UNIVERSAL FREE SCHOOL MEALS: IMPLEMENTATION OF THE COMMUNITY ELIGIBILITY PROVISION AND IMPACTS ON STUDENT NUTRITION, BEHAVIOR, AND ACADEMIC PERFORMANCE

by

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ABSTRACT

Food insecurity, defined as limited or uncertain access to adequate food, affects more than 11 million U.S. children. Childhood food insecurity is associated with numerous negative physical and mental health consequences, as well as poor cognitive function and academic performance. Through the Community Eligibility Provision (CEP), high-poverty schools participating in the U.S. Department of Agriculture's school meal programs are able to provide universal free breakfast and lunch. Rolled out over three years in ten states and the District of Columbia, CEP became available to eligible schools nationwide in 2014. Though emerging evidence suggests benefits of CEP for student health, learning, and behavior, one-third of eligible schools have not yet opted in. This dissertation explores implementation of CEP and its impacts on student nutrition, behavior, and academic performance. Findings are presented in three manuscripts.

The first paper evaluates which school, district, and state characteristics were associated with CEP participation across U.S. public schools in School Year 2017-18. Odds of CEP participation were higher in higher in schools with more students directly certified for free meals, in Title I schools, in middle and high schools, in urban schools, in schools with lower enrollment and a lower proportion of Hispanic students, in very large districts, in districts and states without Republican elected officials, and in states where CEP had been available longer. Barriers to adoption may be addressed through federal or state policy change and through targeted technical support from advocates and state education agencies to schools in suburban and small districts.

The second paper uses in-depth interviews with food service staff at schools participating in CEP in Maryland to explore perceived facilitators and barriers to implementation and benefits for

students, staff, and food service operations. Perceived benefits of CEP include increased meal participation, reduced student stigma and financial stress among parents, and improved staff morale. Identified implementation barriers, including concerns about impacts of CEP on federal, state, and grant funding, may be addressed through policy intervention. Identified best practices for implementation, including strong communication with parents and creative strategies to boost student meal participation, can be adopted by participating schools and districts.

The third paper uses a comparative interrupted time series design to estimate the relationship between CEP adoption and student meal participation, behavior, and academic performance outcomes in Maryland schools. The study compares outcomes in CEP-participating schools to schools that are eligible or near-eligible but not participating using data from five years pre-implementation and four years post-implementation. Results show that CEP participation is linked to increased breakfast and lunch participation in elementary and middle schools, and lunch participation in high schools. CEP is also associated with improvements in elementary school attendance, middle school disciplinary referrals, and elementary science test scores.

Dissertation findings highlight barriers to CEP adoption, best practices for implementation, and benefits for students, families, and schools. Results point to opportunities to increase CEP uptake through state and federal policy change and targeted promotion by anti-hunger advocates and state education agencies. Future research should assess how state policies influence CEP adoption and how CEP impacts student stigma, food security, and school finances.

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LIST OF ABBREVIATIONS

ADP	Average daily participation
CEP	Community Eligibility Provision
CFIR	Consolidated Framework for Implementation Research
CI	Confidence interval
CM	Cafeteria manager
FRAC	Food Research & Action Center
FRPM	Free and reduced-price meals
FSD	Food service director
ISP	Identified student percentage
MMFA	Maryland Meals for Achievement
MSA	Maryland State Assessment
MSDE	Maryland State Department of Education
NCES	National Center for Education Statistics
NSLP	National School Lunch Program
OR	Odds ratio
PARCC	Partnership for Assessment of Readiness for College and Career
SBP	School Breakfast Program
SNAP	Supplemental Nutrition Assistance Program
SWP	Title I Schoolwide Program
SY	School year
TAP	Title I Targeted Assistance Program
USDA	United States Department of Agriculture

CHAPTER ONE

INTRODUCTION

STATEMENT OF THE PROBLEM

One in seven U.S. children lives in a food insecure household (i.e., a household with limited or uncertain access to adequate food).[1] A growing body of literature suggests that household food insecurity has a deleterious effect on children's physical and mental health.[2–5] Children who are food insecure are also more likely than their food secure peers to experience poor academic performance and lower cognitive function.[6,7]

Research has consistently demonstrated that the National School Lunch Program (NSLP) and School Breakfast Program (SBP), federal programs administered by the U.S. Department of Agriculture (USDA) that provide meals at low or no cost to low-income students, can decrease household food insecurity.[8] Numerous barriers to student participation in these meal programs have been documented, including stigma associated with receiving a subsidized meal, lack of outreach to enroll eligible students, and confusion among parents regarding eligibility.[9,10] In part to address these barriers, through the Healthy, Hunger-Free Kids Act of 2010, Congress authorized the Community Eligibility Provision (CEP), which allows eligible schools in high-poverty areas to provide free breakfast and lunch to all students regardless of income.[11] Rolled out over a three year period in 10 states and the District of Columbia, CEP became available nationwide to eligible schools in 2014. By School Year (SY) 2018-19, 28,614 schools participated in CEP, representing 65% of all eligible schools.[12]

Despite growing interest in solutions to unpaid school meal debt and childhood food insecurity, one third of eligible schools nationally have not adopted CEP and little research has assessed barriers to adoption or implementation. Further, while a growing body of literature explores the

impact of CEP on student nutrition, behavior, and academic performance, no studies have measured long-term impacts of CEP or impacts on stigma, one of the key outcomes CEP is designed to address. This dissertation evaluates barriers to CEP adoption and implementation and CEP's impact on food service and student outcomes, including stigma.

RESEARCH OBJECTIVES AND DISSERTATION AIMS

The overarching goal of this study is to evaluate implementation of CEP and its impact on food service and student outcomes. Specific aims of the research are as follows:

Specific Aim 1: Assess how schools participating in CEP differ from eligible-nonparticipating schools on school, district, and state characteristics.

Specific Aim 2: Explore perceptions of barriers and facilitators to, and consequences of, CEP implementation among food service directors and cafeteria managers in participating schools in Maryland.

Specific Aim 3: Evaluate the relationship between CEP participation and student meal participation, behavior, and academic outcomes, comparing participating and eligible nonparticipating Maryland schools over time.

BACKGROUND AND LITERATURE REVIEW

Food Insecurity Among U.S. Children

In 2018, one in seven U.S. children under 18 lived in a food insecure household, meaning they had limited or uncertain access to adequate food.[1] Prevalence of food insecurity in the U.S. is disproportionately high among households headed by Black and Hispanic parents and single mothers, and located in large cities and rural areas.[1] Annual costs to the health care and education systems associated with food insecurity among families with young children ages 0-6 years alone are estimated at more $1.2 billion.[13]

Children in food insecure households may experience awareness of food scarcity cognitively (knowledge that food is scarce), physically (hunger, pain, tiredness, weakness), or emotionally (worry, sadness, anger).[14] Food insecurity among children has adverse physical health effects, including increased rates of iron-deficiency anemia and acute and chronic illness.[2–4,15,16] Studies exploring the association between food insecurity and weight outcomes among children, however, have reported inconsistent findings.[17–21]

Children who are food insecure are at greater risk of experiencing adverse mental health outcomes including anxiety, depression, suicide symptoms, internalized and externalized behavioral problems, and psychosocial dysfunction.[2,5,22–26] Further, food insecurity among children is associated with developmental delay and poor cognitive function.[27,28] Food insecure children are also less likely to succeed in school: compared to their food secure peers, food insecure children have lower test scores and levels of school engagement and higher rates of tardiness and absenteeism.[29–33]

The National School Lunch and Breakfast Programs

Two federal assistance programs designed to reduce food insecurity among children are the NSLP and SBP, which provide meals at low or no cost to low-income students in U.S. public and nonprofit private schools.[8] Ninety-five percent of U.S. public schools participate in the NSLP, which is administered by the USDA.[8] In 2019, 29.5 million children received lunch and 14.8 million received breakfast daily through the NSLP and SBP (representing 58% and 29%, respectively, of the 50.8 million children enrolled in U.S. public schools[34]). Together, the NSLP and SBP cost approximately $18.2 billion in 2019, representing nearly three-quarters of the total USDA budget for child nutrition programs.[35]

Under the traditional USDA reimbursement model, children in households with incomes at or below 130% of the federal poverty level are eligible for free meals, and children in households with incomes between 130% and 185% of the federal poverty level are eligible for reduced-price meals (approximately 30 cents for breakfast and 40 cents for lunch).[8] In 2019, 74% of children participating in the NSLP received lunch at the free or reduced-price rate (20.1 million free, 1.7 million reduced-price) and 85% participating in the SBP received breakfast at the free or reduced-price rate (11.8 million free, 700,000 reduced-price).[35] Children who do not meet the income requirements can also purchase a school meal (a "paid" meal) at a subsidized rate (on average nationally, $2.48-$2.74 for lunch and $1.46-$1.55 for breakfast).[36]

Students are identified as eligible for free or reduced-price meals (FRPM) either by submitting an application documenting their household income or through direct certification. Direct certification identifies students who are "categorically eligible" for free meals because their household participates in other federal assistance programs including the Supplemental Nutrition

Assistance Program, Temporary Assistance for Needy Families or the Food Distribution Program on Indian Reservations, or if they are in foster care, in the Head Start program, homeless, a runaway, or a migrant.[37] In some states, students are also identified as categorically eligible based on income data available in Medicaid administrative records. The USDA estimates that nationally, for every 10 categorically eligible students, six more would be eligible for FRPM if they completed an application.[38]

Nearly half of all U.S. public school children are eligible for FRPM.[8] Despite elevated prevalence of food insecurity among such students, rates of student participation in USDA school meals programs are low: in 2015, 43% of students eligible for FRPM participated in breakfast and 81% participated in lunch.[39] Documented barriers to participation in the school meal programs include: stigma associated with receiving a subsidized meal[10,40–42], unappealing menu offerings[9], cost to the student of a reduced- or full-price meal[43], lack of awareness and outreach to enroll eligible students, and difficulty and confusion among parents regarding eligibility and completing applications[44–47].

The Community Eligibility Provision

The Community Eligibility Provision (CEP) – an alternative to the traditional USDA reimbursement model – enables eligible schools in high-poverty areas to provide free breakfast and lunch to all students regardless of household income.[11] CEP aims to improve access to school meals for low-income students and reduce administrative burden for schools by eliminating applications to collect household income information and the need to track student meal charges. Authorized as part of the Healthy, Hunger-Free Kids Act of 2010, CEP was

phased in over a three-year period in 10 states and the District of Columbia, and became available nationwide to eligible schools in July 2014.[11] In SY 2014-15, the first year that CEP was available nationwide, 14,214 schools had adopted CEP.[12] By SY 2018-19, adoption had doubled to 28,614 schools (65% of those eligible), serving 13.6 million children.[12]

A school, group of schools, or district is eligible to participate in CEP if their aggregate identified student percentage (ISP, or percentage of students directly certified for free meals) is 40% or higher. Schools opt into CEP for a four-year period but can opt out at any time. Schools adopting CEP are reimbursed using a formula based on their ISP at the beginning of the four-year cycle. A school's ISP is multiplied by 1.6 (the average ratio of students categorically eligible for free meals compared to students receiving free or reduced-price meals) to calculate the percentage of meals served that are reimbursed at the "free" rate; the remainder of meals served are reimbursed at the lower "paid" rate.[36] For example, a school with an ISP of 62.5% would be reimbursed at the USDA "free" rate for 100% of meals served (62.5% ISP * 1.6), while a school with an ISP of 50% would be reimbursed at the USDA's "free" rate for 80% of meals served (50% ISP * 1.6), and at the "paid" rate for the remaining 20% of meals. Schools participating in CEP have an incentive to increase meal participation, as the per unit cost decreases as volume of meals served increases (given a large proportion of production cost is fixed[48]).

Maryland, the focus of the second and third papers of this dissertation, made CEP available to eligible schools beginning in SY 2013-14, the third year of the phase-in period. In the first two years that CEP was available in Maryland, participation was low: six public schools participated

in SY 2013-14 and 24 in SY 2014-15.[49] The number of participating public schools rose to 222 in SY 2015-16, 228 in SY 2016-17, 240 in SY 2017-18 and SY 2018-19, and decreased to 236 in SY 2019-20.[49] In SY 2019-20, there were 63 individually eligible public schools (schools with ISPs 40% or greater) in Maryland that did not participate in CEP.[49] Schools in 12 of Maryland's 24 districts participated in CEP in SY 2019-20, including three districts that participated in CEP district-wide. (Figure 1.1)

Impact of NSLP and SBP on Student Nutrition and Academic Performance

Student Nutrition Impacts

Research has consistently demonstrated the benefits of school meal participation for reducing food insecurity.[50–52] Studies assessing associations between school meal participation and dietary intake or quality, however, report inconsistent findings. Some studies have found higher energy intake among school meal participants compared to nonparticipants[53,54], while other studies have found comparable[55–57] or lower energy intake among school meal participants relative to nonparticipants[58]. Similarly, some studies have reported better diet quality among school meal participants relative to nonparticipants[58–62], while other studies have found equivalent diet quality across groups[20,53]. Research also suggests that participation in school meals may have both desirable and undesirable associations with specific dietary components: desirable associations with calcium[63] and fruit and vegetable intake[58,64], but undesirable associations with fat[54,55] and sodium[63].

Studies measuring associations between SBP and obesity have consistently found lower rates of obesity among SBP participants compared to nonparticipants.[57,65] The relationship between

NSLP participation and obesity, however, is inconclusive: two studies have found higher rates of obesity among NSLP participants compared to nonparticipants[65,66], while a third found lower rates of obesity among participants[50].

Student Academic Performance Impacts

Natural experiments that have assessed the impact of school meal participation on student academic outcomes have largely reported positive effects. Using differences in state mandates to adopt breakfast programs as a source of identifying variation, Frisvold found SBP availability was associated with improvements in math and reading achievement.[67] Hinrichs leveraged variation in eligibility criteria for free and reduced-price meals across states and birth cohorts and found that adults who participated in NSLP as children experienced greater long-term educational attainment.[68]

Impact of Universal Free Meal Programs on Student Nutrition, Academic Performance, and Waste

Several studies have explored the impacts of universal free meal programs other than CEP, including municipal free meals initiatives and USDA's prior universal free meal options, Provisions 1, 2, and 3. Similar to CEP, Provisions 1, 2, and 3 are alternatives to the traditional model of annually certifying students for free meals, but have different eligibility cut-offs and length of cycle. For example, Provision 1 allows schools with greater than 80% of students eligible for free meals to certify students for two years rather than one. Most studies on universal free meal programs other than CEP have focused on school breakfast; only one study has explored impacts of a universal free lunch program.

Student Nutrition Impacts

Research has consistently demonstrated benefits of universal breakfast programs for breakfast participation rates. A review of universal free breakfast program evaluations through 2004 found consistent evidence of increased breakfast participation.[69] Since then, additional studies using strong causal research designs have provided further evidence of increased meal participation linked with universal free meals.[70–74] In a randomized controlled pilot study from 2000 and 2003, the USDA evaluated the impact of providing universal free breakfast in elementary schools in six districts across the country.[75] The authors found that in treatment schools, breakfast participation nearly doubled and consumption of nutritionally substantive breakfasts increased. In a later re-analysis of these data using a quasi-experimental design, Schanzenbach and Zaki also found gains in breakfast participation.[72] In North Carolina, Ribar and Haldeman found a 12% increase in all-student breakfast participation associated with providing universal free breakfast; while most of the increase in participation was driven by formerly ineligible students, there was also an increase in participation among those who were eligible all along.[73] Leos-Urbel et al. evaluated implementation of a universal free breakfast program in New York City using a triple difference analysis and also found a modest increase in participation for all FRPM eligibility groups.[70]

Student Behavior and Academic Performance Impacts

Studies reveal conflicting findings about impacts of other universal free meal programs on student behavior and academic performance. Six studies have explored the impact of universal free meals on test scores and have found different effects by academic subject and age group. Five of these studies focused on universal breakfast programs: three found no change in test

scores[72-74] and two found improvements[76,77]. A final study examined universal lunch in middle schools and found improvements in test scores.[71] Evidence about the impact of universal free meal programs on attendance rates is also mixed. Six studies examined the impact of universal breakfast on attendance: three found no change[72–74], two found improvements across the study sample[76,77], and one found improvements only among certain racial and socioeconomic subgroups[70].

Wasted Food Impacts

A small number of studies have examined the impact of universal free meal programs on wasted food. The USDA pilot study of the universal free breakfast program compared perceptions among cafeteria managers of wasted food at randomized treatment and control schools, and found that at the end of the first and third years, a greater proportion of cafeteria managers in schools serving universal free breakfast reported increased plate waste.[75] In another study of ten public elementary schools in a large urban school district that had adopted a universal free breakfast program, interviews with students, teachers, parents, and cafeteria managers indicated that increased participation rates in the breakfast program resulted in an overall increase in the perceived amount of wasted food.[78]

Impact of CEP on Student Nutrition, Academic Performance, and Behavior[1]

Studies representing a wide range of geographies and grade levels have reported promising outcomes following CEP adoption. These key evaluation studies are listed in Table 1.1 and

[1] The following section (pages 7-10) is adapted from: Hecht AA, Turner L, Pollack Porter KM. (In press) Impact of the Community Eligibility Provision of the Healthy, Hunger-Free Kids Act of 2010 on Student Nutrition, Behavior, and Academic Outcomes (2011-2019). *Am. J Pub Health*.

summarized below. Most studies employ strong analytic methods including difference-in-difference and instrumental variable approaches that allow for causal inference. Where non-causal study designs were used, it is noted in Table 1.1 and the text below.

Student Nutrition Impacts

Four studies have evaluated the impact of CEP on breakfast and lunch participation, and all detected significant increases.[79–82] Two studies focused on multiple states participating in CEP prior to nationwide rollout[80,81] and two examined specific states after nationwide rollout (California[79] and Pennsylvania[82]). Increases in participation ranged from 3.5 to 37.8 percentage points for breakfast and 3.5 to 11.8 percentage points for lunch; some variation in findings was due to different student subgroups studied. Analytic rigor of these studies also differed: the California analysis compared participation rates before and after adoption but did not use a comparison group[79], and the Pennsylvania compared participation rates in CEP adopting and non-adopting schools one year after adoption while controlling for baseline participation[82]. The two national studies used stronger causal designs.[80,81] Gains in meal participation occurred among students previously eligible for free and reduced-price meals, as well as those previously above the eligibility cut-off. Taken together, these studies suggest that CEP significantly increases program reach for the SBP and NSLP.

Critics of CEP feared that students at participating schools would "double-dip," both bringing their lunch from home and eating the school meal, leading to higher caloric intake and increases in obesity. There is no evidence to support this claim. On the contrary, the one study that has assessed weight outcomes in the context of CEP found a 1 percentage point decrease in body

mass index among students at CEP-participating schools[85]. Further, evidence suggests that revised nutrition standards issued by USDA in 2012-13 have led to an improvement in the nutritional quality of school meals, and that meals served in schools are of higher nutritional quality than those brought by children from home.[58] Therefore, students switching to school meals instead of home-packed meals may experience improvements in nutritional outcomes.

Finally, two studies have considered the relationship between CEP adoption and food security status. One modeling study simulated the impact of CEP on families' food purchasing power and food insecurity.[86] The authors found that in 2014, by increasing purchasing power, CEP may have allowed 3.2% of food-insecure children and their families (693,411 families) to move to full food security. In Maryland, surveys of families in five matched CEP participating schools and eligible nonparticipating schools showed that adjusted odds of living in a food insecure household were twice as great for students at nonparticipating schools.[87] While neither study uses longitudinal data and findings are not causal, they do suggest that CEP adoption may be linked to improved household food security.

Student Academic Performance Impacts

Three studies have explored the impact of CEP on test scores and have found different effects by academic subject and age group. Two detected improvements[81,83] and the third detected no change in test scores[84]. Notably, the study that found no change included only data from one year post-implementation. In an evaluation comparing changes in test scores in CEP-participating compared to nonparticipating schools in South Carolina, Gordanier et al. detected a significant increase (0.06 standard deviations) in elementary school math scores, but no change in

elementary school reading scores or middle school scores.[83] In a national evaluation that leveraged the staggered rollout of CEP to compare early and late adopting states, Ruffini found that math performance increased 0.02 standard deviations in districts with the largest shares of students becoming eligible for free meals.[81] After scaling by the share of newly eligible students, gaining access to free meals increased students' math scores by 0.07 standard deviations. While these gains are relatively small, they are similar in magnitude to those seen when families receive other forms of income support, such as the earned income tax credit.[81]

Only one study to-date has explored the impact of CEP on on-time grade promotion rates. In that study, Kho found that by the second year of CEP adoption in Tennessee, students at participating schools were 0.6 percentage points more likely to be promoted to the next grade on time.[84]

Evidence about the impact of CEP on attendance is mixed. Three studies have examined this question: one found positive effects[85], one found positive effects among elementary, but not middle schoolers[83], and the third found small but negative effects[84]. In Wisconsin elementary schools, Bartfeld et al. found participation in CEP led to a 3.5 percentage point reduction in students with low attendance, particularly among economically disadvantaged children.[85] In South Carolina elementary schools, Gordanier et al. found CEP participation led to a reduction in absences equivalent to one fifth of a day per student, but had no effect on attendance in middle schools.[83] In Tennessee, Kho detected an increase in absences equivalent to half a day per student due to CEP[84].

Student Behavior Impacts

Two studies have examined the impact of CEP on student disciplinary referrals and both found positive effects. In a national evaluation, Gordon and Ruffini found that CEP participation reduced suspension rates among white elementary school males by 1 percentage point, but lacked statistical precision to estimate changes for other groups by race or school level.[86] In Tennessee, by the third year after CEP adoption, Kho found that disciplinary referrals decreased 2.3 percentage points, with the greatest reductions among high school students.[84]

Summary of the Evidence on CEP Impacts

While the aforementioned studies reflect early stages of policy implementation (primarily assessing outcomes one to three years after adoption), most use strong causal methods to produce credible results, and are corroborated by other studies with findings in the same direction. It is notable that these studies have identified positive effects so soon after policy implementation given outcomes such as weight reflect the cumulative effect of years of exposure and take time to change. Evidence suggests that benefits have accrued to both students previously eligible and ineligible for free or reduced-price meals, indicating that families may have needed meal assistance despite earning above the cutoff. This is important because as many as 15% of marginally food secure and 10% of food insecure students do not qualify for free or reduced-price meals based on household income.[87] Additional research is warranted to explore the longer-term impact of CEP, including on other outcomes such as stigma and graduation rates.

Barriers and Facilitators to CEP Implementation

Three previous studies have quantitatively explored CEP implementation: two USDA evaluations assessed district characteristics associated with district CEP participation during the

phase-in period and one year after national rollout[80,88,89], and Turner et al. assessed school and district characteristics associated with school adoption of any universal free meal provisions (CEP plus Provisions 1, 2, and 3) in California through SY 2016-17[79].

The USDA evaluation of the phase-in period found CEP participation was significantly associated with four factors: ISP, enrollment, state, and, in one state, charter status.[77] The USDA evaluation one year after national rollout found that district participation was higher in districts with higher ISPs, in urban areas, in the Southeast compared to the Northeast, and in states where CEP had been available longer.[91] Turner et al. found that adoption of universal free meal provisions in California was higher at schools with more students, with predominantly Latino students, at elementary versus high schools, and in rural areas.[79] Research using more recent national data that considers a wider range of school, district, and state-level factors potentially associated with adoption is warranted to inform efforts to promote CEP uptake.

The USDA study evaluating the phase-in period also qualitatively assessed barriers to CEP implementation.[90] The study included surveys of district administrators and interviews with State Child Nutrition Agency directors and staff. The report found that two leading barriers to implementation were lack of time during the initial implementation period for districts to learn about CEP and uncertainty about the financial implications of CEP for education funding that is allocated based on free and reduced-price meal eligibility data. While the USDA has worked to provide guidance to eligible schools about CEP and its potential financial impacts, these and other barriers may persist.

CONCEPTUAL FRAMEWORK

This dissertation research was guided by an adapted version of a conceptual framework developed by Chaudoir et al.[90] (Figure 1.1) Factors highlighted in blue were the focus of this dissertation. Factors in black were included in the conceptual framework for context but are outside of the scope of this research. Factors outlined in this framework were included based on a review of the literature and expert input from researchers and practitioners in the fields of school nutrition and implementation science.

Chaudoir et al. borrow extensively from Damschroder et al.[91], Durlak and DuPre[92], and McLeroy's socio-ecological model[93] to outline five levels of factors (structural, organizational, patient, provider, and innovation) that influence implementation. Several studies evaluating policy implementation in the school context have used an adapted version of the Chaudoir et al. framework that divides the organizational level into macro- and micro-organizational levels and includes implementation outcomes.[94,95] Drawing on these previous frameworks, the present study uses a conceptual framework that considers how factors at the structural, macro- and micro-organizational, student and food service staff levels influence implementation outcomes outlined by Proctor et al.[96], which, in turn, impact student and school outcomes.

Factors influencing implementation and outcomes

Structural-level factors represent the broad sociocultural and political context in which the intervention is situated. Structural-level factors relevant to this study include: national school meal laws and regulations, state laws impacting CEP implementation, state political affiliation, and presence of state anti-hunger advocacy groups.

Macro-organizational factors are specific to the broader context in which the implementation is occurring; here, the school district. School district characteristics that may influence implementation and outcomes include: district political affiliation, relationships between district and local or regional farms, district average FRPM rates, and the district's decision-making structure (e.g., if decisions about CEP implementation are made by the Board of Education, food service director, or superintendent).

Micro-organizational factors represent the school context in which implementation is occurring. Relevant school-level characteristics include school climate (e.g., whether students are stigmatized for participating in the NSLP), school characteristics (e.g., charter status, enrollment, urban centric-locale, grade level, ISP, FRPM eligibility, Title I funding, student race and ethnicity), and cafeteria characteristics (e.g., whether the school has electronic point-of-service, menu offerings, capacity of the cafeteria facility and staff to handle a large student load, school and food service budget, whether the school participates in Provision 1, 2 or 3, whether the school serves food prepared off-site or does scratch cooking on premises). Decision-making structure, a potential factor at the macro-level, may also play a role at the micro-level (e.g., if decisions about CEP implementation are made by the school principal or cafeteria manager).

Student- and food service-level factors are specific to the students and staff receiving the intervention. Relevant student characteristics may include: whether a student is eligible for FRPM, direct certification status, race and ethnicity, immigration status, English

language proficiency, household food security status, and perceptions of the universal free meal program. Food service staff characteristics may include: level of training received and perceptions of the universal free meal program.

Implementation outcomes used in this study are adapted from Proctor et al and include: acceptability, adoption, appropriateness, fidelity, feasibility, reach, cost, and sustainability.[96] Acceptability is the degree to which students and cafeteria staff are satisfied with the content, delivery, and complexity of the universal free meal program. Adoption, often referred to as "uptake," is a school's initial decision or action to implement universal free meals using CEP. Appropriateness is the perception among students and food service staff of the program's fit, relevance, and usefulness. Feasibility is the actual utility or fit of the program. Fidelity is the degree to which universal free meals are implemented in a school as intended by policymakers. Reach is the number of students impacted by the universal free meal program within a school. Implementation cost is the financial impact of CEP on a school or district's budget. Sustainability is the extent to which the universal free meal program is maintained or institutionalized within a school or district's ongoing operations.

