A Contextual Evaluation of the Fresh Fruit and Vegetable Program in South Carolina and Related Child Health Behaviors

Kathryn Irene Hoy

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A CONTEXTUAL EVALUATION OF THE FRESH FRUIT AND VEGETABLE PROGRAM IN SOUTH CAROLINA AND RELATED CHILD HEALTH BEHAVIORS

by

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DEDICATION

To my family, I am forever grateful for your unwavering love and support in my pursuit of higher education. Because of you, I know anything is possible and that I have the confidence to reach for it.
ACKNOWLEDGEMENTS

Sonya, your patience and guidance have helped me to grow as a researcher, academic, advocate, and citizen in our beautiful world. Thank you for your time and effort in making me better.
ABSTRACT

Children in vulnerable communities are at increased risk for poor diet.\textsuperscript{1,2} The Fresh Fruit and Vegetable Program (FFVP) is a United States Department of Agriculture (USDA) child nutrition program that increases vulnerable children’s access to and consumption of fruits and vegetables.\textsuperscript{3,4} FFVP is inherently flexible,\textsuperscript{5} has few regulations, and helps identify and develop best practices for individual schools to increase fruit and vegetable consumption among low-resource children.\textsuperscript{6} Flexibility built into the FFVP at the federal level naturally results in a variation of program adoption and implementation at both the state and school-levels.\textsuperscript{7} These variations affect outcomes in complex health promotion programs.\textsuperscript{8–10} However, few studies have examined how variation presents in FFVP schools and its associated impacts.\textsuperscript{3}

To better understand the effects of FFVP adoption and implementation variation on student health behaviors, the Principal Investigator (PI) conducted a mixed-methods study in the Spring of 2018 examining two specific aims. The first aim explored why some eligible schools in South Carolina apply for the FFVP grant while others do not and how school stakeholders decide to apply for the FFVP grant. The second aim explored if children in FFVP schools consumed more significant amounts of fruits and vegetables compared to children in non-FFVP schools, if school-level characteristics affected FFVP
implementation variation, and if FFVP implementation variation increased student consumption of FFVP snacks. Both aims used data collected from fourteen low-resource schools in South Carolina. The South Carolina Department of Education supplied a list of schools operating FFVP in the 2017-2018 school year. The PI randomly selected schools from the provided list representing the four regions of SC (Upstate, Midlands, Pee Dee, and Low Country) then matched the seven FFVP schools demographically and regionally with seven schools not operating FFVP. In addition, the PI conducted observations of lunch and snack service and interviews in each school.

To address specific aim one, the PI purposively selected stakeholders in three groups: stakeholders in FFVP funded schools, stakeholders in schools not operating the FFVP, and state FFVP administration. The PI completed a total of fifty-seven interviews with seven different categories of school stakeholders, including 15 school administrators, 14 school foodservice directors, seven school cafeteria managers, four school FFVP coordinators, seven teachers, seven parents, and three state officials. Based on this sample and these specific aims, school stakeholders apply for the FFVP grant if they feel the program will benefit their children, feel a moral imperative to address injustices, believe they are eligible and can manage the administrative burdens of federal grants.

To address specific aim two, the PI collected a sample of 3849 independent student lunch and FFVP snack consumption observations nested in 88 4th and 5th-grade classrooms. All observations were considered independent, and all data was de-identified. Following school observations, the Principal Investigator (PI) constructed a data set including publicly available school profile statistics, school health index scores, plate
waste observations, and a calculated FFVP implementation score for inclusion in this analysis. The analysis included two sample T-Tests, pairwise correlation, and multi-level models. Based on this sample, students at FFVP schools consume significantly more fruits and vegetables when compared to students in non-FFVP schools (p<.0001). Only school location correlated with FFVP implementation variation. Rural or fringe schools had a strong negative correlation with FFVP program implementation scores. This study indicated that both school and classroom level characteristics affect student consumption of fruit and vegetable snacks provided by the FFVP. Approximately 18% (ICC= 0.18) of the variation in student FFVP snack consumption can be explained by school (0.12) and classroom characteristics (0.06). Based on the model, three variables (School Health Index Score, Frequency of Snack, and Enrollment) appear to affect fruit and vegetable snack consumption among children in FFVP schools. Positive relationships are seen between School Health Index scores and snack frequency with FFVP fruit and vegetable consumption, while a negative relationship is evident between enrollment and consumption.

Children in vulnerable communities are at increased risk for a poor diet. Federal nutrition safety-net programs like the FFVP can help to mitigate this risk through increased access and consumption of fruits and vegetables during the school day. To effectively reduce the burden of poor diet through the FFVP, schools need to be aware of the program, prove eligibility, apply, adopt, and implement the program. Understanding the perspectives of eligible school stakeholders as to why they may or may not apply for the FFVP can help elucidate how to improve application rates to the program and understanding how program variation affects student behaviors can improve program
outcomes. This study suggests that stakeholder motivations for application emphasize context surrounding child welfare and moral imperatives in addition to eligibility systems and capacity. Additionally, while students in FFVP schools consume more fruits and vegetables than students in schools not operating the FFVP, variation in program implementation can impact how much of the FFVP snacks students consume.

This research can help the United States Department of Agriculture and implementing agencies continue the expansion of the FFVP into vulnerable communities. Framing the FFVP to benefit children can potentially drive applications as school stakeholders unanimously agree that child welfare is their primary reason for seeking the funds. This research also provides insights into FFVP efficacy. Program implementation appears to be influenced by school location, targeted resource sharing, capacity building, and training vital for the rural and fringe schools struggling to implement the program entirely. A final aspect of program implementation often overlooked is the influence of the classroom on student behaviors. Based on the multi-level model, the classroom does explain some of the variations in student consumption of the FFVP fruit and vegetable snack, indicating that some standardization may need to be pursued at the school level to improve program outcomes.
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LIST OF ABBREVIATIONS

BMI ......................................................................................... Body Mass Index
CACFP ................................................................................. Child and Adult Care Food Program
CDC ....................................................................................... Centers for Disease Control and Prevention
CICI ............................................................... Context and Implementation of Complex Interventions Framework
CMOs .............................................................. Contexts-Mechanisms-Outcomes
CSA ........................................................................................ Community Supported Agriculture
DRI ........................................................................................ Dietary Reference Intake
DRNI .............................................................. Dietary Recommended Nutrient Intake
ERS ................................................................. Economic Research Service
FFVP ................................................................................ Fresh Fruit and Vegetable Program
IRB ............................................................... Institutional Review Board
NHANES ......................................................... National Health and Nutrition Examination Survey
NSLP ................................................................................ National School Lunch Program
RDA .................................................................................... Recommended Daily Allowances
RQ ....................................................................................... Research Question
SBP .................................................................................... School Breakfast Program
SFSP ................................................................................ Summer Food Service Program
SMP ....................................................................................... Special Milk Program
SNA ...................................................................................... School Nutrition Association
SNAP .................................................................................... Supplemental Nutrition Assistance Program
US ......................................................................................... United States
USDA ............................................................................... United States Department of Agriculture
WHO ................................................................................. World Health Organization
WIC ...................................................................................... Women, Infants, and Children Program
CHAPTER 1
INTRODUCTION

The United States has several food-based programs and policies in schools to improve child health and diet. These programs include the school meals programs, offering breakfast, lunch, and sometimes dinner to children in schools, and other programs that provide specific foods, such as the Special Milk Program and the Fresh Fruit and Vegetable Program. According to program evaluations, multi-component school-based programs modestly increase daily fruit and vegetable consumption. These evaluation studies used a wide variety of outcome measurements, duration of exposure, and study design, making it difficult for public health experts to interpret true program impact. Also, most US school food-based program evaluation studies have limited process evaluation, resulting in poorly characterized program implementation. When implementation is measured well, it focuses on changes made to the food environment without much attention to the process for creating such changes. The variability in both implementation and measurement of these programs indicates a need for integrated evaluation.

Advances in implementation science, including new theories, allow for the exploration of the implementation process and the development of a complete understanding of the influence of food-based programs in schools, specifically as they relate to child health. The Context and Implementation of Complex Interventions
Framework (CICI), as seen in Appendix A, is used to conceptualize a program within systems and guides program evaluators toward an in-depth assessment of context, implementation, and outcomes. The research details an integrated evaluation of the Fresh Fruit and Vegetable Program (FFVP) in South Carolina using the CICI framework to better understand the impact of the FFVP on child health.

The World Health Organization (WHO) describes child health as "a state of physical, mental, intellectual, social, and emotional well-being and not merely the absence of disease or infirmity. Healthy children live in families, environments, and communities that provide them with the opportunity to reach their fullest development potential". Further, healthy children are food secure, meaning they can access and consume enough healthful foods to support their growth, activity, and development. In the United States, Healthy People 2030 has developed science-based, 10-year, national objectives for improving children's health by reducing food insecurity, an increase in food access, and improved food and nutrient consumption. The USDA has led the major nutrition policy initiatives to meet these Healthy People 2030 goals through school nutrition programs designed to meet the dual goals of improving the nutrition status among children while simultaneously supporting US agriculture.

The majority of the US population, including children, does not meet dietary intake recommendations for fruits and vegetables. Among all children aged 1-18, approximately 60% do not meet recommendations for fruit intake, and NHANES reports a range in consumption from 0.8-1.2 cup-equivalents per day. Similarly, 93% of children aged 1-18 do not meet intake recommendations for vegetables, and NHANES reports a range in consumption from 0.8-1.3 cup-equivalents per day. Schools provide between
26%-47% of the average child's calories per day, depending on the child's participation in school meal programs. Child participants consume approximately 0.2-.25 cups of fruit and 0.3-0.4 cups of vegetables daily.\textsuperscript{23,24} According to the most recent data from the National Center for Educational Statistics (NCES) approximately 53.7 million children in the United States are between the ages of 5-17 years.\textsuperscript{25} Schools serve about 30 million children daily through food-based programs meaning they stand to influence the dietary patterns of approximately 56% of the US school-aged population. Schools also serve about 30 million children daily through food-based programs meaning they stand to influence the dietary patterns of over 60% of the US school-aged population.\textsuperscript{26} According to the scientific justification provided in the Dietary Guidelines for Americans, increasing the consumption of fruits and vegetables should improve individual child health through reduced risk of developing chronic diseases, healthy gut development, enhanced immune function, and growth.\textsuperscript{27}

Additionally, consuming a diet rich in fruits and vegetables has multiple benefits for child health through other pathways such as reduced environmental impacts,\textsuperscript{28,29} diversification of the agricultural production systems, and improved rural development.\textsuperscript{30-32} Additionally, dietary patterns high in fruits and vegetables correlate positively with increased sustainable farming practices. Sustainable farming practices improve year-round food access, especially for food-insecure children, which increases their school attendance and subsequent educational attainment. Sustainable food movements increase social cohesion and local capacity to solve problems\textsuperscript{33} resulting in the greater operational capacity to address child health issues in rural areas.\textsuperscript{34,35}
The Fresh Fruit and Vegetable Program (FFVP) is a relatively new United States Department of Agriculture (USDA) program that provides fresh fruits and vegetables to children in participating low-income elementary schools across the United States. The program's stated goal is "to improve the overall diet of children and create healthier eating habits that could impact a child's life both immediately and in the future." The program is inherently flexible, has few regulations, and helps to identify and develop best practices for increasing fresh fruit and vegetable consumption by low-resource children, which could improve nutrition and combat obesity. To date, FFVP evaluation research has focused on whether or not children eat fresh fruits and vegetables and postulates how these dietary changes may impact childhood obesity rates. These evaluations have found small effect sizes and lacked detailed process evaluations to explain why the effect sizes are small.

While evaluation researchers acknowledge ecological theories and nod to several spheres of possible influence on child health and diet, none of the evaluations to date examine the systemic effects of FFVP on children, their schools, and their communities, or control for the variety of contexts that affect implementation. The USDA evaluation of FFVP in 2013 made specific requests for contextually integrated assessment of the program and an examination of how FFVP variation in implementation affects outcomes and impacts of the program, indicating a gap in the evaluation literature that pertains to FFVP. An integrated evaluation of the FFVP could more appropriately explore the ecological pathways and mechanisms that improve child health.

Child health is the result of complex inter-related processes that are both distinct and synergistic. These processes involve multiple stakeholders, interactions, and systems
across the individual, household, community, governmental and worldwide spheres. Thus, we cannot view child health in a vacuum. Instead, we should view child health as an aggregation of these contexts and environments. At the individual level, children may experience benefits from programs such as the FFVP through reduced food insecurity, improved nutrition education, increased preference for fresh fruits and vegetables, increased social support for healthful dietary patterns, and empowerment in other food environments. Households may experience echoes of their child's newfound fruit and vegetable preferences resulting in increased availability of fruits and vegetables in the home, affecting behaviors, budgets, and social roles. FFVP may affect child health through community and governmental systems such as improved support for comprehensive school health policies and initiatives, reinforcement of national child health partnerships, increased community partnership, improved child nutrition program capacity, and support for the domestic agriculture industry.

This research explored stakeholder perspectives as they related to FFVP application and adoption and measured program efficacy by examining program implementation variation and its relationship to student health behavior. Two specific aims guided this research:

Specific Aim 1: Describe the differences among schools that do and do not apply for FFVP grants to provide a rich contextual foundation for ethnographic aims. Research Questions:

1. What are the demographic differences between schools operating the FFVP and schools not operating the FFVP? Are there similar characteristics among schools operating FFVP? Schools not operating FFVP?
2. What are stakeholder reasons for applying or not applying for the FFVP grant? Are there themes in perceived reasons for success as compared with failure?

3. What are the underlying contexts and ideologies that support the application to FFVP grant opportunities in South Carolina?

*Specific Aim 2:* Explore perceived child health outcomes and behaviors related to FFVP and examine their relationship to implementation variation

Research Questions:

1. What is the relationship between FFVP and child diet?

2. Do children in participating schools consume the fruit or vegetable snack provided? If so, in what quantities?

3. How does FFVP impact child consumption of school meals? Do schools that participate in FFVP demonstrate greater student fruit and vegetable consumption during school meals when compared with comparable schools that do not participate in FFVP?

4. To what extent does school FFVP implementation variation explain student consumption of fruit and vegetable snacks provided?

5. What is the relationship between school-level characteristics and FFVP implementation?

This mixed-methods study contributes to the field of public health because it considers stakeholder perspectives in the pursuit of grant funds and program adoption. Additionally, it is the first study of its kind examining the nested nature of students exposed to the FFVP in school and classroom environments. Understanding the motivations for applying and adopting the FFVP and how implementation variation
affects program efficacy can help stakeholders at multiple levels improve the program and ultimately affect child health in vulnerable communities.

1.1: Preview

In chapter 2, I summarize the background literature related to the Fresh Fruit and Vegetable Program (FFVP) and review evaluations of the FFVP to date. I review the theoretical basis behind the evaluation of the FFVP, the significance of the research conducted, and describe the conceptual map/framework that guided the work.

In chapter 3, I review the study methodology, including the study design, target population, variables of interest, data collection methods, and analysis.

Chapter 4 presents one of two manuscripts. The first manuscript presented is titled: *School stakeholder motivations to apply for the Fresh Fruit and Vegetable Program in low-resource schools*. The manuscript details the qualitative inquiry into stakeholder perspectives of the FFVP and application procedures.

Chapter 5 presents the second manuscript. This manuscript is titled: *School characteristics explain a portion of student consumption of snacks provided through the Fresh Fruit and Vegetable Program*. The manuscript details the quantitative investigation into the relationship between FFVP implementation and child health behavior.

Chapter 6 relates the present research to the broader body of knowledge surrounding the FFVP and child health behavior. I conclude that for the program to maximize its reach and efficacy, reframing the program to stakeholders to benefit children and increasing resources for schools to standardize implementation are necessary.
CHAPTER 2
BACKGROUND

A great amount of literature applicable to the evaluation of government nutrition assistance programs exists. I summarize the background literature related to the Fresh Fruit and Vegetable Program, specifically in the body of this proposal. To provide a more in-depth examination of the literature relevant to child health, obesity, and government nutrition assistance programs, I have included additional background literature review in Appendix B.

2.1: The Fresh Fruit and Vegetable Program

The FFVP is a federally funded program providing money to select elementary schools across the country and US territories to purchase fresh fruits and vegetables, which students consume during the school day. The program supplements the school feeding programs in place; does not provide the majority of calories or directly address food insecurity. In FFVP legislature and distribution materials, the program's stated goal is to improve children's overall diet and create healthy eating habits to improve child health in the present and the future.\(^40\)

2.2: Fresh Fruit and Vegetable Program Funding

The federal government provides each state with an annual grant equal to one percent of the total federal funds earmarked for FFVP in the Farm Bill for that fiscal year to be used October 1\(^{st}\) through September 30\(^{th}\) of the following year. States receive any
remaining and carryover funds based on the state population compared to the rest of the US population.\textsuperscript{41} For example, during the 2016-2017 school year, the federal government provided $184.5 million in FFVP funds and an additional $17.2 million of carryover funds. South Carolina received $3,206,294 from the earmarked federal funds and an additional $299,943 in carryover funds. Thus $3,506,237 in funds were made available for FFVP administration, implementation, and evaluation throughout the 2016-2017 school year in South Carolina.\textsuperscript{42,43} South Carolina received $4,920,955.00 in FFVP funds for the 2017-2018 school year.\textsuperscript{42,44}

State agencies responsible for administering the National School Lunch Program (NSLP) receive FFVP funds from the federal government. This agency is responsible for ensuring the FFVP is implemented correctly and meets all federal mandates. The total granted amount includes the state's program administration budget, and each state is responsible for determining how\textsuperscript{41} “best to manage [the] administration of FFVP within its existing personnel structure, workload considerations, and other factors.”\textsuperscript{45} While the FFVP provision does not require that a state hire an FFVP coordinator, states have the flexibility to determine how best to ensure appropriate enactment of the FFVP as long as administrative costs do not exceed 5% of the total granted amount.\textsuperscript{41} Once the state removes its administrative/operating costs, remaining funds become mini-grants and reimbursements to low-resource schools to prepare and provide fresh fruits and vegetables to their student body. In addition, the agency must ensure that the total enrollment for all schools selected to participate in the program results in a per-student allocation of between $50-75 per year.
2.3: Fresh Fruit and Vegetable Program School Selection Criteria

Once the state receives program funds, the state agency is responsible for reaching out and recruiting eligible participant elementary schools for that fiscal year. A chart of selection criteria is in Table 2.1.45

Complete school applications require a report of the total number of students enrolled in the elementary school, the percentage of that student body eligible for free and reduced meals, a letter of support signed by the school food service manager, school principal, and district superintendent, as well as a program implementation plan.41 Federal guidance instructs state agencies to select schools with the highest free and reduced meal participation to the "maximum extent practicable".45 This means that the agency may choose schools with lower free and reduced meal participation to meet their per-student fund allocation cut point of $50-75.

2.4: Fresh Fruit and Vegetable Program Operations

Schools selected for participation in FFVP agree to receive a grant equivalent to their school enrollment at the state determined per-student allocation of $50-75 per year. In return, these schools submit monthly reimbursement claims for the costs of purchasing, preparing, and serving the snacks and agree to use no more than 10% of the total granted amount for administrative expenses. Schools must provide fresh fruit and vegetable snacks in multiple areas of the school to all enrolled students at least twice a week. The provision of these fresh fruit and vegetable snacks cannot overlap with meal service during the official school day.41 Further, the program guidelines strongly encourage complementary nutrition education and offer opportunities for synergy among nutrition education activities already occurring in schools. There are no requirements for
the frequency or types of nutrition education provided, although the FFVP provision does specify integrating program activities into other school efforts promoting health.\textsuperscript{45}

Implementation of FFVP in schools has some limitations. First, only children enrolled in the school and teachers directly engaged in serving students in their classroom can receive the free fresh fruit or vegetable snack. All other adults and teachers not serving their students in the classroom cannot partake in the snack offering. Second, the types of foods and complimentary food pairings offered to students are restricted. As of 2016, the FFVP does not allow for processed or preserved fruits and vegetables such as canned, frozen, or dried, dip for fruits, fruit or vegetable juices, snack fruit products like fruit leathers or strips, jellied fruit, trail mix, or nuts, cottage cheese, fruit or vegetable pizza, smoothies, carbonated fruit or fruit that has had flavoring added to it.\textsuperscript{45} In the last two years, political coalitions sought to allow processed or preserved fruits and vegetables in the program. This provision is primarily for the states and provinces of the country which lack the capacity for fresh fruits and vegetables year-round or rely on food transported great distances (e.g., Alaska, Hawaii, Guam).\textsuperscript{46}

\textbf{2.5: The Fresh Fruit and Vegetable Program in South Carolina}

In South Carolina, the Department of Education Office of Health and Nutrition is responsible for FFVP administration, and the agency opted to hire a full-time state FFVP coordinator. In the 2017-2018 school year, there were approximately 488 public schools eligible\textsuperscript{47} for the FFVP in the state of South Carolina. Of those eligible, 219 applied for the FFVP, and the state awarded 139.\textsuperscript{44} The USDA affords each state agency flexibility in their methods for evaluating school compliance with FFVP mandates. South Carolina
evaluates funded schools through a review of monthly reimbursement claims and semi-annual process evaluation surveys distributed via email.

2.6: Evaluation of the Fresh Fruit and Vegetable Program

Since the program's inception in 2002, there have been two USDA-initiated evaluations of the program and a smattering of independent assessments. All of these evaluations are similar in that their primary focus was on consumption. The focus on consumption is partly due to the overall goals of FFVP, as stated in the legislature. FFVP legislature reflects the neoliberal ideals behind behaviorally focused programs. An underlying onus exists on a single pathway: consumption of fruits and vegetables as the only method of health improvement. Due to this emphasis, the evaluations of FFVP to date overlook the complexities of implementing a school food program wherein a federal program drops into a school and community which often have their own cultures and contexts which could impact not just individual-level fruit and vegetable consumption but also program adherence, involvement, and other implementation mechanisms. Furthermore, many of these evaluations do not include process evaluations.

The Economic Research Service conducted the first USDA evaluation of the program during the 2002-2003 school year. This evaluation covered the pilot of the FFVP in 105 low-resource schools across four states and one Indian reservation. The pilot program included a volunteer-based sample of schools spanning all ages (e.g., – elementary, middle, and high school). The average enrollment for these schools was 607 students, which meant there was an approximate allocation of $94 per student for the year. The evaluation was a before-and-after comparison design using both interviews and document review.
The pilot evaluation was primarily formative and did not have formalized research questions. However, the final report included information on the program's acceptability, pilot management and implementation, perceived value and effect of the pilot, food and beverage sales, cost considerations, and feasibility of program continuation. The ERS described the program as "very successful" in the executive summary of the report to Congress. Student's indication of their interest in program participation was the measure for success. Using administrative records of fruit and vegetable purchases and project reports describing FFVP implementation, the evaluation team determined that students consumed 92.5% of the servings offered throughout the pilot, and schools reported that 80% of their students were "very interested" in the program. These documents also indicated three primary delivery methods for the fruit and vegetable snack, which included classroom service, kiosks, and free vending machines. The most frequently used delivery method was classroom service across all age groups, although 81% of schools reported using multiple delivery methods. Ninety-three percent of schools provided nutrition education although the "extent and type varied among schools and grade levels". Stakeholder interviews yielded positive comments related to dietary behavior and awareness, such as reduced consumption of less healthy food and increased familiarity with fruits and vegetables. The pilot failed to generate any definitive results related to the program's impact on other school food programs (e.g., – NSLP, SBP) or any causal relationship between the program and dietary outcomes beyond proxies due to evaluation study design limitations.

