

Rapid Health Impact Assessment on USDA Proposed Changes to School Nutrition Standards

Healthy Eating
Research

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Introduction

Each day more than 29.5 million children eat school lunch¹ and 14.7 million eat breakfast² through the National School Lunch (NSLP) and School Breakfast (SBP) Programs operated by the United States Department of Agriculture (USDA). Schools participating in these programs are generally public or nonprofit private schools serving children in kindergarten through grade 12. Participating schools—currently estimated at 99,000 schools nationwide³—are reimbursed for meals meeting federal nutrition standards and they must provide free or reduced-price meals for eligible children meeting income qualifications.⁴

In December 2010, the Healthy, Hunger-Free Kids Act (HHFKA) was passed by Congress and signed into law, setting into motion some of the most significant changes in school meal programs in more than 30 years. As a result of this landmark legislation, the USDA updated nutrition standards for school meals for the first time in 15 years; established nutrition standards for items sold outside of the school meal programs, including via à la carte lines, vending machines, school stores, and snack bars (these items are also known as competitive foods and beverages, or Smart Snacks); and updated requirements for Local School Wellness Policies. Many of these changes went into effect between 2012 and 2014, and required schools to offer more fruit, more servings and varieties of vegetables, more whole grain-rich foods, and less saturated fat and sodium. In addition, schools were required to offer only fat-free or low-fat fluid milk, minimize trans fats, and set calorie limits for meals based on age/grade-groups (K-5, 6-8, 9-12).⁵ Also, as a result of the HHFKA, USDA now provides schools with an additional reimbursement for each lunch served meeting the updated nutrition standards.⁶

The connection between the school food environment and children's consumption has been well established in the scientific literature.^{7,8,9} Ensuring that schools offer nutritious foods and beverages that are in alignment with healthy dietary patterns as recommended by the Dietary Guidelines for Americans (DGA) is especially important for the more than 21.8 million school-age children who receive free or reduced-price lunch each day,¹⁰ as well as the 12.6 million children receiving free or reduced-price breakfast.¹¹ Since the updated standards for school meals, snack foods, and beverages have been implemented, there has been a growing body of evidence showing their effectiveness in improving the nutritional quality of foods served and sold at schools,^{12,13} and in increasing school meal participation rates.¹⁴ Moreover, there is literature showing that there has been no significant impact on plate waste as a result of serving healthier meals.^{15,16} In addition, since implementation of the updated nutrition standards resulting from HHFKA, 99 percent of U.S. schools participating in the NSLP and SBP have reported being able to meet these healthier meal standards.¹²



Despite this reported progress made by schools, USDA has recently begun to repeal portions of the standards. In January 2020, USDA proposed several reforms to school nutrition standards on the basis that the proposed changes will simplify program operations and offer greater flexibility without compromising nutritional quality.¹⁷ In an effort to inform the USDA as it considers these latest program changes, and to better understand how the proposed reforms may impact the nutritional quality of school meals, school meal participation, student consumption and health, and academic performance, Healthy Eating Research, a national program of the Robert Wood Johnson Foundation based at Duke University, conducted a rapid Health Impact Assessment (HIA) of the nutrition provisions in USDA, FNS Proposed Rule 7 CFR Parts 210, 215, 220, 226, and 235: *Simplifying Meal Service and Monitoring Requirements in the School Lunch and School Breakfast Programs*.¹⁸

Health Impact Assessment Background

An HIA is a prospective research tool that guides decision makers in considering the possible health impacts, and in some

cases financial considerations, of proposals.¹⁹ HIAs typically involve six steps: (1) screening, (2) scoping, (3) assessment, (4) recommendations, (5) reporting, and (6) monitoring and evaluation (see Table 1 for more information on each of these steps).²⁰ A rapid HIA is generally undertaken when there is minimal time between a policy proposal and implementation, or in this case, a time-limited window for public comment and input. HIAs are not intended to make definitive or causal predictions about how a policy proposal will affect health and well-being; rather, they are a tool for policymakers to use as they consider the full implications of a particular proposal based on the best available evidence.

Purpose

This HIA is intended to connect existing research on school nutrition and health with the potential policy changes as proposed by USDA. Specifically, this HIA examines the potential impacts on students' health and wellbeing as well as academic performance as a result of changes to the nutritional quality of school meals, school meal participation, and student consumption.

Table 1: Health Impact Assessment (HIA) Elements

Step 1: Screening	The research team convened an advisory committee composed of experts in the fields of school nutrition research and policy. The team and advisory committee determined whether an HIA was needed to address the USDA's proposed changes to school meal programs, if an HIA could be accomplished in a timely manner, and if an HIA would benefit the decision-making process.
Step 2: Scoping	The team and advisory committee identified the potential health impacts on children that could result from the proposed changes, identified pertinent research questions, and devised a plan for completing the assessment.
Step 3: Assessment	The HIA team evaluated the proposed changes and identified the most likely health effects by receiving input from the advisory committee and completing a systematic review of the published literature in order to answer the research questions developed during scoping.
Step 4: Recommendations	The team and advisory committee identified policy implications based on information collected from the assessment step of the HIA.
Step 5: Reporting	The team will disseminate information collected from the HIA including the purpose, process, findings, and policy implications.
Step 6: Monitoring and Evaluation	The team and advisory committee propose a plan for monitoring and measuring the HIA's impact on decision-making and the effects of the implemented decision on health.

Source: Health Impact Assessment. (n.d.). Retrieved from <https://www.pewtrusts.org/en/projects/health-impact-project/health-impact-assessment>

Proposed Policy

The proposed rule, *Simplifying Meal Service and Monitoring Requirements in the School Lunch and School Breakfast Programs*,¹⁸ was determined to be an appropriate policy proposal for a rapid HIA due to its potential to affect the nutrition environment of schools nationwide. Several changes to existing nutrition standards are proposed, which would allow schools to serve less fruit, fewer whole grains, fewer varieties of vegetables, and more starchy vegetables. In addition, the proposal would allow entrees currently served as part of the weekly reimbursable meal program to be served on their own nearly every day of the week, eliminating the need for these individual items to meet Smart Snack nutrition standards. A summary of the proposed changes is outlined in Table 2.

This proposed rule comes on the heels of another recent set of changes to nutrition standards that occurred in December 2018, where USDA rolled back the original (i.e., 2012) milk, whole grain, and sodium requirements. Under this rule, (1) schools are now permitted to offer low-fat flavored milk in the NSLP and SBP, where previously only fat-free flavored milk was allowed to be offered; (2) the requirement that all grains served in the NSLP and SBP be whole-grain rich was reduced by half, so that now only 50 percent of grains offered have to be whole-grain rich; and (3) the deadline for schools to meet stricter sodium reduction targets was extended by retaining sodium target 1 through the end of school year 2023-2024, continuing to Target 2 in school year 2024-2025, and eliminating the final target (which originally would have gone into effect in school year 2022-2023).²¹

Methods

Research Team and Advisory Committee

The research team consists of four staff members from the Healthy Eating Research program, two of whom have extensive experience working in the fields of school nutrition research and policy. To determine if this proposed rule was appropriate for an HIA and to assist with the scoping and assessment stages, the research team convened a national advisory committee made up of experts in the fields of school nutrition research and policy. The advisory committee was engaged in the development of the health determinant pathway diagram and the resulting research questions. The committee also reviewed the research team's search strategy and the draft report. A full list of the research team and advisory committee members can be found in the *Acknowledgements* section.

School meals are required to meet nutrition standards in order to get federal reimbursement. These nutrition standards apply to the meal; not to individual components of the meal. This gives schools the flexibility to occasionally serve a food that does not meet nutrition standards on its own—like pizza or french fries—but when balanced by healthier items—like a salad, fruit, and milk—can be part of a healthy meal.

However, when these foods are sold à la carte, there is no requirement that students choose healthy sides to create a balanced meal. Rather, under the proposed rule, a student could use their lunch money to purchase three slices of pizza in the à la carte line. Allowing this to happen more frequently could have significant impacts on a child's diet.

Origins of the Health Determinant Pathway

The health determinant pathway (Figure 1) was developed using research team and advisory committee expertise and a preliminary review of the literature. Past research has demonstrated that children and adolescents consume up to 50 percent of their daily calories at school²² and that the foods and beverages served have an impact on what students consume both at school and at home.²³ Thus the research team developed the following health determinant pathway diagram, which outlines the hypothesized connections between this proposed rule and the resulting effects on the availability of foods and beverages served (via school meals) and sold (via Smart Snacks) in schools, as well as potential impacts on school meal participation.

The research team hypothesized that the proposed policy changes would affect the availability of foods and beverages offered and sold at elementary, middle, and high schools across the U.S. The proposed reforms (summarized in Table 2), may result in students being served less fruit, fewer whole grains, fewer varieties of vegetables, more starchy vegetables (e.g., potatoes), and exposure to a greater number of less healthy items on a daily and weekly basis via the à la carte exemption. Combined, these changes are likely to impact the overall dietary quality of school meals as measured by Healthy Eating Index (HEI) scores, and result in fewer school meals being aligned with the DGAs.