This dissertation assessed adoption (measured by the number of schools that declare to USDA their intent to implement CEP), acceptability, appropriateness, implementation costs, feasibility, and sustainability (indirectly, as perceptions among food service staff), and reach (measured by average daily meal participation rate). Fidelity was not assessed because CEP schools must follow explicit rules to receive reimbursement; therefore, there is likely little variation in the way that CEP is implemented.

Student and school outcomes may be influenced by CEP implementation. Specifically, by increasing access to meals for food-insecure students and decreasing hunger, CEP may impact student physical and mental health, behavior, and academic outcomes. By decreasing stigma associated with school meal participation, CEP may also improve school climate, student meal participation, mental health, and behavior. It is possible that CEP may impact meal nutrition quality and variety (potentially negatively: because participating schools have a financial interest in increasing meal participation, cafeteria managers may alter menu offerings to provide more appealing (and potentially less healthy) options, or potentially positively: because CEP may increase revenue, schools may have more money to invest in serving healthy foods). It is also possible that provision of universal free meals may impact quantity of wasted food (potentially positively: lunch lines may move faster if students do not need to enter PINs or make cash payments, leaving students more time to eat, or potentially negatively: students may take a school meal but not consume it because they brought a meal from home or find the meal option unappealing) and farm-to-school relationships (potentially positively: by increasing the number of farm purveyors or size of contracts with local farms, or potentially negatively: if schools switch to contracts with larger wholesalers who can meet their increased needs). CEP may also impact levels of federal, state, and grant funding that schools receive because these funds are often allocated based on school FRPM-eligibility data (which CEP schools no longer collect).

DISSERTATION ORGANIZATION

Following this introduction, this dissertation includes a methods chapter, three papers prepared for submission to peer-reviewed journals, and a discussion chapter that integrates findings from

the three papers. The methods chapter outlines the overarching methods used in this dissertation and provide additional details on data acquisition, cleaning, and analysis for each paper. The first paper evaluates which school, district, and state characteristics are associated with CEP participation during SY 2017-18. Odds of CEP participation were higher in higher in schools with more students directly certified for free meals, in Title I schools, in middle and high schools, in urban schools, in schools with lower enrollment and a lower proportion of Hispanic students, in schools in very large districts, in districts and states not controlled by Republican elected officials, and in states where CEP had been available longer. The second paper uses in-depth interviews with food service staff at schools participating in CEP in Maryland to explore perceived facilitators and barriers to and best practices for implementation. Findings highlight implementation barriers, including concerns about impacts of CEP on federal, state, and grant funding and declining rates of students directly certified for school meals, as well as best practices for implementation, including strong communication with parents and creative strategies to boost student meal participation. The third paper uses a comparative interrupted time series design to estimate the relationship between CEP and student meal participation, behavior, and academic performance in Maryland schools. The quasi-experimental study compares change over time in outcomes in CEP-participating schools compared to schools that are eligible or near-eligible for CEP but not participating, using data from up to five years pre-implementation and four years post-implementation. Results show that CEP is linked to increased breakfast and lunch participation in elementary and middle schools, and lunch participation in high schools. Participation in CEP is also associated with improvements in elementary school attendance, middle school disciplinary referrals, and elementary science test scores. The discussion chapter synthesizes key findings and discusses the overall contribution of

this dissertation, limitations of this dissertation, and implications for research, policy, and practice.

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FIGURES

Figure 1.1 Maryland school districts participating in Community Eligibility Provision, School Year 2019-20

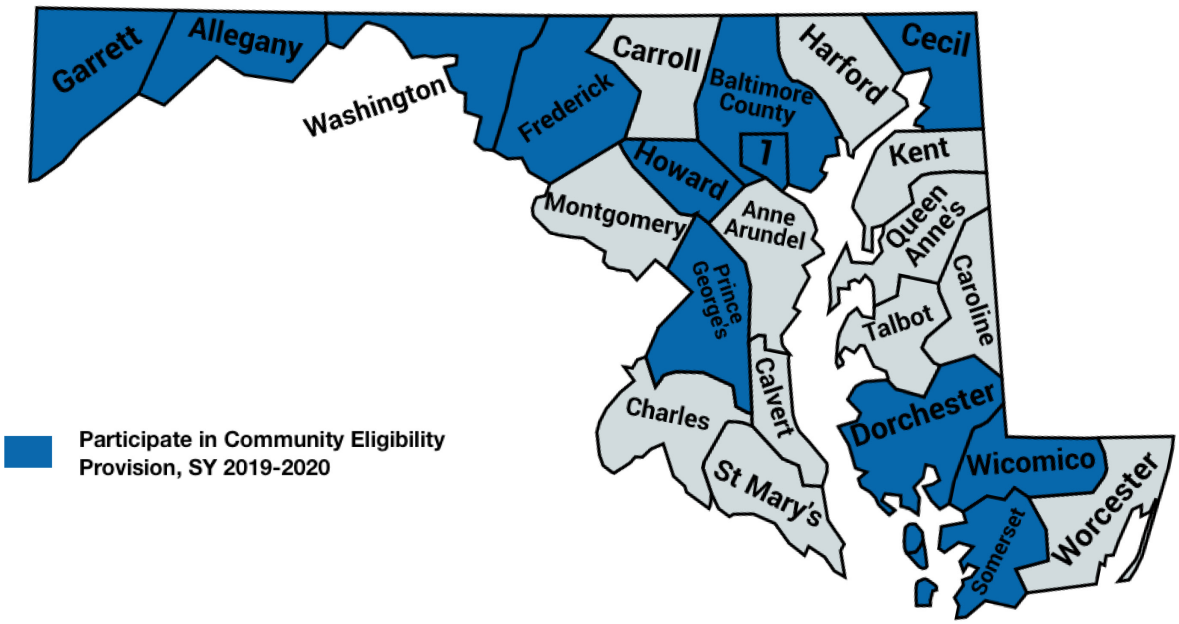
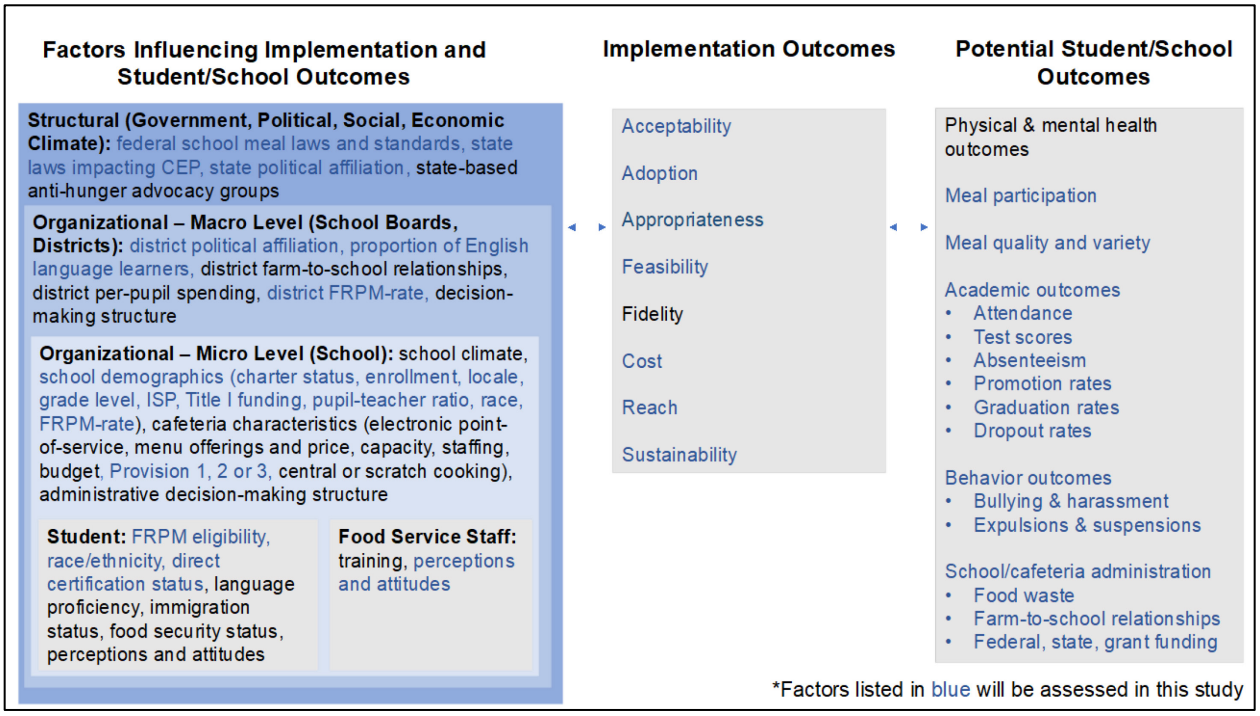


Figure 1.2 Conceptual model adapted from "A multi-level framework predicting implementation outcomes" by Chaudoir et al, 2013



Footnote: Factors highlighted in blue were assessed in this study. Aim 1 identified associations between structural and organizational factors and adoption; Aim 2 qualitatively assessed perceptions among food service directors and cafeteria managers of implementation outcomes and impact of CEP on school and cafeteria administration, behavior, and meal quality and variety; Aim 3 used a quasi-experimental design to examine the effect of CEP adoption on student meal participation, academic, and behavioral outcomes.

TABLES

Table 1.1 Summary of key findings from previous evaluations of Community Eligibility Provision impact on student outcomes

Outcome	Authors	Publication Status	Follow-up Period	Region	Study Design	Findings	Subgroup Effects
Meal participation							
Breakfast and lunch participation	Logan et al.	Government report (2014)	Up to 1.5 years	6 states (Illinois, Kentucky and Michigan, New York, Ohio, and West Virginia) using CEP prior to nationwide rollout	Difference-in-differences: comparing change in participating and propensity score matched nonparticipating districts	Average increase in participation rates for both breakfast and lunch by 3.5 percentage points (p.p.)	
Lunch participation	Pokorney et al.[1]	Peer-reviewed journal article (2019)	1 year	Pennsylvania	Cross-sectional with adjustment for baseline outcomes: comparing participating to eligible nonparticipating schools in the post-period only	Average increase in participation rates for lunch by 8 p.p.	Gains were concentrated among newly eligible students (students classified as "paid" students)
Breakfast and lunch participation	Ruffini	Published working paper (2018)	Up to 4 years	6 states (Georgia, Illinois, Kentucky, New York, Maryland, and West Virginia) using CEP prior to	Difference-in-differences: identification based on timing of CEP adoption, comparing change in early and late	Average increase in participation rates for breakfast by 37.8 p.p and for lunch by 11.8 p.p	In schools with the baseline eligibility rates below the median, average increase participation rates for

				nationwide rollout	adopting districts		breakfast by 40.2 p.p and for lunch by 11.6 p.p
Breakfast and lunch participation	Turner et al.	Peer-reviewed journal article (2019)	Up to 3 years	California	Pre-post: change at participating schools over time	Average increase in participation rates for breakfast by 3.5 p.p. and for lunch by 5.8 p.p.	
Weight							
BMI and healthy weight	Davis & Musaddiq	Preprint (2018)	Up to 3 years	Georgia	Instrumental variables model: CEP eligibility as an instrument for participation Difference-in-differences: intent-to-treat model	Average decrease in BMI by 0.17 points; average increase in number of healthy weight students by 1 p.p.	Not significant in sub-analysis for high school students and rural schools
Food Security							
Household food security	Poblacion et al. (2017)	Peer-reviewed journal article	Not applicable	National	Simulation model: estimating change in food purchasing power (and thus food insecurity) for participating families in 2014	3.2% of food-insecure children and their families (693,411 families) moved to full food security	
Household food security	Gross et al. (2019)	Peer-reviewed journal article	Cross-sectional: data collected 2 years after CEP adoption	Maryland	Cross-sectional: comparing participating to propensity score matched eligible nonparticipating schools in the post-period only	Odds of living in a food insecure household were twice as high for students in CEP eligible, nonparticipating schools compared to	

						participating schools	
Test Scores							
Math scores	Ruffini	Published working paper (2018)	Up to 4 years	National	Difference-in-differences: identification based on timing of CEP adoption, comparing change in early and late adopting districts	Average increase in math test scores of 0.02 of a standard deviation in districts with the largest shares of students becoming eligible for free meals. Scaling by the share of newly eligible students, gaining access to free meals increases math scores by 0.07 of a standard deviation	Improvements concentrated among Hispanic and white students
Math and reading scores	Gordanier et al.	Preprint (2019)	2 years	South Carolina	Difference-in-differences: comparing change in participating schools to all nonparticipating schools, school-level fixed effects	Math: Average increase in math test scores of 0.06 of a standard deviation among elementary schoolers; nonsignificant among middle schoolers Reading: Nonsignificant among elementary or middle schoolers	Improvements concentrated among students who were previously eligible for free lunches, but not on other public assistance programs, and in rural areas

Science, math, and reading scores	Kho	Dissertation (2018)	1 year	Tennessee	Difference-in-differences: comparing change in participating schools to eligible nonparticipating schools	Nonsignificant	
On-time grade promotion							
On-time grade promotion	Kho	Dissertation (2018)	2 years	Tennessee	Difference-in-differences: comparing change in participating schools to eligible nonparticipating schools	Average increase in on-time grade promotion rates of 0.6 p.p by year 2	
Attendance							
Attendance	Bartfield et al.	Peer-reviewed journal article (2019)	2 years	Wisconsin	Difference-in-differences: comparing change in participating schools to eligible nonparticipating schools	Average reduction in elementary schoolers with low attendance of 3.5 p.p by year 2 of CEP	Association only found for economically disadvantaged children
Absences	Gordanier et al.	Preprint (2019)	2 years	South Carolina	Difference-in-differences: comparing change in participating schools to all nonparticipating schools, school-level fixed effects	Average reduction in absences of 0.2 days per student among elementary schoolers; nonsignificant among middle schoolers	Improvements concentrated among students who were previously eligible for free lunches, but not on other public assistance programs, and in rural areas
Attendance	Kho	Dissertation (2018)	3 years	Tennessee	Difference-in-differences:	No statistically significant	

					comparing change in participating schools to eligible nonparticipating schools	change over the 3-year period; in year-by-year effect estimates, by year 3, decrease in attendance by 0.5 days per student	
Disciplinary referrals							
Out-of-school suspension rates	Gordon & Ruffini	Published working paper (2018)	Up to 4 years	National	Difference-in-differences: identification based on timing of CEP adoption, comparing early and late adopting districts	Average decrease in out-of-school suspensions of 1 p.p. among white male elementary schoolers	Lacked statistical precision to identify impacts for other groups by race and age group
Suspension and expulsion rates	Kho	Dissertation (2018)	3 years	Tennessee	Difference-in-differences: comparing change in participating schools to eligible nonparticipating schools	Average decrease in rate of students ever expelled or suspended in year 2 of 1.5 p.p.; in year 3, decrease of 2.3 p.p.	Greatest impact on high school students and in wealthier areas

Footnotes: In this article, Pokorney et al. also analyzed cross-sectional associations between participation in CEP and meal counts in both Maryland and Pennsylvania. The results included above are from longitudinal analyses (controlling for baseline participation) using only Pennsylvania data.

CHAPTER TWO

METHODS

INTRODUCTION

This dissertation used quantitative and qualitative methods to explore implementation and impacts of the Community Eligibility Provision. Using quantitative methods, this research identified systematic barriers to CEP adoption across the U.S. (Chapter 3) and estimated the relationship between changes in student outcomes over time and CEP participation in Maryland schools (Chapter 5). Using qualitative methods, this dissertation provided a nuanced picture of CEP implementation and impact from the perspective of food service staff in Maryland schools participating in CEP (Chapter 4). This chapter provides an overview of study methods and additional details regarding study design, data cleaning, and analysis that could not be included in subsequent chapters owing to journal word limitations.

AIM 1 (CHAPTER 3)

This aim compared eligible participating and nonparticipating schools in School Year (SY) 2017-18 on various school, district, and state characteristics to identify which factors are associated with CEP participation. By identifying predictors of CEP participation, this study aimed to inform strategies by policymakers, advocates, and school administrators to promote CEP uptake.

Measures

Data for Aim 1 were obtained from several publicly available sources (detailed below) and merged to create a single database for analysis.

Dependent variable

The outcome of interest, participation in CEP in SY 2017-18, was retrieved from the 2018 CEP database produced by Food Research & Action Center (FRAC) in partnership with the USDA.[1] FRAC receives information annually from the state agencies that administer the federal child nutrition programs regarding which schools in their state have adopted CEP. To ensure data accuracy, FRAC compares the data they receive directly from the state agencies to publicly available state-published lists of schools that are eligible or near-eligible for CEP (states are required under federal law to publish these lists by May 1 of each year). The FRAC database is updated annually and includes information on CEP participation in the current year and eligibility for the upcoming year.

Independent Variables

Fourteen explanatory variables, selected based on expert input from researchers and practitioners in the field of school nutrition and a review of literature related to school nutrition policy and implementation science, were assessed.

School-Level Explanatory Variables. School ISP from SY 2017-18 was obtained from the FRAC 2017 database, and categorized as 30-39%, 40-49%, 50-59%, 60-69%, 70-79%, 80-89%, 90-100%. All other school-level variables were retrieved from the National Center for Education Statistics (NCES) Common Core of Data[2] for SY 2016-17, the most recent year of data available. The NCES Common Core of Data is a publicly available database updated annually with fiscal and non-fiscal information on all U.S. public elementary and secondary schools and school districts. Data are supplied by state education agencies and include school and district names and addresses, as well as descriptive and demographic information about students and

staff. To ensure data comparability, state education agencies are provided a common set of definitions for all data items requested. Data were downloaded through the Elementary/Secondary Information System online web application.

Continuous variables included pupil-teacher ratio and percent Hispanic students. Categorical variables included school level (elementary, middle, high, or other (e.g., K-12)), charter status (charter, not charter), locale (urban, suburban, township, rural), and school enrollment (small (<400), medium (400-699), large (700-999), very large (≥1000)), and federal funding though Title I of the Elementary and Secondary Education Act (participating, not participating). Title I provides funds to schools with a high percentage of low-income families to support academic programming.[3] Schools may receive Title I Targeted Assistance Program (TAP) funds to support students who are identified as low-performing, or Title I Schoolwide Program (SWP) funds for whole-school approaches to address student performance. Title I funding is allocated to districts based on U.S. Census Data and has traditionally been allocated within districts based on FRPM data.[3] Due to CEP, most schools are no longer collecting FRPM applications, and districts have raised concerns about resulting challenges allocating Title I funds and applying for other education funding that relies on FRPM data.

District-Level Explanatory Variables. An indicator for district political affiliation was generated by matching school district congressional code (retrieved from NCES and corresponding to the state legislatively defined subdivision for the purposes of electing congressional representatives) to a list of U.S. congressional representatives elected in 2016 and their political party (retrieved

from GovTrack).[4] GovTrack data are obtained from a range of sources, including official government data, community data repositories, and through original research.

All other district-level variables were retrieved from NCES for SY 2016-17.[2] District total number of schools was categorized as small (≤10), medium (11-20), large (21-30), or very large (>31). Percent English language learner students was handled continuously. These category cut points were modeled based on cut points used in previous studies.[5,6]

State-level explanatory variables. A state indicator for political affiliation of the governor elected or sitting in 2016 was generating using data from the National Governors' Association roster.[7] A state indicator for USDA region was generated using data from the USDA Food and Nutrition Service regional office list.[8] Finally, to account for states that participated in the CEP phase-in period, an indicator for number of years since CEP became available in the state was generated using data from the USDA evaluation of the phase-in period.[9]

Data Merging

The FRAC 2017 (n=75,712 schools) and 2018 databases (n=80,325 schools) were merged to create a single dataset (n=69,832) with eligibility and participation data for SY 2017-18. Records were probabilistically matched based on district and school ID; records with a match score of below 95% (n=319) were individually assessed and recoded as needed. Data were not available for schools in the outlying U.S. territories (Guam, Puerto Rico, US Virgin Islands, American Samoa, and Northern Mariana).

Separately, data on district political affiliation and state-level explanatory variables were deterministically matched with school and district demographic data from NCES. All records matched. These demographic data were then linked with the merged FRAC database. Records were probabilistically matched based on district and school name, state, and enrollment; those with a match score of below 97% (n=15,367) were individually assessed and recoded as needed. A total of 62,653 schools matched across databases, representing 82.8% of the original FRAC 2017 database.

Schools with ISPs below 30% were excluded (n=18,153). Because schools can adopt CEP as part of a group as long as their pooled ISP is at least 40%, near-eligible schools (ISP 30-39%) often participate in CEP and are included in primary analyses. In sensitivity analyses, near-eligible schools were excluded. Nonoperational schools and schools with no students enrolled were also excluded (n=102). Schools participating in Provisions 1, 2, or 3 were also excluded (n=1,585). Similar to CEP, these provisions are alternatives to the traditional model of annually certifying students for free meals but have different eligibility cut-offs and lengths of cycle. The final matched sample included 42,813 eligible and near-eligible schools in SY 2017-18. The final matched sample was similar demographically to schools in the original 2018 FRAC database.

Analyses

Missing Data

Data were assessed for patterns of missingness. Per NCES guidance, if demographic data were missing for SY 2016-17 but reported in the previous year, prior year values were imputed, given

most demographic data are fairly stable.[11] When data from the previous year were unavailable, multiple imputation using chained equations was used. Percent missingness prior to multiple imputation ranged from 0% to 8.6% (for Title I funding). (Table 2.1)

Regression Analysis

Penalized regression variable selection methods – LASSO and elastic net regression – were used to assess if all 14 predictor variables, identified using the theory-driven approach described above, contributed information to the model. Penalized regression methods shrink coefficients of variables that do not contribute information to the model to zero, ensuring only important predictors stay in the model.[10] Models were tuned using repeated cross-validation. Both penalized regression approaches provided support for inclusion of all variables in the final model.

Each predictor was subject to descriptive and bivariate analyses using t-tests and chi-square tests comparing participating and nonparticipating schools. Generalized logistic regression models were next used to predict odds of CEP participation unadjusted and adjusted for all predictor variables. Standard errors were clustered at the district level.

AIM 2 (CHAPTER 4)

Study Design

Aim 2 used a qualitative phronetic iterative approach[11] to investigate perceived facilitators and barriers to implementation of CEP in Maryland schools. A phronetic iterative approach is similar to more recent iterations of grounded theory[12] but begins with a specific problem of interest and

tags back and forth between consulting existing literature and examining emergent themes.[11] This aim involved consulting existing literature on school nutrition and implementation science throughout the research process.

Recruitment and Sampling

Semi-structured in-depth interviews were conducted with food service staff (n=28) in Maryland schools and districts participating in CEP stratified by two informant categories: 9 food service directors (FSDs) at the district level and 19 cafeteria managers (CMs) at the school level.

Both FSDs and CMs were interviewed to gain a holistic picture of CEP implementation at both the administrative and school levels. In many school districts, CMs are responsible for overseeing day-to-day meal service operations, as well as inventory management and staffing for their school cafeteria. FSDs work closely with CMs to oversee the budget and strategic operations for all school cafeterias in their district, including menu planning and communication with families. In most districts, FSDs play an important role in deciding whether and how to implement CEP. Under the traditional USDA reimbursement model, FRPM applications are also typically processed centrally in the district office.

In Maryland, 12 public school districts and 240 public schools participated in CEP during SY 2018-19. A list of all CEP participating schools in SY 2018-19 was retrieved from the Maryland State Department of Education (MSDE) website.[13] Twelve FSDs, one from each participating district, were invited to participate in this study. A separate CM sampling frame was created including CMs from all 240 participating schools. To provide insight into how implementation

potentially differed across school levels and geographies, the CM sampling frame was stratified by school level based on National Center for Education Statistics classification[2] (elementary, middle, high, other (e.g., grades K-12, grades 9-10)) and district to create 48 mutually exclusive and exhaustive strata. Twenty-two of these strata had no schools – for example, in four counties, only elementary schools participated in CEP, so the middle school, high school, and other school strata were empty. Using a random number generator, one CM from each of the 26 remaining strata was sampled. In districts with schools from only one stratum (e.g., only elementary schools) participating in CEP, one CM was sampled, and in districts with schools at all four levels participating in CEP, four CMs were sampled. If a CM declined to participate or was unreachable after six attempts via email or telephone, a new CM within the same stratum was randomly selected, if available. Participants were eligible if they were ≥18 years, could speak English, and worked at a CEP school or district.

Data Collection

Semi-structured in-depth interviews were conducted from July 2019 – February 2020. An interview guide was developed based on a review of the literature related to policy implementation and school nutrition. Seven experts from across the country reviewed the interview guide for content validity. The interview guide was pilot tested for clarity and ease of administration with two FSDs at districts implementing CEP outside of Maryland and revised based on feedback.

CMs were asked about the process of implementing CEP at their school and factors that facilitated or hindered implementation. They were also asked about perceived consequences of

CEP implementation, including impacts on cafeteria operations, staff workload and morale, wasted food, student behavior, and relationships with local and regional farmers. FSDs were asked the same questions, plus questions about why their district decided to implement CEP, who was involved in decision-making, and the budgetary impacts of CEP. After initial interviews, the CM interview guide was adapted to probe more deeply into barriers and facilitators mentioned in early interviews, including questions about strategies that CMs used to adapt to CEP and promote student participation in school meals, and the feedback CMs received from key stakeholders.

Interviews occurred by phone and lasted 30-55 minutes. All participants provided informed verbal consent. Recordings were transcribed by a third party and all identifying information was redacted prior to analysis. Participants received $20 gift cards.

Data Analysis

Data were analyzed using ATLAS.ti (version 6.0, ATLAS.ti GmbH, Berlin, Germany). Using a phronetic iterative approach[11], the research team developed an analytic codebook composed of 8 coding families and 105 codes. Two researchers coded three transcripts together to ensure agreement and refine the analytic codebook. One researcher then coded the remaining transcripts, which were reviewed by the second researcher. Researchers met regularly to reconcile differences. After coding, data were extracted and analyzed. Relevant codes were categorized according to emergent themes, which were mapped onto the Consolidated Framework for Implementation Research (CFIR).[14] The CFIR framework was selected because of its focus on identifying actionable findings to improve implementation. The framework

outlines five major domains that may impact implementation: the intervention characteristics, the inner setting (i.e., features of the implementing organization), the outer setting (i.e., features of the external context or environment), characteristics of individuals involved in implementation, and the implementation process (i.e., strategies or tactics that might influence implementation). There were no strong themes uniquely related to one domain – characteristics of individuals involved in implementation; thus, this domain was eliminated, and findings presented in Chapter 4 are organized according to the remaining four domains.

