Appendix E-2.32: Evidence Portfolio

Part D. Chapter 4: Food Environment and Settings

What is the impact of school-based policies on the weight status of school-aged children?

Conclusion Statement: Although moderate evidence indicates that school policies improve dietary intake, limited evidence suggests that school policies targeting nutrition, alone and in combination with physical activity, may beneficially affect weight-related outcomes.

DGAC Grade: Limited

Key Findings

- This evidence portfolio includes two systematic reviews (Williams, 2013; Chriqui, 2014), which collectively evaluated 45 studies published between 2003 and 2013. Forty 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 weight-related outcomes.
- The studies included a variety of policies at the school, school-district, or state level, targeting behaviors related to dietary intake, alone and in combination with physical activity. The primary outcome of interest was BMI.
- Limited research exists to systematically review and quantitatively evaluate the effect of school-based nutrition policies on the weight status of children. In addition, high heterogeneity among studies warrants caution when drawing conclusions from the pulled results. In the body of evidence available, the findings related to the impact of school policies targeting nutrition and physical activity on weight outcomes were mixed. Yet, dietary policies related to the School Breakfast Program were associated with a lower body mass index among students who participated in the program in comparison to students who did not participate. Overall, school-based, multi-component interventions including policy elements and policies and laws regarding the availability and accessibility of competitive foods and beverages in schools warrant further research as ways to target childhood obesity.
- The evidence base includes two reviews evaluating several studies by independent investigators with sufficient sample sizes. However, most studies are of weaker design (i.e., cross-sectional) and findings were inconsistent.

Description of the Evidence

This evidence portfolio includes two systematic reviews (Williams, 2013; Chriqui, 2014), of which one includes a meta-analysis (Williams, 2013). Collectively, the reviews included a total of 45 studies published between the years 2003 to 2013, with no overlap of studies between reviews. Study designs included randomized controlled trials (RCTs), non-randomized controlled trials, cross-sectional studies, and pre/post-policy studies. The systematic reviews had relatively low risk of bias, as evidenced by AMSTAR scores, ranging from 9 points out of a possible 11 to 11 out of 11 points.

Population

The studies examined generally healthy children aged 4 to 18 years, with Williams *et al* focusing on children aged 4 to 11 years. Of the 45 included studies, 40 were conducted in the United States, while five 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 Williams *et al* review evaluated policies related to diet and physical activity in schools, alone or as part of an intervention program targeting the weight status of children. Chriqui *et al* assessed state laws and school district policies related to competitive foods and beverages (CF&B).

Outcomes

Weight outcomes reported in the Williams *et al* review include BMI, BMI z-score, body fat percentage, waist circumference, waist-to-hip ratio, waist-to-height ratio, and skin fold thickness. The weight status outcomes addressed in the Chriqui *et al* review were change in weight and change in BMI.

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 weight-related outcomes among students in addition to the 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 but results regarding the weight status of school-aged children were mixed. Four multivariate studies examined the policy influences on BMI and weight outcomes. Two studies reviewed by Chriqui *et al* (Coffield, 2011; Tabler, 2012) reported a decreased odds of being overweight or obese. Tabler et al examined 6300 students in 40 states noting a reduced risk of remaining overweight (-4.8; 95% CI: -9.4, -0.1) as students progressed from 5th grade to 8th grade in states with strong laws related to CF&B in comparison to states without laws. The remaining studies did not find a relationship between laws related to CF&B and the weight status of students.

Williams *et al* reviewed 21 studies evaluating the impact of policies related to diet and physical activity in schools, alone or as a part of an intervention program targeting the weight status of children. Dietary policies related to the School Breakfast Program (SBP), but not the National School Lunch Program (NSLP), were associated with a lower body mass index – standard deviation score (BMI-SDS) (-0.80; 95% CI: -0.143, -0.017) among students who participated in the program in comparison to students who did not participate. The pooled effects of other diet-related policies and physical activity policies on BMI-SDS were non-significant. Multi-component interventions tended to include policy elements related to both diet and physical activity (combined cluster), and although these interventions were too varied to pool their results, significant reductions in weight-related outcomes were demonstrated. The evidence from this review suggests that, when implemented alone, school policies related to diet and physical activity are insufficient to prevent or treat overweight or obesity in children; however, they appear to be impactful when combined with more intense interventions.