Abt Associates conducted the second USDA evaluation of the FFVP under the direction of the Office of Research and Analysis during the 2010-2011 school year.
During this school year, the FFVP expanded to include all 50 states, US provinces, and territories. Additionally, the FFVP legislature limited the program to elementary schools and reduced the per-student funding to $50-75 per year. This evaluation had defined research questions related to the impact and implementation of FFVP and, as such, required two samples and different methods. This evaluation used regression discontinuity methods to assess the impact of the FFVP on student consumption of fruits and vegetables and dietary outcomes based on diary-assisted 24hr dietary recall, parent and teacher surveys. The sample used for impact analysis included 4,696 students from 214 low-resource elementary schools from 16 states. The impact sample was broken down to 2,471 students from 115 FFVP schools and 2,225 students from 99 non-FFVP schools.36

To examine FFVP implementation outcomes, evaluators examined web-based surveys completed by school foodservice directors, school food service managers, and school principals. Surveys asked about methods of program implementation, snack-type/distribution, and student acceptance via observed participation. An additional sample of schools not included in the impact sample was contacted to assess implementation. The final implementation sample included survey responses from 698 participating FFVP schools.

Results from the impact evaluation indicate that elementary school students participating in FFVP consumed on average .32 cups more of fruits and vegetables when compared to students not participating in the FFVP. On average, students consumed more fruit than vegetables and reported that they ate about .06 more cups of fruits and vegetables outside of school. Student surveys also showed increased knowledge,
attitudes, and perceptions of fruits and vegetables among FFVP students when compared to non-FFVP students. The implementation evaluation showed that FFVP schools offered nutrition education activities on average 2.4 times a week compared with .7 times a week in non-FFVP schools. Also, 41% of school representative respondents reported offering a fresh fruit or vegetable snack five days a week which exceeded the USDA recommendation of two times per week. The majority of school respondents (82%) reported making partnerships with organizations external to the school to assist with FFVP implementation and indicated that those partnerships provided nutrition education activities.³⁶

While rigorous in design, this evaluation failed to account for the individual school and student contextual differences and complexities as there was limited opportunity for stakeholder viewpoint expression beyond survey response.

Results of the Independent evaluations of FFVP show positive increases in fruit consumption as well as reported improvements in student fruit and vegetable attitude and preferences; but, these evaluations are similarly limited to dietary outcomes and lack context. As is the case with all studies, a myriad of limitations exist, including small sample sizes, single observations, pretest/posttest designs or quasi-experimental designs based on self-report surveys, low power for the statistical tests, and a general lack of qualitative inquiry. Overall, the evaluative work done related to FFVP adds to the body of knowledge associated with consumption patterns of children in school-based programs; but does little to elucidate the many other impacts and outcomes associated with a school-based fruit and vegetable program. Furthermore, none of the evaluative work to date accounts for the nested nature of the data being collected in their statistical analysis,
meaning that the results of these analyses may be grossly overestimating the effects of the program on student behavior.

2.7: Theory in the Fresh Fruit and Vegetable Program Evaluations

A debate about the value of theory in evaluation work is ongoing. One perspective is that the definition of theory is associated with reductionism. Therefore, it is in direct opposition to holism, or the belief that all systems and their parts must be viewed as wholes and not as the mere aggregation of parts. Conversely, a lack of theory-driven evaluation results in evaluations that rely solely on empirical evidence and lack sensitivity to constructivist epistemology or interpretivist theoretical perspectives. In the middle of the spectrum sits a broader interpretation of theory and its role in evaluation. This perspective suggests that theory is not offering universal truths or predictions; rather, assisting in the explanation and understanding of complex situations and environments. This perspective allows evaluators and researchers to use multiple theories or adopt components from multiple theories and frameworks to more accurately address the complex and dynamic field that is public health.

Much of the evaluation work done to date related to FFVP is firmly rooted in empirical practice with an emphasis on program outcomes and reliance on quantitative analysis to establish program effectiveness. As a result, the literature focuses almost exclusively on establishing that the program worked but provides little information about how or the conditions under which the program works. Furthermore, a lack of both program theory and evaluative theory in the FFVP work to date is evident. The evaluations fail to explicitly define their theoretical underpinnings, which is likely due to the lack of theoretical definition within the program guidelines themselves. The oversight
of theory in the FFVP program guidelines could account for the over-emphasis on quantitative outcomes. Thus, an opportunity presents itself for evaluation theory to define broader contextual outcomes and help account for both systems surrounding a program and the inherent complexity in social interventions.

2.8: Significance

Programs such as the FFVP have the potential to reach almost all of the children at greatest risk for nutrition-related health disparities in the United States; but, due to limited evaluation frameworks, we have little understanding as to how these programs truly affect health when put into complex environments.

Child nutrition programs are designed to improve the welfare of children across the US. Schools are used as vehicles for program services. Schools provide a relatively controlled environment in which the majority of US children live, work, and play daily. The Centers for Disease Control and Prevention identifies schools as a critical leverage point in individual and community behavior change.\textsuperscript{52,53} Utilizing schools, child nutrition programs become possible points of intervention to reduce childhood obesity and improve overall child health.\textsuperscript{54–57} The southeast, when compared to the other six USDA regions, has the greatest potential to affect child health through child nutrition programs. This is based on enrollment and participation numbers. In 2011, approximately 5,359,015 students were eligible for free or reduced-price meals in the southeast which represented over 56\% of the total student population enrolled in school in southeastern states (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee).\textsuperscript{57}
South Carolina’s numbers mirror that of the region. According to Common Core Data, in 2014, there were approximately 756,523 total students enrolled in South Carolina Elementary and Secondary schools, and approximately 422,360 received free or reduced-priced meals. These numbers indicate that 56% of the student population in South Carolina participates in at least one school-based child nutrition program. Further, this information indicates that a majority of the student population in the state of South Carolina could be considered low-resource according to the USDA food assistance eligibility requirements. In the early 2000s, children most often not meeting Dietary Guidelines for fruits and vegetables lived in households between 130%-350% of the federal poverty level. Further, these children and adolescents were more likely to consume high-energy vegetables like French fries and be at risk for overweight. Therefore, child nutrition programs, such as the FFVP, have the potential to reach the majority of children in the US at the greatest risk for health disparities.

Unfortunately, evaluation of child nutrition programs has been too narrow and focused on diet quality and consumption, which ignores how these programs may affect overall child health and how the implementation of these programs is affected by the systems and contexts surrounding them. Furthermore, health outcomes literature has afforded limited attention to the complexity of these multiple influences and, child nutrition outcomes specifically have rarely been framed in the context of child health overall. People and their health represent a complex and dynamic relationship. Health is the result of direct and indirect influences from multiple domains, including but not limited to: physical (built and natural), social, cultural, policy, interpersonal, and intrapersonal environments. People exist and function within several contexts and
settings at any one point in time. Precious little research about the interactions between these domains and how they affect health outcomes exists. Programs designed to improve health operate within these multiple settings and contexts; thus, for a program to be effective, it needs to take these multiple settings and contexts into account. By using an ecological frame when evaluating child nutrition outcomes, the potential to uncover insights about the interactions between multiple settings and contexts as they relate to child health emerges. Additionally, by using a broader ecological lens in an evaluation, programs designed to impact nutrition outcomes such as the FFVP have the potential for wider-reaching impacts on child health through multiple routes. The novel application of a framework that accounts for contexts and implementation in the evaluation of the FFVP program illuminates the relative importance of the various domains of influence and gives a better understanding of the ways child health can be improved.

The emphasis on short-term goals such as child nutrient profile and consumption in child nutrition program evaluations ignores how these programs may affect overall child health and how the systems surrounding the programs may affect implementation and ultimate program service delivery. Few studies account for the complexities and contexts surrounding child nutrition programs. Given that these programs have great potential to reach children across the country at the greatest risk for health disparities, there needs to be a more thorough understanding of how these programs affect child health and the contexts in which they operate. This study is paramount to inform the evaluation process of these highly invested programs in schools as they relate to improving child health outcomes.
2.9: Innovation

Much of the evaluation surrounding FFVP focuses on the consumption of the fruits and vegetables provided to students participating in the program. Given that the FFVP has a dual goal of improving fruit and vegetable consumption and combating obesity through nutrition education activities, these evaluations are missing the impacts of the program on the broader definition of child health as well as ignores the process of implementing the FFVP into a highly complex system which already operates multiple child nutrition programs. This project examined the FFVP and its many possible influences on child health through the lens of implementation, context, and complexity allowing for results that can inform program refinement.

2.10: Overview of Conceptual Map/Framework

This evaluation study is built on the interpretivist premise of realism. The realist perspective views the physical and social world as stratified and emergent, and within this world, causal associations are rarely universal; rather, they are heavily influenced by setting and context. This means that what works in one time and space may not work in another. Critical realism as an epistemology can guide evaluations and help evaluators examine how people understand a social program concerning the structures and elements which exist both within the program and surrounding the program. Realistic evaluations seek to establish what goes on in a system and then explain the connections between various inputs, outputs, agents, settings, strata, and contextual relationships to answer the overall question, “What worked, for whom, and under what circumstances?” As such, realist evaluations cannot simply use an inputs-outputs model and favor a case-study approach. One of the primary tenants of realist research is
pluralism. Pluralism as a research methodology means that any data sources are used based on opportunity and need. Both quantitative and qualitative methods are encouraged and used to provide a rich and nuanced explanation of the traditional evaluation notion of contexts-mechanisms-outcomes (CMOs).

Realism overlays well with complexity theory which adheres to the holist and anti-reductionist views of systems. Complexity theory encourages researchers to examine relationships between entities, the internal structure, and the surrounding environment—social beliefs/narratives and even independent programs or interventions both shape and influence outcomes directly and indirectly. Further, aggregate complexity theory views systems as learning organisms that demonstrate emergent behaviors, grow and change over time. The use of complexity theory in evaluations guides researchers to use comprehensive research methods and to define mechanisms of change through the lens of relationships both within and between entities. Reinforced by inherent theoretical flexibility to use and adapt frameworks as needed, evaluators can capture data in a variety of systems realistically.

A relatively new complexity framework for program evaluators is the Context and Implementation of Complex Interventions (CICI) framework. This framework was developed to be a generic guide for researchers as they consider three primary dimensions in program evaluation: context, implementation, and setting. This framework is in answer to the realist’s call for a more nuanced definition of the CMOs paradigm in traditional empirical evaluation.

Context in this framework refers to a set of characteristics and circumstances which are dynamic and distinct. It is within context that implementation embeds.
Implementation is thus influenced, modified, and constrained by the context within which it is nested. This framework identifies seven contextual domains which may affect implementation and include: geographical, epidemiological, sociocultural, socioeconomic, ethical, legal, and political. Implementation in the CICI framework refers to activities both actively and deliberately planned and enacted to bring an intervention to a particular setting. The implementation of an intervention or program occurs within the contextual domains and is thus learning, growing, and changing. Implementation includes five domains: implementation theory (or program theory), process, strategies, agents, and outcomes. The final dimension of evaluation of concern in the CICI framework is the setting. Setting is the physical environment within which the implementation of an intervention is occurring. The setting interacts with both the context and the implementation.17,81 As is the case with all complexity and realist theories, the CICI framework emphasizes the stratification of program implementation and relationships across those strata. Therefore, within the CICI framework, the program or intervention in question can be influenced by interactions at the micro-, meso-, and macro-levels.81 These levels are represented by the shading of the semicircle wedges seen in the CICI diagram in Appendix A. It is up to the researcher to determine the use and meaning of those levels and whether they are relevant to the evaluation in question. The framework provides checklists for evaluators to consider and include in their data collection and analysis. Evaluators observe interventions of interest and establish characteristics associated with the context and setting in addition to observing implementation processes. The CICI lends itself to case studies, and flexibility is encouraged as cases dictate where and when data is available. Surveys, secondary data, interviews, and
observations serve as multiple sources for data collection. This flexibility makes the CICI suited to mixed methods and multiple case studies. Considering these theories and frameworks, the conceptual map of this evaluation incorporates components from the realist CMOs, the complexity theory’s emphasis on systems and environments, and the CICI’s evaluation domain definitions.

As the FFVP is a naturally stratified program enacted at the federal level, operated at the state level, and further implemented into unique and changing school-by-school settings, the use of these theories and frameworks guides appropriate evaluation study design. The concepts and theories defined here support the use of a case-study approach to explore the impacts of the FFVP on child health. This theoretical base also provides flexibility in research methodology, which is necessary when working in schools where stakeholder turnover is high, documents and paper trails may be partial or incomplete, and resources and stakeholder buy-in may vary both throughout and within the program timeline.

Below, Image 1 details the components of the theories and frameworks described above as they relate to this FFVP evaluation. On the far right, the FFVP intervention sits in the implementation theory (or program theory) box, which includes both the implementation strategy and the implementation agents. This box also overlaps with the implementation process and outcomes diamond as implementation theory, agents, strategy, and the FFVP itself all interact. Both the implementation theory box and the implementation process/outcomes diamond are extended into the CICI contextual domains indicating that the contextual domains have a relationship with the implementation of the FFVP. The contextual domains rest next to each other to depict
how contextual domains are dynamic and assert influence over the other contextual domains as well as the program implementation. Similar to the CICI framework itself, the contextual domains are shaded to represent the micro-, meso-, and macro levels of influence exerted through these domains. The contextual domains abut the setting domain because the physical setting surrounding a program is influenced, if not directly but indirectly, by the many contextual domains. The implementation diamond overlaps the setting domain as the implementation process and outcomes are both directly and indirectly influenced by physical setting characteristics.

Moving left across the concept map, three overlapping circles also overlap with the setting domain. These three circles represent the other independent interventions/programs in existing, stakeholder volition, and narratives. These circles overlap to express the direct and indirect influence between the setting and these concepts. Possible independent interventions in school settings could vary and could include programs dedicated to improving academic performance like the Afterschool Alliance or health initiatives such as Live Free South Carolina. Every school will have its own program "profile," which could both, directly and indirectly, influence the FFVP. Stakeholder volition refers to both stakeholder reasoning and buy-in. Adhering to both complexity theory and realism, people will fall on a spectrum of interest and activation, and as such and will provide individualized reasons for engaging or not engaging in FFVP. Setting and contextual factors within the concept map could influence all of this. Narratives, specifically the medicalization of childhood obesity and the onus on individual behavior, are entities of their own and have a relationship with the setting and the FFVP intervention.
The final component of the concept map is the large circle representing the many outcomes associated with the FFVP. These many outcomes, based on theory, can span from short- to long-term outcomes. The concept map adheres to complexity theory. All interactions are to be considered bidirectional. Thus “flow” across this map doesn’t exist. The overall concept map is seen as a guiding image to visually represent the many theories and frameworks informing the evaluation study. As such, the map is dynamic.
2.11: Tables

Table 2.1: Fresh Fruit and Vegetable Program School Selection Criteria

<table>
<thead>
<tr>
<th>*Be an elementary school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operate the National School Lunch Program</td>
</tr>
<tr>
<td>Submit a complete application to participate</td>
</tr>
<tr>
<td>&gt;= 50% free/reduced-price meal participation</td>
</tr>
</tbody>
</table>

*Elementary schools can be charter, private/parochial, or residential care institutions as long as they operate the National School Lunch Program
Figure 2.1: A Contextual Evaluation of the Fresh Fruit and Vegetable Program in South Carolina and Related Child Health Behaviors Conceptual Map
CHAPTER 3

METHODS

3.1: Preliminary Work

In the Summer of 2017, the researcher attended a nutrition education conference where they met and held an informal focus group with ten federal and state Fresh Fruit and Vegetable Program administrators. At this focus group, the researcher discussed potential stakeholders of interest to include in the study as well as potential questions of interest. The focus group was not recorded, although notes were taken and reviewed when designing the study.

3.2: Approach Overview

This project used the Context and Implementation of Complex Interventions Framework (CICI) as a guide to evaluating the Fresh Fruit and Vegetable Program (FFVP) in SC. Using a mixed-methods case-study design and the CICI, the researcher will explore contexts and ideologies that support the adoption and implementation of the FFVP in the state of South Carolina, in addition to assessing how context and or implementation influence the program and its outcomes.

To answer the research questions under Aim One, the researcher conducted a thorough document review, semi-structured interviews, and key informant interviews. First, to establish demographic profiles and characteristics of schools awarded an FFVP grant in South Carolina, the researcher reviewed all FFVP application packets. This document review assisted in establishing school stakeholder motivations for applying for
FFVP funds. To better understand the perspective of schools not awarded FFVP funds, the researcher conducted one-hour semi-structured interviews with food service directors and principals from schools not operating the FFVP in the 2017-2018 school year. Foodservice directors and principals were the primary points of contact as the Office of Health and Nutrition at the South Carolina Department of Education indicated that they are often the ones completing the application for FFVP funds. Selection and recruitment procedures are detailed in section 4.4. The researcher contacted all principals and food service directors via email and invited them to participate in interviews to establish demographics and characteristics of schools not operating the FFVP as well as to describe the context surrounding application for FFVP funds. After completing the interviews, the researcher completed key informant interviews with state office personnel to further define why some programs apply, some apply and are not awarded, and others do not apply at all. To better understand the perspective of stakeholders in FFVP schools, the researcher recruited a purposeful sample of seven schools awarded the FFVP grant for the 2017-2018 school year. The Office of Health and Nutrition assisted in the selection and recruitment of these schools to ensure maximum variation within the sample. Maximum variation in this study referred to schools with varying levels of FFVP and school food program success and engagement. Based on the preliminary focus group, FFVP stakeholders, including state program administrators, school administrators, FFVP coordinators, the food service director, the school cafeteria manager, teachers, and parents, were asked to participate in semi-structured interviews regarding FFVP. As this study did not examine student perceptions or knowledge, students were not invited to participate in the interviews despite being identified as a stakeholder in FFVP.
implementation during the preliminary focus group. Student knowledge and perceptions associated with FFVP are an area for future study.

To examine student dietary patterns associated with FFVP and answer research questions associated with specific aim two, the researcher observed students during FFVP snack service and NSLP service. To determine implementation variation patterns, the researcher observed all schools selected to participate for at least two non-sequential FFVP delivery days to assess FFVP implementation techniques. The researcher also analyzed all semi-structured interviews and observation notes using thematic analysis approaches to find patterns among stakeholder narratives. After developing initial themes, the researcher created matrices to aggregate and condense data until thematic saturation occurred. Additionally, the research analyzed notes, photographs, South Carolina FFVP audit forms, and environmental checklists, such as the Centers for Disease Control and Prevention School Health Index, documented FFVP implementation processes, strategies, and techniques at each FFVP school for similarities. The researcher established emergent categories for the implementation of FFVP. In addition to the semi-structured interviews and implementation notes at each school, the researcher conducted key informant interviews at the state level and document review to further enrich the contextual picture of FFVP in the state of South Carolina.

The researcher addressed the quantitative research questions associated with aim three through a plate waste study and statistical analysis of school characteristics as they related to student consumption behaviors. As previously mentioned, the researcher recruited seven schools operating FFVP and seven comparison schools not operating the FFVP to determine differences between groups. Plate waste was used to assess student
consumption of fruits and vegetables. The researcher completed plate waste at both FFVP and non-FFVP schools at two-time points during the study. Each site had at least two observations of plate waste both during FFVP delivery (if an FFVP school) and during school meal service to establish dietary intake differences between FFVP and non-FFVP schools. To assess plate waste, the researcher used the Quarter-Waste Method visual estimation method. Cafeteria sales and production records were collected to triangulate plate waste results. Paired T-Tests were used to determine how much students consumed and if they were significantly different between FFVP and schools not operating the FFVP. Pairwise correlation matrices were used to determine relationships between school characteristics and implementation variation. Finally, due to the nested nature of the data (students nested within schools and classrooms), the researcher used multi-level mixed models to assess the impact of FFVP implementation practices on student consumption of the FFVP snacks provided.

3.3: Sampling and Sample Description

The primary purpose of the study was to describe and identify how FFVP works to improve child health behaviors in South Carolina. The research questions which guided this study focused on determining differences between schools operating the FFVP and not operating the FFVP, in addition to observing the FFVP implementation process and examining FFVP impacts on child health behaviors.

The target population for this study was elementary school FFVP stakeholders (and emergent FFVP stakeholders) as determined from preliminary research. To offer the FFVP, schools must be elementary schools, must have high percentages of free and reduced eligible students as compared with other applicant schools, must participate in
the National School Lunch Program, and must complete the annual FFVP application. The state of South Carolina had 153 schools offering FFVP during the 2016-2017 school year representing 37 school districts. According to the Office of Health and Nutrition at the South Carolina Department of Education, 488 elementary schools were eligible for FFVP in 2017. Of those 488, 219 applied, and 139 schools were awarded FFVP grants for the 2017-2018 school year. Eighty schools applied but did not receive funds for the 2017-2018 school year and of those ten were not awarded FFVP funds in 2016-2017. The PI could not access historical applications before 2016-2017 to determine if schools had applied or been awarded.

The study sample included seven FFVP schools, which represented approximately 5% of the entire FFVP school population. The selection of schools was purposeful and based on a list of all FFVP awarded schools provided by the Office of Health and Nutrition staff. The schools selected represented seven different districts and the four geographical regions of the state. All seven schools included in this case study received FFVP funds in the 2016-2017 school year as well as the 2017-2018 school year. Review of FFVP process evaluation documents (e.g., semi-annual reports, monthly requisition forms, audit forms) and guidance from Office of Health and Nutrition staff ensured maximum variation between FFVP schools. Maximum variation in this study referred to schools with varying levels of FFVP and school food program success and engagement. Exclusion criteria for schools in this study included the foodservice operation being in non-compliance with NSLP regulations via annual review and the foodservice operation being in non-compliance with the FFVP regulations.
The sample also included seven schools not operating the FFVP in the 2017-2018 school year. These schools were comparable to selected FFVP schools and were matched based on region. Comparability was defined as having similar average daily school lunch participation, percentage of free and reduced students, school meal program operations (e.g., in-house food preparation vs. foodservice management company), and Office of Health and Nutrition personnel impressions of school meal program operation (e.g., staff engagement, staff turnover rate, continuing education opportunities offered). The selection of non-FFVP schools was from a list of comparable schools provided by the South Carolina Office of Health and Nutrition staff. Three of the seven comparison schools never applied for or received FFVP funds. Four of the seven comparison schools applied for FFVP funds in the 2017-2018 school year and were not awarded. Additionally, the four schools that applied in 2017-2018 had not received FFVP funds in the 2016-2017 school year, but could have received funds in previous school years. The only exclusion criteria for these schools was the foodservice operation being in non-compliance with the NSLP regulations via annual review.

According to preliminary interviews with FFVP experts, stakeholders important to FFVP success included state-level program administrators, school administrators, the FFVP coordinator for the school, the food service director (if different from the FFVP coordinator), the school cafeteria manager, teachers, parents, and students. The researcher invited FFVP and school meal stakeholders to participate in one-hour semi-structured interviews via email and phone. Students did not participate in interviews as observation of student consumption was sufficient to answer the research questions. Observation of student consumption of fruits and vegetables via plate waste included 4th and 5th-grade
students at each school. These students were the eldest in the elementary schools (aged ~10-11yrs). This age range was appropriate for observation given the high obesity prevalence in this population\textsuperscript{53} and the increased likelihood of sub-optimal fruit and vegetable intake when compared to the dietary guidelines\textsuperscript{60}. Therefore, the researcher conducted interviews with at least one school administrator, food service director, FFVP coordinator (if applicable), cafeteria manager, teacher, and parent at all FFVP schools. At schools not operating the FFVP, the researcher conducted interviews with at least one school administrator and the food service director. Fifty-seven interviews were completed with seven different categories of school stakeholders, including 15 school administrators, 14 school foodservice directors, seven school cafeteria managers, four school FFVP coordinators, seven teachers, seven parents, and three state officials. The majority of the participants identified as female (95%) and reported to be 45 years or older (61%). Interview demographics can be seen in Tables 3.1-3.6.

