

Appendix E-2.30: Evidence Portfolio

Part D. Chapter 4: Food Environment and Settings

What is the impact of school-based policies on the dietary intake, quality, behaviors, and/or preferences of school-aged children?

Conclusion Statement: Strong evidence demonstrates that implementing school policies for nutrition standards to improve the availability, accessibility, and consumption of healthy foods and beverages sold outside the school meal programs (competitive foods and beverages) and (or) reducing or eliminating unhealthy foods and beverages are associated with improved purchasing behavior and result in higher quality dietary intake by children while at school.

DGAC Grade: Strong

Key Findings

- This evidence portfolio includes two systematic reviews (Jensen, 2011; Chriqui, 2014), which collectively evaluated 52 studies published between 1990 and 2013. Forty-one studies were conducted in the United States and the remaining studies were conducted in other highly-developed countries. The systematic reviews examined the impact of school policies, at the state and district levels, on dietary intake and behaviors.
- The studies included a variety of policies, including economic incentives and both state and school-district policies, targeting behaviors related to dietary intake. The primary outcomes of interest were fruit and vegetable intakes and availability, purchasing, and consumption of competitive foods and beverages (CF&B).
- In the body of evidence available, school policies were diverse, making comparison across studies challenging. Despite this variability, school-based policies targeting the availability of foods and beverages can positively impact the behaviors related to nutrition among children while they are at school. School-based economic incentive programs can effectively increase fruit and vegetable consumption and reduce consumption of low-nutrient-dense foods while children are at school. The implementation of school policies to change the availability and accessibility of healthier foods and beverages versus unhealthy CF&B is associated with the expected changes in consumption within the school setting. In addition, strong and consistent enforcement of more comprehensive policies to change the availability of healthier foods and beverages versus unhealthy CF&B at schools is associated with desired changes in consumption and purchasing within the school setting. Also, policies restricting the use of food as a reward for academic performance or as part of a fundraiser were associated with a reduction in using foods and beverages for these purposes.
- The evidence base includes two reviews evaluating several studies by independent investigators with sufficient sample sizes. Although findings indicate that school policies can effectively increase the combined intake of fruits and vegetables and/or decrease the availability, purchasing, and consumption of unhealthy CF&B, the magnitude of the effect as well as the public health significance is difficult to ascertain.

Description of the Evidence

This evidence portfolio includes two systematic reviews published in 2011 and 2014 (Jensen, 2011; Chriqui, 2014). Collectively, the reviews included a total of 52 studies published between the years 1990 and 2013, with no overlap of studies between the reviews. Study designs included randomized controlled trials (RCTs), non-randomized controlled trials, cross-sectional studies, pre/post studies, and price simulation analyses. The systematic reviews had relatively low risk of bias, as evidenced by AMSTAR scores, ranging from 8 points out of a possible 11 to 9 out of 11 points.

Population

The studies examined generally healthy children in kindergarten through 12th grade, with Jensen *et al* focusing on children aged 5 to 12 years. Of the 52 included studies, 41 were conducted in the United States, while 11 were conducted in other highly-developed countries. The sample sizes ranged from three high schools to 130,353 children, as well as a varying number of districts. The reviews did not review or present results by gender or race/ethnicity. (See the Overview Table for review-specific details).

Exposures

The studies included in the reviews examined a variety of school-based policies. The studies included in the Jensen *et al* review evaluated economic incentives designed to influence dietary behavior. Some incentives directly targeted students' selection of specific foods by reducing or eliminating the cost of fruits and vegetables available during the school day. Chriqui *et al* assessed state laws and school district policies related to CF&B.

Outcomes

The Jensen *et al* review reported various outcome data regarding food and beverage intake of school-aged children, including food choice observations from controlled experiments (representing intake), self-reported intake with changed economic incentives, observed sales data (a measurement of intake in schools), and intake data measured directly by researchers. The outcomes assessed by Chriqui *et al* included CF&B availability and consumption and weight-related outcomes (e.g., change in weight or BMI, probability of overweight or obesity).

