

Rapid Health Impact Assessment on Changes to School Nutrition Standards to Align With 2020-2025 Dietary Guidelines for Americans

Healthy
Eating
Research

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Introduction

The national school breakfast and lunch programs administered by the United States Department of Agriculture (USDA) are cornerstone federal nutrition assistance programs. In 2019, prior to the COVID-19 pandemic, over 29 million students were receiving school lunches through the National School Lunch Program (NSLP), with 74% of participating children receiving free or reduced-price meals.¹ About 15 million children participated in the School Breakfast Program (SBP); of these, a majority (12.5 million or over 83%) were receiving free or reduced-price meals.¹

School meals have been an important source of nutrition and have bolstered household food security since the lunch program began in 1946. Over the past 75 years, studies of the school meal programs have shown that participation in lunch and breakfast programs has been associated with improved dietary quality, especially among children from families with lower incomes; and often, school meals are healthier than those brought from home. The NSLP and SBP have evolved over the years to meet growing program demands and updates to dietary guidance; however, arguably the most significant changes to what is served in school meals has occurred over the past decade. In 2010, the Healthy, Hunger-Free Kids Act (HHFKA) was passed by Congress and signed into law by President Obama. This landmark legislation directed USDA to update the school meal nutrition standards for the first time in several decades, established the Smart Snacks nutrition standards for competitive foods (i.e., snack foods and beverages sold in schools outside of school meal programs), and strengthened requirements for local wellness policies.² As a result, schools were required to offer more fruit, more servings and varieties of vegetables, more whole grain-rich foods, and less saturated fat and sodium. These standards were implemented between 2012 and 2014, and by the 2014-2015 school year, over 90% of public schools nationwide were in compliance.³

With a change in the federal administration and leadership at USDA, these school meal policies and nutrition standards related to sodium, whole grains, and milk were weakened by several federal actions between 2017 and 2019.⁴ However, the federal school food waivers released by USDA due to the COVID-19 pandemic have turned national attention back to the importance of the school meal programs and the need to enhance the nutrition standards. There are two upcoming policy opportunities that could further improve the nutritional quality of school meals: 1) In early February 2023, USDA released a proposed rule entitled, "[Child Nutrition Programs: Revisions to Meal Patterns Consistent With the 2020 Dietary Guidelines for Americans](#)";^{5,6} and 2) Congress may pass Child Nutrition Reauthorization (CNR), which is a legislative mechanism for updating and/or improving the child nutrition programs. While this process is intended to occur every five years, it has

not occurred since Congress passed the HHFKA in 2010. Both policy opportunities could align the school meal nutrition standards with the 2020-2025 DGA.

The robust evidence base on the impact of school meals on kids' health and wellbeing demonstrates numerous benefits to improving school meal nutrition standards. The Healthy Eating Index (HEI) evaluates the extent to which a set of foods aligns with key food and nutrient recommendations in the DGA. Following the 2012 implementation of the nutrition standards resulting from the HHFKA, HEI scores increased 41% for school breakfasts and 44% for school lunches between school years 2009-2010 and 2014-2015.³ Since implementation of the 2012 standards, school meals are one of the healthiest sources of foods for school-age children, which is significant, as some children receive up to half of their daily calories at school.^{7,8} Other benefits of improved nutrition standards include increased participation in school meal programs and reduced disparities in the school meal environment by offering meals of high nutritional value to students.⁹ Importantly, healthier meals have not been associated with increased cost for schools or increased plate waste.¹⁰

Reducing Disparities in the School Meal Environment

School meals provide an important opportunity to improve students' diet quality and overall health and wellbeing. Schools offer more than one-third of students' total daily caloric intake and are one of the healthiest sources of foods for school-age children. Healthy school meals have the largest potential to positively impact the health of students from households with low incomes and students residing in communities with less access to healthy food. 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 historically, on average, offered more unhealthy foods. Research over the past decade has shown that since implementation of the nutrition standards required through HHFKA, socioeconomic and racial/ethnic disparities in the healthfulness of school food environments have declined. Given that strong school meal nutrition standards are a promising strategy for improving the health and well-being of students from households with low incomes, the potential of updated requirements to reduce disparities in the school meal environment is a focus area of this Rapid Health Impact Assessment.

With opportunities forthcoming to align school meal nutrition standards with the 2020-2025 DGA, Healthy Eating Research (HER), a national program of the Robert Wood Johnson Foundation based at Duke University, conducted a Rapid Health Impact Assessment (HIA) to better understand how these changes may impact the nutritional quality of school meals, school meal participation, and students' health and academic performance as a result of changes in consumption. This report follows a Rapid HIA conducted by HER in 2020 on a USDA Food and Nutrition Service (FNS) proposed rule to roll back many of the school meal nutrition standards at that time.^{11,12} The 2020 Rapid HIA found that the proposed rollbacks would adversely affect students' health and academic performance and that students from families with low incomes attending schools in predominantly Black and rural neighborhoods are most likely to be impacted by the proposed changes.

Health Impact Assessment Background

An HIA is a prospective research tool that can guide decision-makers in considering the possible health impacts, and in some cases financial considerations, of policy proposals.¹³ 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 and how they were undertaken as part of this HIA).¹⁴ A Rapid HIA is generally undertaken when there is minimal time between a policy proposal and implementation. HIAs are not intended to make definitive or causal predictions about how a policy proposal will affect health and wellbeing; rather, HIAs 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 Rapid HIA is intended to connect existing research on school nutrition and health with the forthcoming policy opportunities to align school meal nutrition standards with the 2020-2025 DGA. Specifically, this Rapid HIA examines the potential impacts as a result of changes to the nutritional quality of school meals on school meal participation, student dietary consumption, students' health and wellbeing, and academic performance.

Proposed Policy

Two policy opportunities are expected in 2023 to strengthen the nutritional quality of school meals: 1) In early February 2023, USDA released a proposed rule entitled, "Child Nutrition Programs: Revisions to Meal Patterns Consistent With the 2020 Dietary Guidelines for Americans",^{5,6} and 2) Congress may pass Child Nutrition Reauthorization (CNR), which is a legislative mechanism for updating and/or improving the child nutrition programs.

The recommended requirements are informed by the 2012 HHS nutrition standards, the 2020-2025 DGA, and input from an expert advisory committee. These recommended standards were 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, including an increase in the amount of whole grains served and a reduction in the amount of sodium and added sugars in school meals. The recommended standards are specific to school meal nutrition standards and do not include Smart Snack standards. A summary of the recommended changes is outlined in Table 2.



Table 1. HIA Elements and Application to HER 2020 and Current HIA

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 forthcoming changes to school meal programs, whether an HIA could be accomplished in a timely manner, and whether 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 recommended changes, identified pertinent research questions, and devised a plan for completing the assessment.
Step 3: Assessment	The HIA team evaluated the recommended 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.



Additional School Meals Context

This Rapid HIA assesses the potential impact of improving school meal nutrition standards as a whole package (i.e., assuming all of the changes outlined in Table 2 are implemented), and does not examine the potential of individual nutrients (e.g., sodium) or components (e.g., whole grains) to influence the school meal environment. In this section, additional background information on added sugars and Healthy School Meals for All is provided.

Added Sugars

Evidence over the past decade suggests that children consume high amounts of added sugars, which is linked to poor health outcomes, including overweight and obesity.¹⁵ Efforts to reduce added sugars in the school meal environment have gained attention globally with new policies and standards to reduce added sugars being implemented across the world. However, currently, there is no standard for added sugars or total sugars for meals served through the SBP or NSLP. Smart Snacks nutrition standards do include a limit on total sugars for snack foods and beverages sold during the school day, but not specifically for added sugars. The 2015-2020 DGA were the first national dietary guidelines in the U.S. to include a standard for added sugar, which is that no more than 10% of calories during the day should come from added sugars.¹⁶ This was again recommended in the 2020-2025 DGA.

Two recent studies using data from the School Nutrition and Meal Cost Study, a nationally representative study of the school meal environment discussed in detail in the Methodology section, assessed the availability and consumption of added sugars during the school day.^{17,18} These studies found that 92% of school breakfasts contained 10% or more of calories from added sugars, as did 69% of lunches. Additionally, both studies found that the main source of added sugars in both school breakfasts and school lunches was flavored fat-free milk. One study found that, over 24 hours, 63% of children exceeded the DGA recommended limit for added sugars.¹⁸ These findings demonstrate the prevalence of added sugars in the school meal environment and in children's diets, and support the need for establishing an added sugar standard for reimbursable school meals and competitive foods in alignment with the 2020-2025 DGA recommendations.

Healthy School Meals For All

Healthy School Meals For All, also known as universal free school meals, provides all enrolled children in a school operating the National School Lunch or School Breakfast Programs a free breakfast and/or lunch, regardless of their family's income. During the COVID-19 pandemic, USDA issued policy waivers allowing states to provide free school meals to every child regardless of family income. These waivers expired before the start of the 2022-2023 school year; however, due to the success of Healthy Schools Meals for All, several states have since made universal free school meals permanent via state funding and policy changes. This has provided a natural experiment to look at the benefits of offering free school meals to children and schools, and possible implementation barriers.

Recent research has shown that offering free meals to every student improves access to nutritious school meals and improves equity by eliminating barriers such as filling out meal applications and income-eligibility cut-offs. A systematic review found that universal free school meals increases school meal participation, improves diet quality and attendance, and reduces food insecurity.¹⁹ Another study using data from the School Nutrition and Meal Cost Study found that food-insecure and moderately food-secure students were more likely to attend schools that offered universal free meals compared to food-secure students.⁸ This suggests that efforts to increase participation in school meals by offering universal free meals were appropriately meeting the needs of students from food-insecure households. Although the impacts of Healthy School Meals for All were not assessed in this Rapid HIA due to the scope of this project, evidence suggests that increasing availability of free school meals can improve the availability and consumption of nutritious meals for all children.