Interviews focused on the personal experiences of stakeholders to identify commonalities, perceptions, and ideologies associated with the FFVP overall and with FFVP implementation. The conceptual model includes multiple contextual and intervention domains within which school stakeholders may experience FFVP. Based on the conceptual model, this study sought to include a variety of stakeholder’s perspectives from multiple schools, programs, and responsibility levels.

Units of analysis will be the stakeholder’s experiences and perceptions of FFVP. The researcher included both positive and negative experiences in addition to the daily management and implementation of FFVP or school foodservice operations. The
researcher included stakeholders with multiple FFVP experiences or those with consistent interaction with FFVP to improve the likelihood of achieving saturation.

This project used a purposeful sampling technique. First, the researcher identified schools that had used FFVP with varying engagement and success; then, the researcher determined which stakeholders at those schools had FFVP experience. Maximum variation was sought to ensure information-rich cases. The sample of FFVP participant schools came from the master list of 139 FFVP awarded elementary schools in 2017-2018. The sample of schools not operating the FFVP came from the remaining 269 schools that were eligible for FFVP. The Office of Health and Nutrition guided school selection to ensure maximum variation and school willingness. All school administrators were asked to sign an acknowledgment letter allowing the research project in their school.

The initial procedure for the recruitment of schools was through electronic sources. The researcher emailed each school administrator and food service director to inquire about participation in interviews. School administration stakeholders were asked to assist in recruiting teachers for interviews. All teachers interviewed were drawn from the sample of participating school 4th and 5th-grade classrooms. Teachers completed an acknowledgment form allowing snack service observation to occur in their classroom if the FFVP in their school used classroom service. A certificate of appreciation from the state Office of Health and Nutrition, as well as appreciation on the state website, recognized all school personnel participating in the study.

Parents of 4th and 5th-grade students were recruited through school administrator and teacher suggestions to participate in interviews at their convenience. All parents who
participated were entered into a drawing to win one of four $25 Wal-Mart gift cards. The researcher informed all interviewees that their contribution to the study could inform USDA FFVP policy as well as improve FFVP implementation at the state and local levels. All participants signed a consent form to participate in the study. Interviews with participant stakeholders continued until thematic saturation occurred.

To determine how many plate waste observations were needed for significant results, the researcher made preliminary assumptions. The researcher assumed that each school in the sample had at least two 4th and 5th-grade classrooms based on National Center for Education Statistics Schools and Staffing Survey. Furthermore, based on 4th and 5th-grade enrollment numbers from the highest-need districts in the state of South Carolina, which range from 108-362 students, the researcher assumed that there would be at least 20 students per classroom. Given these assumptions, there would be an estimated 1120 students (20 x 4 x 14 = 1120) observed during meals/snacks from 14 schools. Of this overall population, 560 would be FFVP participants (20 x 4 x 7 = 560). This meant the researcher needed to observe 560 students during FFVP snack and school meal service and 560 students only during school meal service. These numbers would have enough power to detect an effect size of 0.40 with 76% power in a randomized clustered 2-level design according to Optimal Design software.

The complete sample consisted of observations from 3849 independent student tray observations from 88 4th and 5th-grade classrooms in 14 schools. The sample included 737 female and 721 male students. This sample broke down into 761 students in FFVP schools and 697 students in non-FFVP schools.
3.4: Measures

There were several sources of data in this evaluation, including FFVP and school meal documents, interview transcripts, observation notes, public school demographic data, and plate waste data.

The South Carolina Department of Education Office of Health and Nutrition provided public school demographics. This information included the socioeconomic status of the average student in the school, the average daily participation in school meal programs, enrollment numbers, class size, and school geographical location (either urban or rural) according to the National Center for Educational Statistics. The South Carolina state FFVP Coordinator, Diane Gillie, provided access to FFVP applications, semi-annual reports, audits, school requisition claims, and invoices.

All interviews occurred at the time and place of interviewee choosing, although efforts were made to schedule interviews during school observations to reduce researcher travel. The researcher conducted direct observations and plate waste at two separate time points during the study timeline in the school cafeteria and at the location of FFVP service (e.g., classroom, cafeteria). The researcher made copies of school cafeteria production and sales records at each participating school to assist in data validation.

The researcher used plate waste to measure student consumption of snacks and meals. Descriptions of plate waste methods are in the following section.

3.5: Data Collection Methods

All interviews were semi-structured based on the interview guide in the Appendix (Appendix C). By conducting semi-structured interviews, the researcher maintained flexibility and collected as much information from the subject's experience as possible. A
single researcher was responsible for data collection. The researcher guaranteed participant confidentiality. The purpose of the study did not warrant the identification of any stakeholders or the schools participating.

The researcher used two digital recorders during all interviews and transcribed all interviews verbatim using Rev.com before analysis. A journal is kept by the researcher to establish an audit trail, reflexivity notes, and general perceptions, issues, or other observations throughout the study. A single interview guide existed for both FFVP schools and schools not operating the FFVP.

General school observations were guided by the CICI framework checklist, which provided questions and systematic methods for evaluating environments based on the contextual and implementation domains defined in the conceptual map (17). This process involved the researcher examining each of the domains of the CICI framework (e.g., geographical, epidemiological, sociocultural, socioeconomic, ethical, legal, and political) as they related to the school being observed. During school observations, the researcher noted if and when stakeholders in these schools indicated that these domains influenced their school, programs, and lives. Additionally, during document review, interviews, or plate waste observation, the researcher noted if these domains were present in the narrative. The CICI framework provided the researcher with reflexive questions (e.g., "How do these aspects of context interact with the intervention/program?") , which the researcher could use to focus on areas for observation. Thus, observations using the CICI framework used a table with the domains listed and the researcher's observations and notes related to those domains. These observations were then used to help define emergent categories in interview transcripts during analysis.
Plate waste observations used the Quarter-Waste visual estimation method. The researcher collected plate waste at two separate times throughout the study timeline at each participating school. To determine the impacts of FFVP on fruit and vegetable consumption as well as school meal consumption, the researcher collected plate waste at lunch and snack service for all available 4th and 5th-grade students at FFVP schools. This method required that the researcher arrive at the lunchroom approximately half an hour before lunch or snack service. The researcher took note of all items on the menu and determined an average weight for a serving of each of these items using a scale tared to remove packaging weight. The researcher recorded the weight of the servings on a form titled the "Measured Weight Sheet." A sample measured weight sheet is included as Appendix D. The researcher then observed trays as students completed their meals and indicated the quantity of items consumed using a coding system on a printed plate waste observation form. A sample plate waste observation form is included in Appendix E. The code system for the Quarter Waste Method assigns a 0-4 for each food on a student's tray. These codes represent the percentage of the food serving eaten. The code system is visible in Table 3.7.

When interpreting the codes, a 0 means the student ate the entire portion, a 1 means the student ate ¾ of the food serving, a 2 means the student ate half of the food serving, a 3 means the student ate ¼ of the food serving, and four means the student didn't eat any of the food serving. After observation, the researcher then calculated how much of each food item was consumed or wasted using the weight of the servings established before meal/snack service and the percentage eaten recorded from the visual estimation. This method is reliable with an inter-rater reliability of .9.87 While not as accurate as
weighing individual student trays both before and after the lunch period, visual estimation is highly correlated with percent waste ($r = .93$). As such, methods like the quarter waste method are appropriate measures of waste/consumption in schools given the ability to estimate the waste for large groups of individuals in a tight space quickly with relatively reliable accuracy. Another benefit of using this method in schools is that it does not require student identification as visually assessed student demographics, including gender and grade, can be entered next to tray numbers without having to track a student from the line to the trashcan. The researcher has extensive experience with this method and has been using it for over six years to estimate the impact of school food programs.

T-tests, correlation matrices, and multi-level models assessed the impact of the FFVP on dietary patterns and its relationship to implementation variation. Several 3-level and 2-level hierarchical models examined the relationship between school-level variables, classroom-level variables, and student-level variables. The dependent variable in these models was student consumption of fruits and vegetables in ounces. Class level variables of interest included: the number of male and female students, FFVP snack distribution time (before/after lunch), FFVP snack-type (fruit/vegetable), and grade.

School-level variables of interest included: program (FFVP or Non), school urban/rural status, average school enrollment, average daily school meal participation, percent of student-body eligible for free and reduced meals, School Health Index score, implementation score, frequency of FFVP snack distribution during the week, number of direct nutrition education opportunities offered each year, number of indirect nutrition education opportunities offered each year and previous year FFVP funding status.
3.6: Data Management

To protect participant identity codes linked all interview participants to their interview. The code consisted of a randomly generated number and the initials of the school along with a general stakeholder classification (administrator, director, manager, instructor, parent). The researcher obtained consent forms from all interview participants either in paper form or via email. The researcher also collected acknowledgment forms from both school administrators representing all schools included in the study and all teachers allowing FFVP observation in their classroom. All consent and acknowledgment forms have been kept in a locked cabinet in the researcher's office. All tools used for quantitative data collection (i.e., observation forms and plate waste forms) were free of any names and identifiers.

Interviews were at the leisure and in the environment of the participant’s choosing. All efforts were made to ensure that the interview site was secure and private. The researcher kept all interview transcriptions on an external hard drive locked in a filing cabinet in the researcher's office. Following transcription, the researcher deleted all recordings of the interviews. All paper materials, documents, and data (e.g., plate waste data, production, and sales records) have been placed into a locked filing cabinet in the researcher's office and were in the locked cabinet when not in transit between the school site and office or being entered/analyzed. The researcher entered all plate waste data into a secured Excel file and stored this file on the same external hard drive as the interview transcriptions. The researcher locked the external hard drive in a cabinet in their office when not in use. The South Carolina Department of Education Office of Health and Nutrition keeps all FFVP applications, semi-annual reports, invoices, claims, and
requisitions on a secured hard drive. Access is only permitted when on the state network onsite. As such, the researcher only accessed this data when onsite at the Department of Education. Data was only available to the researcher and the researcher's advisor as data analysis was being completed. Upon completion of the study, the researcher scanned paper copies of the data, stored them on the same study external hard drive as the other study data, and locked this external hard drive in a filing cabinet. Data will be kept for up to five years.

No foreseen risk associated with participation in this study exists; however, in the event of unanticipated problems or breaches of confidentiality, the researcher will immediately inform the participants in question and the University of South Carolina IRB following the Adverse Event Reporting Guidelines.

3.7: Data Analysis

As the overall purpose of this study was to provide insights into the lived experiences of FFVP stakeholders as it relates to FFVP implementation, the researcher used a phenomenological orientation in the analysis of interview data. Data analysis was an ongoing process throughout the study, with frequent reviews and meetings between the researcher and their advisor. Following transcription, the researcher began a phenomenological reduction and bracketed interview information by research presuppositions. The researcher sought categories of data based on stakeholder experience, implementation strategy, or process such as classroom FFVP service or cafeteria FFVP service as well as positive or negative experiences of FFVP. Within these categories, the researcher looked for units of meaning, implicit theories, tools, and plans, amongst other emergent concepts—the units of meaning clustered to form themes.
To validate findings and define emergent codes and themes of this study, the researcher provided all notes and analyses to their advisor for review and consensus. Axial coding was used to explore connections among categories. The thematic analysis approach identified patterns among stakeholder narratives related to FFVP. After developing initial themes, the researcher created matrices to aggregate and condense data until thematic saturation occurred. As these stakeholders have difficult schedules, especially during the school year, methodological modification resulted in flexibility in interview times, locations, and subjects as needed.

Interviews were transcribed using Rev.com. The researcher used NVIVO 11 software for analytics. The researcher coded interviews by identifying emergent themes. The researcher's advisor reviewed these codes and noted any discrepancies in the "working" codebook. Office of Health and Nutrition personnel reviewed the "working" codebook to inform grouping and simplification of any similar themes and to improve validity. The researcher then aggregated any modification of themes and created an overall summary of each interview so that general and unique themes for all interviews could be determined.

The researcher examined completed stories as identified in thematic saturation using narrative analysis techniques. In this way, the researcher viewed complete stakeholder narratives and interpreted them to determine meaning. Thematic analysis from the interviews identified the content of the data, and the researcher engaged in a process called narrative smoothing wherein the overall summaries and contextualization of themes were examined to show how the stakeholders actively worked and used this content to achieve FFVP implementation. Narrative smoothing is the process by which
researchers place stories back into the context from which the data came and account for events, actions, and relationships which influence the lived experience of that participant. As such, the narrative nests into the context of that individual, and clusters of narratives nest into the context of the shared environment. These contextualized narratives were interpreted and included in a composite summary which provided a rich, although reduced, story of the program and the individuals involved.

The researcher used the Critical Appraisal Skills Program (CASP) throughout the study to ensure data quality. The inclusion of multiple stakeholders at varying levels of authority within the school environment as well as the interaction of school culture and personal beliefs and expectations resulted in complex data which required careful interpretation to provide accurate and valid data. Furthermore, the narratives produced for an interview required special interpretation because the narrative provided by a stakeholder is, in fact, a product of and embedded into the interaction between the researcher and the stakeholder. There was the possibility of bias in this study related to the researcher’s role as a Department of Education consultant as well as a former researcher working in school-based food assistance programs.

The researcher used SAS 9.5 for Windows to analyze quantitative data. Two-sample t-tests were used to assess the relationship between FFVP and children's daily consumption of fruits and vegetables in ounces. As this data was de-identified, this data was not treated as repeated measures within a subject. To assess the relationship between FFVP implementation and school characteristics, the researcher completed a pairwise correlation analysis. The simple bivariate analysis was deemed appropriate given the
small sample size of FFVP schools (n=7) and lack of variation between schools in implementation scores.

The researcher used multi-level models to examine the relationship between school FFVP implementation (independent variable) and student consumption of fruits and vegetables in ounces (dependent variable). Before modeling, the researcher assessed for collinearity, and variables of interest were removed from the proposed models. Analyses will begin with univariate and bivariate analyses to examine the distribution of sample characteristics and the relationship between variables. The analyses followed the traditional model-building approach with the simplest model, not including any predictors, and the most complex model including all level one and level two predictors in addition to any interactions which may emerge during the initial review of the data. Analysis used PROC MIXED and estimated using maximum-likelihood. Model fit was determined using -2 log-likelihood. The -2 log-likelihood is distributed as $X^2$, with covariates determining the degrees of freedom in each model. All variables lacking a "true" zero which were not bivariate, were grand mean-centered.
### 3.8: TABLES

Table 3.1: Interview Participant Demographics by Stakeholder Title

<table>
<thead>
<tr>
<th>Stakeholder Title</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>7 (18.4%)</td>
<td>7 (43.8%)</td>
<td></td>
<td>14 (24.5%)</td>
</tr>
<tr>
<td>Assistant Principal</td>
<td>1 (2.6%)</td>
<td></td>
<td></td>
<td>1 (1.8%)</td>
</tr>
<tr>
<td>Foodservice Director</td>
<td>7 (18.4%)</td>
<td>7 (43.8%)</td>
<td></td>
<td>14 (24.5%)</td>
</tr>
<tr>
<td>Teacher</td>
<td>7 (18.4%)</td>
<td></td>
<td></td>
<td>7 (12.3%)</td>
</tr>
<tr>
<td>Cafeteria Manager</td>
<td>6 (15.8%)</td>
<td>1 (6.3%)</td>
<td></td>
<td>7 (12.3%)</td>
</tr>
<tr>
<td>Parent</td>
<td>7 (18.4%)</td>
<td></td>
<td></td>
<td>7 (12.3%)</td>
</tr>
<tr>
<td>Area Supervisor</td>
<td>2 (5.3%)</td>
<td>1 (6.3%)</td>
<td></td>
<td>3 (5.2%)</td>
</tr>
<tr>
<td>Nurse</td>
<td>1 (2.6%)</td>
<td></td>
<td></td>
<td>1 (1.8%)</td>
</tr>
<tr>
<td>State FFVP Program Coordinator</td>
<td></td>
<td></td>
<td>1 (33.3%)</td>
<td>1 (1.8%)</td>
</tr>
<tr>
<td>State Child Nutrition Program Director</td>
<td></td>
<td></td>
<td>1 (33.3%)</td>
<td>1 (1.8%)</td>
</tr>
<tr>
<td>State Child Nutrition Program Agent</td>
<td></td>
<td></td>
<td>1 (33.3%)</td>
<td>1 (1.8%)</td>
</tr>
</tbody>
</table>
### Table 3.2: Interview Participant Demographics by Stakeholder Education Level

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Reported</td>
<td>9 (23.3%)</td>
<td>7 (43.8%)</td>
<td></td>
<td>16 (28.1%)</td>
</tr>
<tr>
<td>High School Degree/GED</td>
<td>3 (7.9%)</td>
<td></td>
<td></td>
<td>3 (5.2%)</td>
</tr>
<tr>
<td>Some College</td>
<td>2 (5.3%)</td>
<td></td>
<td></td>
<td>2 (3.5%)</td>
</tr>
<tr>
<td>Associates Degree</td>
<td>2 (5.3%)</td>
<td>1 (6.3%)</td>
<td></td>
<td>3 (5.2%)</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>12 (31.6%)</td>
<td>4 (45%)</td>
<td>2 (66.7%)</td>
<td>18 (31.6%)</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>9 (23.7%)</td>
<td>4 (45%)</td>
<td></td>
<td>12 (21.1%)</td>
</tr>
<tr>
<td>PhD</td>
<td>2 (5.3%)</td>
<td></td>
<td>1 (33.3%)</td>
<td>3 (5.2%)</td>
</tr>
</tbody>
</table>
Table 3.3: Interview Participant Demographics by Stakeholder Years of Experience

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Reported/Declined</td>
<td>4 (10.5%)</td>
<td></td>
<td></td>
<td>4 (7%)</td>
</tr>
<tr>
<td>&lt;5yrs</td>
<td>2 (5.3%)</td>
<td>2 (12.5%)</td>
<td></td>
<td>4 (7%)</td>
</tr>
<tr>
<td>6yrs-10yrs</td>
<td>6 (15.8%)</td>
<td>6 (10.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11yrs-15yrs</td>
<td>6 (15.8%)</td>
<td>3 (18.8%)</td>
<td>1 (33.3%)</td>
<td>10 (17.5%)</td>
</tr>
<tr>
<td>16yrs-20yrs</td>
<td>5 (15.8%)</td>
<td></td>
<td>5 (8.7%)</td>
<td></td>
</tr>
<tr>
<td>21yrs-25yrs</td>
<td>10 (26.3%)</td>
<td>4 (25%)</td>
<td></td>
<td>14 (24.6%)</td>
</tr>
<tr>
<td>&gt;25yrs</td>
<td>5 (15.8%)</td>
<td>7 (43.8%)</td>
<td>2 (66.7%)</td>
<td>14 (24.6%)</td>
</tr>
</tbody>
</table>
Table 3.4: Interview Participant Demographics by Stakeholder Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Reported/Declined</td>
<td>4 (10.5%)</td>
<td>3 (18.8%)</td>
<td></td>
<td>7 (12.2%)</td>
</tr>
<tr>
<td>&lt;25yrs</td>
<td>0 (0%)</td>
<td></td>
<td></td>
<td>0 (0%)</td>
</tr>
<tr>
<td>26yrs-30yrs</td>
<td>3 (7.9%)</td>
<td></td>
<td>3 (5.2%)</td>
<td>3 (5.2%)</td>
</tr>
<tr>
<td>31yrs-35yrs</td>
<td>4 (10.5%)</td>
<td></td>
<td>4 (7%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>36yrs-40yrs</td>
<td>4 (10.5%)</td>
<td></td>
<td>4 (7%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>41yrs-45yrs</td>
<td>3 (7.9%)</td>
<td>1 (6.3%)</td>
<td>4 (7%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>46yrs-50yrs</td>
<td>4 (10.5%)</td>
<td>4 (25%)</td>
<td>8 (14%)</td>
<td>8 (14%)</td>
</tr>
<tr>
<td>51yrs-55yrs</td>
<td>2 (5.3%)</td>
<td>2 (12.5%)</td>
<td>2 (66.7%)</td>
<td>6 (10.5%)</td>
</tr>
<tr>
<td>56yrs-60yrs</td>
<td>8 (21.1%)</td>
<td>5 (31.3%)</td>
<td>13 (22.8%)</td>
<td>13 (22.8%)</td>
</tr>
<tr>
<td>&gt;60yrs</td>
<td>6 (15.8%)</td>
<td>1 (6.3%)</td>
<td>1 (33.3%)</td>
<td>8 (14%)</td>
</tr>
</tbody>
</table>
Table 3.5: Interview Participant Demographics by Stakeholder Self-Identified Race/Ethnicity

<table>
<thead>
<tr>
<th>Self-Identified Race/Ethnicity</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black American</td>
<td>18 (47.3%)</td>
<td>6 (37.5%)</td>
<td>2 (66.7%)</td>
<td>26 (45.6%)</td>
</tr>
<tr>
<td>White</td>
<td>19 (50%)</td>
<td>8 (50%)</td>
<td>1 (33.3%)</td>
<td>28 (49.1%)</td>
</tr>
<tr>
<td>Not Reported/Declined</td>
<td>1 (2.6%)</td>
<td>2 (12.5%)</td>
<td></td>
<td>3 (5.2%)</td>
</tr>
</tbody>
</table>
Table 3.6: Interview Participant Demographics by Stakeholder Self-Identified Gender

<table>
<thead>
<tr>
<th>Self-Identified Gender</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1 (2.6%)</td>
<td>1 (6.3%)</td>
<td>1 (33.3%)</td>
<td>3 (5.2%)</td>
</tr>
<tr>
<td>Female</td>
<td>37 (97.3%)</td>
<td>15 (93.8%)</td>
<td>2 (66.7%)</td>
<td>54 (94.7%)</td>
</tr>
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</table>
Table 3.7: Quarter Waste Method Coding System

<table>
<thead>
<tr>
<th>Plate Waste Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None of the food serving is wasted</td>
</tr>
<tr>
<td>1</td>
<td>1/4 of the food serving is wasted</td>
</tr>
<tr>
<td>2</td>
<td>1/2 of the food serving is wasted</td>
</tr>
<tr>
<td>3</td>
<td>3/4 of the food serving is wasted</td>
</tr>
<tr>
<td>4</td>
<td>All of the food serving is wasted</td>
</tr>
</tbody>
</table>
CHAPTER 4

SCHOOL STAKEHOLDER MOTIVATIONS TO APPLY FOR THE FRESH FRUIT AND VEGETABLE PROGRAM IN LOW RESOURCE SCHOOLS¹

¹K. Hoy, S. Jones, R. Davis, C. Blake, M. Burke. To be submitted to Journal of School Health
4.1: Abstract

**Background:** Children in vulnerable communities are at increased risk for a poor diet. The Fresh Fruit and Vegetable Program (FFVP) is a United States Department of Agriculture (USDA) child nutrition program that increases vulnerable children’s access to and consumption of fruits and vegetables. Contextual evaluations are not widely conducted and are essential for establishing how programs operate locally. The purpose of this study was to conduct a contextual evaluation of FFVP to better understand stakeholder motivations for applying and adopting the program.