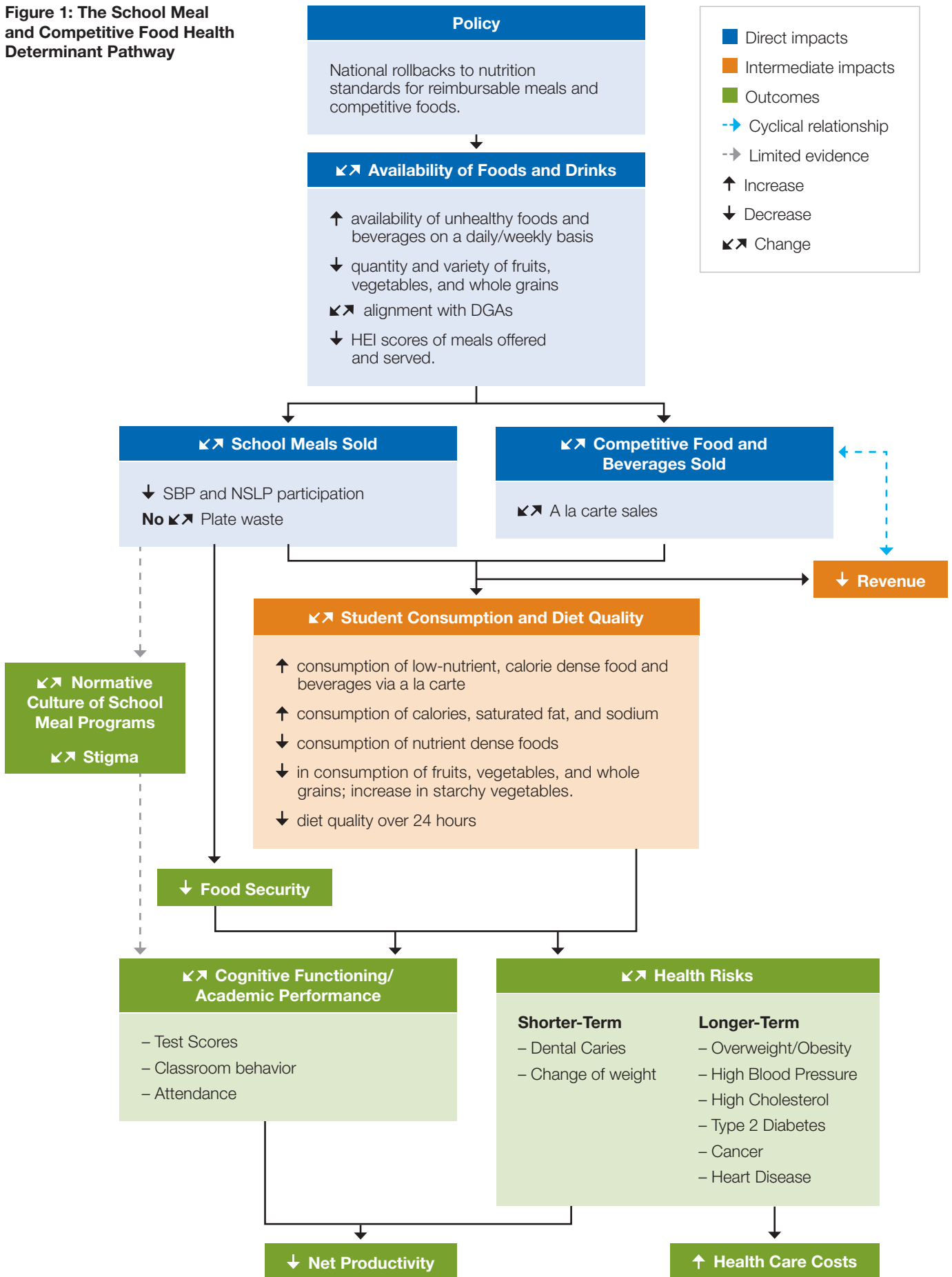
As a result of proposed changes, the research team further hypothesized that there are likely to be shifts in student purchasing patterns and consumption, with the biggest expected shift being fewer students will purchase school meals, and more students will purchase less healthy à la carte items via the Smart Snacks exemption. Ultimately, these shifts in purchasing and meal participation may also impact food security, stigma, the flow of revenue, academic performance, and health risks.

Table 2: SDA, FNS proposed rule, *Simplifying Meal Service and Monitoring Requirements in the School Lunch and School Breakfast Programs*—Provisions Examined for this HIA

Program Change	Regulation	Current Requirement	Proposed Rule
Smart Snacks –Entrée Exemption	7 CFR 210.11(c)(3)	Currently an entrée is exempt from Smart Snacks standards the day it is served as part of the NSLP or SBP, and the day after.	An entrée would be exempt from Smart Snacks standards the day it is served as part of the NSLP or SBP, and for two days after—for a total of three days out of the week.
Smart Snacks –Sale of Water	7 CFR 210.11(l)	Calorie-free, flavored waters, with or without carbonation may be sold to students in grades 9-12.	Schools would be allowed to sell calorie-free, flavored waters, with or without carbonation to students in all grades.
NSLP – Vegetable Subgroups	7 CFR 210.10(c)(2)(iii) 7 CFR 210.10(m)(ii)	Schools must offer different amounts of five vegetable subgroups—dark green, red/orange, legumes, starchy, and other—over the course of a week. Minimum amounts required vary by age/grade group and are identified by the DGAs (based on nutrient content and the goal to optimize health benefits).	Schools would be allowed to offer the same amount of vegetables from all five subgroups to all age/grade groups, which reduces the amount of red/orange vegetables, and allows for more starchy vegetables than currently allowed. Schools would be allowed to count the legumes offered as a meat alternate toward the weekly legumes vegetable requirement.
SBP – Fruit Requirement	7 CFR 220.8(c)(2) 7 CFR 220.8(m)(1)	Schools must offer 1 cup of fruit per day and 5 cups of fruit per week.	With approval from the State Agency, schools serving breakfast in a non-cafeteria setting would be allowed to offer ½ cup of fruit per day (2 ½ cups per week). This reduces the current requirement in half.
SBP – Meats/ Meat Alternates and Daily Grain Requirements	7 CFR 220.8(c)(2)	Schools may offer meats/meat alternates at breakfast after the minimum daily grains requirement is offered.	Schools would be allowed to offer a meat/meat alternate or a grain at breakfast (or a combination of the two) with no daily minimum grain requirement. Schools would now be able to meet this requirement by serving meat and a no-grain product.
SBP, NSLP – Potable Water Requirement	7 CFR (210.10(a)(1)(i)) 7 CFR (220.8(a)(1))	Schools are required to make unflavored, potable water available and accessible without restriction to children at no charge in the places where lunches are served during the meal service.	Schools would be allowed to offer naturally flavored water to meet the potable water requirement. Naturally flavored could be fruit infused with water, or flavoring meeting the FDA definition of “natural flavor or natural flavoring” as described at 21 CFR 501.22(a)(3).
SBP, NSLP – Meal Patterns		Schools are required to offer meals that meet requirements established for three age/grade groups (K-5, 6-8, 9-12), based on calorie and nutrient limits for age and developmental period.	Schools with unique grade configurations would be allowed to add or subtract a grade on either or both ends of an established age/grade group (e.g., a school serving K-6, could follow the K-5 meal pattern). Schools with unique grade configurations in school food authorities with fewer than 2,500 students would have the option to use one (or two) meal patterns for established age/grade groups for all students (e.g., a small school serving grades K-12, could choose to follow the 9-12 meal pattern for all students).
SBP, NSLP, Smart Snacks – Trans Fat	7 CFR 210.10(f)(4) 7 CFR 210.11(g) 7 CFR 220.8(f)(4)	Trans fats are prohibited in NSLP, SBP, and Smart Snacks.	This proposal would remove USDA’s trans fat ban effective July 1, 2021, as the FDA is removing trans fats from the food supply.

Source: USDA’s proposed rule: *Simplifying Meal Service and Monitoring Requirements in the National School Lunch and School Breakfast Programs*. Proposed January 23, 2020. Document Citation: 85 FR 4094

Figure 1: The School Meal and Competitive Food Health Determinant Pathway



Key Research Questions

Three central categories of research questions emerged from this scoping focused on diet and nutrition, meal participation and revenue, and academic performance. They are as follows:

Diet and Nutrition

- How will the proposed changes affect the availability of foods and beverages **sold outside of reimbursable schools (i.e., Smart Snacks)**, student purchases of these items, and student consumption at school?
- How will the proposed changes affect the availability of foods and beverages **served in school meals**, student participation in meals, and student consumption at school?
- How will changes in student consumption of foods served and sold in schools affect chronic disease outcomes and health care costs? Specifically, via increased risk for:
 - Near term: dental caries, changes in weight, high cholesterol, high blood pressure;
 - Long term: overweight, obesity, type 2 diabetes, heart disease, cancer; and
 - Future health care costs.
- How will changes in student consumption of foods and beverages at school affect daily food and beverage consumption (in a 24-hour period) and diet quality?
- Will changes in meal program participation have any unintended consequences regarding stigma associated with student participation in school meals and ultimately student's mental health?

Meal Participation and Revenue

- How will the proposed changes affect student's participation in the school meal programs and school food service revenue?
- How will a shift in student's participation in meal programs affect food security at the student and household level?

Academic Performance and Health Outcomes

- How will changes in student consumption of foods at school affect academic performance? Specifically,
 - Attendance;
 - Classroom behavior;
 - Cognitive functioning; and
 - Test scores.
- How will changes in stigma associated with school meal participation affect academic performance?
- How will changes in academic performance impact societal productivity? Specifically, via
 - Graduation rates, and
 - Income earning potential.

The health determinant pathway provides a visual mapping of the research questions and outcomes examined in this HIA.

Potential Impacts on Under-Resourced Populations

A primary consideration of this HIA was how vulnerable populations, including students from lower-income families who qualify for federally subsidized school meals (e.g., free and reduced-price lunch and breakfast), may be affected by USDA's proposed policy changes. While the research team hypothesized that, collectively, these proposed changes will impact all students eating school meals or Smart Snacks at any U.S. school participating in the federal meal programs, these changes are likely to have a disproportionate impact on the 74 percent of program participants receiving free or reduced-price meals. These students are more likely to suffer from food insecurity where they have limited or uncertain access to adequate food; to be overweight or obese; to suffer from type 2 diabetes, hypertension, and other chronic diseases; and to have untreated dental caries, all of which are associated with reduced quality of life, more frequent school absences, and longer-term health problems.²⁴

Although federal policies are implemented at a national level, they do not impact every school food authority, school, or child the same way. For example, schools that are rural, smaller, or have predominantly black and/or Hispanic students have on average, more unhealthy foods.^{12,25,26} Nutrition standards following the HHFKA were effective in improving offerings in these schools and reducing gaps in disparities, however, disparities still remain.²⁵ The research team hypothesizes that the proposed changes may reverse these improvements, disproportionately impacting rural, smaller, predominantly black/Hispanic schools, and further widening the disparities in the healthfulness of the school food environment and also children's health outcomes. The potential impacts on under-resourced populations was explored under each of the above research questions.