In summary, limited research exists to systematically review and quantitatively evaluate the effect of school-based nutrition policies on the weight status of school-aged children.

Overview Table

Summary of systematic review examining school-based approaches and dietary intake, quality and behavior			
Author, Year AMSTAR Score* Number of Included Studies	**Purpose of Review Subject Population Location of Included Studies**	**Independent Variable Outcomes**	**Results**
Chriqui, 2014	To examine the potential	**Independent Variables:**	Of the 24 included studies, 4 multivariate

Systematic review AMSTAR Score: 9/11 24 studies: • 3 longitudinal • 20 cross-sectional • 1 combined 16 studies examined pre- and post-policy changes 8 studies examined post-policy changes	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) Laws and policies impacting schools; grades kindergarten through 12th grade **Location:** US	State laws or school district policies related to CF&B • State laws: 14 studies • District policies: 8 studies • Combined laws and policies: 2 studies **Outcomes:** • Change in BMI or weight; probability of overweight or obesity: 4 studies • CF&B consumption: 10 studies • CF&B availability: 13 studies Examined more than 1 outcome: 3 studies	studies examined the policy influences on BMI and weight outcomes, reporting mixed results overall.
Williams, 2013 Systematic review and meta-analysis AMSTAR Score: 9/11 21 studies: • 2 randomized controlled trials • 3 controlled before/after • 11 cohort studies • 5 cross-sectional studies Policies: • Diet-related: 10 studies • Physical activity (PA)-related: 5 studies Combined diet and PA: 6 studies	To evaluate the effects of policies related to diet and physical activity in schools, either alone, or as part of an intervention program on the weight status of children Children aged 4-11 y participating in full time education **Location:** 16 studies in the US 1 each in Australia, Canada, Italy, Mexico, UK	**Independent Variables:** Diet or physical activity-related school policies either alone or as part of intervention programs **Outcomes:** Body mass, body mass index z-score or standard deviation score, percentage of body fat, waist circumference, waist-to -hip ratio, waist-to-height ratio, skin pinch/skin fold thickness	Multi-faceted interventions tended to include diet and physical activity policy elements. These interventions demonstrated significant reductions in weight-related outcomes; however they were too varied to pool results. **Change in BMI-SDS (standard deviation score)** Pooled effects of the physical activity and other diet related policies on BMI-SDS were non-significant: BMI-SDS = −0.021 (95% CI −0.066, 0.023; NS) Participation in National School Lunch Program (NSLP): BMI-SDS = 0.038 (95% CI: -0.193, 0.269; NS) Participation in School Breakfast Program (SBP): BMI-SDS = −0.080 (95% CI: −0.143, −0.017; Significant)
*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 45 independent studies evaluated in two systematic reviews. The reviews are of high quality with AMSTAR scores of 9 and 11 out of 11 possible points. The evidence base consists mostly of cross-sectional studies (n=25). Two RCTs, three controlled pre/post studies, eleven cohort studies, three longitudinal studies, and one study of combined design (i.e., longitudinal with cross-sectional analyses) also are included.

Consistency: Overall, the research findings were mixed. Also, there was high heterogeneity among studies which reduced confidence in drawing conclusions from the pooled results of the meta-analysis.

Impact: The impact of nutrition policies on weight-related outcomes is unknown at this time.

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 quality of the studies included in their analyses varied, with some studies having a high risk for bias. The number of relevant empirical studies was limited. Therefore, meta-analyses could not be completed for some topics due to insufficient data. 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.

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 Pediatr 2014;168(3):279-86. PMID:24473632. http://www.ncbi.nlm.nih.gov/pubmed/24473632
2. Williams AJ, Henley WE, et al. Systematic review and meta-analysis of the association between childhood overweight and obesity and primary school diet and physical activity policies. Int J Behav Nutr Phys Act 2013;10:101. PMID:23965018. http://www.ncbi.nlm.nih.gov/pubmed/23965018