**Methods:** The principal investigator completed fifty-seven one-hour in-depth interviews with stakeholders from fourteen low-income South Carolina schools.

**Results:** School stakeholders apply for the FFVP grant if they feel the program will benefit their children, feel a moral imperative to address injustices, believe they are eligible and think they can manage federal grants' administrative burdens.

**Conclusions:** Stakeholders interviewed framed their arguments about applying for FFVP in familiar ways. For example, they want to and are morally obligated to work for the benefit of children, but the state bureaucratic machine is burdensome. Reframing the FFVP to highlight benefits to the children, reducing administrative burdens, and exploring more inclusive funding structures can increase both the application and adoption of the program.
4.2: Background

Children who lack access to and do not consume diets rich in fruits and vegetables are at risk for a wide variety of diseases. Those who are Black, Indigenous, or People of Color (BIPOC) experience more significant risks for diet-related disease, in part because of even greater problems accessing fruits and vegetables. In the United States, the children most vulnerable to diet-related diseases live below the poverty line, experience food insecurity, and live in the Southern region. To improve nutrition, health and address inequities in access to healthy food, several federal food assistance programs provide states funding to support households' and schools' food purchases. Schools may offer breakfast, lunch, dinner, afterschool snacks, and in-school snacks through these programs. In addition, some schools can offer these meals completely free to their student body regardless of household eligibility through the Community Eligibility Provision (CEP). One of the most recently launched programs focuses on offering fruit and vegetable snacks during the school day.

The Fresh Fruit and Vegetable Program (FFVP) is a United States Department of Agriculture (USDA) child nutrition program that targets schools with the highest free and reduced-price meal enrollment to increase children's access to and consumption of fruits and vegetables. Children exposed to the FFVP eat more fruits and vegetables; however, not all eligible schools apply for the program. USDA and state officials have called for evaluations of FFVP that include more information about the application and adoption processes. To adopt FFVP, schools or school districts must apply for and be awarded a grant from the state agency that manages FFVP funding. This paper
uses a contextual evaluation framework to explore stakeholder perspectives about why schools apply to the FFVP.

Contextual evaluations are essential for establishing how programs, such as the FFVP, are operationalized at the local level, but they are not widely conducted. Bartlett and colleagues summarized rigorous evaluations of FFVP in a Final Report to the USDA; however, they noted that the evaluation was relatively limited to issues of internal validity such as increased fruit and vegetable intake among children and did not include details related to stakeholder perspectives. We applied the Context and Implementation of Complex Interventions (CICI) framework to in-depth interviews with school stakeholders about the FFVP setting (schools and classrooms), program implementation procedures, and contextual factors related to the decision-making process. The CICI explains that interventions, like the FFVP, are delivered in specific settings where they interact with context and implementation across micro-, meso- and macro-levels; ultimately, these interactions affect intervention success making it an appropriate framework for this study. Applying the CICI framework in the qualitative study of the FFVP allows for a greater understanding of how setting, context, and program implementation affect stakeholder's motivations for applying to and adopting the FFVP in low-income schools.

For this qualitative analysis, we explored the following questions:

1) Why do some eligible schools apply for the FFVP grant?

4.3: Methods

We conducted this study in the state of South Carolina (SC). SC consistently ranks in the top third of US states in prevalence measures of food insecurity, poverty, and chronic disease. Children in SC are at particular risk for poor diet due to persistent
poverty and food insecurity. Over 60% of children in SC participate in child nutrition programs. Approximately 473,000 children receive school meals daily in SC, and 58% are free or reduced, making schools a vital source of nutrition for most children in the state. FFVP application and adoption rates in SC remain suboptimal. In the 2017-2018 school year, approximately 511 public schools served children up to 5th grade eligible for the FFVP in SC. Of those eligible, 211 applied for the grant, and 139 received awards. The combination of high poverty rates, risk of poor diet, and reach of child nutrition programs create ideal circumstances to study the FFVP.

The SC Department of Education provided a list of schools operating FFVP in the 2017-2018 school year. The principal investigator (PI) randomly selected seven schools from this list representing the four regions of SC (Upstate, Midlands, Pee Dee, and Low Country). The PI then matched the seven FFVP schools demographically and regionally, with seven schools not operating FFVP for a total of 14 schools included in the study. School administrators provided consent for lunchroom/snack observations and interview recruitment via email. Following initial invitation emails, three non-FFVP schools declined participation resulting in their replacement. After school administration provided consent, the PI recruited school stakeholders through word of mouth while observing school lunchrooms.

Participants:

This qualitative study was part of a more extensive mixed-methods study. For the qualitative portion of the study, we purposively selected stakeholders from three groups: FFVP schools, non-FFVP schools, and state FFVP administration. We invited people to participate in this study based on their experience with the FFVP and school food
programs. Stakeholders primarily represented FFVP funded schools (n=38). The PI also interviewed stakeholders from FFVP eligible schools that applied but did not receive funds (n=16) and all SC Department of Education FFVP administration staff (n=3) to understand the application and award process better. We collected interviews until we met the point at which most qualitative studies can attain theoretical saturation. The PI completed fifty-seven interviews with seven different categories of school stakeholders, including 15 school administrators, 14 school foodservice directors, seven school cafeteria managers, four school FFVP coordinators, seven teachers, seven parents, and three state officials. The majority of the participants identified as female (95%) and reported to be 45 years or older (61%) (Tables 4.1 – 4.2). Data collection took place in the spring of 2018.

Instruments:

The PI collected data through one-hour in-depth interviews using a standardized semi-structured interview guide. The semi-structured interview guide was pre-tested with five FFVP professionals, independent of this study, at a national nutrition education conference in the Fall of 2017 to ensure appropriate wording. The interview guides used vignettes as the primary elicitation method. Vignettes provide focus and uniformity when collecting large amounts of qualitative data while allowing participants to comment on potentially sensitive topics, such as school policy and actions related to child health, in a non-threatening space. Vignettes in this study included quotes from elementary school stakeholders in other states speaking about the FFVP, child nutrition, child health, and overall school culture. In addition, open-ended follow-up questions elicited discussion of the application for the grant, stated ideologies that supported application or aversion to
the grant, and what drives the adoption of the program. Interview guides did not include CICI framework language, and the content of the interviews was allowed to surface organically. Conversations were audio-recorded and subsequently transcribed and coded in NVIVO 12. Participants were offered the opportunity for in-person or telephone interviews; eighteen opted for telephone interviews. All participants consented to an interview, and 54 agreed to audio-recording. Detailed notes for all participants were taken by the interviewer and used in place of recording for three participants.

**Data Analysis:**

Analysis occurred in three phases: open coding, thematic analysis, and narrative smoothing. The lived experience of each participant guided bracketing and reduction of information. We applied a general inductive approach to capture emergent themes otherwise overlooked with established codebooks. The PI and a second coder (SJ) completed open coding. Researchers compared open codes, reconciled discrepancies through discussion, and created a working codebook. The working codebook was tested with a single transcript by an FFVP expert unaffiliated with the study (JB). The PI discussed any code discrepancies from the test with the second coder (SJ) until they reached a consensus. The PI then applied the final codebook to all interviews and created matrices to reduce and condense interview content until thematic saturation occurred. Following theme reduction, the PI smoothed the data by clustering themes into stakeholder categories, placing them into respective CICI framework dimensions, and sorting them to support or oppose application. The PI smoothed the data further by reducing the narratives into a general flow of information and motivations for applying to the FFVP.
4.4: Results

School stakeholders in this study applied for the FFVP grant because they feel the program will benefit their children, feel a moral imperative to address injustices, believe they are eligible, and think they can manage federal grants' administrative burdens. Themes emerged in all dimensions of the CICI framework, and the decision-making process followed a similar pattern for stakeholders through 1) context, 2) setting, and 3) program implementation. Table 4.3 shows emergent themes in their respective dimension of the CICI framework and if they were facilitators or barriers to application. Descriptions of each dimension and subsequent themes are visible in greater detail below. Further, data in this study indicate that context supports application while school setting and program implementation processes hinder it.

**Context:**

Some stakeholders described their motivations to apply for an FFVP grant as a willingness to do things that benefit their students. One teacher stated, "I believe in it. I believe that the kids need this…I believe that when they get older, they'll go to the store, and they'll buy cauliflower, and they'll say, 'Oh Mr. X made me eat that." A school administrator explained that applying year after year despite being rejected was because "There's no negatives about it [applying for the FFVP]. It's [the FFVP is] only a good thing for us." Another administrator described the additional burden of time or resources to apply as justified, “…It is a lot to do. It is a lot to do. But I'm not going to say that we're burdened because in education you do what you've got to do. So, I won't say we're burdened because if my students are benefitting from it, then it's worth it." Stakeholders stated the FFVP improved student focus, attention, and learning as a foodservice director
described, "It's a good mid-morning snack that gives them extra nutrition and helps them concentrate in class…" A teacher commented that student behaviors improved with the offering of the FFVP snacks, "Our [disciplinary] behaviors have been better…discipline is down from last year and down from the prior year."

Further, participants stated the program staved off observable hunger, bolstered soft skills, prevented chronic disease development, shaped dietary patterns, and reduced the burden of food insecurity on children in more impoverished communities. For example, an administrator said, "To be well-rounded, and for them [students] to think and to work and make sure they are focused in school…we need to make sure their tummy is full…you got some kids that you know when they leave you on Friday, you aren't sure what they're going to eat on Saturday and Sunday. So, making sure you're able to give those kids what they need when you can."

Some stakeholders felt even more strongly motivated to apply for FFVP, describing their motivations stemming from a moral imperative to address injustice by seeking funding to support vulnerable children.

"When it comes down to what’s best for children. I don’t think that type of mentality is one, that again, is what’s in the best interest of children… So, for the federal government to be giving this and for you and the school to be able to address, again, a well-known problem, which is child obesity and health issues, and then not take part in that would be…yeah, that’s definitely a problem."

[Principal, Non-FFVP School]
“If your school is in a community where you know that the children are from low-income areas and one of the things that you can do is to get assistance to help them…then it’s a grant, it’s free, why not go for it?” [Parent, FFVP School]

"I have a moral objection to not doing it. We're not going to let a kid, um, for example, sit there with an abscessed tooth and just put them on the bus every day to come back with the same problem. You know, we're going to try to find a way to pursue it to help that child." [Principal, Non-FFVP School]

While some stakeholders describe a commitment to applying for grants that benefit students and a moral obligation to bring money into vulnerable communities, we also heard about feelings that motivated people to not apply for FFVP. A food service director from a non-FFVP school said, "Some districts are in cahoots with the state department. They [the state department] target certain districts, and they [the schools] get it year after year. So, I just quit applying. It costs a lot to employ a grant writer to get a 'No' year after year." A school administrator said, "…the state says you need to do this, and the state says you need to do that, but nobody is taking anything off our plate… I mean, come on." [Principal, FFVP School]

Stakeholders stated that the eligibility guidelines were too strict and represented a narrow view of the need in a community, as demonstrated by this statement from a foodservice director:

“Maybe they need to change the qualifications. Maybe it don’t need to be based on free and reduced. Maybe it needs to be based on the fact that we’re a rural school district with severe needs, you know. Maybe it needs to be based on that for districts like ours. The demographics that are similar to ours. I think that
maybe they need to change the qualifications based on our qualifications. You know, why make it available only to some schools...some students? [pause] I mean, I know that everything is centered around funding...I understand. I just wish there was a way to make it more discretionary.” [Foodservice Director, FFVP School]

One food service director from a non-FFVP school indicated that categorical grants, like FFVP, highlight disparities in funding within their district:

“Because it’s like these two schools get all the money, that’s what’s happened in the past. And none of the other district students get anything. But, you know, with this program, it would just be nice to have to give all the schools at least...maybe a smaller scale of some of those [FFVP funds]. It’s [poor nutrition] a problem everywhere, right? That's exactly the way I feel. That it's mainly for the low-income when it could benefit the entire school district. Because there is an issue district-wide. It's not just at a specific school.” [Foodservice Director, Non-FFVP]

Setting:

All stakeholders in this study stated that a school's CEP status influenced the success of its grant application. If the school qualified as CEP, stakeholders felt they had a greater chance of receiving the funds. However, several participants indicated that they received instruction not to apply because their school did not qualify for CEP, as seen in this comment from a school administrator:

“The reason I did not [apply] was because of the way they [the state department] explained to us... ’cause, actually, when we got turned down last year, I called.
And then she [the state department representative] explained it was because of the CEP program and all these other districts going to CEP...” [Principal, Non-FFVP School]

Additionally, several stakeholders stated that applying for FFVP would not be helpful to their school because they already had a program that would do something similar. Stakeholders implementing FFVP in 2018 indicated that they applied because they didn’t have another option for providing fresh produce to their children. FFVP filled the need for those districts in the past but, stakeholders passed over it when they deemed it unnecessary. A school administrator applauded only applying for the grant when necessary:

"I think there are many districts who already do something like this [FFVP] and don't need to apply. And I'm going to say kudos to them. If they don't need that, leave it for the districts who do need it because they might not apply for it [FFVP] because they already do a good job in their district on nutritional things. For those who do [apply], it's because it is what's best for the children. But then you also do it [apply] because there isn't another system to go through for that district for them to be able to offer fresh fruits and vegetables." [Principal, FFVP School]

Implementation:

If stakeholders were motivated to apply and their schools were eligible, they described a need for administrative support and incentives. For example, when describing the application process, school stakeholders stated that if their administration supported the program, then there was a higher chance of success in receiving the grant, as seen in the following comment from a foodservice director:
"Buy-in from the administration and the teachers. When we get their buy-in, then that really helps. If you can tie it into another program, then that helps, too, and making sure that your manager of your school is engaged in the program, too."

[Foodservice Director, FFVP School]

Stakeholders described a variety of incentives to apply. Some districts provided schools gift baskets or certificates as a show of appreciation for completing the application. Other districts committed to providing district funds to support the program (i.e., additional coolers or human resources) so that FFVP funds could solely purchase produce. Stakeholders also described FFVP as a way for their school to fulfill a nutrition education requirement for secondary granting agencies like BOEING or Blue Cross and Blue Shield. Two food service employees explained why their schools applied for FFVP:

"...when he [the principal] started it [the FFVP], it was because he was doing stuff like Fuel Up to Play 60, and we got a HUSSC [Healthier US School Challenge Grant], and that's why he started it. I think he started it because he wanted more PE equipment, I think, trying to get the two together to like...to tie in together" [Cafeteria Manager, FFVP School]

"So, I believe with the Boeing grant, because you're required to do some of these things in order to earn that money. I think money is...I do believe in the district that money is pretty much the deciding factor on a lot of things that we do."

[Foodservice Director, Non-FFVP School]

Stakeholders also described their previous experiences with managing federal grant programs as a reason they did not apply. They were concerned about the administrative burden and inconsistent funding.
A teacher described how the administrative burden to maintain the grant affected their decision not to apply: “It’s been my experience that federal grants or even state grants...or grants in general, come with a lot of red tape. And even though it [the FFVP] would be beneficial for the children, it’s do they [the school] have the time and personnel.” A food service director commented:

"I have a lot of schools that would qualify for the Fresh Fruit and Vegetable Program...and it's simple. It's crazy but simple. I don't have the storage for the five days of fresh fruits and vegetables it would take to do it. Then, you know, like if you have a lot of federal grants going on, people, they have grants out there, and you’re supposed to apply for all of them, but, behind the scene of the grant, the grants are a lot of work to keep up with because they require a lot of paperwork and documentation and somebody has to do that. You’re trying to do good, and you’re trying to provide extra things for your children in the school, but then you put a lot of tax and burden on your existing staff trying to keep the grants up with paperwork and meeting deadlines and all that stuff.” [Foodservice Director, Non-FFVP School]

State agency representatives indicated that they tried to "spread the wealth" across the state to broaden the program reach. Still, stakeholders felt that sporadic funding and irregular delivery of funds resulted in higher operation costs to the schools. One foodservice director explained that applying for the FFVP funds requires balancing erratic funding with foodservice regulations:

“There was one year I didn’t even find out about the money until I got the paperwork at the district office, and it was the end of August. I didn’t even know I
was part of the program. So, there I was, scrambling trying to spend this money…a significant amount of money in such a short period of time... But I can’t have someone build a [novel delivery] cart in that time period. Because if we are, then I need them working on it now. And if we don’t get it, then I’m supposed to pay for it from the foodservice program? [shakes head no] I’m not going to risk that, and then someone come back and ding me in an audit for using monies inappropriately or not for the NSLP [National School Lunch Program] or SBP [School Breakfast Program]. So…” [Foodservice Director, FFVP School]

4.5: Discussion

All children in the United States need nutritious foods, including fruits and vegetables, daily to support their health and growth, but not all children have access to these foods in their homes, communities, or schools. Nutrition safety-net programs, such as the FFVP, increase access to fresh fruits and vegetables. Additionally, children that participate in FFVP consume more fruits and vegetables than children that do not.\textsuperscript{36,107,108} Unlike school lunch and breakfast programs, where all schools with eligible children may participate, the FFVP program is made available to states through a block-granting program, distributed to schools through competitive grants. This paper explores how stakeholders sought to help children access nutritious fruits and vegetables through the FFVP granting process.

School food programs are major federal education initiatives. Initially enacted as a form of national security that bolstered child health, the programs are avenues for educational federalism.\textsuperscript{109–111} Participation in these programs supports federal educational and agricultural goals and state goals for student achievement and equity.\textsuperscript{112}
Policymakers have long touted the benefits of school food and argue for increasing participation in school meal and snack programs. Further, experts agree that school meals can improve the nutrition status of children, boost academic performance, increase school attendance and reduce behavioral problems. The FFVP is a relatively new program designed to address both federal, state, and individual goals to increase fruit and vegetable consumption among children. Stakeholders in this study supported FFVP program goals regardless of whether they applied for the grant. Goal alignment and prosocial behaviors like grant seeking are interactive, with goal alignment increasing application rates. As not all eligible schools in SC apply yet still support the program's goals; it appears that program application is not simply an issue of goal alignment.

Understanding stakeholder perspectives about why they apply for the FFVP can help identify ways to improve the program's reach and ultimately the diet of children in vulnerable communities. We examined the perspective of 57 stakeholders in South Carolina to better understand why some schools apply while others do not. We found that school stakeholders apply for the FFVP grant if they feel the program will (a) benefit their children, (b) feel a moral imperative to address injustices, (c) believe they are eligible, and (d) can manage the administrative burdens of federal grants.

2b (a) benefits the children

One school stakeholder summarized, “if my students are benefitting from it, then it's worth it,” as their motivation for applying for an FFVP grant. This perspective and the others like it we heard from stakeholders are similar to findings in studies of grant-seeking behaviors. For example, economists Benabou and Tirole found that prosocial behaviors, such as grant-seeking among educators, reflect altruistic motivations and
These altruistic motivations, such as wanting to contribute to society, are evident in educators. Further, educators reported their desire to innovate or include new programs in their classrooms related to their students' experience and learning. In our study, even stakeholders who did not apply described altruistic motivation as their primary interest in writing for the FFVP grant. Recall the administrator who explained, "For those who do [apply], it’s because it is what’s best for the children. But then you also do it [apply] because there isn’t another system to go through for that district for them to be able to offer fresh fruits and vegetables.” Thus, the desire to benefit children was the primary reason cited for application to the program, but not all stakeholders saw the FFVP grant as the only or best way to improve the well-being of children in their schools. Some stakeholders used other programs like the USDA Department of Defense Fruit and Vegetable Program or local vendor deals to provide for their students without added burdens of grant administration.

2c (b) morally obligated to address injustices

Educators appear to be embracing the moral argument for reducing forms of “othering” within their districts and society, leading to an increase in grant-seeking that fosters more inclusive or equitable programs. Stakeholders reported feeling a sense of moral obligation to support the vulnerable children they served, as stated by one school administrator, “I have a moral objection to not doing it...” Children need support and protection which they receive from other people and institutions like schools. Thus, schools share the social responsibility of raising and caring for children, which also manifests in educators’ sense of moral obligation. This moral obligation is linked to the situational vulnerability that poverty inflicts upon children already
experiencing a general vulnerability due to their age and agency. Poverty can impact not only a child's well-being but, as Schweiger says, "well-becoming," their well-being in the future, making the harm experienced exponential. Additionally, poverty and the process of "othering" have a long history together, with those living in poverty demarcated as different and inferior. Social systems and power structures define people as "other" since people seldom volunteer for this treatment. In schools, children are zoned into particular schools from their neighborhoods resulting in the pooling of wealth and resources in only some schools within a district. From this perspective, children are a marginalized social group with limited control of their circumstances, increasing the sense of moral and ethical responsibility among educators. Educators play a unique role in the mitigation of situational vulnerability experienced by students. Education and the educational environment can reduce the effects of poverty and improve health. Elliot and Davis suggest that educators can be agents of change in food systems, and school food programs can influence food security among children. As a result, the FFVP grant becomes a viable option for educators to improve equity within their food system and bolster vulnerable communities.

2d (c) eligibility

State interpretation of federal program guidance creates an agenda for the FFVP that limits applications only to those from schools operating CEP despite greater need across the state. The use of the CEP as an understood cut-off for eligibility limited stakeholder’s interest in applying as one foodservice director said, “The reason I did not [apply] was because of the way they [the state department] explained to us…” Educators reported being actively discouraged from applying unless the school was CEP which left
many schools in their districts without support even if they were eligible. The USDA program does not specify that a school must be CEP to receive the FFVP, only that the school must serve a population that is greater than 50% free and reduced. By stipulating that schools operate CEP, the state effectively creates a separate agenda for the FFVP beyond serving all eligible students fresh fruits and vegetables. The agenda here is unknown but, political dynamics routinely influence agenda-setting and prioritization for additional money. This top-down approach can prioritize the state needs over the needs of the students or community. Utilizing more nuanced funding distribution systems or algorithms could improve funding equity and expand the program's reach.

2e (d) administrative capacity

Grants like the FFVP are seen as "a lot of work" by stakeholders because they require documentation, paperwork, and physical resources, but incentives can drive application despite school capacity issues. Capacity is multi-factorial and encompasses local and regional needs, politics, administration, and finances. Rural and low-income schools are often more administratively disadvantaged when compared to well-funded or suburban schools. Stakeholders in this study indicated that administrative burdens included a lack of support at the school, human resources, physical space, and funding continuity. Stakeholders also reported a reluctance to applying as they are already overburdened. Not surprisingly, Monahan wrote that educators do not view grant-seeking behaviors as their primary role in schools. They further reported that schools themselves do little to support grant-seeking behaviors (i.e., incentivizing stakeholders with reduced teaching loads or reimbursement for time), making it apparent that grants are not a priority for many schools. These results diverge from our research, which
says that school stakeholders feel like grants are extra work and stretch capacity, but many schools provide support/incentives internally. This result implies that these schools may have a culture of grant-seeking despite their capacity limitations. Thus, while administrative burdens serve as limitations to FFVP applications from vulnerable schools in SC, incentives appear to drive some of the FFVP application processes with stakeholders.

