DIETARY QUALITY OF MEALS AND SNACKS SERVED BY IN-HOME CHILD CARE PROVIDERS TO CHILDREN 2-5 YEARS-OF-AGE IN LOW- INCOME AREAS IN MICHIGAN

By

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ABSTRACT

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Obesity and nutritional deficiencies among young children are serious diet-related health issues. Since many young children consume large portions of their daily food and beverage intake at child care, it is especially important to examine dietary quality of meals and snacks served by in-home child care providers. This study investigated the dietary quality of foods and beverages served to children 2-5 years of age by in-home child care providers and qualitatively assessed the barriers and facilitators to serving foods and beverages that align with the Child and Adult Care Food Program (CACFP) nutrition standards.

Dietary quality of the foods and beverages served for a lunch and one snack in 116 child care provider homes was assessed with direct diet observation, analyzed and compared to: a menu, Healthy U.S.-Style Eating Pattern food groups, Dietary Reference Intakes (DRI's) and the American Heart Association recommendations. Results indicated that only 40% of menus matched the observations of foods and beverages served. Additionally, only 2% and 3% of in-home child care providers served foods and beverages that aligned with all of the food group recommendations for children 2-3 and 4-5 years-of-age respectively, whole grains and vegetables were the least met. Likewise, 47%, 35%, and 36% of child care providers did not serve the correct portions and types of CACFP-eligible fluid milk, vegetables and fruit. Only 40% of menus matched the observation of foods and beverages served. CACFP compliance was greater for those who also cared for children 4-5 years of age. A total of 67 of the 116 in-

home child care homes were randomized into two groups to receive a 6-month nutrition education intervention or to receive a delayed intervention. There were no significant differences in lunch or snack CACFP scores or the total amount (cups, ounces, grams, milligrams, micrograms, percentage of calories) of food groups and nutrients served between the intervention and control child care providers after controlling for pre intervention CACFP scores, nutrient and food group amounts, location, age, and CACFP participation.

Qualitative thematic analysis showed that in-home child care providers perceived food preferences of children and providers, higher cost and lower availability of CACFP-approved items, celebrations and food rewards, excessive time and effort needed to prepare foods and beverages and dietary restrictions to be barriers to them serving CACFP-eligible foods and beverages. Perceived facilitators included: using nutrition education, finding easy ways to prepare foods and beverages, using CACFP and WIC, increasing variety of foods and beverages served, child care provider modeling and encouragement, mixing preferred foods/beverages with less preferred, social media and peer support, providing children with food choices, serving the same food and beverages to all children regardless of age, and connecting eligible foods and beverages to children's health and behavior.

In conclusion, the foods and beverages served by in-home child care providers are not aligning with dietary recommendations for children 2-5 years-of-age. Efforts to enhance CACFP and nutrition guideline adherence should address provider needs and challenges in conjunction with tailored nutrition education that addresses shortcomings.

This dissertation is dedicated to my Mom.
Thank you for always believing in me and showing me the way. Till we meet again.

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CHAPTER 1 - Introduction

A. Background

Sixty-one percent of children under 5 years of age are in some type of regular child care arrangement from 21-36 hours a week, which means that a significant amount of the daily food and beverages that young children consume come from child care settings.[1,2] In-home child care providers have the potential to influence current and life-long healthy eating behaviors in young children as taste preferences and dietary habits are formed early in life.[3,4] Improving dietary quality and physical activity in child care settings has the potential to decrease obesity risk and nutrient deficiencies.[5,6]

Among the multifactorial elements that are associated with childhood obesity, dietary quality and physical activity are key contributors.[5,6] At least one in every five children 2 to 5 years-of-age is overweight or obese, and obesity rates are especially high among low-income and minority populations.[6] Nearly 14% of children, 2 to 5 years-of-age, who are enrolled in the Women, Infants and Child (WIC) program, are classified as obese.[6] In addition, while only 14.1% of non-Latino White and 6.8% of Asian-American children are obese, respectively 22.5% of Latino and 20.2% of Black children are obese and the smallest declines in childhood obesity are reported among American Indians and Alaska children.[6,7]

The Dietary Guidelines for Americans, Healthy U.S.-Style Eating Pattern, Dietary Reference Intakes (DRI's) and the American Heart Association provide daily and weekly dietary recommendations for children and adults.[8-13] Child care providers are encouraged to follow the Child and Adult Care Food Program (CACFP) nutrition standards, which are based on the Dietary Guidelines for Americans, for guidance on the nutritional quality and quantity of foods and beverages they serve to children.[14] Although 3.3 million children receive nutritious meals and

snacks through CACFP, not all child care providers participate or are eligible to participate.[15] Food components, similar to the food groups, and the amount for each component are regulated through CACFP and recently the Healthy, Hunger-Free Kids Act, made the first major changes in the CACFP meal and snack guidelines since the program started in 1968.[3] The updated CACFP nutrition standards include a greater variety of vegetables and fruit, more whole grains, and less added sugar and saturated fat and hence aligns better with WIC, which provides funding for food for children up to five years of age.[3,4]

With increasing amounts of foods and beverages being consumed in child care settings, examining the food and beverages served at in-home child care settings and the determining the impact of nutrition education programs in child care settings are vital.[2] The primary goal of this project was to: 1) describe the foods and beverages that are served by in-home child care providers to children 2-5 years of age; 2) compare them to national recommendations; 3) compare them to a written menu; 4) determine what child care provider characteristics are associated with improved dietary quality; 5) determine the impact of a nutrition education intervention, *Healthier Child Care Environment,* on foods and beverages served; and 6) determine perceived barriers and facilitators to adherence to the 2017 Child and Adult Care Food Program (CACFP) nutrition standards. The research was accomplished by the following three specific aims.

B. Specific Aims

Specific Aim 1 was to examine the dietary quality of foods and beverages served by in-home child care providers by direct diet observation in comparison to a planned written menu and the following national recommendations: 1) Healthy U.S.-Style Eating Pattern 2) Dietary Reference Intakes (DRI's) 3) American Heart Association daily added sugar guidelines; and

4) 2017 CACFP nutrition standards. The specific aims, corresponding research questions and hypotheses included:

1. Aim 1A

Described the dietary quality of foods and beverages served by in-home child care providers to children 2-5 years of age in low-income areas in Michigan in comparison to national recommendations and the written menu.

2. Aim 1B

Examined whether in-home child care provider characteristics are associated with dietary quality as evidenced by adherence with national CACFP recommendations. Aim 1a and 1b are guided by the following research questions:

1. To what extent do the food groups and nutrients of food and beverages served to children 2-5 years of age for lunches and snacks by in-home child care providers in low-income areas in Michigan meet national recommendations?

   H_1: Foods and beverages served for lunches and snacks will not meet the recommendations for vegetables, whole grains, oils, dietary fiber, vitamin E, vitamin D, iron, potassium, folate, vitamin A and zinc and will exceed recommendations for energy, dairy, protein foods, refined grains, dietary fat, carbohydrates, protein, saturated fat and sodium.

2. To what extent do the food and beverages served to children 2-5 years of age by in-home child care providers in low-income areas in Michigan meet the 2017 CACFP nutrition standards for lunch and one snack?

H_1: Food and beverages served to children 2-5 years of age by in-home child care providers in low-income areas in Michigan will meet the 2017 CACFP nutrition standards for a lunch and a snack in 30% of the child care provider homes.

3. To what extent do the foods and beverages on child care provider menus match the actual foods and beverages served to children 2-5 years of age by in-home child care providers in low-income areas in Michigan?

   H_1: Foods and beverages on child care provider menus will match the actual foods and beverages served to children 2-5 years of age by in-home child care providers in low-income areas in Michigan in 66% of the child care provider homes.

4. What in-home child care provider characteristics are positively associated with meeting the 2017 CACFP nutrition standards?

   H_1: As the age of children cared for increases in the home there will be an increased likelihood that CACFP nutrition standards will be met based on the CACFP meal component total score.

   H_2: As child care providers participate in CACFP there will be an increased likelihood that CACFP nutrition standards will be met based on the CACFP meal component total score.

   H_3: As the number of children the provider cares for increases in the home there will be an increased likelihood that CACFP nutrition standards will be met based on the CACFP meal component total score.

3. Aim 2

Specific Aim 2 examined whether the *Healthier Child Care Environment* nutrition education intervention can positively impact dietary quality of foods and beverages that are served within a child care home. Research questions and the corresponding hypotheses include:

1. Does the dietary quality (food groups, nutrients and components) of foods and beverages served to children 2-5 years-of-age improve after the *Healthier Child Care Environment* nutrition education intervention?

   H_1. After the *Healthier Child Care Environment* nutrition education intervention, there will be an increase in food group servings per day of vegetables, vegetables subgroups and fruits in the intervention child care provider group compared to the control child care provider group.

   H_2. After the *Healthier Child Care Environment* nutrition education intervention, there will be an increase in fiber, vitamin E, iron, potassium, vitamin A and zinc in the intervention child care provider group compared to the control child care provider group.

   H_3. After the *Healthier Child Care Environment* nutrition education intervention, there will be a decrease in refined grains, dietary fat, carbohydrates, protein, saturated fat, sugar and sodium in the intervention child care provider group compared to the control child care provider group.

2. Does the Healthier Child Care Environment nutrition education intervention increase the dietary quality (CACFP nutritional standards) of foods and beverages served to children 2-5 years-of-age?

H_1. After the *Healthier Child Care Environment* nutrition education intervention, there will be an increase of In-home child care providers who meet the 2017 CACFP nutrition standards in the intervention child care provider group compared to the control child care provider group.

4. Aim 3

Specific Aim 3 allowed researchers to qualitatively examine the barriers and facilitators, including motives, perceived by in-home child care providers in low-income areas in Michigan to serving foods and beverages that align with the 2017 CACFP nutrition standards, as well as provider - perceived usefulness of community programs available to them. Research questions include:

1. What are the barriers for in-home child care providers to serving foods as recommended by the CACFP nutrition standards to children 2-5 years of age in low-income areas in Michigan?
2. What are the facilitators, including motives, for in-home child care providers to serving the recommended CACFP nutrition standards to children 2-5 years of age in low-income areas in Michigan?
3. How do community organizations and groups influence child care provider's ability to meet the CACFP nutrition standards?

C. Significance of Research

In 2016, over 10,000 child care providers were licensed and registered in the United States, and 60% were in-home child care providers.[16] In-home child care providers care for more than 1.5 million children in the United States.[17] Because they have the potential to influence nutritional behaviors of young children that impact dietary quality, there is a need for further

research with this important segment of child care. On average, children enrolled in part and full-time child care consume about 1/3 of the daily caloric intake during 1-2 daily meals and snacks eaten in child care settings.[1] Over 300,000 meals and snacks eaten by children away from home are influenced by the child care environment and provider each day.[15] Past research investigating the dietary quality in child care centers indicated that children are not receiving the daily recommended levels for vegetables and whole grains and child care center menus did not meet key nutrient daily recommended levels for energy, carbohydrates, protein, vitamin D, vitamin E, vitamin A, vitamin C, iron, sodium, saturated fat and dietary fiber.[18-20] Although some progress has been made in the past decade concentrating on the influence that center-based child care providers have on dietary quality and physical activity, there is a paucity of research with in-home child care settings.

Nutrition education interventions including those that focus on assessing and educating child care providers on nutrition and physical activity policies and environmental changes have been associated with positive environmental nutrition and physical activity outcomes in a variety of child care settings.[21-27] In 2016, over 71 unique nutrition education interventions were documented as being used in child care settings and the majority have been effective in positively impacting obesity and obesogenic behaviors including physical activity and screen time.[28] Specifically, 48% of the interventions had an association with decreased obesity and 87% on increased dietary quality.[28] There are a limited number of studies that actually focus on nutrition education interventions and if receiving the intervention may actually impact the dietary quality of foods and beverages served. More specifically, to our knowledge, none were conducted with in-home child care settings.

Previous research reviews have documented the need for broadening the scope of research in early childhood education settings to include other child care settings beyond centers, specifically child care homes, and license-exempt care sites (unlicensed child care providers).[29] This research is unique in that the focus is on evaluating in-home child care provider settings and the dietary quality of the meals and snacks they serve. It is also unique due to the focus on the impact of the dietary quality from the nutrition education intervention received. The timeliness of the qualitative data, identifying barriers and facilitators to adhering to CACFP nutrition standards, will add to the literature in which there is no current studies considering the new CACFP nutrition standards started in October of 2017.

The overall goal of this research is to positively influence the healthfulness of foods and beverages served by in-home child care providers to young children by improving dietary quality. Qualitative and quantitative results from the study can be used to generate foci for further nutrition education interventions or to modify the *Healthier Child care Environment* nutrition education intervention. Possible implications include nutrition education programs that that are tailored for in-home child care providers on changing child care policies and the environment. Furthermore, results may inform child care organizations, such as CACFP sponsor organizations, both in Michigan and nationally on nutrition focused professional development needs of child care providers. Implications may include aligning funding for CACFP with other programs; such as the Supplemental Nutrition Assistance Program Education (SNAP-Ed), increased CACFP reimbursement rates, and positively influencing state or national level child care nutrition licensing regulations.

D. Organization of the Dissertation

This dissertation is organized into six chapters. Chapter one presents the general

introduction of the problem and the rationale for the study. Chapter two provides a review of the literature on early childhood obesity, early childhood food and beverage intake, early childhood dietary recommendations, child care settings including in-home child care provider characteristics, programs for child care providers, potential barriers and facilitators to widespread implementation of 2017 Child and Adult Food Program standards with the alignment of theories. Chapter three presents the methods used to achieve the objectives of the study. Chapter four, manuscript one, encompasses Aim 1a and 1b findings. Chapter five, manuscript two, addresses the second aim of the study, which is focused on the dietary quality associations with the nutrition education intervention. Chapter six, manuscript three, provides qualitative findings of the perceived barriers and facilitators to adherence to the CACFP nutrition standards. Chapter seven provides an overall summary of the three studies with conclusions and recommendations for future research studies.

E. Working Definition of Terms

The following terms will be discussed throughout the dissertation:

1. **Child and Adult Care Food Program (CACFP)** – a federal program that provides reimbursement for healthful meals and snacks served to children and adults.
2. **Extension** – A nationwide, non-credit educational network designed to help people use evidence-based knowledge to improve their lives. The service is provided by land-grant universities throughout the country and includes a network of local offices throughout each state.
3. **Michigan State University Extension (MSUE)** – An organization that has successfully taught nutrition education statewide since 1914 using trained community health workers, supervised by professional staff and supported by MSUE campus staff. The organization

also provides Michigan residents with research-based information and programming in the areas of agriculture, business and community, family, food and health, lawn and garden, natural resources, and youth.

4. **In-Home Child Care Providers** – In Michigan, a private home registered to care for up to six children at a time is considered a family home. In Michigan, a private home licensed to care for up to 12 children at a time is considered a group home. Both are included as in-home child care providers. The terms child care home and provider have also been used interchangeably throughout the document.
5. **Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) -** Nutrition and physical activity environmental self-assessment instrument to assess 41 areas of and nutrition and physical activity policies and practices in child care settings.
6. ***Healthier Child Care Environment*** **Intervention** – A Michigan State University Extension intervention that utilizes the NAP SACC assessment, followed by action planning, coaching and mentoring from a nutrition professional for 6 months.
7. **Unlicensed Child Care Providers** – In Michigan, an adult who is 18 years or older and enrolled to provide child care for up to four children at a time (or six children, if all children are siblings or living at the same address). Unlicensed providers who are not related to the child can provide care only in the child's home.
8. **CACFP Sponsor Organizations -** Sponsoring non-profit organizations that enter into agreements with their state administering agency to assume administrative and financial responsibility for CACFP operations at the local level.

CHAPTER 2 - Review of the Literature

A. Obesity and Nutrient Deficiencies in Early Childhood and the Connection to Child Care

Childhood obesity is the most common chronic childhood condition and one of the most prevalent health challenges across the world.[30] Obesity is often diagnosed with measurement of body mass index (BMI). BMI is a screening method used to define weight category, and is an easy and inexpensive tool used to detect possible weight issues in children and adults.[31] BMI is calculated using an individual's weight in kilograms divided by the square of height in meters and BMI values are plotted on age and sex specific charts for children.[31] In children and adolescents, aged 2 to 19 years, obesity is often defined using the body mass index (BMI) at or above the 95th percentile[6] and the 85th to 95th percentile range are considered overweight.[31] By monitoring a child's weight routinely and observing trends in a child's weight, weight problems can be detected before a child becomes overweight.[5] The American Academy of Pediatrics (AAP) recommends evaluating the BMI percentile at each annual child visit starting at two years of age.[32] A Healthy People 2020 goal includes reducing the proportion of children 2 to 5 years of age who are considered obese from 10.4 to 9.4%. [9,30]

Data from the 2011-2012 National Health and Nutrition Examination Survey (NHANES) demonstrated almost 17% of people 2 to 19 years of age were obese.[6] Childhood obesity prevalence remain high with 8.4% of children in the United States obese at 2-5 years-of-age with more than 2% severely obese, above the 99th percentile.[6] Nationally, boys have a higher obesity prevalence rate, 9.5%, than girls of the same age, 7.2%.[6] Prevalence rates of obesity among low-income preschoolers remain high at 14.7% among all races; Latinos at 18.7%, Whites at 12.7 %, Blacks at 11.8%, and Asian/ Pacific Islanders at 11.6%.[33] Between 2010 and 2014, significant decreases were reported among preschool-aged children but many high risks groups, including

low-income, black and Latinos are experiencing severely high obesity rates.[6,34]

Between 2008 and 2011, most low-income, preschool children obesity prevalence rates have stabilized although specific state level data has shown the smallest declines in childhood obesity among American Indians and Alaska children.[7] In Michigan, childhood obesity prevalence rates in 2011 for children 2-4 years of age was reported as 13.2% from a women, infant and child (WIC) survey.[35]

Childhood obesity is a complex health issue which affects millions of children, and can lead to long term health problems into adulthood.[30] Obesity between the ages of 5 and 14 years was reported four times as high among children who had been overweight when entering kindergarten compared to children who had a normal weight at that age,[36] suggesting that as age increases through childhood the incidence of obesity also increases.[34]

While childhood obesity is of concern, obesity prevalence is not the only outcome of interest for public health interventions. The entire range of undernutrition, micronutrient deficiency and the risk for obesity are connected.[37] Childhood obesity research has focused on weight and BMI percentiles but often does not include a focus on overall child nutritional health. These include nutrient deficiencies from poor dietary quality may also result in a higher risk of obesity and stunting among children of all categories of weight status.[38] Nutritional well-being of young children of all weight statuses is critical.[37]

B. Risk Factors Contributing to Childhood Obesity and Nutrient Deficiencies

Childhood obesity, especially between the ages of 2-5 years, is a public health problem and has many contributing factors. The factors contributing to obesity include the individual and family environment.[39-41] Individual risk factors for childhood obesity include such factors as energy intake in excess of energy needs, calorie-dense and nutrient poor food choices, low

physical activity, little or excess sleep, genetics, prenatal exposure, psychological conditions and certain medications.[40] Genetics is the most significant risk factor for a child being overweight.[41] The food and activity environments that children spend the majority of their day, place children at a higher risk for obesity and associated weight problems.[5] Food and activity environments may include the neighborhood, community, child care site, school or even the home and neighborhood characteristics and specifically the number of fast food restaurants, grocery stores, parks, bike paths and transportation options. It is difficult to determine if genetics or the environment is causal to obesity since children share both factors.[5] Studies that link each one of these factors to obesity are inconsistent, as correlation is not causation, and diet-related and physical activity characteristics may show a greater impact on the role of decreasing obesity.[5,42]

Another risk factor is specific foods such as sugar-sweetened beverages, potato chips and red-meats have been reported to be associated with the risk of obesity but foods such as fruits, vegetables, nuts, whole grains and yogurt are not associated with obesity.[5,40,42] Equally as important, decreased physical activity, increased sedentary behavior and lack of sleep or excessive amounts of sleep are also associated with obesity.[43] Data from the 2008 Feeding Infants and Toddlers Study (FITS) showed that only 2% of toddlers met the recommendation for no screen time, whereas 79% of preschoolers met the recommendation to limit daily screen time to 2 hours or less.[44] The same research also showed that 56% of toddlers and 71% of preschoolers met the recommendation of at least 1 hour of daily outdoor play.[44] Family-related predictors of body weight and weight-related behaviors among children found that eating more nutritious foods was most often related to increased parental monitoring of the food consumed.[45]

Obesity has physical and psychological health ramifications during childhood, adolescence and leading into adulthood. Childhood obesity may increase the likelihood of

increased weight status as an adult, risk for chronic disease as a child and the normal growth of a child.[46,47] The significant health consequences of childhood obesity include cardiovascular diseases; diabetes; musculoskeletal disorders such as osteoarthritis; gastrointestinal, musculoskeletal and orthopedic complications, asthma, chronic inflammation, sleep apnea, and endometrial, breast, and colon cancers.[42,48] For example, the incidence of type 2 diabetes has increased in adults and youth for those who are also obese.[46] Also in children, the additional weight can lead to pain and limitations in mobility by injuring the developing epiphyseal growth plates.[46] Additionally, obese youth and adolescents are more susceptible to psychosocial effects including anxiety, depression, behavior problems, low self-esteem, poor body image, and bullying.[49]

An estimate from 2008, projects that obesity will account for more than 16% of all health care expenditures by the year 2030 as obesity tracks from childhood into adulthood.[50] Obese adult workers miss more workdays due to illness, injury, or disability than non-obese adults and the majority of children that are classified as overweight and obesity remain in the same BMI category during their adult life, resulting in significant costs to the economy over their lifetime.[51] Previous studies suggest that the lifetime cost of an obese child is $19,000 more relative to child who maintains normal weight throughout adulthood.[52]

Pediatric malnutrition, specifically endorsed by Academy of Nutrition and Dietetics, the American Society for Parenteral and Enteral Nutrition, and the American Academy of Pediatrics, is an imbalance between nutrient requirements and consumption, resulting in growing deficits of energy, protein, or micronutrients.[53,54] The four most common micronutrient deficiencies, that contribute to 12% of all deaths for children five years of age and under, include iron, iodine, vitamin A, and zinc.[55] Malnutrition can be non-illness related and caused or influenced by

environmental or behavioral factors or possibly both.[54] Proper child human development, cognitive and physical, is not possible unless undernutrition and micronutrient deficiencies are controlled or removed.[55] The child care environment in which a child consumes about one-third or more of their food and beverage intake and in which the food and beverages served shape intake patterns may contribute to the risk for obesity and malnutrition.[1]

The type of child care setting where a child is receiving care may also put a child at risk. In-home child care settings with a relative and non-relative providing care were both positively associated with child obesity.[56] A previous study showed that child care in the first 6 months of life in someone else's home was associated with an increased weight-for-length body mass index z score at one year and three years of age.[57] Central and total adiposity measures were also shown to be significantly higher in children as there time increased in non-relative, child care and were give meals and snacks while in care.[58]

The number of children and the amount of time a child spends in child care settings are on the rise.[2] Over 60% of children under the age of 5 are receiving care from a child care home or center.[2] The average child spends 21-36 hours a week and most preschoolers, with children whose parents are employed spend 33 hours per week in some form of care setting.[2] With young children spending increasingly larger time in child care, a larger amount of meals and snacks are being served in child care potentially contributing to the overall dietary quality and possibly the risk for overweight, obesity and malnutrition.[1,59] On average, children under the age of 5 in child care settings, receive one or two daily meals plus snacks representing one-third of their total energy intake.[1] The responsibility of dietary quality for young children is now increasingly focused on the child care provider in addition to the parents.

C. Dietary Quality Recommendations

Standards to evaluate dietary quality, in this dissertation, are based on recommendations from the United States Departments Agriculture and Health and Human Services (Dietary Guidelines for Americans[10,60] and Healthy U.S. Style Eating Pattern[10]), the Institute of Medicine (Dietary Reference Intakes (DRI's)[11,12], the American Heart Association (Dietary Recommendations for Healthy Children)[13], and CACFP.[14] Together these provide nutritional guidelines and standards for food groups, nutrients, and meal pattern components, including the amount of certain foods and beverages that should be consumed and limited.

1. Healthy U.S.-style Eating pattern, Dietary Reference Intakes and American Heart Association Recommendations

The Dietary Reference Intakes estimate calorie needs based on age, sex and physical activity levels.[11,12] The calorie level recommendation for children 2-5 years-of-age ranges from 1,000 to 1,600 calories per day to meet the daily nutrient needs.[60] According to a Academy of Nutrition and Dietetics position paper, children in full time child care should receive 50-67% of that recommended calorie level for daily nutrient needs from the food and beverages served in child care.[59]

The 2015–2020 Dietary Guidelines for Americans (DGA's), eighth edition, was designed to assist Americans on how to eat a healthier diet and is utilized by policymakers and health professionals for nutrition education, dietary quality interventions, and creation of policies as well as the influence of funding streams related to dietary quality.[60] The DGA's for Americans and the American Heart Association Recommendations call for consumption of nutrient-dense foods and beverages that are lean, low in solid fats, have little or no added solid fats, sugars, refined starches, or sodium.[60] Specific food group portion size recommendations for children, 2-8 years of age, includes: 1-1 ½ cups of fruit, 1-1 ½ cups of vegetables, 1½ to 2 ½ ounce equivalents of

whole grains, 2-4 ounce equivalents of protein, 2- 2 ½ cups of dairy and no more than 3-4 teaspoons of oil per day.[60] Nutrients of public health concern for young children in the United States include calcium, potassium, vitamin E, vitamin A, iron, folate and zinc.[8,60,61] The specific Healthy U.S.-style eating pattern, DRI's, American Heart Association recommendations for children 2-5 years-of-age are summarized in Table 1.

Table 1.1 Compilation of Healthy U.S-Style Eating Pattern, Dietary Reference Intakes and American Heart Association Recommendations for Children 2-5 Years of Age

Food Group, Nutrient or Additional Component Variable	Recommended Level of Intake	Source of Nutritional Guideline
Total Dairy	2 cup-equivalents/day per1,000 calories	Healthy U.S.-Style Eating Pattern
Total Protein Foods	2-ounce equivalents/day per 1,000 calories	Healthy U.S.-Style Eating Pattern
Seafood	3-ounce equivalents/week per 1,000 calories per day)	Healthy U.S.-Style Eating Pattern
Nut, Seeds and Soy Products	2-ounce equivalents/week per 1,000 calories per day	Healthy U.S.-Style Eating Pattern
Total Vegetables	1 – 1.50 cup equivalent/day per 1,000 calories	Healthy U.S.-Style Eating Pattern
Dark green leafy	0.50 cup equivalent/day per 1,000 calories	Healthy U.S.-Style Eating Pattern
Red or orange	2.5 cup equivalents/week per 1,000 calories per day	Healthy U.S.-Style Eating Pattern
Starchy	1-3 yrs. 2 cup equivalents per week 4-5 yrs. 3.50 cup equivalents per week	Healthy U.S.-Style Eating Pattern
Other Vegetables (e.g. green beans)	1-3 yrs. 2 cup equivalents per week 4-5 yrs. 2.50 cup equivalents per week	Healthy U.S.-Style Eating Pattern
Beans and Peas	0.50 cup equivalent/week per1,000 calories per day)	Healthy U.S.-Style Eating Pattern
Total Fruit	1 cup equivalent/day per 1,000 calories	Healthy U.S.-Style Eating Pattern
Total Whole Grains	1.5-ounce equivalent/day per 1,000 calories	Healthy U.S.-Style Eating Pattern
Total Refined Grains	1.5-ounce equivalent/day per 1,000 calories	Healthy U.S.-Style Eating Pattern

Table 1.1 (cont'd)

Oils	1-3 yrs. 15 grams/day 4-5 yrs. 17 grams/day	Healthy U.S.-Style Eating Pattern
Energy	1-3 yrs. 1,000 calories/day 4-5 yrs. 1,200 calories/day	Dietary Reference Intakes
Total Dietary fat	1-3 yrs. 30-40% of calories 4-5 yrs. 25-35% of calories	Dietary Reference Intakes
Total Saturated Fat	1-5 yrs. <10% of calories	Dietary Reference Intakes
Total Carbohydrates	45-65% of calories 1-5 yrs. 130 grams/day	Dietary Reference Intakes
Total Protein	1-3 yrs. 5-20% of calories 4-5 yrs. 10-30% of calories	Dietary Reference Intakes
Dietary Fiber	1-3 yrs. 14 grams/day 4-5 yrs. 16.8 grams/day	Dietary Reference Intakes
Sodium	1-3 yrs. 1,500 milligrams/day 4-5 yrs. 1,900 milligrams/day	Dietary Reference Intakes
Calcium	1-3 yrs. 700 milligrams/day 4-5 yrs. 1,000 milligrams/day	Dietary Reference Intakes
Iron	1-3 yrs. 7 milligrams 4-5 yrs. 10 milligrams	Dietary Reference Intakes
Vitamin E	1-3 yrs. 6 Mg AT/day 4-5 yrs. 7 Mg AT/day	Dietary Reference Intakes
Potassium	1-3 yrs. 3,000 milligrams/day 4-5 yrs. 3,800 milligrams/day	Dietary Reference Intakes
Folate	1-3 yrs. fifteen0 Mcg DFE/day 4-5 yrs. 200 Mcg DFE/day	Dietary Reference Intakes
Vitamin A	1-3 yrs. 300 Mg RAE/day 4-5 yrs. 400 Mg RAE/day	Dietary Reference Intakes
Zinc	1-3 yrs. 3 milligrams/day 4-5 yrs. 5 milligrams/day	Dietary Reference Intakes
Added Sugar	25 grams/per day	American Heart Association

2. Child and Adult Care Food Program (CACFP)

The Child and Adult Care Food Program (CACFP) is a federal program which offers nutrition training and financial reimbursement for approved meals and snacks served in licensed child care homes, approved unlicensed child care homes and approved licensed child care centers.[15] Over 108,000 child care homes nationwide participate in CACFP and in Michigan 5,119 participate according to the Michigan Department of Education.[3,16] Participating in CACFP

has decreased by 60% since 1996, which is a result of the decreased federal reimbursement amount per meal that child care providers receive.[15] Although CACFP is available for eligible providers, not all providers participate and one study showed that only 48% of rural, low-income child care centers participate in the program.[18]

The nutrition standards of the program are based on nutritional needs of the population including the Dietary Guidelines for Americans and the Dietary Reference Intakes.[3] Child care providers are reimbursed for each meal or snack that meets the required components of the CACFP nutrition standards multiplied by the appropriate reimbursement rate for each breakfast, lunch, supper, or snack they are approved to serve.[14] Sponsoring organizations also receive administrative funds related to the documented costs they incur in planning, organizing, and managing CACFP and is administered in Michigan by the Department of Education and funded by the United States Department of Agriculture. For example, Mid-Michigan Child Care Food Program (MMCCFP), Campfire 4 C's and the Association for Child Development (ACD) are the three "sponsors" of CACFP in Michigan and have a contract from the state to provide services and reimbursements directly to participating child care homes and centers.

The goal of CACFP is to promote good nutrition, educate children to make healthy food choices, assist providers with the planning of well-balanced meals and snacks, provide financial assistance to child care providers, and reassure parents that their children will receive nutritious meals under these providers care.[3] Healthy, Hunger-Free Kids Act, in 2015 initiated the first major changes in the CACFP meals and snacks since the program started in 1968 to align with the Dietary Guidelines for Americans. The goal of the updated meal pattern requirements is to enhance the nutritional quality of meals and snacks served to children and adults. The updated meal pattern requirements include the separation of fruit and vegetables as two components in

hopes to increase variety as well as total consumption, increase in whole grain-rich foods, decrease in added sugar, decrease in saturated fat, as well as the encouragement for breastfeeding.[14] In 2017, 2.1 billion meals are projected to be funded by CACFP in child and adult care centers and homes.[62]

Past research with children in non-CACFP centers found that more saturated fat, trans fats and less milk were served than to children in CACFP centers.[63] Caloric intake and dietary fiber were below recommendations in both groups. Additionally, providers at CACFP-participating homes reported healthier beverage selections compared with providers at non-CACFP homes.[64] CACFP centers reported serving more fresh fruit and whole grains at snack time and serving low-fat milk.[65] Previous studies also show that CACFP and reimbursement rates were positively associated with food expenditures, nutritional quality of foods, as well as the decrease of days of illness.[66-69] Raising CACFP reimbursements may improve the nutrition of foods and beverages served in child care by about 10% mean dietary quality.[66] According to a statewide survey done in California when serving foods and beverages to children 2-5 years of age, CACFP participating sites and Head Start centers in particular, served more fruits, vegetables, milk, and meat/meat alternatives, and fewer sweetened beverages and other sweets and snack-type items than non-CACFP sites.[69] To determine the effects of CACFP policies on nutritional quality of menus, sixty in-home child care providers participating in CACFP, in Washington State showed positive adherence to the prior CACFP nutritional guidelines on menus.[67] Whole grains were served an average of once daily while whole fruits and vegetables were served just over twice daily.[67] CACFP reimbursed meals include significantly more servings of milk and vegetables, fruit, meat/meat alternatives and significantly less fat and sweet components including beverages and vitamin A, riboflavin and calcium were significantly higher among children

receiving CACFP meals and snacks.[68,69]

Because the 2017 nutrition standards are fairly new, research that investigates the compliance of child care providers to meeting the nutrition standards is limited, however, in nine centers, results indicate that centers were compliant with the unflavored, low-fat milk, partially compliant for fruits and vegetables and not compliant for one serving per day of whole grains.[70] Another study looking at child care provider knowledge of the new standards indicated that providers scored low on standards related to yogurt, juice, breakfast cereal, and whole grain.[71]

D. Early Childhood Dietary Quality

The total daily energy intake for preschoolers ages 2 to 6 years, increased overall by 109 calories between 1989 and 2008.[72] A 2-5 year-old male child consumed about 1,571 and a female consumed 1,395 calories in a given day in 2014.[73] During this 20-year period, there was a marked increase in foods high in added sugars, solid fats, and sodium including specific foods such as pizza/calzones, sweet snacks and candy, mixed Mexican dishes, and fruit juice.[72] In 2014, total sugar intake ranged from 90-104 grams of sugar, 18.8-20.1 grams of saturated fat and 2110-2396 milligrams of sodium was consumed by female and male children 2-5 years-of-age.[73] In addition today, many nutrients and food groups are not aligning with current nutritional recommendations in young children including vegetables, whole grains, iron, calcium, vitamin E and potassium.[60,61]

1. Nutrients and Additional Components

Most Americans are consuming sufficient amounts of most nutrients, but potassium, dietary fiber, choline, magnesium, calcium, iron and vitamins A, D, E, and C have been reported as being under consumed due to low intakes of vegetables, fruits, whole grains, and dairy.[60] There is currently also minimal risk of vitamin and mineral deficiencies in toddlers and preschoolers in

the United States.[61] However, vitamin E and potassium were reported as not adequate for a small subset of children.[61] While intake is good for most micronutrients, the intakes of synthetic folate, pre-formed vitamin A, zinc, and sodium exceeded the tolerable upper intake level in a significant proportion of children.[61]

In 2008 dietary assessment data of toddlers and preschoolers showed that most macronutrients were adequately consumed.[61] A macronutrient that exceeded recommended levels included, saturated fat, exceeding 10% of energy recommendations.[61] Young children are consuming 11-15% of calories from added sugars compared to recommended intake of 10% of calories or less from added sugars as well as 11.1-12.6 % of calories from saturated fat compared to the recommended intake of less than 10% of calories.[60] Sodium intake also is exceeding recommendations with intake ranging from 2,000 to 2,600 milligrams for young children.[60] With the top ten ranked foods contributing to excess intake for ages two and above including bread and rolls, cold cut meats, pizza, soups, sandwiches, meat mixed dishes, pasta mixed dishes and savory snacks.[74] Low consumption of overall dietary fat was also reported which may result in a low intake of essential dietary fats but this may also have been underreported due to use in cooking.[61] Dietary fiber was also low in the majority of toddlers and preschoolers.[61]

2. Fruit and Vegetables

Only 30% of preschoolers met the recommendation for 5 daily servings of fruits and vegetables combined [44] and on average, 93% of children consume fewer vegetables and 60% of children consume fewer fruits than recommended.[75] Among two year old children, 30% were not consuming any fruit or vegetable and in a given day sweets were more commonly consumed than vegetables or fruit.[76]

The Dietary Guidelines and Healthy U.S-Style Eating Pattern emphasize that the majority

of fruit consumed should be whole fruit, rather than juice which makes up about 47% of the intake for children ages 1-3 years.[60] Although the majority of the population does not meet daily fruit recommendations, most children ages 1 to 8 years do with 53% coming from whole fruit and 47% from juice.[60] According to the FITS survey data, almost three quarters of children consumed fruit as at least once in a day and fresh fruit was the most commonly consumed type of fruit.[77] The four most commonly consumed fruits among two and three year old's were fresh apples, bananas, grapes, strawberries and canned applesauce.[77]

Vegetables are widely under consumed by all ages and sexes including young children.[75] As a whole, the current average intake of vegetables does not meet or exceed one cup per day.[61] Vegetable consumption is inadequate in all subcategories except for legumes for 1-3 year old's, which is considered a starchy vegetable.[75] The Dietary Guidelines also recommends shifting to consume more vegetables including a variety of vegetables, especially dark green, orange, red vegetables and legumes as potatoes and tomatoes are the most commonly consumed vegetables, which accounts for 21% and 18% of total vegetable consumption.[60] Vegetables are present in a variety of foods consumed by young children including as a separate food item, a mixed dish such as pizza, casseroles, tacos, pasta, snack foods, condiments, and even gravies.[60] French fries and other fried potatoes were the most commonly consumed vegetable by children, one in five of 2 and 3-year old's, and cooked vegetables were more commonly consumed than raw vegetables.[77] The top five most commonly consumed vegetables, not including French fries, were green beans, corn, broccoli, mashed/whipped potatoes, and mixed vegetables.[77] Only 15% of two and three year old children consumed dark-green and deep-yellow vegetables in a day.[77] The low consumption of vegetables is often linked to the low intake of dietary fiber in toddlers and preschoolers.[60]

3. Grains

Although total grain intake is close to meeting Healthy U.S-Style Eating Pattern recommendations, the average intake of whole grains is far below recommended levels across all age and sex groups.[60] About 20% of refined grain intake comes from snacks and sweets, 30% cereals, breads, and rice and 50% from mixed dishes.[60] The daily consumption of cold or hot breakfast cereal is 55% for two and three year old children and 40% were considered whole-grain breakfast cereals.[77] For bread, this was not the same with 36% of two and three year old children consuming bread and only 9% of children consuming whole grain bread.[77] Snack foods such as crackers, pretzels, and rice cakes are also consumed in large amounts and the majority are not considered whole grains.[77]

4. Dairy/Protein/Oil

Average dairy intake for children ages 1 to 3 years, generally meets recommended intake with the consumption of fluid milk, cheese, yogurt and fortified soy beverages.[60] Data from the FITS study, reported that 34% and 27% of children two and three years of age consumed whole milk with the most commonly consumed type of milk being 2% milk and 1% and skim milk were the least commonly consumed.[77] The majority of children consumed unflavored, white milk but 10% and 14% of children two and three years of age consumed flavored milk.[77] Protein intake also is also close to recommended consumption, although seafood and legumes consumption is often consumed in low amounts.[60] Oil consumption is slightly lower than recommended, with the majority of oils being consumed from packages foods including chips, mayonnaise, seeds and prepared vegetables but the Dietary Guidelines recommend shifting from solid fats to oils to meet the recommendations.[60]