Research Quality: Credibility, Transferability, Dependability, and Confirmability

Quality of qualitative research can be measured by credibility, transferability, dependability, and confirmability, the qualitative corollaries to internal validity, external validity, reliability, and objectivity used in quantitative research, respectively.[15,16] Several strategies were used to ensure research quality. To promote credibility, informal member checking[17] was attempted. FSDs were emailed a document outlining major themes and asked to provide feedback (and reminded via email if they did not respond to the first request); however, only one participant provided feedback. Special attention to negative cases (searching for examples that contradict the emerging explanation of the phenomena under study) was also used.[15,17] To promote both credibility and transferability, long and detailed quotations from participants were provided to ensure the voice of participants was heard.[18] To enhance dependability and confirmability, clear description of data collection and analysis methods was provided (see Methods, Chapter 4). Additionally, two researchers conferred to develop analysis codes, providing as an "external audit" to promote dependability.[16]

AIM 3 (CHAPTER 5)

Study Design

Aim 3 used a quasi-experimental study design with a comparative interrupted time series analytic approach to identify the effects of CEP participation, comparing changes in student outcomes over time in schools that adopted CEP in SY 2015-16 to schools that were eligible or near-eligible for CEP in SY 2015-16 but not participating. In its simplest form, interrupted time series design measures the same outcome several times before and after an intervention, adjusting for trends in the pre-intervention data. The addition of a comparison group helps isolate causal effects by accounting for confounding factors such as historical events and changes in instrumentation that may have occurred over the study period.[19] In recent years, "short" comparative interrupted time series designs (between three and 20 pre-intervention measures of the outcome) have been increasingly used to investigate effects of education programs and policies implemented at the school-level.[20] In this aim, outcomes were compared using data from up to five pre-intervention time points and four post-intervention time points.

Study Sample

This study compared Maryland schools adopting CEP in SY 2015-16 (intervention schools) to schools that were individually eligible (ISP 40% or greater) or near-eligible (ISP 30-39%) for CEP in SY 2015-16 but not participating (comparison schools). Schools that were individually near-eligible were included in the comparison group in primary analyses because these schools commonly participate in CEP as part of group or district-wide adoption; near-eligible schools were excluded in sensitivity analyses. Schools that opted into CEP before or after SY 2015-16 were excluded from the study sample, as this group (n=46) may be different in unobservable

ways from schools that adopted CEP in SY 2015-16. Further, schools that adopted CEP before 2015-16 lack sufficient baseline data and schools that adopted after 2015-16 lack sufficient follow-up data for analysis. Schools that closed during the study period were also excluded. Additionally, seven schools began offering universal free meals during the study period using district funds (separate from CEP); these schools were also excluded. The final sample included 334 comparison schools and 188 intervention schools.

Measures

Outcome Measures

All outcome data were obtained from the Maryland State Department of Education (MSDE) (downloaded from their website or provided through a data request) and measured annually at each school.[21] Data are transferred electronically from each district to MSDE and subjected to quality assurance procedures by MSDE to promote accuracy. The primary outcomes were 1) average daily participation (ADP; total annual meals served divided by the product of enrollment and number of operating school days) in school breakfast and 2) ADP in school lunch.

Secondary outcomes include: 1) cohort-adjusted dropout (percent of first-time 9th grade students who drop out, adjusted for students who transfer in and out); 2) cohort-adjusted graduation (percent of first-time 9th grade students who graduate in four years, adjusted for students who transfer in and out); 3-5) 9^{th}-11^{th} grade promotion (percent of students who advance to the next grade); 6) average daily attendance; 7) absenteeism (percent of students absent more than 20 school days); 8) suspensions and expulsions (annual aggregate number of suspensions and expulsions divided by enrollment); 9) suspensions and expulsions associated with bullying

and/or harassment; and 10-12) percent of students scoring "proficient" or above on standardized tests in reading, math, and, for elementary schools only, science.[22] Graduation requirements changed from year to year over the study period but remained uniform across the state.[23] While the federal and state government provide some guidance on handling of disciplinary referrals[24], decisions regarding suspension and expulsion are largely at the discretion of school administrators.

Between 2014 and 2016, Maryland modified the state standardized tests, moving from the Maryland School Assessment (MSA) to the Partnership for Assessment of Readiness for College and Career (PARCC) test. Per state guidelines, students were considered scoring "proficient" or above if they scored "proficient" or "advanced" on the MSA test, or "Level 4" or "Level 5" on the PARCC test.[25] Despite the evidence-based guidance put forth by MSDE and Maryland Assessment Research Center providing equivalent cut-points for "proficiency" across tests, the PARCC test is widely considered more difficult than the MSA, and the proportion of students scoring "proficient" or above dropped dramatically with the transition to the PARCC test (for example, across the sample, the proportion of students who scored proficient on the elementary math test dropped from 62% in 2014 to 20% in 2015). As such, an indicator was included in analysis to control for whether the MSA or PARCC test was used in the study year.

For some outcomes, data were capped below 5% and above 95% by MSDE to protect student privacy. To handle outcome data continuously, 2.5% and 97.5% were imputed for data capped below 5% and above 95%, respectively. In sensitivity analyses, for attendance, absenteeism, dropout, promotion, and graduation, a binary variable was created to indicate "improvement"

relative to the previous year. For example, for dropout, "improvement" was achieved if the outcome decreased or stayed below 5%, and for attendance, "improvement" was achieved if the outcome increased or stayed above 95%.

Dropout, graduation, promotion, attendance, absenteeism, test score, and discipline outcome data were from SY 2010-11 (five years pre-intervention) through SY 2018-19 (four years post-intervention). ADP data were from SY 2012-13 (three years pre-intervention) through SY 2018-19 (four years post-intervention). (Table 2.2) Years described below refer to the spring semester (e.g., SY 2018-19 will be referred to as 2019).

Covariates

Data on CEP participation (yes, no), CEP eligibility (yes, no) and participation (yes, no) in the Maryland Meals for Achievement Program (MMFA) for each study year were retrieved from the MSDE website.[13,26] MMFA is a state-funded universal free breakfast in the classroom program that pre-dated CEP. Schools are eligible for MMFA if 40% or more students are FRPM-eligible, but state funding is limited and not all eligible schools are able to participate.

Baseline school-level variables were obtained for SY 2014-15, the year prior to CEP adoption in study schools. Baseline school ISP and enrollment were obtained from the MSDE website.[13,21] All other baseline covariates were retrieved from the National Center for Education Statistics Common Core of Data[2] (described in Aim 1 methods above), including: school type (alternative, regular, career/technical, special education); locale (city, suburb, town, rural); funding status through Title I of the Elementary and Secondary Education Act, which provides financial

support for academic programming in high-poverty schools (described in Aim 1 methods above; categorized as: receiving funding; eligible but not receiving funding; not eligible); percent of students eligible for free meals; percent of students eligible for reduced-price meals; and percent of students who self-identify as Black.

Statistical Analysis

Missing Data

Data were analyzed for patterns of missingness. Percent missingness for covariates ranged from 0.0 to 0.6%. (Table 2.3) For primary outcomes, percent missingness was 2.1%, and for secondary outcomes, 1.6 to 6.9%. (Table 2.4) Per NCES guidance, if demographic data were missing for SY 2014-15 but reported in the previous year, prior year values were imputed.[11] For missing data, separately by intervention status, the mean value was imputed. Sensitivity analyses comparing analyses using complete cases versus imputed data demonstrated that imputation did not meaningfully alter the direction or magnitude of findings.

Regression Analyses

Descriptive and bivariate analyses were conducted using t-tests and chi-square tests to compare characteristics of intervention and comparison schools. To estimate intervention impact, mixed effects linear regression models were built separately for each outcome using a comparative interrupted time series approach. Each model controlled for other baseline (SY 2014-15) outcomes and the covariates described above, which were identified *a priori* based on a review of the literature. Models included school-specific random intercepts to account for correlation across observations from the same school in different years. Standard errors were clustered by

district to account for similarities between schools within a district. Interaction variables for (intervention status * year) and (intervention status * year * pre/post-intervention period) were included to model linear time trends separately for the intervention and comparison groups in the pre- and post-intervention periods. The parameter of interest was estimated using a linear combination of the coefficient of (intervention status * pre/post-intervention period) plus (years since intervention * the coefficient of (intervention status*year*pre/post-intervention period)). Results (see Chapter 5) show the estimated impact of intervention (difference-in-difference) separately for each year in the post-intervention period.

To account for the large number of statistical tests and minimize the likelihood of p-values of less than 0.05 that may occur simply by chance, a Benjamini-Hochberg correction procedure was used.[27] A Benjamini-Hochberg procedure with a false discovery rate of 0.05 was used for the outcomes examined within each year (e.g., corrections were applied to outcomes in the main model separately for SY 2016, 2017, 2018, and 2019).[27] Statistical significance reported for regression findings below are based on the corrected critical value.

Sensitivity Analyses

In sensitivity analyses, the sample excluded 1) near-eligible schools and 2) Baltimore City Public Schools. Of the 188 intervention schools, 174 were in Baltimore City. It is therefore possible that secular trends in Baltimore City unrelated to CEP may skew findings. In particular, the civil unrest in Baltimore City that followed the death of Freddie Gray, an unarmed black man who died from injuries sustained in police custody in April 2015, has been linked to negative outcomes for residents of neighborhoods proximal to the unrest, including increased rates of

maternal depression[28] and violent crime[29], and may also impact student outcomes such as attendance[30]. As described above, a final sensitivity analysis also used mixed effects logistic regression to determine odds of "improvement" relative to the previous year for measures with capped outcomes.

Alternative Methodological Approaches Explored

One strategy often used to minimize risk of selection bias and balance the distribution of covariates in the treatment and control groups is propensity score weighting or matching.[31] Propensity scores were generated using baseline covariates and outcomes. Despite attempts to use a range of propensity score weighting and matching techniques (e.g., inverse probability of treatment weighting, nearest neighbor matching, subclassification), adequate covariate balance was not achieved. Instead, to minimize risk of selection bias, as described above, this analysis adjusted for baseline covariates and outcomes in regression analysis and limited the comparison group to eligible and near-eligible schools.

SOFTWARE

Stata version 14.1 (StataCorp LP, College Station, TX) was used for Aim 1 data merging and cleaning, multiple imputation, and descriptive, bivariate, and generalized logistic regression analyses and all Aim 3 analyses. R version 3.6 (R Foundation for Statistical Computing, Vienna, Austria) was also used for Aim 1 multiple imputation and penalized regression. ATLAS.ti version 6.0 (ATLAS.ti GmbH, Berlin, Germany) was used to code transcripts and analyze themes for Aim 2.

HUMAN SUBJECTS

This study was reviewed by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board and determined to be non-human subjects research. (Figure 2.1) The Baltimore City Public Schools Institutional Review Board reviewed and approved the Aim 2 study protocol (IRB #2019-074). (Figure 2.2)

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FIGURES

Figure 2.1 Determination letter from Johns Hopkins Bloomberg School of Public Health Institutional Review Board

FWA #00000287

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Email: jhsph.irboffice@jhu.edu
Website: www.jhsph.edu/irb

NOT HUMAN SUBJECTS RESEARCH
DETERMINATION NOTICE

Date: November 28, 2018

To: Keshia Pollack Porter, PhD
(Amelie Hecht)
Department of Health Policy and Management

Re: **Study Title**: "Community Eligibility Provision: Implementation and Longitudinal Impacts on Student Nutrition, Behavior and Academic Performance"
IRB No: 00009229

The JHSPH IRB reviewed the above-referenced study new application **November 28, 2018**. We have determined that the proposed activity described in your application will involve conducting study key informant interviews and analysis of existing de-identified data to examine the impact of the Community Eligibility Provision on student nutrition, academic and behavior outcomes in Maryland, and to explore barriers, facilitators, and unintended consequences of CEP implementation. No personal or private information will be collected. Thus, the proposed activity does not qualify as human subjects research as defined by DHHS regulations 45 CFR 46.102, and does not require IRB oversight.

We anticipate that you will follow ethical practices in your interactions with individuals in the community during the course of your study. You are responsible for notifying the JHSPH IRB of any future changes that might involve human subjects and require IRB oversight.

If you have any questions regarding this action, please contact the JHSPH IRB Office at (410) 955-3193 or via email at jhsph.irboffice@jhu.edu.

ES/teb

JHSPH IRB NHSR Determination Notice
V6, 18Sept2014

Figure 2.2 Determination letter from Baltimore City Public Schools Institutional Review Board

BALTIMORE CITY
PUBLIC SCHOOLS

Bernard C. "Jack" Young	Linda Chinnia	Dr. Sonja Brookins Santelises
Mayor, City of Baltimore	*Chair, Baltimore City Board of School Commissioners*	*Chief Executive Officer*

01/14/2020 2019-074

Keshia Pollack Porter, PhD

Johns Hopkins Bloomberg School of Public Health
624 N Broadway
Baltimore, MD 21205

Dear Dr Pollack Porter:

IRB# 2019-074

TITLE OF PROPOSAL: *Community Eligibility Provision: Implementation and Longitudinal Impacts on Student Nutrition, Behavior and Academic Performance*

This is to notify you of the approval of your project by the Office of Achievement and Accountability (OAA) Institutional Review Board (IRB) for the Protection of Human Subjects. It's the opinion of this Board that you have provided adequate safeguard for the rights and welfare of participants selected for this study. Your proposal seems to be in compliance with OAA's Federal Wide Assurance 00008794 and DHHS Regulations for the Protection of Human Subjects.

Date of Full Board Approval: 10/31/2019

Your approval is valid until 10/30/2020. Please note that the assigned IRB number must be displayed on the Informed Consent Form and copies of that form should be submitted to OAA IRB. All research members of this project who will have any interactions with students must be fingerprinted by City Schools Human Capital Office.

This project should be conducted in full compliance with all applicable sections of the IRB Guidelines. The IRB should be notified immediately of any proposed changes. You should also report any unanticipated problems involving risks to participants or others to the IRB. For projects that continue beyond one year from the starting date, the IRB will request continue review and update of the research project. Your study will be due for continue review as indicated above. The investigator must also advise the IRB when this study is completed or discontinued.

If you have any questions, please contact the IRB Chair at (443) 642-4032, or by email at diibor@bcps.k12.md.us. Thank you for your interest in City Schools.

Respectfully,

Ike Diibor, Ph.D.
IRB Chair

C: Theresa D. Jones, Chief Achievement and Accountability Officer.

TABLES

Table 2.1 Aim 1 missing data (n=42,813)

	Missing n	Missing %
School Characteristics		
School Level	0	0.0
Charter Status	2190	5.1
Locale	0	0.0
School Size	33	0.1
ISP	0	0.0
Title I Funding	3667	8.6
Pupil-Teacher Ratio	476	1.1
Hispanic (%)	579	1.4
District Characteristics		
Congressional District Party	0	0.0
District Number of Schools	0	0.0
English Language Learners (%)	2880	6.7
State Characteristics		
Governor Political Party	0	0.0
Region	0	0.0
Year CEP Became Available	0	0.0

Table 2.2 Aim 3 outcome data availability by year

	Pre-Intervention					Post-Intervention			
Outcome	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Breakfast ADP			X	X	X	X	X	X	X
Lunch ADP			X	X	X	X	X	X	X
Total Referrals	X	X	X	X	X	X	X	X	X
Bullying/Harassment Referrals	X	X	X	X	X	X	X	X	X
Attendance	X	X	X	X	X	X	X	X	X
Absenteeism	X	X	X	X	X	X	X	X	X
Math Proficient	X	X	X	X	X	X	X	X	X
Reading Proficient	X	X	X	X	X	X	X	X	X
Science Proficient	X	X	X	X	X	X	X	X	X
Dropout	X	X	X	X	X	X	X	X	X
Graduation	X	X	X	X	X	X	X	X	X
9th Grade Promotion	X	X	X	X	X	X	X	X	X
10th Grade Promotion	X	X	X	X	X	X	X	X	X
11th Grade Promotion	X	X	X	X	X	X	X	X	X

Footnote: ADP = Average Daily Participation

Table 2.3 Aim 3 missing baseline covariate data (n=521)

Covariate	**Missing n**	**Missing %**
School Type	0	0.0
School Level	0	0.0
Charter Status	0	0.0
Locale	0	0.0
Identified Student Percentage	0	0.0
Title I Funding	0	0.0
Black (%)	0	0.0
Enrollment	3	0.6
Free Meal Eligible (%)	2	0.4
Reduced-Price Meal Eligible (%)	2	0.4
Maryland Meals for Achievement Participation	0	0.0

Table 2.4 Aim 3 missing outcome data

Outcome	**Missing n**	**Missing %**
Breakfast ADP (n=3794)	83	2.2
Lunch ADP (n=3794)	83	2.2
Total Referrals (n=4878)	86	1.8
Bullying/Harassment Referrals (n=4878)	86	1.8
Attendance (n=4072)	88	2.2
Absenteeism (n=4072)	93	2.3
Math Proficient (n=4581)	246	5.4
Reading Proficient (n=4581)	246	5.4
Science Proficient (n=3184)	217	6.8
Dropout (n=448)	31	6.9
Graduation (n=448)	31	6.9
9th Grade Promotion (n=368)	15	4.1
10th Grade Promotion (n=376)	23	6.1
11th Grade Promotion (n=440)	30	6.8

Footnote: Ns differ by outcome. For example, 9th grade promotion is only measured in high schools that include a 9th grade and science test proficiency is only measured in elementary schools that include a 5th grade. ADP = Average Daily Participation

CHAPTER THREE

FACTORS ASSOCIATED WITH UNIVERSAL FREE MEAL PROVISION ADOPTION AMONG U.S. PUBLIC SCHOOLS

ABSTRACT

Introduction. The Community Eligibility Provision (CEP) allows high-poverty schools participating in U.S. Department of Agriculture meal programs to offer universal free school meals. Emerging evidence suggests benefits of CEP for student meal participation, behavior, and academic performance. Though CEP became available nationwide in 2014, one-third of eligible schools still do not participate. This study evaluates which school, district, and state characteristics are associated with CEP participation in order to identify potential barriers to adoption and inform strategies to promote uptake.

Methods. Associations between CEP participation during School Year 2017-18 and school, district, and state characteristics were assessed, comparing participating and eligible nonparticipating U.S. public schools (n=42,813) using penalized and generalized logistic regression models.

Results. Adjusted odds of CEP participation were higher in schools with more students directly certified for free meals, in Title I schools, in middle and high schools, in urban schools, and in schools with lower enrollment and a lower proportion of Hispanic students. Adjusted odds were also greater for schools in very large districts, in districts and states not controlled by Republican elected officials, and in states where CEP had been available longer. Differences by geographic region also existed.

Conclusions. To address factors associated with participation and promote uptake, advocates and state agencies should provide targeted technical support for smaller and suburban districts, and federal and state policymakers should consider revising current policies to facilitate CEP adoption.

INTRODUCTION

One in seven U.S. children lives in a food insecure household, or a household with limited or uncertain access to adequate food.[1] Food insecurity among children has a deleterious effect on physical and psychosocial health and academic performance.[2,3,4]

The National School Lunch Program and School Breakfast Program, federal programs administered by the U.S. Department of Agriculture (USDA), provide meals at low or no cost to low-income students and are effective at reducing household food insecurity.[5,6] Numerous barriers prevent students from participating in these meal programs, including stigma associated with receiving a subsidized meal, limited outreach to enroll eligible students, and confusion among parents regarding eligibility.[7,8] To address these barriers, as part of the Healthy, Hunger-Free Kids Act of 2010, Congress authorized the Community Eligibility Provision (CEP), which allows eligible schools in high-poverty areas to provide free breakfast and lunch to all students regardless of income.[9] A school, group of schools, or district is eligible to participate in CEP if its identified student percentage (ISP, or percentage of students identified as categorically eligible for free meals through existing administrative data, such as participation in the Supplemental Nutrition Assistance Program) is 40% or greater. In addition to decreasing stigma and improving meal access for low-income students, CEP aims to reduce administrative burden for schools by eliminating the need to collect meal applications and track students' meal charges.

Phased in over a three-year period in 10 states and the District of Columbia, CEP became available nationwide in July 2014. During School Year (SY) 2018-19, 28,614 schools in 4,698 districts participated in CEP, representing 65% of all eligible schools and 54% of all eligible

districts.[10] In participating schools, the number of meals reimbursed at the "free" rate (on average, $3.41 for lunch, $1.84 for breakfast[11]) is equivalent to the school's ISP multiplied by 1.6. All other meals are reimbursed at the "paid" rate (on average, $0.32 for lunch, $0.31 for breakfast[11]). For example, a school with an ISP of 50% would be reimbursed at the "free" rate for 80% of meals served, and at the "paid" rate for the remaining 20% of meals.

Emerging research suggests that CEP has positive effects on student nutrition, behavior, and academic outcomes. There is strong evidence of benefits of CEP for meal participation rates, and limited but promising results showing gains in test scores, attendance, food security, and weight outcomes.[12–24] While no published studies have measured the impact of CEP participation on food security status, research has shown increases in breakfast participation ranging from 3.5 to 37.8 percentage points and lunch participation ranging from 3.5 to 11.8 percentage points, depending on the student subgroup studied.[25] Additionally, CEP may have positive financial implications for district food service budgets, increasing federal revenue and decreasing per meal production costs.[12,16]

Given the benefits of program participation, it is important to understand why more than one-third of eligible schools have not opted into CEP. Prior USDA investigations explored implementation of CEP during the phase-in phase[12] and one year after nationwide rollout[26]. Both studies focused on district-level adoption and explored associations with a limited number of district-level characteristics. These reports called for additional evaluation to explore associations between school-level CEP participation and school, district, and state characteristics to better understand barriers to adoption. This study seeks to fill this gap, comparing eligible

participating and nonparticipating schools in SY 2017-18 on various school, district, and state characteristics to identify factors associated with adoption. This study aims to help policymakers, advocates, and school administrators identify barriers to participation and inform strategies to promote uptake.

METHODS

Study Sample

In partnership with the USDA and state education agencies, the Food Research & Action Center (FRAC) produces an annual national database of all schools that are participating in CEP or eligible or near-eligible to participate in CEP.[27] The database provides information on school CEP participation in that year and eligibility for the upcoming year. To obtain data on school CEP eligibility and participation for SY 2017-18, eligibility data from the FRAC 2017 database (n=75,712 schools) were merged with participation data from the 2018 database (n=80,325 schools) to create a single dataset (n=69,832).

Participation and eligibility data were linked with school and district characteristic data from National Center for Education Statistics (NCES) Common Core of Data[28] for SY 2016-17, the most recent year of data available at the time of analysis. A total of 62,653 schools matched across databases, representing 82.8% of the original FRAC 2017 database. Schools with ISPs below 30% were excluded (n=18,153). Because schools can adopt CEP as part of a group as long as their pooled ISP is at least 40%, near-eligible schools (ISP 30-39%) often participate in CEP and are included in primary analyses. In sensitivity analyses, near-eligible schools were excluded. Nonoperational schools and schools with no students enrolled were also excluded

(n=102). Schools participating in Provisions 1, 2, or 3 (other universal free meal provisions with different lengths of cycle and eligibility cut-offs) (n=1,585) were also excluded. The final matched sample included 42,813 eligible and near-eligible schools in SY 2017-18.

Measures

The primary outcome, CEP participation in SY 2017-18, was obtained from the FRAC 2018 database. Fourteen explanatory variables selected based on expert input and a review of literature related to school nutrition policy and implementation science were included (Table 3A.1).

School-Level Explanatory Variables

School ISP from SY 2017-18 was obtained from the FRAC 2017 database, and categorized as 30-39%, 40-49%, 50-59%, 60-69%, 70-79%, 80-89%, 90-100%. All other school-level variables were retrieved from NCES for SY 2016-17.[28] Continuous variables included pupil-teacher ratio and percent Hispanic students. Categorical variables included school level (elementary, middle, high, or other (e.g., K-12)), charter status (charter, not charter), locale (urban, suburban, township, rural), and school enrollment (small (<400), medium (400-699), large (700-999), very large (≥1000)). Federal funding though Title I of the Elementary and Secondary Education Act was coded as participating or not participating. Title I provides funds to schools with a high percentage of low-income families to support academic programming and is allocated to districts based on U.S. Census Data, and within districts often based on free and reduced-price meal (FRPM) application data.[29] Due to CEP, most schools are no longer collecting FRPM applications, and districts have raised concerns about challenges allocating Title I funds and applying for other education funding that relies on FRPM data.

District-Level Explanatory Variables

District-level variables, with the exception of district political affiliation, were retrieved from NCES for SY 2016-17.[28] District political affiliation (Republican, other) was generated by matching NCES school district congressional code to a list of U.S. congressional representatives elected in 2016 and their political party. District total number of schools was categorized as small (≤10), medium (11-20), large (21-30), or very large (>31). Percent English language learner students was handled continuously.

State-Level Explanatory Variables

State-level variables included: political affiliation of the governor elected or sitting in 2016 (Republican, other)[31]; USDA region[32]; and the number of years since CEP became available in the state.

Statistical Analysis

Data were assessed for patterns of missingness. Per NCES guidance, if demographic data were missing for SY 2016-17 but reported in the previous year, prior year values were imputed.[33] When data from the previous year were unavailable, multiple imputation using chained equations was used.

Penalized regression variable selection methods – LASSO and elastic net regression – were used to assess if all 14 predictor variables, identified using the theory-driven approach described above, contributed information to the model. Penalized regression methods shrink coefficients of

variables that do not contribute information to the model to zero, ensuring only important predictors stay in the model.[34] Models were tuned using repeated cross-validation. Both penalized regression approaches provided support for inclusion of all variables in the final model.

Each predictor was subject to descriptive and bivariate analyses using t-tests and chi-square tests comparing participating and nonparticipating schools. Generalized logistic regression models were next used to predict odds of CEP participation unadjusted and adjusted for all predictor variables. Standard errors were clustered at the district level. All analyses were conducted using Stata versions 14.1 and 16.1 (StataCorp LP, College Station, TX).

RESULTS

The study sample (n=42,813) included all U.S. public schools that were eligible (n=32,493) or near-eligible (n=10,320) to participate in CEP during SY 2017-18 and that matched across databases. Of the final sample, 19,184 (44.8%) schools participated in CEP. (Table 3.1)

Several school-level factors were significantly associated with CEP participation (Table 2). Adjusted odds of CEP adoption among eligible schools were greater in middle schools (OR: 1.14, 95% CI: 1.04, 1.25) and high schools (OR: 1.36, 95% CI: 1.15, 1.61) compared to elementary schools, and in Title I compared to non-Title I schools (OR: 2.19, 95% CI: 1.91, 2.50). Adjusted odds of participation increased as ISP increased and were highest among schools with ISPs between 70-79% compared to near-eligible schools (OR: 12.54, 95% CI: 10.10, 15.57). Adjusted odds were lower in schools with a greater proportion of Hispanic students (OR:

0.37, 95% CI: 0.25, 0.56) and schools that were located in rural, township, or suburban areas compared to urban areas, with the lowest odds of participation in suburban areas (OR: 0.29, 95% CI: 0.23, 0.37). Likelihood of CEP participation also decreased as school enrollment increased, with the lowest odds of participation in schools with very large compared to small enrollment (OR: 0.58, 95% CI: 0.47, 0.71).

At the district level, two factors were significant: odds of participation were higher in very large compared to small districts (OR: 1.53, 95% CI: 1.18, 1.99), and lower in districts with Republican congressional representatives (OR: 0.76, 95% CI: 0.62, 0.93). Similarly, political affiliation at the state level was significant: odds of participation were lower in states controlled by Republican governors (OR: 0.79, 95% CI: 0.63, 0.98). Two additional state-level factors emerged as significant: odds of CEP participation were greater in states where CEP had been available longer (OR: 1.36, 95% CI: 1.22, 1.52), and lower in states in the Midwest (OR: 0.42, 95% CI: 0.29, 0.61), Mountain Plains (0.63, 95% CI: 0.42, 0.93), and West (OR: 0.34, 95% CI: 0.24, 0.50) compared to the Mid-Atlantic. These findings were substantively robust to exclusion of near-eligible schools (data not shown).