Assessment Methods

To complete this HIA, the research team performed an extensive review of the scientific literature; reviewed findings from the USDA School Nutrition and Meal Cost Study (SNMCS) released in April 2019; and incorporated stakeholder engagement via the advisory committee. A detailed description of the methods, including databases searched, inclusion/exclusion criteria, and search terms used for each research question is provided in Appendix A. A full listing of included studies reviewed for this HIA is provided in Appendix B.

Key Research Findings

This HIA summarizes the current understanding regarding how changes to the nutrition standards for school meals and Smart Snacks, as proposed by USDA, may impact school meal participation, student consumption and health, and academic performance.

Diet and Nutrition

How will the proposed changes affect the availability of foods and beverages sold in schools (i.e., Smart Snacks), student purchases of these items, and student consumption at school?

There is strong evidence showing that nutrition standards for à la carte foods and beverages do impact the availability of foods and beverages sold in schools, student purchases of these items, and student consumption. In recent years, strong evidence has emerged indicating that nutrition standards for competitive foods and beverages is associated with increased participation in school meals and therefore increased consumption of nutritious foods. Research suggests that by changing or rolling back the nutrition standards for competitive foods and beverages, school meal participation and student consumption of nutritious foods are likely to decrease.

Four systematic reviews, meta-analyses, or reviews and 18 original articles related to this research question were included in this review. Evidence reviewed for the HIA shows the following:

- Multiple studies have demonstrated that nutrition standards for foods and beverages sold outside of the reimbursable meal (i.e., competitive foods, Smart Snacks) affect the types of foods available to students and student consumption.^{8,27,28,29,30,31}
- Decreasing the availability of unhealthy competitive foods improves the overall nutritional quality of foods and beverages offered and consumed at school. Specifically, the implementation of Smart Snack standards was associated with offering more fruits and vegetables, and decreased availability of less nutritious foods and beverages.³² Researchers also found that after implementation of a state-level policy similar to Smart Snack standards, there was a decrease in the number of after-school unhealthy snacks consumed. On average, students consumed 22 fewer grams of sugar (five teaspoons) daily after implementation.³³ Among 5th-graders, restricting the availability of snack foods was associated with greater fruit and vegetable consumption.³⁴
- The dietary quality of foods served to students improves with the implementation of competitive food and beverage nutrition standards. A study in Massachusetts assessing the nutritional quality of snacks sold before and after state-level competitive food nutrition standards were implemented found that post-implementation, among all competitive foods, calories, saturated fat, sodium, and sugar decreased, and fiber increased.³⁵ Another study of eight school districts across the United States observed a general trend in lower caloric density (calories per product) and sugar density (grams of sugar per product) over a three-year period (school years 2011-2012, 2012-2013, and 2013-2014) as a result of the nutrition standards being in place.³⁶
- Restricting the sale of low-nutrition competitive foods can increase participation in school meals. Connecticut legislation incentivizing voluntary elimination of unhealthy competitive foods at the school district-level was associated with increased lunch participation rates between 7 percent and 23 percent for middle- and high-school meal programs.³⁷ Boehm and colleagues found that in a Northeastern urban district with universal free meals, the overall meal participation increased and the number of entrees with vegetables were higher when competitive foods were completely removed from the cafeteria in high schools.³⁸ A case study of San Francisco nutrition standards found that changes in the à la carte menus and district nutrition standards were associated with a dramatic increase in participation in the federally subsidized free school lunch program and a minimal decrease in participation in the federal reduced-price lunch program.³⁹ Another study examining competitive food and beverage legislation in California found that average lunch participation increased from 21.7 percent to 25.3 percent and average breakfast participation increased from 8.9 percent to 10.3 percent before (2006-2007) and after (2007-2008) the legislation was implemented.⁴⁰
- Data from the School Nutrition Meal Cost Study (SNMCS) suggest that the nutritional quality of lunches served at schools that did not sell competitive foods during meal times was healthier, or had a higher healthy eating index (HEI-2010) score, than the nutritional quality of lunches served alongside competitive foods. Overall, the mean HEI-2010 score for schools that did not sell competitive foods at meal times was 2.8 points higher than the mean score for similar schools that did sell competitive foods at meal times (84.2 versus 81.4). The strongest association was found among middle and high schools.⁴¹

How will the proposed changes affect the availability of foods and beverages served in school meals, student participation in meals, and student consumption at school?

There is strong evidence showing that nutrition standards for reimbursable meals improve the nutritional quality of school meals, increase student participation in school meal programs, and improve the nutritional quality of student consumption. Overall, the nutritional quality of school meals has dramatically improved since the implementation of updated nutrition standards following the Healthy, Hunger-Free Kids Act. There is *moderate evidence* demonstrating that improved nutrition standards and the resulting improved nutritional quality of school meals is associated with increased meal participation, and that school meals are more healthful than meals packed from home.

Five systematic reviews, meta-analyses, or reviews and 29 original articles related to this research question were included in the review. Evidence reviewed for the HIA shows the following:

- Nutrition standards for reimbursable meals set by the Healthy, Hunger-Free Kids Act have successfully increased the availability and consumption of healthy meals.¹³ Specifically, nutrition standards for school lunches have increased fruit intake, and reduced student intakes of total fat, saturated fat, and sodium.^{8,42} A study consisting of annual cross-sectional surveys of 4,630 elementary schools found that the percentage of schools regularly offering healthful items such as vegetables (other than potatoes), fresh fruit, salad bars, whole grains, and more healthful pizzas increased significantly from 2006-2007 to 2013-2014, and the percentage of schools offering less healthful items decreased significantly.²⁶
- Research shows that with nutrition standards for reimbursable meals, more students participated in the school meal program and there was no effect on competitive food selection. A robust observational cohort study examining the updated school meal nutrition standards and competitive food standards similar to those implemented in HHFKA found that after both standards were implemented, 13.6 percent more students chose a school meal versus no school meal. Significant increases in the selection of and participation in school meals and no changes in the selection of competitive foods were observed. Students did not compensate for the healthier school food environment by consuming unhealthy foods and beverages after school; rather students consumed significantly fewer unhealthy snacks and less total sugar after school following implementation of the nutrition standards.³³
- Since implementation of updated nutrition standards, the total HEI-2010 scores for school lunches and breakfasts increased significantly. Between school year 2009-2010 and school year 2014-2015, the total HEI score for lunches increased from 58 percent (out of 100) to 82 percent, and the total score for breakfasts increased from 50 percent to 71 percent. Scores for meal components increased by more than 20 percentage points for whole grains, refined grains, and empty calories at all meals; greens and beans for lunches; and whole fruit and sodium for breakfast.⁴³
- Since implementation in 2012, 99 percent of U.S. schools have met USDA's healthier meal standards resulting from the HHFKA. Updated standards have resulted in lunches being 41 percent healthier and breakfasts 44 percent healthier as measured by the HEI-2010 scores. Researchers have found that serving lunches of higher nutritional quality is associated with higher school lunch participation rates.¹²
- A nationally representative survey spanning 1994-2014 among school children aged 5-19 years found that, over this time period, the ratio of whole grains to total grains consumed at school rose from 4.0 percent to 21.5 percent. Moreover, between 2011-2012 and 2013-2014—the time period during which updated nutrition standards for school meals went into effect—among those consuming school foods, the ratio of students consuming whole grains increased from 1 in 4 to 1 in 2.⁴⁴
- Evidence consistently shows that school meal nutrition standards increased fruit selection and consumption, while there are mixed results about vegetables.¹⁵ Among middle school students in an urban, low-income school district, the percentage of students choosing fruit significantly increased from 54 percent to 66 percent and fruit consumption among those who selected a fruit remained high at 74 percent. Comparatively, the percentage of students who chose a vegetable decreased from 68 percent to 52 percent, but students selecting vegetables ate nearly 20 percent more of them, which lowered vegetable waste overall.¹⁶ In addition, on average, children consumed over half of their daily fruit and vegetable intake at school. Children with low fruit and vegetable intakes of less than five servings daily consumed a higher proportion of their daily intake at school than children with higher daily fruit and vegetable intakes.⁴⁵
- The nutritional quality of school lunches is significantly higher than packed lunches brought from home since the implementation of updated nutrition standards for reimbursable meals.^{12,46} Among schools in rural Virginia, packed lunches had significantly more amounts of energy, fat, saturated fat, sugar, vitamin C, and iron, and less protein, sodium, fiber, vitamin A, and calcium compared to school lunches.⁴⁶ The SNMCS also found that lunches served as part of the reimbursable meal were of higher nutritional quality than lunches brought from home.¹²
- Research shows that participation in NSLP has increased following implementation of updated nutrition standards resulting from HHFKA. A longitudinal study conducted

among low-income public schools with large populations of black and Hispanic students in New Jersey cities found that NSLP participation rates among students eligible for free or reduced-price meals increased from 49 percent (in school year 2008-2009) to 59 percent (in school year 2013-2014) to 64 percent (in school year 2014-2015). SBP rates also increased among enrolled students from 52 percent to 59 percent.⁴⁷ Although there are several factors that could influence student participation in the school lunch program, this research suggests that the HHFKA did not have a negative impact on school meal participation over time. Moreover, researchers found that serving lunches of higher nutritional quality was associated with higher school lunch participation rates.¹²

How will changes in student consumption of foods and beverages served and sold in schools affect chronic disease outcomes and health care costs?

A moderate amount of evidence supports that nutrition standards and consumption of healthful school meals is associated with more positive weight outcomes, such as decreased body mass index (BMI). Furthermore, research suggests that the consumption of specific foods is more strongly associated with weight outcomes than other foods. The direct association between nutrition standards and other health outcomes, such as diabetes and cholesterol, is *not well researched*; however, the relationship between poor dietary patterns and risk for chronic disease outcomes is well established in the literature. Thus, it is important to note that the strength of nutrition standards for all foods sold and served in schools could have significant impacts on long-term chronic disease incidence and obesity rates. In addition, the strong association between risk for and incidence of these chronic disease outcomes with increased future health care costs is also well established in the literature.