5. Sweets and Sugar Sweetened Beverages

About 85% of two and three year old children consume some type of sweetened beverage, dessert, sweet, or salty snack in a day.[61] The consumption of sweets and sweetened beverages continues with preschoolers and beyond.[77,78] Only 52% of preschoolers meet the recommendation to limit consumption of sugar-sweetened beverages and they currently make-up 8% of children's total daily calories.[44,79] Low-nutrient dense foods and beverages such as sugar-sweetened beverages and foods high in total dietary fat intake are positively associated with increased risk for a child to be overweight.[80]

Data from the FITS study showed that seventy-two percent of toddlers consumed some type of dessert, sweet or sweetened beverage at least once in a day.[81] The current intake of sweets and sugar-sweetened beverages greatly contribute to discretionary calorie intake and often result in increased sugar, fat and calorie consumption over the recommended levels contributing to the risk for obesity.[61] Flavored milk and fruit-flavored drinks were the most common types of sweetened beverage and most consumed beverages.[77,78] The consumption of sugar-sweetened beverages starts at a young; with 94% of children ages 3 to 5 years consuming sweetened milk products, 88% consuming fruity drinks, 63% consuming sodas, and 56% consuming sports drinks and sweet tea daily.[78] Among two and three year old children; 35% of children are consuming fruit-flavored drinks, 8% consuming carbonated soda, and 7% consuming sweetened tea or coffee daily.[77]

Fifty percent of children 2 and 3 years of age consume some type of cake, pie, cookie, or pastry daily and 26% of the same children consumed candy daily and 14% consumed ice cream, frozen yogurt, or pudding.[77] In addition, condiments are also providing a large source of added sugar with almost a quarter of children consuming syrup, jelly, or preserves daily.[77]

E. Child Care Providers

Child care arrangements may include mothers, fathers, siblings, grandparents and other relatives in a child's or child care providers' home as well as more formal child care arrangements including in-home child care providers and child care facilities/centers.[2] Centers and facilities often provide meals and snacks to a larger number of children, have the largest number of child care providers, assistants and often food service directors and may have formal professional development and training opportunities available to providers as compared to in-home child care providers.[17,82,83]

1. Characteristics of In-home Child Care Providers and Families

In-home child care serves children from birth through age 12, but is most commonly used among children ages birth to age three years, although the mean age of children utilizing in-home care is 4 including 6-12 year old's in afterschool care.[17] The number of children that are being cared for at an in-home child care provider may vary based on the licensing status of the home, but in Michigan may not exceed a total of 12 children.[83] Child care centers often caring for 12 or more children have shown a high scores on nutrition environment and policy assessments.[84]

Family characteristics of those families who use in-home child care most often include the following: children from low-income families, children whose parents have a high school degree or less education, children from single-parent households, and children from racial and ethnic minorities including African American and Hispanic.[17] Trust, familiarity with the caregiver, child care provider flexible hours including evening and weekends, and sharing similar culture and values are all reasons that parents choose in-home child care over other child care settings and arrangements.[17]

In-home child care providers make up more than 80% of the total caregiving population in

the United States.[17] On average, in-home child care providers are in their mid-40's in age, report low incomes and tend to have higher education levels than family, friend, and neighbor providers.[17] In-home child care providers report different forms of motivation for providing child care including: want to stay at home with their children and earn an income, want to help out their families, and want to keep child care within the family due to conflicts with parents, isolation, work-related stress, difficulty balancing child care with work outside the home and managing difficult behavior of the children they care for each day.[17] In-home child care providers report being interested in a variety of training topics but specifically trainings focused on child development, health and safety, child behavior management, communicating with parents, child care provider licensing, and community resources available.[17] Some parents may stray away from in-home child care as the overall quality rating of in-home child care for all providers is often reported as inadequate to minimal based on opportunities to develop language and reasoning skills, learning activities, social interactions, space and furnishings, care routines, program structure and adult needs.[17]

2. Child Care Provider Regulations and Standards

Regulations at the local, state, and federal level have also been implemented that affect child care policies and procedures[85] including those that may influence the dietary quality of foods and beverages that are served in child care homes, particularly in Michigan. A Healthy People 2020 goal is to increase the number of states, 24 to 34, with nutrition standards for foods and beverages provided to preschool-aged children in child care.[9] Regulations and policies may assist in increasing consumption of more healthful foods and the decrease of less healthful food and beverage options.[85] National regulations may include the implementation of the CACFP nutrition standards,[14,15,86] state regulations may include state licensing regulations[82,83] and local

regulations may be more specific and target particular behaviors in a geographic or site location.[85] An example a state regulation includes New York State in which children can only be served juice that is 100 % juice, and no more than 6 ounces per day and only served to children 8 months old and older.[85] In addition children cannot be served beverages with added sweeteners and must have water available and easily accessible throughout the day.[85] Another example, is Delaware State in which each child should be provided the opportunity for a minimum of 20 minutes of moderate to vigorous physical activity for every three hours the child attends the child care.[85]

This dissertation focused on in-home, child care providers which in the State of Michigan includes family and group child care homes. According to Michigan's Department of Licensing and Regulatory Affairs (LARA), any person who provides care for one to six unrelated children in their home for more than four weeks in a calendar year and receives compensation exceeding $600 in that calendar year must be registered as a family child care home.[82] Any person who provides care for seven to twelve unrelated children in their home for more than four weeks in a calendar year must be licensed as a group child care home provider.[82] A family child care provider may stay registered as an "unlicensed provider" or apply for licensure.[82] Michigan requires licensed and recommends unlicensed child care providers to provide nutritious food, as recommended by CACFP nutrition standards as well as active play.[83] According to the Michigan licensing rules, "Each child will be provided with nutritional and sufficient food as required by the minimum meal requirements of the child care food program, as administered by the Michigan department of education, based on national research council's recommended dietary allowances for appropriate age groups, unless parents provide the food" which means that child care homes in Michigan are recommended to comply with the minimum meal requirements of

CACFP even if a home does not participate in this federally funded food program.[83] Eligible, In-home child care providers receive monetary reimbursement for serving meals and snacks to enrolled children that meet CACFP nutrition standards if participating in CACFP.[15] Although many states indicate that all child care providers should follow CACFP nutrition standards as a part of licensing standards, 52% of non-CACFP centers had never heard of CACFP and only 21% received information about following the CACFP standards and practices.[65] The following items that pertain to food and beverage intake are highlighted in the licensing requirements in Michigan: 1) Children shall be offered food at intervals as individually appropriate, but not to exceed more than 4 hours unless the child is asleep; 2) Drinking water shall always be available : and 3) Food shall be prepared, served, and stored in a safe and sanitary manner.[83]

Aside from the regulations above, there are no additional state policy regulations in place that effect the dietary quality of foods and beverages that are served in child care homes or centers in Michigan, although individual child care homes and centers may have specific home and center-level policies they choose to enforce and follow. Policies, standards and regulations may increase the amount of healthful foods and beverages served in child care settings.[87] A previous study from 2011, showed that if a preschool had a written, healthy eating policy there was less concern that children would refuse to eat the food written on the menu which was the main concern of the staff serving food to the children.[88] Additionally, a previous research study looking at compliance with written center-level policies showed that 75% of centers complied with policies related to serving milk and 67% did not serve sugar-sweetened beverages as stated in the center policy.[87]

3. Child Care Provider Menus

A menu that records the foods and beverages that may or has been served in a child care

provider home may provide a plan or record for what foods and beverages are served to young children. A study completed in Georgia child care centers showed that menus of foods and beverages served met requirements for energy, carbohydrate, protein and vitamin A and C but exceeded recommendations for saturated fat and sodium.[20] If the menu is used to estimate nutrition adequacy, it is imperative for the menu to be accurate. Although a menu may be a plan for what may be served it is not always an accurate representation of the food and beverage and portion of what is actually served in a child care setting.[89] The CACFP program requires menus to be submitted for the reimbursement of foods and beverages served so a menu may be the first step in the identification of healthy food and beverage options for young children.[14] There is a lack of studies that investigate the association between menus and what is actually served in a home-based child care setting.

When comparing the direct observation of foods and beverages served to children, 87% of the foods and beverages listed on the menus as well as substitutions matched what was served and 12% of foods and beverages listed on the menus were not served in child care centers.[90] Milk, cheese, yogurt, protein and mixed dishes had matching items 80% of the time although water and foods high in sugar had the lowest match percentages between what was observed and what appeared on the menu.[90] Water was not served 71% of the time it was listed on the written menu and 68% of the time water was served it was not listed on the menu.[90] The most common discrepancy of foods and beverages served versus what was observed occurred at breakfast and snack.[90] Also previous literature showed higher match percentages between what was served and what was observed when the child care center was participating in CACFP, was a head start site, or had staff responsible for food purchases and menu planning.[90]

4. Foods and Beverages Served by Child Care Providers

As early as 1977, the consumption of foods and beverages served in child care centers to toddlers have been examined for dietary quality.[91] A previous study completed in 2014, suggests a strong, direct relationship between what a child care center serves and what a child actually consumed.[87]

Regarding food group recommendations, previous studies have shown that child care centers did not serve food group recommendations for vegetables and whole grains.[20] Less than half of rural and low-income child care sites frequently offered a variety of fruits, vegetables, and whole grains.[18] Another study looking at child care homes had similar results in which 46% of providers did not serve whole grains at all, 35% served fewer than three servings of fruit and vegetables per day and the majority of providers served whole milk instead of reduced fat milk to children over the age of 2 years.[92,93]

Another previous study in 24 child care centers in Georgia showed similar results in that child care centers menus did not meet the recommended levels for energy, carbohydrates, protein, vitamin A, vitamin C, iron and fiber.[20] Additionally, saturated fat and sodium often exceeded the recommendation with again 71% of child care providers serving whole or 2% milk daily and 100% or providers served a sweet snack daily.[20] Remarkably, 100% of centers did serve a fruit daily but 29% of centers did not serve a vegetable daily.[20]

One study which focused on the nutritional quality of meals compared to snacks found the menu composition differed significantly between the snack and the meal.[93] The majority of snacks are comprised of sweet and salty foods including juice but lack vegetables, fruit and meat/meat alternatives including animal crackers, fruit gummy snacks, pretzels and crackers being offered at least three times a week.[93] Fascinatingly, lunch menus were frequently

comprised of fruit and meat/meat alternatives and infrequent non-starchy vegetables.[93]

Although many child care providers do not serve foods and beverages that align with national dietary quality recommendations, child care homes are a primary early child care setting in which nutrition education and obesity-related strategies can greatly influence young children.[94]

F. Programs for Child Care Providers

Federal, state and local programs and resources can be very beneficial to child care providers especially for low-income families with young children that focus on nutrition education and physical activity. Previous studies have documented the need for interventions and programs to target children at a young age, before meal patterns are established and especially before preschool age.[78] Early learning settings such as within child care provider homes are a suggested target for community based programs and interventions.

The Centers for Disease Control (CDC) established a spectrum of opportunities for obesity prevention in the early care and education setting including focusing on CACFP utilization, licensing regulations, funding needs, technical assistance, professional development, access to healthy environments and family engagement to improve nutrition environments.[95] All of these opportunities and additional opportunities at the national, state and local level can provide a best practice for obesity prevention efforts in early care settings such including in-home child care.[95]

1. Nutrition Education for Child Care Providers

A variety of programs, organizations and funding streams are dedicated towards nutrition education efforts for child care providers. These nutrition education opportunities may not be available and accessible to all child care providers and one study found that only 70% of child

care homes reported receiving nutrition education training, zero to three times, during the past 3 years.[96]

Team Nutrition resources and funding, under the United States Department of Agriculture, support child nutrition programs with training and assistance for foodservice professionals, nutrition education for children and their providers, and support for healthy eating and physical activity for schools and the community. Resources are provided to schools, child care settings, and summer meal sites that participate in these programs. Nutritional messages are often sent to children and their caregiver through food service initiatives, classroom and child care activities, school-wide events, at home activities, community programs and events, and social media.

NAP SACC (Nutrition and Physical Activity Self-Assessment for Child Care) is an evidence-based assessment that has been used by many states in efforts to enhance nutrition and physical activity environments in child care settings to improve the overall dietary quality of food and beverages, the amount and quality of physical activity, staff-child interactions, and nutrition and physical activity policies and practices.[23,25] The original NAP SACC research was done by Ammerman and colleagues in a randomized, controlled study which included child care directors and staff completing the 44 question from nine nutrition and physical activity areas self-assessment instrument to assess center nutrition and physical activity policies, practices, and the overall environment.[23] In various models of implementation, the educators using NAP SACC worked with child care centers to develop an action plan to improve at least three target areas of concern identified from the self-assessment instrument and deliver three workshops on childhood overweight, healthy eating for children, and physical activity for children over a six month period.[23] Various other research studies have tested other workshop topics as well as not

offering the same workshop to all providers.[25] NAP SACC is a research tested assessment that has shown mixed results including significant improvements in center's written policies, children's physical activity, strengthening specific education including not using food as a reward, parent and child care center staff knowledge and strengthening of center's nutrition policies but some studies are controversial on the impact on child body mass index and the nutritional quality of meals.[23-25,85,97]

Specific nutrition education curricula that have been developed to target child care providers include *Cooking Matters for Child Care Providers*[98] as well as curricula that target young children including: *I am moving, I am learning, Color me Healthy, and Sports, Play and Active Recreation (SPARK!).*[85] Specific funding streams such as the Supplemental Nutrition Assistance Program Education (SNAP-Ed) are available for child care providers who reside in low-income areas and have state agencies that focus education on child care providers. The majority of these educational curricula, programs and funding streams target center-based child care providers.

Past nutrition education interventions that assess and educate child care providers on nutrition and physical activity policies and environmental changes demonstrate increased sustainability, child, and child care provider nutritional outcomes.[95,99,100] Food and beverages on a menu, related to food groups, improved as a result of nutrition education interventions including a 0.1-0.2 serving per day increase for vegetables, dairy and meat and 0.4-0.5 servings per day of grains and fruit.[100] Additionally, energy, fiber, calcium, potassium, zinc, and folate increased significantly and sodium decreased according to the foods and beverages listed on a menu after the nutrition education intervention but the link to dietary quality is unknown.[100]

Implementing multiple changes at different levels can occur through utilization of the

social ecological model.[101] This includes the social and cultural norms and values, sectors, settings, and individual factors, of the social-ecological model. The can be effective in improving eating behaviors, including the food and beverage environment and previous studies using school policies to enhance the school food environment led to better dietary quality of the food consumed during the school day.[60]

G. Barriers and facilitators to adherence to CACFP nutrition standards

The 2017 CACFP meal pattern standards were made official on October 1, 2017 and thousands of in-home, child care providers throughout the state of Michigan were expected to align with the nutritional standards.[3] Compliance with the 2017 CACFP meal pattern standards are influenced by the ability of child care providers to understand and replicate the standards as well as other barriers and facilitators that may influence compliance. In addition, children as well as the parents of the children in care, may complicate the degree of complexity in following the standards.

Previous barriers, identified through implementation of the NAP SACC assessment, to child care centers serving foods and beverages that align with Dietary Guidelines included cost, access, staffing, facilities, policy, and experience level of staff.[29] Barriers to child care providers may include lack of training, lack of time to train due to long working hours, high food costs, parental support, conflicting priorities, staff perception of their responsibility to children's health, and health concerns of the provider.[29,69] Additional surveys completed by The Yale Rudd Center, focused on child care centers, identified barriers to healthy eating in early care to include: lack of support, sale of unhealthy foods at fundraisers, serving unhealthy foods at social events, insufficient funds, inadequate food preparation or storage facilities, limitations of food service providers or vendors, lack of policies, and lack of training for food.[102] Barriers related to

healthful menu planning for child care staff may include the lack of menu variety, balancing dietary needs with preferences of the children, as well as the catering to specific dietary needs for individual children.[88] Additionally perceived barriers to healthy eating in child care from the parent's point-of-view as well as from home child care providers may include the children preferences and knowledge toward certain foods and beverages, parent's preferences and beliefs toward certain foods and beverages and management of fussy eaters.[88,103]

Previous research has demonstrated that resources, programs and trainings are the top three possible facilitators for improving the nutrition and physical activity environment of in-home child care providers including the foods and beverages served.[103] A specific resource may include coupons for fruits and vegetables and increasing the reimbursement amount received from CACFP for foods and beverages served to children in their home.[103] A main theme in previous research includes training as a key facilitator to healthy eating compliance which may also influence the 2017 CACFP nutrition standards.[88] Specific training topics included general healthy eating, specific dietary needs, menu planning and suggestions for overcoming barriers.[88,103] In addition community nutrition dietitians and those providing training may need to tailor trainings to meet the needs of child care providers.[88] Tailored training may include specific meal pattern components, such as the new whole-grain requirement, elimination of grain-based deserts or even recommendations to meet best practices on variety of fruits and vegetables to be served.[3,88] Facilitators should positively influence nutritional dietary quality of foods and beverages that are served in child care homes.

H. Conceptual Framework

The primary purpose of this dissertation was to describe the dietary quality of foods and beverages served by in-home child care providers and identify the barriers and facilitators to

serving foods and beverages that align with CACFP nutrition standards and utilize the findings to work towards an evidence-based nutrition education intervention for child care providers. The conceptual framework expands on two frameworks, Health Belief Model (HBM) and the Self-Determination Theory (SDT). The HBM model assists in explaining an individual's beliefs and attitudes, perceived benefits and/or barriers such as the availability of resources relative to the CACFP nutrition standards and the SDT can explain one's motives for adopting certain practices, specifically the nutrition standards as they pertain to current research.[104-107]

1. Health Belief Model

The Health Belief Model, dating back from the 1950's, explains changes in health behavior resulting from individuals' beliefs and attitudes, perceived benefits and perceived barriers.[104,106,108] These can be influenced by self-efficacy and cues to action. The Health Belief Model articulates that behavior change is initiated by 1) readiness to take action (motivation), which is based on a balance of health-related beliefs and 2) environmental factors.[108] This models work to assist society and individuals to: change beliefs or activate those that already exist by removing barriers, instituting social pressure and directly targeting several beliefs at once.[108] For child care providers, the Health Belief Model may explain perceived barriers and facilitators to meeting or not meeting the CACFP nutrition standards, motivation for meeting nutrition standards and external influences on meeting or not meeting the standards.

2. Self-Determination Theory

The Self-Determination theory, represents a broad framework of human motivation and personality.[107] This theory describes the interplay between the extrinsic forces acting on persons and the intrinsic motives and needs inherent in human nature while also taking into account social and cultural factors.[107] It addresses the questions of why people do what they do and the

costs and benefits of various ways of socially regulating or promoting behavior.[107] These models and theories provided insight about what may influence the foods and beverages that are served to children in child care and meeting the CACFP nutrition standards.

CHAPTER 3 - Methods

A. Aim 1 Methods Overview

The first component of this dissertation used a cross-sectional design to describe the food groups, nutrients and CACFP meal components served to children 2-5 years-of-age by in-home child care providers in low-income areas. All food and beverages that are served during lunch and snack in approximately 116 child care provider homes in 24 Michigan counties were described and compared to the Healthy U.S.-Style Eating Pattern, Dietary Reference Intakes, American Heart Association, 2017 CACFP nutrition standards, and the planned written menu. The outcomes for Aim 1 determined the dietary quality of foods and beverages served by in-home child care providers. The following outcomes were used to determine dietary quality:

- average food groups and nutrients served,
- comparison of average food groups and nutrients served to 39% of Healthy U.S.-Style Eating Pattern, Dietary Reference Intakes, and American Heart Association recommendations,
- percentage of child care providers meeting 39% of each daily recommendation,
- percentage of child care providers meeting each daily CACFP nutrition standard for lunch and one snack,
- percentage of child care providers serving foods and beverages that match the written menu.

In addition, Aim 1b examined whether any child care provider characteristics (participation in CACFP; CACFP sponsor organization; geographic classification; the number of children the home is licensed for and the age category of children served in the home) are positively or negatively associated with meeting the CACFP nutrition standards.

B. Recruitment

1. Sample Selection and Eligibility

Child care providers were eligible for participation in the study if the following criteria were met: residing in a low-income area as documented through the CACFP area eligibility map, providing care for two to twelve children 2-5 years-of-age and serving meals and snacks.

Child care providers were recruited from the Great Start to Quality website (https://stage.worklifesystems.com/parent/4), which is a database of child care providers who are registered and licensed in the state of Michigan. The database was used to search for cities and towns that are located within 24 Michigan counties (Table 3.1). The bases for deciding which 24 counties to select were diversity in race and ethnicity as evidenced by the 2018 county health rankings, urban vs. rural classification by the United States Census Bureau[109,110] and proximity to the nutrition professionals conducting training and evaluation. Fifteen urban counties and six rural counties were targeted.

Table 3.1 Geographic Locations of Child care Providers for Recruitment in the Study

County	% African American	% White	% Asian	% Hispanic	Rural or Urban
Bay	1.5	90.2	0.7	5.1	Urban
Berrien	14.8	75.3	2.0	5.3	Urban
Calhoun	10.8	78.0	2.6	5.0	Urban
Clinton	1.7	90.1	1.6	4.5	Rural
Eaton	6.7	83.4	2.1	5.3	Urban
Genesee	20.5	72.6	1.0	3.2	Urban
Ingham	11.4	71.7	5.6	7.6	Urban
Ionia	4.7	88.4	0.5	4.7	Rural
Jackson	8.0	84.9	0.8	3.5	Urban
Kalamazoo	10.8	78.9	2.6	4.5	Urban
Kent	9.5	75.3	2.6	10	Urban
Macomb	10.3	83.2	3.5	3.5	Urban
Oakland	13.6	77.3	5.6	2.4	Urban
Saginaw	18.5	69.6	1.4	8.4	Urban
Washtenaw	12.3	70.6	9.1	4.6	Urban
Wayne	39.2	50	2.9	5.6	Urban
Arenac	0.4	94.8	0.3	2.0	Rural
Branch	2.0	0.5	0.6	4.3	Rural
Gratiot	5.7	0.6	0.5	5.5	Rural
Huron	0.5	95.4	0.6	2.3	Rural
Livingston	0.6	94.8	0.9	2.2	Urban
Montcalm	2.2	92.0	0.4	3.5	Rural
Sanilac	0.5	94.2	0.4	3.7	Rural
Shiawassee	0.6	94.1	0.5	3.0	Rural

Child care providers were classified as low-income based on the CACFP area eligibility map, https://www.fns.usda.gov/areaeligibility. Only those child care providers whose address when entered into the CACFP area eligibility map appeared as red, were invited to participate into the study. Addresses appeared as red if at least 50 percent of the children in the attendance

area of a local school or within a census tract area are eligible for free or reduced-price school meals. Area eligibility was valid for five years.[3]

2. Recruitment Procedures

For this component, eligible child care providers were recruited through phone calls. Trained research assistants called child care providers from the Great Start to Quality database following a phone recruitment script. Trained research assistants who completed the calls included four junior or senior undergraduate dietetics students and one primary researcher also serving as the lead Registered Dietitian. The recruitment script introduced the study, asked inclusion criteria questions and reviewed the incentives to participation. If the child care provider requested additional information, research assistants mailed or emailed the recruitment flyer (APPENDIX A: Recruitment Flyer) or connected the provider with the primary researcher. If a child care provider was not interested in the research but would still like nutrition education, they were referred to a nutrition professional at Michigan State University Extension office for nutrition education services. All child care providers called were placed on a call log to avoid duplication and a child care provider was called up to three times before they were recorded as not reachable. Child care providers who declined participation were also recorded on the call log with a reason for declining if stated.

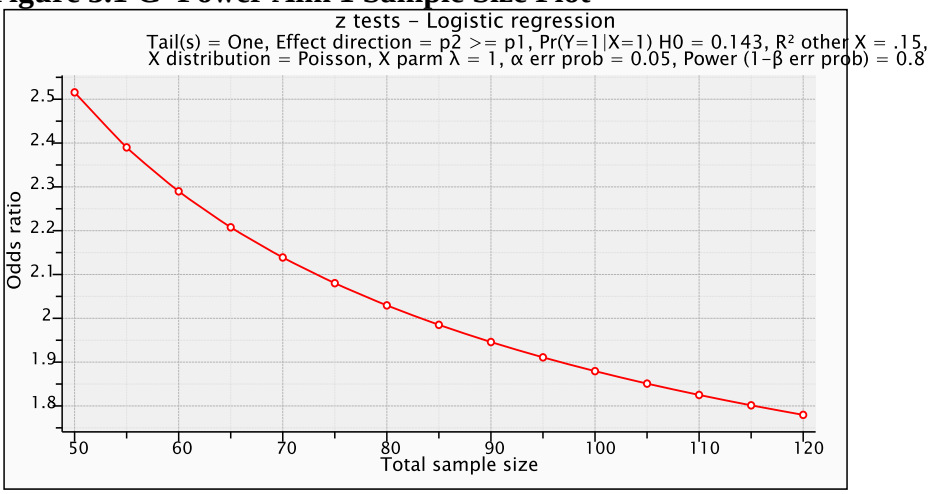
Child care providers who verbally agreed to participate, over the phone, were scheduled for a direct diet observation of snack and lunch to collect the pre-assessments. Consent forms were collected from all in-home child care providers and assistants who were present during the data collection. All consent forms were signed and collected by five Michigan State University trained research assistants before the data collection occurred and stored in a locked file in the Department of Food Science and Human Nutrition at Michigan State University. This research

project was approved by the Michigan State Institutional Review Board (APPENDIX B: IRB Approval). This project was implemented by the Department of Food Science and Human Nutrition at Michigan State University.

3. Sample Size Determination

G power version 3.1[111] was used to calculate a sample size based on an ad hoc z test using logistic regression. This model was used because the dependent variable; CACFP score variable (fluid milk, meat/meat alternative, fruit, vegetable, grain, lunch and snack) is a dummy variable, which means the value will be either "0" or "1". An odds ratio was used as an index of effect size. Previous research studies that compare the dietary quality of foods and beverages served to national recommendations in child care homes and centers are limited, and effect sizes are not well documented. Preliminary data collection analysis indicated an odds ratio range from 1.5 to 2.5. An odds ratio of 1.8 to 2.5 as shown in Figure 2 resulted in a sample size range of 50-120 child care providers.

Figure 3.1 G*Power Aim 1 Sample Size Plot



An odds ratio of 1.8 was selected as the smallest effect to detect how much the independent variables will influence the dependent variable. The odds ratio of 1.8 means the probability of receiving a "1" for any CACFP score variable is 64% and receiving a "0" is 36%. A significance of 0.05 and 80% power resulted in a sample size of about 116 child care homes. No attrition rate was added for this component of the research as it only requires a one-time measurement that is primarily descriptive based on the baseline characteristics of the child care providers recruited.

C. Data Collection and Instruments

Data collection for Aim 1 included:

1. Diet observation of lunch and snack served utilizing direct diet estimation method
2. Five-day menu collection of foods served for breakfast, lunch, snack(s) and dinner

1. Direct Diet Observation

The direct diet observation method was used to estimate all foods and beverages served to children 2-5 years-of-age by the in-home child care providers. The direct diet observation method is the gold standard for research in observing and estimating foods and beverages served and consumed by young children in early childhood settings.[112] The observation for each in-home child care provider included lunch and either a morning or afternoon snack during one day at a child care provider home. A maximum of 4 children were observed at one time by one researcher. Children under the age of 2 and over 6 years of age were not observed. A total of six trained undergraduate dietetics research assistants as well as the primary researcher completed the observations.

A direct diet observation form was used to document the preparation, type and amount of foods and beverages served per children 2-5 years-of-age (APPENDIX C: Direct Diet

Observation Form). The direct diet observation form was adapted from Ball and colleagues to allow for the addition of vegetable subgroups and beverages other than milk.[112] On the direct diet observation form, demographics were collected including: ages of children, number of children cared for in the home, race and ethnicity of children and child care providers and assistants. In addition, a notes section allowed for any additional observations such comments made by the child care provider related to eating, distractions that were observed in the environment, or food waste from dropping or throwing away foods and beverages during lunch or snack. Participation in CACFP and the identity of the CACFP sponsor were recorded on the observation form as well. Data observation followed the direct diet observation protocol (APPENDIX D: Diet Observation Protocol) developed by Ball and colleagues.[112]

2. Menus

All foods and beverages served to children 2-5 years-of-age at breakfast, lunch, snack(s) and dinner were collected for Monday through Friday of the week the direct diet observation was completed. Research assistants provided the child care providers with a menu template (APPENDIX E: Five Day Written Menu Template and Instructions), reviewed written instructions for completion, or asked the child care provider to give them their current written menu. Research assistants reviewed the menu template recording instructions with the child care provider that included:

• record food and beverages for all meals and snacks served for the week in which the direct diet observation was completed

• record specific brands and kinds of foods and beverages such as “Cheerios” or, “Meijer brand Raisin Bran” instead of writing “cereal

• record whether fruits and vegetables are canned, fresh or frozen and if using canned

fruit, record if packed in juice or syrup and if using canned vegetables, indicate if low in sodium

• record portions served as well as any substitutions made.

The priority was to collect the menu during the direct diet observation visit, but if a menu was not collected at the day of observation, research assistants provided a self-addressed and postage paid envelope for the provider to mail in the menu. Research assistants made a one-week follow-up reminder phone call to make sure menus were mailed to the primary researcher, if not collected at observation. If a child care provider did not follow the menu template recording instructions, a research assistant called the provider to probe for any remaining missing information.

3. Direct Diet Observation and Menu Collection Training

Research assistants received twelve hours of training in the direct diet estimation method from the lead Registered Dietitian using the University of North Carolina data collection training protocol.[112] To become certified as a research assistant, using the direct diet estimation method, the following skills were assessed for accuracy:

- practice using the direct diet observation tool including assigning food and drinks to categories, item descriptions and recorded portions using food models
- measure the 20 foods and beverages most commonly consumed in a child care setting within a 30 minutes time span with liquid and dry measuring cups and spoons
- direct diet estimation of foods and beverages served and consumed in a laboratory setting using various portions served in cups, bowls and plates within a 30-minute time span for 90% of foods and beverages
- direct diet estimation of foods and beverages served and consumed in an in-home child care with 90% agreement with registered dietitian trainer.

Research assistants were instructed to only include children 2-5 years-of-age in the observation. The direct diet observation tool was first initiated while the child care provider was preparing the meal and snack. Research assistants were instructed to arrive at the home 15 minutes prior to the snack or meal being served. The focus of the tool was on what type of food was served and portions served plus notes regarding interactions and other qualitative observations that may influence the meals and snacks served. This included quotes from the child care provider or environmental observations.

In addition, research assistants received one hour of training on the menu template. Training included reviewing the template, practicing using the template and utilizing probing questions to capture missing information. Research assistants were also trained in the MSU human research protection certification and consent form procedures. Research assistants recorded his/her name on each data observation form to allow for clarification upon data entry.

D. Variables and Coding of Variables

Demographic variables of the child care providers and the children cared for in the home were collected on the direct diet observation form. These included race, gender, ethnicity, age, participation in CACFP; CACFP sponsor organization, geographic classification of the child care provider based on United States Census Bureau county residence; the number of children licensed for care for in the home and the mean age of children cared for in the home (Table 3.2).

Table 3.2 Child Care Provider Characteristics

Independent Variable	Measurement
Participating in CACFP/not participating	Yes or No (binominal)
CACFP Sponsor if participating	Campfire West Michigan 4C, Association for Child Development, Mid-Michigan Child Care Center, Inc. (categorical)
Rural or Urban location	Rural or Urban (binominal)
Number of children provider licensed for in the home	Six or twelve (binomial)
Age category of children being cared for in the home	2-3-year-old children 4-5-year-old children Both (categorical)
Child care provider ethnicity	Hispanic/Latino or not (binomial)
Child care provider race	White, black, Asian, American Indian/Alaskan Native, Native Hawaiian, Other (categorical)

The variables that were chosen to describe dietary quality and compare foods and beverages to national recommendations were selected to be consistent with previous dietary intake studies that reported intakes that were higher or lower than recommendations for children 2-5 years of age.[1,61,68,113,114] The data collection of foods and beverages served by in-home child care providers at observation and on the menu template were converted through nutritional analysis and coding into the following food group variables: dairy, protein food, seafood, meats/poultry/eggs, nut/seeds/soy, total vegetables, dark green leafy vegetables, red or orange vegetables, starchy vegetables, other vegetables, beans/peas, fruit, whole grains, refined grains, and oils. The nutrient and additional component variables included energy, total dietary fat, saturated fat, carbohydrates, protein, dietary fiber, sodium, calcium, iron, vitamin E, potassium, folate, vitamin A and zinc. The mean amount of each variable served by all child care providers for lunch and snack was compared to the Healthy U.S.-Style Eating Pattern, Dietary Reference Intakes (DRI's) and the American Heart Association recommendation for children 2-3 and 4-5 years-of-age that should be provided by lunch and one snack. The percentage of child care providers serving each subgroup variable, for children 2-3 and 4-5 years-of-age, over five days

was collected including: seafood, nut/seeds/soy, dark green leafy vegetables, red or orange vegetables, starchy vegetables, other vegetables and beans/peas.

Additional variables that were created to describe dietary quality of the foods and beverages served by child care providers during the direct observation and the menu template collection included the CACFP component categories for snack and lunch. The variables included: 1) total snack score, 2) fluid milk score, 3) meat/meat alternative score, 4) vegetable score, 5) fruit score, and 6) grain score. A score of "0" was assigned to each variable for which the nutrition standard was not met, including the type of food and the preparation method used. A code of "1"was assigned if they meet the nutrition standards. If only a portion of the nutrition standards for that variable was met, a score of "0" was assigned (APPENDIX F: Scoring Procedure for CACFP Nutritional Standards). Each child care provider was be assigned a total score ranging from 0-6 based on the six variables.

To determine to what extent child care provider menus matched the observed foods and beverages served, data collection included weekly menus, collected the same week the observation occurred. The day of the observation and the written menu were coded into the following variables: total lunch plus snack matching score, lunch matching, snack matching, lunch fruit, lunch dairy, lunch vegetable, lunch protein and lunch grain scores. The variables were coded as "1" the menus match the type of food or beverage served and "0" if the food or beverage observed does not match the menu.

E. Data Analysis

For this component of the research, descriptive statistics including means and standard deviations were calculated for each food group, nutrient, and additional component (Table 1), using Stata (version 14.0). Each child's, 2-5 years of age, total food and beverage served for

snack and lunch were averaged together per home for an average score for all children 2-3 and all children 4-5 years-of-age. If a provider did not have children in care during the observations for one of the age categories, that category was left blank. The average score included all portions served initially or as additional portions throughout the meal or snack time. Nutritionist Pro (version 10.0) was used to estimate each nutrient variable for the food and beverages served. Each food and beverage were coded using Microsoft Excel into the correct food group after conversion into cup and ounce equivalents. Food group, nutrient and additional components served data was reported using the same metric as reported in the DRI', Healthy-US Eating Style Patterns of American Heart Association recommendations. DRI and Healthy-US Style Patterns corresponded with the following: 1) children 1-3 years of age recommended to consume 1,000 calories daily, and 2) children 4 to 5 year-of-age recommended to consume 1,200 calories per day.[60] National Health and Examination Survey (NHANES) data in 2003-2004, determined that children 2-5 years received between 27 and 32% of daily calorie needs from lunch and 14-26% from snacks.[115] Because CACFP reimburses two snacks per day and the observation only included one snack, 7% was used for the comparison of one snack and 32% for one lunch.[115] The mean served for each food group and nutrient variable were compared to 39% of the recommendations for children 2-3 and 4-5 years-of-age. Chi-square analysis was used to determine if there was a significant difference between the two age groups. The number and percentage of child care providers were reported for each child care provider who served foods and beverages that met: 1) each individual food, nutrient or component recommendation 2) all food group recommendations 3) each individual weekly sub-group recommendation 4) all weekly sub-group recommendations 5) individual nutrient recommendations and 6) all nutrient recommendations.

The child care provider characteristics were compared to meeting CACFP nutrition standards, for each individual CACFP component, using single-level, at the home level, and multi-level, at the observation level, logistic regression. A p value of $<.05$ was considered statistically significant. All child care providers' homes were observed at a different time of the year so the season of the observations (early Fall to early Spring) and (late Spring to early Fall) were compared to determine if there was a significant difference between the providers who were observed in the winter months versus the summer months using Pearson's chi-square statistical analysis. No significant difference was detected, so the season of observation was not added as a control variable. Along the same lines, child care providers who served a morning or afternoon snack were compared via chi-square analysis to determine if there was a significant difference in food groups and nutrients between the two snack serving times and again no significant differences were detected. Table 3.3 outlines the research questions, statistical analyses, variables and outcomes utilized for this component of the research

Table 3.3 Aim 1 Alignment of Research Questions and Statistical Analysis

Aim	Research Question	Statistical Analysis	Variables/Outcomes
Aim 1a	To what extent do the food groups and nutrients of food and beverages served to children 2-5 years-of-age for lunches and snacks by in-home child care providers in low-income areas in Michigan meet the National recommendations?	Descriptive Statistics	Descriptive Statistics: Mean (SD), for food groups, nutrients and components served to only children 2-3 and only children 4-5 years-of-age Frequency and percentage of child care providers meeting 39% of each daily national recommendation
Aim 1a	To what extent do the food and beverages and portions served by in-home child care providers to 2-5-year-old children in low-income areas meet the CACFP nutrition standards for lunch and snack?	Descriptive Statistics	Descriptive Statistics: Frequency and percentage of child care providers meeting: fluid milk, meat/meat alternative, fruit, vegetable, grains, snack and all CACFP nutrition standards
Aim 1a	To what extent do the foods and beverages on the child care provider menu match the actual foods and beverages served by in-home child care providers in low-income areas to children 2-5 years-of-age?	Descriptive Statistics	Descriptive statistics: Frequency and percentage of child care providers in which the observation matches the menu for the lunch and snack and lunch food groups of fruit, vegetable, protein, grain and dairy

Table 3.3 (cont'd)

Aim 1b	What in-home child care provider characteristics are positively associated with meeting the 2017 CACFP nutrition standards?	Multi-level and single-level binary and ordinal logistic regression	V1= Dependent: Meeting CACFP recommendations score measurement: ordinal 0 to 6 meeting all CACFP recommendations: 0 or 1 V2=Independent: CACFP participation measurement: 1) Sponsor 1 2) Sponsor 2 3) Sponsor 3 *Reference: Not participating in CACFP V3=Independent: Number of children licensed for in the home Measurement: 6 or 12 *Reference 12 V4: Age Category of Children Measurement: 2-3 and 4-5 years-of-age *Reference Providers who care for both V5: County location measurement: rural or urban *Reference urban

F. Aim 2 Methods Overview

The second component of this dissertation investigated the impact of the *Healthier Child care Environment intervention*, a self-assessment and nutrition education intervention, on diet quality served to 2-5-year-old children receiving care from in-home child care homes. A total of 67 of the 116 child care providers agreed to participate in Aim 2 and were randomized to receive the nutrition education intervention or control or receive a delayed-intervention after six months. The main outcome of this component was to compare the dietary quality of the foods and beverages served by the child care providers before and after the intervention for the intervention and control groups.