DISCUSSION

This study is the first to explore associations between school-level CEP participation and school, district, and state characteristics using a national dataset. Odds of CEP participation were higher in middle and high schools, urban schools, and schools with higher ISPs, a lower proportion of Hispanic students, smaller enrollment, and receiving Title I funding. Likelihood of CEP participation was also greater for schools located in very large districts, in districts and states

without Republican elected officials, and in states where CEP had been available longer. Differences in adoption also existed across USDA regions.

Among eligible schools, those with higher ISPs were more likely to participate in CEP. This is expected given school meal reimbursement is tied to the percent of students categorically eligible for free meals; schools with ISPs below 62.5% are not reimbursed fully at the "free" rate and take on additional financial risk participating in CEP. While the Healthy, Hunger-Free Kids Act of 2010 capped the ISP multiplier between 1.3 and 1.6 (it is currently set at 1.6 by the USDA), in a political environment favorable to universal meals, legislation that increased the multiplier could make CEP more financially feasible for schools with ISPs between 40% and 62.5%. If the multiplier increased to 1.8, schools with ISPs above 55.5% would be fully reimbursed at the free rate, increasing likelihood of participation and extending free meal access to an estimated more than 2,100 new schools serving a total of one million children. Additionally, states could boost school ISPs by improving the accuracy of their direct certification systems, which, in SY 2016-17, failed to identify, on average, 8% of children directly eligible for free meals.[23]

Notably, the COVID-19 pandemic had led to historic rates of unemployment and increased participation in the federal assistance programs that are used to calculate ISPs. As a result, ISPs are expected to increase for SY 2020-21; some schools will be newly eligible for CEP and, for others, CEP will become more financially favorable. Future research should assess changes in CEP participation linked with the COVID-19 pandemic.

Participation in the federal Title I funding program was positively associated with CEP participation. Schools participating in CEP no longer collect FRPM application data – data that have traditionally been used to allocate Title I funding within districts. While USDA has provided guidance on alternate strategies to apportion Title I funding, qualitative research demonstrates that concerns regarding loss of funding persist, and are frequently cited by school decision-makers as a barrier to participation.[36,37] However, this study finds that even after controlling for ISP, odds of participation are higher among Title I schools, suggesting that the potential loss of Title I may not be a major barrier to participation. Additional research comparing odds of adoption by Title I funding amount and assessing changes in Title I funding after schools adopt CEP is warranted.

Participation in CEP was also associated with percent of Hispanic students, a measure often used to estimate the size of a school's immigrant population. Because direct certification is based on the percentage of students participating in federal public benefit programs – programs that immigrant families are less likely to qualify or apply for – ISPs may underestimate need in schools with a high proportion of immigrant families.[38,39] As a result, some schools with large immigrant populations may not participate in CEP, deciding instead to continue to serve free or reduced-price meals to students based on household eligibility, or opt into Provision 2, a universal free meal provision for which eligibility is determined based on FRPM applications rather than ISP. Federal policies that discourage participation of immigrant families in federal benefit programs including the Categorical Eligibility for SNAP proposed rule[40] or Inadmissible on Public Charge Grounds final rule[41], should be revised to avoid negatively impacting school meal access.

Higher participation in the largest compared to smallest districts may reflect the benefit of economies of scale of serving more meals that occur in larger districts with centralized kitchens, or the greater administrative capacity in larger districts to assess budgetary impacts of participation. At the same time, lower CEP participation in schools with greater enrollment suggests that large schools may not have sufficient cafeteria or kitchen space or related resources necessary to provide meals to all students. Additionally, schools in suburban areas were the least likely, compared to those in urban areas, to participate. Poverty has increased in suburban communities at a faster rate than urban or rural communities over the last decade, yet suburban areas often receive less attention from advocates and the media.[42] Anti-hunger advocacy organizations should consider providing targeted guidance and technical assistance to smaller and suburban school districts, and should advocate for grant funding for larger schools to support capital improvements to accommodate increased meal participation.

Schools located in districts and states with Republican elected officials were less likely to participate in CEP, suggesting that state or district policies or politics, including attitudes toward government assistance programs, may influence CEP adoption. Relatedly, differences in participation across USDA regions, after controlling for other state-level factors, may reflect discrepant levels of outreach to eligible schools by regional USDA offices or state agencies administering CEP. Advocates should develop strategies to promote CEP in regions with lower participation and ensure that bipartisan messaging is used to encourage CEP uptake by school, district, and state decisionmakers. Future research should explore state and local level policies that might impact adoption.

Odds of participation increased as length of time since CEP became available in the state increased. States were selected by USDA to participate in the CEP phase-in based on interest and number of CEP qualifying districts; this finding may simply reflect greater interest in and support for CEP among schools and districts in phase-in states.[12] However, it may also indicate that barriers to adoption decrease over time as states and districts become more familiar with CEP.[26] Qualitative research suggests that changes in state-level policies related to compensatory education funding, such as the Maryland Hunger-Free Schools Act of 2015, may have also made adoption easier over time.[37] States with low participation rates could consider if similar legislative interventions may boost participation.

Three previous studies have explored CEP implementation: two USDA evaluations assessed district characteristics associated with district adoption during the phase-in period and one year after national rollout,[12,26] and Turner et al. assessed school and district characteristics associated with school adoption of any universal free meal provisions (CEP plus Provisions 1, 2 and 3) in California through SY 2016-17.[15] While results of the present study were largely consistent with previous studies, some findings do contrast. Specifically, the USDA reports found differences by USDA region, district enrollment, and charter status, and Turner et al. found differences by school enrollment, school level, and proportion of Hispanic students; some of these differences were undetected in the present study or pointed in the opposite direction from results of the present study. Differences in findings may be explained by shifts in participation since earlier evaluations, different units of analysis (i.e., this study looks at school, rather than district-level participation), and differences in outcome (i.e., Turner et al. examined participation in Provisions

1, 2, and 3 together with CEP). Previous studies also incorporated fewer school and district-level characteristics and did not use rigorous variable selection methods to triangulate inclusion of relevant factors in their modeling. Additionally, the present study uses data from SY 2017-18, providing a more contemporary snapshot of participation trends with a larger sample.

Limitations

Due to a lack of unique identifiers available across datasets, observations were matched using probabilistic matching methods, and approximately 17% of schools in the original FRAC database were unmatched. Some data from the 2017 FRAC database were missing due to poor data quality. The final dataset, however, does contain representation across all U.S. states and regions and schools in the final dataset are demographically similar to those in the FRAC 2018 database. This observational quantitative study was unable to explain which factors were drivers of participation and why some differences exist. Future studies should explore barriers to adoption, including cost, qualitatively through interviews with decision-makers; additionally, longitudinal studies should assess drivers of adoption, including state and local policies, over time.

CONCLUSIONS

With rising national attention on school meal debt and meal shaming, CEP has become an increasingly appealing solution to schools seeking to increase meal participation and decrease stigma. Yet one in three schools eligible to participate in CEP does not. Likelihood of CEP participation was linked to ISP, district and school size, locale, ethnicity, political affiliation, Title I funding, USDA region, and length of time since CEP became available in the state. To

increase access to free meals through CEP, advocates and state agencies administering CEP should consider targeting technical support toward smaller and suburban districts and larger schools. Additionally, gains in participation may be achievable through state policies that promote adoption and improve direct certification systems and shifts in federal policy to increase the ISP multiplier and eliminate barriers to participation in federal public benefit programs.

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TABLES

Table 3.1 Characteristics of Community Eligibility Provision participating and non-participating U.S. public schools in School Year 2017-2018 (n=42,813)

Characteristic	**Not Participating (n=23,629)**	**Participating (n=19,184)**	**Total (n=42,813)**	**P-Value**
School Characteristics				
	Percent			
School Level				**<0.001**
Elementary	61.80	65.27	63.35	
Middle	16.80	13.68	15.08	
High	16.22	14.86	15.87	
Other	5.29	6.19	5.69	
Charter Status				**<0.001**
Charter	5.90	8.1	6.85	
Not Charter	94.10	91.90	93.15	
Locale				**<0.001**
City	25.94	48.94	35.69	
Suburb	32.44	16.20	25.17	
Township	15.89	13.40	14.77	
Rural	26.73	21.46	24.37	
School Total Enrollment				**<0.001**
Small (<400)	39.14	42.93	40.84	
Medium (400-699)	37.43	38.54	37.92	
Large (700-999)	14.08	12.62	13.42	
Very Large (≥1000)	9.36	5.91	7.81	
ISP Category				**<0.001**
30-39%	37.29	7.87	24.10	
40-49%	27.59	15.54	22.19	
50-59%	16.78	21.23	18.77	
60-69%	9.61	26.14	17.02	
70-79%	5.07	16.88	10.36	
80-89%	2.51	9.97	5.85	
90-100%	1.15	2.37	1.70	
Title I Funded				**<0.001**
Funded	76.13	90.03	82.20	
Not funded	23.87	9.97	17.80	

	Mean (SD)			
Pupil-Teacher Ratio	16.53 (8.32)	16.03 (11.15)	16.30 (9.70)	**<0.001**
Hispanic (%)	33.90 (30.58)	28.93 (31.72)	31.67 (31.20)	**<0.001**
District Characteristics				
Congressional Party				**<0.001**
Republican	46.10	55.23	50.19	
Democrat or Other	53.90	44.77	49.81	
Number of Schools				**<0.001**
Small (≤10)	43.62	33.42	39.04	
Medium (11-20)	16.08	13.51	14.93	
Large (21-30)	10.21	8.36	9.38	
Very Large (>31)	30.09	44.71	36.65	
	Mean (SD)			
English Language Learners (%)	12.01 (11.58)	11.45 (11.63)	11.76 (11.61)	**<0.001**
State Characteristics	**Percent**			
Governor Political Party				**0.001**
Republican	50.39	48.76	49.66	
Democrat or Other	49.61	51.24	50.34	
USDA Region				**<0.001**
Mid-Atlantic	8.82	10.62	9.63	
Midwest	14.27	17.85	15.87	
Mountain Plains	6.87	4.15	5.65	
Northeast	5.27	10.39	7.57	
Southeast	20.75	26.71	23.42	
Southwest	19.86	19.16	19.55	
Western	24.16	11.11	18.31	
Year CEP Became Available				**<0.001**
SY 2011-2012	7.95	14.81	11.02	
SY 2012-2013	5.24	16.02	10.07	
SY 2013-2014	12.09	10.76	11.49	
SY 2014-2015	74.72	58.41	67.41	

Footnotes: SD, Standard deviation; CEP, Community Eligibility Provision; ISP, Identified student percentage. p-value from t-tests for continuous variables and chi2 tests for categorical variables. Boldface indicates statistical significance ($p \leq 0.05$).

Table 3.2 Adjusted and unadjusted odds of Community Eligibility Provision adoption in School Year 2017-2018 (n=42,813)

Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
School Characteristics		
School Level (ref. Elementary)		
Middle	**0.80 (0.73, 0.87)*** **	**1.14 (1.04, 1.25)** **
High	**0.84 (0.77, 0.93)*** **	**1.50 (1.27, 1.77)*** **
Other (e.g., K-12 schools)	1.11 (0.95, 1.29)	1.11 (0.95, 1.30)
Charter Status	**1.33 (1.02, 1.73)***	0.87 (0.64, 1.19)
Locale (ref. city)		
Suburb	**0.25 (0.20, 0.32)*** **	**0.29 (0.23, 0.37)*** **
Township	**0.43 (0.34, 0.54)*** **	**0.68 (0.54, 0.86)*** **
Rural	**0.41 (0.33, 0.51)** **	**0.65 (0.53, 0.81)*** **
Pupil-Teacher Ratio	0.99 (0.98, 1.00)	1.00 (1.00, 1.01)
Hispanic (%)	**0.70 (0.51, 0.96)***	**0.37 (0.25, 0.56)*** **
School Total Enrollment (ref. small (<400))		
Medium (400-699)	0.94 (0.86, 1.02)	**0.91 (0.84, 0.99)***
Large (700-999)	**0.81 (0.69, 0.96)***	**0.81 (0.69, 0.96)***
Very Large (≥1000)	**0.58 (0.47, 0.70)*** **	**0.58 (0.47, 0.71)*** **
ISP (ref. 30-39%)		
40-49%	**2.67 (2.45, 2.91)*** **	**2.62 (2.39, 2.87)*** **
50-59%	**6.00 (5.35, 6.73)*** **	**5.91 (5.20, 6.73)*** **
60-69%	**12.89 (9.98, 16.66)*** **	**11.45 (9.58, 13.69)*** **
70-79%	**15.77 (12.30, 22.22)*** **	**12.54 (10.10, 15.57)*** **
80-89%	**18.83 (10.86, 32.65)*** **	**12.41 (7.97, 19.34)*** **
90-100%	**9.77 (5.69, 16.76)*** **	**6.95 (4.07, 11.89)*** **
Title I Funded	**2.66 (2.36, 2.99)*** **	**2.19 (1.91, 2.50)*** **
District Characteristics		
Congressional representative Republican	**0.69 (0.57, 0.84)*** **	**0.76 (0.62, 0.93)** **
Number of Schools (ref. small (≤10))		
Medium (11-20)	1.10 (0.93, 1.29)	1.22 (0.99, 1.50)
Large (21-30)	1.07 (0.83, 1.37)	1.22 (0.89, 1.66)
Very Large (≥31)	**1.92 (1.47, 2.52)*** **	**1.53 (1.18, 1.99)*** **

English Language Learners (%)	1.16 (0.47, 2.87)	1.69 (0.55, 5.16)
State Characteristics		
Governor Republican	1.07 (0.86, 1.33)	**0.79 (0.63, 0.98)***
USDA Region (ref. Mid-Atlantic)		
Midwest	1.04 (0.65, 1.66)	**0.43 (0.30, 0.62)*****
Mountain Plains	**0.50 (0.33, 0.77)****	**0.60 (0.40, 0.89)***
Northeast	**1.64 (1.10, 2.44)***	0.96 (0.67, 1.36)
Southeast	1.07 (0.71, 1.62)	0.85 (0.58, 1.25)
Southwest	0.80 (0.54, 1.89)	0.87 (0.60, 1.24)
Western	**0.38 (0.25, 0.58)*****	**0.35 (0.24, 0.50)*****
Years Since CEP Available	**1.46 (1.32, 1.62)*****	**1.36 (1.22, 1.52)*****

Footnotes: CEP, Community Eligibility Provision; CI, Confidence interval; ISP, Identified student percentage; OR, Odds ratio; USDA, U.S. Department of Agriculture.

Boldface indicates statistical significance (*p≤0.05, **p≤0.01, ***p≤0.001). OR for continuous variables represent the expected change in odds associated with a 1% increase in the predictor variable. OR for categorical variables represent the odds ratio comparing the reference category to the comparison category.

All results are from generalized logistic regression models with standard errors clustered by district. Model 1: unadjusted bivariate associations; Model 2: Adjusted for all 14 variables (school level, school charter status, school locale, school pupil-teacher ratio, school percent Hispanic students, school total enrollment, school identified student percentage, school Title I funding status, district congressional representative political affiliation, district number of schools, district percent of English language learner students, state governor political affiliation, state USDA region, years since CEP became available in state).

Table A3.1 Data source and variable type for school, district, and state-level characteristics included as independent variables

Variable Name	Data Source	Variable Type
School-Level Characteristics		
School level	National Center for Education Statistics	Categorical (elementary, middle, high, other (e.g., K-12))
Charter status	National Center for Education Statistics	Binary (charter, non-charter)
Locale	National Center for Education Statistics	Categorical (city, suburb, township, rural)
Total enrollment	National Center for Education Statistics	Categorical [small (<400), medium (400-699), large (700-999), very large (≥1000)]
Identified student percentage	Food Research & Action Center	Categorical (30-39%, 40-49%, 50-59%, 60-69%, 70-79%, 80-89%, 90-100%)
Hispanic (%)	National Center for Education Statistics	Continuous
Title I status	National Center for Education Statistics	Binary (participating; not participating)
Pupil-teacher ratio	National Center for Education Statistics	Continuous
District Characteristics		
English language learners (%)	National Center for Education Statistics	Continuous
District number of schools (Aggregate number of schools that are operational and regular)	National Center for Education Statistics	Categorical [small (≤10), medium (11-20), large (21-30), very large (>31)]
District political affiliation (political affiliation of U.S. congressional representative elected in 2016)	GovTrack	Binary (Republican or other)
State Characteristics		
State political affiliation (political affiliation of governor elected or sitting in 2016)	National Governors Association	Binary (Republican or other)

U.S. Department of Agriculture region	United States Department of Agriculture regional offices website	Categorical (Mid-Atlantic, Midwest, Mountain Plains, Northeast, Southeast, Southwest, Western)
Years since CEP became available	USDA CEP Evaluation	Continuous

Footnote: CEP, Community Eligibility Provision

CHAPTER FOUR

UNIVERSAL FREE MEALS THROUGH THE COMMUNITY ELIGIBILITY PROVISION: MARYLAND SCHOOL FOOD SERVICE PROVIDER PERSPECTIVES ON IMPLEMENTATION AND IMPACT

ABSTRACT

Since 2014, the Community Eligibility Provision (CEP) school meal funding option has enabled high-poverty schools nationwide to serve universal free breakfast and lunch. Evidence suggests that CEP has benefits for student meal participation, behavior, and academic performance. This qualitative study explores perspectives on 1) CEP implementation barriers and facilitators, 2) best practices, and 3) impacts on students and school operations, among food service staff (n=28) in CEP-participating school districts in Maryland. Identified implementation barriers, including concerns regarding CEP's impact on federal, state, and grant education funding provide insight into potential policy interventions that may promote uptake. Identified best practices, including strong communication with parents and creative strategies to boost student meal participation, can be adopted by other districts.

INTRODUCTION

Among children, food insecurity, defined as limited or uncertain access to nutritionally adequate, safe and acceptable foods[1], is associated with developmental delay and poor academic performance, including low test scores and attendance rates.[2–4] Food insecurity is also associated with a range of adverse physical and mental health outcomes.[5–9] In 2018, one in seven U.S. households with children experienced food insecurity.[1]

Two federal school-based nutrition programs through the U.S. Department of Agriculture (USDA) designed to address childhood food insecurity are the National School Lunch Program and School Breakfast Program.[10] Through these programs, nearly 30 million lunches and 15 million breakfasts are served each day at low or no cost to students.[10] Almost half of U.S. public school students qualify to receive free or reduced-price meals (FRPM) because their household incomes are below 130% or 185% of the federal poverty level, respectively.[11] Despite high rates of food insecurity among FRPM-eligible students, school meal participation among eligible students is low: in 2015, 43% of eligible students participated in school breakfast and 81% participated in school lunch.[11] Barriers to participation in school meal programs include stigma among students and challenges for parents completing meal applications due to limited English or literacy skills.[12,13]

To address these barriers, as part of the Healthy, Hunger-Free Kids Act of 2010, Congress authorized the Community Eligibility Provision (CEP).[14] High-poverty schools that opt into CEP serve universal free breakfast and lunch to all students, regardless of household income. CEP is

an alternative to the traditional USDA model of certifying students annually for FRPM based on household size and income.

Schools, groups of schools, or entire school districts can opt into CEP if their aggregate identified student percentage (ISP) is 40% or greater. The ISP is the percent of students directly certified for free meals based on existing administrative data, such as participation in the Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance to Needy Families. State education agencies conduct direct certification data matching between school enrollment lists and existing administrative databases at least once per year and are required to notify districts which schools are eligible or near-eligible for CEP each spring. Participating schools must be recertified for CEP every four years.

In CEP schools, federal meal reimbursement rates are calculated based on the ISP. The ISP multiplied by 1.6 determines the percentage of meals served that are reimbursed at the "free" rate (on average, $3.41 for lunch, $1.84 for breakfast), while the remainder of meals served are reimbursed at the lower "paid" rate (on average, $0.32 for lunch, $0.31 for breakfast).[15] For example, a school with an ISP of 62.5% would be reimbursed at the "free meal" rate for all meals served (62.5% x 1.6 = 100%), whereas a school with an ISP of 50% would be reimbursed at the "free" rate for 80% of meals served (50% x 1.6 = 80%), and at the "paid" rate for the remaining 20% of meals served. Schools with ISPs below 62.5% aim to make up the difference in federal reimbursement through reduced administrative overhead and improved meal participation, leading to greater economies of scale.

CEP was phased in over a three-year period in 10 states and the District of Columbia, and then became available nationwide beginning in School Year (SY) 2014-15. By SY 2018-19, 28,614 schools, or approximately two-thirds of eligible schools, offered CEP, serving 13.6 million children.[16] Maryland began offering CEP in SY 2013-14, the third year of the phase-in period. In Maryland, only six public schools participated in CEP in the first year it was available and 24 participated the next year. Maryland schools were hesitant to adopt CEP due to uncertainty about how it could impact state compensatory education funding: under CEP, schools no longer collect applications for FRPM, which provide data that the state has historically used to determine compensatory education funding levels for schools.[17] Maryland allocates approximately $1.3 billion annually in state compensatory education funding to schools that serve a high proportion of economically disadvantaged students.[18] To address concerns regarding potential loss of funding, in May 2015, the Maryland General Assembly enacted the Hunger-Free Schools Act of 2015, which guaranteed a minimum state compensatory education funding rate for schools participating in CEP.[19] By the following year (SY 2015-16), 198 new schools had opted into CEP, including all 183 Baltimore City Public Schools, which opted in district-wide. By SY 2019-20, 236 Maryland public schools were participating in CEP; there were 63 individually eligible schools (schools with ISPs 40% or greater) that did not participate in CEP.[20]

A growing body of literature has explored the impact of universal free meals on student health, behavior, and academic performance.[21–32] A recent synthesis of quantitative studies evaluating universal free meal programs, including CEP, found strong evidence of increased meal participation rates; limited but promising evidence of benefits for on-time grade promotion, food security, and weight outcomes; and mixed evidence of improvements in attendance and test

scores.[33] Yet nationally, one third of eligible schools have not adopted CEP [16]. Only one study to-date has qualitatively explored perceived benefits of and barriers to CEP implementation.[27] That study, published by the USDA in 2014, focused on states participating in the phase-in period and included surveys of district administrators and interviews with State Child Nutrition Agency directors. The study found that two leading barriers to implementation were lack of time during the initial implementation period for districts to learn about CEP and the uncertainty about the financial implications of CEP both for meal reimbursement and for education funding that is often allocated based on FRPM application data. While the USDA has since worked to provide guidance to eligible schools about CEP and its potential financial impacts,[34] these and other barriers may persist.

Since CEP became available nationwide in 2014, no published study has qualitatively explored its implementation. This study assesses perspectives on barriers and facilitators to CEP implementation among food service staff at schools and in districts that have adopted CEP in Maryland. The focus is on barriers to implementation that may be addressed through policy or programmatic changes, as well as best practices that can be used by other school and district administrators across the country. Findings may help guide targeted strategies by advocates, policymakers, and state education agencies to promote CEP uptake and ease implementation.

METHODS

Recruitment and Sampling

Semi-structured in-depth interviews (n=28) were conducted with food service staff in Maryland schools and districts participating in CEP stratified by two informant categories: 9 food service

directors (FSDs) at the district level and 19 cafeteria managers (CMs) at the school level. Both FSDs and CMs were interviewed in order to gain a holistic picture of CEP implementation at the administrative and school levels. In many school districts, CMs are responsible for overseeing day-to-day meal service operations, as well as inventory management and staffing for their school cafeteria. FSDs work closely with CMs to oversee the budget and strategic operations for all school cafeterias in their district, including menu planning and communication with families. In most districts, FSDs play an important role in deciding whether and how to implement CEP. Under the traditional USDA reimbursement model, FRPM applications are also typically processed centrally in the district office.

In Maryland, 12 public school districts and 240 public schools participated in CEP during SY 2018-19. A list of all CEP participating schools in SY 2018-19 was retrieved from the Maryland State Department of Education website.[20] Twelve FSDs, one from each participating district, were invited to participate in this study. A separate CM sampling frame was created with CMs from all 240 participating schools. To provide insight into how implementation potentially differed across school levels and geographies, the CM sampling frame was stratified by school level based on National Center for Education Statistics classification (elementary, middle, high, other (e.g., grades K-12) and district to create 48 mutually exclusive and exhaustive strata.[35] (Table 1) Twenty-two of these strata had no schools – for example, in four counties, only elementary schools participated in CEP, so the middle school, high school, and other school strata were empty. Using a random number generator, one CM from each of the 26 remaining strata was sampled. Between one and four CMs were interviewed per district: in districts with schools from only one stratum (e.g., only elementary schools) participating in CEP, one CM was

sampled, and in districts with schools at all four levels participating in CEP, four CMs were sampled. If a CM declined to participate or was unreachable after six attempts via email or telephone, a new CM within the same stratum was randomly selected, if available. Participants were eligible if they were ≥18 years, could speak English, and worked at a CEP-participating school or district.

The overall response rate was 76%. Three FSDs declined to participate; one cited a district policy limiting outside research and two did not provide a reason. In one district where the FSD declined to participate, researchers were asked not to contact the CMs. In the two other districts where FSDs refused, two CMs declined to participate without explicit permission from the FSD, and there were no other CMs in the same stratum to sample. In another district, two CMs were unable to be reached but were replaced by CMs in the same stratum.

Data Collection

Semi-structured in-depth interviews were conducted from July 2019 – February 2020. An interview guide was developed based on a review of the literature related to policy implementation and school nutrition. (Supplemental figure) Eight experts from across the country reviewed the interview guide for content validity. The interview guide was pilot tested for clarity and ease of administration with two FSDs at districts implementing CEP outside of Maryland and was revised based on their feedback.

CMs were asked about the process of implementing CEP at their school and factors that facilitated or hindered implementation. They were also asked about perceived consequences of

CEP implementation, including impacts on cafeteria operations, staff workload, staff morale, wasted food, student behavior, and relationships with local or regional farmers. FSDs were asked the same questions, plus questions related to why the district decided to implement CEP, who was involved in CEP decision-making, and the budgetary impacts of CEP.

Interviews occurred by phone and lasted 30-55 minutes. All participants provided informed verbal consent. Recordings were transcribed by a third party and all identifying information was redacted prior to analysis. Participants received $20 gift cards. This study was reviewed and determined to be non-human subjects research by the [BLINDED] Institutional Review Board. The Institutional Review Board for [BLINDED] also approved this study (IRB #2019-074).

Data Analysis

Data were analyzed using ATLAS.ti (version 6.0, ATLAS.ti GmbH, Berlin, Germany). Using a phronetic iterative approach,[36] the research team developed an analytic codebook composed of 8 coding families and 105 codes. Two researchers coded transcripts, meeting regularly to discuss findings and reconcile differences. After coding, data were extracted and analyzed. Relevant codes were categorized according to emergent themes, which were mapped onto the Consolidated Framework for Implementation Research.[37] This framework was selected because of its focus on identifying actionable findings to improve implementation. The framework outlines five major domains that may impact implementation: the intervention characteristics, the inner setting (i.e., features of the implementing organization), the outer setting (i.e., features of the external context or environment), characteristics of individuals involved in implementation, and the implementation process (i.e., strategies or tactics that might influence implementation).