Three systematic reviews, meta-analyses, or reviews and 18 original articles related to this research question were included in the review. Several chronic disease outcomes were included in the search: dental caries, changes in weight, high cholesterol, high blood pressure, overweight, obesity, type 2 diabetes, heart disease, and cancer. Evidence reviewed for the HIA shows the following:

- There is mixed evidence regarding the association between school meal participation and students' weight status (using BMI). A systematic review including 14 studies from the United States and four from the United Kingdom found that overall there was a decline in the rate of increase in overweight prevalence after state-level implementation of competitive food nutrition standards policies similar to Smart Snacks.⁴⁸ One review described a study in South Carolina that found no significant relationship between SBP, NSLP, or combined participation and BMI-percentile, while another study in Georgia found that higher SBP participation was associated with higher BMI, and that high NSLP participation was associated with lower BMI.⁴⁹

- A review of research from 2006-2016 discussed that high schools meeting the USDA meal nutrition standards were found to be associated with lower prevalence of overweight and obesity. In addition, the absence of sugar-sweetened beverages was associated with lower prevalence of overweight and obesity among Hispanic middle school students.⁷
- Another robust systematic review of competitive food and beverage policies like Smart Snacks reported associations between the strength of competitive food and beverage policies and lower middle school student BMI and weight outcomes, although variation existed among grades and genders within studies.²⁸ As for school meals, Vericker and colleagues found that boys who ate school lunches after implementation of the updated nutrition standards experienced slower BMI z-score growth than did nonparticipants, although no significant relationship was found among girls.⁵⁰
- Factors associated with school breakfast consumption have been found to be associated with weight outcomes. A longitudinal observational study of middle school students found that students who regularly consume breakfast at school were more likely to have a healthy weight trajectory. Further, there was increased odds of overweight/obesity among frequent breakfast skippers compared with double breakfast eaters.⁵¹ Another study found that for every additional breakfast per week consumed by an SBP participant, BMI declined by 0.15 points, although the relationship between participation in either of the meal programs and BMI was not influenced by participation.⁵²
- Another study using data from the third School Nutrition Dietary Assessment (SNDA-III) found that among elementary school children, offering french fries and similar potato products in school meals more than once per week and offering dessert more than once per week were each associated with significantly higher likelihood of obesity. This finding suggests that the proposed increase in starchy vegetables included in the January 2020 proposed rule could increase obesity risk. This study also found that middle school children had higher average BMI z scores when the school had higher availability of low-nutrient, energy-dense foods in vending machines, such as those frequently available before implementation of Smart Snacks.⁵³
- Using systematic reviews and a microsimulation model of national implementation of interventions, researchers found that implementing nutrition standards for foods and beverages sold in schools outside of school meal programs could save 345,000 cases of childhood obesity in 2025 and the net savings per dollar spent would be \$4.56. This is a significant finding that demonstrates the reach and potential impact of nutrition standards of school meals.⁵⁴

How will changes in student consumption of foods and beverages at school affect daily food and beverage consumption (in a 24-hour period) and diet quality?

There is strong evidence showing that consumption of foods and beverages at school affects total daily intake and total diet quality. Based on the available evidence, we conclude that the proposed changes are likely to reduce the total diet quality of students consuming school meals and foods and beverages sold à la carte. This relationship is best documented among low-income school meal participants because nearly half of their daily intake comes from school meals. There is *moderate evidence* suggesting that various school programs, such as breakfast in the classroom, were significantly associated with greater impacts on total daily intake among participants.

One systematic review and six original articles met the inclusion criteria and were included. Evidence reviewed for the HIA shows the following:

- Daily student participation in SBP and NSLP was associated with higher diet quality over a 24-hour period. A cross-sectional observation study conducted among U.S. children 4-15 years old between 2013-2015 found that students who consumed school breakfast daily reported higher daily intakes of fruits, vegetables, legumes, whole grains, and daily dietary fiber compared to students who did not eat school breakfast every day. Researchers also found that students who ate school lunch every day reported higher daily dairy and calcium intakes.⁵⁵ Hanson and colleagues also found that among low-income children, participation in both school breakfast and lunch was associated with a higher total HEI score due to higher scores for grains, meat and beans, and milk.⁵⁶
- Researchers have found an association between nutrition standards for competitive foods and beverages and improved total daily intake of healthful foods and beverages among students. One study found that strong competitive food and beverage standards reduced consumption of sugar-sweetened beverages by 0.18 servings per day and reduced low-nutrient snack intake by 0.17 servings per day.⁸ An observational cohort study also found that following implementation of Smart Snack standards, the number of after-school unhealthy snacks consumed decreased and that students consumed on average 22 fewer grams of sugar (five teaspoons) daily when compared to before implementation.³³

- Research suggests that low-income students obtain a large portion of the day's calories from school meals. A study by Cullen and colleagues found that among low-income students, 47 percent of the day's energy intake was provided by school meals. Just under half (40.6%) and more than three-quarters (77.1%) of children's total consumption of vegetables and milk, respectively, are coming from foods and beverages consumed during school meals.⁵⁷ This observation indicates that nutrition standards could have a greater impact on the total daily intake of low-income students compared to other students.
- Specific programs have been associated with improved daily diet quality more than others. Among 4th- and 5th-grade students, students who consumed their breakfast in the classroom had higher overall diet quality compared to students who ate breakfast at home, in the cafeteria or second chance breakfast.⁵⁸ Students in schools participating in the Fresh Fruit and Vegetable Program reported a higher daily fruit and vegetable intake compared to those in non-participating schools.⁵⁹

How will changes in student's participation in meal programs affect the normative culture of school meal programs and associated stigma and ultimately student's mental health?

The association between student participation in meal programs and stigma is *not well researched*. No systematic reviews, meta-analyses, or reviews met the inclusion criteria for this study, and while eight original articles were reviewed, the body of evidence largely focused on parent's perception of stigma rather than the relationship between student's school meal participation and stigma.

A previous HIA conducted by Pew in 2012, examining the potential impact of a national competitive foods policy on diet and nutrition also reviewed the link between child eligibility for and participation in free and reduced-price school meals and stigma, and found little research on the topic. However, the authors point out that children are influenced by their peers, and existing research on the topic indicates social modeling occurs during school meals, with children often basing their food selection on what others around them are eating. Thus, it is plausible that the presence of snacks foods and beverages in the school environment that look quite different from the school meal, might unintentionally stigmatize students who do not have the means to purchase these items, such as students receiving free or reduced-price meals.²⁴

Meal Participation and Revenue

How will the proposed changes affect student's participation in the school meal programs and school food service revenue?

There is strong evidence showing that nutrition standards affect student's participation in school meal programs and school food service revenue. Stronger nutrition standards increase the likelihood of a student's participation in school meal programs, thus increasing food service revenue.

A majority of the available literature describes the impact of nutrition standards for foods and beverages sold outside of the reimbursable meal on school food service revenue. There is *strong evidence* showing that revenue does not decrease with implementation of nutrition standards for competitive foods and beverages. Although there is *mixed evidence* on whether revenue from competitive foods and beverages stays the same or increases with nutrition standards, available data support that improving nutrition standards for these à la carte items can increase participation in school meals, which brings in additional school food service revenue.

No systematic reviews, meta-analyses, or reviews met the inclusion criteria; however, 12 original articles were included. Evidence reviewed for the HIA shows the following:

- Recent evidence suggests that nutrition standards for competitive foods do not negatively impact total revenue of the school meal program. Rather, stronger nutrition standards for competitive foods and beverages are associated with an increase in participation in school meal programs, and the revenue from an increase in participation has been found to offset any reductions in à la carte sales.^{38,39,60,61}
- Moreover, the SNMCS did not find an association between nutritional quality of the school meals as measured by HEI scores and reported cost for the school to produce the meal after the updated nutrition standards went into effect in school years 2014-2015, indicating that healthier meals do not cost more to produce than other meals.⁶² USDA defines reported costs as the costs that are charged to the school foodservice account, typically including the costs of food, salaries and fringe benefits for food service personnel, and supplies.
- One study analyzing Connecticut legislation incentivizing voluntary school district-level elimination of unhealthy competitive foods found that districts choosing to adopt the state policy observed an increase in school lunch participation, which led to an estimated revenue increase of roughly \$30,000 for an average school district per year.³⁷ Another study examining this association in California found that after limiting competitive foods and beverages, average lunch participation increased by 17 percent and average breakfast

participation increased by 16 percent leading to a significant increase in average meal revenue of 23 percent.⁴⁰

- Student participation in breakfast also plays an important role in school meal revenues. Among rural high schools that expanded the SBP, schools sold enough breakfast meals to break even on the daily cost of operating an expanded program. Moreover, schools recouped costs associated with expanding the breakfast program within 15-46 days.⁶³ Increasing participation provides many opportunities for schools to increase their revenue, and Ollinger and colleagues found that food costs dropped with increased volume of products purchased.⁶⁴
- Evidence suggests that improving nutritional quality of school meals can increase participation. Ensuring the healthfulness of school breakfasts will likely increase revenue for schools. The Food Research and Action Center (FRAC) develops an annual breakfast scorecard. FRAC found that for the 2018-2019 school year, if every state had met FRAC's goal of serving 70 low-income students breakfast for every 100 who eat school lunch, states could have received an additional \$783.9 million in the 2018-2019 school year to support school food services and local economies.⁶⁵

How will a shift in student's participation in meal programs affect food security?

There is strong evidence showing that participation in school meal programs increases food security among children.

This relationship is further strengthened among students who have access to the Summer Food Service Program and SBP. The relationship between food insecurity and food insufficiency—defined by USDA as not having access to enough food to support a healthy life and as an inadequate amount of food intake due to lack of resources, respectively—and negative impacts on health and well-being, including student physical and mental health, behavior, and educational attainment have been well documented in the literature. Evidence reviewed in this HIA suggests that weakened nutrition standards are likely to lead to reduced participation in school meals, which increases the risk of students falling into food insecurity.

No systematic reviews, meta-analyses, or reviews met the inclusion criteria for this research question, however eight original articles were included in the research team's analysis. Evidence reviewed for the HIA shows the following:

Participation in child nutrition programs reduces food insecurity among low-income families. A USDA report on child nutrition programs and food security found that participation in the NSLP, Summer Food Service Program, and Child and Adult Care Food Program were associated with lower rates of food insecurity among households with children.