Table 2. Recommended Requirements to Align School Meal Nutrition Standards with 2020-2025 Dietary Guidelines for Americans

Program Change	Current Requirement ^{a,b}	Recommended Changes ^c
Whole Grains	At least 80% of weekly grains in the school lunch and breakfast menus must be whole grain-rich.	Require 100% of grains to be whole grain-rich at breakfast and lunch (instead of at least 80%).
Meat/Meat Alternate	Offer a daily meat/meat alternate at lunch only. Once schools meet the daily minimum grain quantity for breakfast, they are allowed to offer a meat/meat alternate in place of grains.	Require meat/meat alternate to be offered at breakfast (as well as lunch), no more than half of which can be processed (e.g., hot dogs, sausages, ham).
Milk	All fluid milk must be fat-free (skim) or low-fat (1% fat or less). Milk may be unflavored or flavored, provided that unflavored milk is offered at each meal service.	Milk may not be flavored. All fluid milk must adhere to the new added sugars standard (with no more than 10% of total calories from added sugars).
Saturated Fat	Fewer than 10% of total calories can be from saturated fat per day. Discretionary sources of calories (solid fats and added sugars) may be added to the meal pattern if within the specifications for calories, saturated fat, trans fat, and sodium. Foods of minimal nutritional value and fluid milk with fat content greater than 1% milk fat are not allowed.	Require discretionary sources of calories (e.g., from solid fats and added sugars) to meet the added sugars specifications (in addition to meeting the specifications for calories, saturated fat, trans fat, and sodium as already required).
Sodium	Implement Sodium Target 1 for school lunch and breakfast in SY 2022-2023 and implement a Sodium Interim Target 1A effective for school lunch beginning SY 2023-2024.	Require two to three interim and final sodium targets to align with age-based sodium recommendations in the 2020-2025 DGA (current sodium targets are higher than those recommended by the 2020-2025 DGA).
Added Sugars	No requirement.	New added sugar standard; fewer than 10% of calories should be from added sugars for the overall meal pattern.
Fruits	Offer fruit daily at breakfast and lunch; offer fruits and vegetables as two separate meal components.	No change.
Vegetables	Offer vegetables daily at lunch, including specific vegetable subgroups weekly (dark green, red/orange, legumes, and starchy).	No change.
Calories	Offer meals that meet specific calorie ranges for each age/grade group.	No change.
Trans Fat	Nutrition label or manufacturer specifications must indicate zero grams of trans fat per serving.	No change.
NSLP/SBP Meal Patterns	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.	No change.

a = Detailed meal patterns of the current School Breakfast Program and National School Lunch Program can be found here (SBP: <https://www.fns.usda.gov/sbp/meal-pattern-chart>, NSLP: <https://www.fns.usda.gov/nslp/national-school-lunch-program-meal-pattern-chart>)

b = The current requirements for milk, whole grains, and sodium are following transitional standards set in February 2022.

c = The recommended requirements largely overlap with the meal pattern requirements outlined in the standards passed through Healthy, Hunger-Free Kids Act with few exceptions. The full meal pattern requirements from HHFKA and HER's recommended nutrition standards aligning with the 2020-2025 DGA are included in Appendix A.

Methods

The research team consisted of two staff members from the HER program, who have extensive experience working in the fields of school nutrition research and policy; and an expert advisory committee, consisting of individuals with expertise in school nutrition policy and research from around the country. A full list of the research team and advisory committee members can be found in the Acknowledgements section.

The research team revised a hypothesized pathway, originally developed for the 2020 Rapid HIA, between the proposed policy, health determinants, and health outcomes. The hypothesized pathway was used to develop a set of research questions and corresponding key word combinations. To complete this Rapid HIA, the research team updated the extensive scientific literature review conducted for the 2020 Rapid HIA to include peer-reviewed research published from 2020 to October 2022, to identify studies to answer each of the research questions.

School Nutrition and Meal Cost Study-I

Of note, many of the original peer-reviewed articles included in this Rapid HIA are part of an HER-supported [special issue in the journal *Nutrients*](#) published in 2020, which focused on studies conducting secondary analyses of the School Nutrition and Meal Cost Study-I (SNMCS-I) data. The School Nutrition and Meal Cost Study is a nationally representative study funded by USDA to assess school meal programs and school food environments. SNMCS-I was conducted during the 2014–2015 school year and was the first nationally representative study to collect data from schools following the implementation of updated nutrition standards resulting from the HHFKA. Results from the SNMCS-I and a public use dataset were released by USDA in the fall of 2019.



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 table below.

Strong	The literature review yielded robust evidence supporting the association with few if any contradictory findings and low risk of bias. 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.

A detailed description of the methods for this HIA, including inclusion/exclusion criteria, additional details of the SNMCS-I, and search terms used for each research question is provided in Appendix B. A full listing of included studies reviewed for this HIA is provided in Appendix C.

Key Research Questions

The central categories and individual research questions were selected to be consistent with the 2020 Rapid HIA. The research questions focus on diet and nutrition, meal participation and revenue, and academic performance and health outcomes. They are as follows:

Diet and Nutrition

- How will the changed standards affect the availability of foods and beverages served in the reimbursable school meals, student participation in meals, and student consumption of these meals?

- How will the changed standards affect the availability of foods and beverages sold in schools outside of the reimbursable school meals (i.e., competitive foods), student purchases of these items, and student consumption?
- 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?
- How will changes in student consumption of foods and beverages served and sold in schools affect chronic disease outcomes and healthcare costs? Specifically, will there be changes in risk for:
 - Near-term and/or acute: dental caries, high cholesterol, high blood pressure, changes in weight.
 - Long-term and/or chronic: overweight, obesity, type 2 diabetes, heart disease, cancer.
 - Future healthcare costs.

Meal Participation and Revenue

- How will the changed standards affect rates of student participation in the school meal programs and school food service revenue?
- How will changes in meal program participation affect stigma associated with student participation in school meals and, ultimately, students' mental health?
- How will a shift in student participation in meal programs as a result of the changed standards affect the prevalence of household food security among children in school?

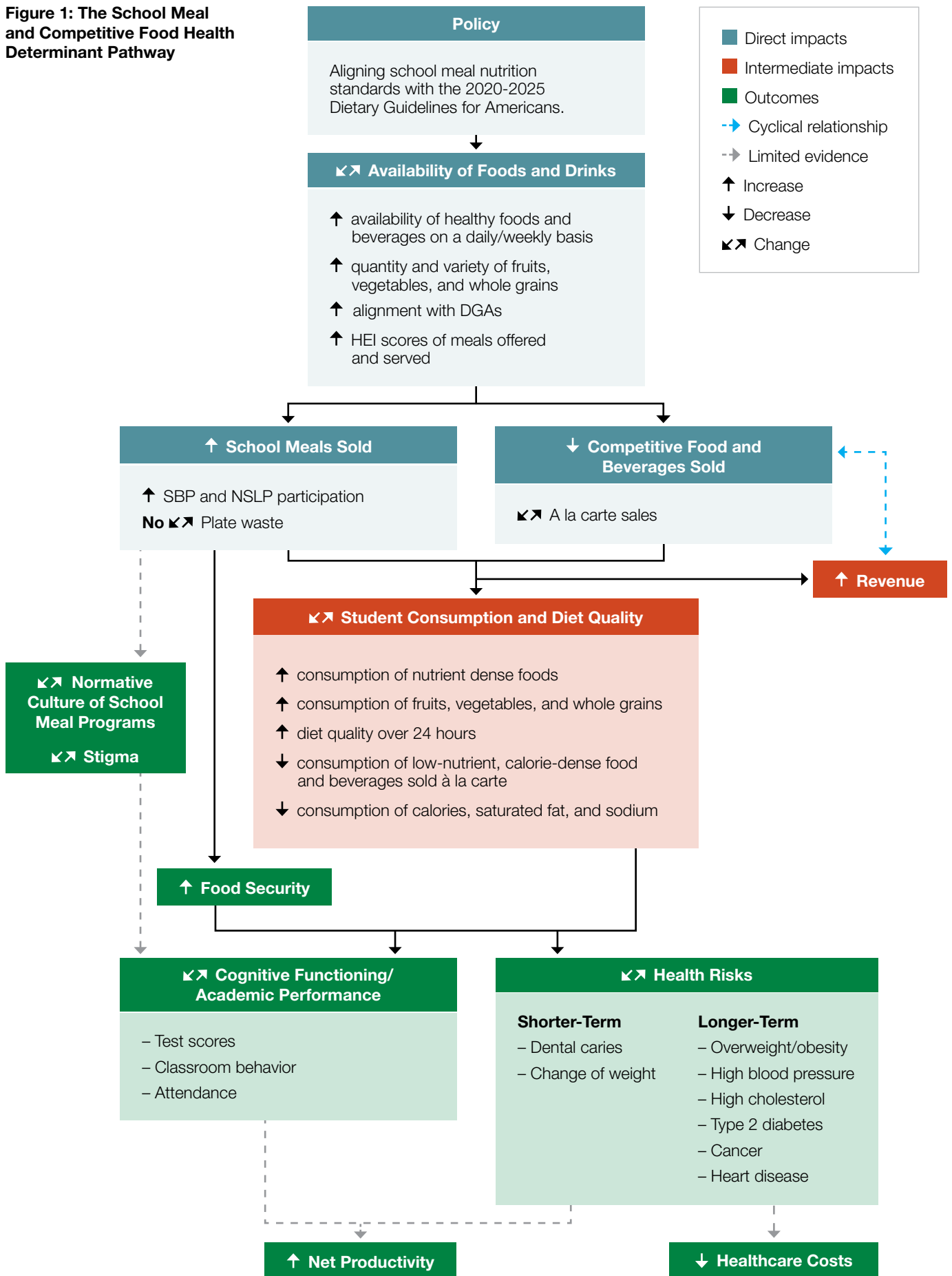
Academic Performance and Health Outcomes

- How will changes in student consumption of foods at school resulting from the changed standards affect academic performance, including:
 - Attendance.
 - Classroom behavior.
 - Cognitive functioning.
 - Test scores.
- How will changes in stigma of school meals resulting from the changed standards affect academic performance?

Health Determinant Pathway

The health determinant pathway (Figure 1) was developed using research team and advisory committee expertise and is based on the robust literature review conducted for the 2020 Rapid HIA. The pathway includes the policy change and potential direct impacts, intermediate impacts, and outcomes. The health determinant pathway diagram outlines the hypothesized

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



connections between the recommended standards and the resulting effects on the availability of foods and beverages served and sold in schools, as well as potential impacts on school meal participation.