Evidence Synthesis

Chriqui *et al* reviewed 24 studies examining the relationship between state laws and/or school district policies (in practice, not just “on the book” policies) and student weight-related outcomes and availability, purchasing, and consumption of CF&B. In general, the findings demonstrate the effectiveness of school-based policies to reduce CF&B availability and consumption within schools. Fifteen of 24 studies reviewed found that state laws and/or district policies had significant positive impact on consumption, BMI, or other weight outcomes; while nine of 24 studies reported mixed or non-significant results. Strong and consistent enforcement of more comprehensive policies to reduce or eliminate the availability of CF&B at schools was associated with greater changes in purchasing and consumption within the school setting. Also, policies restricting the use of food as a reward for academic performance or as part of a fundraiser were associated with a reduction in using foods and beverages for these purposes. The report did not quantify the impact of the policies on the outcomes of interest. The authors stated that caution should be exercised when interpreting the results since the studies were primarily of cross-sectional design. Additionally, the studies were “natural experiments” which raises concerns regarding the internal and external validity of the findings.

Jensen *et al* reviewed 28 studies that aimed to improve the diets of children using economic incentives. School-based programs to reduce or eliminate the cost of fruits and vegetables effectively increased consumption, especially when the program focused on the cost and availability directly to the student. Additionally, findings indicate that economic incentives can be used to simultaneously increase fruit and vegetable intakes while reducing the intake of foods low in nutrient

density (e.g., soda, candy, and chips). Limited information suggested that economic incentives focused on physical, social, and political environmental factors also may promote healthier eating behaviors among students, but effectiveness was not clearly documented. The multitude of programs and policies assessed in this systematic review made it difficult to draw strong conclusions; and the lack of a meta-analysis precluded quantifying the magnitude of dietary behavior responses. In summary, Jensen *et al* concluded that manipulating the cost of foods can impact dietary intake and behaviors (i.e., food purchases) among school-aged children.

Collectively, the research indicates that school-based policies targeting the availability of foods and beverages can positively impact behaviors related to nutrition, such as the purchasing and consumption of certain foods, among children while they are at school.