Researchers also found that participation in child nutrition programs improved diet quality and academic performance for children in low-income and food-insecure households.⁶⁶

Participation in SBP has also been shown to reduce food insecurity. One study, using data from Common Core, found that state policies requiring schools to offer SBP reduced food insecurity among elementary students. Access to SBP also reduces the likelihood of low food security by over 15 percentage points.⁶⁷

Research suggests that NSLP participation reduces food insecurity among low-income households.⁶⁸ A longitudinal study found that in summer months when NSLP is not available, the food insecurity rate among recipients is about 0.7 percentage points higher than that in non-summer months. The average monthly food insecurity rate was 3.9 percent in the sample, indicating that the NSLP participation is associated with a 14 percent reduction in the risk of experiencing food insecurity compared to low-income children that do not participate in the NSLP program.⁶⁹

Academic Performance and Health Outcomes

How will changes in student consumption of foods at school affect academic performance?

There is moderate evidence showing an association between nutrition standards and improved dietary consumption with improved academic performance and cognitive function. The connections between diet quality and attendance, classroom behavior, cognitive functioning, and test scores were included in the literature search. *A moderate amount of evidence* supports positive impacts of consuming breakfast on cognitive functioning. Based on the literature reviewed in this HIA, it's possible that weakening of nutrition standards could impact cognitive functioning, especially among the population more likely to participate in school meal programs such as Hispanic or black children from low-income households.

Three systematic reviews, meta-analyses, or reviews and 16 original articles related to this research question met the inclusion criteria. Evidence reviewed for the HIA shows the following:

- The relationship between consumption of nutrient dense foods and adequate calories and cognitive functioning is well documented in the literature. Cognitive functioning plays an important role in academic achievement in children and adolescents. Recent reviews document that breakfast consumption specifically has a positive association with academic achievement.⁷⁰ One systematic review compared the effects of breakfast consumption with fasting and found that breakfast consumption facilitated tasks requiring attention, executive function, and memory more reliably than fasting among children and adolescents.⁷¹

- A recent systematic review evaluating whether healthier dietary consumption among children and adolescents impacts executive functioning found positive associations between healthier overall diet quality and executive functioning. Moreover, the review found that nutrient-rich foods (e.g., whole grains, fish, fruits, vegetables) were positively associated with executive function, whereas less healthy snack foods, sugar-sweetened beverages, and red/processed meats were inversely associated with cognitive function.⁷²
- Using a difference-in-differences design and unique longitudinal, student-level data, researchers estimate that extending free school lunch to all students, regardless of income, would increase academic performance in both math and language.⁷³
- Existing research suggests that children's cognition, behavior, and learning are impacted by nutritional status,^{74,75} and that participation in school meals is associated with better academic outcomes. This is especially true for food insecure students where studies have concluded that greater participation in school meals makes them healthier, more focused students.²⁴

How will changes in stigma of school meals affect academic performance?

The literature search conducted for this HIA did not find any relevant articles on the relationship between stigma and academic performance; therefore, the potential relationship cannot be discussed in this HIA.

How will changes in academic performance impact societal productivity?

There is strong evidence showing the relationship between academic performance and societal productivity, including impacts on graduation rates and income earning potential. Studies consistently show a strong relationship between educational attainment and health over a lifetime, with better educated individuals living longer and having lower risks for chronic diseases.⁷⁶ In large part, this relationship has to do with linkages between educational attainment and health knowledge and behaviors, employment and income, and social and psychological factors. Educational attainment has also been shown to affect health across generations.⁷⁶

Due to time constraints, and the well-established relationship in the literature on the connection between academic performance and societal productivity, the research team decided not to do a new review of the literature on this topic. However, based on the strength of the existing evidence in this area as well as the previously presented data on the relationship between diet quality and cognitive functioning and academic performance, it is likely that changes to school meal programs resulting in a lower HEI score for meals and/or shifts in the nutritional quality

of à la carte snack foods and beverages (i.e., Smart Snacks) whereby students would be exposed to more calorie-dense items and fewer nutrient dense items will impact cognitive functioning and academic performance of students in the short term, as well as societal productivity in the long term.

Which populations are most likely to be impacted by this proposed policy?

NSLP and SBP participants are more likely than nonparticipants to be from households that are low-income, less educated, and food insecure. Furthermore, participants are more likely than nonparticipants to be enrolled in lower grades, male, Hispanic or non-Hispanic black, and have obesity. SBP participants are lower-income and more food insecure compared to NSLP participants.⁴¹ The nutritional quality of meals served varies by school demographic factors. Schools that are predominately black, in rural areas, and are small or medium are more likely to serve meals of lower nutritional quality compared to large schools that are predominately white and in urban areas.^{25,26,41} Changes to nutrition standards for NSLP, SBP, and Smart Snacks as included in the proposed rule are likely to have a larger impact on the diets of these students, and thus may exacerbate existing disparities in these students' health and academic performance.

Recommendations

Based on the evidence reviewed and information collected for this rapid HIA, the research team identified several policy implications.

Recommendation 1: Monitoring and Evaluation

Should USDA move forward with this policy as proposed, the agency should prioritize monitoring and evaluation of the effects of the proposed changes. Specifically, USDA should monitor school food authority and schools' adherence to the standards by regularly reviewing breakfast and lunch menus as well as competitive food offerings, and student selection of such foods and beverages. Furthermore, regular collection of participation and revenue data would allow USDA and collaborating researchers the opportunity to explore the relationships prioritized in this HIA.

Investing in data collection efforts such as the SNMCS permits USDA and collaborating researchers to explore the short- and long-term impacts of changes to federal regulations that affect the nutritional quality of foods available during

the school day. Despite a considerable amount of evidence related to school meals, longitudinal studies exploring long-term outcomes are lacking in the school meal evidence base due to the financial limitations of conducting a nationally representative study with robust methodology and sufficient sample size. USDA should hold the essential position of ensuring such data and evidence is available to evaluate current regulations and inform future policies.

Recommendation 2: Technical Assistance

Regardless of whether or not this proposed policy is adopted, USDA should continue to provide training and technical assistance to schools and districts that are struggling to meet federal nutrition standards.

Conclusions and Policy Implications

This HIA examined the potential public health impacts of changes to school meal and Smart Snack nutrition standards put forward by USDA in the proposed rule released in January 2020. The HIA included an extensive systematic review of the literature and expert input from the advisory committee throughout the process. Overall, the available research indicates that implementation of strong nutrition standards following passage of the HHSFKA resulted in healthier, well-balanced meals and that these improvements have significant short- and long-term positive implications for child health and cognitive performance, as outlined in the HIA pathway. Specifically, strong nutrition standards improve the healthfulness of meals available and consumed by children—both at school and throughout the day—increase participation in the school meal programs, increase food security, and improve cognitive functioning without a negative financial effect on schools.

The evidence supports that the changes to school meal and Smart Snack nutrition standards as proposed by USDA could shift children's diets in the opposite direction and likely have adverse impacts on their overall health, food security, and academic performance. Preventing weakened standards would positively impact the most vulnerable children in public school settings, most notably children from low-income, low-educated households in predominantly black and rural schools. USDA should maintain strong nutrition standards for all foods served and sold in schools, support school food authorities in meeting those standards via enhanced training, and technical assistance, and invest in school kitchen equipment and infrastructure.

Appendix A. Methodology and Key Research Questions

Methodology

A research team from Healthy Eating Research alongside an expert advisory committee consisting of individuals with expertise in school nutrition policy and research from around the country, hypothesized a pathway between the proposed policy, health determinants, and health outcomes. The hypothesized pathway was originally developed using the research team's expertise and a preliminary literature review. The pathway includes the policy change and potential direct impacts, intermediate impacts, and outcomes based on a preliminary review of the literature. From the hypothesized pathway, the research team and advisory committee developed a set of research questions and corresponding keyword

combinations to be used in a literature search that would address the connections identified in the pathway. These research questions and the accompanying health determinant pathway diagram are included in the body of the report.

Literature Review

To complete this HIA, the research team conducted an expedited literature review using systematic methodologies to minimize bias and identify studies to answer each of the identified research questions. In total, 16 systematic reviews, meta-analyses, or reviews and over 60 original articles published between January 2012 and February 2020 were included and

Category	Research Questions	Search Terms	Articles Reviewed	Articles Included
Diet, Nutrition and Health	How will the changed (i.e., rolled-back) standards affect the availability of foods and beverages sold in schools (comp foods), student purchases of these items, and student consumption at school?	National School Lunch Program, NSLP, School Breakfast Program, SBP, child nutrition program, school meal program, school meals, meal patterns, menu changes, nutrition standards, nutrition, standards, food standards, competitive foods, competitive foods standards, smart snacks, à la carte, Healthy, Hunger Free Kids Act, HHFKA, fruits, vegetables, fruits and vegetables, whole grains, availability, offered served, sold, available, consumed, intake, healthy eating index, HEI, diet variety, nutritional quality, dietary pattern, diet pattern	113	4
	How will the changed (i.e., rolled-back) standards affect the availability of foods and beverages served in school meals, student participation in meals, and student consumption at school?	National School Lunch Program, NSLP, School Breakfast Program, SBP, child nutrition program, school meal program, school meals, meal patterns, menu changes, nutrition standards, nutrition, standards, food standards, fruits, vegetables, fruits and vegetables, whole grains, Healthy Hunger Free Kids Act, HHFKA, availability, offered served, sold, available, consumed, intake, healthy eating index, HEI, diet variety, nutritional quality, dietary pattern, diet pattern	120	5
	How will changes in student consumption of foods served and sold in schools affect chronic disease outcomes and health care costs?	National School Lunch Program, NSLP (and similar terms), meal patterns, menu changes, nutrition standards, nutrition, standards, food standards, competitive foods, smart snacks, à la carte, fruits, vegetables, fruits and vegetables, whole grains, availability, offered served, sold, available, consumed, intake, healthy eating index, HEI, diet variety, nutritional quality, dietary pattern, diet pattern, indicators of adiposity (i.e., obesity, overweight, BMI, BMI trajectory, skinfold thickness), obesity prevention and control, insulin resistance, health status, nutrient levels, dental caries, oral health, long term risk for chronic illness (e.g., heart disease)	13	3
	How will changes in student consumption of foods and beverages at school affect daily food and beverage consumption (24-hour) and diet quality?	NSLP (and similar terms), impact, nutrition, schools, snacks, calories, children, à la carte, dietary intake, food preferences, environment, food environment, 24-hour recall, consumption, healthy eating index, HEI, diet variety, nutritional quality, dietary pattern, diet pattern	140	1
	How will changes in student's participation in meal programs affect the normative culture of school meal programs and associated stigma and ultimately student's mental health?	NSLP (and similar terms), nutritional status, school meals, competitive foods, school performance, school meal eligibility, stigma, free and reduced lunch, free lunch, participation, school meals, mental stress, school lunches, stress, mental health, behavioral health, participation, participant	180	0