The research team hypothesized that the recommended policy changes would affect the availability of foods and beverages offered and sold at elementary, middle, and high schools across the U.S. The recommended reforms (summarized in Table 2) may result in students being served more whole grains, less sodium, and substantially less added sugars on a daily and weekly basis. Although the proposed changes are specific to reimbursable school meals, existing evidence shows that the nutritional quality and availability of reimbursable school meals and the availability and consumption of competitive foods are closely linked. Combined, these changes are likely to impact the overall dietary quality of school meals as measured by HEI scores and result in more school meals being aligned with the DGA recommendations.

As a result of recommended changes, the research team further hypothesized that there are likely to be shifts in student purchasing patterns and consumption, likely seeing increased participation in the school meal program and therefore improved dietary quality. Ultimately, these shifts in purchasing and meal participation may also impact food security, stigma, the flow of revenue via meal reimbursement rates, academic performance, and health risks.

Key Research Findings

Diet and Nutrition

How will the changed standards affect the availability of foods and beverages served in the reimbursable school meals, student participation in meals, and student consumption of these meals at school?

There is **STRONG EVIDENCE** showing that nutrition standards closely aligned with the DGA positively affect: 1) the availability of foods and beverages served in reimbursable school meals, 2) student participation in meals, and 3) student consumption of these meals at school.

The research conducted to-date emphasizes the importance of nutrition policies at the national, state, and local levels in improving student consumption of healthful meals. Evidence from more recent years suggests that strengthening standards for school meals can reduce disparities in the nutritional quality of meals served.

- Policies implemented at the national, state, and school levels can positively impact the availability of healthful reimbursable school meals and improve student consumption. A study comparing cross-sectional observational data from 2013-2015 among 401 U.S. elementary and middle schools found that most schools (74%) reported meeting the reimbursable school meal nutrition standards and that most grains offered at lunch were whole grain-rich (82%). In a systematic review conducted by Cohen and colleagues, a majority of peer-reviewed publications (8 out of 12) found significant positive associations between offering more food options for students to choose and consumption of fruits and vegetables.²⁰
- Research suggests that the implementation of stronger nutrition standards nationwide improved the nutritional quality of school meals served and reduced disparities in the healthfulness of school meals. In a secondary analysis of the SNMCS-I data, researchers found that regardless of the composition of students (i.e., household income, race/ethnicity), schools provided nutritious lunches with total HEI-2010 scores ranging from 81% to 83% of the maximum score, reducing disparities in the nutritional quality of lunches present before implementation of the 2012 standards.²¹ Valizadeh and colleagues found that between the 2009-2010 and 2015-2016 school years, the quality of children's intake at school increased by four HEI points and this effect more than doubled after HHSFKA implementation (4.28 HEI point increase).²² In another study using NHANES data pre- and post-HHSFKA implementation, researchers found that NSLP participants had an increase in dietary quality for lunch that was significantly larger than the increase among non-participants post-HHSFKA implementation.²³
- Several recent studies show that stronger nutrition standards can impact the availability and consumption of individual meal pattern components in addition to overall nutritional quality of the meal. An observational cafeteria-based study conducted in fall of 2018 among almost 2,000 students grades 3-8 found that the majority of meals served (87%) met the Target 2 sodium standards and over a third met the Target 3 sodium standards. This study also found that students consumed more of the lower-sodium foods than the higher-sodium options.²⁴ A study evaluating the effects of a policy removing chocolate milk from secondary schools found that the proportion of students selecting milk and consuming milk significantly declined and that estimated added sugars from milk declined significantly (3.1 grams per student). Despite a decrease in selection and consumption, there were no significant reductions in key milk-related nutrients.²⁵

- *2020 Rapid HIA Findings:* The literature reviewed for the 2020 Rapid HIA similarly demonstrates that improving nutrition standards for reimbursable school meals can positively impact student participation in school meals and improve consumption of these school meals. Data from SNMCS-I show that updated standards resulted in lunches being 41% healthier and breakfast being 44% healthier as measured by the HEI-2010 scores, yet did not increase plate waste. These improvements in the nutritional quality of school meals were largely driven by reductions in refined grains, empty calories, and sodium, and increases in whole grains, greens, beans, and total fruit.²⁶ Data from the SNMCS and a longitudinal study conducted among public schools with majority students from families with low incomes in New Jersey found that serving lunches of higher nutritional quality was associated with higher school lunch participation rates.^{9,27}

How will the changed standards affect the availability of foods and beverages sold in schools outside of the reimbursable school meals (i.e., competitive foods), student purchases of these items, and student consumption?

There is **STRONG EVIDENCE** that stronger standards affect the availability of competitive foods, student purchases of these items, and student consumption. There is evidence showing that strong state and local laws can improve the school meal environment. Robust evidence demonstrates that most foods and beverages sold in schools are compliant with Smart Snack standards. Furthermore, decreasing the availability of unhealthy competitive foods has been shown to improve the healthfulness of reimbursable meals offered and consumed at school.

- The availability of unhealthy competitive foods and beverages is strongly related to the purchasing and consumption of unhealthy competitive foods and beverages. A study conducted among 1,000 children of military parents found that the number of unhealthy competitive food and beverage items in school was associated with in-school food purchasing of sweets, snacks, and sugar-sweetened beverages.²⁸ Another study using SNMCS-I data found that competitive foods were commonly available across all schools, but higher proportions of schools serving low-poverty, majority White, and diverse students offered competitive foods compared to other types of schools including high-poverty, majority Black or majority Hispanic schools. The researchers suggest this could be due to stronger policies in schools serving higher poverty and/or majority Black and Hispanic students.²¹ Similarly, Schwartz and colleagues found that schools in states with stronger laws had fewer unhealthy competitive foods and beverages for sale.²⁹ Finally, one key finding from a systematic review of strategies to increase consumption of reimbursable school meals was that limiting students' access to competitive foods during the school day was associated with increased school meal consumption.²⁰

- Research conducted in SY 2014-2015 suggest that most competitive foods and beverages available in schools are compliant with Smart Snack standards. Strong state and local laws can further improve the school meal environment by reducing unhealthy foods and beverages sold in schools and thus improving the diet quality of children in school. In a secondary analysis of SNMCS-I data, Chriqui and colleagues found that most beverages sold in middle and high schools were compliant with Smart Snack standards. In high schools, they found that consumption of non-compliant beverages was lower in schools with more compliant beverages, although this was not observed in middle schools.³⁰ A cross-sectional observational study similarly found that 78% of competitive foods complied with Smart Snack standards before they were required.³¹ Among a nationally representative sample of adolescents assessed annually for seven years, strong competitive food state laws were found to be associated with lower soda intake overall.³² Turner and colleagues used data from the SNMCS-I to examine the association of state snack laws with consumption of solid fats and added sugars. They found that on average, students in states with laws requiring schools to implement Smart Snacks consumed fewer calories per day from solid fats (37.7 calories) and added sugars (16.2 calories) compared to students in states without such laws.³³

- *2020 Rapid HIA Findings:* Key findings from the 2020 Rapid HIA suggest that decreasing the availability of unhealthy competitive foods improves the overall nutritional quality of reimbursable meals offered and consumed at school.^{9,34-40}



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 the nutritional quality of school meals served impacts students' overall diet quality over a 24-hour period. Evidence reviewed for the 2020 Rapid HIA strongly supports this relationship and only one impactful, low-bias manuscript has been published on this topic since the last HIA; therefore, evidence from the 2020 Rapid HIA was heavily considered to answer this research question.

- The nutritional quality of meals served at school positively impacts the total overall diet quality (over a 24-hour period) of students participating in school meals, but foods consumed outside of school negatively impact children's total diet quality. In a secondary analysis of the SNMCS-I, researchers found that NSLP participants' lunches received significantly higher total HEI-2010 scores than those of nonparticipants for most students.⁴¹ HEI scores for NSLP participants remained higher than nonparticipants over 24 hours, but the nutritional quality of their 24-hour intakes was much lower than that for lunch. This suggests that foods consumed at home or outside of school negatively influences students' overall diet quality.
- *2020 Rapid HIA Findings:* Research reviewed for the 2020 Rapid HIA emphasized the strong relationship between consumption of foods and beverages at school and total diet quality, especially among school meal participants from families with low incomes. Hanson and colleagues also found that among children from families with low incomes, 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.⁴² A study by Cullen and colleagues found that among students from families with low incomes, 47% of the day's energy intake was provided by school meals.⁴³ 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. This observation indicates that nutrition standards could have a greater impact on the total daily intake of students from families with low incomes compared to other students.

How will changes in student consumption of foods and beverages served and sold in schools affect chronic disease outcomes and healthcare costs? Specifically, how will changes impact risk for:

- Near-term and/or acute: dental caries, high cholesterol, high blood pressure, changes in weight.
- Long-term and/or chronic: overweight, obesity, type 2 diabetes, heart disease, cancer.
- Future healthcare costs.

There is **STRONG EVIDENCE** showing that changes in student consumption of foods and beverages served and sold in schools affect overweight and obesity outcomes, while the effects on other near- and long-term health outcomes are **NOT WELL-RESEARCHED**.