Limitations:

The current study helps to explain why eligible school stakeholders may decide to apply for the FFVP. However, examination of stakeholders from only one state limits the generalizability of the results. As state agencies administer the FFVP, stakeholders in other states may have different experiences and perspectives related to the application and adoption of the program. Despite this limitation, the participant pool was heterogeneous concerning stakeholder position, years of experience, education level, age, and geographical representation. Additionally, most schools included in the study had at one point operated the FFVP, even if not during the study period, and stakeholders reported having both experienced applying for and not applying for the FFVP. The heterogeneity of the population and broad experiences of the stakeholders minimize the limitations and provide insight into why eligible school stakeholders may apply for the FFVP.

Conclusions:

Children in vulnerable communities are at increased risk for a poor diet. Federal nutrition safety-net programs like the FFVP can help to mitigate this risk through increased access and consumption of fruits and vegetables during the school day. To
effectively reduce the burden of poor diet through the FFVP, schools need to be aware of the program, prove eligibility, apply and adopt the program. Understanding the perspectives of eligible school stakeholders as to why they apply for the FFVP can help elucidate how to improve application rates to the program. This study suggests that school stakeholders consider context, setting, and implementation in their decision to apply. Stakeholder motivations for application emphasize context surrounding child welfare and moral imperatives in addition to eligibility systems and capacity.

4.6: Implications for School Health

The stakeholders we interviewed framed their arguments about applying for FFVP in familiar ways—they want to and are morally obligated to work for the benefit of children, but the state bureaucratic machine is burdensome. In another stakeholder study related to child hunger, we also found that stakeholders framed social problems in these terms, which we characterized as a welfare state frame and a free market frame. Critics of these frames might argue that while schools, as part of the welfare state, seek to benefit vulnerable children, they stand in the way of children's own voice and agency to advocate for their well-being. Likewise, viewing the state's rules and accountability requirements as administrative burden hints that left to their own devices, schools and private individuals within communities would feed children fairly and equally without administrative oversight. We offer these critical alternatives as "themes of omission" in our research.

Interestingly, when we explore these frames and the themes of omission, we reveal the possibility of improving the FFVP program access. For example, stakeholders across the board agree that benefiting children is the primary reason they would write a
grant for the FFVP; thus, emphasizing how the FFVP benefits children even more than other programs will be necessary for encouraging additional applications. Inviting children to describe how participation in the FFVP affects them might be particularly powerful in motivating applications. Likewise, stakeholders wanted to apply but found the state's guidance, rules, and paperwork a barrier. Federal, state and local officials can all take steps to reduce this burden while also doing a better job communicating how required reporting processes aligns with stakeholders' values of moral imperative to address injustices, as most bureaucratic processes are results of civil rights and laws that protect the well-being of children in particular. For instance, focusing on CEP-eligible schools might be the state's way of ensuring that children in greatest need have the greatest access to the FFVP.

Addressing stakeholder context, school setting, and program implementation is needed to increase the reach and potential benefit of programs like the FFVP in vulnerable schools. Reframing the cultural narratives surrounding child nutrition programs can increase applications as it reduces contextual and implementation barriers to an application. Another viable way to increase application is to use a more equitable approach to distributing federal funds throughout the state. As opposed to statewide, regionally based competition can improve access in the neediest areas of a state by reducing the applicant pools. If regional funding is not an option, formula funding at the state level can reduce schools' administrative costs from applying. Using a comprehensive formula or tiered application to determine eligibility can improve the opportunity for districts to get money for all their schools based on their percentage of qualifying students rather than an all-or-nothing approach to funding. Ultimately,
administrators for the FFVP program need to be mindful of stakeholder perspectives and accommodate them to improve application and adoption.

4.7: Human Subjects Approval Statement

All research activities were approved by the University of South Carolina Institutional Review Board. Informed consent was obtained from all participants before data collection.
### 4.8: Tables

**Table 4.1: Participant Demographics by Stakeholder Age**

<table>
<thead>
<tr>
<th>Age</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Reported/Declined</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25yrs</td>
<td>4 (10.5%)</td>
<td>3 (18.8%)</td>
<td></td>
<td>0 (0%)</td>
</tr>
<tr>
<td>26yrs-30yrs</td>
<td>3 (7.9%)</td>
<td></td>
<td></td>
<td>3 (5.2%)</td>
</tr>
<tr>
<td>31yrs-35yrs</td>
<td>4 (10.5%)</td>
<td></td>
<td></td>
<td>4 (7%)</td>
</tr>
<tr>
<td>36yrs-40yrs</td>
<td>4 (10.5%)</td>
<td></td>
<td></td>
<td>4 (7%)</td>
</tr>
<tr>
<td>41yrs-45yrs</td>
<td>3 (7.9%)</td>
<td>1 (6.3%)</td>
<td></td>
<td>4 (7%)</td>
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<tr>
<td>46yrs-50yrs</td>
<td>4 (10.5%)</td>
<td>4 (25%)</td>
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<td>8 (14%)</td>
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<tr>
<td>51yrs-55yrs</td>
<td>2 (5.3%)</td>
<td>2 (12.5%)</td>
<td>2 (66.7%)</td>
<td>6 (10.5%)</td>
</tr>
<tr>
<td>56yrs-60yrs</td>
<td>8 (21.1%)</td>
<td>5 (31.3%)</td>
<td></td>
<td>13 (22.8%)</td>
</tr>
<tr>
<td>&gt;60yrs</td>
<td>6 (15.8%)</td>
<td>1 (6.3%)</td>
<td>1 (33.3%)</td>
<td>8 (14%)</td>
</tr>
</tbody>
</table>
Table 4.2: Participant Demographics by Stakeholder Self-Identified Gender

<table>
<thead>
<tr>
<th>Self-Identified Gender</th>
<th>Stakeholders from Schools Operating FFVP (n=38)</th>
<th>Stakeholders from Schools NOT Operating FFVP (n=16)</th>
<th>State Staff (n=3)</th>
<th>Entire Population (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1 (2.6%)</td>
<td>1 (6.3%)</td>
<td>1 (33.3%)</td>
<td>3 (5.2%)</td>
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<tr>
<td>Female</td>
<td>37 (97.3%)</td>
<td>15 (93.8%)</td>
<td>2 (66.7%)</td>
<td>54 (94.7%)</td>
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</table>
Table 4.3: Emergent Themes and their Respective Dimension of the CICI Framework

<table>
<thead>
<tr>
<th>CICI Dimension</th>
<th>Barriers to Application</th>
<th>Supports of Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context</td>
<td>• Eligibility guidelines are perceived as too strict</td>
<td>• Stakeholders are willing to invest time if it benefits their students</td>
</tr>
<tr>
<td></td>
<td>• Stakeholders resent the state agency and their oversight</td>
<td>• Stakeholders believe in the program</td>
</tr>
<tr>
<td></td>
<td>• Stakeholders are willing to invest time if it benefits their students</td>
<td>• Stakeholders have a moral imperative to provide opportunities to children</td>
</tr>
<tr>
<td></td>
<td>• Stakeholders believe in the program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stakeholders have a moral imperative to provide opportunities to children</td>
<td></td>
</tr>
<tr>
<td>Setting</td>
<td>• Community Eligibility Provision schools receive preference</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>• Schools and stakeholders lack resources to implement the program</td>
<td>• Administration supports it</td>
</tr>
<tr>
<td></td>
<td>• There is a reasonable alternative for the FFVP available</td>
<td>• There are incentives to apply</td>
</tr>
<tr>
<td></td>
<td>• Program funding continuity is sporadic</td>
<td></td>
</tr>
</tbody>
</table>
4.9: References


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CHAPTER 5
SCHOOL CHARACTERISTICS EXPLAIN A PORTION OF STUDENT CONSUMPTION OF SNACKS PROVIDED THROUGH THE FRESH FRUIT AND VEGETABLE PROGRAM

2K. Hoy, S. Jones, R. Davis, C. Blake, M. Burke. To be submitted to Journal of Nutrition Education and Behavior
5.1: Abstract

Objective: To better understand Fresh Fruit and Vegetable Program (FFVP) implementation variation and its relationship to student intake of fruits and vegetables at school.

Design: Cross-section observational comparison.

Setting: Fourteen low-income elementary schools in South Carolina; seven operating the FFVP and seven comparison schools.

Participants: 3849 independent observations of student consumption from lunch and FFVP snack nested in 88 4th and 5th-grade classrooms.

Main Outcome Measures: Plate waste and a scaled score representing FFVP implementation variation.

Analysis: T-Tests, pairwise correlation, and multilevel modeling.

Results: Students in FFVP schools consume more fruits and vegetables than non-FFVP students (p<0.000). A strong negative correlation exists between implementation variation and school location in the rural-fringe area. Approximately 18% (ICC= 0.18), of the variation in student FFVP snack consumption can be explained by school (0.12) and classroom characteristics (0.06). The frequency of snacks and School Health Index (SHI) both have a positive effect. Enrollment has a negative effect.

Conclusions and Implications: Student diet benefits from the FFVP; however, efficacy is affected by school and classroom-level implementation. Rural-fringe schools may improve implementation with resource sharing or dedicated training. Classroom variation appears to influence student consumption of the snack, yet more research is needed to determine which characteristics are most impactful.
Children in vulnerable communities are at increased risk for a poor diet.\textsuperscript{11,20,147} The Fresh Fruit and Vegetable Program (FFVP) is a United States Department of Agriculture (USDA) child nutrition program that increases vulnerable children’s access to and consumption of fruits and vegetables.\textsuperscript{36,107} FFVP is inherently flexible\textsuperscript{45}, has few regulations, and helps identify and develop best practices for individual schools to increase fruit and vegetable consumption among low-resource children.\textsuperscript{36} Flexibility built into the FFVP at the federal level naturally results in the variation of implementation at both the state and school levels.\textsuperscript{36,148} Variation in implementation affects outcomes in complex health promotion programs.\textsuperscript{10,148,149} Few studies have examined how variation presents in FFVP schools and its associated impacts.\textsuperscript{5,36} The objective of this study was to better understand FFVP implementation variation and its relationship to student intake of fruits and vegetables by addressing the following questions:

1) Do children at FFVP schools in South Carolina consume greater amounts of fruits and vegetables when compared to children at elementary schools not participating in FFVP?

2) Do school-level characteristics (e.g., urban/rural, enrollment, average daily participation, percentage of student body eligible for free and reduced-price meals, and the number of child wellness initiatives adopted by the school) affect FFVP implementation variation?

3) Does FFVP implementation variation (e.g., frequency of snack distribution during the week, frequency and type of nutrition education offered) increase student consumption of FFVP snacks provided?
5.3: Methods

Design:

This cross-section observational study used data from an extensive mixed-methods evaluation of the FFVP conducted in the Spring of 2018—this paper details results related to implementation of the program and student consumption of fresh fruits and vegetables. The study included fourteen schools representing the four regions of South Carolina (Upstate, Midlands, Pee Dee, and Low Country). Researchers matched seven schools operating the FFVP demographically and regionally with seven schools that had applied for the FFVP but not received funding. This study included a sample of 3849 independent observations of student consumption nested in 88 4th and 5th-grade classrooms in South Carolina elementary schools. All observations were considered independent, and all data was de-identified. Following school observations, the Primary Investigator (PI) constructed a data set including publicly available school profile statistics, school health index scores, plate waste observations, and a calculated FFVP implementation score for inclusion in this analysis. This study was approved by the University of South Carolina Institutional Review Board for the Protection of Human Subjects.

Measures:

The PI observed plate waste using the Quarter Waste visual estimation method at two different time points in each participating school to measure student consumption. The PI weighed each food item served either in the snack or at lunch in ounces once before service. Student trays and snacks were observed, and estimated consumption recorded using a coding system as shown in Table A.1. We observed 4th and
5th-grade lunch and, if applicable, FFVP snack service. An external rater (AB) reviewed images and plate waste estimations for a sample of trays and snacks at each school to ensure data quality. Each school averaged six 4th and 5th grade classrooms with three teachers per grade. Plate waste data collection occurred in person using paper forms. The PI entered all data into Excel, resulting in the creation of eight tables. Using exploratory data analysis, typos and inconsistencies were corrected. The PI created the final data set and cross-validated it with an external data analyst (ZL) to ensure accuracy.

We created a scaled score to represent FFVP implementation variation using information collected from state FFVP audit forms. The audit forms cover all requirements of FFVP administration as stated in Section 4304 of the Food, Conservation, and Energy Act of 2008. Calculated scores are a continuous variable where schools earn a point for every best practice implemented and can range from 25-42 points. In this study, schools received scores ranging from 18-35, resulting in scaled scores spanning .8-1.6.

State agency and federal public access data warehouses supplied class and school demographic, location, and School Health Index information for the 2017-2018 school year. The School Health Index (SHI) is an assessment and planning tool for elementary schools that is evidence-based and identifies policies and practices that can reduce youth health risk behaviors. The SHI is broken into ten assessment areas representing school-wide environments. The PI included only the Nutrition Environment and Services assessment area in this study. Calculated scores are a continuous variable where schools earn from zero to three points to implement fourteen nutrition environment policies to
their fullest extent and range from 0-42 points. In this study, schools received scores ranging from 18-35 points.

Dependent variables of interest in these analyses included: fruit and vegetable consumption in weight (ounces), school meal consumption in weight (ounces), FFVP implementation score, and FFVP snack consumption in weight (ounces). Class level variables of interest included: the number of male and female students, FFVP snack distribution time (before/after lunch), FFVP snack-type (fruit/vegetable), and grade. School-level variables of interest included: program (FFVP or Non), school urban/rural status, average school enrollment, average daily school meal participation, percent of student-body eligible for free and reduced meals, number of child wellness initiatives adopted by the school, School Health Index score, frequency of FFVP snack distribution during the week, number of direct nutrition education opportunities offered each year, number of in-direct nutrition education opportunities offered each year, average teacher salary, previous FFVP funding status, and the number of students reported in poverty. Variables of interest were narrowed from school profile databases based on literature reviews and anecdotal responses from state agency guidance.

Statistical Analysis:

Most of the classrooms had two days of observation data available. However, nine classrooms were observed only once (either lunch or FFVP snack). Observation summaries are in Tables A.2-A.4 in the Appendix. Missing data were most often related to field trips, testing, and field day activities. To account for missing data, we performed data simulation analysis. Based on the simulation, if two-day data were exact duplications, about 50% of the p-values are larger than the two-day data without
duplications. As such, it is reasonable to conclude that observations from each day of the two-day plate waste data collected are independent of the other.

We used two-sample t-tests to assess the relationship between FFVP and children's daily consumption of fruits and vegetables in ounces. As identifiable information was not available for each student, we calculated class-level averages. The class level averages were created by summing the average fruit and vegetable consumption at snack and lunch for each FFVP classroom and dividing by the number of students. Non-FFVP schools did not have fruit and vegetable snack data; thus, the average fruit and vegetable consumption at lunch was used. Histograms and Shapiro-Wilks normality tests indicated a left skew in the non-FFVP sample. This indication of non-normality necessitated a Wilcoxon-Mann-Whitney (WMW) nonparametric test to detect mean differences. Least squares means detected the effects of snack type (fruit/vegetable) and snack timing (morning/afternoon) on consumption. We removed classrooms with only one day of observation for this matched analysis.

To assess the relationship between FFVP implementation and school characteristics, we completed a pairwise correlation analysis. The simple bivariate analysis was deemed appropriate given the small sample size of FFVP schools (n=7) and lack of variation between schools in implementation scores. School-level characteristics were selected for inclusion based on the availability of data for the entire sample. The school-level characteristics included: average implementation score, past FFVP funding status, CEP status, total implementation score, average daily participation, percent of the student population eligible for free and reduced-price meals, total school enrollment, School Health Index score, geographic location, and the overall number of child wellness
initiatives adopted by the school as reported in FFVP audit documents. Two school
characteristic variables (i.e., past FFVP funding status and CEP status) were not included
in the final analysis as there was no variation within this sample for these variables. In
addition, school location was a character variable with four levels. It was included in the
analysis with four dummy variables: city, town distant, rural fringe, and rural distant. All
other school characteristic variables were continuous variables.

We used multilevel models to examine the relationship between school FFVP
implementation (independent variable) and student consumption of fruits and vegetables
in ounces (dependent variable). Before modeling, we assessed for collinearity, and
variables of interest were removed from the proposed models. Class level variables of
interest included: the number of male and female students, FFVP snack distribution time
(before/after lunch), FFVP snack-type (fruit/vegetable), and grade. Classroom level
variables were narrowed in the model depending on variation, t-tests, and Pearson
Correlation tests. There was no variation in the snack type (fruit or vegetable) and timing
(before lunch or after lunch) variables between classrooms resulting in their removal
from the models as a class level characteristic. These variables were shifted to school-
level characteristics as a result. A two-sample t-test examined the 4th and 5th-grade
variables. Grade did not significantly differ in the consumption of fruit and vegetables
during snack time (p=.189). The female ratio represented the sex variable in a Pearson
correlation test. This test indicated that the female ratio and fruit and vegetable
consumption have a linear relationship (p=.899). Based on these analyses, all class-level
variables proposed were excluded from the model-building process; however, we still
estimated class effects.
School-level variables of interest included: program (FFVP or Non), school urban/rural status, average school enrollment, average daily school meal participation, percent of student-body eligible for free and reduced meals, School Health Index score, implementation score, frequency of FFVP snack distribution during the week, number of direct nutrition education opportunities offered each year, number of indirect nutrition education opportunities offered each year and previous FFVP funding status. Given the mutually exclusive nature of the hypotheses in the study, variables with significant results in previous analyses were excluded (i.e., school urban/rural status, snack-type, and snack time). ADP, enrollment, and percentage of student body eligible for free and reduced-price meals were all representative of the same school characteristic given the sample included only schools with 100% free and reduced-price meal status. As a result, enrollment as the highest order variable was included, and ADP and percent of student body eligible for free and reduced-price meals were excluded. Program status was excluded as the model would only include schools operating FFVP. Univariate analysis indicated that all schools were CEP and had received FFVP funding in the previous year. As a result, previous FFVP funding status was excluded. This left six variables for inclusion in the model: enrollment, School Health Index score, implementation score frequency of snack distribution during the week, number of direct nutrition education opportunities offered each year, and number of indirect nutrition education opportunities offered each year.

A total of 63 models were built and examined. The simplest model did not include any predictors, and the most complex of the models included all level one and level two predictors. The model structure was kept simple due to the small sample size and lack of
variation between level two units. As such, only random intercepts were included in the analysis. Analysis was completed using PROC MIXED and estimated using maximum likelihood in SAS 9.5. Model fit was determined in four steps. First, t-test results were compared to determine models with significant fixed effects. This narrowing removed 57 of the 63 models. Second, change in -2 log-likelihood was examined to compare full and reduced models. The -2 log-likelihood was distributed as $X^2$, with covariates determining the degrees of freedom in each model. Third, models that had high correlations among their fixed predictors were excluded to prevent multicollinearity. Finally, the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were compared and the lowest selected. Model building and selection were replicated by an external statistical consulting group (NC State Statistical Group) in R using the “Imer” function. Full equations for the null, level one, and level two combined models can are visible in the Appendix, along with a diagram of model selection (Image A.1-A.2). Results are based on model 1 (null) and model 29, as shown in the equation in Appendix Image A.3.

5.4: Results

Descriptive Statistics:

The complete sample consisted of 3849 independent student tray observations from 88 4th and 5th-grade classrooms in 14 schools. The sample included 737 female and 721 male students. As indicated on school report cards from the South Carolina Department of Education, the schools were predominantly serving Black American students. A summary of the univariate analysis is visible in Table A.5.5. FFVP schools offered approximately 4.5 ounces of fruits and vegetables daily, while non-FFVP schools offered on average approximately 3.5 ounces daily. FFVP snacks averaged approximately
3 ounces in each snack offering. The average amount of fruits and vegetables consumed per student across both FFVP and non-FFVP schools each day was 2.3 ounces with a range from 0-19 ounces (Median = 2.3, Std. Dev =1.9, Variance=3.4 Q1=.7, Q3=3.9). Teachers were predominantly female (n=37), with only one male teacher included in the sample.

Students in FFVP schools consume significantly more fruits and vegetables than non-FFVP students (p=<0.000). The average amount of fruit and vegetables consumed at FFVP schools was 7.1 ounces, just under one cup of fruit or vegetables daily. The average at non-FFVP schools was 4.3 ounces or just over one-half of a cup of fruits or vegetables daily. On average, students at FFVP schools eat approximately 2.7 more ounces of fruit and vegetables when compared to students at non-FFVP schools. These results are visible in Table A.6.

Furthermore, FFVP classrooms consume more fruit at lunch (p=<0.000); however, when fruits and vegetables are examined together, the effect is no longer significant (p=.655). The t-test found that snack timing does not affect lunch consumption (p=.072) or fruit and vegetable consumption (p=.131) at the class level. Least squares means was used to assess differences in mean lunch and fruit and vegetable consumption of each classroom with snack offered either in the morning or afternoon. The mean difference between snack timing in the morning and afternoon was 1.7 ounces, and the mean difference between snack-type, either fruit or vegetable, was 1.1 ounces.

When examining the correlation matrix, a strong negative correlation between implementation characteristics and school location in a rural area presented. Moderate correlations exist between average daily participation (ADP) and the percentage of the
student population eligible for free and reduced meals, enrollment, and the overall number of child wellness initiatives adopted by the school. Image A.4 details the correlation matrix.

Approximately 18% (ICC= 0.18), of the variation in student FFVP snack consumption can be explained by school (0.12) and classroom characteristics (0.06). The best-fitted model is presented below in Table 2. Based on the p-value, the fixed effects of three independent variables are significant. The model included: frequency of snacks, School Health Index Score (SHI), and school enrollment. The frequency of snacks and SHI both have a positive effect on student fruit and vegetable snack consumption. Enrollment has a negative effect. When controlling for SHI and enrollment, increasing snack frequency by one serving a week would increase student fruit and vegetable snack consumption by approximately .4 ounces. With all other variables controlled, a one-point increase in SHI increases student fruit and vegetable snack consumption by approximately 3.7 ounces. With all other variables controlled, with every decrease in enrollment by one person, there would be increased student fruit and vegetable snack consumption by .4 ounces. Table A.5.7 details the Solution for Fixed Effects.

The data were screened for violations of assumptions before analysis. The residual plot (Appendix Image A.5) shows the data points even spread around the central line, but a non-constant trumpet shape can be seen. This conflicts with assumptions of normality in the error term. Some extreme values are present in the QQ-plot and histogram of residuals which may explain the non-constant variance. A greater sample size at the school level would wash out these extreme values.
5.5: Discussion

Children require a diet rich in fruit and vegetables to grow and thrive; however, not all children have access to these foods. The USDA created programs like the FFVP to increase access to fruits and vegetables for children in low-resource communities to enrich diets. Implementation of the FFVP varies as there are few required programmatic components. The variation in implementation affects student consumption. This paper details student consumption of fruits and vegetables related to variation in the FFVP among low-resource schools in South Carolina.

