journal of the American Dietetic Association*. 109(2 Suppl): S79-90.

Briefel, R.R., Crepinsek, M.K., Cabili, C., Wilson, A., and Gleason, P.M. (2009). School food environments and practices affect dietary behaviors of US public school children. *Journal of the American Dietetic Association*. 109(2 Suppl): S91-107.

Champouxt, T., Chan, H., Rosen R., Marquart L., and Reicks, M. (2007). Healthy whole-grain choices for children and parents: A multi-component school-based pilot intervention. *Public Health Nutrition*. 11(8): 849-859.

Clark, M.A. and Fox, M.K. (2009). Nutritional quality of the diets of US public school children and the role of the school meal programs. *Journal of the American Dietetic Association*. 109(2 Suppl): S44-56.

Condon, E.M., Crepinsek, M.K., and Fox, M.K. (2009). School meals: types of foods offered to and consumed by children at lunch and breakfast. *Journal of the American Dietetic Association*. 109(2 Suppl): S67-78.

Crepinsek, M.K., Gordon, A.R., McKinney, P.M., Condon, E.M., and Wilson, A. (2009). Meals offered and served in US public schools: Do they meet nutrient standards? *Journal of the American Dietetic Association*. 109(2 Suppl): S31-43.

Cullen, K.W., Eagan, J., Baranowski, T., Owens, E., and De Moor, C. (2000). Effect of a la carte and snack bar foods at school on children's lunchtime intake of fruits and vegetables. *Journal of the American Dietetic Association*. 100(12): 1482-1486.

Cullen, K.W., Hartstein, J., Reynolds, K.D., Vu, M., Resnicow, K., Greene, N., and White, M.A. (2007). Improving the school food environment: Results from a pilot study in middle schools. *Journal of the American Dietetic Association*. 107(3): 484-489.

Cullen, K.W. and Thompson, D.I. (2005). Texas school food policy changes related to middle school a la carte/snack bar foods: Potential savings in kilocalories. *Journal of the American Dietetic Association*. 105(12): 1952-1954.

Cullen, K.W., Watson, K., Zakeri, I., and Ralston, K. (2006). Exploring changes in middle-school student lunch consumption after local school food service policy modifications. *Public Health Nutrition*. 9(6): 814-820.

Cullen, K.W., Watson, K., and Zakeri, I. (2008). Improvements in middle school student dietary intake after implementation of the Texas Public School Nutrition Policy. *American Journal of Public Health*. 98(1): 111-117.

Cullen, K.W. and Watson, K. (2009). The Impact of the Texas Public School Nutrition Policy on student food selection and sales in Texas. *American Journal of Public Health*. 99(4): 1-7.

Cullen, K.W. and Zakeri, I. (2004). Fruits, vegetables, milk, and sweetened beverages consumption and access to a la carte/snack bar meals at school. *American Journal of Public Health*. 94(3): 463-467.

Davee, A.M., Blum, J.E., Devore, R.L., Beaudoin, C.M., Kaley, L.A., Leiter, J.L., and Wigand, D.A. (2005). The vending and a la carte policy intervention in Maine public high schools. *Preventing Chronic Disease*. 2 Spec no: A14.

Foster, G.D., Sherman, S., Borradaile, K.E., Grundy, K.M., Vander Veur, S.S., Nachmani, J., Karpyn, A., Kumanyika, S., Shults, J. (2008). A policy-based school intervention to prevent overweight and obesity. *Pediatrics*. 121(4):e794-802.

Fox, M.K., Gordon, A., Nogales, R., and Wilson, A. (2009). Availability and consumption of competitive foods in US public schools. *Journal of the American Dietetic Association*. 109(2 Suppl): S57-66.

Fox, M.K., Dodd, A.H., Wilson, A., and Gleason, P.M. (2009). Association between school food environment and practices and body mass index of US public school children. *Journal of the American Dietetic Association*. 109(2 Suppl): S108-117.

French, S.A., Story, M., Fulkerson, J.A., and Hannan, P. (2004). An environmental intervention to promote lower-fat food choices in secondary schools: Outcomes of the TACOS Study. *American Journal of Public Health*. 94(9): 1507-1512.

Fulkerson, J.A., French, S.A., Story, M., Nelson, H., and Hannan, P.J. (2004). Promotions to increase lower-fat food choices among students in secondary schools: Description and outcomes of TACOS (Trying Alternative Cafeteria Options in Schools). *Public Health Nutrition*. 7(5).

Gatenby LA. (2007). Nutritional content of school meals in Hull and the East Riding of Yorkshire: a comparison of two schools. *Journal of Human Nutrition and Diet*. 20(6):538-548.