There were no strong themes uniquely related to one domain – characteristics of individuals involved in implementation; thus, this domain was eliminated, and findings presented below are organized according to the remaining four domains.

RESULTS

Participant Characteristics

Nine FSDs and 19 CMs participated in this study, representing 10 school districts (in one district, an FSD declined to participate but CMs from the district participated) and 20 schools (one cafeteria manager served two schools). Characteristics of participating FSDs, CMs, and the districts and schools they represented are summarized in Table 2. All three districts in Maryland that had opted into CEP district-wide were represented. Nine CMs worked in schools that, in the year prior to adopting CEP, participated in Maryland Meals for Achievement, a universal free breakfast in the classroom program in Maryland that launched in 1998.[38]

Barriers and Best Practices for Implementation

FSDs and CMs discussed perceived impacts of CEP and factors that may impact ease of CEP implementation at each level of the Consolidated Framework for Implementation Research. FSDs and CMs also outlined best practices for CEP implementation. (Table 3)

Intervention Characteristics: Perceived Relative Advantages and Disadvantages of CEP

Stakeholder perceptions of the CEP program itself, including of its complexity and advantages relative to the traditional meal reimbursement model, may influence implementation.[37] This section presents FSD and CM perceptions of CEP's relative advantages and disadvantages,

including its impact on cafeteria operations, menu offerings, wasted food, student and staff morale, parental financial stress, and the broader school community.

Perceived Impact on Cafeteria Operations

Overall, attitudes toward CEP were positive across participating FSDs and CMs. Most FSDs characterized CEP as an administrative change, with few implementation challenges and little ongoing required maintenance. Most FSDs reported that the decision to adopt CEP was based primarily on financial considerations, coupled with a desire to feed hungry students. In Maryland school districts, Food and Nutrition Services operate financially independently from the rest of the district and FSDs are responsible for maintaining a balanced budget. One FSD highlighted the importance of the bottom line when considering adopting CEP:

"You know, we balance many facets of feeding kids and balancing budgets and pleasing parents and Board members and public, and health and wellness, nutrition. There's a lot of facets that you have to balance, but, at the end of the day, it is a business." – FSD 7

For adopting schools, CEP impacted both revenue (e.g., federal meal reimbursement and sales of à la carte menu items (snacks and entrees sold separately from the main meal service)) and expenditures (e.g., food, labor, and equipment costs). Most FSDs reported positive budget impacts associated with CEP participation; however, two FSDs reported losing money due to CEP. One of the FSDs who reported a financial loss explained that in their first four-year CEP cycle, they had a higher aggregate ISP, and thus a higher reimbursement level, which led to a budget surplus. The FSD went on to say that since recertifying with a lower ISP, they have run a

deficit. The second FSD who reported a loss stated that their Board of Education subsidizes their budget deficit associated with CEP participation, a cost the Board knew it would incur when it decided to adopt CEP but considered worthwhile. Districts that experienced budget gains have used that money to pay down past debts or reinvest in their program. One FSD described how their district handled its budget surplus:

"It helps to support some of the [non-CEP] schools that maybe don't do as financially well…So a lot of this extra revenue is going just to that. We're buying new ovens. We're buying new refrigeration. We're buying new serving lines, serving lines that are breaking down and falling apart. So, all that extra revenue is going right back into our program and mostly going back into our infrastructure." – FSD 3

Some financial savings associated with CEP may come from reduced administrative overhead. Most FSDs reported that CEP has decreased the amount of time they spend at the school and district levels collecting, processing, and verifying FRPM applications. Reductions in administrative burden appeared to be greater among districts that opted-in district-wide, and lower among districts in which only a small proportion of schools participate in CEP. One FSD explained how CEP reduced their administrative burden:

"We saved a lot of labor hours – not only labor hours, but postage, letters that went out…Everybody would get a [free and reduced-price meal] application in their first day at school in their folders, the kids, to take home. So, then we would have all these applications coming in, many of the applications which were duplicates because they were on the [direct

certification] list already. It's just a lot of work and reworking…Or, then, if the application wasn't complete, you would have to call people to get the information, and that was kind of hard." – FSD 6

Nearly all FSDs and CMs reported that CEP led to increased student participation in school meals, especially lunch. A few FSDs and CMs noted that gains in participation were concentrated among students who were previously eligible for reduced-price meals or with household incomes at the borderline for FRPM eligibility.

"I would say that our participation probably jumped up about 10 percentage points, because more reduced kids and full-pay kids that maybe didn't buy lunch decided, 'Well, I'll get a lunch if it's free.' …It was a bit of a savings for them at home." – FSD 3

Notably, however, most CMs at schools that were previously participating in the Maryland Meals for Achievement universal free breakfast in the classroom program reported small or no gains in breakfast participation. Additionally, several CMs in schools that had very high meal participation rates prior to CEP adoption reported small or no gains in meal participation. One CM at a school that offered meals prepared off-site noted that their school did not experience a change in participation, which the CM attributed to students "hating" the school food.

Most CMs reported their total workload had stayed the same or decreased due to CEP. Many CMs reported that CEP streamlined their interactions with students at the point-of-service by removing the need to collect and process cash payments and eliminated the need to call or send

letters home to parents of students with unpaid meal debt. A small number of CMs, however, reported that because CEP increased the total number of students participating in school meals, their staff experienced an increase in total workload associated with preparing more meals. With a few exceptions, most of these CMs added that staffing increased correspondingly (either by hiring new employees or transitioning part-time staff to full-time) to accommodate the increased meal participation rates:

"I guess the workload really hasn't changed. Obviously, with feeding more students a day, obviously, we're putting out more food, but [the district is] really good about staffing. At no point do we ever feel understaffed." – CM 17

Even considering the increases in student meal participation, about half of FSDs and CMs reported that the lunch line moved faster because cafeteria staff no longer needed to process payments. Some schools switched from requiring students to enter PINs to using a simple headcount to track the total number of students participating in meals; CMs at these schools more frequently reported faster line flow:

"The line moves a lot faster because when before they had to put the [PIN] numbers in, the little ones, the second-grade kids, a lot of time they don't remember their number. They had to struggle, stay there and think about it.…So this kind of time really hold[s up] the other kids. It's not fair for other kids… [now] kids got more time to eat. They can go faster." – CM 20

Districts that continue to use PINs explained that they did so in order to track students with allergies or to maintain the habit of entering PINs, in case a student transfers or advances to another school in the district without CEP. Only one FSD reported slower lines due to increased student participation; that FSD's district continued to use PINs at the point-of-service.

Perceived Impact on Menu Offerings and Wasted Food

With a few notable exceptions, most FSDs and CMs did not report a change due to CEP to the healthfulness of the menu, the types of foods that students were served and ate, or the purchasing relationship schools had with local and regional farmers. In most districts, menus are set at the district level, leaving CMs in CEP schools little flexibility to customize the menu. Two CMs, however, reported that with the introduction of breakfast in the classroom and grab-and-go breakfast service (changes that were implemented to increase participation), their schools began to serve more packaged and processed foods, which they perceived to be easier to distribute, but often less healthy. On the other hand, one FSD reported an increase in the total volume of fruits and vegetables they were able to purchase from local farmers due to increased student meal participation. Another FSD reported that due to increased revenue associated with CEP, they were able to offer healthier items that were previously too expensive.

While most FSDs and CMs reported no difference in the perceived amount of food that students wasted following adoption of CEP, there were both reports of positive and negative changes from a small number of participants. One FSD reported less wasted food in their district because students had more time to eat, while another FSD reported an increase in total waste produced due to higher meal participation, but no change in per-student waste. A CM reported that the

switch to offering breakfast in the classroom, which was made to increase participation rates after CEP adoption, led to an increase in food waste. That CM explained that perishable food that is sent to classrooms but not consumed must be discarded because it has been left at room temperature and may be spoiled (as opposed to if the meal had been served in the cafeteria, where it might have been temperature-controlled):

"When delivering the breakfasts in the morning, we have to send out enough breakfasts to cover for every student who is enrolled in the school, but each day there are…[some students who do not eat the school breakfast, and their] meals are having to go into the waste bin, because we can't take them back in and keep them, and then reuse them after just sending them out. So, I think that creates some more waste as well." – CM 17

Perceived Impact on Student and Staff Morale

Most FSDs and CMs considered the greatest benefit of CEP to be that it enabled them to feed more children. Nearly all CMs expressed gratitude that CEP had eliminated meal payment and debt, which can be stressful for parents and children alike, particularly for those with household incomes at the borderline between free and reduced-price eligibility. Most CMs described how, before CEP, they regularly encountered children whose parents had forgotten to fill out the FRPM application form or could not afford to put money into their accounts. Prior to CEP, most schools had policies that allowed students without money in their accounts to charge up to a certain number of meals, and then were required to serve students with unpaid meal debt an alternative to the hot meal such as a cheese sandwich. A few FSDs reported that a desire to eliminate this practice of providing students alternative meals, known as "meal shaming," was

one of the driving factors that led their district to adopt CEP, and several FSDs and CMs reported that eliminating meal shaming had boosted both staff and student morale:

"Since we had this program, the kids are very happy. We're happy too because we won't be hearing the kids say, 'I don't have no money and can't pay my lunch. My dad don't have no job. Ma don't have no income. My house no food.'…The kids really like coming to school because they say, 'We come to school, I won't be hungry.'" – CM 20

"I think it has been positive for [cafeteria staff]. I think that no one likes to be put in a position when you're taking meals away from students. I think that's pretty demoralizing as a worker. And I don't think people want to do that." – FSD 5

A small number of FSDs and CMs noted that CEP led to an improvement in student behavior and health. One FSD said that a school administrator had reported that he had received fewer student complaints of headaches related to hunger since the introduction of CEP. A few FSDs and CMs also reported a decrease in stigma associated with participation in school meals. Several CMs remarked that students from low-income households appeared less embarrassed when moving through the lunch line:

"I'm just glad…all of the students is on the same level that they can come in and don't feel embarrassed about getting a free lunch…it's nothing to them now. You don't have to hear nobody in line discussing, well, 'I don't have my money.' Or, you know, 'Can you loan me this?'…It feels good." – CM 12

"When the kids do come through, it probably is better because the kid in front of them doesn't know if they got a free lunch and this kid was paying. So, I think it stopped some bullying and not getting kids picked on." – CM 18

Perceived Impact on Parents and Broader School Community

Several FSDs and CMs reported receiving strong community support for CEP and positive feedback from parents, teachers, and administrators. Many CMs described speaking with parents who were relieved that they no longer had to complete FRPM application forms or pay for student meals. One CM drew attention to how CEP helped circumvent the literacy and language barriers that prevent parents of income-eligible children from completing FRPM applications. Several CMs also noted that students were often from very low-income families, and that eliminating payment cut down on stress for parents making hard trade-offs between paying for school meals and other bills:

"I had parents stop me in, like, the grocery store and be like, "Hey, thanks for getting free lunch for my kid,"…So, the parents loved it; the students love it. Administration really liked it…It's just-- it's made life easier for everyone. Community, administration, teachers, my staff and I." - CM 19

Inner Setting: School and District Implementation Climate

Characteristics and climate of adopting schools and districts can determine implementation success.[37] This section presents perceptions among FSDs and CMs regarding how engagement

from leadership and the resources and practices that were in place prior to CEP influenced implementation.

Leadership Engagement

In all districts, FSDs took responsibility for leading the charge to adopt CEP, a role that typically included researching the financial implications of adoption and persuading other decision-makers. Across districts, FSDs had varying levels of autonomy regarding CEP adoption. In a small number of districts, the FSD held ultimate decision-making power regarding adoption. In most cases, however, FSDs shared decision-making power with the district superintendent or financial officers, or final decision-making power rested with the Board of Education. In districts in which the FSD did not hold primary decision-making power, FSDs emphasized the importance of being well-prepared to answer questions about the potential financial ramifications of CEP, including impacts on state and federal education funding. One FSD described the adoption process in their district:

"I think the biggest challenge came before implementing CEP, because it was fairly new. And a lot of it was trying to get people in other departments to buy into it. There was a lot of concerns about Title I…[and] how were they going to retrieve [free and reduce-price meal] data that they needed for grants and stuff." – FSD 6

Only one CM reported being consulted in the decision to adopt CEP in their school; the rest learned of the program only once the decision had been finalized. FSDs pointed to other

champions, including principals, who helped encourage expansion of CEP into new schools. One FSD explained how principals throughout their district were pushing for CEP in their schools:

"[Principals of] schools that didn't have CEP were approaching me and saying, 'Do I qualify for CEP? If I qualify for CEP, I want to be in CEP'…They were advocating on their own. One of the reasons why they were advocating is because they saw the importance of every child eating for free. They saw the issue with not having to deal with negative balances and not having to deal with free and reduced applications." – FSD 1

Other potential champions, such as vice principals, teachers, parent associations, and school nurses were not mentioned by any FSDs.

Existing Internal Resources and Practices

Most FSDs and CMs reported having sufficient equipment, space, and staff to accommodate increased student meal participation. Some CMs hired more staff or increased labor hours for existing staff to handle the increased participation. A small number of schools also made changes to equipment, including replacing outdated ovens and refrigerators and adding new serving lines and milk coolers. No CMs or FSDs mentioned cafeteria seating capacity constraints as an issue; several noted that their cafeterias were built to provide seating for students who previously packed their lunch. Some FSDs reported taking each school's equipment and kitchen capacity into consideration when deciding which schools to include in CEP adoption. One FSD described waiting to make changes to staffing and equipment until they could see how CEP impacted meal participation rates:

"That was one of my fears, to be honest with you, was just as far as [kitchen] space, whether it be dry storage or, I mean, more so, refrigeration and freezer. But it hasn't been an issue…We were waiting to see what the impact was going to be, you know. I didn't want to make any drastic changes prior to. And unfortunately,…for some of those schools, the space is what it is. Some of those kitchens are very small, and there's not a whole lot more you can do." – FSD 8

CMs at schools that were previously participating in Maryland Meals for Achievement often reported having an easier time with implementation of CEP because they were already accustomed to serving universal free breakfast. Similarly, schools that had high proportion of students eligible for FRPM prior to CEP often described implementation as straightforward, with only minor changes in participation rates:

"It was fairly easy. It wasn't any trouble…We had been doing the [universal free] breakfast meals, so it wasn't that hard, and the majority of my students anyway, they were already free, so it wasn't difficult for me." – CM 6

Outer Setting: Funding and External Resources

The external context, including federal and state policies and the political climate outside of implementing schools and districts, may influence CEP implementation.[37] This section describes how policies that impact education funding and reimbursement rates influence implementation decisions, and highlights the external resources that FSDs and CMs used to support themselves through the implementation process.

Federal, State and Grant Education Funding

All FSDs described concerns, both resolved and ongoing, among school and district administrators regarding how CEP may impact federal, state, and grant education funding. Schools participating in CEP no longer collect FRPM applications data, which previously served as the basis for allocating federal funding through Title I of the Elementary and Secondary Education Act (financial support for academic programming in schools with a high percentage of low-income families[39]). FRPM data were also used to determine state compensatory education funding and some grant funding (for example, for student loan forgiveness programs for teachers).

FSDs reported that the fear that CEP adoption would negatively impact their state compensatory education funding was a key barrier that prevented them from adopting CEP earlier. Most FSDs reported that their districts only felt comfortable adopting CEP after Maryland passed the Hunger-Free Schools Act of 2015, which fixed state compensatory education funding rates for CEP schools and thereby alleviated this concern.

Similarly, most FSDs reported that administrators in their districts were hesitant to adopt CEP due to concerns about its potential impact on Title I funding. Title I funding is allocated to school districts based on U.S. Census poverty data; therefore, the amount of federal funding each district receives is not influenced by CEP participation. However, districts must then distribute the funds to individual schools, a process that is often done based on FRPM data. A few FSDs said that after switching from using FRPM data to using ISP data to allocate funds in their district, some schools reported experiencing a disproportionate loss of Title I funding. For

example, schools with a higher proportion of low-income families that are not participating in SNAP and other federal programs (e.g., immigrant families) often have lower ISPs and may experience a disproportionate change in the amount of Title I funding they receive. One FSD explained:

"[Collecting free and reduced-price meal applications] is an incredibly important data collection process for the district in terms of garnering resources for things that are outside school meals…So what happened with Title I is…we found that many of our schools that were high English language learner were dropping out of Title I at a disproportionate rate. And these students were not being counted, simply because those families are less likely to be on SNAP. This has obviously gotten worse as the years have gone by." – FSD 5

Some FSDs explained that principals whose schools had experienced reduced Title I funding continue to raise concerns about the loss of FRPM application data. One FSD also highlighted that loss of FRPM application data also presents a challenge for schools and teachers applying for external grants, which often use FRPM data as a proxy for poverty.

Schools that participate in CEP are prohibited from using USDA funds to cover the administrative costs associated with collecting and processing FRPM applications. CEP schools may collect alternate income forms using other district funds, however, and a small number of FSDs reported that they currently collect these alternative income forms or plan to do so. One FSD explained that their district plans to use alternative income data to monitor the proportion of

FRPM-eligible students that are captured by the ISP, as well as to report school-level poverty rates on funding applications:

"This school year coming, we are going to ask those CEP schools, even though they're on CEP…we're gonna ask those parents to fill out free and reduced applications, because we wanna get an accurate to-date picture of where we stand in those communities, and that's more for the compensatory education funding…So, we are gonna ask folks to fill out an application, full well knowing that it's not gonna have any effect on whether or not their kid is gonna get a free meal. We just wanna collect it for the purposes of having data." – FSD 3

Reimbursement rates

Most FSDs explained that a school's ISP, which determines the rate at which it is reimbursed for meals served, was the most important criterion they considered when deciding which schools in their district would participate in CEP. Most FSDs were concerned about their ability to continue to participate in CEP due to dropping ISPs (and thus, reimbursement), and a few had already removed some schools within their districts from the CEP program or planned to in the upcoming year. FSDs attributed falling ISPs to declining national participation in SNAP and other federal assistance programs (i.e., programs from which data is drawn to calculate ISPs) associated with economic growth and increased employment at the time of study. Several FSDs also mentioned these changes may also be driven by federal policy changes that have limited participation in federal programs and a political climate in which immigrants are concerned that federal program participation may jeopardize their immigration status.

External Resources

FSDs described using a range of resources to guide them through the CEP implementation process. Most FSDs reported that the support they received from the Maryland State Department of Education was especially valuable. Several FSDs described conversations with the Maryland State Department of Education staff that helped them work through the logistics of CEP implementation and its financial implications. Only one FSD reported challenges working with the Maryland State Department of Education; they described encountering administrative obstacles when working with agency staff on CEP and other programs.

A few FSDs also used resources created by the USDA and Food Research & Action Center, including fact sheets, webinars, and a customizable calculator to estimate the financial impact of CEP on meal reimbursement. FSDs also reported drawing on support from FSDs in other adopting districts in Maryland and neighboring states. A handful of FSDs of smaller districts described waiting for other districts in the state to implement first so they could learn from their experiences:

"We kind of let other counties figure that out so that we didn't have to be the guinea pig…We saw them figuring out how to make things work. We also saw the legislature understanding what's going on and trying to adapt the regulations – Maryland regulations – to help allow the program to operate easier with less loss of income. So, it was really just watching them and then trying to utilize what they had already started." – FSD 2

Implementation Process: Implementation Strategies

This section presents strategies that FSDs and CMs highlighted as key to successful CEP implementation: using innovative approaches to boost school meal participation; communicating clearly and early with relevant stakeholders; launching CEP as a pilot in a small number of schools; and taking proactive steps to prepare for increased meal participation. (Table 3)

First, FSDs and CMs described using diverse strategies to grow participation in the meal program. High meal participation rates, particularly among schools whose ISPs are below 62.5% (and thus not reimbursed for all meals served at the free rate), is often critical to achieving adequate economies of scale to remain financially solvent. A small number of FSDs and CMs reported shifting their meal service delivery style to encourage increased participation, including offering breakfast in the classroom and grab-and-go meal options. Others described working to draw in more students through improvements to the menu; identifying favorite dishes through focus groups and taste tests; offering more fruits and vegetables; and offering more hot meal options. A few FSDs and CMs also reported increasing participation in the main meal by eliminating à la carte sales or only allowing à la carte sales after all students had been served the main meal. One CM described seasonally decorating the carts on which breakfast meals were delivered to the classroom to get students excited as well as offering pizza parties in the classroom to draw in new students:

"We said, hey, why don't we [offer pizza parties], since we can basically treat every student to a slice of pizza and a meal, and this exposes those other kids who are still packing for whatever reason…Maybe a little bit of extra work goes into that. But I feel like it pays dividends in the

long run for many reasons, like I said, not just the participation issue but making sure that those students, you know, are aware that maybe school lunch isn't quite so bad." – CM 7

Second, FSDs emphasized the importance of good communication with school administrators, parents, and the broader community. A small number of FSDs and CMs reported that parents were confused about how CEP functioned, particularly when they had children who transferred or advanced from a CEP school to a non-CEP school within the district, or when siblings attended schools with and without CEP. Schools participating in CEP are no longer required to collect FRPM applications from students, yet one FSD described misunderstandings among school administrative staff about whether students were required to complete FRPM applications, which may have contributed to confusion among parents.

CMs largely reported that they did not engage in communication with parents about CEP (except when asked directly or when confused parents tried to send in money to pay for their child's meals), but rather left communication to FSDs and school principals. FSDs described using a range of channels to communicate with parents about CEP, including the school website, newsletters, robocalls, media coverage, signs throughout the school, emails and letters, social media, and announcements at Back-to-School nights. One FSD explained the importance of good communication:

"It's all about the communication. It's going to be about not just the Food and Nutrition communication [and] buy in, [but also] the school administration [and] the community buy in.

All of that together, that's what's going to make it successful. [Without] everybody working together and understanding that end goal and that purpose, it's not going to work." – FSD 4

One FSD described also taking parental confusion into account when selecting which schools in the district would adopt CEP; in their district, they adopted CEP in schools that were linked feeder schools (i.e., offering CEP in an elementary school and the middle school into which the elementary school fed). Most FSDs and CMs noted that parental confusion decreased over time as the community came to understand the program better.

A few FSDs recommended implementing CEP in a small number of schools at first, monitoring the impact on budget and meal participation rates, and then expanding the program to other schools in the district. One FSD explained that it was easier to sell CEP to their Board of Education as a pilot program:

"We presented the CEP Provision to our Board of Education as a pilot program.…And then, each year after that, we started bringing more schools into the program that we could successfully pull off CEP… the pilot piece came in as a test to make sure that we could pull off the program and that it would not be an impact to other departments in the school district, such as our Title I department and our finance department when it came to [state compensatory education] funding." – FSD 1

Finally, several CMs described a short adjustment period when CEP was first introduced during which they constantly monitored food inventory and staffing to ensure they were meeting the

increased demand for school meals. CMs explained the importance of ordering enough food in the first few weeks to serve the entire student body and then recalibrating their orders to more accurately meet the demand after a few weeks. Most CMs had been in their role for many years and felt confident in their ability to successfully navigate these changes:

"Be prepared, because you don't know how many [are] going to eat, and make sure you order plenty at the beginning. For say, three to four weeks, you go through a cycle…You got to have that extra food. And if you got that, you're fine." – CM 2

DISCUSSION

Overall, FSDs and CMs reported positive perceptions of CEP implementation and highlighted several benefits of CEP, including its potential to increase meal participation, reduce student stigma, alleviate financial stress among parents, and boost staff morale. Though FSDs and CMs provided mixed reports about the impact of CEP on their overall budget, line flow, and workload, all expressed gratitude for CEP and a desire to continue participating in future years. FSDs and CMs also described several best practices that can be adapted by other districts and schools.

Perceptions regarding the ease of CEP implementation and the degree to which CEP affected key outcomes appeared to differ, in part, based on district and school characteristics. Districts and schools that were previously participating in the Maryland Meals for Achievement universal free breakfast in the classroom program or that had a large proportion of students previously receiving FRPM often described CEP implementation as easier than others, but also saw less

dramatic shifts in outcomes such as meal participation rates. Districts that opted into CEP district-wide also found implementation easier and saw greater benefits, including reductions in the administrative work associated with processing meal applications. FSD and CM perceptions were highly complementary, with no instances in which most CMs felt one way and most FSDs another, suggesting that, by-and-large, FSDs have a clear picture of the relevant day-to-day operations within schools.

Perceptions among some FSDs and CMs that CEP produced improvements in student behavior, decreased stigma, and fewer instances of bullying are supported by emerging quantitative research indicating that CEP adoption may lead to fewer disciplinary referrals.[25,26] Reports of financial impacts of CEP on food service budgets differed across districts; quantitative research is needed to measure the impacts of CEP on districts' budgets. Analyses should consider changes in food service operational costs and revenue, as well as federal, state, and grant education funding, and the degree to which these impacts differ based on school and district characteristics.

Among schools with ISPs below 62.5%, maintaining high meal participation rates is critical to making CEP financially feasible. Some of the strategies that FSDs and CMs described as successful in growing meal participation rates, however, may have negative unintended consequences for student health and nutrition. For example, while research does show that breakfast in the classroom is associated with increased meal participation, there is mixed evidence regarding the impact of breakfast in the classroom on diet quality and obesity.[40–43] Food service staff at CEP-participating schools seeking to grow meal participation rates should weigh potential nutritional impacts.

Implications for Policy and Practice

FSDs and CMs highlighted barriers and facilitators to implementation at each level of the Consolidated Framework for Implementation Research, providing insight into potential policy and programmatic interventions that may promote CEP uptake. First, among the chief barriers to CEP adoption cited by FSDs were concerns regarding the financial impacts of CEP on federal, state, and grant funding. This barrier was also identified in the USDA report assessing implementation during the initial rollout of CEP;[27] the current study provides evidence that this barrier persists despite USDA guidance issued in the intervening years that outlines alternate strategies districts can use to allocate Title I funding.[34] Indeed, some districts in this study were already collecting, or were considering plans to collect alternate income forms to document FRPM eligibility, an administrative undertaking that requires considerable time and money, and which CEP was designed to eliminate. Schools using alternative income forms may also be unable to gather complete and reliable information because parents have less incentive to complete the form since it does not directly affect their child's ability to receive school meals. To alleviate concerns about loss of FRPM data, USDA, state education agencies, and anti-hunger advocates should consider new strategies to strengthen and clarify messaging about CEP's impact on Title I funding. Given FSDs reports that the state education agency and FSDs from other districts served as key resources during the implementation process, using these messengers to educate FSDs and other administrators at prospective CEP schools about financial implications may help promote uptake. Grant funders should also consider using alternate measures of poverty in place of FRPM eligibility data such as ISP or composite measures using multiple types of poverty data.[44]

Second, most FSDs reported feeling comfortable adopting CEP only after Maryland passed legislation that protects CEP schools from a decline in their state compensatory education funding rate. In other states with low CEP adoption rates, anti-hunger advocates and policymakers should explore if similar state-level legislative changes may also encourage participation among late adopters. Laws used in other states to promote CEP adoption, such as California's SB 138, which requires schools with ISPs above 62.5% to participate in a universal free meal provision and to use Medicaid data to directly certify students, could also be considered to promote uptake.[45]

Finally, this study found that declining ISPs were of major concern to districts considering recertifying for an additional four-year cycle of CEP or adding new schools to CEP. Due to rising rates in unemployment and increased participation in federal benefit programs associated with the COVID-19 pandemic, however, ISP are expected to rise in SY 2020-21.[46] As a result, some schools will be newly eligible for CEP and, for others, CEP will become more financially favorable. Importantly, however, ISPs declines during the study period may have been attributable in part to policies that make it more challenging for income-eligible families to enroll in public benefit programs (for example, the Categorical Eligibility for SNAP proposed rule[47]) or promote fear that participation in these programs will negatively affect immigration status (for example, the revised Inadmissible on Public Charge Grounds final rule[48]). These policies should be revised to avoid negative impacts on school meal access. Improvements to direct certification systems that identify students as categorically eligible for free meals are also warranted nationwide to ensure ISPs accurately reflect student need; in SY 2016-17, states failed to certify

an average of 8% of children directly eligible for free meals[49]. Additionally, 19 states are authorized by USDA to use income data available in Medicaid administrative records in their direct certification systems; research suggests that extending this practice to other states, including Maryland, may increase ISPs and better reflect poverty levels in different communities[50].