- A secondary analysis of SNMCS-I data found that having stronger state laws on competitive foods and beverages was associated with significantly lower student BMI-for-age percentiles. The data showed that the more unhealthy competitive foods and beverages available in a school, the higher the student BMI, however this relationship was not statistically significant.³⁶ In a nationally representative sample of adolescents assessed annually (the NEXT study), stronger state school nutrition laws were associated with reduced likelihood of children having overweight or obesity. Stronger farm-to-school state laws were associated with reduced likelihood of overweight/obesity only in states with strong competitive food laws.³⁹
- Several new studies have also demonstrated the positive effects of HHFKA nutrition standards on weight outcomes of participating students. A study conducted in California examining the effects of California school nutrition policies implemented in 2004-2005 and HHFKA in 2012-2013 found that implementation of both CA policies and HHFKA were associated with decreased overweight/obesity prevalence trends. The largest decrease in overweight/obesity was observed among Pacific Islander girls in 5th grade, suggesting that while disparities still exist, policies like HHFKA have promising potential to reduce disparities in overweight/obesity rates.⁴⁴ Similarly, Kenney and colleagues conducted an interrupted time series study from 2003-2018 to model the health impacts of the HHFKA and found that the risk of obesity declined substantially each year after HHFKA's implementation among children living in poverty. While there was not a significant association between the legislation and overall rates of child obesity, this study found that the risk of obesity would have been 47% higher among children living in poverty in 2018 without the HHFKA legislation.⁴⁵
- There was **MIXED EVIDENCE** on the association between SBP and NSLP participation and weight status. A study utilizing data from the SNMCS-I examining the relationship between NSLP and SBP participation and weight status found no statistically significant relationship.⁴⁶ In contrast, a cohort study using cross-cohort comparisons of children found that children from kindergarten through 5th grade participating in NSLP had an obesogenic BMI trajectory before implementation of HHFKA, but this was absent after implementation, suggesting that nutritional standards implemented through HHFKA improved the BMI trajectories of school meal participants.⁴⁷

■ *2020 Rapid HIA Findings:* The review conducted for the 2020 Rapid HIA resulted in similar findings; most articles found a relationship between strong nutrition standards and more positive outcomes, such as decreased body mass index. The relationship between school nutrition standards and other health outcomes such as diabetes and cholesterol is **NOT WELL-RESEARCHED**. The current search did not yield results on healthcare costs, but one impactful study was included in the 2020 Rapid HIA. Researchers found that implementing nutrition standards for food 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 study was conducted using systematic reviews and a microsimulation model of national implementation of interventions.⁴⁸

Meal Participation and Revenue

How will the changed standards affect the rates of student participation in the school meal programs and school food service revenue?

There is **MODERATE EVIDENCE** showing that nutrition standards affect the rates of student participation in school meal programs and school food service revenue. Neither the 2020 Rapid HIA nor the current literature review yielded any systematic reviews, meta-analyses, or reviews on the relationship of changed standards on participation and revenue, although numerous original articles were included in 2020. Two additional original articles on school food service revenue resulted from the current literature search.

■ Two secondary analyses of SNMCS-I data were conducted to examine impacts of nutrition standards on participation in SBP and NSLP. One study found that strong district policies, as opposed to no policies, were associated with more students eating and liking the school breakfast. This relationship was stronger with students in schools that served breakfast free of charge.⁴⁹ The other study conducted by Forrestal and colleagues found that students from food-insecure and moderately food-secure households were significantly more likely to participate in NSLP than food-secure students. This finding suggests that efforts to improve nutrition standards will improve the diets of students from food-insecure households as they are more likely to participate in school meals.⁸

■ *2020 Rapid HIA Findings:* 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.^{32,33,50,51} Moreover, the SNMCS-I did not find an association between improved nutritional quality of the school meals as measured by HEI scores and reported cost increases for meal production. This indicates that healthier meals resulting from the updated nutrition standards did not cost more to produce during the 2014-2015 school year. 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.

How will changes in school meal nutrition standards affect stigma associated with student participation in school meals and ultimately students' mental health?

The relationship between changes in school meal nutrition standards and stigma and mental health is **NOT WELL-RESEARCHED**. The literature search conducted for this HIA yielded no in-scope new reviews or original articles for this research question. The 2020 Rapid HIA similarly did not yield any in-scope reviews. Literature searches conducted for both Rapid HIAs produced literature on parental perceptions of stigma, but these findings were determined out of scope for this review.

How will a shift in student participation in meal programs as a result of the changed standards affect the prevalence of household food security among children in school?

There is **MODERATE EVIDENCE** showing an association between students' participation in meal programs and food security. Neither the 2020 Rapid HIA nor the literature review conducted for this HIA yielded any systematic reviews, meta-analyses, or reviews for inclusion. However, numerous peer-reviewed original articles have found a strong relationship between participation in child nutrition programs and reduction in food insecurity, especially among children from families with low incomes.

- The secondary analysis of SNMCS-I data conducted by Forrester highlights the important role school meals play in the diets of children from food-insecure households. In addition to finding that students from food-insecure and moderately food-secure households were more likely to participate in NSLP than food-secure students, they also found that school meals contributed significantly more energy to food-insecure and moderately food-secure students' diets than to food-secure students. In this study, school meals contributed about one quarter of daily energy needs to children from food-insecure households compared to 13% for children from food-secure households.⁸
- *2020 Rapid HIA Findings:* Research suggests that NSLP participation reduces food insecurity among children from low-income households.⁵² A longitudinal study found that in summer months when the NSLP is not available, food insecurity rates among recipients is about 0.7 percentage points higher than in non-summer months. Moreover, the average monthly food insecurity rate (3.9%) indicates that NSLP participation is associated with a 14% reduction in the risk of experiencing food insecurity compared to children from families with low incomes that do not participate in the NSLP program.⁵³

Academic Performance and Health Outcomes

How will changes in student consumption of foods at school as a result of the changed standards affect academic performance, including the following metrics?

- Attendance.
- Classroom behavior.
- Cognitive functioning.
- Test scores.

There is **MODERATE EVIDENCE** showing an association between nutrition standards and improved dietary consumption with academic performance. The literature search conducted for this Rapid HIA did not yield any new articles found to be in scope on this topic. However, a

significant body of evidence was reviewed for this research question in the 2020 Rapid HIA. These findings are discussed below:

- 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.⁵⁴ 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.⁵⁵
- A 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.⁵⁶
- Existing research suggests that children's cognition, behavior, and learning are impacted by nutritional status, and that participation in school meals is associated with better academic outcomes.^{57,58}

How will changes in stigma of school meals as a result of the changed standards affect academic performance?

The relationship between changes in stigma of school meals as a result of the changed standards and academic performance are **NOT WELL-RESEARCHED**. The literature search conducted for this rapid HIA and the 2020 Rapid HIA did not find any relevant articles on the relationship between stigma and academic performance; therefore, the potential relationship cannot be discussed.

Recommendations

<p>Recommendation 1: Update Nutrition Standards to Align With the 2020-2025 DGA</p>	<p>The evidence reviewed for this rapid HIA suggests that aligning the school meal nutrition standards with the 2020-2025 DGA will result in healthier meals being served in schools, which can have significant positive implications for child nutrition and overweight and obesity outcomes, and are likely to increase student participation in school meal programs, improve food security, and increase school food service revenue and academic performance.</p> <p>Specifically, the following revisions are needed to align school meals with the 2020-2025 DGA:</p> <ul style="list-style-type: none">– Require 100% of grains offered to be whole grain-rich.– Require meat/meat alternate to be served at breakfast and lunch, and require that no more than 50% of the meat/meat alternate ounce equivalents be processed meats.– Introduce a nutrient standard for added sugars (this may be a phased approach) that ultimately requires no more than 10% of calories in weekly menus come from added sugars, including beverages such as flavored milk.– Update sodium reduction targets to ultimately align meals with sodium recommendations in the 2020-2025 DGA as the current targets are above these limits.
<p>Recommendation 2: Ensure Schools and Districts Have Adequate Resources for Successful Implementation</p>	<p>In order for schools and districts to successfully implement updated school meal nutrition standards, adequate training and technical assistance, consistent messaging, and access to updated school kitchen equipment are vital. Training and technical assistance are particularly important when school meal nutrition standards are changed. For example, with the addition of an added sugar standard, USDA should provide school districts and school food service staff with training and technical assistance for meeting and communicating the importance of an added sugar standard. Similarly, successful implementation of stronger sodium reduction targets will require tailored technical assistance and consistent messaging on the importance of sodium reduction to schools, parents, and students. Continued and additional federal dollars for school cafeteria equipment is necessary to support schools in offering nutritious meals that meet the nutrition standards. USDA should engage with industry to ensure that palatable products are made available that meet these standards. Regional Team Up trainings and What's Shaking? resources were successful past USDA initiatives that could be reinstated and modified to align with updated school meal standards.</p>
<p>Recommendation 3: Expand Access to School Meals</p>	<p>With school breakfast and lunch being the healthiest source of meals for school-age children, strategies that improve access to the SBP and NSLP should be prioritized. Specifically, access to school meals should be expanded through universal free meals and/or national expansion of the Community Eligibility Provision (CEP). CEP is a free meal service option offered by USDA that allows schools and school districts in low-income areas to serve breakfast and lunch at no cost to all enrolled students without collecting household applications.</p> <p>Recent research has demonstrated the benefits of offering free school meals to all students. Most importantly, offering free meals to every student improves access to nutritious foods and improves equity by eliminating barriers such as filling out applications, reduces lunch shaming, and eliminates income eligibility cut-offs. Offering universal free school meals has also been shown to increase school meal participation, improve diet quality and attendance, and reduce food insecurity.</p>

**Recommendation 4:
Reevaluate
Reimbursement Rates**

Schools continue to face significant challenges related to budget constraints, staffing shortages, and supply chain issues. Meal reimbursement rates are currently adjusted annually based on changes in the Food Away From Home series of the Consumer Price Index for All Urban Consumers. Although this series provides valuable insights into average food expenditures, it might not accurately reflect inflation, supply chain issues, and challenges experienced by schools alone. The meal reimbursement rates should be reevaluated and increased regularly to allow school food directors the ability to successfully order and procure foods and beverages that are healthy and appealing to students, while being able to train and retain skilled staff. Schools received a higher reimbursement rate during the COVID-19 pandemic through waivers. The waiver has since ended, resulting in a drop of reimbursement rates, although schools are still facing many of the same challenges experienced during the pandemic.

**Recommendation 5:
Monitor and Evaluate**

The School Nutrition and Meal Cost Study-I (SNMCS) offers data that are critical to understanding the impact of school meal nutrition standards on school food service operations (e.g., revenue, policies, other operations metrics) and student-level (e.g., diet quality, participation) outcomes. This comprehensive evaluation of the school meal programs should be updated every five years, and the objectives and outcomes of interest should be regularly re-evaluated. Despite a considerable amount of evidence related to school meals, longitudinal studies exploring long-term outcomes are lacking in the school meal evidence base. Much of the school meal literature to-date include cross-sectional studies, which are typically not rigorous enough for measuring long-term health outcomes such as obesity and stable food security, unlike longitudinal studies, which allow researchers to follow the same students over a longer period of time. USDA should hold the position of ensuring such data and evidence are available to evaluate current regulations and inform future policies.