G. Nutrition Education Intervention

1. Components of the Intervention

The nutrition education intervention, *Healthier Child Care Environment,* was a nutrition education intervention developed and offered through Michigan State University Extension in child care provider centers and homes in Michigan. The nutrition education intervention includes professional coaching to assist child care providers in completing: 1) the Nutrition and Physical Activity Self-assessment (NAP SACC), an evidence-based assessment used to enhance nutrition and physical activity environments in child care settings and to improve the overall dietary quality of food and beverages, the amount and quality of physical activity, staff-child interactions, and nutrition and physical activity policies and practices[23,25,27] 2) an action planning process; 3) implementation of the selected action plans.

All child care providers completed the following components; introduction to the program; consent for child care providers and assistants; and randomization into intervention or control group. Intervention child care providers received six months of nutrition education

assessment and education directly after the pre- data collection occurred. Child care providers randomized into the control group were offered the same education after the post- data collection had taken place.

The *Healthier Child Care Environment* intervention coaching and mentoring included hands-on assistance in completing the web-based NAPSACC assessment. Based on the results of the NAP SACC, child care providers selected nutrition and physical activity best practices that they would like to work on. If pre-assessment scores were not meeting best practices, child care providers were instructed to choose a minimum of three action items from the fruits and vegetables nutrition area. If all areas were meeting best practices, child care providers choose from the following areas that may also influence fruit and vegetable best practices:

- Meats, Fats, Grains
- Menus and Variety
- Feeding Practices
- Foods Offered outside of Regular Meals & Snacks
- Support for Healthy Eating
- Nutrition Education
- Nutrition Policy

Professional coaching was provided to assist child care providers with improving the best practice action plans and including: the distribution of resources, reviewing barriers to achieving best practices and practice implementing the new best practice. For example, if a child care provider selected the best practice of serving a vegetable daily that does not include green beans, potatoes and corn, education may focus on: sampling new vegetables, choosing recipes with

other vegetables, coordinating a weekly menu with other vegetables or even creating a policy limiting corn, green beans and potatoes to be served three times per week.

Physical activity action plans were implemented if all nutrition areas that were assessed above currently met best practices or after child care providers complete three nutrition action plans. Technical resources for the coaching were chosen by nutrition professionals from the website titled "Healthier Child Care Environments Toolkit" located at http://msue.anr.msu.edu/program/snap_ed/child care. All resources included in the toolkit were previously reviewed for accuracy as well as coming from educational programs and government sources. On average, nutrition professionals were instructed to spend 10 hours of education and coaching, over the period of 6 months, completing the self-assessments, action plans and nutrition education. Incentives for child care providers included $100 worth of nutrition education reinforcement items, toddler plates, fruit and vegetable poster set and an average of 10 hours of continuing education for licensure distributed after completion of the *Healthier Child Care Environment* nutrition education intervention and post- observation.

2. Coaching by Nutrition Professionals

Nutrition professionals served as coaches for the intervention and were trained employees from Michigan State University Extension and Kidney Foundation of Michigan. Nutrition professional experience varied from Bachelor's degree to Master's degree nutrition professionals. To increase program fidelity, all nutrition professionals received the same one-day training and protocol (APPENDIX H: Training Protocol for Nutrition Educators). Communication in minutes, demographics, and number of best practices selected were documented by each nutrition professional during the nutrition education intervention (APPENDIX H: Nutrition Education Tracking Form).

H. Recruitment

1. Sample Selection and Eligibility

The sample for Aim 2 included the child care providers recruited for Aim 1. Eligibility criteria for Aim 1 included: residing in a low-income area as shown through the CACFP area eligibility map, providing care for two to twelve children 2-5 years-of-age and serving meals and snacks. CACFP map eligibility corresponded with free and reduced lunch census tract eligibility.

2. Randomization Procedures

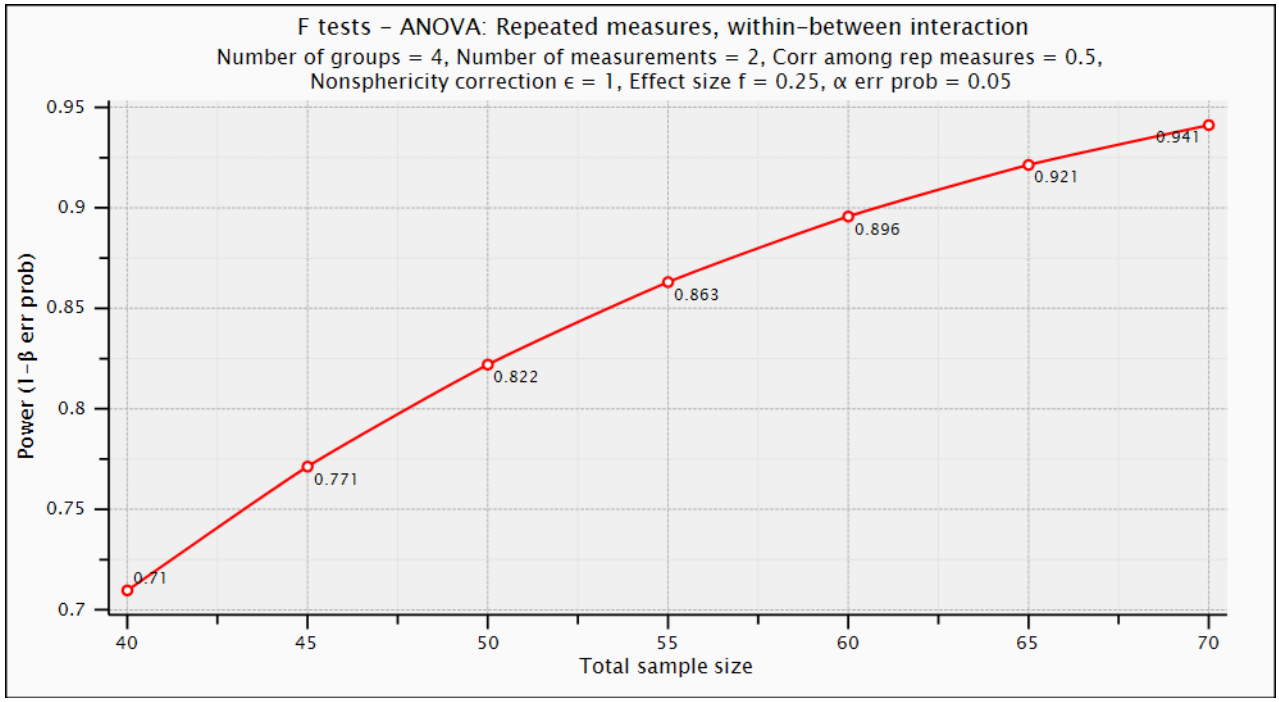
Child care providers who chose to participate in the *Healthier Child Care Environment* nutrition education were randomized into the control (delayed intervention) or intervention group after they signed the consent form and participated in the pre-data collection process. Randomization occurred in the following 2-step process: Step 1) starting with the first provider that signed the consent form within a county, providers with a phone number ending in 0-4 were randomized into the intervention group and providers with a phone number ending in 5-9 were randomized into the control group. Step 2) the second provider that signed the consent form within the county were randomized to the opposite group as the first provider to sign the consent form. This process was repeated for each consecutive pair of providers signing the consent form in each county to ensure a numerical balance between control and intervention groups.

3. Sample Size Determination

Previous nutrition education interventions with child care providers measuring pre- to post- intervention changes resulted in a small to medium effect size of 0.25 for fruits and vegetables, 0.33 for meals and snacks, and 0.57 for nutrition education.[100] Using G-power software, an ad hoc sample size was calculated based on a repeated measurement, mixed design. The repeated measurement was based on differences between four groups of intervention with a

pre- and post- measurement. This model was selected to power Aim 2 to detect differences between the four groups. The calculation resulted in a sample size range of 16-224 child care providers. The range was based on an effect size of 0.25 to 0.57 and a correlation between measures of 0.10 - 0.50 at 80% power. A probability of 0.05 was used to detect a significant effect from the intervention. Figure 3.2 showcases the sample size curve for Aim 2 at various effect sizes and shows 80% power at a midrange effect size of 0.25.

Figure 3.2 G*Power Aim 2 Sample Size Plot



A correlation range of 0.10 to 0.50 based on a 0.25 effect size resulted in a range of 48-84 child care providers. A moderate effect size of 0.25 and a 0.10 correlation between repeated measures with 80% power resulted in a sample size of 84 child care providers. We anticipated a 15% attrition rate and therefore our sample size goal was a total of 97 child care providers recruited for Aim 2. Although we recognized that there might be some degree of under-powering, based on the most stringent calculations, we were realistic with potential limitations of

community nutrition research including high attrition rates and the transition of nutrition professionals within their structured roles. A total of 60 child care provider homes, based on a 0.25 correlation and a 0.30 effect size calculation, was the minimum goal for enrollment in this component of the study.

I. Data Collection and Instruments

Data collection for Aim 2 included:

1. Pre- and post- diet observation of lunch and snack served from direct diet estimation method
2. Pre- and post- five-day menus of foods served for breakfast, lunch, snack(s) and dinner
3. Pre- and post- Nutrition and physical activity (NAP SACC) self-assessment
4. Nutrition professional tracking to document hours of education, level of completion and number of nutrition and physical activity nutrition and physical activity best practices completed

1. Direct Diet Observation

Direct diet observation was used to estimate all foods and beverages served to children 2-5 years of age by the in-home child care providers. The direct diet observation method is the gold standard for research in observing and estimating foods and beverages served and consumed by young children in early childhood settings.[112] The observation for each in-home child care provider included lunch and either a morning or afternoon snack during one day of observation at a child care provider home. A maximum of 4 children were observed at one time by one researcher. Children under the age of 2 and 6 years of age and older were not observed. A total of six trained, undergraduate dietetics, research assistants as well as the primary researcher completed the diet observations.

The direct diet observation form was used to document the preparation, type and amount

of foods and beverages served per children 2 years and 3-5 years (APPENDIX C: Direct Diet Observation Form). The direct diet observation form was adapted from Ball and colleagues to allow for the addition of vegetable subgroups and beverages other than milk.[112] On the direct diet observation form demographics were collected including: participation in CACFP and the CACFP sponsor organization, ages of children observed, number of children the home was licensed for, race and ethnicity of children and child care providers. In addition, a notes section allowed for any additional observation notes such as comments made by the child care provider related to eating, distractions that may be observed in the environment or food waste from dropping or throwing away foods and beverages during lunch or snack. Data observations followed the direct diet observation protocol (APPENDIX D: Diet Observation Protocol) developed by Ball and colleagues.[112]

2. Menus

All foods and beverages served to children 2-5 years of age at breakfast, lunch, snack(s) and dinner were collected for Monday through Friday of the week the direct diet observation was completed. Research assistants provided the child care providers with a menu template (APPENDIX E: Five Day Written Menu Template and Instructions), reviewed written instructions for completion, or asked the child care provider to give them their current written menu. Research assistants reviewed the menu template recording instructions with the child care provider that included:

- record food and beverages for all meals and snacks served for the week in which the direct diet observation was completed
- record specific brands and kinds of foods and beverages such as “Cheerios” or, “Meijer brand Raisin Bran” instead of writing “cereal

- record whether fruits and vegetables are canned, fresh or frozen and if using canned fruit, record if packed in juice or syrup and if using canned vegetables, indicate if low in sodium
- record portions served as well as any substitutions made.

The priority was to collect the menu during the direct diet observation visit, but if a menu was not collected on the day of observation, research assistants provided a self-addressed and postage paid envelope for the provider to mail in the menu. Research assistants made a one-week follow-up reminder phone call to make sure menus were mailed to the primary researcher, if not collected at observation. If a child care provider did not follow the menu template recording instructions, a research assistant called the provider to probe for any remaining missing information.

3. Nutrition and Physical Activity Self-Assessment (NAP SACC)

NAP SACC (Nutrition and Physical Activity Self-Assessment for Child Care) is an evidence-based assessment that has been used by many states to enhance nutrition and physical activity environments in child care settings to improve the overall dietary quality of food and beverages, the amount and quality of physical activity, staff-child interactions, and nutrition and physical activity policies and practices.[27] The NAP SACC assessment includes 44 questions from nine nutrition and physical activity areas.[26,27] The nutrition and physical activity self-assessment (NAP SACC) was used to assess practices in their child care regarding fruit, vegetables, meats, fats, grains, menu variety, feeding occasions, foods offered outside of regular meals and snacks, support for healthy eating, nutrition education and nutrition policy. The NAP SACC assessment was part of the *Healthier Child Care Environment* intervention and informed the child care provider and nutrition professional which best practice areas should be improved.

The assessment also documented which best practices were selected for nutrition education during the nutrition education intervention.

4. Nutrition Professional Nutrition Education Tracking

The nutrition professional tracking form was created by Michigan State University Extension and was an excel spreadsheet that documented minutes of communication, demographic characteristics of child care providers and number of best practices selected. This tracking form was collected at the end of the intervention from the nutrition professionals through email (APPENDIX H: Nutrition Education Tracking Form).

J. Variables and Coding

1. Dietary Quality Variables

The data collection of foods and beverages served by in-home child care providers at observation and on the menu template were converted through nutritional analysis and coding into the following food group variables: total dairy, total protein food, seafood, nut/seeds/soy, total vegetables, dark green leafy vegetables, red or orange vegetables, starchy vegetables, other vegetables, beans/peas, total fruit, total whole grains, total refined grains and oils. The nutrient and additional component variables included energy, total dietary fat, total saturated fat, total carbohydrates, total protein, dietary fiber, sodium, calcium, iron, vitamin E, potassium, folate, vitamin A and zinc. The mean amount of each variable served by all child care providers for lunch and snack to children 2-3 and 4-5 years-of-age were compared to 39% of the daily recommendation that should be provided by lunch and one snack.[115]

Additional variables that were created to describe dietary quality of the foods and beverages served by child care providers during the direct observation and the menu template collection included CACFP component variables of: 1) total snack score 2) fluid milk score 3)

meat/meat alternative score 4) vegetable score 5) fruit score and 6) grain score. A code of "0" was assigned for each variable if they did not meet the nutrition standards, including the type and preparation of the food. A code of "1" was assigned if they met the nutrition standards. If only a portion of the nutrition standards for that variable was met, a score of "0" was assigned. Each child care provider was assigned a total score ranging from 0-6 based on the six variables.

2. NAPSACC Variables

The NAP SACC assessment variables pre and post included the 44 assessment question responses from nine nutrition and physical activity areas. Each assessment question response was coded as a 3,2,1,0 or 99 Likert scale response. Best practice "Scoring" is as follows on the NAP SACC: achieving best practices (3), nearly achieving best practices (2), starting to achieve best practices, needs improvement (1), not achieving best practices (0) and not applicable (99).

3. Nutrition Education Tracking Variables

The nutrition professional tracking form was used to document the average nutrition education hours per provider, number of visits with each child care provider and the number of nutrition education best practice action items completed. Child care providers self-select based on assessment results and areas of weakness. The 17 possible practices included:

- offer fruit (not juice) at least 2 times a day
- offer vegetables (not fried) at least 2 times a day
- offer vegetables, other than potatoes, corn or green beans 1 or more times per day
- prepare cooked vegetables without added meat fat, margarine or butter
- create and maintain a written nutrition policy that is available and followed. Include items from the nutrition key areas
- communicate the nutrition policy to parents, families and visitors

- celebrate holidays with mostly healthy foods and non-food treats
- provide and enforce written guidelines for healthier food brought in and served for holidays and celebrations
- offer beans or lean meats at least once a day
- offer fried or pre-fried potatoes less than once a week or never
- include a combination of new and familiar foods on weekly menus
- include foods from a variety of cultures on weekly menus
- use a cycle menu of 3 weeks or greater that changes with the seasons
- child care providers offer planned nutrition education opportunities for children 1 time per week or more
- child care providers offer nutrition information to parents 2 times per year or more
- child care providers always serve meals family style (preschoolers serve themselves with limited help)
- caregivers gently encourage children to try new or less favorite foods in positive ways.

To assist with nutrition education program fidelity, whether and when child care homes completed the Healthier Child Care Environment intervention including the assessments and action plans, a tracking form was used. The tracker accumulated the magnitude of the completion of the intervention with the following options: 1) did not complete the pre assessment 2) completed the pre assessment but did not complete an action plan 3) completed the action plan but did not choose to improve three nutrition best practices within the child care environment, policies or practices 4) completed the action plan and chose to improve 3 or more nutrition best practices.

K. Data Analysis

The analysis for this component of the dissertation research included post data collection at 6 months compared to the pre data collection of foods and beverages served in the control and intervention child care provider groups. A p value of <.05 was considered statistically significant. An attrition rate of 3% was calculated from initial consent to the completion of the nutrition education intervention.

Using Stata, descriptive statistics were calculated on the child care providers in the intervention and control groups and chi-square analysis was used to compare the two groups. All foods and beverages served were analyzed for nutrients, food groups and CACFP nutrition standards. The CACFP and food group scoring protocol for control and intervention child care providers, as mentioned in Aim 1, will be used again in Aim 2. Linear regression was used to compare the pre- and post- nutrient variables differences with respect to the changes observed in the intervention and control groups. The Houseman test was performed to determine if an instrumental variable was needed to determine the magnitude of the Healthier Child Care Environment intervention on the food groups and nutrients. A smaller mean squared error result compared to the linear regression analysis resulted in linear regression with the post mean score serving as the outcome variable. The CACFP nutrition standard score of 0 to 6 was compared for control and intervention groups using ordinal logistic regression and for each individual CACFP component, binary logistic regression. The covariates of child care provider characteristics controlled in the model included: rural/urban county location, number of children licensed for in the home, CACFP participation and age category of children. The alignment of research questions and the statistical analysis methods used for Aim 2 is documented in Table 3.4.

Table 3.4 Aim 2 Alignment of Research Question

Aim	Research Question	Statistical Analysis	Variables/Outcomes
Aim 2	Does the *Healthier Child Care Environment* nutrition education intervention increase the dietary quality (nutrients and food groups) of foods and beverages served to children 2-5 years-of-age?	Linear regression	V1: Dependent: Post food group, nutrient or component mean V2: Independent: Pre food group, nutrient or component mean V3: Independent: Intervention/Control Variables controlled for: Rural/Urban, CACFP participation and age category of children
Aim 2	Does the *Healthier Child Care Environment* nutrition education intervention increase the dietary quality of foods and beverages evidenced by meeting the CACFP nutrition standards?	Ordinal and binary logistic regression	V1: Dependent: Post CACFP score V2: Independent: Pre CACFP score V3: Independent: Intervention/Control Variables controlled for: Rural/Urban, CACFP participation and age category of children

L. Aim 3 Methods Overview

The third component of this dissertation was to qualitatively gain insight into the barriers and facilitators for in-home child care providers in low-income areas in Michigan adhering to the CACFP nutrition standards, specifically those passed in 2017. Additionally questions within the barriers and facilitators included: 1) if and how child care providers are guided or assisted to meet the CACFP nutrition standards, but more importantly the overall dietary quality of meals and snacks and 2) how to improve and enhance CACFP compliance and to guide intervention and education development in the future. With the new CACFP nutrition standards undergoing the first major revision since 1968, child care providers are being expected to follow and comply with the new nutrition standards to receive reimbursement for the foods and beverages they serve in child care. However, complying with specified rules especially the new nutrition standards, which were revised and implemented in October of 2017, may not always be easy or fully understood by child care providers.

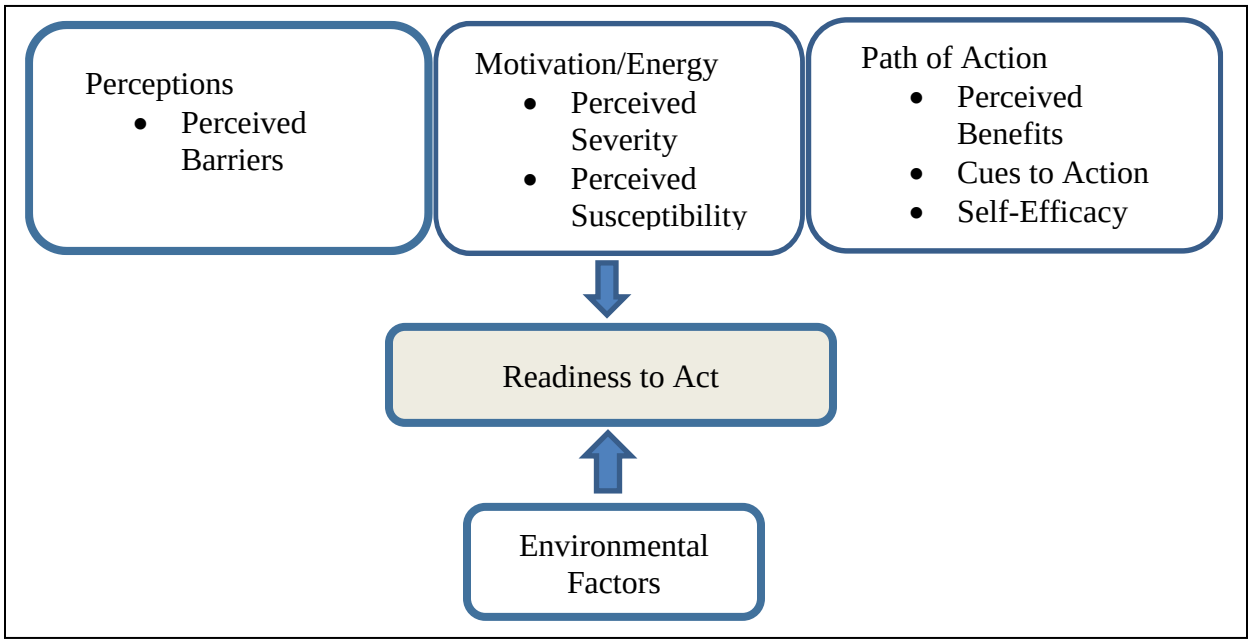
The theoretical foundation for this qualitative study was based on the Health Belief Model and the Self-Determination Theory.[104-107] These theories were selected because 1) the health belief model can help to explain an individual's beliefs and attitudes, perceived benefits and/or barriers including the availability of resources relative to the nutrition standards 2) the self-determination theory can explain one's motives for adopting certain practices, specifically the nutrition standards as they pertain to the current research.

The Health Belief Model, which dates back to the 1950's, explains health behavior changes associated with individuals' beliefs and attitudes, perceived benefits and barriers,[104,108] which can be influenced by self-efficacy and cues to action. The Health Belief Model articulates that behavior change is initiated by 1) readiness to take action (motivation), which is based on a

balance of health-related beliefs and 2) environmental factors.[104] This model focuses on how society and individuals change beliefs or activate those that already exist by removing barriers.[104]

The Health Belief Model, Figure 3.3, was used in this study to frame the explanation for how an individual's beliefs, expectations, and goals are incorporated into child care provider behavior of the foods and beverages they serve in their home. This model proposes that an individual's likelihood of a behavior change or the readiness to act depends on perceived barriers, self-efficacy, motivation, perceived benefits and cues to action (including external resources). The model was adjusted by adding in the impact of environmental factors as the Health Belief Model does not account for environmental factors that may prohibit or promote the recommended action.[108]

Figure 3.3 Health Belief Model Representing How Perceptions, Motivation, Path of Action and Environmental Factors Influence Action



Adapted from Health Behavior and Health Education. Theory, Research and Practice. Glanz et al, 2002.

Many studies have used the Health Belief Model as a framework for explaining how health-related behaviors influence adult and childhood obesity. The Health Belief Model has

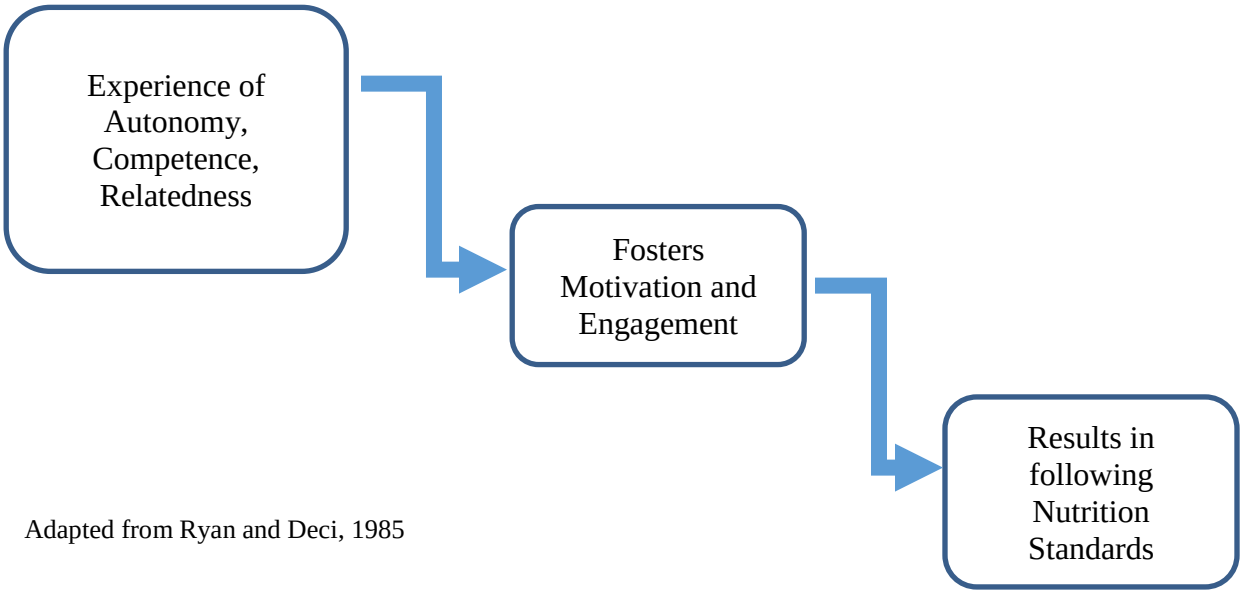
typically been used in nutrition as a framework for explaining how health behaviors influence adult and childhood obesity.[103] Within the context of child care, it is possible that some elements of the model are inherent in selection of foods and beverages served and CACFP nutrition standard adherence and non-compliance. Results from a qualitative study that utilized the health belief model, with family child care providers, found that cultural influences, provider training, types of feeding, perceived responsibility and program regulations, such as CACFP, were the key factors that influenced how providers fed preschool-aged children.[116]

The Self-Determination theory, represents a broad framework for the study of human motivation and provides a basis for gaining insight into child care provider food and beverage decision-making process relative to what they serve.[107] This theory describes the interplay between the extrinsic forces acting on persons and the intrinsic motives and needs inherent in an individual, while also taking into account social and cultural factors.[107] It addresses the questions of why people do what they do and the costs and benefits of various ways of socially regulating or promoting behavior.[107] Child care providers may use extrinsic motivation to encourage children to consume vegetables.[117]

The Self-Determination theory, Figure 3.4, is also used in this study to determine the motivations for child care providers to serve healthy foods. Self-Determination theory focuses explicitly on what motivates people to change behaviors and relevant to this qualitative portion, specifically the motivation to align with the CACFP nutrition standards.[118] Ryan and Deci propose three basic human needs involved in self-determination, which motivate people to initiate behavior which include: autonomy, competence and relatedness.[107] When people are more autonomous, motivated more so by their value for the behavior or other goals that are served by engaging in the behavior, or by their interest and enjoyment of the behavior, they tend

to be more persistent in behavior, feel more satisfied, and have feelings of higher well-being overall.[107] Competence refers to being effective in one's activity and relatedness refers to the need to feel connected and belongingness with others.[107]

Figure 3.4 Model Conceptualization of Self-Determination Theory

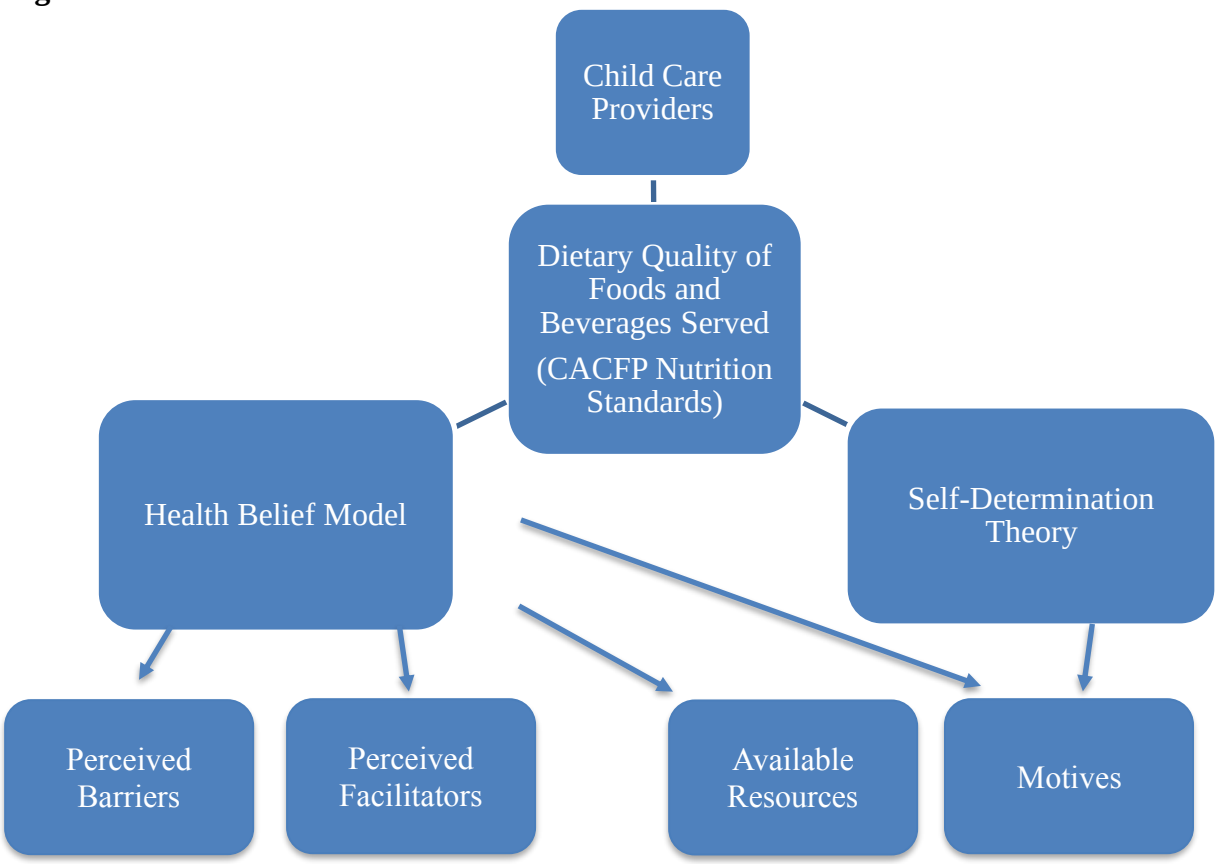


Adapted from Ryan and Deci, 1985

Studies using the self-determination theory have been successful in explaining the motives for behavior change. An intervention study targeting child care homes and centers utilized the self-determination theory to identify factors influencing the behaviors of child care owners such as expectations and expectancies, autonomy, competence and relatedness.[119] Shim and colleagues indicated that caregivers may influence preschoolers to consume a greater quantity of fruits and vegetables by practicing feeding behaviors that encourage child autonomy in food choice, competence, and positive relatedness, such as the establishment of a food environment with easy access to vegetables.[117] Although focused on physical activity within an adolescent population, a study using the self-determination theory, showcased the importance of facilitating intrinsic motivation with a supportive physical activity environment in which adolescents can satisfy their needs for autonomy, competence, and relatedness.[120]

Figure 3.5 shows the study model which integrated relevant concepts in both the Health Belief Model and Self-Determination theory that provided insight into what influenced child care providers decisions regarding what foods and beverages they serve and the relevance to the CACFP nutrition standards. This integrated model prioritized perceived barriers and facilitators to meeting or not meeting the CACFP nutrition standards, external resources and motivations that impact child care providers' food and beverage decisions relative to the CACFP nutrition standards.

Figure 3.5 Theoretical Model



Qualitative, semi-structured interviews were used because they enabled a more conversational approach, which allowed the primary researcher to foster a notion of partnership

with participants and elicit richer input.[121] A modified semi-structured interview guide that was previously used to identify barriers and facilitators to practicing family-style meal service[121] was adapted to inquire about the barriers, facilitators, and motives of in-home child care providers to serving foods and beverages that meet CACFP nutrition standards and if and how resources in the community such as community organizations may be influential (APPENDIX I: Semi-Structured Interview Guide) based on the Health Belief Model and Self-Determination Theory.

Adherence to the 2017 CACFP nutrition standards are specifically focused on the following new nutrition standards:

- Grain based desserts are not allowed
- Fruit and vegetables are now separate components
- Whole-grain rich foods must be served at least once per day
- Yogurt must contain ≤ 23 grams of sugar per 6 ounces
- Breakfast cereal must contain ≤ 6 grams of sugar per 1 ounce
- Flavored milk for children ≤ 5 years is not allowed
- 100% Juice can only be served once per day to meet the fruit and vegetable requirement for children ages 1-18 years of age and not at all for infants (less than 1 year of age)
- Foods cannot be deep fried on-site.

M. Sample and Recruitment

Participants for this study were selected from all child care providers who had been recruited from Aim 1 and Aim 2, using purposive sampling to allow for diverse perceptions from multiple child care providers.[107,122] Providers were sampled based on their primary

differentiating characteristics (CACFP participation, rural and urban location, race- ethnicity and licensure status (licensed for 6 children, 12 children or unlicensed) which may be influential in meal and snack serving practices. A minimum of one child care provider was sampled from each of the 13 child care provider characteristic categories (Table 3.5).

Table 3.5 Matrix of Qualitative Sampling

Category	Options			
CACFP Participation	Sponsor 1	Sponsor 2	Sponsor 3	Not participating
Licensure Status	Licensed – 6 children (family)	Licensed – 12 children (group)	Unlicensed	
Geographic county location	Urban	Rural		
Child care Provider Race	White	Black		
Child care Provider Ethnicity	Hispanic/Latino	Not Hispanic		

Selected child care providers were invited to participate in the study via a phone call from the primary researcher. A telephone script was used, (APPENDIX J: Qualitative Telephone Recruitment Script), to explain the purpose and format of the interview, re-check eligibility from their prior participation in previous components of the dissertation and to schedule a virtual semi-structured interview. Recruitment continued until theoretical data saturation was reached where responses were not repeated or introduced. A sample size of at least 15-20 child care providers was estimated, based on previous qualitative research with semi-structured interviews (n=18) addressing barriers and facilitators experienced by child care providers to serving meals family style to preschool children in Headstart.[123] Electronic gift cards of $20 were given after completion of the interview to incentivize participation in the semi-structured interviews, which required 45-60 minutes for completion. A total of twenty child care provider interviews were conducted.

N. Data Collection Procedures and Instruments

Child care providers who agreed to participate were e-mailed a consent form, login phone number and Zoom link after agreeing to participate in the interview during the telephone recruitment. Zoom technology is a web-based platform used to host webinars (online meetings) and phone meetings. Therefore, access to a computer, phone, tablet, IPAD or mobile device was required for each child care provider. The primary researcher read the consent form to participants via Zoom if they did not read the e-mailed copy prior to the interview and asked for their verbal consent to participate in the study. Virtual, semi-structured interviews followed an interview guide (APPENDIX I: Semi-Structured Interview Guide). The interview guide was pilot tested for expert content validity with three researchers with experience in qualitative research design and two child care providers to establish face validity. Pilot interviews were also used to confirm ease of process, allow for refinement, and establish exact timing. Table 3.6 outlines the theories, research questions and interview questions used during the interviews.

Table 3.6 Theory, Research Question and Interview Question Alignment

Theory	Research Question	Interview Question
Health Belief Model Self-Determination Theory	What are the perceived barriers to serving foods and beverages that meet the CACFP nutrition standards? What are the perceived facilitators, including motives, to serving foods and beverages that meet the CACFP nutrition standards?	a) What can you tell us about the kinds of beverages/drinks that you serve? • What makes it easy to serve these beverages? • What makes it difficult to serve beverages that you would like to give to the children? • What helps you decide what beverages that you actually serve? b) What can you tell us about the fruits and vegetables that you serve? • What makes it easy to serve fruits and vegetables? • What makes it difficult to serve fruits and vegetables? • What helps you decide what fruits and vegetables that you actually serve? c) What can you tell us about starchy foods that are not vegetables that you serve? • What makes it easy to serve these starchy foods? • What makes it difficult to serve these starchy foods? • What helps you decide what starchy foods that you actually serve? d) What can you tell us about the type of yogurt you serve? • What makes it easy to serve these kinds of yogurt? • What makes it difficult to serve these kinds of yogurt? • What helps you decide what kind yogurt you actually serve? e) What can you tell us about the breakfast cereal you serve? • What makes it easy to serve these kinds of cereal? • What makes it difficult to serve these kinds of cereal? • What helps you decide what cereal you actually serve? f) What can you tell us about the kinds of desserts/snacks/sweet treats that you serve? • Can you give us some examples? • What helps you decide on the desserts/snacks/sweet treats that you actually serve? g) What can you tell us about how you prepare foods? • What food preparation methods are easier to use at your home for the children? Why? • What food preparation methods are difficult to use? Why?

Table 3.6 (cont'd)

	How do community organizations and groups influence child care provider's ability to meet the CACFP nutrition standards?	• What helps you decide what food preparation method you should use for the foods for the children? 1) What helps you decide what foods and beverages you will serve to the children you care for? 2) What do you know about government nutrition expectations? 3) Are there any recommendations you have that will help child care providers serve foods and beverages that meet government nutrition expectations? 4) Are there any challenges that you may have that prevent you from serving foods and beverages that you think would meet government nutrition expectations? 5) What are examples of helpful information you have received about foods and beverages that should be served to the children you care for? 6) What are examples of information that was not as helpful? 7) Where and from whom have you received information about types, kinds and amounts of foods and beverages you should serve to children in your care? 8) What kinds of things have you learned from this information that you received about foods and beverages? 9) What types of information or resources would make it easier for you and other day care providers to serve foods and beverages that meet government nutrition expectations?

All semi-structured interviews were led by the primary researcher, audio-recorded digitally for preparation of transcripts via Zoom and a trained undergraduate student also captured detailed notes. Interviews will also be recorded on a digital recorder as a back-up to the zoom recording. The interview began by assuring child care providers that no individual identifiers will be shared with anyone outside of the research team (2 primary researchers, a trained undergraduate research assistant, and an experienced graduate student secondary data coder) for individual responses. They were also informed that child care program practices were not being inspected. In order to reduce bias during data collection, the questions to all respondents were asked in the same order. The research assistant took notes during the interview. Data triangulation and consensus occurred through the use of an audit trail tracking of each step of the qualitative process including the selection of theories, research questions and interview questions, and alignment with the two theories, collection of data from multiple data sources, two data coders and the use of an interview guide.[121,122,124-127]

O. Data Analysis

Descriptive statistics were analyzed, using Microsoft Excel 2016, and included information of ethnicity and race of child care providers and children in their care, CACFP participation, license status, number and age of children cared for in the home, age of children cared for in the home and geographic county location. Qualitative analysis progressed through the six steps of thematic analysis outlined by Braun and Clarke, 1) becoming familiar with the data; 2) generating initial codes (categories) and applying them to recorded interview transcripts; 3) creating potential themes by examining all quotes associated with each code and organizing codes into themes; 4) refining themes by examining all codes and quotes associated with a theme, collapsing or eliminating as needed 5) defining and naming themes by describing the

essence of each theme and giving it a compelling name; and 6) producing the report [128]. The primary researcher and a graduate student with qualitative research training coded the data independently and resolved any discrepancies until consensus was reached. NVIVO, (version 12.0), was used to classify, sort and arrange information and examine relationships in the data. Themes from previous studies focused on healthy eating in child care centers included: time constraints, lack of training, lack of resources and support, priorities of child care providers as well child-related health concerns of the child care providers.[116] Facilitators included nutrition education training and resources from external organizations, CACFP sponsor organization training and technical support, continued reimbursement of meals and snacks, and the child care provider motivation for feeling influential in promoting healthy eating and physical activity behavior.[116]

Chapter 4 - Dietary Quality of Foods and Beverages Served by In-Home Child Care Providers

Target Journal: Journal of Nutrition Education and Behavior

A. Abstract

Objectives: The objectives of the study were to: 1) determine the dietary quality of foods and beverages served by in-home child care providers in low-income areas in Michigan, 2) determine the extent to which foods and beverages served compared to nutrition recommendations, 3) compare what is served to a written menu, and 4) determine whether in-home child care provider characteristics were associated with increased dietary quality.