Meal Participation and Revenue	How will the changed (i.e., rolled-back) standards affect student's participation in the school meal programs and school food service revenue?	NSLP (and similar terms), meal patterns, menu changes, nutrition standards, nutrition, standards, food standards, competitive foods, smart snacks, à la carte, fruits, vegetables, fruits and vegetables, whole grains, availability, offered served, sold, available, consumed, intake healthy eating index, HEI, diet variety, nutritional quality, dietary pattern, diet pattern, USDA meal program revenue, revenue, schools, school district	200	0
	How will a shift in student's participation in meal programs affect food security?	NSLP (and similar terms), food security, school meals, children, hunger, schools, breakfast, lunch, participation	50	0
Academic Performance/ Cognitive Functioning	How will changes in student consumption of foods at school affect academic performance?	NSLP (and similar terms), nutrition, educational outcomes, academic outcomes, academic achievement, school performance, nutritional status, school breakfast, school lunch, school meals, competitive foods, school performance, nutritional status, consumption, intake, dietary intake, consumed, healthy eating index, HEI, diet variety, nutritional quality, dietary pattern, diet pattern	49839	3
	How will changes in stigma of school meals affect academic performance?	NSLP (and similar terms), nutrition, educational outcomes, academic outcomes, academic achievement, school performance, nutritional status, school breakfast, school lunch, school meals, competitive foods, school performance, school meal eligibility, stigma, free and reduced lunch, free lunch, participation, school meals, mental stress, school lunches, stress	0	0

reviewed for this HIA. The research questions, search terms, and a summary of the total number of articles reviewed and included in the analyses is outlined in the following table.

The research team conducted a rapid literature review using systematic methodologies to answer each of the identified research questions. The search was first limited to systematic reviews, reviews, or meta-analyses of studies for each research question available online and published in the past eight years (2012) using PubMed and Google Scholar. Key words and groupings included: school meals, National School Lunch Program, School Breakfast Program, competitive foods, meal patterns, nutrition standards, diet quality, Healthy Eating Index, food security, food insufficiency, stress, stigma, academic performance, cognitive functioning, BMI, weight change, obesity, overweight, health impacts, and revenue. Abstracts were then read to confirm inclusion.

To be included, all studies had to be published from January 1, 2012 to February 2020; published in English; and conducted primarily among study populations in the United States.

If fewer than six systematic reviews, reviews, or meta-analyses were found for a specific research question, the search was repeated for original articles. When searching for

original articles, the research team included U.S. agency and nonpartisan organization research reports and publications. Publications and reports that were included in the search include the USDA School Nutrition Meal Cost Study Reports and USDA rules and regulations.

After following the protocol outlined above, the team reviewed 50,655 titles and identified 15 systematic reviews, reviews, or meta-analysis that met the inclusion criteria. Four of the nine research questions did not come up with any systematic reviews, reviews, or meta-analysis, and one research question resulted in zero reviews or grey literature. The subsequent searches for original articles (when necessary) resulted in the inclusion of over 60 peer-reviewed articles.

Multiple search strings and keyword groupings were used when searching for original articles to return the most exhaustive list of literature possible. Articles that were repeatedly referenced in the included articles, and that contributed significant findings to the field of research, were included in the text regardless of publication date. Four resources were identified outside of the peer-reviewed literature (SNMCS, FRAC score card, USDA report, and the Dietary Guidelines for Americans 2015 Committee Report).

Strength of evidence

Throughout the report, the strength of the evidence is qualitatively described and categorized as: *strong* evidence, *moderate* evidence, *mixed* evidence, and *not well researched*. Each of these terms is further defined in the following table.

USDA School Nutrition and Meal Cost Study

In addition, the research team reviewed findings from the USDA School Nutrition and Meal Cost Study (SNMCS), a comprehensive nationally representative study released in April 2019, which collected information on the nutrition quality and costs of school meals as well as 24-hour student dietary recalls. The study produced four separate volumes of reports summarizing study findings by: (1) School Meal Program Operations and School Nutrition Environments;

(2) Nutritional Characteristics of School Meals; (3) School Meal Costs and Revenues; and (4) Student Participation, Satisfaction, Plate Waste, and Dietary Intakes. A volume on study design, sampling, and data collection, as well as a stand-alone summary of findings are also available. This is the first nationally representative data set collected post-implementation of updated school meals and Smart Snack nutrition standards resulting from passage of the HHFKA.

Stakeholder Involvement

Finally, stakeholder engagement is a core element and guiding principle of HIA practice. Due to the short timeframe under which this rapid HIA was conducted, stakeholder feedback was incorporated primarily through an advisory committee, which included a thorough peer review process.

Strong	The literature review yielded robust evidence supporting the association with few if any contradictory findings. The evidence indicates that the research community largely accepts the existence of the relationship.
Moderate	The literature review yielded several studies supporting the association, but a large body of evidence was not established; or the review yielded a large body of evidence but findings were inconsistent with only a slightly larger percent of the studies supporting the association; or the research did not incorporate the most robust study designs or execution or had a higher than average risk of bias.
Mixed	The literature review yielded several studies with contradictory findings regarding the association.
Not well researched	The literature review yielded few if any studies or only yielded studies that were poorly designed or executed or had high risk of bias.

Appendix B. Key Studies Included

A literature search using keywords and search strings relevant to each research question was conducted in PubMed and Google Scholar. The titles below were identified as articles that met the inclusion criteria. The included meta-analyses, systematic reviews, or reviews are shaded in blue.

Study Name	Authors	Year	Article Type
Research Question: How will the changed (i.e., rolled-back) standards affect the availability of foods and beverages sold in schools (comp foods), student purchases of these items, and student consumption at school?			
Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis.	Micha R, Karageorgou D, Bakogianni I, Trichia E, Whitsel LP, Story M, Penalvo JL, Mozaffarian D.	2018	Review
School food and nutrition policy, monitoring and evaluation in the USA.	Hirschman J, Chriqui J.	2012	Review
Snacks, Sweetened Beverages, Added Sugars, and Schools.	Council on School Health, Committee on Nutrition	2015	Review
Influence of School Competitive Food and Beverage Policies on Obesity, Consumption, and Availability A Systematic Review.	Chriqui J, Pickel M, Story M.	2014	Review
Removing competitive foods v. nudging and marketing school meals: a pilot study in high-school cafeterias.	Boehm R, Read M, Henderson K, Schwartz M.	2020	Original Article
Impact of Connecticut legislation incentivizing elimination of unhealthy competitive foods on National School Lunch Program participation.	Long M, Luedicke J, Dorsey M, Fiore S, Henderson K.	2013	Original Article
Does competitive food and beverage legislation hurt meal participation or revenues in high schools?	Pearl T, Kao J, Crawford J, Samuels S, Crapo L, Woodward-Lopez G.	2012	Original Article
The Relationship Between State Policies for Competitive Foods and School Nutrition Practices in the United States.	Merlo C, O'Malley Olsen E, Galic M, Brener N.	2014	Original Article
The Impact of 1 Year of Healthier School Food Policies on Students' Diets During and Outside of the School Day.	Cohen J, Gorski Findling M, Rosenfeld L, Smith L, Rimm E, Hoffman J.	2018	Original Article
Impact of Nutrition Standards on Competitive Food Quality in Massachusetts Middle and High Schools.	Gorski M, Cohen J, Hoffman J, Rosenfeld L, Chaffee R, Smith L, Rimm E.	2016	Original Article
Implementation of Competitive Food and Beverage Standards in a Sample of Massachusetts Schools: The NOURISH Study.	Hoffman J, Rosenfeld L, Schmidt N, Cohen J, Gorski M, Chaffee R, Smith L, Rimm E.	2015	Original Article
Product reformulation and nutritional improvements after new competitive food standards in schools.	Jahn J, Cohen J, Gorski-Findling M, Hoffman J, Rosenfeld L, Chaffee R, Smith L, Rimm E.	2018	Original Article
Improvements and disparities in types of foods and milk beverages offered in elementary school lunches, 2006-2007 to 2013-2014.	Turner L, Ohri-Vachaspati P, Pwell L, Chaloupka F.	2017	Original Article
Nutrition Quality of US School Snack Foods: A First Look at 2011-2014 Bid Records in 8 School Districts.	Wang Y, Hsiao A, Chamberlin P, Largay M, Archibald A, Malone A, Stevlos J.	2017	Original Article
Restricting snacks in U.S. elementary schools is associated with higher frequency of fruit and vegetable consumption.	Gonzalez W, Jones S, Frongillo E.	2009	Original Article
Healthier choices and increased participation in a middle school lunch program: effects of nutrition policy changes in San Francisco.	Wojcicki J, Heyman M.	2006	Original Article
Smart Snacks in School Legislation Does Not Change Self-Reported Snack Food and Beverage Intake of Middle School Students in Rural Appalachian Region.	Mann G, Hosig K, Zhang A, Shen S, Serrano E.	2017	Original Article
The Availability of Competitive Foods and Beverages to Middle School Students Before Implementation of the 2014 Smart Snacks in Schools Standards.	Mann G, Kraak V, Serrano E.	2015	Original Article
USDA Snack Policy Implementation: Best Practices From the Front Lines, United States, 2013-2014.	Asada Y, Chriqui J, Chavez N, Odoms-Young A, Handler A.	2016	Original Article
A National Evaluation of the Impact of State Policies on Competitive Foods in Schools.	Fernandes M.	2013	Original Article
Healthier standards for school meals and snacks: impact on school food revenues and lunch participation rates.	Cohen J, Gorski M, Hoffman J, et al.	2016	Original Article
Lessons learned from evaluations of California's statewide school nutrition standards.	Woodward-Lopez G, Gosliner W, Samuels SE, Craypo L, Kao J, Crawford P.	2010	Original Article

Research Question: How will the changed (i.e., rolled-back) standards affect the availability of foods and beverages served in school meals, student participation in meals, and student consumption at school?