In addition to SNMCS, which happens every five years, we also recommend USDA develop more robust routine monitoring of schools' breakfast and lunch menus, student food and beverage selection, meal program participation, and revenue. Boosting the current monitoring efforts would not only allow USDA and collaborating researchers the opportunity to explore various relationships, but would also more readily identify needs for technical assistance.

Conclusions and Policy Implications

This rapid HIA examined the potential public health impacts of aligning the school meal nutrition standards with the 2020-2025 DGA. The rapid 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 the passage of the HHSFKA resulted in healthier meals. The research reviewed as part of this HIA indicates that implementation of strong nutrition standards aligning with the 2020-2025 DGA recommendations will

result in healthier meals and positive outcomes for child nutrition and health, as well as improved meal program participation, improved child food security and academic performance, and increased school food service revenue. More research is needed to examine the relationship between improved school meal nutrition standards and near- and long-term health outcomes, stigma and mental health, and the relationship between school meal participation stigma and academic performance.

Appendix A. School Meal Nutrition Standards Passed Through HHFKA and Recommended in This Rapid HIA

Meal Component	HHFKA Requirements	Recommended Requirement
Whole Grains	50% of all grains offered in SBP and NSLP must be whole grain-rich.	100% of grains offered in SBP and NSLP must be whole grain-rich.
Meat/Meat Alternate	Offer a daily meat/meat alternate at lunch.	Offer a daily meat/meat alternate at breakfast and lunch, no more than half of which can be processed. Once schools meet the daily minimum grain quantity for breakfast, they are allowed to offer a meat/meat alternate in place of grains.
Milk	All fluid milk must be fat-free (skim) or low-fat (1% fat or less). Flavor is only allowed in fat-free milk.	All fluid milk must be fat-free (skim) or low-fat (1% fat or less). Milk may not be flavored. Any milk offered must also adhere to the added sugars standard.
Saturated Fat	Fewer than 10% of total calories can be from saturated fat per day.	Fewer than 10% of total calories can be from saturated fat per day. Discretionary sources of calories (solid fats and added sugars) may be added to the meal pattern if within the specifications for calories, saturated fat, trans fat, sodium, and added sugars. Foods of minimal nutritional value and fluid milk with fat content greater than 1% milk fat are not allowed.
Sodium	Schools must make a gradual reduction in the sodium content of the meals. Schools are required to meet interim sodium targets and a final target by July 2022 for each age/grade group in the SBP and NSLP.	Schools must make a gradual reduction in the sodium content of the meals. Interim targets for school lunch and breakfast with a final target that aligns with the quantitative sodium recommendations for all age groups in the 2020 Dietary Guidelines.
Added Sugars	No requirement.	Fewer than 10% of total calories can be from added sugars for the overall meal pattern.
Fruits	Offer fruit daily at breakfast and lunch; offer fruits and vegetables as two separate meal components.	Offer fruit daily at breakfast and lunch; offer fruits and vegetables as two separate meal components.
Vegetables	Offer vegetables daily at lunch, including minimum amounts of all vegetable subgroups weekly identified by the 2010 Dietary Guidelines (dark green, red/orange, legumes, and starchy).	Offer vegetables daily at lunch, including minimum amounts of all vegetable subgroups weekly identified by the 2020 Dietary Guidelines (dark green, red/orange, legumes, and starchy).
Calories	Offer meals that meet specific calorie ranges for each age/grade group.	Offer meals that meet specific calorie ranges for each age/grade group.
Trans Fat	Nutrition label or manufacturer specifications must indicate 0 grams of trans fat per serving.	Nutrition label or manufacturer specifications must indicate 0 grams of trans fat per serving.
NSLP/SBP Meal Patterns	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.	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.

Appendix B. Methodology

Research Team and Advisory Committee

The research team consists of two staff members from the Healthy Eating Research program who have extensive experience working in the fields of school nutrition research and policy. 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 updating the methodology, developing of the health determinant pathway diagram, and developing the resulting research questions. The committee also reviewed the research team's search strategy and the draft report. A majority of the advisory committee also advised HER's 2020 Rapid HIA and were able to weigh in on consistency and overall process. A full list of the research team and advisory committee members can be found in the Acknowledgements section.

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.

Literature Review

To complete this Rapid HIA, the research team conducted an expedited literature review using systematic methodologies to minimize bias and identify studies to answer each of the research questions. The literature review conducted for this Rapid HIA was intended to update the literature review conducted in 2020, which reviewed literature from January 2012 to January 2020. Therefore, only articles published between January 2020 and October 2022 were considered.

To be included, all studies had to be published from January 1, 2020, to October 2022; published in English; conducted primarily among study populations in the United States; and be free full text. The search was first limited to systematic reviews, reviews, or meta-analyses of studies for each research question using PubMed. If fewer than six systematic reviews, reviews, or meta-analyses were found for a specific research question, the search was repeated for original articles. Abstracts were then read to confirm inclusion. After following the protocol outlined above, the team reviewed 1,234 titles and identified one systematic review, review, or meta-analysis and 23 original articles that met the inclusion criteria. The research questions, search terms, and a summary of the total number of articles reviewed and included in the analyses is outlined in the table on the following page.



Research Question	Search String	Articles Reviewed	Articles Included
How will the changed standards affect the availability of foods and beverages served in the reimbursable school meals, student participation in meals, and student consumption of these meals at school?	("schools"[MeSH Terms] OR "school meal"[Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields]) AND ("loattrfree full text"[Filter] AND ("meta analysis"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Filter]) AND "english"[Language]) AND (("Energy Intake"[MeSH Terms] OR "diet, healthy"[MeSH Terms] OR "nutritional quality"[All Fields] OR "diet quality"[All Fields] OR "schools/standards"[MeSH Terms]) AND ("loattrfree full text"[Filter] AND ("meta analysis"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Filter]) AND "english"[Language])) AND (("school food environment"[All Fields] OR "food-consumption behaviors"[All Fields] OR "food waste"[All Fields] OR "Nutrition Policy"[MeSH Terms]) AND ("loattrfree full text"[Filter] AND ("meta analysis"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Filter]) AND "english"[Language])) AND ((ffrft[Filter]) AND (meta-analysis[Filter] OR review[Filter] OR systematicreview[Filter]) AND (english[Filter]) AND (2020:2022[pdat]))	46	6
How will the changed standards affect the availability of foods and beverages sold in schools outside of the reimbursable school meals (i.e., competitive foods), student purchases of these items, and student consumption?	("schools"[MeSH Terms] AND ("loattrfree full text"[Filter] AND ("meta analysis"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Filter]) AND "english"[Language]) AND (("competitive food"[Text Word] OR "snack food"[Text Word] OR "snacked"[All Fields] OR "snacks"[MeSH Terms] OR "snacks"[All Fields] OR "snack"[All Fields] OR "snacking"[All Fields]) OR "a la carte"[All Fields]) AND ("loattrfree full text"[Filter] AND ("meta analysis"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Filter]) AND "english"[Language])) AND ("loattrfree full text"[Filter] AND ("meta analysis"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Filter]) AND "english"[Language])) AND ((ffrft[Filter]) AND (meta-analysis[Filter] OR review[Filter] OR systematicreview[Filter]) AND (english[Filter]) AND (2020:2022[pdat]))	86	8
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?	((("Energy Intake"[MeSH Terms] OR "diet, healthy"[MeSH Terms] OR "nutrition quality"[All Fields] OR "nutritional quality"[All Fields] OR "diet quality"[All Fields] OR ("diet"[MeSH Terms] OR "diet"[All Fields]) OR "schools/standards"[MeSH Terms] OR "nutritional status"[All Fields] OR "healthy eating index"[All Fields] OR "HEI"[All Fields] OR "diet variety"[All Fields] OR "nutrient adequacy"[All Fields] OR "dietary pattern"[All Fields] OR "diet pattern"[All Fields] OR "24-hr"[All Fields] OR "24-hour"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language]) AND ("schools"[MeSH Terms] AND ("loattrfree full text"[Filter] AND "english"[Language])) AND ((ffrft[Filter]) AND (english[Filter]))	746	1

Research Question	Search String	Articles Reviewed	Articles Included
<p>How will changes in student consumption of foods and beverages served and sold in schools affect chronic disease outcomes and healthcare costs? Specifically, increased risk for:</p> <ul style="list-style-type: none"> Near-term and/or acute: dental caries, high cholesterol, high blood pressure, changes in weight Long-term and/or chronic: overweight, obesity, type 2 diabetes, heart disease, cancer Future healthcare costs 	<p>((("school meal"[Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language]) AND (((("Body Composition"[MeSH Terms] OR "Body Mass Index"[MeSH Terms] OR "Obesity"[MeSH Terms] OR "Body Weight"[MeSH Terms] OR "Overweight"[MeSH Terms]) AND ("loattrfree full text"[Filter] AND "english"[Language])) OR (("diabetes mellitus, type 2"[MeSH Terms] OR "Blood Glucose"[MeSH Terms] OR "Diabetes Complications"[MeSH Terms] OR "Prediabetic State"[MeSH Terms] OR "Insulin Resistance"[MeSH Terms]) AND ("loattrfree full text"[Filter] AND "english"[Language])) OR ("Dental Caries"[MeSH Terms] AND ("loattrfree full text"[Filter] AND "english"[Language])) OR (("Health Care Costs"[MeSH Terms] OR "Health Expenditures"[MeSH Terms]) AND ("loattrfree full text"[Filter] AND "english"[Language]))) AND ((ffrft[Filter] AND (english[Filter]) AND (2020:2022[pdat]))</p>	22	6
<p>How will the changed standards affect the rates of student participation in the school meal programs and school food service revenue?</p>	<p>("school meal participation"[All Fields] OR "student meal participation"[All Fields] OR "student participation"[All Fields]) AND ((ffrft[Filter] AND (meta-analysis[Filter] OR review[Filter] OR systematicreview[Filter]) AND (english[Filter]) AND (2020:2022[pdat]))</p>	128	2
	<p>((("school meal"[Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields] OR "School Meal Nutrition Standards"[All Fields] OR "School Nutrition Standards"[All Fields] OR "School Meal Standards"[All Fields] OR "Nutrition Standards"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language]) AND (("economics"[MeSH Subheading] OR "economics"[All Fields] OR "cost"[All Fields] OR "Costs and Cost Analysis"[MeSH Terms] OR ("costs"[All Fields] AND "cost"[All Fields] AND "analysis"[All Fields]) OR "Costs and Cost Analysis"[All Fields] OR ("revenue"[All Fields] OR "revenues"[All Fields]) OR "Cost Effectiveness"[All Fields] OR "Costs and Cost Analysis"[MeSH Terms]) AND ("loattrfree full text"[Filter] AND "english"[Language]))) AND ((ffrft[Filter] AND (english[Filter]) AND (2020:2022[pdat]))</p>	76	0