Methods**:** Cross-sectional, observational study with in-home child care providers (n=116) from rural and urban Michigan counties (n=24) recruited from the Great Start to Quality Child care database. Foods and beverages served for one lunch and one snack to children 2-5 years of age collected via direct diet observation were coded into food groups, nutrients, and Child and Adult Care Feeding Program (CACFP) categories of fluid milk, fruit, vegetables, grains and meat/meat alternatives. Food group and nutrient amounts and CACFP scores were compared to recommendations using descriptive statistics and Wilcoxon rank sum test. Menus were compared and coded to observation results for matching foods and beverages. Single and multi-level binary logistic regression was used to compare the child care provider characteristics to dietary quality outcomes (significance level $p<0.05$).

Results: All food group recommendations were met by 2% and 3% of child care providers who served children 2-3 and 4-5 years-of-age, respectively with whole grains and vegetables the food groups least frequently met. The CACFP components of fluid milk, followed by vegetables and fruit failed to align with nutrition standards for 47%, 35%, and 36%

of providers. Only 40% of menus matched the observation of foods and beverages served. Providers were more likely to align with CACFP standards if caring for older children, 4-5 years of age.

Conclusions: Tailored efforts to address shortcomings in meeting recommendations among in-home child care providers are needed to enhance preschool children's nutrition.

B. Introduction

A significant public health issue among children 2-5 years-of-age is the prevalence of overweight or obese.[6] Diet is an important risk factor for obesity and adequate nutrition and eating habits are crucial to growth at a young age. Therefore, it is important to examine the dietary quality of meals and snacks served by child care providers as many young children are spending increasingly more hours in a child care setting. Sixty-one percent of children under five years of age are in some type of regular child care arrangement from 21-36 hours a week, meaning that a significant amount of their daily food and beverage consumption occurs in these settings.[1,2] Child care environments include center-based programs, preschools and Head Start classrooms, which can care for 12-36 children at a time, and in-home settings that care for one to twelve children at a time. In-home child care providers make up more than 80% of the total caregiving population in the United States[17] and over 60% of the total caregiving population in Michigan. Therefore, in-home child care providers have the potential to influence current and life-long healthy eating behaviors in young children as taste preferences and dietary habits are formed early in life.[129] Improving dietary quality and physical activity in child care settings has the capacity to improve nutritional adequacy and decrease obesity risk.[5,6]

Although much has been learned in the past decade relative to the influence that child care centers have on dietary quality and physical activity, there is a paucity of research that

focuses on in-home child care settings. In-home child care programs serve children from birth through age 12, with a mean age of four, but is most commonly utilized among children birth to three years of age.[17,84] In Michigan, the number of children cared for by licensed in-home child care provider may not exceed a total of 12.[83]

The Dietary Guidelines for Americans (DGA), which include Healthy U.S.-Style Pattern food group recommendations,[10] Dietary Reference Intakes (DRI)[11],and the American Heart Association[13] provide nutritional guidelines and standards for food groups, nutrients and an additional component, sugar, based on age, sex and physical activity levels. Calorie level recommendations for children 2-5 years of age range from 1,000 to 1,600 calories per day.[60] The Academy of Nutrition and Dietetics position paper for nutrition in child care recommends that children in full time child care receive 50-67% of recommended daily calories from the food and beverages served in child care.[59]

The Child and Adult Care Food Program (CACFP)[15] also provides nutritional guidelines and provides reimbursement to eligible child care providers for meals and snacks. Reimbursement for meals served in child care homes is based on income eligibility, with more reimbursement being available to low-income area providers. In 2016, the United States Department of Agriculture (USDA) Food and Nutrition Service revised the CACFP nutrition standards to improve the availability of key food groups, better meet the nutritional needs of infants, children, and adults, and to promote healthy eating habits.[14]

National surveys have shown that the total daily energy intake for preschoolers ages 2 to 6 years increased overall by 109 kcal between 1989 and 2008.[72,73] But, many young children are not meeting current recommendations for food groups or nutrients including vegetables, whole grains,

iron, calcium, vitamin E and potassium.[60,61,72] Intakes of synthetic folate, pre-formed vitamin A, zinc, and sodium have been reported to exceed the tolerable upper intake level in children, 2-6 years-of-age.[15] Vegetables are widely under-consumed by all ages and genders, including young children, with the current average intake of vegetables not meeting or exceeding one cup per day.[61, 18,19] Consumption of the vegetable subgroups is inadequate, for children ages 1-3 years, in all subcategories except for starchy vegetables.[11,75] French fries and other fried potatoes, consumed by one in five children, are the predominantly-consumed vegetable by this age group.[77] The average intake of whole grains is far below recommended levels across all age and gender groups.[60] The average dairy intake for children, ages 1 to 3 years, generally meets recommended intake through the consumption of fluid milk, cheese, yogurt and fortified soy beverages.[60] The most commonly consumed milk was whole with 34% and 27% of children two and three years of age consuming whole milk compared to 2%, 1% or skim milk.[77] The majority of children consumed unflavored, white milk but flavored milk was consumed by 10% and 14% of children two and three years of age respectively.[77] Consumption of low-nutrient dense foods and beverages such as sugar-sweetened beverages and foods high in total dietary fat is positively associated with an increased risk for a child to be overweight; 72% of toddlers consumed some type of dessert, sweet or sweetened beverage at least once in a day.[15,23,81]

The aims of this study were to assess the following: 1) dietary quality of foods and beverages served by in-home child care providers to children 2-5 years of age in low-income areas in Michigan, 2) the extent to which foods and beverages served align with nutritional guidelines, 3) the extent to which a written menu corresponds with foods and beverages served, and 4) whether in-home child care provider characteristics were associated with increased dietary quality. The focus was on in-home child care providers in low-income areas because families

who use in-home child care most often include children from low-income families, children from single-parent households, and children from racial and ethnic minorities.[4] Based on previous literature with child care centers [86,130-135], it was hypothesized that: 1) foods and beverages served for lunches and snacks in child care homes will not align with nutritional recommendations for vegetables, whole grains, refined grains, dietary fiber, carbohydrates, sugar, protein, saturated fat, sodium, vitamin E, vitamin D, iron, potassium, folate, vitamin A and zinc, 2) menus will align with what is served 80% of the time, and 3) child care providers will be more likely to serve foods and beverages that align with the CACFP nutrition standards if the provider participates in CACFP, cares for older children, and serves a larger number of children.

C. Methods

1. Study Sample

A cross-sectional, observational study design was used to collect data in 116 child care provider homes in 24 counties in Michigan. Study eligibility included: 1) being located in a low-income census tract, 2) providing care for two to twelve children between the ages of two and five and 3) serving meals and snacks. Provider and home are used interchangeably throughout the study and refer to 116 homes with 182 child care providers including primary and assistant providers in the home providing care.

2. Procedures

In-home child care providers were recruited from the Great Start to Quality website (https://stage.worklifesystems.com/parent/4), a database of child care providers in the state of Michigan. The database was used to search for cities and towns that were located within 24 Michigan counties that were selected due to the diversity in race and ethnicity as evidenced by the 2017 county health rankings and geographic representation of the county in terms of a rural

or urban classification by the United States Census Bureau.[109] Child care providers were classified as residing in low-income areas based on the CACFP area eligibility map, https://www.fns.usda.gov/areaeligibility. Only those child care providers whose address, when entered into the map, appeared in a red area were recruited into the study which corresponds with whether or not at least 50 percent of the children are eligible for free or reduced-price school meals in the attendance area of a local school or within a census tract area. Area eligibility is valid for five years.[16]

Trained research assistants recruited providers by calling providers from the Great Start to Quality database following a phone recruitment script. All child care providers called were placed on a call log to avoid duplication. Providers were recorded as not reachable if there was no response after three contact attempts. In addition, 10% of providers were recruited by convenience sampling through recommendations from nutrition professionals working for Michigan State University Extension and The Kidney Foundation of Michigan to reach providers from local networks. Providers recruited in this manner also met the study eligibility criteria.

Direct diet observation was used to estimate all foods and beverages served by the in-home child care providers to children two to five years of age, direct observation being the gold standard for research to estimate foods and beverages served and consumed by young children in early childhood settings.[16] The observation for each in-home child care provider included lunch and either a morning or afternoon snack during one day of observation. A maximum of four children, utilizing Ball and colleagues original direct diet observation data collection observation form, were observed at one time by one researcher. Children present who were under the age of two and over the age of six years were not observed. Observations and recruitment were completed by a total of six trained research assistants who were undergraduate junior or senior

level students majoring in dietetics and the primary researcher and all research assistants had ICC values above 0.85 in the lab and at the child care home trial observations. All research assistants were trained following the direct diet observation training protocol developed by Ball and colleagues.[27] A direct diet observation form was used to document the preparation, type and amount of foods and beverages served to children.[112] All foods and beverages served to children 2-5 years of age at breakfast, lunch, snack(s) and dinner were recorded by providers for Monday through Friday of the week the direct diet observation was completed via a menu template with instructions. All procedures followed were approved by the Michigan State University Human Research Protection Program.

3. Variables

The outcome variables used to describe dietary quality and compare foods and beverages to the guidelines were selected from previous dietary intake studies that reported intakes that were higher or lower than recommendations for children 2-5 years of age.[1,20,61,68,93,113,114,132,133] Foods and beverages served by in-home child care providers at observation, including portions served and second portions taken, were coded using Microsoft Excel 2013 into food groups after conversion into cup and ounce equivalents. Nutritionist Pro version 10.0, 2017-2018, was used to construct nutrient and component variables of interest from foods and beverages served. Variables constructed included: dairy, protein foods, seafood, nut/seeds/soy, total vegetables, dark green leafy vegetables, red or orange vegetables, starchy vegetables, other vegetables, beans/peas, fruit, total grains, whole grains and total refined grains. The nutrient and additional component variables included energy, dietary fat, saturated fat, carbohydrates, protein, dietary fiber, sodium, calcium, iron, total sugar, vitamin E, potassium, folate, vitamin A and zinc. For each home, variables were averaged within age groups to compile a mean score for each variable for

each age group (2-3 and 4-5 years). For the two providers that served family-style meals, the CACFP required standard portion amount was utilized for analysis.

Additional variables to describe dietary quality and assess compliance with CACFP guidelines included the CACFP nutrition standard component categories at snack and lunch. These variables included: 1) fluid milk score 2) meat/meat alternative score 3) vegetable score 4) fruit score 5) grain score and 6) total snack score. To determine CACFP variable scores, a code of "1" was assigned if they did serve foods and beverages that met the nutrition standards for both type of food and method of preparation of the food, and a code of "0" was assigned if they did not. Each observation and menu were coded by three individuals - the primary researcher and two research assistants. Any discrepancies were reviewed and resolved via consensus. A total score, ranging from 0-6, was totaled from the individual component scores. A score below six is associated with decreased dietary quality or not meeting the CACFP recommendations and a score of six is associated with meeting all CACFP nutrition standards.

To determine if a child care provider's written menus corresponded to one day's direct observation of foods and beverages served for lunch and one snack, a menu matching variable was created. The same process of assigning a score of 0 of 1 was used for the menu matching variables of both lunch and snack, lunch individually, snack individually and the lunch food groups of fruit, vegetable, protein, grain and dairy

To determine the child care provider characteristics that were associated with CACFP dietary quality, the predictor variables of interest included: urban or rural county location, participation in CACFP, CACFP Michigan sponsor organization, race of provider and the age category of children served in the home. Based on an independence test for collinearity, CACFP sponsor and CACFP participation were correlated so CACFP sponsor 1-3 and participation were

combined into one variable with four categorical options of CACFP participation with sponsor 1, sponsor 2, sponsor 3 and not participating in CACFP. Most providers were female, below the age of 60 years and licensed so these variables were not included in the model. CACFP participation was examined as a predictor to determine whether dietary quality was higher when providers were program participants, as has been found in previous studies. [63,64] Because it is unknown which provider characteristics are associated with dietary quality of foods and beverages served, all other characteristics were added into the model.

D. Data Analysis

Descriptive statistical analyses were completed for child care provider, home, and child characteristics, CACFP nutrition standards, food groups, components, nutrient and menu matching variables using STATA version 14.0 (Stata Corp., College Station, TX).

The mean, standard deviation, number and percentage of child care provider homes serving children 2-3 and 4-5 years-of-age was compiled for each food group, all food groups, nutrient and additional component variables. The means and number of providers meeting each recommendation was compared to 39% of the daily energy intake (25 plus 14%), 25% and 28% of daily calorie intake is consumed at lunch and two snack per day.[115,132,136] Tests of distribution indicated data was not normally distributed, therefore Wilcoxon rank-sum test was used to compare the average score for each variable to the recommended level. Pearson Chi-Square was used to compare if there was a difference between what was served to the 2-3 and 4-5 year-old-children for each recommendation. A p value of $<.05$ was considered statistically significant in all models.

Observations occurred during different months throughout the year and the snack occurred in the morning or afternoon so the season of the observation and the time of day of the

snack observations were compared with Pearson Chi-Square. No significant seasonal or time of day differences were found when comparing the food groups and nutrients in meals and snacks.

To determine the association of child care setting characteristics with CACFP adherence, an odds ratio of 1.8 was used as an index of effect size, based on preliminary data collection. An effect size was used, as previous research studies in child care homes are limited, and effect sizes are not well documented. G*Power Version 3.1[111] was used to calculate a sample size based on an ad hoc z test using logistic regression of 116 child care homes. A multi-level (observation level, n=696 which is 116 providers with 6 observations for each CACFP component each) binary logistic regression model assessed the likelihood of meeting the CACFP lunch requirements for each individual CACFP component and each provider characteristic. For the reference CACFP component, meat/meat alternatives was chosen because 1) the meat/meat alternative guideline was met by the majority (80%), of providers at lunch and 2) results showed the greatest associations between compliance with the meat/meat alternative guideline and compliance with other CACFP components and with provider characteristics. A single level (home level, n=116), binary and ordinal logistic regression were used to see which child care provider characteristics were most likely to be associated with fulfilling the CACFP requirements for each component (fruit, vegetable, grain, fluid milk and meat/meat alternative). A p value of $<.05$ was considered statistically significant in all models.

E. Results

A total of 116 child care provider homes, made up of 182 providers and assistants and 378 children, participated in the study. Most homes were located in urban counties based on the US census bureau classification, licensed in the State of Michigan, and participated in the Child and Adult Care Food Program (CACFP) (Table 4.1). Of the 182 child care providers, the

majority of providers were female, under the age of 60 years, and of either Caucasian or African American race and not of Hispanic Ethnicity. The mean age of children cared for in the home was three years. In the 116 child care provider homes, 49 (43%) of the homes were licensed to care for up to 12 children and are classified in Michigan as a group home provider; 67 (58%) cared for up to 6 children and are classified as a family home provider. A total of 109 homes served children 2-3 years and 76 homes served children 4-5 years-of-age, respectively present on observation day with the remaining serving both age categories in their home.

Table 4.1: Child Care Provider, Home and Child Characteristics

Child Care Providers n=182	
Gender	**N (%)**
Female	179 (98.35)
Age	
Under 60	157 (86.26)
60+	25 (13.74)
Race	
Caucasian	119 (65.38)
African American	58 (31.87)
Multiracial/Other	5 (2.75)
Ethnicity	
Hispanic	6 (3.30)
Child Care Homes n=116	
Location	
Rural	24 (20.69)
Urban	92 (79.31)
Number of Children Licensed for	
Six	67 (57.76)
Twelve	49 (42.24)
Licensed	
Yes	109 (93.97)
CACFP Participation	
Sponsor 1	56 (48.28)
Sponsor 2	9 (07.76)
Sponsor 3	41 (35.34)
Not Participating	10 (8.62)
Age Category of Children Served	
2-3 Years	39 (23.88)
4-5 Years	9 (7.76)
Both 2-3 and 4-5 Years	68 (58.62)
Children (n=378)	
Age of Children Observed in the Home	
Two	152 (40)
Three	117 (31)
	2-3 Years = 109 Homes
Four	92 (24)
Five	17 (5)
	4-5 Years = 76 Homes
	Mean SD
Median Age of Children Cared for in the Home	2.90 1.20

1. Comparison with Healthy U.S.-Style Eating Pattern Recommendations

When comparing the foods and beverages served for lunch and snack to the Healthy-U.S.-Style Eating Pattern recommendations, the majority of providers did not align with guidelines for either children 2-3 or 4-5 years-of-age for whole grains (25% and 49% respectively) and vegetables, (13% and 16% respectively) (Table 4.2). Additionally, for children 4-5 years-of-age, most homes failed to meet the recommended guidelines in all categories except protein foods. Only 2% and 3% of child care providers who served children 2-3 and 4-5 years-of-age, respectively, met all food group recommendations. When comparing the two age categories, there were significant ($p<.01$) differences in homes meeting guidelines for each food group; 2 to 3-year-old children were more likely to be served according to guidelines than were 4 to 5-year-old children for all grains, fruit, dairy products and protein foods. Table 4.3 quantifies the differences between age groups in extent to which guidelines are met for each age group. For example, whole grains were served at 38% and 70% less than the recommended level for children 2-3 and 4-5 years-of-age respectively, and vegetables were served at 67% below the recommended level to both age groups.

Table 4.2 Healthy U.S.-Style Eating Pattern Recommendation Alignment for Groups of Foods Served to Children 2-3 or 4-5 Years-of-Age by In-Home Child Care Providers (n=116)

	Calculated[1] Recommended[2] Intake from Lunch and One Snack		Observed Foods and Beverages Served		Number (%) of Child Care Homes that Served Recommended Amounts		Association Between Age Categories
Food Group	**2-3 Years**	**4-5 Years**	**2-3 Years in 109 homes**	**4-5 Years in 76 homes**	**Children 2-3 Years in 109 homes**	**Children 4-5 Years in 76 homes**	
			Mean (SD)	**Mean (SD)**	**n (%)**	**n (%)**	***p* value**
Grains (oz.)	1.6	2.0	2.28 (1.59)	2.28 (1.73)	66 (61)	37 (49)	<0.001
Whole grains (oz.)	0.8	1.0	0.73 (1.35)	0.69 (1.30)	27 (25)	37 (49)	<0.01
Vegetables (cups)	0.6	0.6	0.35 (0.28)	0.37 (0.32)	14 (13)	12 (16)	<0.001
Fruit (cups)	0.4	0.6	0.74 (0.51)	0.72 (0.55)	84 (77)	36 (47)	<0.001
Dairy (cups)	1.00	1.00	1.06 (0.54)	0.97 (0.59)	60 (54)	36 (47)	<0.001
Protein (oz.)	0.8	1.6	1.60 (1.29)	1.52 (1.36)	78 (72)	41 (54)	<0.001
All groups					4 (3)	2 (2)	<0.001

[1] Calculated based on 39% of daily recommended intake from lunch and one snack[115]
[2] Recommended Intake from Healthy U.S.-Style Eating Pattern[10]

Table 4.3 Mean Amounts of Food Groups Served by 116 In-Home Child Care Homes Compared to Healthy U.S.-Style Eating Pattern Recommendations

Food Group	Calculated[1] Recommended [2] Intake from Lunch and One Snack		Lunch and Snack Served Compared to Recommended Intake			Lunch and Snack Served Compared to Recommended Intake		
	2-3 Years	4-5 Years	Children 2-3 Years In 109 homes			Children 4-5 Years In 76 homes		
			Mean (SD)	% difference[3]	*p*-value	Mean (SD)	% difference[3]	*p*-value
Grains (oz.)	1.6	2.0	2.3 (1.6)	144	≤.001	2.3 (1.7)	115	0.58
Whole grains (oz.)	0.8	1.0	0.3 (0.43)	(38)	≤.001	0.7 (1.3)	(70)	≤.001
Vegetables (cups)	0.6	0.6	0.4 (0.3)	(67)	≤.001	0.4 (0.3)	(67)	≤.001
Fruit (cups)	0.4	0.6	0.7 (0.5)	175	≤.001	0.7 (0.6)	117	0.47
Dairy (cups)	1.00	1.00	1.0 (0.6)	100	0.58	0.7 (0.7)	(70)	0.41
Protein (oz.)	0.8	1.6	1.6 (1.3)	200	≤.001	1.5 (1.4)	(94)	0.15

[1] Calculated based on 39% of daily recommended intake from lunch and one snack[115]
[2] Recommended Intake from Healthy U.S.-Style Eating Patterns
[3] Difference between served and recommended. Numbers in parentheses represent that less of the food group was served than recommended by the guidelines; numbers without parentheses represent that more of the food group was served than recommended.

For food categories with weekly recommendations, including the vegetable subgroups, most providers did not serve those subgroups at lunch or for a snack on the day observations were made. (Table 4.4). For dark green leafy vegetables, only 5% and 4% of providers met recommendations for children 2-3 and 4-5 years-of-age respectively. The vegetable subgroups served most often include other, starchy, and red/orange. Vegetables most frequently served were carrots, tomatoes and green beans (data not shown). French fries were served by 6% of the providers (data not shown).

Table 4.4 Healthy U.S.-Style Eating Pattern Recommendation Alignment for Vegetable Subgroups Served to Children 2-3 or 4-5 Years-of-Age by In-Home Child Care Providers (n=116)

Food Subgroup	Calculated[1] Recommended [2]Intake from Lunch and One Snack		Observed Foods and Beverages Served Mean (SD)		Number (%) of Child Care Homes that Served Recommended Amounts	
	2-3 Years	4-5 Years	Children 2-3 Years in 109 homes	Children 4-5 Years in 76 homes	Children 2-3 Years in 109 homes	Children 4-5 Years in 76 homes
Dark green leafy vegetables (cups)	0.03	0.06	0.01 (0.04)	0.01 (0.04)	5 (5)	3 (4)
Red/orange vegetables (cups)	0.14	0.17	0.14 (0.23)	0.15 (0.25)	28 (26)	20 (26)
Starchy vegetables (cups)	0.11	0.20	0.07 (0.13)	0.08 (0.15)	28 (26)	15 (20)
Beans/peas/legumes (cups)	0.03	0.03	0.05 (0.15)	0.02 (0.06)	20 (18)	8 (11)
Other vegetables (cups)	0.08	0.14	0.08 (0.11)	0.11 (0.16)	38 (35)	23 (30)
Seafood (oz.)	0.17	0.33	0.08 (0.11)	0.11 (0.16)	5 (5)	4 (5)
Nuts/seeds/soy	0.11	0.17	0.05 (0.15	0.02 (0.06)	27 (25)	16 (21)

[1] Calculated based on 39% of daily recommended intake from lunch and one snack[115115]

[2] Recommended Intake from Healthy U.S.-Style Eating Patterns[10]

2. Comparisons with DRI and American Heart Association Recommendations

Comparing food served with national recommendations for macronutrients and additional components, kilocalories in one lunch and one snack exceeded recommendations for 50% and 20% of homes for 2-3-year-olds and 4-5-year-olds respectively and were lower than recommendations for 15% and 38% of homes (Table 4.5). Most homes were also not meeting recommendations for the percentage of total energy from fat, saturated fat, or carbohydrates, however recommendations for percent of calories from protein were met by most homes. The recommendations to serve less than 10% of calories from fat was met by 31% and 47% for homes or 2-4-year-olds and 4-5-year-olds respectively. Recommendations for maximum grams of sugar were met by only 2% and 4% of the homes. Table 4.6 further shows that, on average, child care homes served more than triple the maximum sugar recommended for both age categories.

The micronutrient recommendations least frequently met were for vitamin D, potassium, vitamin E and sodium (Table 4.6). For vitamin D, only 6% and 3% of homes served recommendations for children 2-3 and 4-5 years-of-age respectively. For potassium, only17% and 4% of homes served the recommended amount to children ages 2-3 and 4-5 respectively. vitamin E, 25% and 12% of homes met it while for sodium 28% and 49% of homes exceeded the recommendations for children 2-3 and 4-5 years-of-age respectively. Looking further to determine the extent to which they were low, vitamin D content of foods served amounted to 55% and 43% of recommendations, while potassium amounted to 71% and 52% of the recommended intake for 2-3-year-olds and 4-5-year-olds respectively (Table 4.7). Additionally, sodium was served to 2-3 year-old-children at 140% of the recommendation levels, and vitamin

E was served at 80% and 56% of the recommended levels for 2-3-year-olds and 4-5-year-olds respectively.

Table 4.5 Child Care Provider Homes (n=116) Lunch and Snack Serving Adherence to Macronutrient or Component Recommendations for Children 2-3 or 4-5 Years-of-Age

Macronutrients and Components	Calculated[1] Recommended[2] Intake from lunch and One Snack		Observed Foods and Beverages Served Mean (SD)		Number (%) of Child Care Homes that Served Recommended Amounts			
	2-3 Years	4-5 Years	Children 2-3 Years in 109 homes	Children 4-5 Years in 76 homes	Range	Children 2-3 Years in 109 Homes	Range	Children 4-5 Years In 76 Homes
Energy (kcal)	390-546	468-702	576.19 (199.51)	547.56 (218.11)	<390	16 (15)	<468	29 (38)
					390-546	39 (36)	468-702	32 (42)
					>546	54 (50)	>702	15 (20)
Sugar, (maximum) (g)	9.75	9.75	37.77 (18.13)	34.89 (21.00)		2 (2)		3 (4)
Dietary Fiber (g)	5	7	5.63 (5.18)	5.04 (3.10)		51 (47)		13 (17)
As a percentage of total energy								
Fat (%)	30-40	25-35	40 (21)	31 (18)		33 (30)		24 (32)
Saturated Fat (%)	<10	<10	14 (9)	11 (7)		33 (31)		35 (47)
Carbohydrates (%)	45-65	45-65	66 (30)	53 (24)		47 (44)		36 (48)
Protein (%)	5-20	10-30	22 (10)	18 (9)		61 (56)		56 (75)

[1] Calculated based on 39% of daily recommended intake from lunch and one snack[115]

[2] Recommendations from Dietary Reference Intakes[12] and American Heart Association[13]

Table 4.6 Child Care Provider Homes (n=116) Lunch and Snack Serving Adherence to Micronutrient Recommendations for Children 2-3 or 4-5 Years-of-Age

Micronutrients	Calculated[1] Recommended[2] Intake from lunch and One Snack		Observed Foods and Beverages Served Mean (SD)		Number (%) of Child Care Homes that Served Recommended Amounts	
	2-3 Years	4-5 Years	Children 2-3 Years in 109 homes	Children 4-5 Years in 76 homes	Children 2-3 Years in 109 Homes	Children 4-5 Years in 76 Homes
Vitamin C (mg)	5.9	9.8	34.20 (31.11)	37.57 (46.38)	93 (85)	53 (70)
Vitamin E (mg)	2.3	2.7	1.83 (2.07)	1.52 (1.69)	27 (25)	9 (12)
Folate (ug DFE)	58.5	78	83.28 (58.31)	81.76 (57.17)	66 (60)	34 (45)
Calcium (mg)	273	390	443.39 (207.76)	409.02 (212.67)	85 (77)	37 (49)
Vitamin A (ug RAE)	117	156	270.15 (198.73)	251.89 (171.85)	90 (83)	53 (70)
Vitamin D (mcg)	5.9	5.9	3.23 (2.97)	2.55 (1.54)	7 (6))	2 (3))
Iron (mg)	2.7	3.9	2.98 (1.80)	2.87 (1.80)	50 (46)	16 (21)
Zinc (mg)	1.2	2.7	2.79 (2.15)	2.42 (1.65)	92 (84)	25 (33)
Sodium (mg)	585	741	832.21 (443.14)	785.04 (413.09)	31 (28)	37 (49)
Magnesium (mg)	31.2	50.7	74.79 (44.21)	67.28 (41.05)	102 (94)	44 (60)
Potassium (mg)	1,170	1,482	834.75 (409.28)	763.29 (377.99)	19 (17)	3 (4)

[1] Calculated based on 39% of daily recommended intake from lunch and one snack[115]

[2] Recommendations from Dietary Reference Intakes[12]

Table 4.7 Wilcoxon Rank Sum Results Comparing Mean Amounts of Nutrients and Food Components Served by 116 In-Home Child Care Providers to Dietary Reference Intake and American Heart Association Sugar Recommendations

Food Group	Calculated[1] Recommended[2] Intake from Lunch and one Snack		Nutrients Served for Lunch and Snack			Nutrients Served for Lunch and Snack		
	2-3 Years	4-5 Years	Children 2-3 Years in 109 homes			Children 4-5 Years in 76 homes		
			Mean (SD)	% dif[3]	*p*-value	Mean (SD)	% dif[3]	*p*-value
Energy (kcal)	390-546	468-702	576.19 (199.56)	106	0.63	547.56 (218.11)	In Range	
Fat (%)	30-40	25-35	0.40 (0.21)	In Range		0.31 (0.18)	In Range	
Saturated Fat (%)	<10	<10	0.14 (0.09)	140	≤.001	0.11 (0.07)	110	≤.001
Carbohydrates (%)	45-65	45-65	0.66 (0.30)	101	≤.001	0.53 (0.24)	In Range	
Sugar (g)	9.75	9.75	37.77 (18.13)	387	≤.001	34.89 (21.00)	358	≤.001
Protein (%)	5-20	10-30	0.22 (0.10)	110	≤.001	0.18 (0.09)	In Range	
Dietary Fiber (g)	5	7	5.63 (5.18)	113	0.77	5.04 (3.10)	(72)	≤.001
Vitamin C (mg)	5.9	9.8	34.20 (31.11)	580	≤.001	37.57 (46.38)	383	≤.001
Vitamin E (mg)	2.3	2.7	1.83 (2.07)	(80)	≤.001	1.52 (1.69)	(56)	≤.001
Folate (ug DFE)	58.5	78	83.28 (58.31)	142	≤.001	81.76 (57.17)	105	0.76
Calcium (mg)	273	390	443.39 (207.76)	162	≤.001	409.02 (212.67)	105	0.55
Vitamin A (ug RAE)	117	156	270.15 (198.73)	231	≤.001	251.89 (171.85)	161	≤.001
Vitamin D (mcg)	5.9	5.9	3.23 (2.97)	(55)	≤.001	2.55 (1.54)	(43)	≤.001
Iron (mg)	2.7	3.9	2.98 (1.80)	110	0.99	2.87 (1.80)	(74)	≤.001
Zinc (mg)	1.2	2.7	2.79 (2.15)	233	≤.001	2.42 (1.65)	(90)	0.02
Sodium (mg)	585	741	832.21 (443.14)	142	≤.001	785.04 (413.09)	106	0.67
Magnesium (mg)	31.2	50.7	74.79 (44.21)	240	≤.001	67.28 (41.05)	133	≤.01
Potassium (mg)	1,170	1,482	834.75 (409.28)	(71)	≤.001	763.29 (377.99)	(52)	≤.001

[1] 39% of the daily recommended dietary reference intake was calculated.

[2] Recommendations from Dietary Reference Intakes[12] and American Heart Association Sugar recommendations[11]

[3] For nutrients with a recommended range, the median was used for calculating the percentage difference between the recommended intake and the nutrient served

3. Comparison with CACFP Nutrition Standards

The CACFP standards require providers to choose two of the five required components for snacks. In the majority of child care provider homes (73%) served a snack that aligned with this standard (Table 4.8**)**. The majority of the child care providers chose to serve fruit (54%) and grains (68%) for snacks (data not shown).

Compliance with the lunch standard was not as common as it was with the snack standard. Only 23% of child care provider homes served a lunch that met all the nutrition standards. Standards for nutrition components that were most frequently not met were for fluid milk (47%), vegetables (35%) and fruit (36%).

Table 4.8 Child Care Home Compliance with CACFP Meal Components Served at Lunch and Snack (n=116)

Lunch	n (%)
Meeting Zero Components	3 (3)
Meeting One Component	7 (6)
Meeting Two Components	21 (18)
Meeting Three Components	31 (27)
Meeting Four Components	27 (23)
Meeting All Components	27 (23)
Fluid Milk	
Meeting (Score of 1)	62 (53)
Not Meeting (Score of 0)	54 (47)
Meat/Meat Alternative	
Meeting	93 (80)
Not Meeting	23 (20)
Vegetable	
Meeting	75 (65)
Not Meeting	41 (35)
Fruit	
Meeting	73 (64)
Not Meeting	41 (36)
Grain	
Meeting	87 (75)
Not Meeting	29 (25)
Snack	
Meeting	85 (73)
Not Meeting	31 (27)

4. Characteristics of Child Care Homes Associated with CACFP Standards

When determining whether child care home characteristics were associated with meeting the CACFP nutrition standards, results show that homes serving only children 4-5 years-of-age are 3.19 times more likely ($p<0.05$) to meet the CACFP nutritional standards compared to providers that served both 2-3 and 4-5 year-old children (Table 4.9). Individual CACFP component nutrition standard scores were not associated with any child care provider characteristics (Table 4.10). The intraclass correlation was calculated at 0.18 suggesting that would be meaningful to use a multilevel model to

investigate the clustering within the home. When a multilevel model was used at the observation level, where children are nested within a child care home (a wide format of the data, n=696), again no child care provider characteristics were associated with the CACFP score (Table 4.11).

Table 4.9 Characteristics of Child Care Providers Associated with Meeting CACFP Standards: Single-Level Logistic Regression (n=116)

Child Care Characteristics		CACFP Ordinal Score 0-6		Meeting all CACFP Standards Binary Score of 6	
		Odds Ratio (SE)	95% Confidence Interval	Odds Ratio (SE)	95% Confidence Interval
CACFP[1]	Sponsor 1	0.51 (0.33)	0.15-1.82	0.37 (0.43)	0.04-3.59
	Sponsor 2	2.24 (1.44)	0.63-7.93	3.24 (2.50)	0.71-14.74
	Sponsor 3	1.03 (1.34)	0.50-2.12	1.09 (0.60)	0.38-3.18
Number of children licensed for in the home Twelve[2]		0.67 (0.25)	0.32-1.38	0.95 (0.52)	0.32-2.75
Age Category[3]	2-3 Years	1.11 (0.71)	0.31-3.92	2.26 (2.09)	0.37-13.84
	4-5 Years	1.48 (0.56)	0.70-3.10	*3.19 (1.70)	1.12-9.05
County location Rural[4]		1.71 (0.71)	0.76-3.85	1.42 (0.87)	0.43-4.69

*$p<0.05$

References: [1] not CACFP participating, [2] licensed for 6 children, [3] both 2-3 and 4-5 age categories, [4]urban county location

Table 4.10 Characteristics of Child Care Homes Associated with Meeting Individual CACFP Component Standards: Single-level Logistic Regression (n=116)

Child Care Characteristics	Fluid Milk		Meat/Meat Alt.		Fruit		Vegetable		Grain		Snack	
	Odds Ratio (SE)	95% CI	Odds Ratio (SE)	95% CI	Odds Ratio (SE)	95% CI	Odds Ratio (SE)	95% CI	Odds Ratio (SE)	95% CI	Odds Ratio (SE)	95% CI
CACFP Sponsor 1[1]	0.44 (0.33)	0.10-1.89	0.67 (0.55)	0.14-3.33	0.30 (0.22)	0.07-1.28	0.88 (0.65)	0.21-3.78	0.56 (0.46)	0.11-2.78	0.72 (0.54)	0.16-3.14
CACFP Sponsor 2[1]	2.42 (1.83)	0.55-10.67	2.24 (2.52)	0.25-20.24	1.19 (0.91)	0.26-5.34	1.24 (0.94)	0.28-5.47	1.66 (1.45)	0.30-9.15	2.00 (1.71)	0.37-10.72
CACFP Sponsor 3[1]	0.96 (0.41)	0.41-2.21	0.97 (0.52)	0.34-2.75	0.74 (0.33)	0.31-1.79	0.97 (0.42)	0.41-2.26	1.22 (0.61)	0.46-3.25	2.31 (1.18)	0.85-6.30
Number of children licensed for in-home Tweleve[2]	0.57 (0.25)	0.24-1.33	2.20 (1.21)	0.40-32.86	0.41 (0.19)	0.17-1.00	1.23 (0.54)	0.52-2.91	0.47 (0.23)	0.18-1.24	0.76 (0.37)	0.29-1.98
Age Category 2-3 Years[3]	1.71 (1.33)	0.37-7.87	3.64 (4.09)	0.40-32.86	0.85 (0.67)	0.18-3.99	0.59 (0.44)	0.14-2.51	1.08 (0.96)	0.19-6.21	0.54 (0.44)	0.11-2.64
Age Category 4-5 Years[3]	1.07 (0.46)	0.46-2.49	2.16 (1.20)	0.72-6.44	1.06 (0.48)	0.44-2.56	1.79 (0.80)	0.74-4.32	1.41 (0.71)	0.52-3.79	0.53 (0.25)	0.21-1.33
County location Rural[4]	2.47 (1.25)	0.92-6.65	1.16 (0.74)	0.34-4.03	1.83 (0.96)	0.65-5.13	1.00 (0.49)	0.38-2.63	3.58 (2.43)	0.94-13.56	1.19 (0.66)	0.40-3.54

CI= Confidence Interval

References: [1] not CACFP participating, [2] licensed for 6 children, [3] both 2-3 and 4-5 age categories, [4]urban county location

Table 4.11 Predictors of Meeting Individual CACFP Components at Lunch in Child Care Homes: Multi-level Logistic Regression (n=696)

CACFP Component Predictors		Odds Ratio	Standard Error	95% CI	*p* value
CACFP Components[1]	Fluid Milk	0.48	0.36	0.11-2.10	0.33
	Fruit	0.38	0.29	0.09-1.66	0.20
	Grains	2.22	1.97	0.39-12.65	0.37
	Snack	0.55	0.42	0.12-2.50	0.44
	Vegetable	0.42	0.32	0.09-1.90	0.26
Child Care Characteristic Predictors					
CACFP Participation[2]	Sponsor 1	1.24	1.33	0.15-10.07	0.84
	Sponsor 2	0.84	0.98	0.08-8.31	0.89
	Sponsor 3	1.49	1.82	0.13-16.51	0.75
Number of Children Licensed for Twelve[3]		0.61	0.43	0.15-2.46	0.49
Age Category[4]	2-3 Years	0.85	0.75	0.15-4.74	0.85
	4-5 Years	0.69	0.36	0.25-1.91	0.48
County Location Rural[5]		1.46	1.15	0.31-6.85	0.63
Intraclass Correlation (ICC)		**0.18**	0.14	0.04-0.57	

CI= Confidence Interval

References:[1] Meat/meat alternative [2] not CACFP participating, [3]licensed for 6 children, [4] both 2-3 and 4-5 age categories, [5]urban county location

5. Comparison of Written Menu with Observations of Food Served

For lunch, written menus submitted by providers matched direct observations of foods served for 66% of the homes (Figure 4.1). For the snack, this decreased to 47% of the homes. Overall only 40% of providers served foods and beverages that matched for both lunch and a snack. For lunch, the food groups that most often did not match the food groups on the menu were fruit and vegetables at 26% and grains at 25% (Figure 4.2).