A primary objective of the FFVP is to increase student consumption of fruits and vegetables. Children in FFVP schools eat significantly more fruits and vegetables when compared to those in non-FFVP schools ($p<.0001$). The average amount of fruit and vegetables consumed at FFVP schools in this study was 7.01 ounces which is just under one cup of fruit or vegetables daily. The average at non-FFVP schools was 4.3 ounces or just over one-half of a cup of fruits or vegetables daily. The difference in consumption is approximately 2.7 ounces, which is just over 1/3 of a cup. This finding mirrors Bartlett et al.'s results showing students participating in the FFVP eat about 1/3 of a cup (i.e., 2.6 ounces) more fruit and vegetables daily compared to students not participating in the FFVP. This increase in fruit and vegetable consumption could be a function of increased offering. Children eat more fruits and vegetables at lunch when offered more. This study reinforces the USDA evaluations of the FFVP program as a potential way to increase the consumption of fruits and vegetables in vulnerable populations through increased access and availability.
Variation in the implementation of health promotion programs like the FFVP affects health behaviors such as consumption. School location characteristics significantly affect FFVP implementation. Rural or fringe locations have a strong negative correlation with implementation scores of the FFVP. The relationship between rural schools and lagging implementation is not new in school food programs. Schools often cite lack of capacity, small staff, and inadequate training when describing barriers to implementation. To overcome these barriers, schools have tried collaborating with other districts to increase capacity, increased networking to improve training, and improved funding for infrastructure and equipment. Interestingly, no other school characteristics were found to influence the FFVP implementation significantly. This could be related to the relatively small sample size of only seven schools and the lack of an objective measure of implementation beyond the delivery of fruits and vegetables to students on state audit forms. In addition, FFVP implementation is not well defined. The only compulsory component of the program is the distribution of fruits and vegetables to students. Schools are encouraged to supplement fruit and vegetable distribution with nutrition education, health promotion, and capacity building. However, schools are allowed to determine how much or how little they will supplement their program. Thus, a broad spectrum in implementation exists. Some schools operate a purely environmental program, wherein students only receive fruit and vegetable snacks. Other schools offer a multi-component program where students may also receive multiple exposures to nutrition education or health promotion activities in addition to their snacks. The development of an implementation definition and an objective tool for
quality of implementation would benefit schools trying to implement the program and
evaluators as they determine program efficacy.

The FFVP is traditionally described as a school-based intervention; however,
variation in the program can occur at multiple levels. Simultaneous flexibility in program
implementation guidance and rigid definition of what is compulsory in the program leave
the definition of program activities up to school leadership. If leadership does not clearly
define a direction or activities, the lack of standardization results in individual
definitions.163–165 Thus, program delivery can change at the school level and the
classroom level. This is evident in educational literature with academic outcomes as
well.166,167

Results in this study indicated that both school and classroom level characteristics
affect student consumption of FFVP fruits and vegetables. It appears that classrooms are
engaging in supplementary activities which have disparate effects on student-level
outcomes. Little research examines the classroom level, and these results help explain
why some school-based initiatives do not see significant results in student behaviors.
Additionally, the model that we used could not include classroom-level characteristics as
there was slight variation between them or linear relationships existed. The lack of
significant classroom characteristics in this study indicates that more robust classroom-
level variables are needed. Additional qualitative work can also help to clarify how
implementation truly varies within classrooms. Furthermore, individual definitions limit
the ability to link implementation to outcomes and program fidelity. If this program relies
on teachers to deliver high-quality nutrition education and model healthful behaviors,
teachers need greater support for training and support in health promotion practices.168–170
The results from this study reinforce the need for training, support from school leaders, a standard definition of program activities at the school level, and the exploration of what tools and techniques teachers need to deliver the program in conjunction with the snacks.

Based on the model, three variables (School Health Index Score, Frequency of Snack, and Enrollment) appear to affect fruit and vegetable snack consumption among children in FFVP schools. Positive relationships are seen between School Health Index scores, frequency of snack and fruit and vegetables snack consumption, while a negative relationship is evident between enrollment and consumption. This study provides preliminary evidence of behavior change associated with SHI best practices in schools, supporting results from several studies that link wellness initiatives with improved consumption of fruits and vegetables.171–173 It is not surprising that the frequency of snacks increases FFVP fruit and vegetable consumption among students. As exposure, access, and offering all increase consumption, the result is desired and expected.39,172,174–176 Interestingly, this study shows the negative relationship between enrollment and fruit and vegetable snack consumption. This result could be explained by the general lack of flexibility and mobility that large organizations have. Additionally, larger schools in lower-income areas are often overburdened, and program implementation suffers.177,178 Further research is needed to review this finding as it relates to student health and food.

This study has several limitations. Being cross-sectional, interpretation of these results should be taken with care. Student consumption patterns could reflect seasonal influences or bias from being observed. Regardless, access and offering are related to consumption, and the FFVP achieves both in its program design. Another limitation is the small sample. Including only 14 schools and only 7 FFVP schools limits generalizability as
well as the variation between schools. The limited variation reduces the ability of these tests to account for classroom-level characteristics which appear to influence student behaviors. While limited, the study results are still significant, indicating that larger sample sizes will help reduce statistical error but likely confirm the results that student behavior in the FFVP is influenced by the hierarchical nature of the school setting. The strengths of this study are the geographically representative sample and matching. FFVP schools were spread across the state and effectively paired with similar non-FFVP schools making the results less affected by regional bias or proximity to wealthy areas. This is the first study to examine the association between FFVP implementation and student consumption behaviors to the author's knowledge.

5.6: Implications

The FFVP is present in low-income schools across the United States. Replicating this study and expanding the sample size in other states could determine if the results are specific to South Carolina or more generalizable.

To reap the full benefits of the FFVP in student diets, school stakeholders must apply for, be awarded, and implement the program. Application and award are described in another publication. However, this paper is the first to document that implementation of the FFVP appears to be multilevel. While the FFVP is typically referred to as a school-based intervention, this study suggests that both class-level and school-level characteristics influence student consumption behaviors. This isn't surprising as inherent program flexibility results in children experiencing vastly different programs from class to class and school to school. For example, some children only receive snacks while
others receive more comprehensive programs, including nutrition education and role-modeling.

Further examination into classroom-level differences should be examined to determine how much these program variations influence student consumption behaviors. In the meantime, improving definitions of implementation at the school level can assist teachers in delivering the FFVP. This can be achieved with greater training, resource-sharing, and guidance from the state agencies for school leaders.
### 5.7: Tables

**Table 5.1: Quarter Waste Method Coding System Summary Table**

<table>
<thead>
<tr>
<th>Plate Waste Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None of the food serving is wasted</td>
</tr>
<tr>
<td>1</td>
<td>1/4 of the food serving is wasted</td>
</tr>
<tr>
<td>2</td>
<td>1/2 of the food serving is wasted</td>
</tr>
<tr>
<td>3</td>
<td>3/4 of the food serving is wasted</td>
</tr>
<tr>
<td>4</td>
<td>All of the food serving is wasted</td>
</tr>
</tbody>
</table>
Table 5.2: Number of Independent Student Tray Observations

<table>
<thead>
<tr>
<th>Program</th>
<th>School Operating FFVP</th>
<th>School NOT Operating FFVP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFVP</td>
<td>1190</td>
<td>0</td>
<td>1190</td>
</tr>
<tr>
<td>NSLP</td>
<td>1321</td>
<td>1338</td>
<td>2659</td>
</tr>
<tr>
<td>Total</td>
<td>2511</td>
<td>1338</td>
<td>3849</td>
</tr>
</tbody>
</table>
Table 5.3: Number of Independent Classroom Observations

<table>
<thead>
<tr>
<th>Program</th>
<th>School Operating FFVP</th>
<th>School NOT Operating FFVP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFVP</td>
<td>69</td>
<td>0</td>
<td>69</td>
</tr>
<tr>
<td>NSLP</td>
<td>75</td>
<td>89</td>
<td>164</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>89</td>
<td>233</td>
</tr>
</tbody>
</table>
Table 5.4: Classroom-Level Observation Day Summary Table

<table>
<thead>
<tr>
<th>Schools</th>
<th># of classroom</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 1</td>
<td>Day 2</td>
<td></td>
</tr>
<tr>
<td><strong>FFVP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upstate School A (Clinton)</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Low Country School A.1 (Cottageville)</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Midlands School A.1 (Fairfield)</td>
<td>14</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Low Country School C.1 (Goodwin)</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Low Country School E.1 (Hardeeville)</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>PeeDee School A.1 (Pageland)</td>
<td>16</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>PeeDee School C.1 (Sumter)</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Non-FFVP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PeeDee School D.1 (Brooklyn Springs)</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>PeeDee School B.1 (Douglas)</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Low Country School B.1 (Edisto)</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Upstate School B (Flat Rock)</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Midlands School B.1 (Newberry)</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Low Country School F.1 (Ridge Spring Monetta)</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Low Country School D.1 (St. Stephen)</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.5: Univariate Analysis – Demographic Information

<table>
<thead>
<tr>
<th>Grade</th>
<th>School Type</th>
<th>FFVP School (n=7)</th>
<th>Non-FFVP School (n=7)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td></td>
<td>21</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt;</td>
<td></td>
<td>21</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

**Gender (% boys)**

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFVP School (n=7)</td>
<td>379</td>
<td>382</td>
</tr>
<tr>
<td>Non-FFVP School (n=7)</td>
<td>358</td>
<td>339</td>
</tr>
<tr>
<td>p-value</td>
<td>0.58</td>
<td></td>
</tr>
</tbody>
</table>

**Race (%)**

<table>
<thead>
<tr>
<th></th>
<th>FFVP School (n=7)</th>
<th>Non-FFVP School (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>1879</td>
<td>1416</td>
</tr>
<tr>
<td>White</td>
<td>846</td>
<td>1189</td>
</tr>
<tr>
<td>Hispanic</td>
<td>582</td>
<td>394</td>
</tr>
<tr>
<td>Two or more races</td>
<td>157</td>
<td>113</td>
</tr>
<tr>
<td>American Indian/Alaska Native</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Hawaiian/Pacific Islander</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Asian</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>p-value</td>
<td>&lt;.0001</td>
<td></td>
</tr>
</tbody>
</table>

1. Number of boys and girls in classrooms observed
2. Number of students of different races in schools. Based on school report cards
3. P-value from Chi-square test for independence
Table 5.6: Results from Two-Sample T-Test Comparing FFVP and Non-FFVP Classroom Fruit and Vegetable Consumption Averages

<table>
<thead>
<tr>
<th>FFVP School</th>
<th>Non-FFVP School</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean (sd)</td>
</tr>
<tr>
<td>66</td>
<td>7.1 (1.9)</td>
</tr>
</tbody>
</table>

1. Results from two sample T-Test
2. Results from WMW Test
Table 5.7: Solution for Fixed Effects of Best-Fitting Model

| Effect                | Estimate | Standard Error | Degrees of Freedom | t Value | Pr > |t| |
|-----------------------|----------|----------------|--------------------|---------|------|---|
| Intercept             | 184.1    | 36.8           | 6.9                | 5       | 0.001|
| Frequency of Snack    | 0.4      | 0.1            | 9.2                | 4.5     | 0.001|
| School Health Index   | 3.7      | 1.3            | 7.3                | 3       | 0.01 |
| Enrollment            | -0.4     | 0.1            | 6.9                | -5      | 0.001|
Figure 5.1: Full Terms for Multilevel Models

Null model:

\[ y_{jk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + \epsilon_{yk} \]

One-variable model:

**Model 1:** \[ y_{jk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + A_i + \epsilon_{yk} \]

Two-variable model:

**Model 7:** \[ y_{jk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + A_i + B_i + \epsilon_{yk} \]

Three-variable model:

**Model 22:** \[ y_{jk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + A_i + B_i + C_i + \epsilon_{yk} \]

Four-variable model:

**Model 42:** \[ y_{jk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + A_i + B_i + C_i + D_i + \epsilon_{yk} \]

Five-variable model:

**Model 57:** \[ y_{jk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + A_i + B_i + C_i + D_i + E_i + \epsilon_{yk} \]

Six-variable model:

**Model 63:** \[ y_{jk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + A_i + B_i + C_i + D_i + E_i + F_i + \epsilon_{yk} \]
model 29 is the “best” model

Figure 5.2: Diagram of the Model Fit Process
\[ Y_{ijk} = \mu + \alpha_i + S_{k(i)} + \beta_{j(i)} + S_{k(j)} + Freq_{Snk} + SHI_i + Enroll_i + \epsilon_{ijk} \]

\[ S_{k(i)} \sim N(0, \sigma^2_S); \quad S_{k(j)} \sim N(0, \sigma^2_C); \quad \epsilon_{ijk} \sim N(0, \sigma^2); \quad S_{k(i)} \perp \epsilon_{ijk}; \quad S_{k(j)} \perp \epsilon_{ijk} \]

Figure 5.3: Final Model Equation for the Best-Fitting Model – Model 29
Figure 5.4: Correlation Matrix between School Characteristics and Implementation
Figure 5.5: Residual Plot for Best Fitting Multilevel Model
5.8: References


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CHAPTER 6
CONCLUSION

6.1: Summary

The purpose of this study was to explore stakeholder perspectives as they related to FFVP application and adoption as well as measure program efficacy by examining program implementation variation and its relationship to student health behavior. To achieve this, the researcher conducted a mixed-methods study in the Spring of 2018. The researcher interviewed school stakeholders from both FFVP schools and non-FFVP schools in addition to observing school lunchrooms and FFVP snack service. Two specific aims and corresponding research questions informed the research.

Specific Aim 1: Describe the differences among schools that do and do not apply for FFVP grants to provide a rich contextual foundation for ethnographic aims.

Research Questions:

4. What are the demographic differences between FFVP applicant schools and non-applicant schools? Are there similar characteristics among applicant schools? Non-applicant schools?

5. What are the stakeholder reasons for applying, or not applying for the FFVP grant? Are there themes in perceived reasons for success as compared with failure?
6. What are the underlying contexts and ideologies that support the application to FFVP grant opportunities in South Carolina?

Specific Aim 2: Explore perceived child health outcomes and behaviors related to FFVP and examine their relationship to implementation variation.

Research Questions:

6. What is the relationship between FFVP and child diet?

7. Do children in participating schools consume the fruit or vegetable snack provided? If so, in what quantities?

8. How does FFVP impact child consumption of school meals? Do schools that participate in FFVP demonstrate greater student fruit and vegetable consumption during school meals when compared with comparable schools that do not participate in FFVP?

9. To what extent does school FFVP implementation variation explain student consumption of fruit and vegetable snack provided?

10. What is the relationship between school-level characteristics and FFVP implementation?

To address specific aim one, the PI purposively selected stakeholders in three groups, stakeholders in FFVP funded schools, stakeholders in non-FFVP funded schools and state FFVP administration. The PI completed a total of fifty-seven interviews with seven different categories of school stakeholders, including: 15 school administrators, 14 school foodservice directors, 7 school cafeteria managers, 4 school FFVP coordinators, 7 teachers, 7 parents, and 3 state officials.
Findings for specific aim 1:

Based on this sample and these specific aims, school stakeholders apply for the FFVP grant if they feel the program will benefit their children, feel a moral imperative to address injustices, believe they are eligible, and can manage the administrative burdens of federal grants. Themes emerged in all dimensions of the CICI framework, and the decision-making process followed a similar pattern for stakeholders through 1) context, 2) setting, and 3) program implementation. The stakeholders we interviewed framed their arguments about applying for FFVP in familiar ways—they want to and are morally obligated to work for the benefit of children, but the state bureaucratic machine is burdensome. Addressing stakeholder context, school setting, and program implementation is needed to increase the reach and potential benefit of programs like the FFVP in vulnerable schools.

Reframing the cultural narratives surrounding child nutrition programs can increase applications as it reduces contextual and implementation barriers to an application. Another viable way to increase application is to use a more equitable approach to distributing federal funds throughout the state. As opposed to statewide, regionally based competition can improve access in the neediest areas of a state by reducing the applicant pool. If regional funding is not an option, formula funding at the state level can reduce schools’ administrative costs from applying. Using a comprehensive formula or tiered application to determine eligibility can improve the opportunity for districts to get money for all their schools based on their percentage of qualifying students rather than an all-or-nothing approach to funding. Ultimately,
administrators for the FFVP program need to be mindful of stakeholder perspectives and accommodate them to improve application and adoption.

To address specific aim two, the PI collected a sample of 3849 independent student lunch and FFVP snack consumption observations nested in 88 4th and 5th grade classrooms. All observations were considered independent, and all data was de-identified. Following school observations, the Principal Investigator (PI) constructed a data set including publicly available school profile statistics, school health index scores, plate waste observations, and a calculated FFVP implementation score for inclusion in this analysis. Analysis included two sample T-Tests, pairwise correlation, and multi-level models.

Findings for specific aim 2:

Based on this sample, students at FFVP schools consume significantly more fruits and vegetables when compared to students in non-FFVP schools (p<.0001). Only school location correlated with FFVP implementation variation. Rural or fringe schools had a strong negative correlation with FFVP program implementation scores. Approximately 18% (ICC= 0.18) of the variation in student FFVP snack consumption can be explained by school (0.12) and classroom characteristics (0.06). Based on the model, three variables (School Health Index Score, Frequency of Snack, and Enrollment) appear to affect fruit and vegetable snack consumption among children in FFVP schools. Positive relationships are seen between School Health Index scores and frequency of snack with FFVP fruit and vegetable consumption while a negative relationship is evident between enrollment and consumption. While the FFVP is typically referred to as a school-based intervention, this study suggests that both class-level and school-level characteristics
influence student consumption behaviors. This isn’t surprising as inherent program flexibility results in children experiencing vastly different programs from class to class and school to school. For example, some children only receive snacks while others receive more comprehensive programs, including nutrition education and role-modeling.

Further examination into classroom-level differences should be examined to determine how much these program variations influence student consumption behaviors. In the meantime, improving definitions of implementation at the school level can assist teachers in delivering the FFVP. This can be achieved with greater training, resource-sharing, and guidance from the state agencies for school leaders.

Overall Findings:

To effectively reduce the burden of poor diet through the FFVP, schools need to be aware of the program, prove eligibility, apply, adopt, and implement the program. Results from this study suggest that stakeholder motivations for application emphasize context surrounding child welfare and moral imperatives in addition to eligibility systems and capacity. Of specific note in South Carolina, educators reported being actively discouraged from applying unless the school was CEP which left many schools in their districts without support even if they were eligible. Additionally, while students in FFVP schools are consuming more fruits and vegetables than students in non-FFVP schools, variation in program implementation can impact how much of the FFVP snacks are consumed.

6.2: Connections to Previous Literature

Results from this large mixed-methods study align with much of the literature available surrounding school food programs and child health behaviors. Children in
schools operating FFVP are found to consumer greater amounts of fruits and vegetables when compared to children in schools without the FFVP. 4,6,36,179 This is a boon to the program as its primary goal is to affect change in vulnerable children’s diets.45 Also, application behaviors of school stakeholders reflect moral imperatives and narratives expressed by those working in similar food assistance settings.180 Stakeholders indicated application behavior is rooted in the desire to benefit children much like the welfare state frame expressed in studies of child hunger.180 Primary barriers to application align with literature surrounding grant-seeking behaviors in educational settings. Capacity and eligibility limit applications while training and reduce administrative burdens support application.125,143,145 A divergence from educational literature is the support of this study for a school’s grant-seeking behaviors. Districts and schools supported application through incentive structures which previous literature theorized did not exist.125 Implementation literature to date did not examine FFVP variation and as such, little literature exists examining it. Small case studies define implementation by the basic delivery of fruits and vegetables to children and do not expose the greater depth and detail that can occur at multiple levels of influence.6 This study indicates that there are multiple places for influence on student health behaviors, such as consumption but, greater definition of implementation is required to best measure these influences.

6.3: Strengths and Limitations

The qualitative study helps to explain why eligible school stakeholders may decide to apply for the FFVP. However, examination of stakeholders from only one state limits the generalizability of the results. As state agencies administer the FFVP, stakeholders in other states may have different experiences and perspectives related to the
application and adoption of the program. Despite this limitation, the participant pool was heterogeneous concerning stakeholder position, years of experience, education level, age, and geographical representation. Additionally, most schools included in the study had at one point operated the FFVP, even if not during the study period, and stakeholders reported having both experienced applying for and not applying for the FFVP. The heterogeneity of the population and broad experiences of the stakeholders minimize the limitations and provide insight into why eligible school stakeholders may apply for the FFVP.

The quantitative study has several limitations. Being cross-sectional, interpretation of these results should be taken with care. Student consumption patterns could reflect seasonal influences or bias from being observed. Regardless, access and offering are related to consumption, and the FFVP achieves both in its program design. Another limitation is the small sample. Including only 14 schools and only 7 FFVP schools limits generalizability as well as the variation between schools. The limited variation reduces the ability of these tests to account for classroom-level characteristics which appear to influence student behaviors. While limited, the study results are still significant, indicating that larger sample sizes will help reduce statistical error but likely confirm the results that student behavior in the FFVP is influenced by the hierarchical nature of the school setting. The strengths of this study are the geographically representative sample and matching. FFVP schools were spread across the state and effectively paired with similar non-FFVP schools making the results less affected by regional bias or proximity to wealthy areas. This is the first study to examine the
association between FFVP implementation and student consumption behaviors to the author's knowledge.

6.4: Recommendations for Research and Practice

Children eat more fruits and vegetables when their schools participate in the FFVP. The program has the potential to affect diet quality for most children in South Carolina thus expansion of the program is of interest to federal and state program administrators. Stakeholders across the board agree that benefiting children is the primary reason they would write a grant for the FFVP, thus emphasizing how the FFVP benefits children even more than other programs will be important for encouraging additional applications. Reframing the FFVP to highlight the benefits for children capitalizes on cultural frames already surrounding child hunger and child nutrition programs which may drive applications from late adopters. Federal, state, and local officials can reduce barriers to application by addressing administrative burdens and unspoken eligibility “rules” such as current CEP status to receive funds.

Additionally, this study provides a springboard into the discussion of implementation and federal nutrition support programs across multiple levels. It is not surprising that variation in implementation across classroom and schools affect student behaviors; however, more research is needed to define the extent of the variation. To capture the downstream effects of programs like the FFVP beyond student consumption, more detailed and standardized definitions of implementation are needed and should be explored. In-dept qualitative and environmental audits exploring multiple levels of implementation are needed.
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APPENDIX A

THE CONTEXT AND IMPLEMENTATION IN COMPLEX INTERVENTIONS

(CICI) FRAMEWORK

Figure A.1: The CICI Framework – Conceptual Map
APPENDIX B

BACKGROUND LITERATURE REVIEW

B.1: Obesity as an Issue- A Review of Framing and Obesity Frames

In 1971, Omran postulated an epidemiological shift in which the world population would be more dramatically affected by chronic diseases rather than infectious diseases in the modern era. This unidirectional theory failed to recognize the complexity of the environments within which illnesses arise. In recent years there has been a need to focus not just on chronic disease, but multifaceted and concomitant illness. To this point, the increased attention on the myriad disease burden associated with obesity. The prevalence and severity of obesity in the American population has increased dramatically over the past five decades with the greatest jump of obesity noted between the 1970’s and the late 1990’s. The increasing rate of obesity was relatively overlooked by the mass media until the early 2000’s when the surgeon general released a report on the subject. The report is thought to have catalyzed the addition of obesity to the political agenda and the subsequent attention in national newspapers. Concurrent with the politicization of the obesity issue, the American public’s awareness and concern for the issue increased sevenfold.

When an issue, such as obesity, garners more public attention, people attempt to make sense of the issue through multiple streams of information including media, information gleaned from social networks, personal experience, political ideology and
Framing is a dynamic process of structuring and presenting a problem or issue so that individuals can interpret the meaning of events both in their own lives and in the world around them. The way an issue is framed influences the public opinion and policy-making environment. Four dimensions frame public health risks which influence the social climate and the ultimate enactment of policy. The four dimensions used to frame public health risks include: 1) portraying a health risk as acquired deliberately or involuntarily, 2) portraying a health risk as a universal threat or a threat for a particular population, 3) portraying a health risk as arising from within an individual or arising from exposure to the environment, and 4) portraying a health risk as intentionally created by others or not. According to framing theory, framing an issue as involuntary, universal, and an environmental risk which is knowingly created results in a social climate open to policy solutions.