Overview Table

Summary of systematic review examining school-based approaches and dietary intake, quality and behavior			
Author, Year Study Design AMSTAR Score* Number of Included Studies	Purpose of Review Subject Population Location of Included Studies	Independent Variable Outcomes	Results
<p>Chriqui, 2014</p> <p>Systematic review</p> <p>AMSTAR Score: 9/11</p> <p>24 studies:</p> <ul style="list-style-type: none"> • 3 longitudinal • 20 cross-sectional • 1 combined <p>16 examined pre-/post-policy changes</p> <p>8 examined post-policy changes</p>	<p>To examine the potential influence of federal rule on the relationship between state laws and/or school district policies and student body mass index (BMI) and weight outcomes, consumption and availability of competitive foods and beverages (CF&B)</p> <p>Laws and policies impacting schools; grades kindergarten through 12th grade.</p> <p>Location: US</p>	<p>Independent variables: state laws or school district policies related to CF&B</p> <ul style="list-style-type: none"> • State laws: 14 studies • District policies: 8 studies • Combined laws and policies: 2 studies <p>Outcomes:</p> <ul style="list-style-type: none"> • Change in BMI or weight; probability of overweight or obesity: 4 studies • CF&B consumption: 10 studies • CF&B availability: 13 studies <p>Examined more than 1 outcome: 3 studies</p>	<p>15 of 24 studies reviewed found that state laws and/or district policies had significant positive impact on consumption, BMI or weight outcomes, while 9 of 24 studies reported mixed or non-significant results.</p> <p>Selected Results:</p> <ul style="list-style-type: none"> • 3 bivariate studies reported that milk policy changes reduced calories and saturated fats • 3 bivariate studies, all examining early policy changes in Texas (2 state law studies and 1 district policy study), reported a mix of expected, unexpected, and non-significant policy influences
<p>Jensen, 2011</p> <p>Systematic review</p> <p>AMSTAR Score: 8/11</p> <p>28 studies (30 publications):</p> <ul style="list-style-type: none"> • 4 randomized controlled trials • 10 quasi-experimental • 4 price simulation experiments • 4 cafeteria sales incentives • 6 cross-sectional 	<p>Focused on interventions that aimed to improve the diets of children using various types of economic incentives.</p> <p>Non-obese children aged 10–12 y</p> <p>Location:</p> <p>17 studies the US 3 studies in Norway 1 each in Ireland, UK, Australia 5 not identified</p>	<p>Independent variables: economic incentives designed to influence dietary behavior – measured as intake of relevant foods, beverages, and snacks – or the availability of healthy foods and beverages in schools</p> <p>Outcomes: food choice observations (representing intake), self-reported intake with changed economic incentives, observed sales, and intake data measured directly by researchers</p>	<p>In general, the review supports the hypothesis that the choice of foods, snacks, and beverages by schoolchildren can be influenced by economic incentives.</p> <p>Overall, studies of price incentives in schools suggested that incentives are effective for increasing fruit and vegetable consumption in schools in the short term and, to some extent, in the long term.</p> <p>Two crucial determinants for the effectiveness of price instruments were identified: 1) foods or beverages are offered (for sale) at the schools, and 2) 10–12-year-old children bring money to school to buy some of these items.</p>
*Quality assessed by AMSTAR (Shea, 2007: http://www.ncbi.nlm.nih.gov/pubmed/17302989)			

Assessment of the Body of Evidence

Quality and Quantity: Collectively, the evidence base includes 52 independent studies evaluated in two systematic reviews. The reviews are of high quality with AMSTAR scores of 8 and 9 out of 11 possible points. The evidence base consists mostly of cross-sectional studies (n=26), quasi-experimental studies (n=10), and incentive/price simulation studies (n=8). Three longitudinal studies, four RCTs, and one study of combined design (i.e., longitudinal with cross-sectional analyses) also are included.

Consistency: Overall, the majority of research findings were consistent and positive. No explicit contradictory findings were evident, although some studies included in the reviews had null or mixed results.

Impact: The impact of policies to change the availability and consumption of certain foods, such as fruits, vegetables, and CF&B, in schools is generally strong. However, the public health significance of the results is unknown given that detailed findings regarding daily food and beverage consumption are limited.

Generalizability: Collectively, the studies included in the reviews were geographically diverse (primarily domestically), but information on the characteristics of the participating children was very limited. Thus, the generalizability of the findings is not known with confidence.

Limitations: While the included reviews were of high quality, the authors of the individual reviews commented that the quality of the studies included in their assessments varied, with some studies having a high risk for bias. The number of relevant empirical studies was limited. Many of the studies focused on “natural experiments;” thus, traditional randomized controlled study designs were not possible and the studies are subject to numerous threats to both internal and external validity. For example, separating the effects of economic incentives from those of other intervention strategies is difficult.

Implications*

Existing evidence indicates that school-based programs designed to improve the food environment and support healthy behaviors may effectively promote improved dietary intake and weight status of school-aged children. Programs that emphasize multicomponent, multidimensional approaches (including increased physical activity) are important to changing behavior and need to be reinforced within the home environment, as well as the community, including neighborhood food retail outlets that surround schools. Policies should strive to support effective programs that increase availability, accessibility, and consumption of healthy foods and beverages, while reducing less healthy competitive foods and beverages. The combination of economic incentives along with specific policies can increase the likelihood that specific approaches will be effective.

The recently updated USDA nutrition standards for school meals and snacks and beverages sold in schools will ensure that students throughout the U.S. will have healthier school meals and snack and beverage options, but schools need support and active engagement from students, parents, teachers, administrators, community members, and their districts and states to successfully implement and sustain them.