Figure 4.1 Matching of Direct Diet Observation to a Written Menu for Lunch, Snack and both Lunch and Snack (n=87)

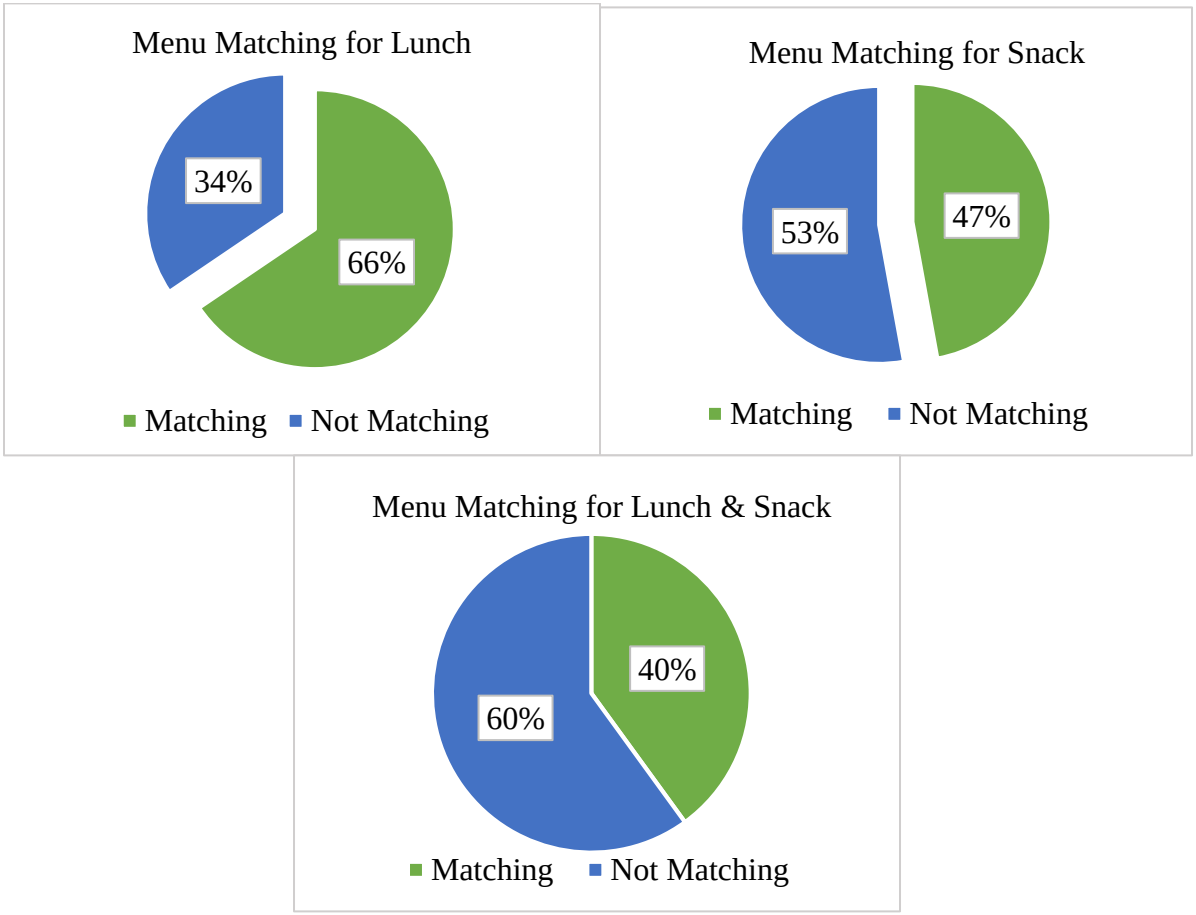
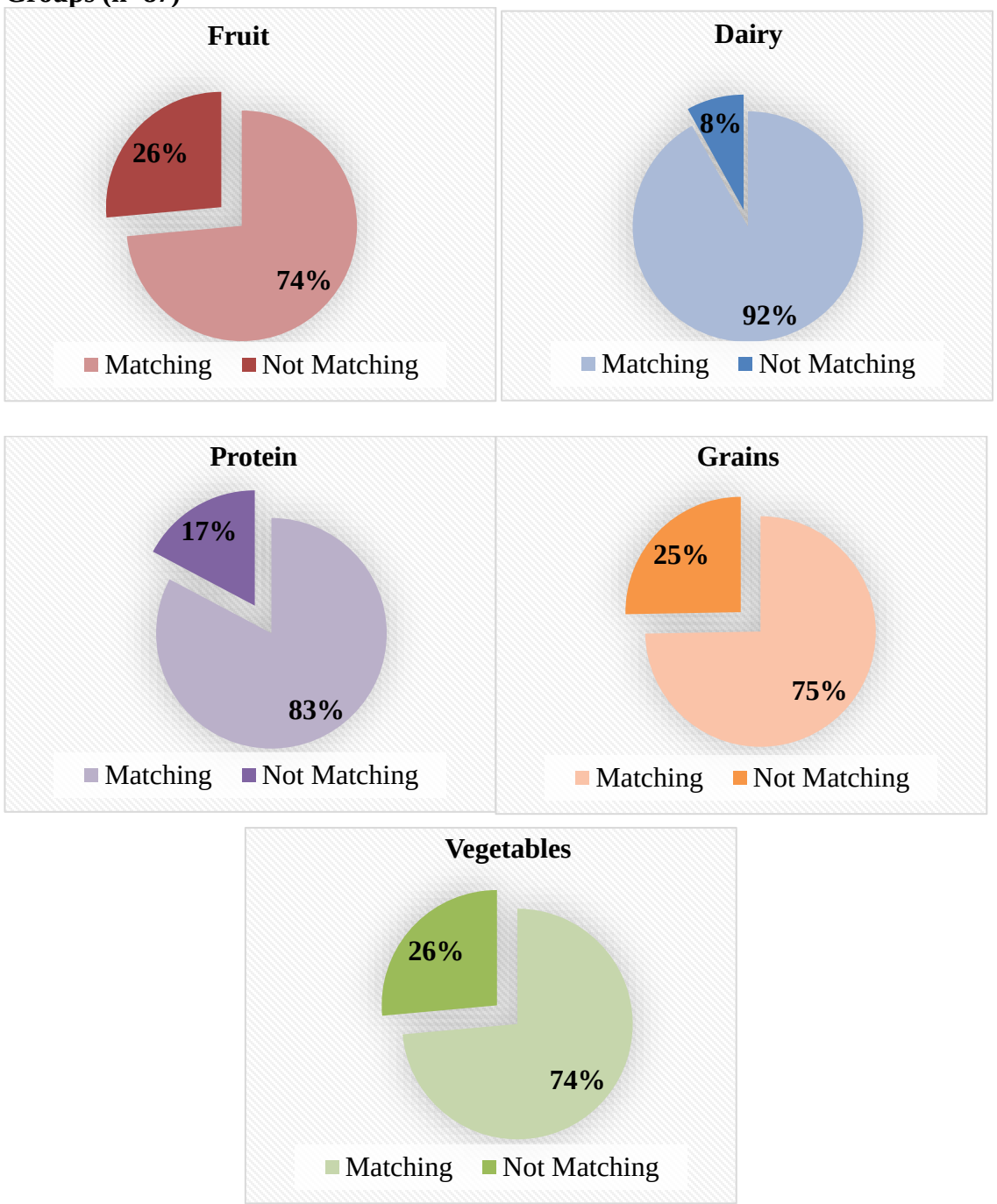


Figure 4.2 Matching of Direct Diet Observation to a Written Menu for Lunch Food Groups (n=87)



F. Discussion

In this study of 116 in-home child care settings in Michigan, most homes served a lunch and snack that did not align with national recommendations for food groups, nutrients or CACFP

nutrition recommendations. To our knowledge, this is one of few studies specifically investigating in-home child care providers regarding dietary quality of lunch and a snack served, as previous studies have focused mainly on child care centers. Also, this is one of few studies directly observing the foods and beverages served by in-home child care providers, comparing them to the 2017 CACFP nutrition standards for lunch and a snack, and specifically exploring associations between child care provider characteristics and meeting the standards. A previous study conducted in 2015 comparing the proposed nutrition standards to what was being served in 38 child care centers found that the majority of centers did not meet the proposed 2017 standards; [132] however, other studies found that the majority of child care centers were serving foods and beverages that did meet the previous version of the CACFP nutrition standards.[20,130]

In the current study, the majority of child care homes were serving whole grains at lower than recommended levels, which is consistent with other studies in centers.[131-133,135,137] Similar patterns have been shown in overall daily intake of young children from the Feeding Infants and Toddlers Study (FITS), in which 95% of two to three year old children consumed a grain product, but only 59% consumed a whole grain-rich food.[76] In this study, most providers served fruit or a grain for a snack. Most providers did not serve a whole grain as a snack as they are only required to serve one whole grain rich item per day and often choose to serve it at breakfast. This finding is similar to previous research done in centers.[20,93] As a best practice, child care providers are encouraged to serve more than one serving of whole-grains per day.[3,4]

Our study is consistent with previous ones in centers in that vegetables were served to young children at lower than recommended levels.[22,25,26,93,134] Recent studies have found that French fries are the most commonly consumed vegetable by young children[76] but in contrast starchy vegetables were interestingly not the most commonly served vegetable subgroup and

French fries were served by only 6% of providers in our study. Our results however show that "red and orange" and the "other" vegetable subgroup were most often served by in-home providers. Whereas center-based research has shown dark, green leafy vegetables to be commonly served, in our study was the vegetable subgroup that was served the least.[132] This may be an important difference between what vegetables are served at in-home versus center-based child care, and merits further in-depth exploration.

Children in our study were served triple the grams of sugar recommended for one meal and one snack. Foods and beverages served that included high amounts of sugar included sweetened cereal, granola bars, cupcakes/brownies, graham crackers or wafers, yogurt tubes and mainly large portions of juice and other sugar-sweetened beverages. This is highly consistent with other toddler consumption data in which sugar is a concern, and with studies showing that child care centers are serving sugar at levels well beyond 25 grams per day.[76,138,139]

Most child care homes in this study served children 2-3 years-of-age foods with more calories than are recommended for a lunch and snack, but we also found that some were not serving enough calories. This is consistent with past studies in centers where calories served were either inadequate or significantly exceeding recommendations.[15, 114,132]

Vitamin D in both the lunch and snack served was far lower than expected. Vitamin D intake studies in child care centers have had inconsistent findings, with some centers serving lower and some higher than recommended levels.[114,132, 49] In our study, the children were being served increased amounts of alternative milk options and many providers were not serving foods and beverages fortified with vitamin D. Our findings of low potassium, vitamin E and iron in foods served to the children corresponds with other research showing these nutrients to be consistently lower than recommended levels in child care.[19,61,114,132] Our observation of excessive

sodium content in foods served to children 2-3 years-of-age has been consistently documented in other research.[19,61,132]

Most in-home providers in our study were not meeting the 2017 CACFP nutritional standards for lunch while being observed. The most common meal component not meeting CACFP standards was fluid milk. Child care providers enrolled in the study did not meet the fluid milk component because of one of the following explanations: they did not serve the minimum portion size requirement (majority of providers), they were serving an unapproved type of milk (2%, whole, almond milk) for children 2-5 years-of-age or did not serve milk at all with the lunch meal. Past studies done in centers have also found that milk portions served were lower than the recommended portions and that higher fat versions of milk, 2% and whole, were often served to children 2-5 years of age. [63,93,132,135,137] Child care providers were also not serving the CACFP recommendations for vegetables, due either to low portion size servings or just not serving a vegetable at all. Previous studies also found similar results in which fruit and vegetables served and consumed by young children in centers were at lower than recommended levels.[19,63,135,140] Our study found child care providers are most likely to serve the recommended meat/meat alternative component at lunch, which may be a result of providers basing the lunch meal around the meat/meat alternative source and providing fruit, vegetable and fluid milk to complement.

On the other hand, child care providers were meeting the majority of CACFP snack standards. This may be due to increased flexibility in the components that they can serve where they have a choice to serve two of the five components for snacks which has not changed with the new nutrition standards.

Results from our study also show that homes serving only children 4-5 years-of-age are 3.19 times more likely ($p<0.05$) to meet the CACFP nutritional standards compared to providers that serve both 2-3- and 4-5-year-old children. This could be attributed to a less chaotic environment when all the children are slightly older. It might also reflect fewer of the food jags or picky eating episodes more common in toddlers, which children may outgrow as their age increases and they are more willing to try a variety of fruits and vegetables.[140] Unlike previous studies,[64,66,69] our study did not find that that in-home providers who participate in the CACFP program were more likely to serve foods and beverages of increased dietary quality. Some studies of center-based child care such as Head Start sites have shown higher dietary quality regardless of CACFP participation, attributed to increased performance standards and increased training opportunities for staff.[141] In-home child care providers may also need more in-depth training such as that received by Head Start staff.

In our study, a written menu was not an accurate method for ascertaining what is actually served or consumed in a child care home. This is inconsistent with other studies that found menus to be close-to-accurate for what is served.[89] Menus are helpful in ensuring that various food and beverage components are included and may need to be a focus for in-home nutrition education and guidance.

A major strength of the study is the use of the direct diet observation method, which although costly, is the gold standard in the observation of foods and beverages served to and consumed by young children.[112] However, the direct diet observation method of assessing foods and beverages served has some drawbacks. It may present an overly positive or negative picture of dietary quality if what is served during the observation period is not typical of normal routine. A provider may adjust serving behavior because of the presence of an observer. Additionally,

this study's one-day observation for lunch and one snack may not best represent usual foods and beverages served regularly. Although the observation period in this study was relatively brief, our results reinforced that menus may not be an accurate method to collect dietary quality data. Although the study sample included 24 ethnically diverse counties, participating in-home providers were not as ethically-diverse as expected, so findings may not be generalizable to all child care homes, especially the Hispanic community. The decision to evaluate compliance with recommendations using 39% of a total day's recommendation as the standard for one lunch and one snack was based on respected recommendations[115], however, 39% was estimated from literature suggesting that 32% of daily calorie needs should come from lunch and 14-26% from all snacks. So, the 39% may be either slightly higher or lower depending on the frequency of snacks provided per day. Despite these limitations, these findings provide an opportunity to compare current dietary quality of lunch and a snack served by in-home child care providers to the current nutritional guidelines and help in identifying educational foci.

G. Implications for Research and Practice

Our findings show that child care homes do not provide lunches and snacks that align with the majority of nutritional recommendations. Findings provide support for nutrition education interventions that focus on increasing whole grains and a variety of vegetables and decreasing sugar and sodium. Specific education should address reducing the frequency of high sugar foods and beverages including sugar-sweetened beverages, sweets and high-sodium convenience foods served and the reduction of portion sizes to younger children. In addition, providers may appreciate education messages relating to planning, shopping and preparing simple, scratch meals and snacks that are economical but include a variety of vegetables, whole grains and vitamin D fortified foods and beverages. Emphasis is apparently needed on preparing

and adhering to menus that meet CACFP lunch nutritional standards, particularly for vegetables, fluid milk (portions and types), and fruit. These topics could be the focus of child care provider professional development, child care licensing and monitoring policies, and nutrition education guidance by dietitians and other public health nutrition experts to help increase overall nutrition quality of foods served to young children. These targeted educational areas of need correspond to general nutrition education needs for adults, youth and families. Strategies that are utilized for the general population may thus also be beneficial for child-care providers.

Children's nutritional status may be positively impacted by implementing nutrition education for in-home child care providers, however further research would be helpful to verify the impact of various modes of education on the overall quality of foods served. The portion size requirements provided by CACFP may be beneficial to all providers to avoid the over or under-feeding of calories and other nutrients that we saw from our study. Additional research into the barriers and facilitators to serving whole grains and vegetables and limiting added sugars and sodium is also warranted to inform resource development, technical assistance and strategies for in-home child care providers to better meet recommendations and improve dietary quality. Additional research could also explore improvements in diet observation methods in child care, such as ways to more easily make multiple-day observations or through the use of digital food estimation to collect observational data in future studies.[142]

Most providers, despite participation in CACFP, were not meeting the guidelines when observed. Although the recent changes to the CACFP nutrition standards are moving in the right direction, the results of this study suggest that CACFP may benefit from possible changes in program structure and delivery. These include: 1) refining nutritional standards to allow increased flexibility similar to the snack standards 2) providing non-punitive monitoring and helpful

informal educational visits from CACFP sponsors to give feedback to providers of foods and beverages served without losing reimbursement for foods and beverages served 3) and revising the incentive structure for providers that may decrease non-compliance and more closely align with the cost of CACFP-eligible foods and beverages especially in rural areas. Future research may include pilot testing of these options or a mix of options to determine which result in the maximum rate of compliance.

Chapter 5 - Generic Nutrition Education Intervention Does Not Increase Dietary Quality in Child Care Homes

Target Journal: Journal of Nutrition Education and Behavior

A. Abstract

Objective: To determine if the *Healthier Child Care Environment* nutrition education intervention increased the dietary quality of foods and beverages served by in-home child care providers.

Design: An intervention study was conducted from 2016-2018. The foods and beverages served to children, two to five years, in child care provider homes during lunch and a snack for one day were compared before and after the intervention.

Participants: In-home, adult child care providers (n=67) in 19 rural and urban ethnically-diverse Michigan counties were recruited from the Michigan Great Start to Quality child care provider database.

Intervention: *Healthier Child Care Environment*; a 6-month nutrition education intervention focused on enhancing nutrition and physical activity environments, policies and the dietary quality of food and beverages.

Main Outcome: Dietary quality of foods and beverages served during a lunch and snack

Analysis: The foods and beverages served during lunch and a snack for one day by the intervention and control providers were compared controlling for pre-intervention values, county location, age group, and Child and Adult Care Food Program (CACFP) participation. CACFP nutrition standard scores, coded from foods and beverages served, were compared with t-tests, binary and ordinal logistic regression models. Linear regression models compared the amount of food groups and nutrients served.

Results: After the intervention, there were no significant differences and small effect

size differences in lunch or snack CACFP scores or amount of food groups and nutrients served between the intervention and control child care providers after controlling for pre intervention values, county location, age groups, and CACFP participation.

Conclusions**:** Nutrition education interventions in child care homes may need to be more specific with an emphasis on CACFP nutrition standards, food groups, nutrients and additional component recommendations to improve dietary quality. Further research should also determine the best modality for nutrition education with in-home providers to enhance "buy in" and positive outcomes.

B. Introduction

Sixty-one percent of children under five years of age are in some type of child care arrangement from 21-36 hours a week, which means that young children consume a significant amount of their daily foods and beverages in child care settings.[1,2] In-home provides constitute eighty percent of child care providers nationally and over 60% of Michigan; hence, in-home child care providers play a large role in the current and life-long eating behaviors among young children as taste preferences and dietary habits are formed early in life.[3,4,17] Improving dietary quality and physical activity in child care settings has the potential to decrease childhood chronic, diet-related disease risk and nutrient deficiencies.[5,6]

Previous studies have investigated dietary quality in child care centers and found providers did not serve the recommended amounts of vegetables and whole grains, or a variety of fruits, vegetables, and whole grains.[18,20] In a study of child care centers in Georgia, menus of foods and beverages served met 50-67% of the recommended levels for energy, carbohydrates, protein, vitamin A, vitamin C, iron and fiber.[20] Saturated fat and sodium exceeded Dietary Guidelines for Americans (DGA) recommendations with 71% of child care providers serving

whole or 2% milk daily, instead of skim or 1%, and 100% of providers served a sweet snack daily.[20] Remarkably, 100% of centers did serve a fruit daily, but 29% did not serve a vegetable daily.[20] The majority of previous studies have focused on child care centers, but one study in child care homes found similar results in that 46% of providers did not serve whole grains at all, 35% served fewer than three servings of fruit and vegetables per day and the majority of providers served whole milk instead of reduced fat milk to children over the age of 2.[92,93]

Although there are some programs, organizations and funding streams that are dedicated to nutrition education efforts for child care providers, opportunities may not be available and accessible to all child care providers. One study documented that 70% of child care homes reported receiving nutrition education training zero to three times and 32%, four to seven times, during the past three years.[96]

Previous studies have documented the need for nutrition education interventions and programs to target children at a young age before meal patterns are established, but few studies identify the impact of the nutrition education on dietary quality.[78] The majority of studies have focused on assessing and educating child care providers on nutrition and physical activity policies and environmental changes.[95,99,100] Although outside of the United States, one study did focus on the dietary quality impact in South Australia where intake significantly increased by 0.2-0.4 servings per day for all food groups, except vegetables after a nutrition intervention in child care settings.[100] The intervention included training on general child nutrition, the importance of children's eating environment, menu modification, and developing and improving a nutrition policy.[100]

The purpose of the current study was to determine if a nutrition education intervention, the *Healthier Child Care Environment* intervention, increased dietary quality of foods and

beverages served to young children in child care homes. Research questions included: 1) By how much did the dietary quality of foods and beverages for food groups and nutrients served to children 2-5 years of age increase after the *Healthier Child Care Environment* nutrition education intervention; and 2) by how much did the dietary quality of foods and beverages served that meet the CACFP nutrition standards increase after the *Healthier Child Care Environment* nutrition education intervention? We hypothesized that after the nutrition education intervention, there would be 1) an increase in food group cups per day served of fruit, vegetable, and vegetables subgroups; 2) an increase in fiber, vitamin E, iron, potassium, vitamin A and zinc served; and 3) a decrease in refined grains, total dietary fat, total carbohydrates, total protein, saturated fat, sugar and sodium served. As a result of these changes we also anticipated an increase of in-home child care providers who met the CACFP nutrition standards.

C. Methods

1. Sample and Recruitment

An intervention study occurred in 67 child care provider homes, residing in low-income census tract areas in 19 counties in Michigan. Child care providers were recruited from the Michigan Great Start to Quality database (https://greatstarttoquality.org/) eligible for participation in the study if the following criteria were met: Supplemental Nutrition Assistance Education Program (SNAP-Ed) eligible; providing care for two to twelve children, two to five years of age; and serving meals and snacks. Child care providers were determined to be eligible for SNAP-Ed eligibility if they resided in communities where at least 50 percent of the children are eligible for free or reduced-price school meals in the attendance area of a local school or within a census tract area based on the CACFP area eligibility map, https://www.fns.usda.gov/areaeligibility.

Trained research assistants, seven undergraduate and graduate dietetic students, recruited child care providers by calling providers from the Great Start to Quality database, a database of registered and licensed child care providers in Michigan, utilizing a phone recruitment script. All child care providers called were placed on a call log to avoid duplication and a child care provider was called up to three times before they were recorded as not reachable. In addition, 10% of child care providers were recruited by Michigan State University Extension and The Kidney Foundation of Michigan nutrition professionals to reach additional registered child care providers who may not be listed on the Great Start to Quality database. Upon recruitment into the study, child care providers provided written consent and were randomized into intervention or control group.

2. Data Collection Procedures

Data was collected on all food and beverages that were served in the participating child care providers' homes during lunch and one snack pre- and post- intervention via direct diet observation. The direct diet observation method is the gold standard for research in observing and estimating foods and beverages served by young children in early childhood settings.[16] Each observation included one lunch and either a morning or afternoon snack within one day at a child care provider home. A direct diet observation form was used to document the preparation, type and amount of foods and beverages served to children. A maximum of four children, ages 2-5 years, were observed at one time. All research assistants followed the direct diet observation training protocol developed by Ball and colleagues during observation.[20] All foods and beverages served to children at breakfast, lunch, snack(s) and dinner at the child care were collected, Monday through Friday, of the week of observation via a menu template. All

procedures followed were in accordance with the ethical standards of the Michigan State University human research protection program.

3. Nutrition Education Intervention

The nutrition education intervention, *Healthier Child Care Environment,* was developed and offered through Michigan State University Extension in child care provider centers and homes in Michigan. The nutrition education intervention included professional coaching to assist child care providers in completing: 1) the Nutrition and Physical Activity Self-assessment (NAP SACC), an evidence-based assessment tool to enhance nutrition and physical activity environments in child care settings and nutrition and physical activity policies and practices[23,25,27] 2) an action planning process; 3) implementation of nutrition and physical activity action plans. To enhance program fidelity, all nutrition professionals completed a 6-hour training on implementation of the intervention including a step-by-step outline for each educational session with the child care provider. Nutrition professionals were able to join a 1-hour technical support session with the primary researcher each month to address questions and highlight best practice actions occurring in child care settings.

NAP SACC includes 44 questions from nine nutrition and physical activity areas: fruit, vegetables, meats, fats, grains, menu variety, feeding occasions, foods offered outside of regular meals and snacks, support for healthy eating, nutrition education and nutrition policy.[27] The NAP SACC results, which highlighted strength and weakness areas, informed the nutrition education coaching topics. Coaching included the distribution of resources for weakness areas, reviewing barriers and removal of barriers to reduce weakness areas and practice implementing improved practices. Physical activity action plans, although not a focus, were implemented if all nutrition areas were perceived as already meeting best practices or after child care providers completed

three nutrition action plans. Technical resources for the coaching were chosen by nutrition professionals from the website titled "Healthier Child Care Environments Toolkit" located at http://msue.anr.msu.edu/program/snap_ed/child care. On average, nutrition professionals were instructed to spend a total of 10 hours on education, over a period of 6 months. An excel spreadsheet was used to document the minutes of education, demographic characteristics of child care providers, the number of best practices selected for action and the resources that were used during the coaching process to assist in tracking program fidelity. The spreadsheet was also used to determine the level of completion of the intervention as follows: 1) did not complete the pre assessment; 2) completed the pre assessment but did not complete an action plan; 3) completed the action plan but did not choose to improve three nutrition best practices within the child care environment, policies or practices and 4) completed the action plan and chose to improve three or more nutrition best practices. Incentives for child care providers who completed the intervention and evaluations included $100 worth of nutrition education reinforcement items, toddler plates for each child in care, fruit and vegetable poster sets, and an average of 10 hours of continuing education that child care providers would apply to licensure.

4. Variables

The main outcome measure of this study was the dietary quality of the foods and beverages served by child care providers, based on the CACFP component categories (fluid milk, fruit, vegetables, grains, and meat/meat alternatives) for a snack and lunch and individual nutrients, components and food groups. Foods and beverages served by in-home child care providers at observation were converted through nutritional analysis (Nutritionist Pro version 10.0) and coded into the following food group variables: dairy, protein, fruit, grains, total grains, whole grains and refined grains. The nutrient and additional component variables included

energy, total dietary fat, total saturated fat, total carbohydrates, total protein, dietary fiber, total sugar, sodium, calcium, iron, vitamin E, potassium, folate, vitamin A and zinc. Each food group, component and nutrient were treated as a continuous variable and a mean was calculated for each child care provider home.

The Child and Adult Care Food Program (CACFP)[15] is a federal program that provides reimbursement to eligible child care providers for meals and snacks. CACFP stipulates a set of nutrition standards that providers must meet in order to be eligible for reimbursement of foods and beverages served. To be reimbursed for lunch, child care providers must serve the minimum portion amount and meet the nutrition standards for all five meal components including fruit, grain, fluid milk, vegetable and meat/meat alternative. For snacks, two of the five components, listed above must meet the portion and nutrition standards. The CACFP variables included: 1) fluid milk score 2) meat/meat alternative score 3) vegetable score 4) fruit score and 5) grain score and 6) total snack score. Each child care provider was assigned a total score ranging from 0-6 based on the six components. A code of "0" was assigned for each variable in which a child care provider did not serve or only served a portion of the nutrition standard, including the type and preparation. A code of "1" was assigned if they did serve foods and beverages that met the nutrition standards. Each observation and menu was coded by the primary researcher and two research assistants; any discrepancies were reviewed and coded together. A score below six signified decreased dietary quality or not meeting all the CACFP component recommendations and a score of six meant that the provider met all CACFP component nutrition standards.

Intervention-related variables focused on feeding practices, policies and environmental supports in the home and included: offering 100% juice, fruit in its own juice, vegetables (not fried), vegetables other than potatoes, corn or green beans, vegetables without added fat, beans or

lean meats, less fried or pre-fried potatoes, a combination of new and familiar foods on menus, foods from a variety of cultures on menus, a seasonal cycle menu and meals family style. Other nutrition environmental supports and policies included: writing a nutrition policy, communicating the nutrition policy, celebrating holidays with mostly healthy foods and non-food means, providing and enforcing written guidelines for celebrations, offering nutrition education to children and parents, and providing visible support for good nutrition. The variables responses were answered and coded as: (3) achieving, (2) nearly achieving, (1) started but more effort is needed to achieve and (0) not achieving at all.

5. Nutritional Analysis

Pearson Chi-square analyses were used to compare the characteristics of the control and intervention child care home. The pre and post nutrition and physical activity self-assessment best practice scores for 18 best practices were totaled together and compared with paired t-tests. To assess differences from pre- to post- for both the intervention and control groups, the mean CACFP component scores, lunch scores, snack score, food groups, additional components and nutrients for the intervention and control group were compiled. Child and Adult Care Food Program (CACFP) nutrition standard scores, coded from foods and beverages served, were compared with binary and ordinal logistic regression models controlling for pre-intervention values, county location, age category, and CACFP participation. Initially, an instrumental variable was used in the regression model, but after the results of a Hausman test, linear regression was determined to have a higher root mean square error between the two data sets. Linear regression models were then used to compare the amount of food groups and nutrients served controlling for pre-intervention values, county location, age category, and CACFP participation.

Observations occurred during different months throughout the year, so the season of the observations was compared to determine if there was a difference between the providers who were observed in the winter versus the summer months using Pearson Chi-square analysis. Similarly, the food groups and the nutritional quality of the snacks served in the morning versus the afternoon were compared with Pearson Chi-square analysis. There was no significant season or snack time difference. All analyses were conducted using STATA (Stata version 14.0; Stata Corp. LP, College Station, TX).

D. Results

A total of 71 child care providers enrolled and were deemed eligible if they completed the action plan and improved three or more nutrition best practices in the study. A total of 5% of the child care providers (N=4) dropped out before the post assessment. Based on a total sample of 67 child care provider homes, the majority of homes (71.64%) were located in an urban county based on the US census bureau classification,[109] were licensed in the State of Michigan (95.52%) and participated in CACFP (91.04%). The majority of providers were female (95.52%), under the age of 60 years (82.09%) of either Caucasian (62.60%) or African American (32.84%) race and not of Hispanic Ethnicity (94.03%) (Table 5.1). The mean and median age of children cared for in the home was three years old, 59.70% of the child care providers cared for up to six children in their home, and 40.30% cared for up to 12 children in their home. In Michigan, there are three different CACFP sponsor organizations and the majority of our sample of providers receive reimbursement and training from two of the sponsors. The majority of child care providers, 67%, also served both age categories of children, 2-3 years and 4-5 years. When comparing the control and intervention child care homes, no differences were detected in the home and child care provider characteristics. Over 90% of the child care providers reported

improving three or more nutrition best practices and received a mean of 10 hours of nutrition education. On average, child care providers adopted four environmental nutrition best practices with three focused on fruits and vegetables and the fourth on physical activity.

Table 5.1 Child Care Provider and Home Characteristics

	All Providers N=67	Control N=33	Intervention N=34
Gender	**N (%)**	**N (%)**	**N (%)**
Female	64 (95.52)	31 (93.94)	33 (97.06)
Age			
Under 60	55 (82.09)	32 (96.97)	30 (88.24)
60+	12 (17.91)	01 (02.94)	04 (12.12)
Race			
Caucasian	38 (56.72)	15 (45.45)	09 (26.47)
African American	24 (35.82)	16 (48.48)	22 (64.71)
Multiracial/Other	5 (07.47)	02 (06.06)	03 (08.82)
Ethnicity			
Hispanic	4 (05.97)	02 (06.06)	02 (05.88)
Location			
Rural	19 (28.36)	06 (18.18)	13 (38.24)
Urban	48 (71.64)	27 (81.82)	21 (61.76)
Number of Children Home is Licensed for			
Six	39 (58.21)	21 (63.64)	18 (52.94)
Twelve	28 (41.79)	12 (36.36)	16 (47.06)
Licensed			
Yes	64 (95.52)	32 (96.97)	32 (94.12)
CACFP Participation			
Sponsor 1	36 (53.73)	16 (48.48)	20 (58.82)
Sponsor 2	04 (05.97)	02 (06.06)	01 (02.94)
Sponsor 3	21 (31.34)	10 (30.30)	12 (35.29)
Not Participating	06 (08.96)	05 (15.15)	01 (02.94)
Age Category of Children Cared for			
2-3-year-old children	16 (23.88)	08 (24.24)	08 (23.53)
4-5-year-old children	06 (8.96)	03 (9.09)	03 (8.82)
Both age categories	45 (67.16)	22 (66.67)	23 (67.65)

For the intervention child care providers (n=34) although not significant, there was an increase from 36.64 to 36.76 in the NAP SACC total score (Table 5.2).

Table 5.2 Nutrition and Physical Activity Self-Assessment (NAP SACC) Results (n=34)

	Pre Score				Post Score			
	0	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Offer fruit (not juice) at least 2 times a day	1 (2.94)	1 (2.94)	3 (8.82)	29 (85.29)	3 (8.82)	2 (5.88)	3 (8.82)	26 (76.47)
Fruit is offered canned in its own juice	2 (5.88)	6 (17.65)	11 (32.35)	15 (44.12)	1 (2.94)	3 (8.82)	6 (17.65)	24 (70.59)
Offer vegetables (not fried) at least 2 times a day	2 (5.88)	4 (11.76)	11 (32.35)	17 (50.00)	1 (2.94)	3 (8.82)	9 (26.47)	21 (61.76)
Offer vegetables, other than potatoes, corn or green beans	2 (5.88)	6 (17.65)	9 (26.47)	17 (50.00)	0 (0.00)	4 (11.76)	8 (23.53)	22 (64.71)
Prepare cooked vegetables without added fat	1 (2.94)	2 (5.88)	8 (23.53)	23 (67.65)	1 (2.94)	0 (0.00)	4 (11.76)	29 (85.29)
Offer beans or lean meats at least once a day	2 (6.06)	11 (33.33)	14 (42.42)	6 (18.18)	1 (2.94)	11 (32.35)	16 (47.06)	6 (17.65)
Offer fried or pre-fried potatoes less than once a week	1 (3.03)	7 (21.21)	5 (15.15)	20 (60.61)	0 (0.00)	2 (5.88)	9 (26.47)	23 (67.65)
Create and maintain a written nutrition policy	12 (35.29)	12 (35.29)	2 (5.88)	8 (23.53)	5 (14.71)	9 (26.47)	3 (8.82)	17 (50.00)
Communicate the nutrition policy to parents and families	15 (44.12)	3 (8.82)	6 (17.65)	10 (29.41)	3 (8.82)	2 (5.88)	7 (20.59)	22 (64.71)
Celebrate holidays with mostly healthy foods and non-food	5 (14.71)	12 (35.29)	12 (35.29)	5 (14.71)	5 (14.71)	6 (17.65)	12 (35.29)	11 (32.35)
Provide and enforce written guidelines for celebrations	18 (52.94)	8 (23.53)	3 (8.82)	5 (14.71)	7 (20.59)	18 (52.94)	2 (5.88)	7 (20.59)
Include a combination of new and familiar foods on menus	0 (0.00)	14 (41.18)	13 (38.24)	7 (20.59)	0 (0.00)	5 (14.71)	14 (41.18)	15 (44.12)

Table 5.2 (cont'd)

Include foods from a variety of cultures on menus	7 (20.59)	17 (50.00)	7 (20.59)	3 (8.82)		4 (11.76)	16 (47.06)	11 (32.35)	3 (8.82)
Use a seasonal, cycle menu	16 (47.06)	3 (8.82)	3 (8.82)	12 (35.29)		12 (35.29)	3 (8.82)	4 (11.76)	15 (44.12)
Offer nutrition education to children	11 (32.35)	7 (20.59)	3 (8.82)	13 (38.24)		6 (17.65)	7 (20.59)	4 (11.76)	17 (50.00)
Offer nutrition information to parents	16 (47.06)	1 (2.94)	1 (2.94)	16 (47.06)		10 (29.41)	5 (14.71)	5 (14.71)	14 (41.18)
Serve meals family style	17 (50.00)	9 (26.47)	3 (8.82)	5 (14.71)		7 (20.59)	14 (41.18)	6 (17.65)	7 (20.59)
Support for good nutrition is visibly displayed	15 (44.12)	6 (17.65)	9 (26.47)	4 (11.76)		1 (2.94)	6 (17.65)	9 (26.47)	18 (52.94)
				Pre-Mean (SD)		**Post Mean (SD)**		***p* value**	
Total NAP SACC Score				36.64 (9.02)		36.76 (8.58)		0.94	

The mean of the total CACFP scores, ranging from 0-6, for the control child care providers did increase (3.73 to 4.24) ($p<0.05$) from pre to post (Table 5.3). Intervention child care providers had a large mean score at the pre (4.06) and saw a reduction in score after the intervention. Table 5.4 shows the results from two ordinal logistic regression models with the total CACFP score and the lunch CACFP score as the outcome of interest when holding constant the CACFP pre score, no intervention, county location, CACFP participation and age category of children served. The model indicated significant associations only between the pre and post CACFP scores which means as the pre CACFP score increases the likelihood of having a higher post score also increases, which is to be expected.