Gittelsohn, J., Harris, S.B., Whitehead, S., Wolever, T.M., Hanley, A.J., Barnie, A., et al. (1995). Developing diabetes interventions in an Ojibwa-Cree community in northern Ontario: Linking qualitative and quantitative data. Chronic Diseases in Canada. 16(4):157-164.

Gleason, P.M. and Dodd, A.H. (2009). School breakfast program but not school lunch program participation is associated with lower body mass index. *Journal of the American Dietetic Association*. 109: S118-S128.

Gleason, P.M. and Suitor C.M. (2003). Eating at school: How the National School Lunch Program affects children's diets. *American Journal of Agricultural Economics*. 85(4): 1047-1061.

Gonzalez, W., Jones S.J., and Frongillo E.A. (2009) Restricting snacks in U.S. elementary schools is associated with higher frequency of fruit and vegetable consumption. *Journal of Nutrition*. 139(1):142-144.

Gordon, A.R., Cohen, R., Crepinsek, M.K., Fox, M.K., Hall, J., and Zeidman, E. (2009). The third School Nutrition Dietary Assessment Study: Background and study design. *Journal of the American Dietetic Association*. 109(2 Suppl): S20-30.

Gordon, A.R., Crepinsek, M.K., Briefel, R.R., Clark, M.A., and Fox, M.K. (2009). The third School Nutrition Dietary Assessment Study: Summary and implications. *Journal of the American Dietetic Association*. 109(2 Suppl): S129-135.

Grainger, C., Senauer, B., and Runge, F. (2007). Nutritional improvements and student food choices in a school lunch program. *Journal of Consumer Affairs*. 41(2).

Haerens, L., Cerin, E., Maes, L., Cardon, G., Deforche, B., De Bourdeaudhuij, I. (2008) Explaining the effect of a 1-year intervention promoting physical activity in middle schools: a mediation analysis. *Public Health Nutrition*. 11(5):501-12.

Haerens, L., Cerin, E., Deforche, B., Maes, L., De Bourdeaudhuij, I. (2007) Explaining the effects of a 1-year intervention promoting a low fat diet in adolescent girls: a mediation analysis. *International Journal of Behavioral Nutrition and Physical Activity*. 4:55.

Haerens, L., De Bourdeaudhuij, I., Maes, L., Cardon, G., Deforche, B. (2007) School-based randomized controlled trial of a physical activity intervention among adolescents. *Journal of Adolescent Health*. 40(3):258-65.

Haerens, L., De Bourdeaudhuij, I., Maes, L., Vereecken, C., Brug, J., Deforche, B. (2007) The effects of a middle-school healthy eating intervention on adolescents' fat and fruit intake and soft drinks consumption. *Public Health Nutrition*. 10(5):443-9.

Haerens, L., Deforche, B., Maes, L., Cardon, G., Stevens, V., De Bourdeaudhuij, I. (2006) Evaluation of a 2-year physical activity and healthy eating intervention in middle school children. *Health Education Research*. 21(6):911-21.

Haerens, L., Deforche, B., Maes, L., Stevens, V., Cardon, G., De Bourdeaudhuij, I. (2006) Body mass effects of a physical activity and healthy food intervention in middle schools. *Obesity* (Silver Spring). 14(5):847-54.

Hanley, A.J., Harris, S.B., Barnie, A., Gittelsohn, J., Wolever, T.M., Logan, A., et al. (1995). The Sandy Lake Health and Diabetes Project: Design, methods, and lessons learned. Chronic Diseases in Canada. 16(4).

Hannan, P., French, S.A., Story, M., and Fulkerson, J.A. (2002). A pricing strategy to promote sales of lower fat foods in high school cafeterias: Acceptability and sensitivity analysis. *American Journal of Health Promotion*. 17(1): 1-6, ii.

Harrell, T.K., Davy, B.M., Stewart, J.L., and King, D.S. (2005). Effectiveness of a school-based intervention to increase health knowledge of cardiovascular disease risk factors among rural Mississippi middle school children. *Southern Medical Journal*. 98(12): 1173-1180.

Harrington, K.F., Binkley, D., Reynolds, K.D., Duvall, R.C., Copeland, J.R., Franklin, F., and Raczynski, J.. (1997). Recruitment issues in school-based research: lessons learned from the High 5 Alabama Project. *Journal of School Health*. 67(10): 415-421.

Hartstein, J., Cullen, K.W., Reynolds, K.D., Harrell, J., Resnicow, K., and Kennel, P. (2008). Impact of portion-size control for school a la carte items: Changes in kilocalories and macronutrients purchased by middle school students. *Journal of the American Dietetic Association*. 108(1): 140-144.

Ho, L.S., Gittelsohn, J., Harris, S.B., Ford, E. (2006). Development of an integrated diabetes prevention program with First Nations in Canada. Health Promotion International. 21(2):88-97.