Research Recommendations*

1. New research is needed to document the types and quantities of foods and beverages students consume both at school and daily before, during and after school-based healthy eating approaches and policies are implemented.

Rationale: Effective school-based approaches and policies to improve the availability, accessibility, and consumption of healthy foods and beverages, and reduce competition from unhealthy offerings, are central to improving the weight status and health of children and adolescents. Accurate quantification of the types and quantities of foods and beverages students consume before, during, and after approaches and policies are implemented is fundamental to assessing effectiveness. However, many of the studies included in the systematic reviews and meta-analyses used by the 2015 DGAC to address this issue did not comprehensively measure or report dietary information. While the USDA/FNS-sponsored School Nutrition Dietary Assessment (SNDA) series collects student dietary intake data every 10 years, the DGAC recommends more frequent and consistent data collection, especially before and periodically after implementation of school-based nutrition and physical activity policy and program changes.

2. Improvements are needed in the quality of research studies designed to assess the effects of school-based approaches and policies on dietary behaviors and body weight control to reduce the risk of bias, with an emphasis on randomized control trials.

Rationale: While the methodological quality of the systematic reviews and meta-analyses used by the 2015 DGAC to evaluate school-based approaches and policies on dietary intake and body weight outcomes was high, the authors of these reviews commented that the scientific quality of individual studies was generally poor and the risk of bias high. Many of the studies were done using quasi-experimental (with or without control), pre-post intervention, or cross-sectional designs. Future research should prioritize using prospective, repeated measures, randomized control trial experimental designs, with randomization at the individual, classroom, school, or school district level. Feasibility studies may also be helpful to more quickly identify promising novel approaches to improve dietary intake and weight control outcomes.

3. Post-program follow-up assessments lasting >1 year are needed to determine the longer-term retention of changed nutrition behaviors as well as the usefulness of continuing to offer the programs while children advance in school grade. Also, more research is needed in adolescents (grades 9-12).

Rationale: Literature supports that eating and physical activity behaviors and body weight status of children are predictive of changes over time as they progress into adolescence and adulthood. Ideally, improvements in dietary intake and weight status achieved due to a given school-based approach or policy would be sustained over time and progressive improvements would occur long-term. The vast majority of published research focuses on children in grades K-8, or ages 4-12 years, and new and improved data are needed on adolescents and the transition from childhood to adolescence.

4. A wider variety of innovative school-based approaches and policies are needed to increase vegetable intakes.

Rationale: Consumption of non-potato vegetables is below 2010 Dietary Guidelines for Americans recommendations in both children and adolescents. Published research indicates that school-based approaches and policies designed to increase fruit and vegetable intakes are generally more effective at increasing fruit intake – the documented exceptions being school gardens and economic incentives, which increase vegetable intake among school-aged children. Some past public policies (e.g. the Basic 4) treated fruits and vegetables as a single food group, which prompts the need for new research using prospective, repeated measures, randomized control trial experimental designs specifically targeting increased consumption of healthy vegetables.

*Because the schools questions are complementary, the Dietary Guidelines Advisory Committee chose to develop only one implication statement for the four questions along with collective research recommendations.

References

1. Chriqui JF, Pickel M, Story M. Influence of school competitive food and beverage policies on obesity, consumption, and availability: a systematic review. *JAMA Pediatrics* 2014;168(3):279-86. PMID:[24473632](https://pubmed.ncbi.nlm.nih.gov/24473632/).
<http://www.ncbi.nlm.nih.gov/pubmed/24473632>
2. Jensen JD, Hartmann H, et al. Economic incentives and nutritional behavior of children in the school setting: a systematic review. *Nutr Rev* 2011;69(11):660-74. PMID:22029832.
<http://www.ncbi.nlm.nih.gov/pubmed/22029832>