Table 5.3 Pre and Post CACFP Total Score Characteristics for Intervention and Control Child care Providers (n=67)

CACFP Score		Total CACFP Score (0-6)		Total Lunch CACFP Score (0-5)	
		Control n=33 N (%)	Intervention n=34 N (%)	Control n=33 N (%)	Intervention n=34 N (%)
Pre CACFP Score	0	0 (0.00)	1 (2.94)	0 (0.00)	1 (2.94)
	1	1 (3.03)	1 (2.94)	4 (12.12)	1 (2.94)
	2	5 (15.15)	4 (11.76)	5 (15.15)	7 (20.59)
	3	10 (30.30)	3 (8.82)	10 (30.30)	11 (32.35)
	4	6 (18.18)	12 (35.29)	9 (27.27)	5 (14.71)
	5	8 (24.24)	6 (17.65)	5 (15.15)	9 (26.47)
	6	3 (9.09)	7 (20.59)		
	Mean±SD	3.73±1.33	4.06±1.54	3.18±1.24	3.32±1.31
Post CACFP Score	0	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.94)
	1	1 (3.03)	2 (5.88)	1 (3.03)	2 (5.88)
	2	2 (6.06)	4 (11.76)	6 (18.18)	7 (20.59)
	3	5 (15.15)	8 (23.53)	7 (21.21)	10 (29.41)
	4	10 (30.30)	6 (17.65)	14 (42.42)	9 (26.47)
	5	10 (30.30)	10 (29.41)	5 (15.15)	5 (14.71)
	6	5 (15.15)	4 (11.76)		
	Mean±SD	4.24±1.25	3.88±1.43	3.48±1.06	3.15±1.26
Pre to post	*p* value	0.05	0.61	0.19	0.53

SD = Standard deviation

Table 5.4 Dietary Quality of Lunch and Snack Served by Child Care Providers by CACFP Score: Ordinal Logistic Regressions n=67

Co-variables		Post Total CACFP Score (0-6)		Post Lunch CACFP Score (0-5)	
		Odds Ratio (SE)	95% Confidence Interval	Odds Ratio (SE)	95% Confidence Interval
Pre CACFP-Score		1.41* (0.23)	1.02-1.95	1.64** (0.31)	1.13-2.37
Intervention[1]		0.38 (0.19)	0.15-1.00	0.39 (0.19)	0.15-1.00
County Location[2]	**Rural**	2.45 (1.31)	0.86-7.00	2.49 (1.34)	0.87-7.13
CACFP Participation[3]	**Sponsor 1**	0.93 (0.78)	0.18-4.84	0.77 (0.64)	0.15-3.88
	Sponsor 2	0.48 (0.43)	0.08-2.84	0.40 (0.36)	0.30-2.13
	Sponsor 3	0.74 (0.37)	0.28-1.96	0.79 (0.40)	0.30-2.13
Age Category[4]	**2-3 years**	0.53 (0.45)	0.10-2.82	0.47 (0.42)	0.09-2.64
	4-5 years	1.33 (0.72)	0.46-3.84	1.14 (0.65)	0.37-3.51
Pseudo R2		0.05		0.06	
Delta Odds Ratio		0.17		0.13	

References: [1]control group, [2]urban county location, [3]not participating in CACFP, [4] both 2-3 and 4-5 age categories

When investigating the individual CACFP components, some measures showed a slight increase, although not significant from pre to post. For intervention child care providers the vegetable CACFP score increased (0.62 to 0.74) and control providers the snack from (0.55 to 0.76), vegetable (0.55 to 0.79), fruit (0.52 to 0.67) and grains (0.85 to 0.94) (Table 5.5). In a binary logistic model holding constant the CACFP pre score, no intervention, CACFP participation and age category of children served, rural child care providers were 5.33 times more likely to meet the fluid milk component compared to urban providers (Table 5.6).

Table 5.5 Pre and Post CACFP Snack and Individual Lunch Component Scores for Intervention and Control Child care Providers (Total n=67)

CACFP Score		Pre Intervention n=34 n (%)	Mean ±SD	Post Intervention n=34 n (%)	Mean ±SD	Pre Control n=33 n (%)	Mean ±SD	Post Control n=33 n (%)	Mean ±SD
Snack	**0**	9 (26.47)	0.74±0.45	9 (26.47)	0.74±0.45	15 (45.45)	0.55±0.51	8 (24.24)	0.76±0.44
	1	25 (73.53)		25 (73.53)		18 (54.55)		25 (75.76)	
Fluid Milk	**0**	24 (70.59)	0.53±0.51	23 (69.70)	0.29±0.46	13 (39.39)	0.61±0.50	16 (47.06)	0.30±0.47
	1	10 (29.41)		10 (30.30)		20 (60.61)		18 (52.94)	
Meat/ Meat Alternative	**0**	9 (26.47)	0.76±0.43	7 (21.21)	0.74±0.45	10 (30.30)	0.70±0.47	8 (23.53)	0.79±0.42
	1	25 (73.53)		26 (78.79)		23 (69.70)		26 (76.47)	
Fruit	**0**	13 (38.24)	0.68±0.47	7 (21.21)	0.62±0.49	15 (45.45)	0.52±0.51	11 (32.35)	0.67±0.48
	1	21 (61.76)		26 (78.79)		18 (54.55)		23 (67.65)	
Vegetable	**0**	9 (26.47)	0.62±0.49	11 (33.33)	0.74±0.45	16 (48.48)	0.55±0.51	13 (38.24)	0.79±0.42
	1	25 (73.53)		22 (66.67)		17 (51.52)		21 (61.76)	
Grain	**0**	8 (23.53)	0.82±0.39	2 (6.06)	0.76±0.43	5 (15.15)	0.85±0.36	6 (17.65)	0.94±0.24
	1	26 (76.47)		31 (93.94)		28 (84.85)		28 (82.35)	

SD = Standard deviation

Table 5.6 Dietary Quality of Lunch and a Snack Served by Child Care Providers by CACFP Score: Binary Logistic Regressions for each CACFP Component (n=67)

	Post CACFP Scores	Fluid milk Score (0 or 1)		Fruit Score (0 or 1)		Vegetable Score (0 or 1)		Grain Score (0 or 1)		Meat/meat alt. Score (0 or 1)	
Co-variables		**Odds Ratio (SE)**	**95% CI**	**Odds Ratio (SE)**	**95% CI**	**Odds Ratio (SE)**	**95% CI**	**Odds Ratio (SE)**	**95% CI**	**Odds Ratio (SE)**	**95% CI**
Pre CACFP-Score		2.76 (1.81)	0.77-9.95	2.06 (1.24)	0.63-6.72	3.08 (1.84)	0.95-9.93	0.39 (0.46)	0.04-3.95	7.07** (5.02)	1.76-28.42
Intervention[1]		0.61 (0.41)	0.16-2.26	0.48 (0.29)	0.14-1.56	1.21 (0.74)	0.36-4.00	0.18 (0.16)	0.03-1.02	0.41 (0.30)	0.10-1.74
County Location[2]	**Rural**	5.33* (3.74)	1.34-21.12	0.45 (0.28)	0.13-1.52	1.27 (0.87)	0.33-4.83	2.85 (2.63)	0.47-17.34	5.04 (4.80)	0.78-32.67
CACFP Participation[3]	**Sponsor 1**	4.99 (6.49)	0.39-63.81	0.33 (0.42)	0.03-3.96	1.53 (1.66)	0.33-4.83	1.42 (1.94)	0.10-20.47	0.94 (1.24)	0.07-12.42
	Sponsor 2	4.57 (5.76)	0.39-53.94	0.68 (1.13)	0.03-17.94	0.67 (0.64)	0.11-4.29	0.72 (0.96)	0.05-9.89	0.85 (1.14)	0.01-4.07
	Sponsor 3	2.58 (3.46)	0.19-35.75	0.71 (0.94)	0.05-9.40	0.66 (1.66)	0.08-5.67	2.32 (2.07)	0.41-13.35	0.85 (1.14)	0.06-11.69
Age Category[4]	**2-3**	0.77 (0.60)	0.17-3.58	0.48 (0.33)	0.13-1.82	1.67 (1.29)	0.37-7.59	1.23 (1.14)	0.20-7.55	1.41 (1.19)	0.27-7.36
	4-5	1.08 (1.07)	0.15-7.58	0.51 (0.51)	0.07-3.57	0.44 (0.41)	0.07-2.75	1.43 (1.84)	0.11-17.97	1.57 (1.94)	0.14-17.64
	Pseudo R2	0.16		0.09		0.08		0.12		0.20	
	Delta Odds Ratio	0.45		0.08		0.09		0.02		0.15	

*p<0.05, ** p<0.01 CI= Confidence Interval

References: [1]control group, [2]urban county location, [3] not participating in CACFP, [4] both 2-3 and 4-5 age categories

The intervention group had a decrease and the control group an increase in most food groups from pre to post, although no significant increases were identified (Table 5.7).

Table 5.7 Pre and Post Dietary Quality by Food Groups of Lunch and Snack Served by Child Care Providers by Food Groups for Control and Intervention Child Care Providers (n=67)

Food Group	Intervention			Control		
	Pre	Post		Pre	Post	
	Mean±SD	Mean±SD	*p* value	Mean±SD	Mean±SD	*p* value
Total Grains (oz)	2.52±1.97	2.41±1.80	0.82	2.17±1.28	3.07±2.71	0.08
Refined Grains (oz.)	1.70±1.80	1.53±1.81	0.70	1.60±1.24	2.43±2.94	0.11
Whole Grains (oz.)	0.93±1.86	0.88±1.33	0.87	0.58±1.03	0.64±1.02	0.81
Dairy (cup)	1.07±0.53	1.22±0.73	0.22	1.03±0.57	0.95±0.58	0.47
Fruit (cup)	0.84±0.51	0.71±0.58	0.24	0.71±0.57	0.69±0.55	0.86
Vegetables (cup)	0.45±0.33	0.60±0.51	0.14	0.33±0.31	0.50±0.65	0.17
Total Protein Foods (oz.)	1.54±1.27	1.33±0.97	0.41	1.94±1.54	1.82±1.47	0.66
Seafood (oz.)	0.09±0.51	0.00±0.00	0.32	0.16±0.73	0.09±0.38	0.62
Nuts and Seeds (oz.)	0.12±0.28	0.14±0.33	0.75	0.20±0.39	0.10±0.26	0.15

SD = Standard deviation

Child care providers who served food and beverages to only children 4-5 years of age reported increased cups of fruit at post compared to child care providers who served both 2-3 and 4-5 year-old-children when holding the other variables constant (Table 5.8). There were no significant differences between the pre and post nutrients for intervention or control groups (Table 5.9). Effect sizes ranged from 0.07-0.31, indicating a small effect size.

Table 5.8 Dietary Quality of Foods and Beverages Served by Child Care Providers after Nutrition Education Intervention: Linear Regression (n=67)

Co-variables	Post Food Groups	Total Grains (oz.)	Refined Grains (oz.)	Whole grains (oz.)	Dairy (cups)	Fruit (cups)	Vegetables (cups)	Protein (oz.)
Pre Food Group	**Coefficient (SE)**	0.16 (0.19)	0.19 (0.21)	0.24* (0.10)	0.42**(0.14)	0.41** (0.12)	0.12 (0.24)	0.27* (0.10)
	95% CI	-0.21-0.54	-0.23-0.62	0.03-0.45	0.14-0.71	0.17-0.65	-0.36-0.60	0.06 - 0.47
Intervention[1]	**Coefficient (SE)**	-0.82 (0.62)	-0.95 (0.65)	0.08 (0.31)	0.15 (0.16)	-0.01 (0.13)	0.07 (0.16)	-0.29 (0.30)
	95% CI	-2.07-0.42	-2.26-0.35	-0.53-0.69	-0.16-0.46	-0.27-0.24	-0.25-0.38	-0.89 - 0.30
County Location[2]	**Coefficient (SE)**	-0.16 (0.67)	-0.25 (0.72)	0.05 (0.33)	0.35 (0.18)	-0.01 (0.14)	-0.07 (0.17)	0.24 (0.32)
	95% CI	-1.50-1.18	-1.69-1.19	-0.61-0.72	0.01-0.71	-0.29-0.27	-0.40-0.27	-0.41 - 0.88
CACFP Participation[3] Sponsor 1	**Coefficient (SE)**	1.06 (1.11)	0.56 (1.16)	0.57 (0.54)	0.26 (0.28)	-0.18 (0.2)	0.31 (0.27)	-1.12 (0.52)
	95% CI	-1.16-3.29	-1.77-2.88	-0.52-1.65	-0.30-0.82	-0.63-0.27	-0.24-0.85	-2.16 - -0.08
CACFP Sponsor 2	**Coefficient (SE)**	1.26 (1.59)	0.41 (1.69)	0.89 (0.77)	-0.01 (0.40)	-0.42 (0.33)	0.23 (0.39)	-0.99 (0.75)
	95% CI	-1.92-4.43	-2.97-3.80	-0.66-2.45	-0.81-0.79	-1.07-0.24	-0.55-1.02	-2.50 - 0.52
CACFP Sponsor 3	**Coefficient (SE)**	1.45 (1.16)	1.16 (1.20)	0.39 (0.57)	0.35-0.29	-0.28 (0.24)	0.41 (0.29)	-1.47 (0.54)
	95% CI	-0.88-3.77	-1.24-3.57	-0.76 (1.54)	-0.23-0.93	-0.75-0.20	0.16-0.99	-2.56 - -0.38
Age Category[4] 2-3 Years	**Coefficient (SE)**	-0.21 (0.71)	-0.23 (0.75)	0.01 (0.35)	-0.06 (0.18)	-0.29 (0.15)	-0.22 (0.18)	0.08 (0.34)
	95% CI	-1.63-1.21	-1.73-1.27	-0.69-0.72	-0.30-0.43	-0.59-0.00	-0.14-0.57	-0.60 - 0.76
4-5 Years	**Coefficient (SE)**	-1.13 (1.06)	-0.49 (1.11)	-0.73 (0.54)	0.05 (0.27)	0.50* (0.22)	-0.10-0.26	0.49 (0.50)
	95% CI	-3.25-0.99	-0.80-4.03	-1.80-0.35	-0.49-0.58.	0.06-0.94	-0.63-0.42	-0.52-1.49
	R-squared	0.07	0.08	0.14	0.27	0.31	0.08	0.28

Table 5.8 (cont'd)

	Adjusted R-squared	-0.06	-0.05	0.02	0.17	0.21	-0.05	0.18
	Effect Size eta-squared	0.07	0.08	0.14	0.27	0.31	0.08	0.28

*p<0.05, ** p<0.01

References: [1]control group, [2]urban county location, [3] not participating in CACFP, [4] both 2-3 and 4-5 age categories

Table 5.9 Pre and Post Dietary Quality by Nutrients of Lunch and Snack Served by Child Care Providers by Nutrients for Control and Intervention Child Care Providers (n=67)

Nutrient/ Component	Intervention		*p* value	Control		*p* value
	Pre	Post		Pre	Post	
	Mean± SD	Mean± SD		Mean± SD	Mean± SD	
Calories (kcal)	612.74± 218.88	597.14± 245.21	0.80	571.80± 195.78	625.56± 227.29	0.13
Total fat (g)	21.76±10.47	23.88±14.25	0.47	20.10±11.98	21.10±10.61	0.70
Saturated fat (g)	7.25±3.39	8.78±6.29	0.18	6.85±4.31	7.35±3.99	0.52
Carbohydrates (g)	79.63±33.00	73.57±31.45	0.44	74.20±31.79	83.52±34.72	0.10
Fiber (g)	5.78±3.93	5.87±4.71	0.93	5.39±2.16	5.43±2.62	0.96
Sugar (g)	40.14±15.11	38.22±21.29	0.64	38.09±21.76	41.27±21.12	0.41
Protein (g)	26.87±15.52	25.24±11.11	0.64	24.27± 8.97	27.21±10.38	0.11
Sodium (mg)	937.14± 491.96	979.30± 476.20	0.72	823.23± 357.56	892.43± 385.33	0.30
Calcium (mg)	479.03± 186.81	500.93± 258.87	0.59	453.83± 191.16	443.16± 217.16	0.79
Potassium (mg)	980.23± 506.58	930.16± 376.76	0.87	838.60± 292.44	921.89± 401.25	0.31
Magnesium (mg)	86.30±54.37	80.22±37.89	0.72	73.61±32.01	74.35±28.43	0.79
Iron (mg)	3.72±2.37	2.72±1.25	0.06	2.81±1.04	3.16±1.38	0.19
Zinc (mg)	3.43±3.01	2.71±1.41	0.26	2.62±1.58	2.61±1.24	0.96
Folate (mg)	94.37±84.84	94.51±74.17	0.99	82.55±54.97	95.97±69.91	0.39
Vitamin A (mg RAE)	336.53± 238.64	311.37± 198.22	0.67	258.87± 177.11	218.54± 129.13	0.27
Vitamin C (mg)	43.21±34.26	37.45±44.58	0.51	35.92±39.71	57.54±76.64	0.16
Vitamin D (IU)	3.32±1.58	3.20±1.98	0.86	2.66±1.63	3.14±1.83	0.19
Vitamin E (mg)	1.83±1.55	1.72±1.50	0.78	1.59±1.82	1.67±1.34	0.82

SD = Standard deviation

For every 1-gram increase at the post, the pre carbohydrates and sugar grams increased by 0.39 and 0.47, respectively. (Table 5.10) Rural child care provider's increased by 7.84, 4.28 and 7.73 grams of fat, saturated fat and protein, respectively, for every one-gram increase at the post observation compared to providers located in urban county locations.

Table 5.10 Dietary Quality of Foods and Beverages Served by Child Care Providers: Linear Regression (n=67)

Co-variables	Post Nutrients	Calories (kcal)	Total fat (g)	Sat. fat (g)	Carb (g)	Protein (g)	Fiber (g)	Sugar (g)
Pre Nutrient	**Coefficient (SE)**	0.18 (0.15)	0.05 (0.13)	0.32 (0.16)	0.39** (0.14)	0.02 (0.11)	-0.13 (0.17)	0.47** (0.13)
	95% CI	-0.12-0.49	-0.22-0.32	-0.00-0.65	0.11-0.67	-0.19-0.24	-0.47-0.21	0.20-0.73
Intervention[1]	**Coefficient (SE)**	-52.74 (61.06)	1.95 (3.07)	0.56 (1.25)	-14.71 (8.37)	-4.07 (2.65)	0.58 (1.00)	0.46 (0.13)
	95% CI	-174.97-69.49	-4.20-8.09	-1.94-3.05	-31.47-2.04	-9.38-1.24	-1.42-2.58	0.20-0.73
County Location[2]	**Coefficient (SE)**	95.44 (65.29)	7.84* (3.33)	4.28** (1.35)	1.61 (8.91)	7.73** (2.86)	-0.54 (1.08)	-5.26 (4.91)
	95% CI	-35.24-226.13	1.18-14.50	1.50-6.83	-16.23-19.45	2.00-13.46	-2.70-1.62	-15.09-4.56
CACFP Participation[3] **Sponsor 1**	**Coefficient (SE)**	-12.72 (114.49)	-6.31 (5.48)	-0.68 (2.27)	19.08 (16.39)	5.18 (4.68)	0.47 (1.84)	3.78 (5.32)
	95% CI	-241.90-216.47	17.28-4.66	-5.23-3.87	-13.73-51.90	-4.20-14.56	-3.21 4.15	-6.86-14.43
Sponsor 2	**Coefficient (SE)**	-75.45 (159.33)	-12.59 (7.90)	-2.48 (3.25)	20.75 (21.96)	2.11 (6.72)	0.43 (2.53)	4.78 (9.08)
	95% CI	-394.38-243.48	-28.41 -3.23	-8.99-4.03	-23.22-64.71	-11.34-15.55	-4.64-5.50	-13.39-22.95
Sponsor 3	**Coefficient (SE)**	-39.57 (119.34)	-7.21 (5.70)	-1.39 (2.35)	17.18 (16.87)	0.42 (4.91)	-1.54 (1.99)	2.11 (12.60)
	95% CI	-278.45-199.31	-18.63 - 4.20	-6.09-3.31	-16.59-50.95	-9.41-10.26	-5.53- 2.44	-23.10-27.33
Age Category[4] **2-3 Years**	**Coefficient (SE)**	-24.51 (69.29)	0.69 (11.92)	1.10 (1.44)	-12.68 (9.46)	5.93 (3.06)	-1.03 (1.16)	2.28 (9.45)
	95% CI	-163.21-114.19	-6.37-7.75	-1.77-3.98	-31.61-6.25	-0.18-12.05	-3.35-1.28	-16.64-21.19
	Coefficient	181.06	11.92 (5.27)	3.09 (2.14)	21.63	4.72 (4.71)	1.16 (1.69)	-4.90

Table 5.10 (cont'd)

4-5 Years	**(SE)**	(103.05)			(14.04)			(5.65)
	95% CI	-25.22-387.34	1.37-22.47	-1.18-7.37	-6.47-49.73	-4.70-14.14	-2.23-4.54	-16.20-6.40
	R-squared	0.14	0.22	0.27	0.20	0.20	0.11	0.29
	Adjusted R-squared	0.02	11.86	0.17	0.08	0.09	-0.02	0.19
	Effect Size eta-squared	0.14	0.22	0.27	0.20	0.20	0.11	0.29

*p<0.05, ** p<0.01 CI=Confidence Interval, Carb=carbohydrates, sat.= saturated

References: [1]control group, [2]urban county location, [3] not participating in CACFP, [4]both 2-3 and 4-5 age categories

Linear regression results for the nutrients indicated that rural providers had a 186-milligram increase in calcium for every one milligram increase at the post assessment compared to child care providers located in urban counties. Child care providers who served food and beverages to children 4-5 years of age reported a 469 increase in milligrams of potassium for every one milligram increase in the post compared to child care providers who served both 2-3 and 4-5 year-old-children (Table 5.11). Child care providers that received reimbursement from CACFP sponsor 1 or sponsor 3 reported a 1.28 and 1.59 decrease in milligrams of vitamin E for every one milligram increase in the post score compared to providers who did not participate in CACFP. Child care providers who served food and beverages to children 2-3 years-of-age reported a 1.61 milligram decrease of calcium for every one milligram increase in the post compared to child care providers who served both 2-3 and 4-5 year-old-children. Effect sizes for the results ranged from 0.06-0.29 for nutrients served overall, indicating a small effect.

Table 5.11 Dietary Quality of Foods and Beverages Served by Child Care Providers: Linear Regression (n=67)

Co-variables	Post Nutrients	Sodium (mg)	Calcium (mg)	Potassium (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Folate (mg)	Vit A (mg RAE)	Vit C (mg)	Vit D (IU)	Vit E (mg)
Pre Nutrient	**Coefficient (SE)**	0.14 (0.13)	0.32* (0.16)	0.06 (0.12)	-0.01 (0.10)	0.07 (0.10)	0.02 (0.07)	0.17 (0.14)	-0.02 (0.10)	0.20 (0.22)	0.32* (0.14)	0.08 (0.10)
	95% CI	-0.13-0.41	0.01-0.64	-0.18-0.29	-0.22-0.20	-0.14-0.28	-0.13-0.17	-0.11-0.45	-0.22-0.18	-0.24-0.64	0.04-0.60	-0.12-0.29
Intervention[1]	**Coefficient (SE)**	30.66 (111.45)	1.55 (56.39)	-49.20 (97.96)	3.65 (8.85)	-0.47 (0.37)	-0.06 (0.35)	-6.25 (19.44)	66.92 (43.44)	-19.08 (15.84)	-0.50 (0.47)	0.11 (0.35)
	95% CI	-192.44-253.76	-111.33-114.43	-245.29-146.89	-14.06-21.37	-1.22-0.28	-0.78-0.65	-45.17-32.67	-20.04-153.88	-50.79-12.63	-1.44-0.43	-0.58-0.81
County Location[2]	**Coefficient (SE)**	236.86 (118.98)	185.86** (61.38)	149.25 (105.62)	17.23 (9.44)	-0.14 (0.39)	0.42 (0.38)	-4.71 (20.91)	86.61 (46.17)	-4.70 (17.05)	1.32 (0.50)	0.40 (0.38)
	95% CI	-1.31-475.03	63.00-308.72	-62.17-360.66	-1.67-36.14	-0.91-0.64	-0.35-1.18	-46.56-37.13	-5.82-179.04	-38.83-29.42	0.32-2.32	-0.36-1.17
CACFP Participation[3]	**Coefficient (SE)**	-46.96 (204.93)	116.99 (105.46)	191.81 (176.47)	-3.88 (16.32)	-0.04 (0.70)	0.60 (0.62)	30.74 (35.62)	92.72 (75.86)	-10.00 (28.50)	0.92 (0.82)	-1.28* (0.62)
	95%	-	-94.11-	-	-	-	-0.64-	-40.56-	-59.13-	-67.04-	-0.73-	-2.51-

Table 5.11 (cont'd)

Sponsor 1	**CI**	457.17-363.26	328.09	161.43-545.05	36.56-28.80	1.36 - 1.28	1.85	102.04	244.56	47.02	2.56	-0.05
Sponsor 2	**Coefficient (SE)**	299.74 (282.91)	9.63 (144.31)	91.17 (246.62)	12.36 (22.14)	0.32 (0.92)	0.26 (0.90)	19.31 (49.43)	-26.79 (108.29)	-38.69 (39.94)	0.39 (1.17)	-1.45 (0.88)
	95% CI	- 266.56-866.03	- 279.24-298.49	- 402.50-584.83	- 31.98-56.69	- 1.52 - 2.15	-1.53-2.06	-79.64-118.25	- 243.55-189.98	-118.63 -41.26	-1.96-2.74	-3.22-0.33
Sponsor 3	**Coefficient (SE)**	-61.38 (212.91)	68.02 (107.85)	143.30 (185.12)	-8.27 (17.11)	0.24 - 0.69	0.48 (0.65)	32.06 (38.04)	39.72 (80.20)	-21.47 (30.47)	1.08 (0.86)	-1.59* (0.64)
	95% CI	- 487.57-364.81	- 147.86-283.91	- 227.26-513.86	- 42.54-26.00	- 1.14 - 1.63	-0.83-1.78	-44.07-108.20	- 120.81-200.26	-82.46-39.53	-0.65-2.80	-2.87--0.31
Age Category[4] **2-3 Years**	**Coefficient (SE)**	-3.30 (126.09)	95.27 (64.81)	-28.73 (112.12)	-10.33 (10.05)	- 0.12 (0.41)	0.57 (0.41)	-1.10 (22.14)	-2.47 (48.99)	-23.23 (18.11)	0.19 (0.53)	-0.81 (0.40)
	95% CI	- 255.71-249.10	-34.47-225.02	- 253.16-195.70	- 30.46-9.79	- 0.94 - 0.71	-0.25-1.39	-45.41-43.21	- 100.53-95.58	-59.49-13.02	-0.88-1.25	-1.61*--0.01
4-5 Years	**Coefficient (SE)**	228.42 (190.22)	152.39 (99.68)	468.80** (168.60)	21.21 (14.87)	- 0.12 (0.41)	0.44 (0.62)	32.66 (33.03)	114.65 (72.48)	52.38 (26.78)	1.47 (0.78)	0.48 (0.59)
	95% CI	- 152.36-609.19	-47.13-351.92	131.31-806.28	-8.57-50.99	- 0.94 - 0.71	-0.79-1.68	-33.45-98.78	-30.44-259.74	-1.21-105.98	-0.10-3.04	-0.71-1.66

Table 5.11 (cont'd)

	R-squared	0.16	0.27	0.17	0.13	0.05	0.07	0.06	0.20	0.18	0.22	0.20
	Adjusted R-squared	0.04	0.17	0.06	0.00	-0.08	-0.06	-0.08	0.09	0.07	0.12	0.09
	Effect Size eta-squared	0.16	0.27	0.17	0.13	0.05	0.07	0.06	0.20	0.18	0.22	0.20

*p<0.05, ** p<0.01 Vit=vitamin CI= Confidence Interval

References: [1]control group, [2]urban county location, [3]not participating in CACFP, [4] both 2-3 and 4-5 age categories

E. Discussion

To our knowledge, this is the first study that investigates the effects of a nutrition education intervention on the dietary quality of foods and beverages served at an in-home child care setting compared to studies that look at primarily environmental and practice changes.[21,23-25,85,97] Similar to our improved overall NAP SACC scores, previous studies that have investigated the use of the NAP SACC assessment in a nutrition education intervention have reported a significant improvement in nutrition policies and practices as a result of nutrition education interventions that include the NAP SACC assessment. [22,24-26]

Effect sizes in addition to p-values were calculated to see how much of an increase was documented after the nutrition education intervention. Although dietary components were not significantly increased, the effect sizes showed a positive trend. Previous nutrition education interventions with child care providers measuring pre- to post- intervention changes resulted in a small to medium effect size of 0.25 for fruits and vegetables, 0.33 for meals and snacks, and 0.57 for nutrition education in which our effect sizes were comparable in range.[100]

Our intervention was not CACFP specific and the sample for the intervention was based on a sub sample from an earlier observational study. In addition, parental engagement was not integrated into the intervention, which may have decreased the statistical impact of the study. A review previously conducted showed that multi-component, multi-level early child care interventions with parental engagement are most likely to be effective with improved anthropometric outcomes.[143] Specific components of nutrition education interventions that impact dietary quality have not been thoroughly studied but some previous effort suggest that nutrition education focused on improving menus to align with dietary recommendations increased vegetables, dairy, meat servings, energy, fiber, calcium, potassium, zinc, and folate,

while decreasing sodium.[100]

Implementing multiple changes at different levels can occur through utilization of the social ecological model.[101] This includes the social and cultural norms and values, sectors, settings, and individual factors, of the social-ecological model. The can be effective in improving eating behaviors, including the food and beverage environment and previous studies using school policies to enhance the school food environment led to better dietary quality of the food consumed during the school day.[60]

Strengths of the study included the assessment of foods and beverages served using the direct diet observation method[112] and the use of a sustainable nutrition education intervention model offered through the extension service and utilizing funding through the Supplemental Nutrition Assistance Program Education (SNAP-Ed). Limitations of the study included that the child care provider may have also adjusted their normal daily serving behavior because of the presence of the research team member and that a lunch and snack observed on a single day may not best represent normal foods and beverages served frequently. Further research looking at multiple days of foods and beverages served might give a better indication of food group and nutrient associations with an educational intervention. Other limitations of the study included not measuring if other nutrition education was received by the providers, what the child care providers prior knowledge before the education was, and the mis-alignment of the randomization process in that the control and intervention child care providers did not start with a similar dietary quality status. The intervention child care providers already reported a higher dietary quality suggesting that improvements may not have been as necessary or easily attained and the control group may have been receiving alternative education which could account for the larger changes noted in that group, even though not significant. The ability to determine the

associations of the educational intervention directly was also potentially impacted by the fact that child care providers may have received education on different best practices and the education they received was monitored solely by the number of educational areas of focus they received as opposed to the topics of educational areas received in the 6-month period. More stringent fidelity measures, including observations, should be implemented in future studies. Additionally future studies might include determining what dosage of education is most impactful on dietary quality and follow-up done at a later interval, once policies/environmental changes have been in place for a specified period of time. This may result in significant, positive dietary quality changes in the foods and beverages served in the child care homes.

Worth noting, given the topic of this research, is that the newest version of the CACFP nutrition guidelines were released and implemented during the time pre-intervention and post-intervention data were collected. Data collection for this research study began in August of 2016 and concluded in 2018, and the CACFP guidelines were fully implemented in October of 2017 with early implementation in 2016. It is therefore a possibility that some providers, control and intervention, may have already made changes to the meals and snacks served in their child care homes before enrolling in the study.

F. Implications for Research and Practice

The nutrition education intervention received in this study may be misaligned to impact dietary quality of foods and beverages served as specified by CACFP nutrition standards. The NAP SACC assessment, which helped to determine the education received, may not be specific enough for the standards to impact dietary quality of foods and beverages served. In the future, assessments and educational intervention research should focus on specific nutrients and food groups to be served for lunch and a snack based on a prior assessment of shortcomings or

specific items that need to be addressed. This may include using the observation of the foods and beverages served as a topic of education. This would provide an opportunity to educate on food and beverage selection, preparation, as well as tactics for enhancing food service for in-home child care providers.

Although we did not have increases in dietary quality as a result of the intervention, increases in the dietary quality in the control and intervention groups may also have been a result of the placebo effect of having someone come into the home to complete the observation. In-home child care providers may benefit from frequent observations or informal visits during the meal or snack time as a form of nutrition education. The visits could serve as an opportunity to have informal conversations in which the provider is asked how they could improve the meal and snack informally. Such information should have been noted. Multi-level educational interventions with child care providers, children and parents that are specific to serving foods and beverages that align with dietary recommendations and CACFP nutrition standards and assess prior knowledge is a follow-up goal.

Given the large percentage of children who spend time in child care settings and the increasing amount of time spent in child care, increasing dietary quality of foods and beverages served could have considerable impact in preventing childhood obesity, decreasing nutrient deficiencies, and helping children develop healthy eating behaviors. Determining a multi-level, nutrition education intervention that can impact dietary quality is crucial and further research is needed to determine the approach that is associated with increased dietary quality.

CHAPTER 6 - In-home child care provider perceived barriers and facilitators to adherence to the new child and adult care food program nutrition standards

Target Journal: Journal of the Academy of Nutrition and Dietetics

A. Abstract

Background: Implementation of the new Child and Adult Care Food Program (CACFP) nutrition standards may present challenges, especially for in-home child care providers.

Objective: To elucidate perceived barriers and facilitators faced by in-home child care providers to following the changes in the CACFP food and beverage nutrition standards and to identify opportunities for child care provider education.

Design: Virtual, semi-structured individual interviews elicited qualitative data from a cross section of low-income in-home child care providers in Michigan.

Participants: Stratified purposive sampling (race, ethnicity, urban and rural residence and licensure) was used to recruit 20 in-home child care providers.

Analysis: Thematic coding analysis with NVivo (ver12.0) was used to organize and interpret data.

Results: Primary barriers to adhering to the CACFP nutrition standards included: food preferences of children and providers, higher cost and lower availability of CACFP-approved items, celebrations and food rewards, excessive time and effort needed to prepare foods and beverages especially when there are dietary restrictions for some children. Perceived facilitators included: using nutrition education, finding convenient and easy ways to prepare foods and beverages, using CACFP and WIC guidelines and funding, increasing variety of foods and beverages by using a menu or recalling items recently served, child care provider and peer modeling and encouragement, mixing preferred foods/beverages with less preferred, using

nutrition information available from social media and from peers, allowing children to choose foods and beverages, serving the same eligible foods and beverages to all children regardless of age, and provider concern about impact of foods and beverages on children's health and behavior.

Conclusions: To overcome barriers to and strengthen facilitators for child care providers serving CACFP-eligible foods and beverages in child care homes, CACFP program sponsors and community organizations should focus on: 1) overcoming, identifying and providing acceptable alternatives for foods that are unhealthy and preferred and minimizing food waste through education on modeling of healthy eating, actively encouraging healthy food consumption, allowing choices in foods and portions, mixing preferred foods with less acceptable ones, and communicating with parents about healthy eating at home; 2) developing skills for providers in minimizing costs of healthy foods; 3) finding ways for providers to celebrate and give rewards that do not rely on sugar-sweetened treats; 4) identifying time-saving approaches for providers including shopping, food preparation, and accommodating common food restrictions; and 5) emphasizing the health reasons behind program requirements to child care providers. Methods of education should also include social media that encourages peer-to-peer support from other providers and access to evidence-based reliable resources.

B. Introduction

Sixty-one percent of children under five years of age are in some type of child care for 21-36 hours per week, on average.[144] Children enrolled in part- and full-time child care consume about 1/3 of their daily caloric intake in child care settings.[1] In-home child care providers serve more than 1.5 million children in the United States and make-up 80% of the providers nationwide and 60% in Michigan.[15,17]

Child dietary habits are formed early in life; hence, the food and beverages served by child care providers can impact life-long health and eating behaviors.[3,129] The Child and Adult Care Food Program (CACFP) is a federal program that offers nutrition training and financial reimbursement for approved meals and snacks.[15] Although participation in CACFP has been found to be associated with improved nutritional intakes[64,145,146] not all eligible child care providers participate. One study showed that only 48% of rural, low-income child care centers participated in CACFP.[18]

On October 1, 2017, the United States Department of Agriculture launched several revisions to CACFP which included: separating fruits and vegetables into two components, disallowing grain-based desserts as a reimbursable food option, limiting sugar content in yogurts served, disallowing frying foods on site, requiring one grain per day to be whole grain, and modifying the fluid milk requirement.[14]

The new nutrition standards can potentially increase dietary quality of meals and snacks served by child care providers, however the extent to which this potential has been realized has yet to be investigated. This study aims to determine what perceptions child care providers have about the new guidelines and about their ability to adhere to them.

The theoretical foundations for this qualitative study was based on the Health Belief Model (HBM) and Self-Determination Theory (SDT).[104-107] The HBM, which dates back to the 1950s, explains health behavior changes associated with individuals' beliefs and attitudes and perceived benefits and barriers [104,106,108] that can be influenced by self-efficacy and cues to action. For child care providers, the HBM may explain perceived barriers and facilitators to meeting CACFP nutrition standards, motivation for meeting nutrition standards, and external influences on meeting or not meeting the standards. The SDT represents a broad framework for

the study of human motivation.[104,107] The SDT focuses explicitly on what motivates people to change behaviors. In this study, it provided a basis for gaining insight into child care provider decision-making processes relative to what food and beverages they serve, and to identify motivation to align with the CACFP nutrition standards.[15,118]

Our research expands on past research focused on barriers to young children eating healthy foods, which included: caregiver's lack of meal preparation skills, cost, lack of knowledge and competing unhealthy foods.[147] Additionally, it builds upon a past study which found that a child's fruit and vegetable intake can be positively influenced when child care providers make fruit and vegetables accessible and model consumption, and when children eat with other children.[148] Past research has focused on some, but not all aspects of CACFP nutrition standards.

Because of the recent revisions to the CACFP nutrition standards, the purpose of the current study was to establish a basis for making nutrition education for child care providers more effective by: 1) determining the barriers for in-home child care providers' adherence to the CACFP nutrition standards; and 2) determining the facilitators for in-home child care providers' adherence to the CACFP nutrition standards, including identifying their motivation for following the standards, and 3) examining the influence of community organizations.

C. Materials and Methods

1. Sample and Recruitment

The study used a stratified purposive sampling approach to recruit 20 in-home child care providers based on primary differentiating characteristics, which may influence CACFP nutrition standard adherence– participation vs. non-participation in CACFP, rural vs. urban geography, race and ethnicity, and licensure status (licensed for 6 children, 12 children or unlicensed).

Providers were originally recruited from the Great Start to Quality database of child care providers.[149] The study participants were part of a larger study (sample size = 116) assessing the dietary quality of the meals and snacks served. Providers were stratified and called for recruitment randomly from each category. Access to a computer, phone, tablet, iPad or mobile device was a requirement for provider participation.

A total of 20 selected child care providers were invited to participate in the study via a phone call from the primary researcher in during a telephone script was used to explain the purpose and format for a virtual semi-structured interview. Recruitment continued until data saturation was reached, in other words no new information was obtained and coded from the interview. A sample size of at least 15-20 child care providers was sought, based on a previous qualitative research study with semi-structured interviews (n=18) addressing barriers and facilitators experienced by child care providers to serving meals family style to preschool children in Headstart.[123] Gift cards of $20 were given after completion of the interview to incentivize participation in the interview, which lasted a minimum of 45 and a maximum of 60 minutes.

2. Instruments and Data Collection Procedures

The study and procedures were approved by Michigan State University human research protection program. To maximize content validity of the interview questions, an audit trail tracking each step of the qualitative process was conducted, after which the questions were reviewed by three researchers with experience in qualitative research design, who also confirmed the face validity of the questions. The questions were pilot tested with two child care providers beyond the 20 child care providers to confirm ease of process, allow for refinement, and establish timing. A semi-structured interview format was chosen to enable a more conversational

approach, allowing the primary researcher to foster a notion of partnership with participants and elicit richer input.

Interviews were conducted remotely, using Zoom technology, a web-based platform used to host webinars, online meetings, and phone meetings. Child care providers who agreed to participate were e-mailed a consent form, login phone number and Zoom link. Zoom technology is a web-based platform used to host webinars, online meetings, and phone meetings. All interviews were led by the primary researcher, audio-recorded digitally via Zoom, with a trained, senior-level undergraduate student also capturing detailed notes. As a back-up, interviews were also recorded on a digital recorder. The primary researcher read the consent form to participants via Zoom if they had not read the e-mailed copy prior to the interview, and asked for their verbal consent to participate in the study.[105] For each CACFP nutrition standard discussed, questions were asked to develop rapport, determine barriers, and determine facilitators (APPENDIX I: Semi-structured Interview Guide). For example: 1) what can you tell us about the kinds of beverages/drinks that you serve; 2) what makes it easy to serve these beverages; 3) what makes it difficult to serve beverages that you would like to give to the children. Probes were then used to ask about beverages that are not allowed with CACFP such as flavored milk, full-fat milk, soda, sports drinks and other flavored beverages. This was repeated for fruits and vegetables, yogurt, breakfast cereals, desserts, whole grains and food preparation methods. To probe for possible influences and motives, additional questions included: 1) what helps you decide what foods and beverages you will serve to the children you care for; 2) are there any recommendations you have that will help child care providers serve foods and beverages that meet government nutrition expectations: 3) what are examples of helpful information you have received about foods and beverages that should be served to the children you care for; and 4) what types of

information or resources would make it easier for you and other day care providers to serve foods and beverages that meet government nutrition expectations?