Ho, L.S., Gittelsohn, J., Rimal, R., Treuth, M.S., Sharma, S., Rosecrans, A., et al. (2008). An integrated multi-institutional diabetes prevention program improves knowledge and healthy food acquisition in northwestern Ontario First Nations. Health Education Behavior. 35(4):561-73.

Horne, P.J., Tapper, K., Lowe, C.F., Hardman, C.A., Jackson, M.C., and Woolner, J. (2004). Increasing children's fruit and vegetable consumption: A peer-modeling and rewards-based intervention. *European Journal of Clinical Nutrition*. 58(12): 1649-1660.

Klein, E., Lytle, L., and Chen, V. (2008). Social Ecological Predictors of the Transition to overweight in Youth: Results from the Teens Eating for Energy and Nutrition at Schools (TEENS) Study. *Journal of the American Dietetic Association*. 108(7).

Kubik, M.Y., Lytle, L.A., Hannan, P.J., Perry, C.L., and Story, M. (2003). The association of the school food environment with dietary behaviors of young adolescents. *American Journal of Public Health*. 93(7): 1168-1173.

Kubik, M.Y., Lytle, L.A., and Story, M. (2005). Schoolwide food practices are associated with body mass index in middle school students. *Archives of Pediatric and Adolescent Medicine*. 159(12): 1111-1114.

Lytle, L.A., Gerlach, S., and Weinstein, A.B. (2001). Conducting nutrition education research in junior high schools: Approaches and challenges. *Journal of Nutrition Education*. 33(1): 49-54.

Lytle, L. and Perry., C. (2001). Applying research and theory in program planning: An example from a nutrition education intervention. *Health Promotion Practice*. 2(1).

Lytle, L.A., Murray, D.M., Perry, C.L., Story, M., Birnbaum, A.S., Kubik, M.Y., and Varnell, S. (2004). School-based approaches to affect adolescents' diets: Results from the TEENS study. *Health Education and Behavior*. 31(2): 270-287.

Lytle, L.A., Kubik, M.Y., Perry, C., Story, M., Birnbaum, A.S., and Murray, D.M. (2006). Influencing healthful food choices in school and home environments: Results from the TEENS study. *Preventive Medicine*. 43(1): 8-13.

Marcus, C., Nyberg, G., Nordenfelt, A., Karpmyr, M., Kowalski, J., Ekelund, U. (2009). A 4-year, cluster-randomized, controlled childhood obesity prevention study: STOPP. International Journal of Obesity (London). 33(4):408-17.

Nelson, M., Lowes, K., and Hwang, V. (2007) The contribution of school meals to food consumption and nutrient intakes of young people aged 4-18 years in England. *Public Health Nutrition*. 10(7):652-662.

Neumark-Sztainer, D., French, S., Hannan, P., Story, M., and Fulkerson, J.A. (2005). School lunch and snacking patterns among high school students: Associations with school food environment and policies. *International Journal of Behavioral Nutrition and Physical Activity*. 2.

Nucci, A.M. and Stuhldreher, W.L. (2003). Comparison of consumed lunch nutrient profiles of 6th-grade students before and after implementation of the West Virginia School Nutrition Standards. *The Journal of Child Nutrition and Management*. 1.

Parker, L. and Fox, A. (2001). The Peterborough Schools Nutrition Project: A multiple intervention programme to improve school-based eating in secondary schools. *Public Health Nutrition*. 4(6): 1221-1228.

Perry, C.L., Bishop, D.B., Taylor, G.L., Davis, M., Story, M., Gray, C., Bishop, S.C., Mays, R.A., Lytle, L.A., and Harnack, L. (2004). A randomized school trial of environmental strategies to encourage fruit and vegetable consumption among children. *Health Education and Behavior*. 31(1): 65-76.

Perry, C.L., Bishop, D.B., Taylor, G., Murray, D.M., Mays, R.W., Dudovitz, B.S., Smyth, M., and Story, M. (1998). Changing fruit and vegetable consumption among children: The 5-a-Day Power Plus program in St. Paul, Minnesota. *American Journal of Public Health*. 88(4): 603-609.

Prell, H.C., Berg, M.C., Jonsson, L.M., and Lissner, L. (2005). A school-based intervention to promote dietary change. *Journal of Adolescent Health*. 36(6): 529.

Prell H., Berg, C., and Jonsson, L.M. (2002). Why don't adolescents eat fish? Factors influencing fish consumption in school. *Scandinavian Journal of Nutrition*. 46(4): 184-191.

Reynolds, K.D., Raczynski, J.M., Binkley, D., Franklin, F.A., Duvall, R.C., Devane-Hart, K., Harrington, K.F., Caldwell, E., Jester, P. Bragg, C., and Fouad, M. (1998). Design of High 5: A school-based study to promote fruit and vegetable consumption for reduction of cancer risk. *Journal of Cancer Education*. 13(3): 169-177.