Research Question	Search String	Articles Reviewed	Articles Included
<p>How will changes in school meal nutrition standards affect stigma associated with student participation in school meals and ultimately students' mental health?</p>	<p>(("Social Stigma"[MeSH Terms] OR ("discriminabilities"[All Fields] OR "discriminability"[All Fields] OR "discriminable"[All Fields] OR "discriminably"[All Fields] OR "discriminance"[All Fields] OR "discriminant"[All Fields] OR "discriminants"[All Fields] OR "discriminate"[All Fields] OR "discriminated"[All Fields] OR "discriminates"[All Fields] OR "discriminating"[All Fields] OR "discrimination, psychological"[MeSH Terms] OR ("discrimination"[All Fields] AND "psychological"[All Fields]) OR "psychological discrimination"[All Fields] OR "discrimination"[All Fields] OR "discriminations"[All Fields] OR "discriminative"[All Fields] OR "discriminatively"[All Fields] OR "discriminator"[All Fields] OR "discriminators"[All Fields]) OR "mental health"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language]) AND (("school meal participation"[All Fields] OR "student meal participation"[All Fields] OR "student participation"[All Fields] OR "school meal"[Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language]))) AND ((ffrft[Filter]) AND (english[Filter]) AND (2020:2022[pdat]))</p>	31	0
<p>How will a shift in student participation in meal programs as a result of the changed standards affect the prevalence of household food security among children in school?</p>	<p>((("school meal participation"[All Fields] OR "student meal participation"[All Fields] OR "student participation"[All Fields] OR "school meal"[Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language]) AND (("Food Security"[MeSH Terms] OR "household food security"[All Fields] OR "Food Insecurity"[MeSH Terms] OR "household food insecurity"[All Fields] OR "food sufficiency"[All Fields] OR "food insufficiency"[All Fields] OR "child food insecurity"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language] AND 2020/01/01:2022/12/31[Date - Publication]))) AND ((ffrft[Filter]) AND (english[Filter]))</p>	22	1

Research Question	Search String	Articles Reviewed	Articles Included
<p>How will changes in student consumption of foods at school as a result of the changed standards affect academic performance?</p> <ul style="list-style-type: none"> - Attendance. - Classroom behavior. - Cognitive functioning. - Test scores. 	<p>((("Academic Success"[MeSH Terms] OR ("academe"[All Fields] OR "academic"[All Fields] OR "academic s"[All Fields] OR "academical"[All Fields] OR "academically"[All Fields] OR "academics"[All Fields]) OR "academic performance"[All Fields] OR "academic achievement"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language] AND 2020/01/01:2023/12/31[Date - Publication]) AND (("School Meal Nutrition Standards"[All Fields] OR "School Nutrition Standards"[All Fields] OR "School Meal Standards"[All Fields] OR "Nutrition Standards"[All Fields] OR "school meal participation"[All Fields] OR "student meal participation"[All Fields] OR "student participation"[All Fields] OR "school meal*" [Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields]) AND ("loattrfree full text"[Filter] AND "english"[Language] AND 2020/01/01:2022/12/31[Date - Publication]))) AND ((frft[Filter] AND (meta-analysis[Filter] OR review[Filter] OR systematicreview[Filter]) AND (english[Filter]))</p>	60	0
<p>How will changes in stigma of school meals as a result of the changed standards affect academic performance?</p>	<p>((("school meal*" [Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields] OR "School Meal Nutrition Standards"[All Fields] OR "School Nutrition Standards"[All Fields] OR "School Meal Standards"[All Fields] OR "Nutrition Standards"[All Fields] OR "school meal participation"[All Fields] OR "student meal participation"[All Fields] OR "student participation"[All Fields] OR "school meal*" [Text Word] OR "school lunch"[All Fields] OR "school breakfast"[All Fields] OR "reimbursable school"[All Fields]) AND ("Social Stigma"[MeSH Terms] OR ("discriminabilities"[All Fields] OR "discriminability"[All Fields] OR "discriminable"[All Fields] OR "discriminably"[All Fields] OR "discriminance"[All Fields] OR "discriminant"[All Fields] OR "discriminants"[All Fields] OR "discriminate"[All Fields] OR "discriminated"[All Fields] OR "discriminates"[All Fields] OR "discriminating"[All Fields] OR "discrimination, psychological"[MeSH Terms] OR ("discrimination"[All Fields] AND "psychological"[All Fields]) OR "psychological discrimination"[All Fields] OR "discrimination"[All Fields] OR "discriminations"[All Fields] OR "discriminative"[All Fields] OR "discriminatively"[All Fields] OR "discriminator"[All Fields] OR "discriminators"[All Fields]) OR "mental health"[All Fields]) AND ("Academic Success"[MeSH Terms] OR ("academe"[All Fields] OR "academic"[All Fields] OR "academic s"[All Fields] OR "academical"[All Fields] OR "academically"[All Fields] OR "academics"[All Fields]) OR "academic performance"[All Fields] OR "academic achievement"[All Fields] OR ("attend"[All Fields] OR "attendance"[All Fields] OR "attendances"[All Fields] OR "attendant"[All Fields] OR "attendant s"[All Fields] OR "attendants"[All Fields] OR "attended"[All Fields] OR "attendance"[All Fields] OR "attendants"[All Fields] OR "attender"[All Fields] OR "attenders"[All Fields] OR "attending"[All Fields] OR "attendings"[All Fields] OR "attends"[All Fields]))) AND (2020:2022[pdat])</p>	17	0

The School Nutrition and Meal Cost Study

The School Nutrition and Meal Cost Study (SNMCS), a nationally representative study conducted in 2014-2015 to assess school meal programs and school food environments, was funded by USDA with a contract to Mathematica (Mary Kay Fox, Principal Investigator) to lead the study, including design, methods, data collection, analysis, and results. The study addressed (1) school meal program operations and school nutrition environments; (2) food and nutrient content of school meals, competitive foods, and afterschool snacks, and overall nutritional quality of meals; (3) school meal costs and school foodservice revenues; and (4) student participation, student and parent satisfaction, plate waste, and students' dietary intakes. The SNMCS provides crucial information about the nutritional quality and costs of producing school meals after implementation of the federal Healthy, Hunger Free Kids Act (HHFKA) of 2010. This landmark legislation resulted in transformative reforms to the school lunch and breakfast programs for the first time in over 30 years. The SNMCS was able to evaluate the impact of the updated nutrition standards.

HER received funding from RWJF to support a series of original studies analyzing data from the SNMCS to gain insight on the impact of the HHFKA on the nutritional quality of meals served and sold in school, students' weight status, and to identify ethnic/racial, income, and geographic disparities that may exist. The articles included in this special issue, entitled "*The School Nutrition and Meal Cost Study-I: Findings Related to Improving Diet Quality, Weight, and Disparities in US Children*," seek to identify how we can further improve school meal programs and school food environments and identify promising strategies related to obesity prevention. The *Nutrients* special issue was published after HER's 2020 Rapid HIA. Therefore, the 15 papers included in the special issue were reviewed for this Rapid HIA.

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 table below. The strength of the evidence is determined by assessing the entire body of literature per research question, rather than per individual article reviewed. The risk of bias of each article and the collective body of literature was determined by the reviewer's assessment and did not solely rely on the author's judgement.

Strong	The literature review yielded robust evidence supporting the association with few if any contradictory findings and low risk of bias. 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 C. Key Studies Included

A literature search using keywords and search strings relevant to each research question was conducted in PubMed. The titles below were identified as articles that met the inclusion criteria.

Citation	Article Type	HIA Inclusion
How will the changed standards affect the availability of foods and beverages served in the reimbursable school meals, student participation in meals, and student consumption of these meals at school?		
Cohen JFW, Hecht AA, Hager ER, Turner L, Burkholder K, Schwartz MB. Strategies to Improve School Meal Consumption: A Systematic Review. <i>Nutrients</i> . 2021 Oct 7;13(10):3520. doi: 10.3390/nu13103520. PMID: 34684521; PMCID: PMC8538164.	Systematic Review	Current HIA
Bardin S, Washburn L, Gearan E. Disparities in the Healthfulness of School Food Environments and the Nutritional Quality of School Lunches. <i>Nutrients</i> . 2020 Aug 8;12(8):2375. doi: 10.3390/nu12082375. PMID: 32784416; PMCID: PMC7468741.	Original Article	Current HIA
Valizadeh P, Ng SW. The New school food standards and nutrition of school children: Direct and Indirect Effect Analysis. <i>Econ Hum Biol</i> . 2020 Dec;39:100918. doi: 10.1016/j.ehb.2020.100918. Epub 2020 Jul 29. PMID: 32992091; PMCID: PMC7718326.	Original Article	Current HIA
Kinderknecht K, Harris C, Jones-Smith J. Association of the Healthy, Hunger-Free Kids Act With Dietary Quality Among Children in the US National School Lunch Program. <i>JAMA</i> . 2020 Jul 28;324(4):359-368. doi: 10.1001/jama.2020.9517. PMID: 32721008; PMCID: PMC7388023.	Original Article	Current HIA
Cohen JFW, Richardson S, Roberto CA, Rimm EB. Availability of Lower-Sodium School Lunches and the Association with Selection and Consumption among Elementary and Middle School Students. <i>J Acad Nutr Diet</i> . 2021 Jan;121(1):105-111. e2. doi: 10.1016/j.jand.2020.07.023. Epub 2020 Oct 21. PMID: 33350941; PMCID: PMC7768811.	Original Article	Current HIA
Thompson HR, Ritchie L, Park E, Madsen KA, Gosliner W. Effect of Removing Chocolate Milk on Milk and Nutrient Intake Among Urban Secondary School Students. <i>Prev Chronic Dis</i> . 2020 Aug 27;17:E95. doi: 10.5888/pcd17.200033. PMID: 32857032; PMCID: PMC7478149.	Original Article	Current HIA
School Nutrition and Meal Cost Study: Volume 2 - Nutritional Characteristics of School Meals (Summary). In: U.S. Department of Agriculture FaNS, editor. Alexandria, VA2019.	Original Article	2020 HIA
Mary Kay Fox EG, Charlotte Cabili, Dallas Dotter, Katherine Niland, Liana Washburn, Nora Paxton, Lauren, Olsho LL, and Vinh Tran. School Nutrition and Meal Cost Study, Final Report Volume 4: Student Participation, Satisfaction, Plate Waste, and Dietary Intakes. In: U.S. Department of Agriculture FaNS, Office of Policy Support, editor. Alexandria, VA2019.	Original Article	2020 HIA
Vaudrin N, Lloyd K, Yedidia MJ, Todd M, Ohri-Vachaspati P. Impact of the 2010 US Healthy, Hunger-Free Kids Act on School Breakfast and Lunch Participation Rates Between 2008 and 2015. <i>Am J Public Health</i> . 2018;108(1):84-6. Epub 20171121. doi: 10.2105/ajph.2017.304102. PubMed PMID: 29161063; PubMed Central PMCID: PMC5719678.	Original Article	2020 HIA