Limitations

This study has some limitations. First, nearly one quarter of contacted FSDs and CMs declined to participate in this study. While the FSDs and CMS that declined to participate in the study represent schools and districts that are demographically similar to participants, those that declined may be different in unobservable ways. This study is strengthened by inclusion of perspectives from FSDs and CMs representing ten of the twelve CEP-participating districts in Maryland, and a range of geographies, school levels (elementary, middle, high, and other), and number of years participating in CEP. Second, this study only included districts and schools that were participating in CEP in SY 2018-19. Future research should consider the perspectives of those districts or schools that are eligible for CEP but not participating, as well schools that previously participated in CEP but have since opted out of the program.

CONCLUSIONS

This study is the first since nationwide rollout of CEP to qualitatively explore implementation in schools and the only study to include perspectives from both FSDs and CMs, who provide unique insight into CEP implementation at the school and district levels. Barriers to CEP implementation identified in this study, including concerns regarding CEP's impact on federal,

state, and grant funding, and declining ISP rates provide insight into policy interventions that may promote uptake. Best practices for implementation identified in this study, including strong communication with parents, creative strategies to boost student meal participation, and elimination of PINs to streamline flow through the lunch line, can be adapted by other districts. Strategies to grow meal participation should, however, be designed with potential impacts on nutrition and health in mind. Finally, this study adds depth and nuance to the growing body of quantitative literature that has documented the benefits of CEP for student health, learning, and behavior.[33] Considering the potential benefits of CEP, policymakers, advocates, and state education agencies should use results from this study to better support successful implementation in schools that have adopted CEP and design strategies to encourage adoption among the remaining one third of schools nationally that are eligible for CEP but have not yet opted in.

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FIGURES

Figure 4.1. Food service director and cafeteria manager in-depth interview guide

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GUIDE FOR IN-DEPTH INTERVIEWS

Interviewer: The questions I am going to ask you today are about the Community Eligibility Provision, the provision of the National School Lunch and School Breakfast Programs that allows school systems/schools like yours to serve universal free meals to all students. Your school/school system participates in the Community Eligibility Provision. Because of the Provision, all students at participating schools receive school meals for free without having to turn in any forms to prove their income.

Introductory Questions:

1. What is your current role in your school/school system?

2. How long have you worked in your current role? In this school system?

3. Your school/school system has been offering universal free breakfast and lunch through the Community Eligibility Provision since [X year]. Did your school/school system offer universal free breakfast or lunch to students through a different program before that? (for example, Maryland Meals for Achievement)

4. [FSD only] Do all of the schools in your school system participate in the Community Eligibility Provision?

    a. If no, why not? If no, how did your school system decide which schools would adopt CEP?

    b. If your school system phased in CEP, how did you decide which schools would adopt first?

5. [FSD only] Tell me about the process of deciding to adopt the Community Eligibility Provision in your school system. Who was involved in making that decision? What factors did you consider when deciding to adopt CEP?

6. [CM only] How did you first learn that your school was considering making the switch to CEP? Were you consulted about the decision? What did you think of the decision?

7. I am interested in understanding how you felt about how the switch to offering universal free meals. Can you tell me what you think about how the switch to universal free meals went?

Facilitators and Barriers:

1. Can you tell me about any factors that have helped or made it easier for your school/school system to make the switch to offering universal free meals? To operate the program now? (e.g., champions, positive budget impacts)

2. Was there anyone in your school/school system that championed, or pushed, the change to universal free meals?
    a. If yes, what did that champion do?

3. Can you tell me about any challenges your school/school system faced in making the switch to offering universal free meals, if any?

4. Are there any ongoing issues your school/school system faces in serving universal free meals? (e.g., community buy-in, student participation)

5. How, if at all, did you communicate with parents and students about the switch to universal free meals?

6. [FSD only] Can you comment on any schools in your school system that had a harder or easier time than others making the switch to offering universal free meals? What do you think has made it harder or easier for some schools than others?

7. Can you tell me about the feedback you've received about the switch to universal free meals, if any, from people in your community such as parents, students, teachers, principals? *[Prompt: Has there been any confusion?]*

Operational Impacts

1. What impact has offering universal free meals had on the total number of students participating in breakfast? Lunch? An estimate is ok.

2. [If they experienced an increase in meal participation] Did your school/school system have the resources such as staff, cafeteria space, and equipment to handle more students participating in the school meals?

    a. If no, how have you addressed these resource limitations?

3. [FSD only] How, if at all, has the switch to universal free meals affected the administrative work required to operate the school meals program?

4. [CM only] When your school first started offering universal free meals, before you knew what the impact might be on your participation rates, what steps, if any, did you take to prepare and get ready for the switch? *[Prompt: How did you think about decisions like how much food to order and how many staff to have working in the first few weeks?]*

5. What did food service staff at your school/school system think about the change to offering universal free meals? What do they think now?
    a. What impact has offering universal free meals had on your food service staff? (e.g., workload, attitudes, cohesion)

6. [FSD only] In what ways has the switch to universal free meals impacted your overall school system budget? *[Prompt: i.e., through changes in participation rates, staffing needs, reimbursement, snack sales]*
    a. If positively, how has your school system used the increased revenue?

    b. If negatively, how has your school system compensated for the decreased revenue?

c. If no change, how did you maintain your budget with the change in the reimbursement structure?

d. What impact has offering universal free meals had on your snacks sales?

e. What impact has the switch had on your unpaid meal debt? Have you changed any of your practices as a result? (e.g., giving students a different meal who could not pay?)

7. How has the universal free meals program affected meal service operations at your school/school system?
    a. What changes, if any, have you made to your meal counting process? (e.g., headcount, point-of-service) Why did you chose to use this process?

    b. What impact has offering universal free meals had on the way that students move through the cafeteria line? On the amount of time they have to eat?

    c. What changes, if any, has your school system made to the way in which breakfast and lunch are served (e.g., breakfast in the classroom, grab and go) because of the switch to universal free meals?

    d. What changes, if any, has your school system made to types of food you serve because of the switch to universal free meals?

    e. What impact has offering universal free meals had on the amount of food each student eats? The healthfulness of the foods they eat?

    f. In your opinion, what impact, if any, has offering universal free meals had on student attitudes or behavior?

8. What changes, if any, have you noticed in the amount of food discarded each day since your school/school system began offering universal free meals? *[Prompt: have the number of bags of trash you collect daily changed?]*
    a. If yes, how? Why do you think this has changed?

9. Does your school/school system have relationships with any local or regional farmers?
    a. If yes, what impact has offering universal free meals had on your school/school system's ability to purchase from local or regional farmers?

10. [CM only] What strategies, if any, have you used to try to increase participation in your meal program because of the switch to the universal free meals program?

Other School Concerns

1. [FSD only] To your knowledge, has the switch to universal free meals impacted Title 1 distributions to schools in your school system?

2. Some schools use their free and reduced-price meal applications to certify students to receive other education benefits such as such as discounted prom tickets or yearbooks. To your knowledge, have administrators at your school/school system raised concerns about the impact of not collecting free and reduced-price meal applications on their ability to administer these benefits?

3. [FSD only] School systems need to re-apply to participate in the Community Eligibility Provision every four years. Does your school system plan to re-apply? Why or why not?
    a. If yes, what challenges, if any, do you foresee with the process of re-applying?

4. [FSD only] Can you comment on changes, if any, you've seen to your ISP, or the number of students categorically eligible for school meals since you first opted in? How often do you preform direct certification match searches?

Closing:

1. Do you have any advice for other schools/school systems considering making the switch to universal free meals?

2. Which resources, if any, have you or schools in your school system used to guide you in the switch to offering universal free meals? (e.g., websites, toolkits, advocates, groups) Are there any other resources you would have liked to have to guide you?

3. Is there anything else you would like to share with me regarding how the universal meal program has been rolled out at your school/school system?

TABLES

Table 4.1 Participating food service directors and cafeteria managers by district and school level (n=28)

District (n= CEP participating schools)	**Food Service Director**	**Elementary Cafeteria Manager**	**Middle Cafeteria Manager**	**High Cafeteria Manager**	**Other Cafeteria Manager**
County A	✓	✓	N/A	N/A	N/A
County B	✓	✓	✓	✓	✓
County C	X	X	X	X	X
County D	✓	✓	N/A	N/A	N/A
County E	✓	✓	✓	✓	N/A
County F	✓	✓	✓	✓	N/A
County G	✓	N/A	N/A	N/A	✓
County H	X	✓	X	N/A	N/A
County I	✓	✓	N/A	N/A	N/A
County J	X	✓	X	✓	N/A
County K	✓	✓	N/A	N/A	✓
County L	✓	✓	N/A	N/A	N/A
Total participating	**9**	**10**	**3**	**4**	**3**

Footnotes: Check mark indicates a participant from the stratum participated in the study. X indicates no participant in the stratum participated in the study. N/A indicates there was no school within the stratum to sample. A total of 19 cafeteria managers were interviewed representing 20 schools (one cafeteria manager served two schools).

Table 4.2. Characteristics of participating food service directors and cafeteria managers (n=28) and the districts and schools they represent

Food service director (n=9)	**Mean (Range)**
Years in current role	7.9 (2-21)
Years in school food service	11.8 (5-21)
Districts represented (n=10)[a]	**Mean (Range)**
Years since first school adopted Community Eligibility Provision	4.7 (2-7)
	N
District-wide adoption	3
Cafeteria manager (n=19)	**Mean (Range)**
Years in current role	10.3 (1-27)
Years in school food service	16.3 (1-36)
Schools represented (n=20)[b]	**Mean (Range)**
Years since adopted Community Eligibility Provision	5 (2-7)
	N
School level	
Elementary	10
Middle	3
High	4
Other	3
Maryland Meals for Achievement participant prior to adoption of Community Eligibility Provision[c]	9
Funded through Title I[d]	13
Charter	1
Locale[e]	
Urban	10
Suburban	3
Town	4
Rural	3

Footnotes: a. Ten districts were represented in this study. In one district, the FSD declined to participate, but two CMs participated. b. A total of 19 cafeteria managers were interviewed representing 20 schools (one cafeteria manager served two schools). c. Maryland Meals for Achievement is a universal free breakfast in the classroom program in Maryland that pre-dated the Community Eligibility Provision. d. Title I of the Elementary and Secondary Education Act provides financial support for academic programming in schools with a high percentage of low-income families. e. Locale is classified according to the National Center for Education Statistics designation.

Table 4.3. Cafeteria manager and food service director (n=28) recommendations for Community Eligibility Provision (CEP) implementation best practices

When considering adopting CEP
Adopt the CEP district-wide, if possible, even if the district-aggregate identified student percentage will not yield reimbursement for all meals at the "free" rate, as savings in administrative overhead and economies of scale may make district-wide adoption financially feasible.
If district-wide adoption is not possible, pilot the CEP in a small number of schools and closely monitor the financial impacts.
Adopt the CEP in schools that feed into one another to reduce parental confusion by ensuring that siblings are in schools with the same CEP status, and that students in participating elementary or middle schools advance to participating middle or high schools, respectively.
Use resources such as food service directors in other districts and administrators at the state education agency, as well as online resources from U.S. Department of Agriculture and the Food Research & Action Center.
Once the decision to adopt CEP has been made
Communicate clearly with parents, administrators, and the broader community to reduce confusion and generate buy-in.
In the first few weeks after the CEP is introduced, order extra food and monitor participation closely; adjust ordering and staffing accordingly.
Boost student participation using innovative strategies such as improved menus and classroom pizza parties while weighing potential impacts on health and nutrition.
Eliminate PINs and switch to a headcount process, which may lead to faster lines and more time for children to eat.

CHAPTER FIVE

IMPACT OF UNIVERSAL FREE MEALS THROUGH THE COMMUNITY ELIGIBILITY PROVISION ON STUDENT NUTRITION, BEHAVIOR, AND ACADEMIC PERFORMANCE IN MARYLAND

ABSTRACT

Importance: The Community Eligibility Provision (CEP) enables high-poverty schools participating in U.S. Department of Agriculture meal programs to serve free breakfast and lunch to all students regardless of household income. To date, little research has measured CEP's impact on student nutrition, behavior, or academic outcomes.

Objective: To estimate the relationship between CEP adoption and school breakfast and lunch participation, and secondarily, student behavior and academic performance, four years after CEP adoption.

Design: Quasi-experimental design using a comparative interrupted time series analysis to compare CEP participating schools to eligible and near-eligible nonparticipating schools using data from five years pre-implementation (2011-15) and four years post-implementation (2016-19). Mixed-effects linear regression models adjusted for school-level covariates and baseline outcomes. A Benjamini-Hochberg procedure corrected for multiple tests.

Setting: Maryland public schools

Participants: Schools that adopted CEP in 2015 (intervention schools) compared to eligible and near-eligible nonparticipating schools (comparison schools). Sensitivity analyses excluded Baltimore City and near-eligible schools.

Exposure: Adoption of CEP, a universal free school meal provision

Main Outcome(s) and Measure(s): Primary outcomes: change in breakfast participation and lunch participation. Secondary outcomes: change in total disciplinary referrals; disciplinary referrals associated with bullying/harassment; math, science and reading test scores; attendance, absenteeism (absent more than 20 school days); grade promotion; graduation; and dropout. All outcomes were assessed separately by school level (elementary, middle, high school).

Results: Final sample included 333 comparison schools and 188 intervention schools. Relative to comparison schools, breakfast participation increased in intervention elementary (+19.2%, 95% CI: 15.3, 23.1) and middle schools (+20.7%, 95% CI: 13.3, 28.1) but not high schools. Lunch participation increased in intervention elementary (+6.4%, 95% CI: 4.4, 8.3), middle (+10.3%, 95% CI: 6.0, 14.6), and high schools (+13.0%, 95% CI: 7.4, 18.2). CEP participation was also associated with improvements in elementary school attendance, middle school disciplinary referrals, and elementary science test scores, though these findings were sensitive to model specifications.

Conclusions and Relevance: CEP produces some benefits for student nutrition, behavior, and academic performance, particularly among elementary and middle school children. Findings can inform decisions by school administrators regarding uptake, and decisions by policymakers regarding CEP reauthorization and expansion.

INTRODUCTION

Food insecurity, defined as limited or uncertain access to adequate food, affects one in seven U.S. households with children.[1] Food insecurity during childhood is associated with numerous negative physical and mental health consequences, as well as poor cognitive function and academic performance, including lower test scores and school attendance.[2–8]

The School Breakfast Program (SBP) and the National School Lunch Program (NSLP) are federal programs administered by the U.S. Department of Agriculture (USDA) that provide meals to students at low or no cost.[9] Research has consistently demonstrated that the SBP and NSLP reduce food insecurity, and may also lead to improvements in academic performance.[10–13] Yet student participation in school meal programs is strikingly low, due, in part, to stigma associated with participation and confusion among parents regarding program eligibility.[14,15] To address barriers to participation, as part of the Healthy, Hunger-Free Kids Act of 2010, Congress authorized the Community Eligibility Provision (CEP), which allows eligible high-poverty schools to offer universal free meals.[16] In schools that adopt CEP, students no longer submit forms annually documenting their household income to qualify for free or reduced-price meals; instead, all students are offered free breakfast and lunch. A school, group of schools, or district is eligible for CEP if their aggregate identified student percentage (ISP, or percentage of students identified as categorically eligible for free school meals using existing administrative data, such as participation in the Supplemental Nutrition Assistance Program or Temporary Assistance for Needy Families) is 40% or greater.[17] CEP was phased in over three years in 10 states and the District of Columbia and became available to all eligible schools nationwide in 2014. By School

Year (SY) 2018-19, 28,614 schools, or approximately two thirds of eligible schools, had adopted CEP.[17]

Maryland began offering CEP in SY 2013-14, the third year of the phase-in period. For the first two years that CEP was available in Maryland, however, only 24 schools opted in, due primarily to widespread concerns about potential impacts of CEP participation on state compensatory education funding. Schools that participate in CEP no longer collect household applications for free and reduced-price meals, data that has historically served as the basis for allocation of state compensatory education funding for schools serving a high proportion of economically disadvantaged students.[18] In 2015, the Maryland General Assembly passed a law guaranteeing that state compensatory education funding would not be negatively impacted by CEP participation; by the following year, 198 additional schools had adopted CEP.[19] By SY 2019-20, 236 public schools were participating in CEP; 63 individually eligible schools (ISP≥40%) did not participate in CEP, and others may have been eligible as part of a group or district-wide adoption.[20]

Emerging evidence suggests benefits of CEP participation for student nutrition, behavior, and academic performance. To date, about a dozen studies have evaluated the impact of CEP participation on student outcomes.[21–32] These studies have found strong evidence of positive impacts of CEP on meal participation; limited but promising evidence of positive effects on on-time grade promotion, food security, disciplinary referrals, and weight outcomes; and mixed evidence of impacts on test scores and attendance.[33] Most of these studies have limited follow-up periods, using data from one or two years after CEP implementation. Also, most examine only

one or two outcomes in isolation and therefore cannot provide a holistic picture of how CEP affects students. Although CEP was designed to reduce stigma associated with receiving free meals, no study has evaluated CEP's impact on stigma or bullying. Additionally, as previous literature has pointed to the benefits of school meal participation for student learning and attendance, it is possible that other measures linked with these outcomes, such as graduation and dropout, may also be impacted by CEP; yet no previous study has considered these outcomes. This study builds on existing research by using data from four years after CEP adoption to assess the longer-term impacts of adoption on a range of student outcomes, including novel outcomes such as bullying and graduation.

METHODS

Study Sample

This study compares Maryland schools adopting CEP in SY 2015-16 (intervention schools) to schools that were individually eligible (ISP 40% or greater) or near-eligible (ISP 30-39%) for CEP in SY 2015-16 but not participating (comparison schools). Schools that were individually near-eligible were included in the comparison group in primary analyses because these schools commonly participate in CEP as part of group or district-wide adoption (excluded in sensitivity analyses). Schools that opted into CEP before or after SY 2015-16 were excluded from the study sample, as this group (n=46) may be different in unobservable ways from schools that adopted CEP in SY 2015-16. Further, schools that adopted CEP before 2015-16 lack sufficient baseline data for analysis and schools that adopted after 2015-16 lack sufficient follow-up data for analysis. Schools that closed during the study period were also excluded. Additionally, seven schools began offering universal free meals during the study period using district funds (separate

from CEP); these schools were also excluded. The final sample included 333 comparison schools and 188 intervention schools.

Measures

Outcome Measures

All outcome data were obtained from the Maryland State Department of Education (MSDE) and measured annually at each school.[34] The primary outcomes are 1) average daily participation (ADP; total annual meals served divided by the product of enrollment and number of operating school days) in school breakfast and 2) ADP in school lunch. Secondary outcomes include: 1) cohort-adjusted dropout (percent of first-time 9th grade students who drop out, adjusted for students who transfer in and out); 2) cohort-adjusted graduation (percent of first-time 9th grade students who graduate in four years, adjusted for students who transfer in and out); 3-5) 9^{th}-11^{th} grade promotion (percent of students who advance to the next grade); 6) average daily attendance; 7) absenteeism (percent of students absent more than 20 school days); 8) suspensions and expulsions (annual aggregate number of suspensions and expulsions divided by enrollment); 9) suspensions and expulsions associated with bullying and/or harassment; and 10-12) percent of students scoring "proficient" or above on standardized tests in reading, math, and, for elementary schools only, science. All outcomes were analyzed separately for elementary, middle, and high schools.

Between 2014 and 2016, Maryland modified the state standardized tests, moving from the Maryland School Assessment (MSA) to the Partnership for Assessment of Readiness for College and Career (PARCC) test. Per state guidelines, students were considered scoring "proficient" or

above if they scored "proficient" or "advanced" on the MSA test, or "Level 4" or "Level 5" on the PARCC test.[35] An indicator was included in analysis to indicate if the MSA or PARCC test was used in the study year.

For some outcomes, data were capped below 5% and above 95% by MSDE to protect student privacy. To handle outcome data continuously, 2.5% and 97.5% were imputed for data capped below 5% and above 95%, respectively. In sensitivity analyses, a binary variable was created to indicate "improvement" relative to the previous year. For example, for dropout, "improvement" was achieved if the outcome decreased or stayed below 5%, and for attendance, "improvement" was achieved if the outcome increased or stayed above 95%.

Dropout, graduation, promotion, attendance, absenteeism, test score, and discipline outcome data were from SY 2010-11 (five years pre-intervention) through SY 2018-19 (four years post-intervention). ADP data were from SY 2012-13 (three years pre-intervention) through SY 2018-19 (four years post-intervention). Years described below refer to the spring semester (e.g., SY 2018-19 will be referred to as 2019).

Covariates

Data on CEP participation (yes/no), CEP eligibility (yes/no) and participation (yes/no) in the Maryland Meals for Achievement Program (MMFA, a state-funded universal free breakfast in the classroom program that pre-dated CEP) for each study year were retrieved from MSDE.[20,36] Baseline school-level variables were obtained for SY 2014-15, the year prior to CEP adoption in study schools. Baseline school ISP and enrollment were obtained from MSDE.[20,34] All other

baseline covariates were retrieved from the National Center for Education Statistics Common Core of Data[37], including: school type (alternative, regular, career/technical, special education); locale (city, suburb, town, rural); funding status through Title I of the Elementary and Secondary Education Act, which provides financial support for academic programming in high-poverty schools (receiving funding; eligible but not receiving funding; not eligible); percent of students eligible for free meals; percent of students eligible for reduced-price meals; and percent of students who self-identify as Black.

Statistical Analysis

Data were analyzed for patterns of missingness. Percent missingness for covariates ranged from 0.0 to 0.6%. For primary outcomes, percent missingness was 2.1%, and for secondary outcomes, 1.6 to 6.9%. Per NCES guidance, if demographic data were missing for SY 2014-15 but reported in the previous year, prior year values were imputed.[38] For missing data, separately by intervention status, the mean value was imputed. Sensitivity analyses comparing analyses using complete cases versus imputed data demonstrated that imputation did not meaningfully alter the direction or magnitude of findings (not shown).

Descriptive and bivariate analyses were conducted using t-tests and chi-square tests to compare characteristics of intervention and comparison schools. To estimate associations between the intervention and outcomes, mixed effects linear regression models were built separately for each outcome using a comparative interrupted time series approach. Each model controlled for other baseline outcomes (SY 2014-15) and the covariates described above, which were identified *a priori* based on a review of the literature and input from experts in school nutrition. Models

included school-specific random intercepts to account for correlation across observations from the same school in different years. Standard errors were clustered by district to account for similarities between schools within a district. Interaction variables for (intervention status * year) and (intervention status * year * pre/post-intervention period) were included to model linear time trends separately for the intervention and comparison groups in the pre- and post-intervention periods. Results below show impact of intervention (difference-in-difference) separately for each year in the post-intervention period.

To account for the large number of statistical tests, a Benjamini-Hochberg correction procedure was used.[39] A Benjamini-Hochberg procedure with a false discovery rate of 0.05 was used for the outcomes examined within each year (e.g., corrections were applied to outcomes separately for SY 2016, 2017, 2018, and 2019).[39] Statistical significance reported for regression findings below are based on the corrected critical value.

In sensitivity analyses, the sample excluded 1) near-eligible schools and 2) Baltimore City Public Schools. Of the 188 intervention schools, 174 were in Baltimore City. It is therefore possible that trends in Baltimore City unrelated to CEP may skew findings. In particular, the civil unrest in Baltimore City that followed the death of Freddie Gray, an unarmed black man who died from injuries sustained in police custody in April 2015, has been linked to negative outcomes for residents of neighborhoods proximal to the unrest, including increased rates of maternal depression[40] and violent crime[41], and may also impact student outcomes such as attendance[42]. As described above, a final sensitivity analysis also used mixed effects logistic regression to

determine odds of "improvement" relative to the previous year for measures with capped outcomes.

This study was reviewed and determined to be non-human subjects research by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

RESULTS

Intervention schools (n=188) were more likely than comparison schools (n=333) to be charter schools, high schools and other schools (e.g., grades K-12, grades 9-10), located in cities, and funded through Title I, and to not participate in MMFA. Intervention schools were also more likely to have higher ISPs, lower enrollment, a lower proportion of students eligible for reduced-price meals, and greater proportions of students identified as Black and who were eligible for free lunch. (Table 5.1)

In the main model specification, CEP led to improvements in breakfast participation in elementary and middle schools but not high schools, and lunch participation in elementary, middle, and high schools. (Table 5.2) These gains are significant across the post-intervention period. By the fourth year post-intervention, relative to comparison schools, breakfast participation increased in intervention elementary (+19.2%, 95% CI: 15.3, 23.1) and middle schools (+20.7%, 95% CI: 13.3, 28.1) but not high schools, and lunch participation increased in intervention elementary (+6.4%, 95% CI: 4.4, 8.3), middle (+10.3%, 95% CI: 6.0, 14.6), and high schools (+13.0%, 95% CI: 7.4, 18.2).

Moving to the secondary outcomes, in the main model specification, CEP was associated with improvements in elementary school attendance (+1.4%, 95% CI: 0.9, 2.0) and middle school suspensions and expulsions (-39.4%, 95% CI: -53.6, -25.2). In high schools, however, CEP was associated with decreased attendance (-6.8%, 95% CI: -8.9, -4.8) and increased absenteeism (+11.2%, 95% CI: 5.0, 17.3). CEP was also linked to improvements in elementary school science test scores in the second, third, and fourth years post-implementation (+18.5%, 95% CI: 11.5, 25.4). In the first two years after implementation, CEP was associated with improvements in high school math test scores, elementary school absenteeism, and 10th grade promotion, but benefits attenuate and are not significant in the third and fourth years post-intervention.