In order to encourage candor during data collection, child care providers were assured that their compliance with child care program guidelines was not being evaluated during the interview process.

To maximize the consistency and rigor of the qualitative data collection process the following procedures were followed: 1) use of audit trail tracking of each step of the qualitative process 2) selection of two theories embodying the potential perceived barriers and benefits, 3) use of two data coders; and 4) use of an interview guide, so that questions to all respondents were asked in the same order.[122,126,150-152]

D. Data Analysis

Interviews were transcribed verbatim from the audio recordings by the same research assistant who participated in each interview. Qualitative analysis progressed through the six steps of thematic analysis outlined by Braun and Clark:[128] 1) becoming familiar with the data; 2) generating initial codes and applying them to recorded interview transcripts for each research question; 3) creating potential themes by examining all quotes associated with each code and organizing codes into themes; 4) refining themes by examining all codes and quotes associated with a theme, collapsing or eliminating as needed; 5) defining and naming themes by describing the essence of each theme and giving it a compelling name; and 6) producing the report. The primary researcher and a PhD graduate student with qualitative research training coded the data independently and reached consensus on any discrepancies. NVIVO, (version 12.0), [153] was used to classify, sort and arrange information. Descriptive statistics were generated using Microsoft Excel 2016.

E. Results

1. Demographics

Twenty in-home child care providers, all female, participated in qualitative interviews. Of the participants, 75% identified as white, 20% African American, 5% multiracial, and 10% Hispanic. Most (85%) were licensed child care providers, participating in CACFP. Participants were from 14 counties (40% rural and 60% urban) in Michigan.

Data analysis identified key themes related to barriers and facilitators to child care providers meeting the CACFP nutrition standards, with motivations and influences embedded within. Themes that emerged are discussed below for each research area of focus and with quotes used to illustrate central points (Table 6.1 and 6.2).

Table 6.1: Barriers to Adhering to the CACFP Nutrition Standards

Sub-theme	Mentions	Representative Quote
Food preferences of children and providers	130	*"With the vegetables, I'm having a hard time…most of the kids, they don't eat the vegetables. I asked the parents and…they don't serve vegetables at home."*(ID 88) "*They definitely have their favorites. And I tend to stick to what they love and I know they'll eat.*" (ID 71)
Higher cost and lower availability of CACFP-approved items	22	"*Sometimes it's hard depending on what grocery store you go to, to what they have available. And some you go to you might find…whole wheat bread for $1.19, and…another store and its $3.59, and I'm not going to pay $3.59 for bread when I need three loaves for one meal."* (ID 70)
Celebrations and food rewards	17	*"What we do is we generally use it for a dessert after lunch…I don't ever let the birthday treats replace our snack.* (ID 70) *"So what I do is if everybody's been extra good today, and nobody has gotten on my nerves today, and everybody did homework like they supposed to, I give them a special treat." (ID 30)*
Excessive time and effort needed to prepare foods and beverages	16	"*I don't do a real big meal. I just can't keep an eye on them, it's just too hard."* (ID 86) *"If I want to buy raw vegetables, and everything raw, that is a problem because it's taking too much time, it's not hard but it's taking time, like if I'm alone with the kids, I don't want to spend time in the kitchen."* (ID 47)
Dietary restrictions for some children	11	"*I have one child that his mom says he is vegan, so I have her bring me his lunch, and I will serve him before I serve the other kids."* (ID 68)

Table 6.2 Facilitators to Adhering to the CACFP Nutrition Standards

Sub-theme	Mentions	Representative Quote
Using nutrition education	75	*"They have the programs out there that teaches good nutrition and teaches you how to do it, you just have to want to do it. If you look for them, they're easy to find and readily available."* (ID 30)
Finding convenient and easy ways to prepare foods and beverages	56	*"One company has made single serving, low salt, low to no salt, diced vegetables that are available like prepackaged." (ID 105)*
Using CACFP and WIC guidelines and funding	55	*"I think I do so well because of the food programs, what I can do and what I shouldn't do."* (ID 86) *"There's only certain cereals that they approve (WIC), and also on the Food Program, so I try to follow both of them when I'm purchasing the food."* (ID 72)
Increasing variety of foods and beverages by using a menu or recalling items recently served	38	*"I keep all my menus for a couple months or so…then I just get three or four of them out and I'll go back…"Well we haven't had this in a while."* (ID 84)
Child care provider and peer modeling and encouragement	37	"*When they all eat together, they seem to all eat very well. Even if their parents say they don't eat well."* (ID 68) *"Sitting down and eating the foods with the kids. If they don't see you eating it they don't want to eat it, but if they see you eating something they eat, they will eat it. And if they look over and see their friends scarfing it down, then they'll eat it."*(ID 6) "*If they don't like it they take the no thank you bite*" (ID 32)
Mixing preferred foods/beverages with less preferred	27	*"I try to add fresh fruit with their cereal so they will eat it"* (ID 72)
Using nutrition information available from social media and from peers	26	*"On Facebook we have a page for all the providers…they share ideas and resources to go to different websites."* (ID 88)

Table 6.2 (cont'd)

Allowing children to choose foods and beverages	17	*"So the kids serve themselves how much yogurt they want and then take fruit…some stir it up and eat it, and some eat it like it is as a topping."* (ID 14)
Serving same eligible food and beverages to all children	15	*"I kind of stick on the same diet for everyone."* (ID 79)
Providers concern about impact of foods and beverages on children's health and behavior	11	*"Knowing that there's not a lot of sugar in the cereal… Know what the sugar can do. And I'm helping them to not be used to too much sugar."* (ID 67) *"I think milk is good for them so I always give them milk."* (ID 86)

2. Barriers

1. Food preferences of children and providers

Child care providers stated what they served the children was influenced by the children's preferences (130 mentions). Providers perceived that children's taste preferences changed from day to day, but were influenced by what their parents and caregivers fed them. Foods and beverages served by parents and caregivers shaped children's preferences and willingness to eat items within child care: "*A lot of them are set in their ways"* (ID 78). Specific examples of items expected by children included fried chicken, beverages and cereal high in sugar. Providers believed the CACFP-required foods and beverages were not served by the parents at home. "*You can tell which ones don't eat fruits and vegetables at home because their parents don't eat it, they don't serve it to them, but they'll eat it here*" (ID 6). Providers also indicated they often tell parents they cannot bring in certain food and beverage items for their children, as these items can cause friction when the other children see them and want them. What the children have accepted or refused, influenced providers to serve or not serve a specific food or beverage again. Providers indicated that if a child did not prefer a food or beverage there was also increased food waste. Waste was most often associated with fruits and vegetables. Providers sensed that whole grains, being a different color from grains they were accustomed to, were less acceptable to the children.

Some providers acknowledged that their own individual preference for a food or beverage influenced the children's eating, as well. In-home providers often prepare similar food for the children as they prepare for their families and themselves, so foods already available in their homes influenced menus. Other factors were mentioned that influenced what the provider wanted to serve to the children. Providers did not want to serve specific foods they perceived as

being messy (such as yogurt). Providers wanted to serve a food that "*goes good*" (ID 84) with other foods. Some providers had negative attitudes toward canned and frozen versions of fruits and vegetables. The weather also influenced what they wanted to serve the children. When the weather was hot, milk and yogurt were perceived as undesirable, while frozen yogurts such as"Go-Gurts" and sugar-sweetened beverages such as "Hugs," (ID 30) were perceived as items that should be served, although they do not adhere to CACFP nutrition standards.

2. Higher cost and lower availability of CACFP-approved items

Price, availability, and the seasonality of fruits and vegetables were perceived as barriers to adhering to the CACFP nutrition standards. Price was particularly influential for cereal, yogurt, whole grains, fruits and vegetables. Seasonality was most influential for providers when serving fruits and vegetables. "*I serve seasonal fruit…whatever's ready,"* (ID 14). Child care providers reported sometimes running out of a food or beverage because it was not available and making a substitution which did not follow the CACFP nutrition standards. The most common substitutions mentioned were a higher-fat version of milk or a non-whole grain food item.

3. Celebrations and food rewards

Child care providers perceived that they were unable to adhere to the CACFP standards when celebrations and special events occurred, and when they needed to reward children for good behavior. Some providers found ways to still adhere to the guidelines, like serving the dessert or sweet treat after the regular lunch or giving snack foods to parents to be taken home at the end of the day. Some child care providers made suggestions to parents to bring non-food items for celebrations or suggested healthier options such as, "*fruit, string cheese, vegetable tray or juice."* (ID 71). Some child care providers indicated using food and beverages as rewards for toilet training, cleaning up toys, good behavior, or for encouraging them to leave and go home

with their parents. Specific rewards mentioned included candy, dessert foods, eating out, frozen yogurts, and popsicles.

4. Excessive time and effort needed to prepare foods and beverages

Most providers highlighted that some foods and beverages aligned with the CACFP requirements took a longer time to prepare and were therefore difficult to serve at the same time as watching and caring for the children. Time available for food preparation was perceived as non-existent due to the needs of the children present, as many cared for children alone or with the help of one assistant. Fruits, vegetables, chicken, and oatmeal were perceived as items that took more time to prepare. Additional time was also needed to prepare food items in appropriate serving form and size (to avoid choking) and for the age of the child. "*Dicing, and cutting things up… That's all time intensive,"* (ID 32). Food shopping, included in the overall preparation, was also reported as taking additional time, as providers had to read food labels to check that foods meet sugar and whole-grain CACFP requirements. Although not specific to food preparation, a provider who was not participating in CACFP also mentioned time as a barrier to participation in CACFP, noting that the program was too much work because of the paperwork and submission of menus required with the program.

5. Dietary restrictions for some children

Providers perceived that dietary restrictions for some children were barriers to serving CACFP-approved foods. When children needed modified diets – due either to parent wishes or an allergy, sensitivity, cultural or religious preference or a medical diagnosis - the provider indicated purchasing or preparing different foods and beverages from what the rest of the children received. Providers found it difficult having to change their normal serving routine when children with dietary restrictions were fed outside of the group. One provider reported

increased food waste when she initially gave a child with a restricted diet standard portions out of habit.

3. Facilitators

1. Using nutrition education

Many child care providers reported that online and in-person training sessions helped them serve healthy foods consistent with CACFP nutrition standards. These included annual conferences offered by CACFP sponsors in Michigan (Association for Child Development, Mid-Michigan, and Early Childhood Conferences by Campfire 4 C's) and trainings offered by local organizations including an "*infant and toddler academy*" (ID 67), and child development classes. Community organizations providing trainings that were mentioned included Michigan State University Extension and the Kidney Foundation of Michigan. "*Cooking Matters*"[98] (ID 68) training by both agencies was specifically mentioned as an influential training where child care providers learned to cook healthier foods and beverages, such as yogurt parfaits and read food labels. Any type of cooking or "*hands on*" (ID 68, 71) educational class was preferred by child care providers. Providers also reported that their decisions about which foods and beverages to serve were influenced by information from their own children's doctor, WIC clinic, early intervention services for children with developmental delays or medical conditions, and interestingly relatives who were dental hygienists.

2. Finding convenient and easy ways to prepare foods and beverages

Many providers noted the time they had available to make breakfast, lunch or snack often determined what type of food was served. Some prepared foods on the weekends, in the mornings, or the night before to decrease the time they needed to devote to meal and snack preparation when the children were present. Many providers pointed out that food and beverages

which meet the guidelines can be "*simple*" and "*not have to be cooked from scratch*" (ID 47, 48). One of the foods perceived as easiest to prepare and shop for was cereal, as most providers indicated receiving a list of CACFP-approved cereals from their food program consultants. Additionally, providers noted small, prepackaged food items were easier to serve and prepare, including yogurt, diced vegetables, applesauce squeeze pouches and anything in a small container. Purchasing items like juice online and having it shipped to the home helped providers pick a variety that met CACFP standards. Providers identified that the method of preparation they chose each day was governed by convenience and most often included: steaming, baking, air frying, microwaving and using a toaster. In contrast to the child care providers whose preference for avoiding canned fruits and vegetables was perceived as a barrier to complying with CACFP rules, some providers noted canned and frozen versions were easier to prepare and were more readily available than fresh.

3. Using CACFP and WIC Guidelines

Child care providers indicated that many of the decisions they made regarding what to serve were based on CACFP, WIC, or State of Michigan licensing guidelines. Providers had received education on the CACFP guidelines at their compliance visits, over text, in-person and through e-mail. Additional influences mentioned that helped them follow CACFP guidelines were CACFP sponsor consultants, on-line trainings through the CACFP program sponsor website and a locally-available monthly publication from the CACFP sponsor. Specific CACFP training topics previously received were focused on: whole grain cereals, grain-based desserts, sugar limitations, appropriate milk to serve per age group, how to read a food label and ingredient list, juice and other drink requirements. Providers were influenced by specific lists of foods provided by the CACFP sponsors. When the CACFP guidelines recently changed,

providers stated they adjusted the foods and beverages they served each day - specifically whole grains, juice, fruits, vegetables, cereal, yogurt, milk, and desserts. Providers claimed they were serving the "*right amount of sugar per serving"* (ID 67). Regarding avoiding grain-based desserts, one provider said, *"I am not allowed to, they're not acceptable on the Food Program anymore"* (ID 27). CACFP provides minimum portion requirements for foods and beverages served, and providers mentioned that serving these portion amounts may prevent food waste and decrease food cost. One provider recommends other providers to "watch the quantity, how much I give them, don't overdo it" (ID 78). Providers mentioned that the portion requirements helped them to not serve too much juice. Providers noted that the reimbursement amount should be increased when serving children more than three meals a day.

Resources from CACFP and WIC that providers indicated as beneficial included: allowable food charts, handouts, books about nutrition and eating, gardening curriculum, posters, and recipes. Some providers noted they received publications such as those from "*Team Nutrition*" (ID 30) because they were a licensed provider. Brochures and guidelines from WIC, including the allowable cereal brochure that includes graphic images of allowable cereal were mentioned by multiple providers. Providers noted that having their own young children enrolled in WIC currently or in the past helped them to purchase CACFP-eligible foods as WIC-eligible foods follow the same guidelines.

4. Increasing variety of foods and beverages by using a menu or recalling items recently served

One strategy that some child care providers reported for meeting CACFP requirements for a variety of vegetables and fruits, and for main dishes that align with the CACFP nutrition standards was to consciously serve a variety of foods. A few of them accomplished this by following a menu, but most did so by thinking about what they served earlier in the day or in the

week before preparing a meal or snack. This was perceived as beneficial to avoid serving the same "*routine*" (ID 68) foods and beverages each day. When providers discussed having desserts and treats, they often considered how often they had recently served them before allowing the children to have these items.

5. Child care provider and peer modeling and encouragement

Providers reported using a multitude of tactics to encourage children to try or consume new foods. Providers perceived that peer modeling, where children all see one other consuming the same food, made them more willing to try new foods and beverages. Other tactics mentioned were eating the same food and beverages as the children, asking children to take a "*no thank you bite*" (ID 32), encouraging children to take a food or beverage when serving themselves, making eating fun through gardening and nutrition activities, and encouraging consumption by relating the food or beverage to health and physical activity.

6. Mixing preferred foods and beverages with less preferred ones

Child care providers reported children were much more willing to try or consume "*plain*" (ID 39) CACFP eligible foods if they were mixed with other well-liked foods, i.e., whole-grain bread with peanut butter, low-sugar yogurt with fruit, and low-sugar granola/cereal with fruit. Tactics perceived as beneficial included preparing foods with a variety of spices or herbs, mixing vegetables into commonly consumed dishes, adding ice or fruit to water, or serving fruit in place of candy.

7. Using nutrition information available from social media and from peers

Child care providers reported that social media - "*Facebook and Pinterest*" (ID 78, 84), the internet: "*Google*" (ID 86), email, and television shows influenced the foods and beverages they served. A specific Facebook page of interest was the "*Association for Childhood*

Development" (ID 32), which is sponsored by CACFP. Some providers indicated that they joined online groups with other child care providers who shared helpful information including foods and beverage recipes they serve. Child care providers also reported their family, friends, child care assistants and other child care providers were influential in providing recipes, giving advice for encouraging the children to try new foods, and giving them vegetables from their gardens. Providers also perceived the children and the children's parents as influential when they shared what foods they ate as a family and recipes for those foods and beverages.

8. Allowing children to choose foods and beverages

Providers mentioned children were more accepting of foods and beverages served that met CACFP standards if they received a choice as to how much they took for a serving, what ingredients were added to the main food item, or what foods and beverages were on the menu. Examples of choosing ingredients included the construction of fruit and yogurt parfaits and fruit kabobs.

9. Serving the same eligible food and beverages to all children

Contrary to giving children choice as to what foods and beverages are served, some providers perceived it beneficial to serve all children, regardless of age, the same food and beverages without choice: "*I never really gave them a choice"* (ID 78). Some providers also noted that serving their own family the same foods and beverages and not having other options in the house, helped them follow the CACFP nutrition standards. Child care providers noted that the children they had cared for since infancy, were more likely to consume the eligible food or beverage when they were older because they were familiar with it.

10. Provider concern about impact of foods and beverages on children's health and behavior

Providers indicated they were concerned about the health of the children they cared for and this led to their desire to serve fruits, vegetables, whole grains, foods not deep-fat fried, and cereals and beverages low in sugar. Examples varied from avoiding foods that, "*pose a choking hazard,*" (ID 14) to serving foods and beverages that "*are much better for them*" (ID 71). When a nutritious food or beverage was served, providers reported feeling better about themselves and felt children had improved behavior. Providers identified that when they served nutritious food and beverages the children *"don't seem to be as tired and worn out"* (ID 71). In addition, providers perceived that the preparation method would influence the overall health of children. For example, frying foods was not seen as supporting a healthy diet for either the provider or the children. Providers mentioned they did not want children to be "*obese*" and consume high sugar foods and beverages, as these "*cause diabetes*" and "*cause cavities*" (ID 30, 79).

F. Discussion

Five barriers and ten facilitators to meeting CACFP nutrition standards were identified in our sample of 20 in-home child care providers. The most frequently-perceived perceived barrier was child and provider preference for less healthful foods. Providers felt that child preferences were shaped by the types of foods and beverage they were given at home, so parental preferences were perceived as being very influential. This same barrier has been reported in previous studies in child care centers, which cited children's dislike of healthy foods and staff perception of what parents served to the children at home as a barrier to children's habits and the serving of unhealthy foods at home.[154-157] Providers had adopted a number of techniques to work around this barrier.

Providers believed that individual preferences for specific foods or beverages were predictive of the amount of food waste, previously identified as a barrier[158]. A review study identified specific methods of preparation, texture, appearance and children's ideas of when, where and with whom it is appropriate to eat vegetables were barriers to children actually consuming vegetables as well.[159] A perceived facilitator mentioned included mixing preferred foods with less preferred foods which also was identified in a previous review study in child settings preference of vegetables was assessed,[159] and includes gradually introducing healthier options into the current offerings of foods and beverages.[160]

Providers perceived childrens' preference for certain foods to also strongly associated with the parents of the children. Communication with parents, specifically on trying new foods could be an avenue for parental education that may influence their preference for CACFP-eligible foods and beverages in the child care home. Previous studies identified barriers to communicating with parents in Headstart settings as: parents are too busy to talk with providers, parents prioritize talking about child food issues over nutrition, providers are unsure of how to communicate about nutrition without offending parents, and providers are concerned if parents are receptive to nutrition education materials.[155] Child care centers reported adding in nutrition and physical activity education into parent–teacher conferences supported parent awareness of the importance of healthy eating and physical activity, because some parents lacked knowledge about basic nutrition.[154] Although this may be a difficult conversation for child care providers to have with parents, past research focusing on nutrition education shows programs and education with parents targeting young children is more successful than those targeting adolescents.[45] Additionally, there is not likely a formal opportunity for meetings with parents at in-home child care setting, nutrition education may occur through informal modalities such as food and

beverage charts, handouts, posters, recipes, social media and newsletters, which were identified in our study as facilitators. Framing messages that emphasize the parents' role as a provider with benefits, such as their children becoming more independent and learning new skills may be an impactful method for targeting parent participation and perhaps utilizing social media as a modality.[127]

Additionally, the implementation of home-level, food-related policies and environmental changes may serve as an opportunity for education for the parents and the child care providers' own preference for certain foods and beverages[154,161] through the use of a handbook or another form of communication to share the policy and environmental guidelines. More research to determine parent expectations of foods and beverages served in child care homes and the most appropriate nutrition education modalities for parents whose children attend in-home child care should be performed.

Our study, as well as other studies, have identified cost and availability of foods and beverages as barriers for center and family child care providers to meeting nutrition best practices.[67,159,162-165] Providers mentioned fruits, vegetables and whole grains were often a higher cost, which is consistent with another research study in which in-home child care providers perceived healthier eating to have a higher cost.[166] Child care providers may benefit from nutrition education on low-cost options and shopping tips to follow the CACFP guidelines. Educational sessions of interest mentioned included tips for shopping on a budget and using a variety of frozen, fresh and canned fruits and vegetables.

Previous studies also found child care providers (in-home and center-based) perceive preparation time[159,160,162] and child food and beverage restrictions[165] as barriers to what they serve children in their care. In-home providers may be caring for up to six children alone while

having to prepare a meal or snack and needing to take into consideration dietary restrictions. A facilitator mentioned by child care providers in this study included preparing and shopping for foods and beverages ahead of time, not cooking from scratch and utilizing a rotating menu, which was also reported in a 2012 report.[160] Nutrition education for child care providers may be beneficial if focused around preparation and shopping for foods and beverages with limited time and taking into consideration the management of dietary restrictions and food access constraints. For example, a social media video that shows providers how to make a whole-grain peanut butter and jelly sandwich for 12 children may be practical, yet appropriate for teaching providers to plan meals for a month and to purchase whole grain bread in advance during a monthly trip to an accessible store. Providers also reported the number and age of children in the study may have influenced what they served and additional research on how age and number affect what is served may be helpful.

Although desserts and sweet-treats were still mentioned most often in consideration of special events and celebrations, some providers noted they still were serving the foods and beverages recommended by CACFP and the dessert was either taken home or served after lunch or a snack. This might be problematic, as serving dessert after the meal results in higher energy intakes from both the main course and from dessert, and therefore possibly results in calorie needs being exceeded.[166] Previous research also found parents were one of the largest barriers to serving healthy options for celebrations.[167] An alternative of interest might be allowing grain-based desserts to be served with the meal [166] but to decrease the frequency of how often it can be served per week or every other week as to not significantly increase calorie intake.[168] Nutrition education by community organization staff may also provide tactics and education, including the

use of physical activity and non-food rewards, for providers to decrease the amount of desserts and sweet treats offered.

Child care provider preference for certain foods and beverages was also identified as a common barrier and motive for what they served as seen previously in child care centers and Headstart.[169] In our study if the provider perceived a food or beverage, or the preparation, to be messy or they did not like or prefer the item, they were less likely to serve it. Providers in the study did note competing motives in that some providers mentioned the variety and rotation of food and beverage options was important to them, whereas others mentioned they served the same thing and it was their choice each day. Regardless, it was also found in our study that encouragement and modeling was a common facilitator for serving foods and beverages that align with CACFP nutrition standards, as the children were more likely to consume the foods and beverages served when providers joined them at meals. This is similar to other studies in which encouragement and modeling by parents, child care providers and peers have been associated with intake of healthier foods and beverages for young children.[157,169,170] A modeling facilitator mentioned by providers included growing food and providing garden experiences to young children, which has also been associated with increased fruit and vegetable consumption.[171]

Additionally, a specific tactic mentioned as a facilitator by the providers included serving the same food to all children and giving children choices. This is similar to previous studies with family day care providers reported greater responsibility, with encouragement, in feeding and monitoring food intake of the preschoolers in their care,[172,173] and especially when utilizing a family-style meal approach.[168,169] Although child care providers often perceive family-style meals as "*messy*,"[157] providers who used family-style meals saw that the children more likely to try new foods and practice self-regulation through choice and the providers were more likely to

talk with the children about food [141,169,174] Providers can benefit from increased education on modeling; encouraging communication including responsive feeding techniques which can be used when serving meals and snacks; the use of family-style meals and not using food as a reward.[141]

Important perceived facilitators, aligning with the Health Belief Model, in our study were guidelines and funding from CACFP and WIC for foods and beverages. Past studies found participation in CACFP leads to healthier nutrition environments,[69,146] even at in-home child care settings.[64] Researchers who conducted a qualitative study at child care centers, also found that state licensing regulations improved the nutritional quality of the food served which was even further enhanced for those participating in CACFP.[145] Child care providers, registered and licensed, may benefit highly from nutrition education training on CACFP guidelines, regardless of CACFP participation. Although providers reported being highly influenced by CACFP sponsor websites, online and in-person trainings,[175] and the relationship built with the CACFP sponsor, perhaps trainings and educational opportunities could be provided to all child care providers through State of Michigan licensing and registration of homes.

Another motive and facilitator, aligning with the HBM and SDT, for child care providers in our study was the health of the children and the child care provider. Previous research has associated in-home child care providers with a greater influence on children's health behaviors compared to center providers,[176] possibly due to a lower ratio of children per child care provider and a more intimate relationship. Identifying in-home child care settings as a venue for community organizations to provide nutrition education is advantageous in the public health setting since providers likely have a close relationship with the children they care for.

G. Conclusion

To our knowledge, no other studies have looked at the 2017 CACFP nutrition standards and qualitatively investigated the barriers and facilitators to in-home child care providers. The HBM and SDT components of identifying perceived barriers, benefits and extrinsic motivation identified the perceived barriers and facilitators to meeting or not meeting the CACFP nutrition standards, external resources and motivations that impact child care providers' food and beverage decisions relative to the CACFP nutrition standards.

When evaluating this study, it is important to note there are some limitations. The results may not be generalizable to all child care homes as the sample of child care providers included those who answered their telephone, had the time and technology available for the interview process, and were residing in the State of Michigan. Furthermore, participants in this study may not have always given honest answers to the research questions due to fear of non-compliance if they thought or knew they were not following the 2017 CACFP standards completely. Strengths of the study include using a sample with a diverse range of perspectives from both urban and rural geographic areas throughout Michigan.

Our study mostly focused on external and environmental motives for child care providers to serve foods and beverages that align with CACFP nutrition standards. Future studies should further investigate internal motivations for child care providers. For child care providers, the HBM may explain perceived barriers and facilitators to meeting CACFP nutrition standards, motivation for meeting nutrition standards, and external influences on meeting or not meeting the standards. The SDT represents a broad framework for the study of human motivation.[104,107] The SDT focuses explicitly on what motivates people to change behaviors. In this study, it provided a basis for gaining insight into child care provider decision-making processes relative to what food

and beverages they served, and to identify motivation to align with the CACFP nutrition standards.[15,118]

Efforts to improve CACFP-eligible foods and beverages served by in-home child care providers should concentrate on utilizing perceived facilitators and motives while also taking into consideration external influences and barriers. Areas of focus include: 1) overcoming children's preference for certain foods and minimizing food waste through education on modeling of healthy eating, actively encouraging healthy food consumption, allowing choices in foods and portions, mixing preferred foods with less acceptable ones, and communicating with parents about healthy eating at home; 2) developing skills for providers in minimizing costs of healthy foods; 3) finding ways for providers to celebrate and give rewards that do not rely on sugar-sweetened treats; 4) identifying time-saving approaches for providers including shopping, food preparation, and accommodating common food restrictions; and 5) and motivating providers by emphasizing the overall health reasons behind program requirements to child care providers, which may also influence providers' eating preferences. Methods of education should also include social media that encourage peer-to-peer support from other providers.

CHAPTER 7 – Summary and Conclusions

Overweight, obesity and nutritional deficiencies in children have been identified as public health issues and the dietary quality of foods and beverages consumed are a crucial contributing factor. As many young children, 2-5 years-of-age, consume significant portions of their daily food and beverage intake in child care, it is important to understand how these meals and snacks contribute nutritionally. There is a gap in knowledge of the relevance of the dietary quality of foods and beverages served to young children by in-home child care providers.

The first study used a cross-sectional, observational approach to investigate the dietary quality of foods and beverages served by in-home child care providers for one lunch and one snack. Foods served were compared to Healthy U.S.-Style Eating Pattern, Dietary Reference Intakes (DRI's) and the American Heart Association recommendations and to the menus of child care providers own written menus. Our findings showed that in-home child care providers did not provide lunches and snacks that align with most nutrition recommendations. The whole grain and vegetable food groups were least frequently aligned with Healthy U.S.-Style Eating Pattern recommendations. Dark green leafy vegetables were the vegetable subgroup least frequently served, while carrots, tomatoes and green beans were the vegetables most commonly served.

Many providers served foods that were over the recommended calorie level range with excessive fat, saturated fat, and carbohydrates. Child care providers also served more than triple the maximum sugar recommended. The micronutrient recommendations least likely to be met in the foods served were vitamin D, potassium, vitamin E and sodium.

When translating what was served into how child care providers align with the CACFP nutrition standards, lunch was a problem for the majority of the providers. The components of fluid milk followed by vegetables and fruit served did not align with CACFP nutrition standards

most often. However, the majority of providers did serve a snack that aligned with the standards and fruit and grains were selected to be served most frequently. Findings from this study also showed that most menus were not consistent with the observations of actual foods and beverages served.

This study also focused on determining if certain child care provider characteristics were associated with increased dietary quality of foods and beverages served. In homes that cared for children 4-5 years of age, food and beverages served were more likely to follow the CACFP nutrition standards. Other characteristics, such as geographic location and CACFP sponsor participation, were not associated with child care providers serving foods and beverages that aligned with CACFP nutrition standards.

The second study builds upon the first study to determine if a nutrition education intervention for in-home child care providers, "*The Heathier Child care Environment*" improved the dietary quality of foods and beverages served. There were no significant differences in lunch or snack CACFP scores, or amount of food groups and nutrients served between the intervention and control child care providers after controlling for pre intervention values, location, age groups, and CACFP participation. The NAP SACC assessment, which helped to determine the education received, may not have been focused enough on CACFP to impact dietary quality changes of foods and beverages served.

The third and final study used virtual, semi-structured individual interviews to elucidate perceived barriers and facilitators faced by in-home child care providers to following the current CACFP food and beverage nutrition standards. Findings indicated that primary barriers to adhering to the CACFP nutrition standards included: food preferences of children and providers, higher cost and lower availability of CACFP-approved items, celebrations and food rewards,

excessive time and effort needed to prepare foods and beverages especially when there are dietary restrictions for some children. Perceived facilitators included: using nutrition education available through community organizations, finding convenient and easy ways to prepare foods and beverages, using CACFP and WIC guidelines and funding, increasing variety of foods and beverages by using a menu or recalling items recently served, modeling eating healthful foods and encouraging sampling of new foods and beverages, mixing preferred foods/beverages with less preferred, using nutrition information available from social media and from peers, allowing children to choose foods and beverages, serving same eligible food and beverages to all children, and provider concern about impact of foods and beverages on children's health and behavior.

Together, these analyses provide a better understanding of the dietary quality of foods and beverages served by in-home child care providers and the relevance of identifying an appropriate nutrition education intervention to improve dietary quality considering the perceived CACFP nutrition standards barriers and facilitators. This provides insight for nutrition professionals on how to align education and programs to ultimately influence dietary quality outcomes in child care homes.

Some strengths of these studies include the focus on in-home child care settings, which has not been a prioritized research area of focus even though in-home child care constitutes the largest portion of all child care settings. Also, the use of the direct diet observation method for data collection**,** although costly, provides an accurate representation of foods and beverages served by child care providers to young children. A limitation of the studies included not having multiple-day observational data collection to determine day to day variation. Further research with data for multiple days of foods and beverages served would provide a better indication of food group and nutrient associations with an educational intervention. Due to a small, convenient

sample size for the intervention study, the impact of the intervention may be limited. Further research with a larger sample size is needed. Along the same lines, a limitation of the study included the possible mis-alignment of the randomization process in that the foods served by control and intervention child care providers were not similar in dietary quality at the study onset. The intervention child care providers reported a higher CACFP nutrition standard, food group and nutrient mean score for the majority of the foods and beverages they served suggesting that improvements may not have been as necessary. Additional methods to closely monitor program fidelity such as observational site visits and detailed documentation of actual activities during education should also be included in future studies.

Findings from the first study, presented in chapter 4, provide important recommendations for future nutrition education interventions that can assist in improving the dietary quality of meals and snacks served. Educational foci should include increasing whole-grain foods and a variety of vegetables that are culturally acceptable, while decreasing sugar and sodium. Specific educational information should concentrate on reducing the frequency of high sugar foods and specifically sugar-sweetened beverages, high-sugar cereal, crackers, and high-sodium convenience foods. In addition, in-home child care providers should receive hands-on, educational information focused on planning, shopping and preparing simple, scratch meals and snacks that are economical, but include a variety of vegetables and whole grains. Emphasis should also be on education where providers practice preparing menus that meet CACFP lunch nutritional standards, particularly for vegetables, fluid milk (portions and types), and fruit. The portion size requirements specified by CACFP may be beneficial to all providers to avoid the over or under-feeding of calories and other nutrients evident from study findings.

Most providers, despite participation in CACFP, were not meeting the guidelines. Although the recent changes to the CACFP nutrition standards are moving in the right direction, the results of this study suggest that CACFP may benefit from possible changes in program structure and delivery. These include: 1) refining nutritional standards to allow increased flexibility 2) providing additional monitoring and compliance guidelines for CACFP sponsors, with more frequent visits to compare the written menu to what is observed 3) and increasing the incentive structure for providers may decrease non-compliance. Future research may include pilot testing of these options or a mix of options to find which result in the maximum compliance.

Findings from this study also support the need for additional research in diet observation methodology for in-home child care settings. Methods that focus on multiple-day observations to gather the dietary quality data needed, but also consider the complexities of sporadic child care schedules may be most appropriate. These modalities may also be beneficial in federal program compliance, including the CACFP program, as menus were deemed to not be the most accurate method to reflect what it served. Other methods such as digital food photography may be a better fit to collect observational data in future studies or to test program compliance.[142]

Findings from the second study, chapter 5, show that a generic policy, system and environmental nutrition education, even over a 6-month time span, may not significantly improve dietary quality. This study did provide information on important aspects of nutrition education interventions that should be studied more in-depth to see if they can improve dietary quality including assessments and educational interventions that focus on specific nutrients and food groups to be included in foods served for lunch and snacks. This may include the observation of the foods and beverages prepared and served and the findings of the observation

as a topic of education. This would provide an opportunity to educate on food and beverage selection, preparation, as well as tactics for serving to the children in care. In-home child care providers may benefit from these frequent observations or informal visits during the meal or snack time as a form of nutrition education as opposed to occasional one- or two-hour visits from CACFP sponsor or community nutrition organizations. The visits could serve as an opportunity to have informal conversations in which the provider is engaged in co-determining how the meals or snacks or both could be improved. Children's nutritional status may be subsequently positively impacted by implementing nutrition education interventions for in-home child care providers, however further research that determines what specific educational foci with program fidelity measures result in the overall improvement of the dietary quality of foods and beverages served is needed.

Findings from the third study, presented in chapter 6, provide further evidence for opportunities to improve dietary quality of foods and beverages served by in-home child care providers that align with the CACFP nutrition standards. More specifically this study provides the researcher with information about the challenges and facilitators that the target group faced relative to serving foods and beverages that meet CACFP nutrition standards. These findings can be useful in the modification and creation of nutrition education interventions by those involved in community nutrition education and support as well as in the technical support needs of child care providers regardless of if they participate in the CACFP program or not.

Nutrition educators should focus child care provider education on 1) overcoming children's aversion to healthier food and minimizing food waste through modeling of healthy eating by providers and peers, actively encouraging healthy food consumption, allowing choices in foods and portions, mixing preferred foods with less acceptable ones, and communicating with

parents about healthy eating at home; 2) developing skills in minimizing costs of healthy foods; 3) finding ways to celebrate and give rewards that do not rely on sugar-sweetened treats; 4) identifying time-saving approaches to shopping, food preparation, and accommodating common food restrictions; 5) emphasizing the health reasons behind program requirements. Education for in-home child care providers may be most beneficial when occurring in tandem with CACFP sponsor organizations. Some suggestions of methods, which were mentioned as facilitators by participants, that might enhance success are the use of social media that encourages peer-to-peer support, which has been found beneficial for parents,[177] as well as use of lists and charts for CACFP-eligible foods and beverages. These targeted areas could be the focus of child care provider professional development, child care licensing and monitoring policies, and nutrition education guidance by dietitians and other public health nutrition experts to help increase overall nutrition quality of foods served to young children.

Overall, nutrition education interventions and educational modalities need to be studied more in-depth to examine how they impact and improve dietary quality of foods and beverages served. Dietary quality improvements of foods and beverages served by in-home child care providers can occur with improved nutrition education modalities, improved CACFP program technical support, and policy development for in-home child care providers that utilizes nutritional standards.

APPENDICES

APPENDIX A: Recruitment Flyer

Food Science & Human Nutrition | MICHIGAN STATE UNIVERSITY Extension
msue.anr.msu.edu

HEALTHY *Environment*

FREE COMMUNITY COACHING TO CREATE A HEALTHIER ENVIRONMENT

We are recruiting Family and Group Home Childcare Providers to participate in a Research Study!

The **Healthier Child Care Environment** initiative will help you identify areas for improvement related to nutrition and physical activity policies and environmental practices. A trained nutrition education coach from MSU Extension helps SNAP-Ed eligible child care providers (Unlicensed, licensed, group or family home) through the process and connects them with resources to work towards best practices.

Steps:

- Assessment
- Action planning
- Coaching/Education with MSU Extension
- Implementation of goals
- Reassessment

Benefits to participating:

- $100 Nutrition Education Incentive
- Assessment of your environment
- Free coaching throughout the process
- Assistance creating an action plan
- Up to 10 educational hours
- Healthier environment for you and the children you care for!

Principal Investigators:
Dawn Earnesty, MS, RDN
1 Tuscola, Suite 100A
Saginaw, MI 48607
(989)758-2514
wilcoxd4@anr.msu.edu

Lorraine Weatherspoon, PhD, RD
Trout Bldg. 469 Wilson Rd., Room 140
East Lansing, MI 48824
(517) 355-8474 (ext.136)
weathe43@msu.edu

Project Goal: To improve the variety and preparation of meals and snacks served to 2-5 year old children in diverse low-income childcare settings.

If interested, please e-mail Dawn Earnesty, MS, RDN at wilcoxd4@msu.edu.

"They [children] are more open to trying new foods than they were in the beginning of the year. We have tasted foods such as black beans, cucumbers, sugar snap peas, red/yellow bell peppers, pineapple, brown rice, berries, and tuna." - Participant

These materials were funded by USDA's Supplemental Nutrition Assistance Program-SNAP.