Effect of school wellness policies and the Healthy, Hunger-Free Kids Act on food-consumption behaviors of students, 2006-2016: a systematic review.	Mansfield JL, Savaiano DA.	2017	Systematic Review
Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis.	Micha R., Karageorgo D, Bakogianni I, Trichia E, Whitsel L, Story M, Penalvo J, Mozaffarian D.	2018	Systematic Review and Meta-Analysis
The new federal school nutrition standards and meal patterns: Early evidence examining the influence on dietary behavior and the school food environment.	Cullen K, Dave J.	2017	Review
Food Waste in the National School Lunch Program 1978-2015: A Systematic Review.	Byker Shanks C, Banna J, Serrano EL.	2017	Systematic Review
Factors Related to Fruit and Vegetable Consumption at Lunch Among Elementary Students: A Scoping Review.	Graziose MM, Ang IYH.	2018	Review
Improvements and disparities in types of foods and milk beverages offered in elementary school lunches, 2006-2007 to 2013-2014.	Turner L, Ohri-Vachaspati P, Pwell L, Chaloupka F.	2017	Original Article
The Impact of 1 Year of Healthier School Food Policies on Students' Diets During and Outside of the School Day.	Cohen J, Gorski Findling M, Rosenfeld L, Smith L, Rimm E, Hoffman J.	2018	Original Article
Updated nutrition standards have significantly improved the nutritional quality of school lunches and breakfasts.	Gearan E, Fox MK.	2019	Original Article
School Nutrition Meal Cost Study: Nutritional Characteristics of School Meals. Vol 2. Washington: US Dept of Agriculture	USDA, Mathematica	2019	Original Article
Dietary guidance and new school meal standards: Schoolchildren's whole grain consumption over 1994-2014.	Lin B, Guthrie J, Smith T.	2019	Original Article
Impact of the new U.S. Department of Agriculture school meal standards on food selection, consumption, and waste.	Cohen J, Richardson S, Parker E, Catalano P, Rimm E.	2014	Original Article
New school meal regulations increase fruit consumption and do not increase total plate waste.	Schwartz MB, Henderson KE, Read M, Danna N, Ickovics JR.	2015	Original Article
Associations Between School Meals Offered Through the National School Lunch Program and the School Breakfast Program and Fruit and Vegetable Intake Among Ethnically Diverse, Low-Income Children.	Robinson-Obrien R, Burgess-Champoux T, Haines J, Hannan P J, & Neumark-Sztainer, D.	2010	Original Article
Nutritional Comparison of Packed and School Lunches in Pre-Kindergarten and Kindergarten Children Following the Implementation of the 2012-2013 National School Lunch Program Standards. Journal of Nutrition Education and Behavior.	Farris A, Misyak S, Duffey K, Davis G, Hosig K, Atzaba-Poria N, McFerren M, Serrano E.	2014	Original Article
Impact of the 2010 US Healthy, Hunger-Free Kids Act on School Breakfast and Lunch Participation Rates Between 2008 and 2015.	Vaudrin N, Lloyd K, Yedidia M, Todd M, Ohri-Vachaspati P.	2018	Original Article
Lessons learned from evaluations of California's statewide school nutrition standards.	Woodward-Lopez G, Gosliner W, Samuels SE, Craypo L, Kao J, Crawford P.	2010	Original Article
Healthier choices and increased participation in a middle school lunch program: effects of nutrition policy changes in San Francisco.	Wojcicki J, Heyman M.	2006	Original Article
Impact of Connecticut legislation incentivizing elimination of unhealthy competitive foods on National School Lunch Program participation.	Long M, Luedicke J, Dorsey M, Fiore S, Henderson K.	2013	Original Article
An economic analysis of updating and expanding school breakfast program offerings in high schools.	Shanafelt A, Magliocco B, Milbrath K, Nanney M, Caspi C.	2019	Original Article
Effect of the Healthy Hunger-Free Kids Act on the Nutritional Quality of Meals Selected by Students and School Lunch Participation Rates.	Johnson D, Podrabsky M, Rocha A, Otten J.	2016	Original Article
Participation in the National School Lunch Program and food security: An analysis of transitions into kindergarten.	Arteaga I, Heflin C.	2014	Original Article
Changes in foods selected and consumed after implementation of the new National School Lunch Program meal patterns in southeast Texas.	Cullen KW, Chen T-A, Dave JM.	2015	Original Article
The impact of replacing breakfast grains with meat/meat alternatives: an evaluation of child nutrition policy.	Hansen J, Cantrell O, Paez P, Brens P.	2020	Original Article
Foods and beverages offered in US public secondary schools through the National School Lunch Program from 2011-2013: early evidence of improved nutrition and reduced disparities.	Terry-McElrath Y, O'Malley P, Johnston L.	2014	Original Article

Parental perception of the nutritional quality of school meals and its association with students' school lunch participation.	Ohri-Vachaspati P.	2014	Original Article
Nutrient content of school meals before and after implementation of nutrition recommendations in five school districts across two U.S. counties.	Cummings P, Welch S, Mason M, Burbage L, Kwon S, Kuo T.	2014	Original Article
School lunch entrees before and after implementation of the Healthy, Hunger-Free Kids Act of 2010.	Mozer L, Johnson D, Podrabsky M, Rocha A.	2019	Original Article
Factors associated with school lunch consumption: Reverse recess and school "brunch."	Chapman L, Cohen J, Canterbury M, Carton T.	2017	Original Article
Breakfast quality varies by location among low-income ethnically diverse children in public urban schools.	Polonsky H, Davey A, Bauer K, Foster G, Sherman S, Abel M, Dale L, Fisher J.	2018	Original Article
New School Meal Regulations and Consumption of Flavored Milk in Ten US Elementary Schools, 2010 and 2013.	Yon B, Johnson R.	2015	Original Article
Serving breakfast free to all students and type of breakfast serving model are associated with participation in the school breakfast program.	Solvadini J, Ammerman A.	2019	Original Article
Scientific Report of the 2015 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Health and Human Services and the Secretary of Agriculture. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.	USDA	2015	Original Article
Research Question: How will changes in student consumption of foods sold in schools affect chronic disease outcomes and health care costs?			
The school food environment and obesity prevention: Progress over the last decade.	Welker E, Lott M, Story M.	2016	Review
Influence of School Competitive Food and Beverage Policies on Obesity, Consumption, and Availability A Systematic Review.	Chriqui J, Pickel M, Story M.	2014	Systematic Review
Effect of changes to the school food environment on eating behaviors and/or body weight in children: a systematic review. 968-982.	Driessen CE, Cameron AJ, Thornton LE, Lai SK, Barnett LM.	2014	Systematic Review
A Historical Review of Changes in Nutrition Standards of USDA Child Meal Programs Relative to Research Findings on the Nutritional Adequacy of Program Meals and the Diet and Nutritional Health of Participants: Implications for Future Research and the Summer Food Service Program.	Hopkins LC, Gunther C.	2015	Original Article
Updated nutrition standards for school meals associated with improved weight outcomes for boys in elementary school.	Vericker T, Gearing M, Kim S.	2019	Original Article
School breakfast and body mass index: a longitudinal observational study of middle school students.	Wang S, Schwartz M.	2016	Original Article
School Breakfast Program but Not School Lunch Participation Is Associated with Lower Body Mass Index.	Gleason PM, Hedley Dodd A.	2009	Original Article
Association between school food environment and practices and body mass index of US public school children.	Fox M, Dodd A, Wilson A, Gleason P.	2009	Original Article
Three interventions that reduce childhood obesity are projected to save more than they cost to implement.	Gortmaker S, Wang C, Long M, Giles C, Ward Z, Barrett J, Kenney E, Sonneville R, Sadaf Ajfzal A, Resch S, Cradock S.	2015	Original Article
Impact of competitive foods in public schools on child nutrition: effects on adolescent obesity in the United States an integrative systematic literature review.	Sildén KE.	2018	Original Article
The influence of food portion size and energy density on energy intake: implications for weight management.	Ello-Martin J, Ledikwe J, Rolls B.	2005	Original Article
School Health Guidelines to Promote Healthy Eating and Physical Activity. Morbidity and Mortality Weekly Report 60, no. 5	CDC	2011	Original Article
Dietary energy density is associated with obesity.	Mendoza J, Drewnowsky A, Christakis D.	2007	Original Article
Dietary fiber, glycemic load, and risk of non-insulin-dependent diabetes mellitus in women.	Salmeron J, Manson J, Stampfer M, Colditz G, Wing A, Willet W.	1997	Original Article
Obesity and the metabolic syndrome in children and adolescents.	Weiss R, Dziura J, Burgert T, Tamborlane W, Taksali S, Yeckel C, Allen K, Lopes M, Savoye M, Morrison J, Sherwin R, Caprio S.	2004	Original Article

Fast food consumption and breakfast skipping: Predictors of weight gain from adolescence to adulthood in a nationally representative sample.	Niemeier H, Raynor H, Lloyd-Richardson E, Rogers M, Wing R.	2006	Original Article
Overweight schoolchildren in New York State: Prevalence and characteristics.	Wolfe W, Campbell C, Frongillo E, Haas J, Melnik T.	1994	Original Article
Overweight school children in New York City: prevalence estimates and characteristics.	Melnik TA, Rhoades SJ, Wales KR, Cowell C, Wolfe WS.	1998	Original Article
Childhood Obesity and Schools: Evidence from the National Survey of Children's Health.	Li J, Hooker N.	2010	Original Article
Association between state laws governing school meal nutrition content and student weight status: implications for new USDA school meal standards.	Taber D, Chriqui J, Chaloupka F.	2013	Original Article
Dietary approaches to stop hypertension diet, weight status, and blood pressure among Children and Adolescents: National Health and Nutrition Examination Surveys 2003-2012.	Cohen J, Lehnerd M, Houser R, Rimm E.	2017	Original Article

Reserach Question: How will changes in student consumption of foods and beverages at school affect daily food and beverage consumption (24-hour) and diet quality?

Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis.	Micha R., Karageorgo D, Bakogianni I, Trichia E, Whitsel L, Story M, Penalvo J, Mozaffarian D.	2018	Systematic Review
Eating school meals daily is associated with healthier dietary intakes: The Healthy Communities Study.	Au L, Gurzo K, Gosliner W, Webb K, Crawford P, Ritchie L.	2018	Original Article
Dietary quality were associated after controlling for weekend eating among U.S. school children aged 6 to 17 years.	Hanson K and Olson C.	2012	Original Article
The impact of 1 year of healthier school food policies on students' diets during and outside of the school day.	Cohen J, Gorski M, Rosenfeld L, Smith L, Rimm E, Hoffman J.	2018	Original Article
School breakfast policy is associated with dietary intake of fourth- and fifth grade students.	Ritchie L, Rosen N, Fenton K, Au L, Goldstein L, Shimada T.	2016	Original Article
Increasing child fruit and vegetable intake: Findings from the US Department of Agriculture Fresh Fruit and Vegetable Program.	Olsho L, Klerman J, Ritchie L, Wakimoto P, Webb K, Bartlett S.	2015	Original Article
The contribution of USDA school breakfast and lunch program meals to student daily dietary intake.	Cullen K, Chen T.	2017	Original Article

Reserach Question: How will changes in student's participation in meal programs affect the normative culture of school meal programs and associated stigma and ultimately student's mental health?

Middle School Student and Parent Perceptions of Government-Sponsored Free School Breakfast and Consumption: A Qualitative Inquiry in an Urban Setting.	Bailey-Davis L, Virus A, McCoy T, Wojtanowski A, Vander Veur S, Foster D.	2013	Original Article
Exploring the Parents' Attitudes and Perceptions About School Breakfast to Understand Why Participation is Low in a Rural Midwest State.	Askelson N, Golembiewski E, Ghattas A, Williams S, Delger P, Scheidel C.	2017	Original Article
Understanding Perceptions of School Administrators Related to School Breakfast in a Low School Breakfast Participation State.	Askelson N, Golembiewski E, Bobst A, Delger P, Scheidel C.	2017	Original Article
Who Eats School Breakfast? Parents Perceptions of School Breakfast in a State with Very Low Participation.	Spruance L, Harrison C, Brady P, Woolford M, LeBlanc H.	2018	Original Article
Competitive foods, discrimination, and participation in the National School Lunch Program.	Bhatia R, Jones P, Reicker Z.	2011	Original Article
School Breakfast Programs: Perceptions and Barriers.	McDonnell E, Probart C, Weirich JE, Hartman T, Birkenshaw P.	2004	Original Article
Participation in the National School Lunch Program: Importance of School-Level and Neighborhood Contextual Factors.	Mirtcheva D, Powell L.	2009	Original Article
Factors affecting students' participation in the Cincinnati Public Schools lunch program.	Marples CA, Spillman DM.	1995	Original Article

Research Question: How will the proposed changes affect student's participation in the school meal programs and school food service revenue?

Lessons learned from evaluations of California's Statewide School Nutrition Standards.	Woodward-Lopez G, Gosliner W, Samuels S, Craypo L, Kao J, Crawford P.	2010	Original Article
Healthier choices and increased participation in a middle school lunch program: Effects of nutrition policy changes in San Francisco.	Wojcicki J, Heyman M.	2006	Original Article

Removing competitive foods v. nudging and marketing school meals: a pilot study in high-school cafeterias.	Boehm R, Read M, Henderson K, Schwartz M.	2020	Original Article
Healthier standards for school meals and snacks: impact on school food revenues and lunch participation rates.	Cohen J, Gorski M, Hoffman J, et al.	2016	Original Article
School Nutrition Meal Cost Study: School Meal Costs and Revenues. Vol 3.	USDA	2019	Original Article
Impact of Connecticut legislation incentivizing elimination of unhealthy competitive foods on National School Lunch Program participation.	Long M, Luedicke J, Dorsey M, Fiore S, Henderson K.	2013	Original Article
An economic analysis of updating and expanding school breakfast program offerings in high schools.	Shanafelt A, Magliocco B, Milbrath K, Nanney M, Caspi C.	2019	Original Article
USDA school meal programs: How and why the cost of food purchases varies across locales.	Ollinger M, Guthrie J, Peo A.	2018	Original Article
School Breakfast Scorecard, 2018-2019 School Year.	FRAC	2020	Original Article
Does competitive food and beverage legislation hurt meal participation or revenues in high schools?	Pearl T, Kao J, Crawford J, Samuels S, Crapo L, Woodward-Lopez G.	2012	Original Article
Impact of the 2010 US Healthy, Hunger-Free Kids Act on School Breakfast and Lunch Participation Rates Between 2008 and 2015.	Vaudrin N, Lloyd K, Yedidia M, Todd M, Ohri-Vachaspati P.	2018	Original Article
Effect of the Healthy Hunger-Free Kids Act on the Nutritional Quality of Meals Selected by Students and School Lunch Participation Rates.	Johnson D, Podrabsky M, Rocha A, Otten J.	2016	Original Article
The relationship between unpaid school meal policies and debt in child nutrition programs.	Spruance L, Hill S, Nixon A, Lavering M, Hansen J, Patten E.	2019	Original Article
Research Question: How will a shift in student's participation in meal programs affect food security?			
Participation in the National School Lunch Program and food security: An analysis of transitions into kindergarten.	Arteaga I, Heflin C.	2014	Original Article
Children's Food Security and USDA Child Nutrition Programs, EIB-174, U.S. Department of Agriculture, Economic Research Service.	Ralston K, Treen K, Coleman-Jensen A, Guthrie J	2017	Original Article
The Relationship between the School Breakfast Program and Food Insecurity.	Fletcher J, Frisvold D.	2017	Original Article
Low-income Children's participation in the National School Lunch Program and household food insufficiency.	Huang J, Barnidge E.	2016	Original Article
Children Receiving Free or Reduced-Price School Lunch Have Higher Food Insecurity Rates in Summer.	Huang J, Barnidge E, Kim Y.	2015	Original Article
Seasonal Difference in National School Lunch Program Participation and Its Impacts on Household Food Security	Huang J, Kim Y, Barnidge E.	2016	Original Article
School-based nutrition programs are associated with reduced child food insecurity over time among Mexican-origin mother-child dyads in Texas Border Colonias.	Nalty C, Sharkey J, Dean W.	2013	Original Article
Accessibility of Summer Meals and the Food Insecurity of Low-Income Households with Children.	Miller D.	2016	Original Article
Research Question: How will changes in student consumption of foods at school affect academic performance?			
Is there an association between dietary intake and academic achievement: a systematic review.	Burrows T, Goldman S, Pursey K, Lim R.	2017	Systematic Review
The effects of breakfast and breakfast composition on cognition in children and adolescents: A systematic review.	Adolphus K, Latwon C, Champ C, Dye L.	2016	Systematic Review
School gardens enhance academic performance and dietary outcomes in children.	Berezowitz C, Bontrager Y, Schoeller D.	2015	Review
The effect of healthy dietary consumption on executive cognitive functioning in children and adolescents: a systematic review.	Cohen J, Gorski M, Gruber S, Kurdziel L, Rimm E.		Original Article
Breakfast is associated with enhanced cognitive function in schoolchildren. An internet-based study.	Wesnes K, Pincock C, Scholey A.	2012	Original Article
Eating breakfast enhances the efficiency of neural networks engaged during mental arithmetic in school-aged children.	Pivik R, Tennal K, Chapman S, Gu Y.	2012	Original Article
Let them eat lunch: The impact of universal free meals on student performance.	Schwartz A & Rothbart M.	2019	Original Article
Health Impact Assessment: National Nutrition Standards for Snack and a la Carte Foods and Beverages Sold in Schools.	Pew Charitable Trust	2012	Original Article

School meal quality and academic performance.	Anderson M, Gallagher J, Ramirez Ritchie E.	2018	Original Article
Influence of having breakfast on cognitive performance and mood in 13- to 20-year-old high school students: Results of a crossover trial.	Widenhorn-Muller K, Hille K, Klenk J, and Wiland U.	2008	Original Article
The role of breakfast and a midmorning snack on the ability of children to concentrate at school.	Benton D & Jarvis M.	2007	Original Article
The relationship of school breakfast to psychosocial and academic functioning: Cross-sectional and longitudinal observations in an inner-city school sample.	Murphy JM, Pagano ME, Nachmani J, Sperling P, Kane S, Kleinman RE.	1998	Original Article
Diet breakfast, and academic performance in children.	Kleinman RE, Hall S, Green H, Korzec-Ramirez, Patton K, Pagano M, Murphy J.	2002	Original Article
Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents.	Rampersaud G, Pereira M, Girard B, Adams J, Metz J.	2005	Original Article
Fasting and cognition in well- and undernourished schoolchildren: A review of three experimental studies.	Pollitt E, Cueto S, and Jacoby E.	1998	Original Article
Breakfast Intake and Composition Is Associated with Superior Academic Achievement in Elementary Schoolchildren.	Ptomey L, Steger F, Schubert M, Lee J, Willis E, Sullivan D., Donnelly J.	2016	Original Article
Research Question: How will changes in stigma of school meals affect academic performance?			
No evidence			
Research Question: How will changes in academic performance impact societal productivity?			
Education and Health Issue Brief. Robert Wood Johnson Foundation.	Egerter S, Braveman P, Sadegh-Nobari T, Grossman-Kahn R, Dekker M.	2011	Original Article

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Healthy Eating Research (HER) is a national program of the Robert Wood Johnson Foundation. Technical assistance and direction are provided by Duke University under the direction of Mary Story PhD, RD, program director, and Megan Lott, MPH, RDN, deputy director. HER supports research to identify, analyze, and evaluate environmental and policy strategies that can promote healthy eating among children and prevent childhood obesity. Special emphasis is given to research projects that benefit children and adolescents and their families, especially among lower-income and racial and ethnic minority population groups that are at highest risk for poor health and well-being and nutrition-related health disparities. For more information, visit www.healthyeatingresearch.org or follow HER on Twitter at [@HERResearch](https://twitter.com/HERResearch).

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