Citation	Article Type	HIA Inclusion
How will the changed standards affect the availability of foods and beverages sold in schools outside of the reimbursable school meals (i.e., competitive foods), student purchases of these items, and student consumption?		
Richardson AS, Nicosia N, Ghosh-Dastidar MB, Datar A. School Food and Beverage Availability and Children's Diet, Purchasing, and Obesity: Evidence From a Natural Experiment. <i>J Adolesc Health</i> . 2020 Dec;67(6):804-813. doi: 10.1016/j.jadohealth.2020.03.004. Epub 2020 Apr 21. PMID: 32331931; PMCID: PMC7575612.	Original Article	Current HIA
Bardin S, Washburn L, Gearan E. Disparities in the Healthfulness of School Food Environments and the Nutritional Quality of School Lunches. <i>Nutrients</i> . 2020 Aug 8;12(8):2375. doi: 10.3390/nu12082375. PMID: 32784416; PMCID: PMC7468741.	Original Article	Current HIA
Schwartz MB, Leider J, Cohen JFW, Turner L, Chriqui JF. Association between Nutrition Policies and Student Body Mass Index. <i>Nutrients</i> . 2020 Dec 23;13(1):13. doi: 10.3390/nu13010013. PMID: 33374504; PMCID: PMC7822196.	Original Article	Current HIA
Cohen JFW, Hecht AA, Hager ER, Turner L, Burkholder K, Schwartz MB. Strategies to Improve School Meal Consumption: A Systematic Review. <i>Nutrients</i> . 2021 Oct 7;13(10):3520. doi: 10.3390/nu13103520. PMID: 34684521; PMCID: PMC8538164.	Systematic Review	Current HIA
Chriqui JF, Leider J, Cohen JFW, Schwartz M, Turner L. Are Nutrition Standards for Beverages in Schools Associated with Healthier Beverage Intakes among Adolescents in the US? <i>Nutrients</i> . 2020 Dec 29;13(1):75. doi: 10.3390/nu13010075. PMID: 33383659; PMCID: PMC7824136.	Original Article	Current HIA
Au LE, Ritchie LD, Gurzo K, Nhan LA, Woodward-Lopez G, Kao J, Guenther PM, Tsai M, Gosliner W. Post-Healthy, Hunger-Free Kids Act Adherence to Select School Nutrition Standards by Region and Poverty Level: The Healthy Communities Study. <i>J Nutr Educ Behav</i> . 2020 Mar;52(3):249-258. doi: 10.1016/j.jneb.2019.10.016. Epub 2019 Nov 26. PMID: 31784405; PMCID: PMC7064377.	Original Article	Current HIA
Sanjeevi N, Lipsky LM, Nansel TR, Haynie D, Liu A, Simons-Morton B. Stronger State School Nutrition Laws Are Associated With Healthier Eating Behaviors and Optimal Weight Status in US Adolescents. <i>Am J Health Promot</i> . 2020 Nov;34(8):857-866. doi: 10.1177/0890117120902346. Epub 2020 Feb 10. PMID: 32036683; PMCID: PMC9530457.	Original Article	Current HIA
Turner L, Leider J, Piekarz-Porter E, Chriqui JF. Association of State Laws Regarding Snacks in US Schools With Students' Consumption of Solid Fats and Added Sugars. <i>JAMA Netw Open</i> . 2020 Jan 3;3(1):e1918436. doi: 10.1001/jamanetworkopen.2019.18436. PMID: 31940035; PMCID: PMC6991240.	Original Article	Current HIA
Mary Kay Fox EG, Charlotte Cabili, Dallas Dotter, Katherine Niland, Liana Washburn, Nora Paxton, Lauren, Olsho LL, and Vinh Tran. School Nutrition and Meal Cost Study, Final Report Volume 4: Student Participation, Satisfaction, Plate Waste, and Dietary Intakes. In: U.S. Department of Agriculture FaNS, Office of Policy Support, editor. Alexandria, VA2019.	Original Article	2020 HIA
Merlo CL, Olsen EO, Galic M, Brener ND. The relationship between state policies for competitive foods and school nutrition practices in the United States. <i>Prev Chronic Dis</i> . 2014;11:E66. Epub 20140424. doi: 10.5888/pcd11.130216. PubMed PMID: 24762530; PubMed Central PMCID: PMC4008945.	Original Article	2020 HIA

Citation	Article Type	HIA Inclusion
Cohen JFW, Gorski Findling MT, Rosenfeld L, Smith L, Rimm EB, Hoffman JA. The Impact of 1 Year of Healthier School Food Policies on Students' Diets During and Outside of the School Day. <i>J Acad Nutr Diet</i> . 2018;118(12):2296-301. Epub 20180910. doi: 10.1016/j.jand.2018.07.009. PubMed PMID: 30213618; PubMed Central PMCID: PMC6503661.	Original Article	2020 HIA
Gonzalez W, Jones SJ, Frongillo EA. Restricting snacks in U.S. elementary schools is associated with higher frequency of fruit and vegetable consumption. <i>J Nutr</i> . 2009;139(1):142-4. Epub 20081203. doi: 10.3945/jn.108.099531. PubMed PMID: 19056643.	Original Article	2020 HIA
Long MW, Luedicke J, Dorsey M, Fiore SS, Henderson KE. Impact of Connecticut legislation incentivizing elimination of unhealthy competitive foods on National School Lunch Program participation. <i>Am J Public Health</i> . 2013;103(7):e59-66. Epub 20130516. doi: 10.2105/ajph.2013.301331. PubMed PMID: 23678930; PubMed Central PMCID: PMC3682622.	Original Article	2020 HIA
Boehm R, Read M, Henderson KE, Schwartz MB. Removing competitive foods v. nudging and marketing school meals: a pilot study in high-school cafeterias. <i>Public Health Nutr</i> . 2020;23(2):366-73. Epub 20191203. doi: 10.1017/s136898001900329x. PubMed PMID: 31796143.	Original Article	2020 HIA
Wojcicki JM, Heyman MB. Healthier choices and increased participation in a middle school lunch program: effects of nutrition policy changes in San Francisco. <i>Am J Public Health</i> . 2006;96(9):1542-7. Epub 20060727. doi: 10.2105/ajph.2005.070946. PubMed PMID: 16873747; PubMed Central PMCID: PMC1551958.	Original Article	2020 HIA
Peart T, Kao J, Crawford PB, Samuels SE, Craypo L, Woodward-Lopez G. Does competitive food and beverage legislation hurt meal participation or revenues in high schools? <i>Child Obes</i> . 2012;8(4):339-46. doi: 10.1089/chi.2012.0009. PubMed PMID: 22867073.	Original Article	2020 HIA
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?		
Gearan EC, Monzella K, Jennings L, Fox MK. Differences in Diet Quality between School Lunch Participants and Nonparticipants in the United States by Income and Race. <i>Nutrients</i> . 2020 Dec 19;12(12):3891. doi: 10.3390/nu12123891. PMID: 33352695; PMCID: PMC7765856.	Original Article	Current HIA
Hanson KL, Olson CM. School meals participation and weekday dietary quality were associated after controlling for weekend eating among U.S. school children aged 6 to 17 years. <i>J Nutr</i> . 2013;143(5):714-21. Epub 20130313. doi: 10.3945/jn.112.170548. PubMed PMID: 23486981.	Original Article	2020 HIA
Cullen KW, Chen TA. The contribution of the USDA school breakfast and lunch program meals to student daily dietary intake. <i>Prev Med Rep</i> . 2017;5:82-5. Epub 20161128. doi: 10.1016/j.pmedr.2016.11.016. PubMed PMID: 27957411; PubMed Central PMCID: PMC5149064.	Original Article	2020 HIA

How will changes in student consumption of foods and beverages served and sold in schools affect chronic disease outcomes and healthcare costs? Specifically, increased risk for:

- **Near-term and/or acute: dental caries, high cholesterol, high blood pressure, changes in weight.**
- **Long-term and/or chronic: overweight, obesity, type 2 diabetes, heart disease, cancer;**
- **Future healthcare costs.**