In sensitivity analyses excluding near-eligible schools, the same findings are detected with some exceptions: high school lunch participation, attendance and absenteeism do not change significantly. (Table A5.1) In sensitivity analyses excluding Baltimore City Public Schools, elementary and high school lunch participation and high school attendance are again associated with CEP adoption, but there is no significant association with any middle school outcomes, potentially due to small sample size and limited statistical power. (Table A5.2) In this sensitivity analysis, other associations at the high school level are detected that are not present in other models, including decreased attendance, reading test scores, and increased math test scores and 10th and 11th grade promotion. In sensitivity analyses assessing odds of improvement for capped variables, CEP was associated with improved odds of elementary school attendance (the only outcome to change significantly in this model, and also detected in the main model and sensitivity analysis excluding near-eligible schools). (Table A5.3)

DISCUSSION

This study, the first to consider longer-term impacts of CEP on a range of student outcomes, found that CEP was associated with improvement in breakfast and lunch participation in elementary and middle schools and improvement in lunch participation in high schools. These gains in meal participation persist over time. These findings are consistent with previous studies that have documented gains in breakfast participation ranging from 3.5 to 40.2 percentage points and lunch participation ranging from 3.5 to 18.5 percentage points.[21–23,25,26,43] Some variation in findings across previous studies may be attributable to different student subgroups studied (e.g., some focused only on students previously ineligible for free meals).

No significant improvement in breakfast participation was detected among high school students. Features of the high school food environment may be, in part, responsible for this lack of change: relative to elementary and middle school students, high school students are generally less likely to participate in school meals[44], and more likely to skip breakfast[45], report negative perceptions of school breakfast quality[44], have access to competitive foods on the school campus (i.e., vending machines and à la carte items sold separately from the school meal)[46], and to have open campus policies, enabling them to leave the school grounds during their lunch period[46].

Moving to the secondary outcomes, in the main model, CEP adoption was associated with improvements that persist over time in elementary school science test scores, elementary school attendance, and middle school suspensions and expulsions, but decreased high school attendance and increased high school absenteeism. Secondary outcome findings are sensitive to model specifications and should be interpreted with caution; however, findings of improved elementary

attendance and decreased disciplinary referrals in middle schools are robust across multiple model specifications.

The finding of decreased disciplinary referrals among middle school students detected in this study is largely consistent with the existing literature on disciplinary referrals: two previous studies reported decreased disciplinary referrals associated with CEP adoption[24,30], while a third found no change[29]. Universal free meals may influence student behavior by reducing student hunger (the public health literature has established a correlation between hunger and behavior[4]) and improving the school climate through decreased stigma. National rates of disciplinary referrals are disproportionately high among students who are Black, Hispanic, and American Indian and students with disabilities.[49,50] Students who are suspended or expelled are at greater risk of involvement in the criminal justice system and poor long-term employment outcomes.[48] Thus, by reducing disciplinary referrals among middle school students, CEP may help address disparities in long-term health and economic outcomes.

This study found that CEP was associated with improvement in elementary school science test scores, but not for any other test. This finding is consistent with improvement in elementary school science scores – a 0.06 standard deviation gain – detected in a study of North Carolina schools by Fuller et al.[29] Otherwise, previous studies examining associations between CEP and test scores show mixed results by grade level and subject: Gordanier et al. detected improvements in elementary school math scores, but not elementary school reading scores or middle school scores[28], Ruffini found improvements in math scores[23], and, in further analysis Fuller et al. reported improvements in middle school reading scores, but not middle school

science or high school reading or science[29]. Differences in findings between the present and previous studies may be explained, in part, by use of different measures: the present study uses school-level data and reports changes in the proportion of students who scored "proficient" or above, whereas previous studies use student-level scores and report standard deviation-indexed average change. Taken together, however, these studies suggest that the benefits of CEP for test results may be concentrated among younger students. Notably, unlike the state standardized math and reading tests, the elementary science test in Maryland did not change during the study period; it is therefore possible that performance on other tests improved in CEP schools, but these improvements were obscured by the changes in testing procedures.

This study found that CEP was associated with improved elementary school attendance but decreased in high school attendance. Improved attendance due to CEP was also detected in three previous studies.[28,29,31] A lack of plausible explanation linking CEP with a decrease in high school attendance and an increase in absenteeism, however, coupled with these change being undetected in sensitivity analyses excluding near-eligible schools, suggest that it may be an artifact of residual confounding. Indeed, in sensitivity analyses treating improvement in attendance or staying above 95% attendance as a binary outcome, high school attendance results reverse direction and show (nonsignificant) increased odds of improvement.

CEP was designed, in part, to address stigma associated with receiving a free meal. This study, which used suspensions and expulsions linked to bullying or harassment as a proxy measure for stigma, did not find any change due to CEP. This proxy measure for stigma, however, only captures cases of bullying and harassment extreme enough to result in suspension or expulsion

and is a reflection of how school personnel respond to an incident, rather than a direct measure of student behavior; thus, it may not be sensitive to subtle changes in school climate linked to CEP. Additional research using surveys or interviews with students and teachers may be needed to capture the impact of CEP on school climate and stigma.

Finally, this study found that CEP adoption was not associated with changes in graduation, dropout, or grade promotion. However, these student outcome measures reflect the cumulative effect of years of exposure and may take more time to change. Longer-term studies that track students across their K-12 education may be needed to detect changes in these outcomes.

Limitations

First, the sensitivity analysis excluding Baltimore City produced results with wide confidence intervals, suggesting that this sub-analysis was underpowered to detect meaningful change. Additional research is warranted in cities such as Baltimore to examine how disruptive events such as school closures or civil unrest impact student outcomes in CEP participating schools. Second, over the study period, changes were made to some state education policies, including graduation requirements and state testing procedures; though there is no evidence these changes differentially impacted intervention and comparison schools, it is conceivable that some schools or districts experienced the changes differently from others. Third, variables capped below 5% and above 95% may obscure some important changes that occur at the margins, though sensitivity analyses help address this limitation by using a binary indicator for improvement. Finally, selection into CEP may be associated with unobservable school characteristics that were not included in regression adjustment. Thus, some findings may be due to residual confounding.

By limiting the sample to only eligible and near-eligible schools and adjusting for a wide range of school covariates, however, this risk was minimized.

CONCLUSIONS

This study is the first to measure the impact of CEP on student outcomes four years after implementation of CEP and the first to examine a variety of student outcomes together to provide a comprehensive picture of CEP's impact on students. These findings suggest that CEP participation is linked to benefits for student meal participation, disciplinary referrals, attendance, and science test scores, especially among elementary and middle school children. Anti-hunger advocates and state education agencies can promote uptake of CEP using findings from this study and others in a growing body of literature to educate prospective CEP schools on the potential benefits of CEP. These findings also suggest that funding to support schools that adopt CEP may be an investment with long-term dividends: outcomes such as disciplinary offenses and school attendance are predictive of health and productivity into adulthood[47,48], and these benefits should be factored into policy decisions at the state and federal levels.

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TABLES

Table 5.1 Characteristics of intervention and comparison schools in the baseline year prior to Community Eligibility Provision implementation (School Year 2014-15) (n=521)

	Intervention (n=188)	**Comparison (n=333)**
	Percent (n)	
School Type		
Regular	90.1 (171)	92.8 (309)
Special Ed	3.2 (6)	3.0 (10)
Vocational	3.2 (6)	0.9 (3)
Alternative	2.7 (5)	3.3 (11)
Charter*	15.4 (29)	0.3 (1)
Locale*		
City	94.7 (178)	12.9 (43)
Town	5.3 (10)	67.9 (226)
Suburb	0.0 (0)	4.2 (14)
Rural	0.0 (0)	15.0 (50)
Title I Funding*		
Eligible, not funded	19.2 (36)	40.8 (136)
Not eligible	3.2 (6)	6.3 (21)
Eligible funded	77.7 (146)	52.9 (176)
School Level*		
Elementary	72.3 (136)	73.9 (246)
Middle	4.3 (8)	13.8 (46)
High	13.8 (26)	8.1 (27)
Other	9.6 (18)	4.2 (14)
ISP Category*		
<30%	3.7 (7)	21.0 (70)
30-39%	5.3 (10)	44.4 (148)
40-49%	7.5 (14)	24.9 (83)
50-59%	17.6 (33)	7.5 (25)
60-69%	26.6 (50)	1.8 (6)
70-79%	22.3 (42)	0.3 (1)
80-89%	16.5 (31)	0.0 (0)
90% and above	0.5 (1)	0.0 (0)
MMFA Participation*	30.8 (58)	74.8 (249)
	Mean (SD)	
Enrollment*	472.8 (272.7)	519.6 (257.9)
Percent free meal eligible*	76.8 (15.6)	58.5 (12.9)

Percent reduced price meal eligible*	8.4 (4.0)	8.1 (3.0)
Percent Black*	83.9 (21.2)	39.8 (27.6)

Footnotes: ISP, identified student percentage; MMFA, Maryland Meals for Achievement.

***** Indicates significant difference ($p<0.05$) between participating and non-participating schools based on t-tests (continuous variables) and chi2 tests (categorical variables).

Table 5.2 Main model: adjusted difference-in-difference estimates comparing schools participating in the Community Eligibility Provision to eligible or near-eligible but not participating schools Maryland (School Years 2011-19)

	SY 2016		SY 2017		SY 2018		SY 2019	
	Coeff.	**95% CI**	**Coeff.**	**95% CI**	**Coeff.**	**95% CI**	**Coeff.**	**95% CI**
Elementary School								
Breakfast ADP	**12.72***	**(10.73, 14.72)**	**14.87***	**(13.03, 16.71)**	**17.02***	**(14.36, 19.69)**	**19.17***	**(15.28, 23.06)**
Lunch ADP	**9.90***	**(8.95, 10.85)**	**8.73***	**(7.63, 9.83)**	**7.56***	**(6.08, 9.03)**	**6.38***	**(4.44, 8.33)**
Total Referrals	1.45*	(0.31, 2.58)	0.37	(-1.28, 2.03)	-0.70	(-3.06, 1.65)	-1.78	(-4.90, 1.35)
Bullying Referrals	0.02	(-0.11, 0.14)	-0.02	(-0.18, 0.14)	-0.06	(-0.26, 0.15)	-0.10	(-0.35, 0.16)
Attendance	**1.25***	**(1.00, 1.51)**	**1.31***	**(0.99, 1.64)**	**1.38***	**(0.95, 1.80)**	**1.44***	**(0.90, 1.98)**
Absenteeism	-2.27*	(-2.71, -1.83)	-1.08*	(-1.67, -0.49)	0.11	(-0.75, 0.98)	1.31	(0.13, 2.48)
Reading Proficient	-2.81	(-5.88, 0.25)	-2.45	(-6.41, 1.51)	-2.09	(-7.14, 2.96)	-1.73	(-7.97, 4.51)
Math Proficient	1.62	(-1.16, 4.39)	2.70	(-0.55, 5.96)	3.79	(-0.06, 7.64)	4.88	(0.36, 9.40)
Science Proficient	**-0.83**	**(-2.32, 0.65)**	**5.60***	**(2.94, 8.27)**	**12.04***	**(7.30, 16.79)**	**18.48***	**(11.54, 25.43)**
Middle School								
Breakfast ADP	**7.94***	**(4.11, 11.76)**	**12.18***	**(7.82, 16.55)**	**16.43***	**(10.75, 22.12)**	**20.68***	**(13.30, 28.06)**
Lunch ADP	**12.11***	**(10.40, 13.82)**	**11.51***	**(9.12, 13.90)**	**10.91***	**(7.61, 14.20)**	**10.30***	**(6.01, 14.59)**
Total Referrals	**-7.25***	**(-12.78, -1.72)**	**-17.54***	**(-25.71, -9.36)**	**-28.68***	**(-39.78, -17.57)**	**-39.39***	**(-53.58, -25.19)**
Bullying Referrals	-0.12	(-0.77, 0.52)	-0.36	(-1.39, 0.67)	-0.59	(-2.05, 0.87)	-0.83	(-2.73, 1.08)
Attendance	0.07	(-0.59, 0.74)	-0.35	(-0.93, 0.24)	-0.76	(-1.44, -0.09)	-1.18*	(-2.05, -0.32)
Absenteeism	-0.43	(-2.24, 1.38)	1.33	(-0.43, 3.08)	3.08*	(0.92, 5.25)	4.84*	(1.99, 7.69)
Reading Proficient	-2.99*	(-4.18, -1.79)	-2.92	(-5.44, -0.40)	-2.85	(-7.07, 1.38)	-2.78	(-8.77, 3.21)
Math Proficient	1.56	(-1.02, 4.15)	2.09	(-1.12, 5.30)	2.61	(-2.05, 7.27)	3.13	(-3.26, 9.52)
High School								
Breakfast ADP	-4.34*	(-6.92, -1.76)	-2.98	(-7.08, 1.12)	-1.61	(-8.89, 5.67)	-0.25	(-10.98, 10.49)
Lunch ADP	**14.29***	**(10.17, 18.40)**	**13.85***	**(9.65, 18.04)**	**13.41***	**(8.84, 17.98)**	**12.97***	**(7.80, 18.15)**
Total Referrals	-3.58	(-18.01, 10.85)	-8.39	(-29.72, 12.94)	-13.20	(-42.68, 16.28)	-18.01	(-56.09, 20.06)
Bullying Referrals	0.23	(-0.52, 0.98)	0.50	(-0.69, 1.69)	0.77	(-0.99, 2.52)	1.04	(-1.31, 3.39)
Attendance	**-1.19***	**(-1.82, -0.55)**	**-3.06***	**(-4.07, -2.06)**	**-4.94***	**(-6.46, -3.43)**	**-6.82***	**(-8.89, -4.75)**
Absenteeism	**-0.71**	**(-2.82, 1.40)**	**3.25***	**(0.53, 5.97)**	**7.21***	**(2.89, 11.53)**	**11.17***	**(4.99, 17.34)**
Math Proficient	7.57*	(4.07, 11.07)	4.55*	(0.90, 8.21)	1.53	(-3.47, 6.54)	-1.48	(-8.37, 5.40)
Reading Proficient	-2.37	(-7.36, 2.62)	-4.35	(-9.36, 0.66)	-6.33	(-12.16, -0.50)	-8.30	(-15.49, -1.12)
Dropout	2.39	(-1.32, 6.10)	3.80	(-0.54, 8.14)	5.21	(-0.74, 11.16)	6.62	(-1.33, 14.58)
Graduation	-2.56	(-5.70, 0.58)	-2.32	(-5.19, 0.54)	-2.31	(-6.77, 2.15)	-2.27	(-8.57, 4.02)
9th Grade Promotion	7.04*	(4.26, 9.82)	4.26	(0.08, 8.44)	1.48	(-5.92, 8.88)	-1.30	(-12.24, 9.64)
10th Grade Promotion	6.54*	(3.88, 9.21)	3.98*	(1.49, 6.47)	1.42	(-3.69, 6.53)	-1.15	(-9.32, 7.03)
11th Grade Promotion	4.00*	(0.73, 7.28)	3.01	(-0.92, 6.95)	2.02	(-3.12, 7.16)	1.03	(-5.56, 7.62)

Footnotes: * Indicates finding is statistically significant after using Benjamini-Hochberg procedure with a false discovery rate of 0.05. Confidence intervals do not reflect the Benjamini-Hochberg correction and thus may appear inconsistent with corrected statistical significance. **Bold** indicates that finding is significant across three or more study years.

Results from mixed-effects linear regression with school-specific random intercepts and standard errors clustered by district. Results adjusted for baseline outcomes, baseline school characteristics (school type, school level, charter status, locale, enrollment, Title I funding status, percent of students who are Black, categorically eligible for free meals, eligible for free meals, eligible for reduced-price meals), and participation in the Maryland Meals for Achievement program. Analyses modeling test results also controlled for whether students took the Maryland School Assessment or the Partnership for Assessment of Readiness for College and Career test in the study year.

Table A5.1 Sensitivity analysis excluding near-eligible schools: adjusted difference-in-difference estimates comparing schools participating in the Community Eligibility Provision to eligible but not participating schools Maryland (School Years 2011-19)

	SY 2016		SY 2017		SY 2018		SY 2019	
	Coeff.	**95% CI**	**Coeff.**	**95% CI**	**Coeff.**	**95% CI**	**Coeff.**	**95% CI**
Elementary School								
Breakfast ADP	**9.94***	**(6.00, 13.88)**	**11.21***	**(6.04, 16.39)**	**12.48***	**(5.78, 19.19)**	**13.75***	**(5.39, 22.12)**
Lunch ADP	**9.64***	**(8.53, 10.75)**	**8.94***	**(7.70, 10.19)**	**8.25***	**(6.65, 9.85)**	**7.55***	**(5.49, 9.62)**
Total Referrals	1.19	(-0.06, 2.44)	0.45	(-1.22, 2.11)	-0.29	(-2.97, 2.38)	-1.03	(-4.86, 2.80)
Bullying Referrals	0.01	(-0.14, 0.16)	-0.02	(-0.23, 0.20)	-0.04	(-0.33, 0.25)	-0.06	(-0.43, 0.30)
Attendance	**1.45***	**(0.83, 2.08)**	**1.54***	**(0.88, 2.20)**	**1.62***	**(0.89, 2.36)**	**1.70***	**(0.86, 2.54)**
Absenteeism	-2.83*	(-4.02, -1.64)	-1.71	(-3.25, -0.16)	-0.58	(-2.60, 1.43)	0.54	(-1.99, 3.08)
Reading Proficient	-2.54	(-6.15, 1.06)	-2.25	(-6.84, 2.34)	-1.96	(-7.74, 3.81)	-1.68	(-8.73, 5.38)
Math Proficient	2.81	(0.25, 5.37)	3.28	(0.20, 6.37)	3.76	(0.02, 7.50)	4.24	(-0.23, 8.70)
Science Proficient	**0.20**	**(-1.80, 2.21)**	**6.24***	**(3.61, 8.87)**	**12.28***	**(7.25, 17.31)**	**18.32***	**(10.63, 26.00)**
Middle School								
Breakfast ADP	**4.69**	**(-0.80, 10.18)**	**9.86***	**(3.35, 16.37)**	**15.03***	**(5.62, 24.45)**	**20.20***	**(7.20, 33.20)**
Lunch ADP	**10.93***	**(6.42, 15.44)**	**10.45***	**(5.83, 15.08)**	**9.98***	**(4.95, 15.01)**	**9.51***	**(3.85, 15.16)**
Total Referrals	**-15.73***	**(-24.29, -7.18)**	**-31.94***	**(-44.40, -19.48)**	**-49.05***	**(-66.18, -31.91)**	**-65.70***	**(-87.86, -43.55)**
Bullying Referrals	-0.02	(-1.16, 1.11)	-0.13	(-1.94, 1.67)	-0.25	(-2.77, 2.28)	-0.36	(-3.62, 2.90)
Attendance	0.47	(-0.25, 1.19)	-0.33	(-0.80, 0.15)	-1.13	(-2.13, -0.13)	-1.93	(-3.62, -0.25)
Absenteeism	-0.57	(-4.31, 3.17)	1.22	(-2.63, 5.06)	3.00	(-2.06, 8.06)	4.78	(-2.03, 11.60)
Reading Proficient	-4.58*	(-6.49, -2.68)	-4.37*	(-6.85, -1.89)	-4.15	(-8.46, 0.16)	-3.94	(-10.33, 2.46)
Math Proficient	-0.40	(-3.28, 2.47)	0.74	(-4.09, 5.57)	1.88	(-5.59, 9.35)	3.02	(-7.27, 13.31)
High School								
Breakfast ADP	-7.67	(-18.79, 3.44)	0.77	(-14.83, 16.37)	9.21	(-13.74, 32.17)	17.66	(-13.55, 48.87)
Lunch ADP	3.38	(-10.79, 17.55)	3.14	(-10.20, 16.47)	2.90	(-9.82, 15.61)	2.66	(-9.69, 15.00)
Total Referrals	-8.23	(-34.37, 17.91)	-33.68	(-79.43, 12.08)	-59.13	(-129.43, 11.18)	-84.57	(-180.65, 11.50)
Bullying Referrals	1.96	(-0.77, 4.69)	2.21	(-0.78, 5.20)	2.46	(-1.38, 6.31)	2.71	(-2.29, 7.72)
Attendance	-0.89	(-3.00, 1.22)	-3.07	(-6.27, 0.13)	-5.25	(-10.01, -0.49)	-7.42	(-13.88, -0.97)
Absenteeism	4.58	(-1.63, 10.79)	6.47	(-1.16, 14.10)	8.36	(-2.55, 19.27)	8.36	(-2.55, 19.27)
Math Proficient	11.50*	(9.00, 13.99)	7.09	(0.85, 13.34)	2.69	(-8.15, 13.54)	-1.71	(-17.26, 13.85)
Reading Proficient	-4.95	(-15.15, 5.24)	-9.54	(-20.77, 1.70)	-14.12	(-29.12, 0.88)	-18.71	(-38.71, 1.30)
Dropout	-4.43	(-13.71, 4.86)	-3.84	(-18.09, 10.42)	-3.24	(-23.51, 17.03)	-2.65	(-29.28, 23.97)
Graduation	-1.99	(-5.49, 1.51)	-2.12	(-5.20, 0.95)	-1.96	(-8.25, 4.33)	-2.25	(-12.36, 7.85)
9th Grade Promotion	10.35	(-0.98, 21.68)	5.96	(-4.98, 16.90)	1.57	(-13.55, 16.68)	-2.82	(-24.15, 18.50)
10th Grade Promotion	10.69	(-3.78, 25.17)	4.71	(-3.68, 13.11)	-1.26	(-8.88, 6.35)	-7.24	(-20.36, 5.87)
11th Grade Promotion	12.60	(0.39, 24.80)	8.65	(-0.68, 17.98)	4.70	(-2.93, 12.33)	0.75	(-7.16, 8.66)

Footnotes: * Indicates finding is statistically significant after using Benjamini-Hochberg procedure with a false discovery rate of 0.05. Confidence intervals do not reflect the Benjamini-Hochberg correction and thus may appear inconsistent with corrected statistical significance. **Bold** indicates that finding is significant across three or more study years.

Results from mixed-effects linear regression with school-specific random intercepts and standard errors clustered by district. Results adjusted for baseline outcomes, baseline school characteristics (school type, school level, charter status, locale, enrollment, Title I funding status, percent of students who are Black, categorically eligible for free meals, eligible for free meals, eligible for reduced-price meals), and participation in the Maryland Meals for Achievement program. Analyses modeling test results also controlled for whether students took the Maryland School Assessment or the Partnership for Assessment of Readiness for College and Career test in the study year.

Table A5.2 Sensitivity analysis excluding Baltimore City schools: adjusted difference-in-difference estimates comparing schools participating in the Community Eligibility Provision to eligible or near-eligible but not participating schools Maryland (School Years 2011-19)

	SY 2016		SY 2017		SY 2018		SY 2019	
	Coeff.	**95% CI**	**Coeff.**	**95% CI**	**Coeff.**	**95% CI**	**Coeff.**	**95% CI**
Elementary School								
Breakfast ADP	0.52	(-1.49, 2.54)	-0.90	(-3.92, 2.12)	-2.33	(-6.59, 1.94)	-3.75	(-9.35, 1.85)
Lunch ADP	**4.72***	**(4.07, 5.37)**	**3.74***	**(2.53, 4.96)**	**2.77***	**(0.85, 4.69)**	**1.80**	**(-0.86, 4.45)**
Total Referrals	4.99	(-5.41, 15.40)	3.92	(-3.51, 11.35)	2.85	(-1.87, 7.56)	1.77	(-1.26, 4.80)
Bullying Referrals	0.18	(0.01, 0.35)	-0.04	(-0.20, 0.12)	-0.27*	(-0.46, -0.07)	-0.49*	(-0.74, -0.23)
Attendance	0.55	(-0.38, 1.48)	-0.08	(-0.81, 0.65)	-0.71*	(-1.26, -0.16)	-1.34*	(-1.77, -0.91)
Absenteeism	-1.57	(-3.23, 0.09)	1.39	(0.43, 2.35)	4.35*	(3.72, 4.97)	7.30*	(6.22, 8.38)
Reading Proficient	-4.04*	(-7.47, -0.61)	-2.86	(-7.20, 1.47)	-1.69	(-7.12, 3.74)	-0.51	(-7.14, 6.12)
Math Proficient	-3.28*	(-6.08, -0.48)	-3.05	(-6.15, 0.05)	-2.82	(-7.34, 1.70)	-2.59	(-8.94, 3.76)
Science Proficient	**-2.61***	**(-4.11, -1.11)**	**-3.96***	**(-5.63, -2.29)**	**-5.32***	**(-7.91, -2.72)**	**-6.67***	**(-10.42, -2.91)**
Middle School								
Breakfast ADP	4.85*	(2.36, 7.33)	3.34	(-1.90, 8.58)	1.83	(-7.50, 11.17)	0.33	(-13.28, 13.93)
Lunch ADP	10.69	(0.49, 20.88)	10.61	(-3.09, 24.30)	10.53	(-6.71, 27.77)	10.45	(-10.37, 31.26)
Total Referrals	13.78	(-27.05, 54.61)	20.68	(-52.66, 94.02)	27.58	(-78.33, 133.50)	34.49	(-104.02, 173.00)
Bullying Referrals	1.22	(-0.80, 3.25)	2.72	(-3.18, 8.61)	4.21	(-5.60, 14.01)	5.70	(-8.02, 19.41)
Attendance	-0.83	(-5.55, 3.89)	-2.14	(-7.07, 2.79)	-3.45	(-8.60, 1.70)	-4.76	(-10.14, 0.62)
Absenteeism	3.02	(-11.60, 17.65)	5.27	(-9.66, 20.20)	7.51	(-7.78, 22.80)	9.75	(-5.95, 25.46)
Reading Proficient	1.67	(-5.03, 8.38)	0.06	(-7.40, 7.52)	-1.55	(-10.09, 6.99)	-3.16	(-13.00, 6.68)
Math Proficient	-0.04	(-6.50, 6.42)	-3.07	(-11.22, 5.09)	-6.09	(-16.23, 4.04)	-9.12	(-21.39, 3.14)
High School								
Breakfast ADP	0.43	(-2.00, 2.86)	1.95	(-2.12, 6.02)	3.46	(-3.86, 10.78)	4.98	(-5.83, 15.78)
Lunch ADP	**20.71***	**(16.60, 24.82)**	**25.89***	**(21.77, 30.01)**	**31.07***	**(26.70, 35.45)**	**36.26***	**(31.40, 41.11)**
Total Referrals	**56.43***	**(42.44, 70.42)**	**103.17***	**(83.49, 122.84)**	**149.90***	**(123.32, 176.49)**	**196.64***	**(162.67, 230.62)**
Bullying Referrals	**3.43***	**(2.72, 4.14)**	**9.48***	**(8.52, 10.44)**	**15.53***	**(14.24, 16.82)**	**21.59***	**(19.93, 23.24)**
Attendance	**-6.00***	**(-6.47, -5.52)**	**-8.26***	**(-9.14, -7.38)**	**-10.53***	**(-11.97, -9.08)**	**-12.79***	**(-14.83, -10.75)**
Absenteeism	2.23	(0.20, 4.27)	3.39*	(0.68, 6.10)	4.55	(0.31, 8.79)	5.71	(-0.29, 11.71)
Math Proficient	4.94*	(1.52, 8.35)	4.34*	(0.68, 8.00)	3.75	(-1.46, 8.95)	3.15	(-4.12, 10.42)
Reading Proficient	**-12.74***	**(-17.65, -7.82)**	**-10.10***	**(-15.14, -5.06)**	**-7.47***	**(-13.41, -1.53)**	**-4.84**	**(-12.17, 2.50)**
Dropout	**7.27***	**(3.55, 10.99)**	**22.28***	**(18.18, 26.38)**	**37.29***	**(31.96, 42.62)**	**52.30***	**(45.32, 59.27)**
Graduation	**-0.37**	**(-3.54, 2.80)**	**-12.15***	**(-14.86, -9.44)**	**-24.43***	**(-28.52, -20.34)**	**-36.42***	**(-42.06, -30.78)**
9th Grade Promotion	11.31*	(8.43, 14.19)	2.51	(-1.57, 6.60)	-6.28	(-13.50, 0.93)	-15.08*	(-25.78, -4.38)

10th Grade Promotion	**6.33***	**(3.61, 9.06)**	**12.78***	**(10.48, 15.07)**	**19.22***	**(14.47, 23.96)**	**25.66***	**(17.96, 33.35)**
11th Grade Promotion	**9.78***	**(6.55, 13.02)**	**11.47***	**(7.56, 15.37)**	**13.15***	**(8.02, 18.28)**	**14.83***	**(8.22, 21.45)**

Footnotes: * Indicates finding is statistically significant after using Benjamini-Hochberg procedure with a false discovery rate of 0.05. Confidence intervals do not reflect the Benjamini-Hochberg correction and thus may appear inconsistent with corrected statistical significance. **Bold** indicates that finding is significant across three or more study years.