Reynolds, K.D., Franklin, F.A., Binkley, D., Raczynski, J.M., Harrington, K.F., Kirk, K.A., and Person, S. (2000). Increasing the fruit and vegetable consumption of fourth-graders: Results from the high 5 project. *Preventive Medicine*. 30(4): 309-319.

Reynolds, K.D., Franklin, F.A., Leviton, L.C., Maloy, J., Harrington, K.F., Yaroch, A.L., Person, S., and Jester, P. (2000). Methods, results, and lessons learned from process evaluation of the high 5 school-based nutrition intervention. *Health Education and Behavior*. 27(2): 177-186.

Ritenbaugh, C., Teufel-Shone, N.I., Aickin, M.G., Joe, J.R., Poirier, S., Dillingham, D.C., et al. (2003). A lifestyle intervention improves plasma insulin levels among Native American high school youth. *Preventive Medicine*. 36(3):309-19.

Rosecrans, A.M., Gittelsohn, J., Ho, L.S., Harris, S.B., Naqshbandi, M., Sharma, S. (2008). Process evaluation of a multi-institutional community-based program for diabetes prevention among First Nations. Health Education Research. 23(2):272-86.

Sahota, P., Rudolf, M.C., Dixey, R., Hill, A.J., Barth, J.H., Cade, J. (2001). Evaluation of implementation and effect of primary school based intervention to reduce risk factors for obesity. British Medical Journal. 323(7320):1027-9.

Sahota, P., Rudolf, M.C., Dixey, R., Hill, A.J., Barth, J.H., Cade, J. (2001). Randomized controlled trial of primary school based intervention to reduce risk factors for obesity. British Medical Journal. 323(7320):1029-32.

Saksvig, B.I., Gittelsohn, J., Harris, S.B., Hanley, A.J., Valente, T.W., Zinman, B. (2005). A pilot school-based healthy eating and physical activity intervention improves diet, food knowledge, and self-efficacy for native Canadian children. Journal of Nutrition. 135(10):2392-8.

Schwartz, M.B., Novak, S.A., and Fiore, S.S. (2009). The impact of removing snacks of low nutritional value from middle schools. *Health Education and Behavior*. 36(6): 999-1011.

Shemilt, I., Harvey, I., Shepstone, L., Swift, L., Reading, R., Mugford, M., Belderson, P., Norris, N., Thoburn, J., and Robinson, J. (2004) A national evaluation of school breakfast clubs: Evidence from a cluster randomized controlled trial and an observational analysis. *Child Care, Health, and Development*. 30(5):413-427.

Shemilt, I., Mugford, M., Moffatt, P., Harvey, I., Reading, R., Shepstone, L., and Belderson, P. (2004) A national evaluation of school breakfast clubs: Where does economics fit in? *Child Care, Health, and Development*. 30(5):429-437.

Slusser,W., Cumberland, W., Browdy, B., Lange, L., and Neumann, C. (2007). A school salad bar increases frequency of fruit and vegetable consumption among children living in low-income households. *Public Health Nutrition*. 10(12): 1490-1496.

Story, M., Mays, R.W., Bishop, D.B., Perry, C.L., Taylor, G., Smyth, M., and Gray, C. (2000). 5-a-day Power Plus: Process evaluation of a multi-component elementary school program to increase fruit and vegetable consumption. *Health Education and Behavior*. 27(2): 187-200.

Story, M., Lytle, L.A., Birnbaum, A.S., and Perry, C.L. (2002). Peer-led, school-based nutrition education for young adolescents: Feasibility and process evaluation of the TEENS study. *Journal of School Health*. 72(3): 121-127.

Story, M. (2009). The third School Nutrition Dietary Assessment Study: Findings and policy implications for improving the health of US children. *Journal of the American Dietetic Association*. 109(2 Suppl): S7-13.

Teufel, N.I., Ritenbaugh, C.K. (1998). Development of a primary prevention program: insight gained in the Zuni Diabetes Prevention Program. *Clinical Pediatrics* (Philadelphia). 37(2):131-41.

Vecchiarelli, S., Takayanagi, S., Neumann, C. (2006). Students' perceptions of the impact of nutrition policies on dietary behaviors. *Journal of School Health.* 76(10): 525-31; quiz 540-542.

Veugelers, P.J. and Fitzgerald, A.L. (2005). Effectiveness of school programs in preventing childhood obesity: A multilevel comparison. *American Journal of Public Health*. 95(3): 432-435.

Wojcicki, J.M. and Heyman, M.B. (2006). Healthier choices and increased participation in a middle school lunch program: Effects of nutrition policy changes in San Francisco. *American Journal of Public Health*. 96(9): 1542-1547.