Public health messages vary along the spectrum of political discourse between the frames of personal responsibility and collective responsibility throughout modern US history. In the late 20th century a shift occurred in the political discourse toward personal responsibility and away from the collective frames when defining public health issues. This emphasis on personal responsibility with little acknowledgement of systemic influences results in a form of victim blaming where individuals are forced to adjust their expectations for health solutions. Additionally, narratives framed solely around personal responsibility effectively divert attention from the social causes of disease. When examining the obesity issue, the discourse follows these two dominant public health frames: 1) the belief that obesity is a personal responsibility resultant of personal choices and, 2) the belief that obesity is a collective responsibility and related to
larger environmental forces.\textsuperscript{36} According to health polls, the American public is relatively evenly divided between these two dominant obesity frames.\textsuperscript{36,200,201} However, evidence suggest that the 1980’s obesity framing is shifting to reflect collective responsibility.\textsuperscript{196} This shift relates to the addition of children to the obesity discourse as children are often seen as helpless victims of adult decisions.\textsuperscript{185,196,202} Childhood obesity more easily fits into the frame of universal and environmental risk than adult obesity making childhood obesity policy more easily implemented, as seen in the early policy victories in schools.\textsuperscript{60,187,196}

Reframing obesity narratives to reflect collective responsibility is imperative for appropriate policy change and future policy support. A central challenge with re-framing obesity discourse is that narratives often describe obesity as the result of two individual health behaviors—nutrition and physical activity. As a result, the collective responsibility narratives developed typically become program slogans, such as “Make the smart choice, the easy choice” or the “Fit Business” which is what the framing literature calls a frame trap. In this frame trap, the collective action framing cues the listener to focus on individual choices. Furthermore, framing literature has grossly ignored the systems which affect public health issues such as obesity. Official frames propagated by both private and public institutions do not account for requisite community engagement and or the capacity building needed to achieve a true collective action frame.\textsuperscript{203–205} Collective action framing then focuses on the mobilization of charitable giving between social classes (as seen in food banks) or emphasizes technology distribution among disparate groups (evident in the sustainable agriculture movement).\textsuperscript{206} This results in a lack of sustainable action as proximate symptoms of the disparity garner attention and
underlying determinants of the disparity itself persist. A clearer collective action framing focuses on the interconnections among humans, and their environments (e.g., how an entire social network is likely to be of similar BMI) and encourages structural changes. An example of this could be the “Right to Recess” movement which uses a community-engaged and participatory approach to address the removal of physical activity in local and state school curricula. The movement includes skill-building through public speaking training and evidence-based approaches for engaging policy-makers in the discussion.

It is helpful to approach obesity discourse as a spectrum with personal responsibility on one pole and collective responsibility on the other. This lens allows for the more nuanced views of the obesity issue that encompasses both personal and collective responsibility frames to surface. This lens also recognizes the complexity surrounding obesity as an issue, acknowledges systems, and begets the need for an equally complex and nuanced solution to the obesity problem which views personal and collective responsibility as synergistic.

B.2: Why the Focus on Obesity?

People have ways of knowing about others by “reading” another’s body. This tacit knowledge helps discern differences among people and classify them, generally speaking, as normal or deviant. Further, people use these classifications to determine threats to themselves both physically and morally. One of the characteristics people classify others by is their fatness. Most commonly fatness is viewed as either a part of the natural and healthy diversity of the human body (i.e., normal) or as the product of unhealthy choices and gluttony (i.e., deviant). In recent history, medical
authorities defined a disease state based on body fatness called obesity and incited public alarm over an “obesity epidemic”.

Obesity is a condition characterized by excess adiposity. The medical community, informed by obesity researchers, led by institutions such as the surgeon general and WHO and, bolstered by the mass media, frames obesity as the result of risky health behaviors and situates obesity as both a disease and a risk factor for a variety of other health issues. The authority with which the medical narratives circulate makes it difficult for the alternative frame of “health at all sizes” to gain social support and requires definitive evidence that obesity is in fact not a preventable cause of morbidity and mortality. Four primary claims put forth by medical authorities and obesity researchers urge the public to treat obesity as the primary health concern for the American population. These claims include 1) obesity is an epidemic, 2) obesity is a major contributor to mortality, 3) high adiposity is pathological and a direct cause of disease, and 4) significant long-term weight loss is practical and beneficial medically.

Campos and colleagues conducted a systematic review of these claims and found little scientific evidence supporting the claims themselves, rather overlapping economic interests between public health constituents, universal political support and, a moral panic in which obesity threatens the health and moral fabric of society resulting in the focus on obesity.

B.3: The Problem with Obesity as the Primary Indicator of Health

The most common method of diagnosing obesity in adults is the calculation of the body mass index (BMI) which compares an individual’s weight to their height. Adult BMI ranges and their associated weight status are in Table 4. American weight has
been steadily increasing for the past century; rather, Americans have been steadily getting bigger, in both height and weight, over the past century.\textsuperscript{222–224} It is not a surprise then that studies have seen an increased prevalence of obesity.\textsuperscript{224} However, the alarm over the increased prevalence is in part due to the method used to define body fatness and the subsequent classifications of fat individuals. In fact, some of the shift in obesity prevalence is attributable to the change in BMI classifications from the WHO in 1997 which expanded BMI categories and shifted BMI cut-points for normal and overweight persons.\textsuperscript{223} Obesity could be viewed as less of an epidemic and more the shifting of persons from one BMI category to another.\textsuperscript{225–229}

Table B.3.1: Adult BMI Categories\textsuperscript{214}

<table>
<thead>
<tr>
<th>Clinical Classification</th>
<th>BMI (kg/m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal</td>
<td>18.5 – 24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0 – 29.9</td>
</tr>
<tr>
<td>Obese Class 1</td>
<td>30.0 – 24.9</td>
</tr>
<tr>
<td>Obese Class 2</td>
<td>35.0 – 39.9</td>
</tr>
<tr>
<td>Obese Class 3</td>
<td>40.0+</td>
</tr>
</tbody>
</table>

Starting around 1979, pediatric practice included the diagnosis of obesity in children aged two years to teenagers aged 19 years, using a similar if not more nuanced BMI calculation.\textsuperscript{230} Called BMI-for-age, the measure assesses a child’s height and weight while also accounting for age and gender. Child BMI is expressed as a percentage
and indicates the child’s BMI in relation to the BMI of other children of the same age and gender. BMI-for-age ranges are in Table 5.²³¹

Table B.3.2: Child BMI Categories²³¹

<table>
<thead>
<tr>
<th>Clinical Classification</th>
<th>Percentile Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>Less than the 5th percentile</td>
</tr>
<tr>
<td>Normal</td>
<td>5th percentile to less than the 85th percentile</td>
</tr>
<tr>
<td>Overweight</td>
<td>85th percentile to less than the 95th percentile</td>
</tr>
<tr>
<td>Obese</td>
<td>95th percentile or greater</td>
</tr>
</tbody>
</table>

In recent history, controversy has erupted over the use of BMI as an indicator of health.²²⁸ Using the BMI measure alone as an indicator of obesity and subsequently as an indicator of overall health has several failings.²²⁹,²³² Among the primary critiques, BMI does not: 1) distinguish between fat and non-fat mass such as bone and muscle, 2) does not account for the changes in body composition that occur naturally with age,²³³ 3) does not differentiate where fat mass is carried on the frame (e.g., – centrally or peripherally), and 4) lacks specificity and sensitivity as an individual measure.²²⁸,²³³ These issues with measurement suggest that BMI may be a useful as a broad proxy of obesity at the population-level; but, is less appropriate for individual-level behavior change and counseling. Especially, as BMI may not change with the addition of other beneficial behaviors.²²⁷

Though BMI has been deemed a “reasonable measure” of obesity in children, the errors plaguing the BMI measure in the adult population carry over to the population of
BMI in children is an imperfect measure of adiposity and subsequent risk. Thus, the interpretation of BMI needs to be within the context of other important indicators of health such as cognitive development, physical activity and fitness levels, body composition measurements, diet quality, social and emotional development as well as engagement in other health behaviors. Furthermore, the health discourse should include sociological factors such as socioeconomic status and race which disparately affect health outcomes.

Beyond concerns with the measures themselves, the associations among obesity, disease, and mortality is complex. Some literature postulates links between obesity and medical, psychosocial, economic, and social impacts; but, literature also identifies subtleties in how obesity affects health. Health risks appear in the greatest statistical extremes of BMI; yet, great alarm presents with any diagnosed BMI beyond normal classification. Predicted mortality is lower for people classified as overweight when compared to those classified as normal and people classified in obesity class one have the same predicted mortality rate as people classified as normal weight; yet, this is not normative in the medicalized obesity narrative. Furthermore, excess weight can be protective for certain populations, like the elderly. While there are instances where excess body weight can contribute to disease, body shape and build may be more important than adiposity itself. This is further demonstrated by the improvement in other health markers like insulin resistance, blood pressure, and blood lipid levels from the addition of aerobic activity even when BMI or adiposity does not change. Obesity research, programs, and evaluation need to address these nuances to appropriately construct the reality in which obesity exists and influences health.
B.4: Changes in How we Define Health

Because obesity prevention is the primary focus of many health programs and initiatives, including the FFVP, program benefits which fall in other domains of health may not be observed. The cultural underpinning of personal responsibility and the framing of health partially explain the focus on obesity in the health discourse of America, but, definitions and measures used to judge health are also to blame.

The way health is defined has been changing in the last decade. Health as the absence of disease reigned during the early 20th century when infectious diseases were of paramount concern. This definition of health used simple and often singular mechanisms for disease causation and emphasized measures of morbidity and mortality. Further, child health was not distinguished from adult health. Modern views of health recognize that child health is dynamic and has special characteristics. Child health is a representation of resources which afford opportunities to both individuals and society as a whole. These conceptual changes in the definition of health, specifically child health, imply a need for broader and more integrated measures of health surveillance, program success, and evaluation.

B.5: Nutrition and Child Health

Three narratives in the field of nutrition explain the relationships among food and health: the life science view, the environmental/ecological view, and the social view. The life science view classifies nutrition as a biochemical process and focuses on the molecular and scientific traditions of medical nutrition therapy. The environmental, or ecological view, characterizes nutrition as a function of the biophysical environment and focuses on the food system and the interrelation among agricultural economics and
consumption and subsequent health. The social view explains nutrition as an embedded function within culture, ways of living, and socioeconomic status. Presently, these schools of thought are independent of each other, resulting in a fracturing of the profession with the life science nutrition narrative dominating the others. 255 This dominant narrative underlies the popular effort to quantify the nutritional adequacy of individuals and the subsequent focus on correcting individual dietary behaviors.

For example, in 1941, the United States Food and Nutrition Board established the Dietary Recommended Nutrient Intake (DRNI) and Recommended Daily Allowance (RDA) to ‘serve as the goal for good nutrition’ for the population. Even today, these measures are updated regularly and reflect the way dietary data is collected and used for both individual-level and population-level diet assessment and planning. 256 Additionally, the Dietary Reference Intakes (DRIs) as established by the Institute of Medicine serve as evidentiary backbone for national health and wellness guidelines such as the Dietary Guidelines. 11 The dietary guidelines then inform the development and measurement of health promotion objectives such as the Healthy People 2020.

One problem with the reliance on quantification of group nutrition status is that it affects the way we measure health. Limitations of direct observation lend much of the nutrition assessment research to focus on surveys such as the National Health and Nutrition Examination Survey (NHANES). These surveys show snapshots of individual behaviors at a single point in time. These snapshots are aggregated and used to determine population-level inadequacies in relation to the dietary guidelines and the risk factors associated with preventable death. Thus entire populations are classified on cross-sectional data with limited understanding of the contexts surrounding them. Data
represent individual behaviors but are interpreted in collective nutrition outcomes. This means that population-level assessment of nutrition status must be interpreted carefully and additional research to better understand how these nutrition phenomena occur within populations represent opportunities for value-added contributions to the body of knowledge.

In the most recent NHANES, nearly the entire US population is reported as under-consuming vegetables and whole grains and a majority of the population under-consumes fruit, milk and oils relative to the recommendations. These trends continue in school-aged children as a majority do not meet recommendations for fruit and vegetable consumption. These reports concern clinicians because fruits and vegetables have high concentrations of vitamins, minerals, electrolytes, phytochemicals, polyphenols, and fiber which are crucial for growth and development. These concerns coupled with new research on the effect of nutrition throughout childhood development resulted in increased emphasis on nutrition during every phase of child development in public health initiatives. With great success, the US government dedicated time and resources to affecting change in schools which will reach children within these phases of development. These school-based interventions are historically centered around the modification of nutrient profiles in school meals indirectly placing responsibility of health on children by expecting them to make healthful meal choices.

Good nutrition is recognized as essential to health and developmental potential. The dominant nutrition narrative, life science nutrition, emphasizes the types, mix/proportion and timing of food and exercise. This view needs to be carefully considered and interpreted in the realm of policy as, if left unchecked, it can both directly
and indirectly shift focus onto individual behaviors and ignore the larger social context and community role in achieving health.

**B.6: Systems and Child Health**

A diverse and interconnected set of contexts, such as poverty, climate change and governance influence the links between nutrition and overall child health.\textsuperscript{262,263} Individuals, specifically children, are socially located within the context of households.\textsuperscript{264} Households embed into communities (both physically and socially defined)\textsuperscript{265,266} and macro-level systems such as the government at state, national and international levels affect these communities. Thus, individual health is not just the product of the individual choices; but, the systems in which an individual resides and conducts their life.

**B.7: Social Determinants of Child Health**

Poor health affects the US population disparately.\textsuperscript{265} This disparate effect of poor health cannot be explained just by genetics or communicable disease; but, also by the social environment, known as social determinants of health.\textsuperscript{265} According to Healthy People 2020, social determinants of health are the conditions in which people “live, learn, work, play, worship, and age.” These environments affect a wide range of health, quality of life outcomes, and risks both positively and negatively. To further define these spheres of influence, the World Health Organization identified several social arenas which affect health including the social gradient, stress, early life, social exclusion, work, unemployment, social support, addiction, food, and transportation.\textsuperscript{266} Thorough systemic change is necessary to address health inequities as a result of social determinants. For example, households suffering from material deprivation which manifests as unclean
water or poor nutrition cannot only be provided clean water or bundles of food to remedy health inequities as resources are socially distributed throughout communities and the world.\textsuperscript{1,267,268} Simply providing clean water or food to households deprived of material resources does not remedy the underlying issue that is poverty.

Children and adolescents are not immune to the effects of the social environment. Globally, child mortality is the health outcome most sensitive to material deprivation.\textsuperscript{269} Viner et al. found that child and adolescent health is particularly sensitive to structural factors such as wealth and access to education in addition to supportive families, safe schools, and social support.\textsuperscript{270} Metaphorically, child health is the canary in society’s proverbial coal mine of social environments; effectively indicating when environments are becoming toxic.

When considering the impact of social environments, we must begin with how and where children live. Children, as units of measure, nest into households. Households then nest into communities or neighborhoods. Households vary in content and adoption of domestic institutions, and a “household” is socially interchangeable with a “family.” The domestic unit of a household is treated as economically independent and functions through interactions both within and between other domestic units.\textsuperscript{271} Ecology, technology, demography, class position, cultural background, bureaucratic requirements, and power amongst many other domains all influence household size and form. Child health is affected by all these inter- and intra-household interactions.

Households at the bottom of the social gradient in income are more likely to suffer ill health due to structural, physical, and governance factors. Children are especially impacted by poverty as they carry the ill-effects throughout their lives. As of
2015, one in four children lived in poverty.\textsuperscript{269} Direct effects of poverty on child health include a lack of or inappropriate provision of food resulting in food insecurity and malnourishment, a lack of appropriate shelter such as a home without heating in winter increasing risk for hypothermia, or damp and molded living spaces resulting in breathing disorders.\textsuperscript{269,272} Impoverished neighborhoods often lack safe places for children to play limiting their ability to engage in physical activity, have schools that are poorly funded due to school zoning resulting in greater rates of school drop-out, expose residents to greater amounts of pollutants and contaminants due to lack of governance leading to asthma and illness, and lack social cohesion resulting in greater risk-taking behaviors and crime.\textsuperscript{269,273–275} Additionally, impoverished neighborhoods lack access to services and appropriate healthcare resulting in greater rates of untreated illness.\textsuperscript{276} Psychosocially, poverty results in low self-esteem and increased feelings of powerlessness which subsequently increases the rate of engaging in anti-social behaviors.\textsuperscript{277,278} Children in impoverished households and neighborhoods have higher rates of exposure to domestic conflicts and violence as a result of increased parental stress, normalizing violent behaviors in their social development.\textsuperscript{279} Finally, children in impoverished households and neighborhoods have reduced supervision as parents and guardians are working to support multi-generational families or influenced by the increased prevalence of alcohol and tobacco vendors within close proximity to their home which results in increased rates of child accidents and injuries.\textsuperscript{280}

Households and neighborhoods can also protect children in their immediate social context.\textsuperscript{281} This occurs when accumulated support from household members, peers,
schools, and neighborhoods, are high-quality and encourage health both in the built environment and in the social context.\textsuperscript{282–284}

Thus, poverty and deprivation at the household and neighborhood level link with a wide array of child health outcomes. As such, to improve child health through programs, we cannot overly simplify the relationships between children and the program, we cannot ignore the environments in which children live and how these environments affect program implementation.

**B.8: Food Insecurity and Child Well-Being**

A common nutrition-related factor which affects child development and health is food security.\textsuperscript{117} The USDA recognizes definitions of food security and insecurity from the Life Sciences Research Office. According to these definitions, a household is food secure when all family members have access to enough food to live an active and healthy life at all times. Conversely, a household that has limited or uncertain availability or access to nutritionally adequate and safe food is considered food insecure.\textsuperscript{285,286}

A more complete definition of food security is provided by the United States Economic Research Service (ERS). ERS measures household food security along a spectrum of severity from high food security to very low food security. Based on this spectrum, there are four measurement categories of food security: high, marginal, low, and very low.\textsuperscript{286} Using responses from food security surveys, government agencies separate households into these categories.

Thus food security, as measured by the USDA, is a condition assessed by survey that represents, “a household-level economic and social condition of limited or uncertain access to adequate food.”\textsuperscript{287} Households reporting reduced quality, variety or desirability
of diet without a reduction in intake are households with low food security. Households reporting frequent disruption of eating patterns and reduced intake are households with very low food security. These measures of food security reflect actual food intake. Food insecure households not only report having less food on hand within the household; but, also lower rates of consumption of fruits and vegetables. These results call into question the division that agencies attempt to forge between food security and hunger as they can exist both in conjunction and independently of the other highlighting the complexity of the relationship. It is important to note however that the measure of food security includes both quantity and quality of food in a child’s diet and can thus affect a child’s health and well-being even if food insecurity is occurring independently of hunger.

There are two primary pathways defined in the literature describing how food security affects child health. First, nutritional deficit, this is a direct pathway where a child is malnourished due to poor quantity and or quality of food. Direct nutritional deficit results in iron deficiency, increased frequency of illness, and reported decline in health status. Second, food insecurity as an indirect pathway acts as a stressor on the family unit which affects parenting behaviors and subsequent child reactions to parenting behaviors. In addition to these defined pathways, there are a myriad of associations between food insecurity and adverse behavioral and child health outcomes such as lower test scores and difficulty socializing. Greater risk of adverse health outcomes exists when children are both impoverished and food insecure. Impoverished children are at greater risk for poor health. When compounded with food insecurity, the risk of poor health is increased. While poverty and food insecurity are independent phenomena, much
like hunger and food insecurity, food insecurity is primarily a product of financial constraints, and food insecurity correlates with poverty.\textsuperscript{117,291} This places a great onus on food assistance programs touted to simultaneously relieve the burden of food insecurity, poverty, and improve health outcomes.

\textbf{B.9: Governance and Child Health – A Shift in Purpose}

Food security and social environment impacts on child health cannot be fully understood without further examining macro-level influences such as national and international governance structures. More specifically the food system. The food system is complicated and highly complex, with stakeholders representing individual, industrial, regional, national, and international outcomes. Changes at the national level through policy, such as the Farm Bill can affect both regional and local farmers and consumers while also affecting change in the global supply and variety of food available. The dominant narrative among agriculture experts and stakeholders regarding the food system shifted in the early 20\textsuperscript{th} century from feeding people to profit, resulting in a distancing of people from the food they are consuming coupled with a systemic focus on short-term economic goals and subsequent loss of social and environmental goals.\textsuperscript{204,292}

There are two primary value-based viewpoints dominating agriculture and food system discussions to date. First, is the discussion surrounding the moral responsibility of the agribusiness industry to those receiving and laboring to produce the goods and products of the food system. Second, is the controversy surrounding the responsibility of the agriculture industry to the environment overall.\textsuperscript{293}

Many consider the relationship between agribusiness and consumers (both direct and indirect) special because humans require food to survive; therefore, an assumption
manifests that the agribusiness industry has an increased responsibility to shepherd its consumers toward health. Aiken et al. determined that critics of agriculture often feel agribusiness should be more responsible to their end consumers; however, agribusiness owners surveyed do not hold the same world-view and do not consider that their industry has any greater responsibility than others.293,294

This divergence in perception of responsibility is partly due to the open nature of the agriculture system overall.295 Agriculture is both affected by and affects larger societal institutions like the economy, consumer preferences, culture, and even political systems like immigration and trade. Interactions within and between these systems affect the food that is available, accessible, and ultimately consumed by persons around the world.202,296,297 Farm production decisions dictate the variety and quality of foods available to consumers while farm size and technology use is directly related to the health and vigor of local rural communities.294,298,299 Simultaneously, cultural and societal trends determine what is profitable for farms to produce through consumer demand.300–302 Urbanization and pollution drive farmers off of valuable lands forcing land costs to increase and diminishing crop yield, resulting in a reduction in small farms as they are pushed out of business due to costs.303 Global needs and government organizations affect local farms through subsidized crops, fixed market pricing, commodity and immigration policy.304–306 Thus, corporate agribusiness can interpret their social responsibility in broad terms and create reasonable doubt as to a definitive direction or mechanism through which agriculture results in poor health effectively convoluting their responsibility for population health through the complexity of global food system interactions.307,308
Environmentally, the primary debate surrounds the viability of sustainable practices for producing high quality and cost-effective products without shifting the burden of cost onto farmers while simultaneously reducing environmental impacts. Tangential debates in America surround overall land usage, ownership, and tenure practices and how they affect the future of agriculture. Alternative food advocates stress the importance of establishing relationships between producers and consumers and proclaim that direct to consumer methods like community-supported agriculture (CSA) or farmer’s markets are ideal for transforming the food system. These alternative food systems shorten the economic and social distance between farmers and consumers while supporting participatory democracy and building community. Sustainable agriculture practices and systems have also been found to increase the level of local and intra-regional food production, processing, and distribution thus keeping economic gains in the local community via jobs, product purchase, and product consumption. Sustainable agriculture practices are linked with increases in natural, social, and human capital in rural communities both nationally and internationally. Natural capital improves through increased water retention and organic matter in soil effectively increasing agrobiodiversity. Social capital improves through strengthened social organization and collective management of natural resources resulting in bettered connectedness both within the community and to external policy stakeholders. Human capital improves through an increased capacity to solve problems locally resulting in increased self-esteem among formerly marginalized populations, an increase in the status of women, and ultimately better child health and nutrition.
While sustainable agriculture practices can be beneficial, people assume that if a technological advance or operational change is good for the environment then it must be good for all of society. One example of this in the alternative food movement is the organic sustainable food practice. Organic food production and consumption is socially distributed. First, only specific farms can capitalize on organic farming practices. Farmers are dependent upon the private sector for technological innovation and the relationships between the farm and the private sector dictates which farms receive innovations such as organic pesticides etc. Resultant organic crops are often lower in yield and must be priced in a way that farmers can recoup their increased input and use of sustainable technology. Thus an unintended consequence of alternative environmentally sustainable practices can be the pricing out of entire subsections of the population, most notably the low resource population. This feeds into systemic material deprivation among this population as these resources are not universally available; rather, socially distributed from the genesis of the food system. An additional critique of sustainable food practices relates to the white-washing of agricultural history. Proportionate with the population, Black Americans, those at the bottom of the social gradient, and minority populations do not participate in alternative food programs like farmer’s markets and CSAs. This results in a white middle-class consumer base. Alternative food advocates report that lack of education is the greatest obstacle to participation in alternative food programs; yet, this postulate ignores the white privilege on which agricultural land and labor relations are founded. Guthman reports that a different “aesthetic” exists for participating in local and organic food movements when historically the relationship between food production and family are fundamentally different for Black Americans.
and minority populations when compared to the majority white population. While sustainable and alternative food movements are well-intentioned, they could benefit from a broader community-based participatory approach in developing their systems to address both social and environmental issues.