Results from mixed-effects linear regression with school-specific random intercepts and standard errors clustered by district. Results adjusted for baseline outcomes, baseline school characteristics (school type, school level, charter status, locale, enrollment, Title I funding status, percent of students who are Black, categorically eligible for free meals, eligible for free meals, eligible for reduced-price meals), and participation in the Maryland Meals for Achievement program. Analyses modeling test results also controlled for whether students took the Maryland School Assessment or the Partnership for Assessment of Readiness for College and Career test in the study year.

Table A5.3 Sensitivity analysis with capped results: adjusted difference-in-difference odds ratios comparing schools participating in the Community Eligibility Provision to eligible or near-eligible but not participating schools Maryland (School Years 2011-19)

	SY 2016		SY 2017		SY 2018		SY 2019	
	Odds Ratio	**Confidence Interval**	**Odds Ratio**	**Confidence Interval**	**Odds Ratio**	**Confidence Interval**	**Odds Ratio**	**Confidence Interval**
Elementary School								
Attendance	**8.62***	**(4.99, 14.91)**	**5.76***	**(3.21, 10.32)**	**3.85***	**(1.95, 7.60)**	**2.57**	**(1.13, 5.83)**
Absenteeism	2.82	(1.11, 7.17)	2.08	(0.79, 5.49)	1.54	(0.55, 4.32)	1.13	(0.37, 3.47)
Middle School								
Attendance	2.07	(0.39, 11.04)	1.51	(0.28, 8.14)	1.10	(0.17, 7.17)	0.80	(0.09, 7.20)
Absenteeism	1.97	(0.75, 5.16)	2.06	(0.99, 4.28)	2.15	(0.85, 5.45)	2.25	(0.56, 8.99)
High School								
Attendance	1.14	(0.20, 6.36)	1.05	(0.16, 6.95)	0.96	(0.10, 9.27)	0.89	(0.06, 13.92)
Absenteeism	4.43	(1.15, 17.16)	2.81	(0.60, 13.09)	1.78	(0.26, 12.31)	1.13	(0.10, 12.90)
Dropout	1.39	(0.49, 3.95)	1.80	(0.22, 14.61)	2.34	(0.09, 63.09)	3.04	(0.03, 281.64)
Graduation	2.29*	(1.30, 4.03)	3.41*	(1.33, 8.73)	5.08	(0.97, 26.50)	7.56	(0.67, 85.09)
9th Grade Promotion	4.31	(1.18, 15.66)	1.29	(0.38, 4.33)	0.38	(0.07, 2.16)	0.12	(0.01, 1.38)
10th Grade Promotion	0.41	(0.16, 1.02)	0.26*	(0.09, 0.77)	0.17	(0.04, 0.73)	0.11	(0.02, 0.77)
11th Grade Promotion	0.17*	(0.05, 0.51)	0.10*	(0.02, 0.45)	0.06	(0.01, 0.53)	0.04	(0.00, 0.68)

Footnotes: * Indicates finding is statistically significant after using Benjamini-Hochberg procedure with a false discovery rate of 0.05. Confidence intervals do not reflect the Benjamini-Hochberg correction and thus may appear inconsistent with corrected statistical significance. **Bold** indicates that finding is significant across three or more study years.

Results from mixed-effects logistic regression with school-specific random intercepts and standard errors clustered by district. Results adjusted for baseline outcomes, baseline school characteristics (school type, school level, charter status, locale, enrollment, Title I funding status, percent of students who are Black, categorically eligible for free meals, eligible for free meals, eligible for reduced-price meals), and participation in the Maryland Meals for Achievement program. `

CHAPTER SIX

DISCUSSION

SUMMARY OF FINDINGS

This dissertation was motivated by a desire to understand implementation and impacts of the Community Eligibility Provision (CEP), a novel federal policy option designed to expand access to school meals for low-income children. One in seven U.S. children lives in a household with food insecurity[1], and resultingly, is at greater risk of poor physical and mental health outcomes and academic performance[2–9]. Policies such as CEP that increase access to the school meal programs have the potential to reduce food insecurity and boost child health and wellbeing. To inform policy and practice related to CEP, this dissertation used quantitative and qualitative methods to explore impacts of CEP on students, parents, and food service staff and operations, as well as implementation barriers and best practices. Each paper in this dissertation provided new insights into implementation and impacts of CEP: Chapter 3 was the first paper to examine school, district, and state-level factors associated with adoption of CEP in a national sample; Chapter 4 was the first to qualitatively explore perceived barriers to and impacts of adoption since CEP became available nationwide in 2014; and Chapter 5 was the first to assess the relationship between CEP adoption and long-term student outcomes, including outcomes not previously assessed in the literature, such as stigma and graduation.

Chapter 3 (Aim 1)

One third of schools that are individually eligible for CEP are not currently participating.[10] Previous studies by the U.S. Department of Agriculture have called for research to better understand barriers to adoption by evaluating school, district, and state factors linked with CEP adoption.[11,12] In line with these calls, the first paper explored factors associated with CEP adoption among eligible and near-eligible schools across the U.S. in School Year 2017-18. The

study used penalized and generalized logistic regression modeling to identify which, among a list of 14 factors theorized to be linked with CEP adoption, were significantly associated with adoption. Results indicated that schools were more likely to participate in CEP if they were middle and high schools, urban schools, and schools with more students directly certified for free meals, a lower proportion of Hispanic students, smaller enrollment, and receiving Title I funding. Likelihood of CEP participation was also greater for schools located in very large districts, in districts and states without Republican elected officials, and in states where CEP had been available longer. There were also differences in adoption by USDA region. These findings can guide actions by policymakers and advocates to promote uptake.

Chapter 4 (Aim 2)

The second paper further explored barriers to adoption using in-depth interviews with 28 food service staff at districts and schools in Maryland that participated in CEP in School Year 2018-19. District food service directors and school cafeteria managers were asked about factors that inhibited and facilitated their implementation of CEP. They also described perceived impacts of CEP on food service operations, student behavior, and staff morale, and provided recommendations for best practices for implementation. Participants identified barriers to CEP implementation, including concerns about CEP's impact on federal, state, and grant funding, which can guide policy interventions to promote CEP uptake. Participants also highlighted perceived benefits of CEP, including how CEP helped increase meal participation, reduce student stigma, alleviate financial stress for parents, and boost food service staff morale, but provided mixed reports on impacts on food service budgets, cafeteria line flow, and staff workload. Best practices for implementation outlined by participants, including strong

communication with parents and creative strategies to boost student meal participation, can be adapted by other schools and districts.

Chapter 5 (Aim 3)

The third paper further evaluated the impact of CEP on student outcomes in Maryland using a quantitative approach. This quasi-experimental study used a comparative interrupted time series design to assess the relationship between CEP adoption and change over time in student outcomes, including rates of meal participation, disciplinary referrals, incidents of bullying and harassment, attendance, absenteeism, test scores, dropout, graduation, and grade promotion. Maryland schools that adopted CEP in School Year 2015-16 were compared to schools that were eligible or near-eligible but not participating, using data from up to five years before CEP adoption and four years after CEP adoption. Results showed that relative to comparison schools, breakfast participation increased in intervention elementary and middle schools, but not high schools, and lunch participation increased at all three school levels. CEP participation was also associated with improvements in elementary school attendance and science test scores and middle school disciplinary referrals.

OVERARCHING THEMES

While the findings presented in each paper individually advanced research in the fields of school nutrition and implementation science, triangulating findings across the three studies provides additional valuable insight.

Implementation of the Community Eligibility Provision

Chapters 3 and 4 explored barriers to adoption of CEP, one using a quantitative approach to identify factors associated with adoption and non-adoption, and the other using a qualitative approach to assess perceptions of barriers to adoption among food service staff at Maryland schools that were participating in CEP.

Both studies found that a school's identified student percentage (ISP, or percent of students directly certified for free meals based on existing administrative data, such as participation in the Supplemental Nutrition Assistance Program or Temporary Assistance to Needy Families) was a top predictor of adoption. ISP is tied directly to the rate at which a participating school is reimbursed for meals served; schools with ISPs below 62.5% are not reimbursed fully at the "free" rate for all meals served and take on additional financial risk participating in CEP. In Chapter 3, odds of CEP adoption increased as ISP increased, and were highest among schools with ISPs between 70-79% compared to near-eligible schools (OR: 12.54, 95% CI: 10.10, 15.57). In Chapter 4, food service directors explained that ISP was one of the most important criteria they weighed when deciding whether schools in their district would participate in CEP. Considering the importance of ISP in determining whether schools adopt CEP, policy solutions (discussed in the Implications section below) that increase school ISPs and the reimbursement multiplier (making it easier for schools with lower ISPs to participate), may increase uptake.

The two studies provided conflicting evidence regarding the relationship between CEP adoption and funding through Title I of the Elementary and Secondary Education Act. Title I provides financial support for academic programming in schools with a high percentage of low-income families.[13] Funds are allocated to districts based on U.S. Census Data, and districts have

historically used free and reduced-price meal eligibility data to allocate funds to schools.[13] Because schools participating in CEP no longer collect free and reduced-price meal applications, districts have raised concerns about logistical challenges associated with allocating Title I funds. Many food service directors interviewed in the qualitative study (Chapter 4) explained that concerns among district administrators about the potential impact of CEP adoption on Title I funding allocation delayed their adoption of CEP. They also noted that principals at schools that had experienced changes in Title I funding levels as a result of CEP adoption continued to raise the issue. In the quantitative analysis (Chapter 3), however, schools receiving Title I funds were more likely to participate in CEP compared to schools not receiving Title I funds, even after controlling for a range of school demographic characteristics. These results suggest that while potential impacts of CEP on Title I funds are perceived as a barrier to CEP adoption, schools that receive Title I funds are ultimately not disproportionately deterred from adopting CEP. Additional research comparing rates of CEP adoption by Title I funding amount is warranted.

Other factors associated with CEP adoption in Chapter 3, such as district size and locale, were not mentioned by participants in Chapter 4. Other barriers to CEP adoption reported by food service directors and cafeteria managers, including concerns about state and grant education funding, were outside the scope of the quantitative study and not assessed.

Impacts of Community Eligibility Adoption

Chapters 4 and 5 explored impacts of CEP on a range of outcomes; Chapter 4 used a qualitative approach to assess perceptions among food service staff at Maryland CEP schools of CEP's impact on food service operations and student, parent, and staff wellbeing, while Chapter 5 used

a quantitative approach to estimate changes in student nutrition, behavior, and academic performance in CEP participating schools compared to eligible nonparticipating schools.

Chapters 4 and 5 both explored how CEP affected stigma and bullying at CEP participating schools. By making free meals available to all student regardless of income, CEP was designed to address stigma associated with receiving free school meals. In Chapter 4, several cafeteria managers and food service directors reported noticing decreased stigma and reduced bullying in the cafeteria since CEP adoption. In Chapter 5, however, adoption of CEP was not associated with a change in disciplinary referrals due to bullying or harassment. It is possible that this proxy measure of stigma, which only captures cases of bullying and harassment extreme enough to result in suspension or expulsion, may not be sensitive to subtle, but meaningful, changes in school climate. Additional research using surveys or interviews with students, teachers, and principals may be needed to better measure the effect of CEP adoption on stigma.

Chapter 5 also estimated the relationship between CEP adoption and student academic performance using measures of test scores, graduation, dropout, and on-time grade promotion. Science test scores among elementary students, which increased in intervention schools relative to comparison schools, were the only measure of academic performance to change significantly over time. Though not asked directly about how CEP impacted student performance, a small number of food service directors and cafeteria managers interviewed in Chapter 4 described reports from teachers and other school administrators that students were able to focus better in class and reported fewer headaches linked to hunger since the introduction of CEP. Additional research on the effects of CEP on academic performance is warranted, including studies that take

into account testing time of day (test scores may be influenced by how long it has been since a student's last meal) and day of month (test scores are lower among Supplemental Nutrition Assistance Program beneficiaries at the end of the month, when benefits often run out[14,15]). The effects of CEP on student health, including on nurse office visits, also merit further investigation.

Both Chapters 4 and 5 provided evidence that CEP led to increased meal participation at breakfast and lunch. In Chapter 5, results showed that breakfast participation increased in intervention elementary and middle schools, but not high schools, and lunch participation increased at all three school levels. Increases in breakfast participation rates were almost twice as large as increases in lunch participation rates. In Chapter 4, however, most food service directors and cafeteria managers described significant gains in lunch participation, but modest gains in breakfast participation. Food service staff explained that breakfast participation gains were limited because many of their schools already participated in Maryland Meals for Achievement, a universal free breakfast in the classroom program that pre-dated CEP. The analysis in Chapter 5 controlled for school participation in Maryland Meals for Achievement, which may explain the difference in findings between studies.

Other impacts of CEP reported by food service directors and cafeteria managers in Chapter 4, including improved staff morale and reduced financial stress among parents were not assessed in Chapter 5. Similarly, other outcomes assessed in Chapter 5, such as attendance and absenteeism, were not discussed by participants in Chapter 4.

METHODOLOGICAL LIMITATIONS

In addition to the methodological limitations described in each paper, this dissertation has some overarching limitations. First, while the descriptions of implementation barriers provided by food service staff in Chapter 4 were used, in part, to shed light on barriers to adoption identified quantitatively in Chapter 3, these two studies centered on different samples during different time periods: Chapter 3 focused on a national sample of eligible schools in School Year 2017-18, while Chapter 4 focused on a sample of CEP participating schools in Maryland in School Year 2018-19. Though rates of adoption of CEP in Maryland are very similar to the national average (in School Year 2018-19, 65.8% of eligible schools adopted in Maryland compared to 64.6% nationally[16]), barriers to CEP adoption in Maryland may not be generalizable to a national sample, and barriers to adoption may have changed in the intervening year between samples. Further, all three studies used data on CEP participation provided by state agencies. While state agencies have processes to assure data quality, it is possible there are errors in these data that bias the results of all three papers.

IMPLICATIONS

Policy and Practice

This dissertation contributes to a growing body of literature that demonstrates the benefits of CEP for students, parents, and food service staff. In particular, Chapters 4 and 5 showed that CEP is linked to improvements in meal participation rates, elementary school attendance and science test scores, and middle school disciplinary referrals, as well as perceived improvements in staff morale, reduced parent stress, and streamlined food service operations. These findings suggest that funding for CEP may be an investment with long-term dividends: outcomes such as childhood food security and school attendance are predictive of health and productivity into

adulthood.[17,18] These short and long-term benefits should be factored into federal and state policy decisions that affect CEP, as well as school and district decisions regarding uptake.

Considering the emerging evidence of CEP's benefits, federal and state policymakers should consider strategies to strengthen CEP and promote adoption by eligible schools. In particular, policy changes can be incorporated into Child Nutrition Reauthorization, the process currently ongoing in the U.S. Congress to revise the statutes that authorize the federal child nutrition assistance programs. Policy approaches may include[2]:

1. Increase the federal reimbursement multiplier for CEP schools. Chapters 3 and 4 showed that ISP is a strong predictor of CEP adoption. With the ISP multiplier currently capped at 1.6 by federal legislation, only schools with ISPs of 62.5% or above are fully reimbursed for all meals served; schools with ISPs between 40 and 62.5% must cover the gap in reimbursement themselves. An increase of the multiplier to, say 1.8, would enable full reimbursement for schools with ISPs above 55.5%. As discussed in Chapter 3, this federal policy change could increase the likelihood of CEP adoption for an estimated additional 2,100 new schools and extend universal free meal access to more than one million children.

2. Continue to allow "grouped" schools with aggregate ISPs of 40% or above to participate in CEP. Currently, schools can opt into CEP individually, as part of a group of schools, or

[2] Policy recommendations 1-4 are adapted from: Hecht AA, Turner L, Pollack Porter KM. (In press) Impact of the Community Eligibility Provision of the Healthy, Hunger-Free Kids Act of 2010 on Student Nutrition, Behavior, and Academic Outcomes (2011-2019). *Am. J Pub Health*.

as part of a district, if their pooled ISP is 40% or greater. This allows a district to adopt CEP for all schools in the district, even if some schools are slightly below the 40% ISP mark. For example, a district with 10 schools where ISPs range from 30% (near eligible) to 80% (very high poverty) and a district aggregate ISP of 65% could adopt CEP districtwide. As discussed in Chapter 4, this simplifies administration and often helps districts save money: they can reduce their administrative overhead by eliminating the infrastructure needed to process meal applications and can achieve economies of scale through increased purchasing and production volumes. Districtwide adoption can also reduce confusion among parents that can occur when students move from a CEP participating school to a nonparticipating school within the district, or when one sibling attends a CEP participating school, and another does not.

The 2020 budget proposed by the White House suggested limiting CEP participation to schools with an ISP of 40% or above. This change would prevent districts from including schools with lower ISPs in grouped or districtwide adoption. A small fraction of schools participating in CEP are below the 40% ISP cut-off[19], but as shown in Chapter 4, the ability to pool ISPs and include these schools as part of districtwide implementation was a key consideration for decision-makers. Curtailing the opportunity for districtwide implementation would eliminate these benefits and may result in fewer eligible schools participating.

3. Strengthen state direct certification systems. Given ISP is a top predictor of CEP participation, strategies that improve identification of categorically eligible students and

boost ISPs could lead more schools to adopt CEP. In SY 2016-17, states failed to certify, on average, 8% of children directly eligible for free meals.[20] Direct certification systems could be improved with increased state and federal funding, including through resumption of the Direct Certification Improvement Grant program, which is currently frozen. Additionally, 19 states are currently authorized to use income data available in Medicaid administrative records for direct certification[21]; this authority should be extended to all states. In states that were authorized to use Medicaid data as part of the Direct Certification with Medicaid for Free and Reduced-Price Meals Demonstration Program, direct certification rates increased significantly; in the four states new to the program in 2016, students directly certified for free meals increased between 2.5 and 8.0 percentage points in the first year.[22]

4. Revise federal policies that limit participation in other public benefit programs. ISPs reflect the proportion of students within a school who are identified as directly eligible for free meals based on existing administrative data, including participation in Supplemental Nutrition Assistance Program, Temporary Assistance for Needy Families, and Medicaid. Federal policies that limit participation in these federal benefit programs (for example, the Categorical Eligibility for SNAP proposed rule[23]) or promote fear that participation in these programs will negatively affect immigration status (for example, the revised Inadmissible on Public Charge Grounds final rule[24]), may also lead to lower ISPs. For example, estimates suggest that the Categorical Eligibility for SNAP proposed rule would cause ISPs at schools that serve 142,000 students to drop below 40% (the CEP eligibility cut-off), and ISPs at schools that serve an additional 1.05 million students to

drop below 62.5% (the level at which schools are fully reimbursed for all meals served), putting their CEP status at risk.[25] These policies should be revised to avoid negatively impacting school meal access.

5. Enact state policies that encourage CEP adoption. In Maryland, state compensatory education funding has traditionally been allocated to schools using free and reduced-price meal eligibility data (data that CEP schools no longer collect). In Chapter 4, most food service directors reported feeling comfortable adopting CEP only after Maryland passed legislation that protected schools adopting CEP from experiencing a decline in state compensatory education funding. In states with low CEP adoption rates,[16] policymakers should explore if similar state-level policies serve as barriers to adoption and should make necessary changes to encourage participation. Laws used in other states to promote CEP adoption, such as California's SB 138[26], which requires schools with ISPs above 62.5% to participate in a universal free meal provision and to use Medicaid data to directly certify students for free meals, can also be considered.

In addition to policy approaches, state education agencies, anti-hunger advocates, and the U.S. Department of Agriculture can take practical steps to facilitate adoption:

1. Strengthen and clarify messaging about CEP's potential impacts on Title I funding levels. Concern about the financial impacts of CEP adoption on federal education funding was identified as a top barrier to CEP adoption in Chapter 4. Food service directors reported that representatives from the state education agency and food service directors from

neighboring districts served as key resources during the implementation process; these trusted messengers can be used to educate prospective CEP schools about financial implications and alternate strategies they can use to equitably allocate Title I funds within their districts.

2. Provide targeted technical assistance to small and suburban school districts. Chapter 3 found that schools in small and suburban districts were less likely than those in very large districts and urban districts to participate in CEP. Higher participation in very large compared to small districts may reflect the benefit of economies of scale of serving more meals that occur in larger districts with centralized kitchens, or the greater administrative capacity in larger districts to assess budgetary impacts of participation. Guidance from advocates and federal and state agencies targeting smaller and suburban school districts, including guidance on how to achieve economies of scale and how to assess financial impacts of participation, may help promote uptake.

3. Identify alternative measures of poverty in place of free and reduced-price meal eligibility. For decades, policymakers and grant funders have used free and reduce-price meal eligibility as a proxy for poverty and have allocated funding based on this measure. Potential loss of federal, state, and grant funding due to no longer collecting free and reduced-price meal data was identified as a top barrier to CEP adoption in Chapter 4. To address this concern, researchers and funders should establish alternate measures of poverty to use in place of free and reduced-price meal eligibility data such as ISP.[27]

Research

Through this dissertation, important gaps in the literature related to CEP have been identified. Future research priorities are elaborated below:

1. Assess the relationship between CEP and Title I funding amount. Findings presented in Chapter 3 show that schools that received Title I funding were more likely to participate in CEP than schools that were eligible for but not receiving Title I funding. Yet participants in Chapter 4 describe concerns regarding potential loss of Title I funding as a leading barrier to participation. Rather than comparing adoption in schools with and without Title I funding, future research should assess how CEP adoption differ by Title I funding amount.

2. Evaluate the relationship between CEP adoption and state policies. State policies directly and indirectly related to CEP may influence adoption. For example, some states have waivers from the USDA to use Medicaid data for direct certification, and others, such as California[26], have laws that require all schools with ISPs of 62.5% or greater to adopt CEP. Research should assess impacts of the USDA Medicaid waivers, as well as other state-level policies, on CEP adoption rates.

3. Study the impact of CEP adoption on district finances. Food service directors interviewed in Chapter 4 described uncertainty regarding how CEP would impact school and district budgets as a factor that led them to delay adoption of CEP. They also provided mixed reports about how CEP adoption has affected their food service budgets but were unable

to comment on impacts to other parts of the school and district budgets. Quantitative research is needed to measure the impacts of CEP on districts' full budgets, including impacts on food service operations and federal, state, and grant funding, and the degree to which these impacts differ based on school and district characteristics such as ISP.

4. Assess adoption barriers among CEP non-participating and formerly participating schools. In Chapter 4, food service directors and cafeteria managers from only districts and schools participating in CEP were interviewed about barriers to adoption. Future research should consider the perspectives of those districts or schools that are eligible for CEP but not participating, as well schools that previously participated in CEP but have since opted out of the program.

5. Measure the impact of CEP on stigma and food insecurity. CEP was designed, in large part, to address stigma and child food insecurity. While Chapter 5 sought to assess change in stigma using a measure of disciplinary referrals associated with bullying and harassment, a better approach to measuring stigma and school climate, such as surveys or interviews with students and teachers, should be used in future research. Further, no study has compared rates of food insecurity among children before and after implementation of CEP.

CONCLUSIONS

This dissertation advances research on the Community Eligibility Provision, an innovative policy solution designed to reduce child food insecurity and stigma associated with school meal

participation. Findings suggest that factors associated with CEP adoption include district size, locale, ISP, and that uncertainty regarding the financial implications of CEP participation is a top perceived barrier to adoption. Results also indicate that benefits of CEP adoption include increased meal participation and elementary science test scores and attendance rates, reduced middle school disciplinary referrals, improved staff and student morale, and reduced financial stress among parents. Benefits of CEP appear to be concentrated among elementary school students and perceived benefits are greatest in districts that opt into CEP districtwide. Findings point to potential state and federal policy solutions, as well as strategies that can be used by anti-hunger advocates, state education agencies, and the U.S. Department of Agriculture to promote uptake. Future research is needed to assess how state-level policies and Title I funding levels influence CEP adoption, and to evaluate the impact of CEP on stigma using qualitative measures, and on food security and school and district budgets using quantitative measures.

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Conference Presentations (As Presenter)

Hecht AA, Stuart EA, Pollack Porter KM. *(Accepted; conference canceled due to COVID-19 pandemic)* Impact of universal free meals on student nutrition, behavior, and academic performance in Maryland. Association for Public Policy Analysis and Management Student Conference, Washington, DC. April 24-25, 2020.

Hecht AA, Stuart EA, Pollack Porter KM. Impact of universal free meals on student nutrition, behavior, and academic performance. Robert Wood Johnson Foundation Healthy Eating Research Annual Meeting, Denver, CO. March 4-6, 2020.

Hecht AA, Perez CL. Influence of food and beverage companies on retailer practices and consumer behavior. Robert Wood Johnson Foundation Healthy Food Retail Convening, Washington, DC. January 29, 2020.

Hecht AA, Stuart EA, Pollack Porter KM. Factors associated with adoption of universal free school meals provision among US public schools. American Public Health Association Annual Meeting, Philadelphia, PA. November 2-6, 2019.

Hecht AA, Misiaszek C, Headrick G, Brosius S, Crone A, Surkan PJ. Manager perspectives on implementation of a farmers market incentive program in Maryland. Conference of the Agriculture, Food, and Human Values Society, Anchorage, AK. June 26-29, 2019.

Hecht AA, Biehl E, Barnett DJ, Neff RA. Urban food supply chain resilience for crises threatening food security. Conference of the Agriculture, Food, and Human Values Society, Madison, WI. June 13-16, 2018.

Hecht AA, Zaltz D, Neff R, Benjamin Neelon S. New state nutrition policy for early care and education: Effect on food waste. Conference of the Agriculture, Food, and Human Values Society, Madison, WI. June 13-16, 2018.

Hecht AA, Jue T, Pennington K, Rams Murthy M, Patel AI. An observational study of the characteristics of free drinking water sources and students' water consumption. Academic Pediatric Association Regional Meeting, Monterey, CA. January 31, 2016.

Relevant Skills

- Languages: Spanish, French
- Software: Stata, R, ATLAS.ti, REDCap, ArcGIS, Microsoft Office