Schwartz MB, Leider J, Cohen JFW, Turner L, Chiqui JF. Association between Nutrition Policies and Student Body Mass Index. <i>Nutrients</i> . 2020 Dec 23;13(1):13. doi: 10.3390/nu13010013. PMID: 33374504; PMCID: PMC7822196.	Original Article	Current HIA
Sanjeevi N, Lipsky LM, Nansel TR, Haynie D, Liu A, Simons-Morton B. Stronger State School Nutrition Laws Are Associated With Healthier Eating Behaviors and Optimal Weight Status in US Adolescents. <i>Am J Health Promot</i> . 2020 Nov;34(8):857-866. doi: 10.1177/0890117120902346. Epub 2020 Feb 10. PMID: 32036683; PMCID: PMC9530457.	Original Article	Current HIA
Matsuzaki M, Sánchez BN, Rebanal RD, Gittelsohn J, Sanchez-Vaznaugh EV. California and federal school nutrition policies and obesity among children of Pacific Islander, American Indian/Alaska Native, and Filipino origins: Interrupted time series analysis. <i>PLoS Med</i> . 2021 May 24;18(5):e1003596. doi: 10.1371/journal.pmed.1003596. PMID: 34029318; PMCID: PMC8143391.	Original Article	Current HIA
Kenney EL, Barrett JL, Bleich SN, Ward ZJ, Craddock AL, Gortmaker SL. Impact Of The Healthy, Hunger-Free Kids Act On Obesity Trends. <i>Health Aff (Millwood)</i> . 2020 Jul;39(7):1122-1129. doi: 10.1377/hlthaff.2020.00133. Erratum in: <i>Health Aff (Millwood)</i> . 2020 Sep;39(9):1650. PMID: 32634356; PMCID: PMC7961790.	Original Article	Current HIA
Bardin S, Gola AA. Analyzing the Association between Student Weight Status and School Meal Participation: Evidence from the School Nutrition and Meal Cost Study. <i>Nutrients</i> . 2020 Dec 23;13(1):17. doi: 10.3390/nu13010017. PMID: 33374590; PMCID: PMC7822417.	Original Article	Current HIA
Richardson AS, Weden MM, Cabreros I, Datar A. Association of the Healthy, Hunger-Free Kids Act of 2010 With Body Mass Trajectories of Children in Low-Income Families. <i>JAMA Netw Open</i> . 2022 May 2;5(5):e2210480. doi: 10.1001/jamanetworkopen.2022.10480. PMID: 35511177; PMCID: PMC9073566.	Original Article	Current HIA
Gortmaker SL, Wang YC, Long MW, Giles CM, Ward ZJ, Barrett JL, et al. Three Interventions That Reduce Childhood Obesity Are Projected To Save More Than They Cost To Implement. <i>Health Aff (Millwood)</i> . 2015;34(11):1932-9. doi: 10.1377/hlthaff.2015.0631. PubMed PMID: 26526252; PubMed Central PMCID: PMC9627551.	Original Article	2020 HIA

Citation	Article Type	HIA Inclusion
How will the changed standards affect the rates of student participation in the school meal programs and school food service revenue?		
Leider J, Lin W, Piekarz-Porter E, Turner L, Chriqui JF. The Role of District Wellness Policies in Encouraging Student Participation in the School Breakfast Program, United States. <i>Nutrients</i> . 2020 Jul 23;12(8):2187. doi: 10.3390/nu12082187. PMID: 32717935; PMCID: PMC7469058.	Original Article	Current HIA
Forrestal S, Potamites E, Guthrie J, Paxton N. Associations among Food Security, School Meal Participation, and Students' Diet Quality in the First School Nutrition and Meal Cost Study. <i>Nutrients</i> . 2021 Jan 22;13(2):307. doi: 10.3390/nu13020307. PMID: 33499016; PMCID: PMC7912040.	Original Article	Current HIA
Boehm R, Read M, Henderson KE, Schwartz MB. Removing competitive foods v. nudging and marketing school meals: a pilot study in high-school cafeterias. <i>Public Health Nutr</i> . 2020;23(2):366-73. Epub 20191203. doi: 10.1017/s136898001900329x. PubMed PMID: 31796143.	Original Article	2020 HIA
Wojcicki JM, Heyman MB. Healthier choices and increased participation in a middle school lunch program: effects of nutrition policy changes in San Francisco. <i>Am J Public Health</i> . 2006;96(9):1542-7. Epub 20060727. doi: 10.2105/ajph.2005.070946. PubMed PMID: 16873747; PubMed Central PMCID: PMC1551958.	Original Article	2020 HIA
Woodward-Lopez G, Gosliner W, Samuels SE, Craypo L, Kao J, Crawford PB. Lessons learned from evaluations of California's statewide school nutrition standards. <i>Am J Public Health</i> . 2010;100(11):2137-45. Epub 20100923. doi: 10.2105/ajph.2010.193490. PubMed PMID: 20864696; PubMed Central PMCID: PMC2951961.	Original Article	2020 HIA
Cohen JF, Gorski MT, Hoffman JA, Rosenfeld L, Chaffee R, Smith L, et al. Healthier Standards for School Meals and Snacks: Impact on School Food Revenues and Lunch Participation Rates. <i>Am J Prev Med</i> . 2016;51(4):485-92. Epub 20160414. doi: 10.1016/j.amepre.2016.02.031. PubMed PMID: 27147133; PubMed Central PMCID: PMC7346735.	Original Article	2020 HIA
How will changes in school meal nutrition standards affect stigma associated with student participation in school meals and ultimately students' mental health?		
No new articles reviewed		
How will a shift in student participation in meal programs as a result of the changed standards affect the prevalence of household food security among children in school?		
Forrestal S, Potamites E, Guthrie J, Paxton N. Associations among Food Security, School Meal Participation, and Students' Diet Quality in the First School Nutrition and Meal Cost Study. <i>Nutrients</i> . 2021 Jan 22;13(2):307. doi: 10.3390/nu13020307. PMID: 33499016; PMCID: PMC7912040.	Original Article	Current HIA
Irma Arteaga CH. Participation in the National School Lunch Program and food security: An analysis of transitions into kindergarten. <i>CHildren and Youth Services Review</i> . 2014;47:224-30.	Original Article	2020 HIA
Huang J, Barnidge E. Low-income Children's participation in the National School Lunch Program and household food insufficiency. <i>Soc Sci Med</i> . 2016;150:8-14. Epub 20151215. doi: 10.1016/j.socscimed.2015.12.020. PubMed PMID: 26722983.	Original Article	2020 HIA

Citation

Article Type

HIA Inclusion

How will changes in student consumption of foods at school as a result of the changed standards affect academic performance?

- Attendance.
- Classroom behavior.
- Cognitive functioning.
- Test scores.

<p>Burrows T, Goldman S, Pursey K, Lim R. Is there an association between dietary intake and academic achievement: a systematic review. <i>J Hum Nutr Diet.</i> 2017;30(2):117-40. Epub 20160907. doi: 10.1111/jhn.12407. PubMed PMID: 27599886.</p>	<p>Original Article</p>	<p>2020 HIA</p>
<p>Adolphus K, Lawton CL, Champ CL, Dye L. The Effects of Breakfast and Breakfast Composition on Cognition in Children and Adolescents: A Systematic Review. <i>Adv Nutr.</i> 2016;7(3):590s-612s. Epub 20160516. doi: 10.3945/an.115.010256. PubMed PMID: 27184287; PubMed Central PMCID: PMC4863264.</p>	<p>Systematic Review</p>	<p>2020 HIA</p>
<p>Cohen JF, Gorski MT, Gruber SA, Kurdziel LB, Rimm EB. The effect of healthy dietary consumption on executive cognitive functioning in children and adolescents: a systematic review. <i>Br J Nutr.</i> 2016;116(6):989-1000. Epub 20160804. doi: 10.1017/s0007114516002877. PubMed PMID: 27487986</p>	<p>Original Article</p>	<p>2020 HIA</p>
<p>Wesnes KA, Pincock C, Scholey A. Breakfast is associated with enhanced cognitive function in schoolchildren. An internet based study. <i>Appetite.</i> 2012;59(3):646-9. Epub 20120815. doi: 10.1016/j.appet.2012.08.008. PubMed PMID: 22902600.</p>	<p>Original Article</p>	<p>2020 HIA</p>
<p>Pivik RT, Tennal KB, Chapman SD, Gu Y. Eating breakfast enhances the efficiency of neural networks engaged during mental arithmetic in school-aged children. <i>Physiol Behav.</i> 2012;106(4):548-55. Epub 20120404. doi: 10.1016/j.physbeh.2012.03.034. PubMed PMID: 22504496.</p>	<p>Original Article</p>	<p>2020 HIA</p>

How will changes in stigma of school meals as a result of the changed standards affect academic performance?

No new articles reviewed

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6. Child Nutrition Programs: Revisions to Meal Patterns Consistent With the 2020 Dietary Guidelines for Americans. U.S. Department of Agriculture. Alexandria, VA; 2022.
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8. Forrestal S, Potamites E, Guthrie J, Paxton N. Associations among Food Security, School Meal Participation, and Students' Diet Quality in the First School Nutrition and Meal Cost Study. *Nutrients*. 2021;13(2). Epub 20210122. doi: 10.3390/nu13020307.
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HIA Research Team

Lindsey Miller, MPH

Senior Research Analyst
Healthy Eating Research

Megan Lott, MPH, RDN

Deputy Director
Healthy Eating Research

Mary Story, PhD, RDN

Director
Healthy Eating Research

Advisory Committee

Juliana Cohen, ScD, ScM

Adjunct Associate Professor of Nutrition,
Harvard T.H. Chan School of Public Health
Associate Professor,
Merrimack College

Erica Kenney, ScD, MPH

Assistant Professor of Public Health Nutrition
Harvard T.H. Chan School of Public Health

Marlene B. Schwartz, PhD

Director, Rudd Center for Food Policy & Health and
Professor, Department of Human Development and
Family Sciences
University of Connecticut

Meghan Maroney, MPH

Senior Policy Associate
Center for Science in the Public Interest

Lindsey Turner, PhD

Research Professor College of Education
Boise State University

Sonia Kim, PhD

Senior Director, Evaluation and Data
Alliance for a Healthier Generation

Elizabeth Wenk, MPM

Principal
Burness

Colin Schwartz, MPP

Director of Federal Affairs
Center for Science in the Public Interest

Project Support

Lauren Dawson, MPH

Communications and Program Associate
Healthy Eating Research

Bethany Dieringer, MPH/RDN Candidate

Graduate Student Assistant
Healthy Eating Research

Violet Noe, MPH/RDN Candidate

Graduate Student Assistant
Healthy Eating Research

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About Healthy Eating Research

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