The complex system and structure in which food is produced and delivered to consumers ultimately influences the health benefits that food affords to the population. These influences need to be considered when examining the impact of food assistance programs on child health.

**B.10: United States Food Assistance Programs**

The United States government seeks to address hunger and malnutrition through a variety of federal food assistance programs. These programs are overseen by the United States Department of Agriculture Food and Nutrition Service, administered at the state level by appropriate state agencies, and are broken into four categories which include Food Distribution Programs, Child Nutrition Programs, Supplemental Nutrition Assistance Programs (SNAP), and Special Supplemental Nutrition Programs for Women, Infants and Children (WIC). Within these categories are a total of fifteen individual programs which make up the bulk of the USDA annual budget as 71% of budgetary outlays are dedicated to nutrition assistance. These programs serve broad populations and intervene at various locations along hunger and malnutrition pathways. One in four Americans are estimated to participate in one of the fifteen nutrition assistance programs over the course of the year indicating the broad reach of these assistance initiatives and the monetary investment in their success by the American government.
While the food distribution programs and SNAP endeavors to provide high-quality USDA foods to support the American nutrition safety net, some programs are more targeted and seek to meet the dietary needs of specific participant groups. One such program is WIC, which provides federal dollars to states to provide supplemental foods, nutrition education and necessary health referrals for qualifying pregnant, or post-partum women and children. Child nutrition programs are also designed to address the specific dietary needs of children from young children in child care settings through high school students and some adults in adult day-care, both during the school year and in the summer months.

Child nutrition programs aim to address the dual-burden of hunger and obesity through the reimbursement of organizations like schools and child-care centers which provide meals to children. There are six programs defined by the USDA under the child nutrition programs which include the Child and Adult Care Food Program (CACFP), National School Lunch Program (NSLP), School Breakfast Program (SBP), Special Milk Program (SMP), Summer Food Service Program (SFSP), and the Fresh Fruit and Vegetable Program (FFVP). These six programs account for 23 billion dollars in the USDA budget which represents a quarter of the overall budgetary outlay. Most recent estimates of participation in these programs nationwide range from 2.8 million during the peak of summer in the Summer Food Service Program to 31.2 million students daily in the National School Lunch Program.

Child nutrition programs in some form or another have been in existence since the dawn of the school-house; however, the meal programs were the work of benevolent charity groups and mothers who were “feeding the poor.” The development of
formalized child nutrition programs was the result of converging political needs in the 1920’s – 1930’s. The concern for child nutrition and malnutrition was burgeoning following World War I when over one-third of all men drafted to serve were rejected due to underweight or nutrition-related disease (e.g., – rickets).\textsuperscript{326,327} Nutrition science advocates, often liberal reformers with a focus on education, health, and welfare, were pushing agencies such as the US Department of Agriculture to establish an “American diet” with standards and a modicum of household operation guidelines for mothers to follow. Army officials frightened by the idea of appearing weak in the global eye bolstered the reformers thus schools, hospitals, and even corporations were convinced to start meal service. School lunchrooms were standard by the end of the 1920’s, and with the dawn of nutrition science, nutrition education became the way of the future.\textsuperscript{326} The nutrition education movement emphasized individual eating behaviors, which overlapped well with the neoliberal ideals of the New Deal era, and schools were the perfect vehicle\textsuperscript{328} to influence children given their relatively controlled setting and their possibility to influence families.

After the Great Depression, farm-bloc legislators showed concern over the market for farmers and supported liberal reformers in their push toward the institutionalization of school meals. Reformers and the agricultural sector formed a coalition and proposed that the government purchase farm surplus and supply the surplus to schools to combat population underweight and support US agriculture.\textsuperscript{329} Southern Democrats were the political lynchpin in this agreement and only agreed to support the federal appropriations in exchange for agricultural subsidies under the conditions that federal oversight would be limited and local control would be unlimited. The pursuit of state rights above all
others in the program design allowed for deep-rooted regional classism and racism to permeate program operations. Thus, the original school food programs were designed to bolster US agriculture and the weight of select children. In 1946, the National School Lunch Act became federal law making the National School Lunch Program (NSLP), the only completely child-focused nutrition program at the time, permanent. The goal of the NSLP was twofold: 1) “safeguard the health and well-being of the Nation’s children”, and 2) “encourage domestic consumption of nutritious agricultural commodities and other foods”. Political supporters viewed the solidification of the National School Lunch Program as an institutionalized meal program to be an act of defense arguing that malnourished people could not serve as effective soldiers or workers, especially in a war-riddled world. In further support of this notion, the National School Lunch Program was housed in the Department of Defense and enacted through the Department of Agriculture.

The NSLP continued relatively unchanged until the 1960’s-1970’s when very powerful images of hunger in children circulated in political rings. At this time, program supporters reframed the NSLP as a welfare program for impoverished children and the Child Nutrition Act of 1966 expanded school food to include other child food assistance programs. Under this new act President Johnson added: a pilot breakfast program, summer meal program, equipment grants for schools, state funds for program administration, an expanded Special Milk Program which included more eligible service sites, and centralized the federal arm of the NSLP program under the USDA alone. By making the NSLP a welfare program, the number of meals and overall size of the program increased exponentially. Unfortunately, policy makers failed to account for the
operational costs associated with the rapid growth of the program. The increased funds budgeted for the NSLP were primarily food subsidies and small grants, which would not cover the labor or operating costs necessary to accommodate the new capacity of the program. Political alliances then began pushing for privatization of school food in an effort to off-set costs.  

To supply the necessary food subsidies, the 1966 Child Nutrition Act linked agricultural development with child nutrition programs via the Farm Bill. This action effectively reinforced the original merger between farm-bloc legislators and nutrition reformers. An unintended consequence of this link meant that child nutrition programs were further wed to the agenda of agricultural legislators, forcing nutrition programs to prioritize available commodity goods over updated nutrition science. Thus the policy changes of the 1960’s-1970’s reframed the original NSLP as a welfare program increasing its capacity and services which resulted in a push for privatization and a renewed focus on agriculture.

The Act was set for review every five years; however, major reauthorization and change did not occur until 1988. Again, agricultural legislators pushed for surplus foods to have a greater presence in school meals and their efforts culminated in the reauthorization of the previous appropriations and the authorization of the Commodity Assistance Programs. At this point in the late 1980’s, approximately 20% of school foodservice budgets came from commodities and commercial interests began pushing program legislators to allow and or increase the use of particular products (e.g., ketchup) in the program. Due to attention from private interest groups coupled with the declining educational budgets, schools and districts began offering meals and snacks to children in
the form of vending further entrenching commercial interests in the school food market.328,332

While the privatization of school meals escalated, changes were occurring in the landscape of nutrition science. At the time of NSLP’s founding the primary concern was underweight and there was a very clear link between underweight and malnutrition. School meal regulations reflected this concern and included heavy cream-based sauces, hearty meals, and butter with all grains.326 The advent of modern nutrition science brought attention to the nutritional quality of school meals.328 When nutrition advocates pushed on child nutrition program legislators for improved nutritional quality of meals they pitted themselves against farm-bloc legislators, their former coalition members. Concurrently, alternative agrifood activists began pushing for reform at the local level through local food systems. Based on agrarian ideals and bioregionalism, these activists proffered a movement where proximity to the food system was the only way to achieve social justice and ecological sustainability. This novel idea appealed to politicians and legislators as a method to improve the overall state of school foodservice.292,328,333,334

In 1995, the Department of Defense Personnel Support Center started working with the USDA’s Food and Nutrition Services and Agricultural Marketing Service buying and distributing fresh fruits and vegetables to schools. This is the first record of a school Fresh Fruit and Vegetable Program and continues today as the Department of Defense Fresh Fruit and Vegetable Program which serves as a go-between for schools and fresh produce vendors. In 2002, the Farm Security & Rural Investment Act, otherwise known as the 2002 Farm Bill, passed. In this bill, the USDA formalized a separate Fresh Fruit and Vegetable Pilot in four states and on one protected Indian tribe
location. This program provides funds to schools so they may purchase fresh fruit and vegetables locally. In addition to the commodity reauthorization, the local food trend continued in the 2004 Child Nutrition and WIC Reauthorization act with students being encouraged to consume local foods through “farm-to-cafeteria” activities. There was also a shift toward wellness, as the act required all school districts to write a wellness policy for their students.

The next ideological shift in the Child Nutrition programs occurred with the election of Barack Obama Jr. in 2008. His cabinet and elections to the Centers for Disease Control and Prevention and Department of Health and Human Services signaled a shift away from traditional American individualistic values and toward a public health model. Under his office, review and update of the infrastructure for child nutrition programs occurred. The Agriculture Appropriations act of 2010 diverted child nutrition program funds to support local and regional food systems, school gardens, and renewable energies. While the bulk of child nutrition programs remained untouched there was an effort to update and account for health trends. In 2010, the Healthy, Hunger-Free Kids Act became law with the primary goal of improving child health. New nutrition and environmental standards were put into place. With this act, Obama’s office formalized the FFVP and Farm to School programs, introduced community eligibility standards for child nutrition programs, revised child nutrition program dietary patterns, and implemented requirements for all school districts in the country to submit continuous improvement plans. These changes indicated a commitment to public health while maintaining the historical link to the agricultural agenda.
At the end of Obama presidency, political coalitions began petitioning for a slackening in child nutrition standards. Specifically, the School Nutrition Association (SNA), a professional organization for school food staff, targeted nutrient standards related to whole-grain products and sodium. SNA requested flexibility in the regulations due to loss of money related to increased operating costs for serving more healthful foods and the increased cost for specific products as corporations lag in their production of foods that adhere to the new standards.\textsuperscript{339,340} In response, the USDA issued a phase-based accreditation system for school food programs allowing schools and districts until the summer of 2015 and 2017 respectively to comply with new meal patterns.\textsuperscript{341} Shortly after being announced as the Secretary for Agriculture, Sonny Perdue issued two legislative recalls, one for sodium and one for the overall meal patterns.\textsuperscript{342,343} This legislative action allows schools to apply for waivers from the Healthy, Hunger-Free Kids Act specified whole-grain, fat-free flavored milk, and sodium requirements.\textsuperscript{343} While political stakeholders framed the need for flexibility around costs, the narrative that students find the new meal patterns unpalatable became the driving force for Perdue’s legislative action.\textsuperscript{344} This exchange echoes the debate of the original school meal program designers; do we design a program that improves health for some or all? With a changing definition of health, these changes in the child nutrition program nutrient profile may not be so dire to the health of children. A more comprehensive definition of health allows these programs to improve child health in other manners beyond the nutrient balance sheet.

Much of the literature evaluating the child nutrition programs focus on the nutrient footprint of decades-old programs, like the NSLP; but, relatively little has been done to examine the complexities of these programs especially in the newer programs.
like the FFVP. The remainder of this section will summarize relevant literature related to child nutrition programs and the evidentiary support for associations with child health outcomes.

**B.11: The National School Lunch Program and the School Breakfast Program**

In the state of South Carolina alone there were approximately 478,407 students participating\(^{325}\) in the National School Lunch Program daily in 2016. Census estimates in South Carolina suggest an approximate school-aged population of 803,701.\(^{102}\) These numbers indicate that over 59% of the school-aged population in South Carolina participate in the National School Lunch Program.

An ongoing debate surrounding the efficacy of these programs exists. Evidence shows that some child nutrition programs are effective at reducing food insecurity. Children from food-insecure homes are more likely to eat school meals and receive more of their nutrient intake from school meals than children from food-secure households.\(^{345}\) Specifically, the school breakfast program (SBP) enhances food security for households on the cusp of insecurity. Using probit regression models and data from the fifth wave of the Early Childhood Longitudinal Survey-Kindergarten, Bartfeld and Ahn found that low-income third grade children with breakfast available to them through school had a reduced probability of marginal food insecurity from 48% to 33% when compared to low-income children with no breakfast available at school.\(^{346–348}\) Additionally, when School Nutrition Dietary Assessment (SNDA) III data were analyzed using regression adjusted comparisons, SBP participants had BMIs .75 pts lower than non-participants indicating that SBP may correlate with significantly lower BMI. In two meta-analyses, SBP improved attendance by 4-6 days per year, reduced tardiness among low-income and
undernourished children,\textsuperscript{349–352} and benefited children’s diets.\textsuperscript{347} Conversely, NSLP has little impact on children’s diet and a mixed effect on child weight status.\textsuperscript{347,353–357}

The cost-effectiveness of these programs is also debated. Some public health advocates consider these programs to be too costly for their marginal results while only addressing a symptom of hunger rather than its root causes.\textsuperscript{358} The impact of these food assistance programs on obesity is of concern especially for children with limited resources. Legislators passed the Healthy, Hunger-Free Kids Act and updated competitive food standards in 2010. Touted to result in great changes to the nutritional quality of school meals with their enactment in 2012; their true impact is unclear due to a lack of literature describing post-policy change environments.\textsuperscript{359} Additionally, public health advocates have conducted little research examining the long-term effects of these programs and agency leaders issued a call for more evaluative work of these programs overall. Much of the literature dearth is attributed to measurement difficulties as many studies of these entrenched programs use a wide variety of techniques and methods, and lack process evaluation components making conclusive causal inference impossible.\textsuperscript{351,359}

When reviewing what literature is available describing the impact of child nutrition programs, school feeding programs are found to impact both physical and psychosocial factors in children. There are positive associations between school food program participation and child growth factors (e.g., weight and height), improved fluid intelligence, processing speed and arithmetic. Randomized controlled trials and controlled before and after studies in a variety of both high-income and low-income countries show that consuming any meal at school results in an average yearly gain of 1.3kg per year in children aged 5-19 years when compared to children who did not
consume a meal at school. In higher income countries, children experience a 0.5-1.0 cm gain in height over the course of a year when they participate in school food programs.\textsuperscript{351} While growth factors are the most often used positive markers of child health globally, it is of note that positive improvements in height and weight may not be as important to child development, education, or function later in life as other health outcomes associated with school food participation. Decreased morbidity, improved attention and behavior, as well as improved cognitive functioning may be more important to overall child health in the long-run versus improved height and weight.\textsuperscript{360}

The effect of school feeding on child cognitive function is difficult as results are in part determined by the type of test used in the study. The literature shows a variety of tests are used and, at present, there aren’t any studies that use a battery of tests which could provide a clear neuropsychological impact. In low-income countries, there are significant improvements in math scores seen in randomized controlled trials such that students provided breakfast saw an increase in math scores which were equivalent to 30% of the annual progress in math achievement when compared to students not provided breakfast.\textsuperscript{361–363} In high-income countries, randomized controlled studies and interrupted time series studies showed that elementary students provided breakfast through a breakfast club demonstrated faster task completion by 3.7 seconds\textsuperscript{364} and high school students showed an increase in mean on-task behavior from 62% to 70%.\textsuperscript{365} These results are directional at best because many studies fail to fully explain the cognitive measures used or if those measures were adapted, and these measure lack defined levels of significance for their results in the field. Further, most evaluations of these assistance programs lack cognitive outcomes measures for the student participants which
underestimates the impact of simply having a meal regularly available to children who may suffer food insecurity.\textsuperscript{366,367} While inconclusive in the battle against obesity, the literature shows that school feeding can enhance child health and should be one of multiple interventions designed to improve health and development of children.\textsuperscript{367}
APPENDIX C
INTERVIEW GUIDE

C.1: Introductory Questions

1. To begin, please tell me about yourself. Anything that you’d like to share with me.

   1-1: What comes to mind when I say, “Child Nutrition Programs?”

   1-2: Can you tell me a little about your experience as a [school stakeholder]? How long have you been in that role?

   1-3: What about your role/experience in this school would you change?

   What do you enjoy?

C.2: Questions about FFVP

2. Have you heard of the FFVP program?

   [If they haven’t: “The Fresh Fruit and Vegetable Program (FFVP) is a federal grant program housed in the USDA and administered in South Carolina by the Department of Education. Schools that demonstrated high need (i.e. – high free and reduced population) apply for grant funds from the state. This program provides $50 a child per year in select schools so that they can have a fresh fruit or vegetable snack at least twice a week.”]

3. Tell me what you know about it.

   3-1: What is it? What does it do? Who is it for?
4. What do you think the vast majority of people’s opinions about child nutrition programs are?

4-1: The FFVP program?

5. What are some things that you hear others saying or do you read about the FFVP?

C.3: FFVP School Questions Related to Program Purpose/Outcomes

6. In your opinion, what is the purpose of the FFVP?

7. Can you describe the goals of the FFVP as you see them?

7 – 1: Do you feel that school or community goals influence FFVP goals?

If so, how?

8. What do you think makes a school’s FFVP a success? A failure?

9. Do you think programs like FFVP affect child health? If so, how?

10. Can you describe outcomes that you see in your school related to FFVP?

11. What kinds of things would you like to see as a result of using FFVP in your school?

12. In what ways would you like children to be affected because of the FFVP? Your school? Your family? Your community?

13. Do you think that childhood obesity is a problem in the United States?

13-1: Is it a big problem? How big?

14. Whose main responsibility is it to eliminate or combat childhood obesity?

C.4: Discussion of FFVP Ideologies/Contexts

Passage 1: School Culture and Child Health Programs

"The culture of a school consists primarily of the underlying norm values and beliefs that teachers and administrators hold about teaching and learning," according to Dr. Kent D.
Peterson. That culture is also composed of "traditions and ceremonies schools hold to build community and reinforce their values," says Peterson, a professor in the Department of Educational Administration at the University of Wisconsin-Madison and co-author of Shaping School Culture: The Heart of Leadership. Every school has underlying assumptions about what staff members will discuss at meetings, which teaching techniques work well, how amenable the staff is to change, and how critical staff development is, adds Peterson. That core set of beliefs underlies the school's overall culture.

15. In your opinion, what is the point of this passage?

16. Do you believe that this school has a culture? If so, can you describe that culture to me?

    Probe: What about this school makes it different from others?

17. What do you think when I say, “Culture of Health”?

18. What do you consider part of student/child health?

19. Can you describe some of your community/school values?

20. Do you think that schools have a responsibility to protect/ensure child health?

21. Could you describe the health-related programs in place in this school today?

22. Do you have specific health concerns for your students or your community?

Passage 2: Application

In the state of Mississippi, only 1 in 5 school districts with the neediest and lowest-performing schools in the state apply for federal program grants to give these schools a boost. District representatives reported several reasons for not applying. A local school board member commented, “One of the key things that will come out is that we do not operate with a sense of urgency.” Other school representatives stated, “We just at the
present time did not feel that was something we needed to do. We have received several other federal grants.”

23. In your opinion, what is the main point or points of this short passage?

24. Do you agree/disagree with the points that its making?

25. How does this selected passage fit in with what you think about the FFVP grants?

26. What other reasons do think there are for applying/not applying for funds like FFVP grants?

27. Were you/would you be responsible for applying to the State Office for FFVP funds? If not, whom in your organization completed/would complete the application?

28. Why specifically did/didn’t you apply for the FFVP?

    Probe: What were you hoping FFVP would accomplish in/for your school?

C.5: Only for FFVP Award Schools

29. Can you talk me through the application process?

    Probe: Who was involved in the application process from your school?

    Your community?

30. How did you convince those individuals to assist in the application process?

IF NON-FFVP SCHOOL STAKEHOLDER CLOSE INTERVIEW HERE

Passage 3: Program Implementation

A school foodservice director commented on how implementation of the FFVP has changed over time, “District 60 has had at least one school in the program since it opened to schools across the country in 2008. In early years, it would be up to the school
nurse to use grant money to shop for the food, bring it to the school and prepare it for the kids. Since then it’s gotten easier for schools to manage. The district gets the fruits and vegetables from a vendor that delivers…”

31. In your opinion, what is the point of this passage?
32. Do you agree with the point of this passage?
33. What kind of events/programs do you consider part of the FFVP? Why?
34. Can you walk me through a day when FFVP is being served to your students?
    What is your role in making that happen?
35. What about this process has changed over time?
36. Can you tell me a story about an FFVP day that stands out to you? Why does this story resonate with you?
37. Specific CICI Implementation Questions:
   a. Do you find that your geographical location in the state affects FFVP? i.e.
      - Urban/Rural? Coastal/Mountains?
   b. Does your geography affect the kinds of partners you have?
   c. Is your school over-enrolled? Overburdened? If so, how?
   d. Does the education level of the community affect the program?
   e. Does the lifestyle of those in the community/school affect the program? If so, how?
   f. Are there any historical influences that affect the program? If so, which?
   g. Do you think that the other programs in your school facilitate or retract from the FFVP?
C.6: Demographics:

To wrap up, may I ask you a few demographic questions?

38. Do you mind sharing your age?

39. What race would you consider yourself to be?

Is there anything else you would like to share?
APPENDIX D

SAMPLE WEIGHTED MEASURE SHEET

<table>
<thead>
<tr>
<th>Lunch Item</th>
<th>Measured Weight</th>
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<tbody>
<tr>
<td>1 Pizza Hot Pocket</td>
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</tr>
<tr>
<td>2 Baked Beans</td>
<td></td>
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<tr>
<td>3 Garden Salad</td>
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<tr>
<td>4 Whole Fruit</td>
<td></td>
</tr>
<tr>
<td>5 Ham Sandwich</td>
<td></td>
</tr>
<tr>
<td>6 1% Milk</td>
<td></td>
</tr>
<tr>
<td>7 Chocolate Milk</td>
<td></td>
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<tr>
<td>8 Strawberry Milk</td>
<td></td>
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<tr>
<td>9 Vanilla Milk</td>
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Date: March 21st, 2016
School: Diamond Hill ES
Researcher Name:
APPENDIX E

SAMPLE PLATE WASTE SHEET

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<th>Food Item</th>
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<th>2 M/F</th>
<th>3 M/F</th>
<th>4 M/F</th>
<th>5 M/F</th>
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<th>10 M/F</th>
<th>11 M/F</th>
<th>12 M/F</th>
<th>13 M/F</th>
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