APPENDIX B: IRB Approval

MICHIGAN STATE
UNIVERSITY

45 CFR 46.118 Designation Determination

May 26, 2015

To: Lorraine Weatherspoon
334 Trout FSHN Bldg
MSU

Re: **IRB# 15-562** Category: 45 CFR 46.118 Designation
Approval Date: May 26, 2015
Expiration Date: May 25, 2016

Title: Influencing Policy, System and Environmental Nutrition Education and Physical Activity through a Childcare Provider (CGA143841)

The Institutional Review Board has completed their review of your project. I am pleased to advise you that **your project has been granted 45 CFR 46.118 Designation Determination.**

This approval includes changing the PI from Dawn Earnesty to Lorraine Weatherspoon.

A 46.118 Designation allows investigators to open their Contracts and Grants account, spend funds for certain purposes, and develop study instruments or procedures that may be needed to submit certain grant applications.

Under a 46.118 Designation you cannot contact human subjects or collect data from them. Prior to implementation of the research, the investigator must submit a complete *Application for Initial Review* for approval.

Renewals: IRB approval is valid until the expiration date listed above. If you wish to renew the 45 CFR 46.118 Designation, you must submit a request for renewal of the 45 CFR 46.118 Designation at least one month before expiration.

When you submit a subsequent application, please use the IRB number listed above in your new Initial Application. Please refer to that number in any correspondence with the IRB office.

Good luck with your project. If we can be of further assistance, please contact us at 517-355-2180 or via email at IRB@msu.edu. Thank you for your cooperation.

Sincerely,

Sally Conley
IRB Staff - Administrator II

c: Dawn Earnesty

Office of Regulatory Affairs
Human Research Protection Programs

Biomedical & Health Institutional Review Board (BIRB)

Community Research Institutional Review Board (CRIRB)

Social Science Behavioral/Education Institutional Review Board (SIRB)

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(517) 355-2180
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APPENDIX C: Direct Diet Observation Form

MEALS	FOOD COMPONENT/ITEM	Item description (preparation, type)	Amount Served		Amount Remaining								Notes (Amount added or Wasted)
			2 y.	3-5 y.	2 y.				3-5 y.				
Lunch or dinner	**Fluid milk**												
	Other beverage												
	Meat/meat alternate												
	Lean meat, poultry, & fish												
	Other meat (hamburger, hot dog, chicken nuggets, etc.)												
	Tofu/soy products												
	Cheese												
	Eggs												
	Beans & peas												
	Peanut butter, other nut/seed butters												
	Yogurt												
	Nuts & seeds												
	Vegetables												
	Dark green leafy												
	Red or orange												
	Starchy												
	Other (e.g. green beans)												
	Fruit or 100% juice												
	Grains												
	Whole-grain or enriched bread												
	Whole-grain or enriched bread product (e.g. muffin, biscuit)												
	Whole-grain, enriched, or fortified cooked breakfast												

	cereal/cereal grain/pasta												
	Mixed dishes												
	Pizza												
	Lasagna/Spaghetti												
	Macaroni & cheese												
	Soup (specify)												
	Other (specify)												
	Other												
	Cookies												
	Chips												
	Cake/cupcake												
	Snack foods (i.e. Cheez-Its, pretzels, Goldfish)												
	Candy												
	Other (specify)												
AM or PM snack	**Fluid milk**												
	Other beverage												
	Meat/meat alternate												
	Lean meat, poultry, & fish												
	Other meat (hamburger, hot dog, chicken nuggets, etc.)												
	Tofu/soy products												
	Cheese												
	Eggs												
	Beans & peas												
	Peanut butter, other nut/seed butters												
	Yogurt												

	Nuts/seeds												
	Vegetables												
	Dark green leafy												
	Red/orange												
	Starchy												
	Other (e.g. green beans)												
	Fruit or 100% fruit juice												
	Grains												
	Whole-grain or enriched bread												
	Whole-grain or enriched bread product (e.g. muffin, biscuit)												
	Whole-grain, enriched, or fortified cooked breakfast cereal, cereal grain, or pasta												
	Whole-grain, enriched, or fortified ready-to-eat breakfast cereal (dry, cold)												
	Flakes/rounds												
	Puffed cereal												
	Granola												
	Other												
	Cookies												
	Chips												
	Cake/cupcake												
	Snack foods (e.g. Cheez-Its, pretzels, Goldfish)												
	Candy												
	Other												

Diet Observation Form

Date of observation: ___ / ___ / ___ Start time: ___:___ End time: ___:___ Observer name: _____

Child Care Provider ID#: _____

Ages and number of children present: Meal Service Method (family-style, plated): _____

_____ 2 yr. _____3 yr. _____4 yr. _____ 5 yr.

Number of children present not being observed _____

Number of Children _____ Mean Age of Children _____ Race/Ethnicity of children _____

Race/Ethnicity of child care providers_____

Participation in CACFP Yes or NO CACFP Sponsor _____

Tasks:

- ☐ **Collect signed consent forms. Give a blank consent form to the child care provider.**
- ☐ **Collect weekly menus or distribute templates and explain process for mailing them within one week of today.**
- ☐ **Review sheet to make sure all information is filled out correctly and accurately.**

Key for measurements for PORTION SIZES:

- Cups—"c."
- Tablespoons—"T."
- Teaspoons—"t."
- Each—"e." or "ea." **ONLY USE IF YOU ARE ABLE TO PHYSICALLY COUNT THE NUMBER OF THE FOOD ON THE PLATE**
- **Do <u>not</u> write amounts as fractions. All portion amounts should be legibly written as:**
  - 1/8 = 0.125
  - 1/4 = 0.25
  - 1/3 = 0.33
  - 1/2 = 0.5
  - 2/3 = 0.66
  - 3/4 = 0.75
- **Quick conversions:**
  - 0.33 T. = 1 t.
  - 0.125 c. = 2 T.
  - 6 t. = 2 T.
  - 4 T. = 0.25 c.

Units
1 Tbsp. = 3 tsp.
1/4 cup = 4 Tbsp.
1/2 cup = 8 Tbsp.
3/4 cup = 12 Tbsp.
1 cup = 16 Tbsp.

APPENDIX D: Diet Observation Protocol

DIET OBSERVATION AT CHILD CARE (DOCC)

Procedures and Protocol

Adapted from Univesity of North Carolina

OVERVIEW

Purpose: The purpose of the diet observation is to obtain an accurate estimation of the type and amount of all food and beverages consumed by children in child care.

Data Collectors: Each data collector (field staff) will undergo training and upon complete multiple tests to be certified as an observer.

Process: This process is based on the protocol developed for diet observations of preschool children in child care. [Ball, Sarah C., Benjamin, Sara E. and Ward, Dianne S. Development and reliability of an observation method to assess food intake of young children in child care. *Journal of the American Dietetic Association* 107.4 (2007): 656-661.]

TRAINING

- Field staff will be trained during an intensive training provided by a registered dietitian or trainer designated by the project lead.
- Training will include:
  - i. Lessons on visual serving size estimation.
    1. Using standardized measuring cups/spoons normal serving sizes for a variety of fruits, vegetables, drinks, entrees, and snacks will be displayed. Amounts will include those appropriate to young children.
    2. Observers are encouraged to first practice with dry, solid foods such as cheerios or dry beans and then move to wet foods like yogurt and spaghetti.
    3. Observers should practice with foods in amounts from 2 Tbsp to 3/4 cup, using a variety of bowls and plates. They should practice with beverages in amounts from 1 to 6 ounces, using a variety of cups.
  - ii. Proper food measurement techniques using standardized measuring cups/spoons.
    - Obtain all food measurements in cups, Tablespoons, Teaspoons, or with a measuring tape up to 1/8th of an inch.
    - Obtain all beverage measurements in ounces.
    - Count all objects that cannot be measured accurately (e.g., pretzels, animal crackers, etc.)
    - Use the measuring cup/spoon closest to the amount you plan to plate (for example, use the 1/4 cup measure rather than measuring 4 separate Tbsp)
    - For dry foods (such as oat circle cereal), shake the cup measure to allow foods to settle. Ensure that an equal amount of food is just above and just below the rim. Do not pack/smash. [see Figure 1]

Figure 1. Dry food measurement

Units
1 Tbsp. = 3 tsp.
1/4 cup = 4 Tbsp.
1/2 cup = 8 Tbsp.
3/4 cup = 12 Tbsp.
1 cup = 16 Tbsp.

- For wetter foods (such as applesauce), measure enough so that the food is slightly above the rim, and scrape excess off with a knife. Ensure that all food comes out of the measuring cup, onto the plate for observation. [See Figure 2]
- For pastas and other soft foods that do not pack neatly, gently place in cup measure, ensuring that there are not large gaps of air within the measuring cup. Again, do not pack/press down, and ensure that the same amount of food that is slightly above the rim is also below the rim. [See Figure 3]
- Liquids should be measured at the base of the meniscus (not the top of the curves on the sides) using clear measuring cups.

Figure 3. Wet food measurement

Figure 2. Soft food measurement

iii. General observation techniques. Two mock observation sessions will be set up to allow for multiple observers to practice food observations at one time.

1. Use a variety of serving dishes
2. Practice with a variety of quantities (2 Tbsp – 3/4 cup)

iv. Instruction and demonstration of record keeping and form completion.

1. On the Dietary Observation Form, complete amount served, amount added or wasted, and amount remaining (amount consumed will be calculated)
2. Include brand names whenever possible
3. It is appropriate to record mixed dishes as total amount and component amount (1 cup spaghetti that is 75% noodles, 25% sauce would be 3/4 cup noodles and 1/4 cup sauce)
4. Note whether food quantities are for whole or crushed (e.g., crackers)

v. Overview of general child care rules, regulations, and food service protocol (will vary among sites).

CERTIFICATION

- Objective 1: To ensure adequate skills in estimating serving sizes visually.
  i. Field staff will be shown a series of 20 foods (food and beverages) of varying types and amounts.
     1. These will be typical to what is served to children ages 2–48 months.
     2. Serving amounts will be between 2 Tbsp and 3/4 cup. The amounts should be close to the Ball *et al*, 2007 article. Note that in this article, the amounts were "round" (no amounts were 1/2 cup + 1 tsp). As a guide, the following foods and amounts should be used:

Type of food	Serving size
Finger foods (e.g., goldfish, cheerios)	1/4 – 1/2 cup
Soft foods (e.g., mashed potatoes, yogurt, applesauce, mashed sweet potato)	1/4 – 1/2 cup AND 3 – 5 Tbsp AND 1/2 – 3/4 cup

Mixed wet foods (e.g., spaghetti, mac and cheese, friend rice)	1/2 – 3/4 cup AND 1/4 – 1/2 cup
Sliced foods (e.g., banana, carrots)	3 – 5 Tbsp AND 1/2 – 3/4 cup
Whole and cut up pieces (e.g., chicken nuggets, animal crackers)	16 – 25 whole pieces (e.g., crackers) AND 2 – 5 pieces cut up (e.g., bite size nugget pieces)
Liquid drinks (e.g., water, milk, juice)	3 instances of servings from 3 – 7 ounces

3. Served in a variety of plate, bowls, cups and bottles. Approximately 8–10 "plates" of food will be served.
4. Foods used in certification testing should include a variety as depicted in the table above:
    a. dry/finger foods (e.g., oat circle cereal, goldfish crackers)
    b. soft foods (e.g., applesauce, yogurt)
    c. mixed foods (e.g., mac & cheese, spaghetti)
    d. liquids
    e. foods cut into chunks (e.g., banana and chicken nuggets)

ii. Comparison will be made between the visual estimation of serving size by observers and that made using standardized measuring cups/spoons by certifiers.

1. Observers will write the name of the food and estimated amount on the Data Observation tool.
2. They should estimate using standard cup and spoon measures. They may also provide counts (e.g., 14 animal crackers) or length/width/height measurements (nugget piece was 1/2" x 1/2" x 1/2").

iii. Field staff will have their estimations scored against the measured amount. Observations must be within certain tolerances in order to be considered accurate:

1. ± 1 Tbsp difference of the actual measurement for each food
2. Within 1 ounce for each beverage
3. Food items that are counted (e.g., crackers) instead of measured are to be within 1 item of the actual amount.
4. These levels of accuracy must be met for 80% of the foods shown (i.e., must estimate 16 of the 20 foods within the accuracy tolerance).
5. 100% of foods served must be listed completely and correctly. For example, if animal crackers are listed and the observer writes vanilla wafers, this is incorrect.
6. Observations should be conducted within an amount of time that mimics the length of a typical preschool mealtime.

- Objective 2: To ensure adequate child food consumption observation skills in a natural setting.

i. Field staff will independently observe the same meal, including all foods and beverages consumed by at least 3 children in a field setting without discussion.

ii. Inter-rater reliability will be calculated between observers. Raw data for each observer will be entered in (in Tbsp and ounce units) for each child observed, and a kappa will be calculated.

CONDUCT IN THE FIELD

Materials Needed:

- Pen/pencil
- Clipboard
- Diet Observation Form (DOF; Individual or Group Meal form)
- Child care menu for that day (if available)

Sampling:

- Participating children will be identified by child care staff.
- A field staff member is able to observe up to 4children per day, which includes all meals and snacks provided in the center. This includes morning snack, lunch, or an afternoon snack and dinner.
- Diet data collection will take place over one day.

Preparation:

1. The child care observation days must be prearranged with the center to avoid conflicts in schedule, such as holidays and vacations.
2. Detailed menus (if available) should be obtained from the provider before observation occurs.

General Guidelines:

1. Child/Observer Interaction
   - Attempt to minimize conversation and contact with all children. The children will be aware of the observer's presence and will be told that a visitor is at the classroom for a few days to watch the children play, eat, and participate in child care activities. The children will undoubtedly be curious at first and will try to interact with field staff. Discourage interaction by avoiding eye contact and minimizing conversation in a curt but pleasant manner. Field staff should not interject themselves into interactions between children.

Confidentiality

- All data collected should be treated in a confidential manner. Do not leave notes, IDs, or forms unattended. Do not discuss the food record with the child being observed or with any other child. Do not talk to the children or in any way engage with them during observations.

2. Dress

- Field staff should dress comfortably and wear a name badge in order to communicate to child care providers that you have permission to be there. Name tags should be worn at all times. Comfortable (not open toe) shoes should be worn as well.

Data Collection:

1. Advance preparation

- Prior to arriving at the center, a Diet Observation Form) should be created for the child care provider. The child care provider ID, observer name, and date should be filled in.

- On the DOF, fill in all food and beverage items to be served during all meals and snacks from the menu and preparation of the meal/snack.

2. Observation

a. Access to plates before they are served

- Upon preparation and serving the food to the children the observation will begin. Field staff will record on DOF the amount served in the provided space and the amount traded, spilled, and/or thrown of each item by writing +/- and the serving size.
- Upon completion of the meal the following will be evaluated:

  Amount consumed = amount served – (amount (+/-) + amount remaining).

Food Item	Description	Amt. served	Amt +/-	Amt. remaining
Milk	2%, chocolate	6 oz.	- 2 oz (spilled)	~ 1 oz.
Orange wedges	Regular size with peel	1/2 orange (4 wedges)	- 1 wedge (given away)	none
Cheerios	Plain, Cheerios brand	3 Tbsp	- 8 cheerios (dropped)	None

b. Family-style meals

- Field staff will watch each child carefully to see how much of each item they serve themselves, carefully noting only what lands on the plate that might be eaten, not what is spilled or dropped.
- The meal observation will then begin by following the procedure outlined above.
- Because of the family-style service, children may serve themselves additional amounts of food. This should be recorded by adding +/- in the Amt +/- column. Please note that the amount remaining will be observed in the second portions. For example, a child may scoop out ½ cup of baby peas, eat them all and then add another ½ cup to their tray and eat 1/2 of that extra portion. Field staff will record this as follows:

Food Item	Description	Amt. served	Amt +/-	Amt. remaining
Peas	Baby, green, no butter	1/2 cup	+ 1/2 cup	1/4 cup

3. Post-observation
   - The observer will record the date and meal observed on the DOF.
   - The DOF will be rechecked for completeness and accuracy by field staff before disposing of remaining food and all questions pertaining to that day's food service will be asked and answered before leaving the home that day. All outstanding questions will be addressed by staff as soon as possible.
4. Observing several children at one time
   - Each child will be observed from the moment she/he sits down to eat until she/he leaves the eating area.
   - Field staff will sit or stand in a position so that each of the 4 children can be observed at the same time without having to turn their back on one of the children. The observer's eyes should be able to scan all 4 children at nearly the same time. If possible, the observer will request that all 4 children sit near one another.

QUALITY CONTROL

Quality control is needed to ensure that all observation data are collected in a valid and reliable manner. Of particular concern is the issue of "drift", in which how and what an observer records changes in a systematic manner over time.

1. Validity: To be assessed quarterly in order to minimize observer drift. Field staff will be retested for precision using 6 sample foods/drinks and compared to actual measurement of foods. Based on results (total absolute mean percent error of greater than 20%), field staff may need to undergo retraining and recertification.
2. Booster training and certification: To be conducted prior to each wave, field staff will undergo an abbreviated training, mock observations, and re-certify.
3. Inter-Rater Reliability: To be assessed both before going into the field for observation prior to each wave. Field staff will go into a child care home in pairs to observe children during a meal and snack. It is meant to insure that all field staff, when compared to each other, are reliably collecting the same data.
4. All math used to obtain amount of food consumed will be checked by the Project Manager for completeness and accuracy following the data collection period.

APPENDIX E: Five Day Written Menu Template and Instructions

Child Care Provider ID:
Date:

Please record all meals: Foods and Beverages Served each day as well as portions of each item.

	Monday Date:	Tuesday Date:	Wednesday Date:	Thursday Date:	Friday Date:
Breakfast					
Lunch or dinner					
Snacks					
Dinner					
Substitutions					

How to Record Your Menu

- Record food and beverages for all meals and snacks served on the blank menu provided.
- The meals and snacks recorded should be for the week the data observation occurred.
    - For example: If the data collector observed meals on a Wednesday, you would record all meals and snacks you served starting on the Monday of that same week.

- Be as detailed as possible.

Brand/Type of Food

- Use brand names when possible.

- Specify the kind of food. Instead of writing "Cereal," write "Cheerios" or, "Meijer brand Raisin Bran." Or instead of writing "Crackers," write "Saltines" or, "Ritz."

- When serving milk, write the kind you serve. Skim, 1%, 2%, Whole etc.
    - Indicate if the milk is flavored.

- If serving juice, indicate the type of juice (apple, orange etc.) and if it's 100% juice, juice cocktail, from concentrate etc.

- When serving fruits and vegetables, record whether they are canned, fresh or frozen.
    - If using canned fruit, record if they are packed in juice or syrup.
    - If using canned vegetables, indicate if it is low sodium.

- When serving bread, record type of bread (white, wheat, 100 % whole grain ect.) and brand.

- When serving beans, record if they are dried or canned.

- If possible, save packaging to show the data collectors.

Food Preparation

- Include recipes whenever possible.
- If making something out of a package, for example, boxed macaroni and cheese, include what you added, if anything, while you were preparing the dish.
- Indicate if you are reheating a dish previously made.
- Include portions served.

*If menus are preplanned, please record any substitutions made if need be.

Example of a Menu Record

Breakfast:

Milk- 1% - 1 cup served

Apple slices- fresh- ¼ cup served

1 slice white bread- toasted- spread with "I can't believe it's not butter"

Snack:

Water- ½ cup

Animal crackers- Keebler brand- ~15 crackers served

Pineapple tidbits- canned- packed in light syrup- ½ cup served

Lunch:

Milk- 1%- 1 cup served

Spaghetti with meat sauce- homemade- see attached recipe- 1 cup served

Green Beans- Canned- not low sodium- ¼ cup served

Mandarin Oranges- canned- packed in juice- ¼ cup served

APPENDIX F: Scoring Procedure for CACFP Nutritional Standards

This scoring procedure is to be used to determine if a child care provider food and beverages served for snack and lunch meet the 2017 required meal pattern requirements. Please evaluate every child care provider for the following items and assign a total percentage score to them based on each individual score and divided by seven total components including a lunch score, snack score and the required five individual components for lunch and two components for snack.

If they meet the portion and required component category, they receive 1 point and if they do not meet the standard they receive a 0 for each item. Please pay careful attention to the footnote requirements that are also listed below. Each component must meet the item requirement as well as the portion served. If either component is not met, a 0 score should be assigned.

Evaluate the observation (may also need to look at the menu for items that look at the daily foods and beverages) for each item below 1 point should be subtracted for lunch or snack for the following items:

- Is juice limited to once per day?
- Is at least one serving of grains per day whole grain-rich? (only 1 subtraction per day)
- Is unflavored low-fat or fat-free milk served to children 2 through 5 years old?
- Are any of the foods served fried on site?
- Are there Grain-based desserts served?
- If serving yogurt, does it contain no more than 23 grams of sugar per 6 ounces?
- If serving cereal does it contain no more than 6 grams of sugar per dry ounce?
- Are two vegetables or one fruit and one vegetable served at lunch?
- If meat/meat alternatives are served a breakfast in place of grains, is this only done a maximum of three times per week?

Child Care Provider ID:
Total Score:
Highlights of items not met or overserved:
What two food components were used to meet the snack requirement?

Lunch (Five of the Five Components must be Met)			Score: Yes = 1, No= 0 Total Score 0 to 5	
Food Components and Food Items[1]	**Age 2**	**Ages 3-5**	**Age 2 Score**	**Age 3-5**
Fluid Milk	4 fluid ounces	6 fluid		
Meat/meat alternates				
Lean meat, poultry, or fish	1 ounce	1 ½ ounce		
Tofu, soy product, or alternate protein	1 ounce	1 ½ ounce		
Cheese	1 ounce	1 ½ ounce		
Large egg	½	¾		
Cooked dry beans or peas	¼ cup	⅜ cup		
Peanut butter or soy nut butter or other nut or seed butters	2 tbsp.	3 tbsp.		
Yogurt, plain or flavored unsweetened	4 ounces or ½ cup	6 ounces or ¾ cup		
The following may be used to meet no more than 50% of the requirement: Peanuts, soy nuts, tree nuts, or seeds, as listed in program guidance, or an equivalent	½ ounce = 50%	¾ ounce = 50%		
Vegetables	⅛ cup	¼ cup		
Fruits	⅛ cup	¼ cup		
Grains (oz. eel)				
Whole grain rich or enriched bread	½ slice	½ slice		
Whole grain-rich or enriched bread product, such as biscuit, roll or muffin	½ serving	½ serving		
Whole grain-rich, enriched or fortified cooked breakfast cereal, cereal grain, and/or pasta	¼ cup	¼ cup		

Snack (Two of the five components must be selected)			Score: Yes=1, No=0	
Food Components and Food Items	**Ages 1-2**	**Ages 3-5**	**Age 2 Score**	**Age 3 5 Score**
Fluid Milk	4 fluid ounces	4 fluid		
Meat/meat alternates				
Lean meat, poultry, or fish	½ ounce	½ ounce		
Tofu, soy product, or alternate protein	½ ounce	½ ounce		
Cheese	½ ounce	½ ounce		
Large egg	½	½		
Cooked dry beans or peas	⅛ cup	⅛ cup		
Peanut butter or soy nut butter or other nut or seed butters	1 tbsp.	1 tbsp.		
Yogurt, plain or flavored unsweetened	2 ounces or ¼ cup	2 ounces or		
Peanuts, soy nuts, tree nuts, or seeds	½ ounce	½ ounce		
Vegetables	½ cup	½ cup		
Fruits	½ cup	½ cup		
Grains (oz. eq)				
Whole grain-rich or	½ slice	½ slice		
Whole grain-rich or enriched bread product, such as biscuit, roll or	½ serving	½ serving		
Whole grain-rich, enriched or fortified cooked breakfast	¼ cup	¼ cup		
Whole grain-rich, enriched or fortified ready-to-eat	¼ cup	¼ cup		
Flakes or rounds	½ cup	½ cup		
Puffed cereal	¾ cup	¾ cup		
Granola	⅛ cup	⅛ cup		

- Select two of the five components for a reimbursable snack. Only one of the two components may be a beverage.

APPENDIX G: Training Protocol for Nutrition Educators

A Healthier Childcare Environment Research Study Protocol

Principal Investigators:

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Contents

Training for Staff

Principal investigators (PI) and any individual engaged in human research overseen by Michigan State University (MSU) **must complete** and **maintain** current Human Research Protection training prior to engaging in human subject research. Completion of the MSU Human Research Protection Certification (HRPP/IRB Certification) is required for PIs and any individuals engaged in human research overseen by MSU. HRPP/IRB Certification can be achieved through the Saba training system by completing both the "Overview of Human Research Protection at MSU" and "Ethical and Regulatory Considerations" online modules at: https://goo.gl/Yw8V7y

Recruitment/Eligibility

SNAP-Ed Eligible Childcare Provider Homes (Group and Family)

- Licensed
- Unlicensed
- Child and Adult Care Food Program participating
- Child and Adult Care Food Program non-participating

Family and Group Home Childcare providers will be eligible for participation in the program if all of the following are true:

- SNAP-ED eligible determined by the CACFP eligibility map (http://www.fns.usda.gov/areaeligibility) (Red/Pink in Color)
- care for up to 12 children between the ages of 2-5 years of age
- serve meals and/or snacks
- and are mentally competent to provide consent

Childcare providers will not be eligible for participation in this program if any of the following are true:

- not SNAP-ED eligible determined by the CACFP eligibility map (http://www.fns.usda.gov/areaeligibility) (Blue in color)
- care for more than 12 children
- do not care for at least three children between the ages of 2-5 years of age
- do not serve meals and/or snacks;
- are not mentally competent to provide consent

Non-Eligible childcare providers can still receive the traditional SNAP-ED Healthier Childcare Environment intervention that is not part of the research study. This include childcare centers.

Randomization

Randomization: The process by which each subject has the same chance of being assigned to either intervention or control. Neither the subject nor the investigator should know the treatment assignment before the subject's decision to enter the study!!!! ⇒ This removes investigator bias.

Childcare providers will be randomized to an intervention or a control (delayed intervention) group. Methods of randomization:

- Phone call or e-mail to MSU Food Science and Human Nutrition Department (Nicole Edmonds) Provide Nicole with the following information:
    - Name, address, contact information of Childcare Provider
    - Licensed or unlicensed childcare provider
    - Receiving or not receiving CACFP (Child and Adult Care Food Program)
    - Best time and method to contact that provider as well as the best time to set-up a visit.
- Notification of randomization within 3 business days

Intervention group: Consent form signed, data collection and intervention can begin

Control group: Consent form signed, data collection and intervention can begin in 6 months

Consent

Document of Informed Consent:

Childcare providers and assistants who are involved in the study will sign a consent form acknowledging that they will be participating in a study looking at dietary quality.

Childcare Providers **MUST** read (or be read to), sign and receive a copy of the signed Consent form. All childcare providers who participate in the assessment, preparation of food served to children and educational sessions must sign a consent form.

All consent forms should be signed and collected by MSU trained data collectors at initial data collection on visit 2. MSU data collectors will make copies of the consent forms and mail a copy to the childcare providers.

All signed forms will be locked and secured in the MSU Department of Food Science and Human Nutrition. There are no risks to the childcare providers or children. The program is free to those who are referred to the program, are eligible and choose to participate. They are free to discontinue participation at any time.

Data Collection

MSU trained data collectors will be assigned to each childcare provider home after randomization. The data collector will contact the childcare provider to set-up the data collection visit and will also contact the nutrition professional to let them know of the scheduled date of data collection. **NO visits or education can occur until after the collection of data!!**

All data collected is aggregated, confidential and is will not be associated with an individual childcare provider.

Data collection will include data assessing the dietary quality of meals consumed by the children at the childcare site.

Education/Resources

Healthier Childcare Environment
Presented by: Nutrition Educators, MSU Extension & National Kidney Foundation of Michigan

Intervention

Data collection = Yellow

Time	Agenda	Materials
Introduction/Overview 60 minutes – Visit 1 • *Understand the role of Childcare Providers in the prevention of childhood obesity.* • *Understand the role of nutrition professionals.*	**Healthier Childcare Environment Overview** • Understand the role of Childcare Providers in the prevention of childhood obesity • Understand how MSU Extension nutrition professionals/Michigan National Kidney Foundation will assist you in improving the environment of your childcare setting as it relates to nutrition and physical activity.	PPT Slide Consent Forms distributed
DATA Collection	**Pre – Collection by trained MSU dietetic student**	Childcare Provider Consent Form Diet Observation Collection of Menus
Needs Assessment 60 minutes – Visit 2 • *To identify nutrition and physical activity policy and environment areas of strength and weakness.*	**Complete the Assessment** • The objective of the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) is to assist child care facilities in improving their nutrition and physical activity environments, including policies and practices, for the prevention of obesity in young children.	NAP SACC
Plan of Action 60 Minutes- Visit 3 • *Identify the nutrition and physical activity areas of focus for improvement.*	**Monthly Action Planning and Goal Setting** • Each provider will review the feedback from the NAP SACC assessment outlining the best practice for each area of focus. Each provider will select a minimum of **2 fruit and vegetable specific best practice areas and 1 from the other areas of**: menus and variety, support for healthy eating, feeding practices, foods offered	NAP SACC

• *Identify the timeline for implementation over the next 6 months.*	outside of regular meals and snacks, nutrition education, policy that can also have a fruit/vegetable focus. This best practice area will best fit the needs of the site and a timeline will be set up to address the process. Physical activity and other nutrition sub topics areas can be added in addition to the 3 required.	
Education 180 minutes – Visit 4,5,6,7,8,9 • *Learn activities and concepts that help you understand nutrition education policy and environmental supports.*	**Education** • Nutrition Education-training and technical support-MSU extension/Michigan National Kidney Foundation will provide resources, help with action plan, troubleshoot and provide education to help providers to achieve better practices **Fruits/vegetables best practices** and the NAP SACC areas of: A. Offer fruit (not juice) to children at least 2 times a day. B. Serve fruit canned in its own juice (not syrups), fresh or frozen all the time C. Offer vegetables (not fried) to children at least 2 times a day. D. Offer vegetables, other than potatoes, corn or green beans, 1 or more times a day. E. Prepare cooked vegetables without added meat fat, margarine or butter **Other area best practices:** Any best practice area under the sub topics of: Menus & Variety Feeding Practices Foods Offered outside of Regular Meals & Snacks Support for Healthy Eating Nutrition Education Nutrition Policy	MSU Extension Healthier Childcare Environment Toolbox http://msue.anr.msu.edu/program/snap_ed/childcare Includes: MDHHS Technical Assistance Manuals and Resources
Evaluation/Success 60 minutes – Visit 10 • *To assess nutrition and physical activity policy and environment areas of improvement.*	**Evaluation/Success** • Complete the action plan within 6 months after completing the initial NAP SACC assessment which will evaluate the program and document changes in best practices.	NAP SACC Success Story creation

6 months later DATA Collection	**Post - Collection by trained MSU dietetic student**	Diet Observation Collection of Menus Distribution of nutrition education incentives

Healthier Childcare Environment
Presented by: Nutrition Educators, MSU Extension & National Kidney Foundation of Michigan

Control- Delayed Intervention

Data collection = Yellow

Time	Agenda	Materials
Introduction/Overview 60 minutes – Visit 1 • *Understand the role of Childcare Providers in the prevention of childhood obesity.* • *Understand the role of nutrition professionals.*	**Healthier Childcare Environment Overview** • Understand the role of Childcare Providers in the prevention of childhood obesity • Understand how MSU Extension nutrition professionals/Michigan National Kidney Foundation will assist you in improving the environment of your childcare setting as it relates to nutrition and physical activity.	PPT Slide Consent Forms distributed
DATA Collection	**Pre – Collection by trained MSU dietetic student**	Childcare Provider Consent Form Diet Observation Collection of Menus
6 months later DATA Collection	**Post - Collection by trained MSU dietetic student**	Diet Observation Collection of Menus
Needs Assessment 60 minutes – Visit 2 • *To identify nutrition and physical activity policy and environment areas of strength and weakness.*	**Complete the Assessment** • The objective of the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) is to assist child care facilities in improving their nutrition and physical activity environments, including policies and practices, for the prevention of obesity in young children.	NAP SACC
Plan of Action 60 Minutes- Visit 3 • *Identify the nutrition and physical activity areas of focus for improvement.*	**Monthly Action Planning and Goal Setting** • Each provider will review the feedback from the NAP SACC assessment outlining the best practice for each area of focus. Each provider will select a minimum of **2 fruit and vegetable specific best practice areas and 1 from the other areas of**: menus and variety, support for	NAP SACC

• *Identify the timeline for implementation over the next 6 months.*	healthy eating, feeding practices, foods offered outside of regular meals and snacks, nutrition education, policy that can also have a fruit/vegetable focus. This best practice area will best fit the needs of the site and a timeline will be set up to address the process. Physical activity and other nutrition sub topics areas can be added in addition to the 3 required.	
Education 180 minutes – Visit 4,5,6,7,8,9 • *Learn activities and concepts that help you understand nutrition education policy and environmental supports.*	**Education** • Nutrition Education-training and technical support-MSU extension/Michigan National Kidney Foundation will provide resources, help with action plan, troubleshoot and provide education to help providers to achieve better practices **Fruits/vegetables best practices** and the NAP SACC areas of: A. Offer fruit (not juice) to children at least 2 times a day. B. Serve fruit canned in its own juice (not syrups), fresh or frozen all the time C. Offer vegetables (not fried) to children at least 2 times a day. D. Offer vegetables, other than potatoes, corn or green beans, 1 or more times a day. E. Prepare cooked vegetables without added meat fat, margarine or butter **Other area best practices:** Any best practice area under the sub topics of: Menus & Variety Feeding Practices Foods Offered outside of Regular Meals & Snacks Support for Healthy Eating Nutrition Education Nutrition Policy	MSU Extension Healthier Childcare Environment Toolbox: http://msue.anr.msu.edu/program/snap_ed/childcare Includes: MDHHS Technical Assistance Manuals and Resources
Evaluation/Success 60 minutes – Visit 10 • *To assess nutrition and physical activity policy and environment areas of improvement.*	**Evaluation/Success** • Complete the action plan within 6 months after completing the initial NAP SACC assessment which will evaluate the program and document changes in best practices.	NAP SACC Success Story creation

Incentives

Benefits to participating:

- $100 value nutrition education reinforcement items
- Assistance and coaching on creating a healthier childcare environment
- Great Start to Quality Approved training hours
- Michigan childcare licensing annual training hours

Once all **post data is collected**, childcare providers who consented to participating in the intervention and delayed intervention will receive a $100 value nutrition education reinforcement items as well as nutritional posters and Myplates for each child they care for. To order available incentives for childcare providers once post data collection is complete, please contact Dawn Earnesty.

A Healthier Childcare Environment Research Recruitment Log

Childcare Provider Name	County Location	Facility Type (Family or Group)	Licensed or unlicensed	Accepting CACFP (Child and Adult Care Food Program)	Reason for not participating in Research Study if known Or Enrolled

APPENDIX H: Nutrition Education Tracking Form

Child Care Provider Information					
MSU Extension Staff Name:		MSU Extension Supervisor:		Child Care Provider County:	
Child Care Provider Name:		Facility Type		Child Care Provider Contact:	
Child Care Provider Address:		Child Care Provider Phone Number:		Child Care Provider Email:	
Licensed or Unlicensed		Password for NAPSACC (optional)		Username for NAPSACC (optional)	
Accepting CACFP (Child and Adult Care Food Program)	No				

Venue Population						
Staff Demographics						
Total Number of Staff	1					
Staff Gender	# Male Staff	# Female Staff				
# of each	0	1				
Staff Age	# less than 60	# 60 or older				
# of each	0	1				
Race	American Indian or Alaskan Native	Asian	Black or African American	Native Hawaiian or Other Pacific Islander	White	Other
# of each	0	0	0	0	0	0
Ethnicity: Hispanic	Not Hispanic	Yes, Hispanic or Latino				
# of each	0	1				
Ethnicity: Middle Eastern/Arab	Not Middle Eastern/Arab	Yes, Middle Eastern/Arab				
# of each	0	0				

Child Demographics							
Total Number of Children	8						
Child Gender	#Male Children	#Female Children					
# of each	2	6					
Child Age	Infant	1 year	2 years	3 year	4 years	5 years	6 years +
# of each	0	0	4	2	2	1	
Race	American Indian or Alaskan Native	Asian	Black or African American	Native Hawaiian or Other Pacific Islander	White	Other	
# of each	0	0	0	0	0	0	
Ethnicity: Hispanic	Not Hispanic	Yes, Hispanic or Latino					
# of each	0	8					
Ethnicity: Middle Eastern/Arab	Not Middle Eastern/Arab	Yes, Middle Eastern/Arab					
# of each	0	0					

APPENDIX I: Semi-structured Interview Guide

Child Care Provider Semi-Structured Interview Guide

Introduction/Verbal Consent

Thank you very much for agreeing to participate in this interview. Did you receive my e-mail that I sent with the research content? I will be reviewing that document now with you. This study, "DIETARY QUALITY OF MEALS AND SNACKS SERVED BY IN-HOME CHILD CARE PROVIDERS OF CHILDREN 2-5 YEARS OF AGE IN LOW- INCOME AREAS IN MICHIGAN" is being done to help us gain a better understanding of your views regarding the foods and beverages you serve to preschool aged children (2-5 years) attending your child care. Findings from this research could be used to design Child and Adult Care Food Program educational materials. You are being asked to participate in this study because you are an in-home child care provider that serves food and beverages to children 2-5 years of age. This study is not an assessment of whether your program is meeting certain standards, for example State of Michigan licensing or Child and Adult Care Food Program (CACFP) standards. This interview is a chance for you to let us know how you feel about how easy or difficult it is to follow all the nutrition expectations.

If you are eligible and decide to participate in this study, your participation will involve the following:

- A graduate and undergraduate student from Michigan State University will conduct a 45-60-minute-long interview over Zoom. It will be completed on a computer, IPAD, tablet, or mobile device using Zoom technology, which is a web-based platform used to host webinars (online meetings) and phone meetings.
- The interview will be audio recorded and additional notes will be taken so that we do not miss anything important.
- The recording of the interviews will later be transcribed by the researcher.
- The transcriptions of recordings from each interview will be maintained in a secured file in the laboratory of Dr. Lorraine Weatherspoon, for at least 3 years as required by the research review board and then destroyed.

Participation in this research project is completely voluntary. You have the right not to participate or stop the interviews at any time. To maximize your confidentiality, we will provide you with ID numbers which will not be attached to your name. By carefully studying your responses, we will be able to understand your experiences and feedback in detail. Your contact information will be stored in a password protected database, separate from your recording and transcriptions. Your contact information will only be available to investigators and research staff, but it cannot be connected to your responses from the interview. All digital and document files will be stored on encrypted and password protected university sites. Any information that would allow you to be identified will be removed and destroyed. Protecting your confidentiality will be our first priority. If it is decided to conduct this interview over webinar or phone using Zoom, the system used will be encrypted and password protected.

We expect that any risks, discomforts, or inconveniences will be minor, and we believe that they are not likely to happen. If uncomfortable from any questions asked or any aspects of the interview, you may discontinue your participation at any time.

It is not likely that you alone will benefit directly from participation in this study, but child care providers in Michigan may benefit from the guidance offered to educators and funders as a result of the responses we receive.

There will be no cost for participating in this study. As a thank you for participating in the entire interview, you will receive a $20 gift card electronically for completing the study. Please allow two weeks for processing of the gift cards.

The people in charge of this research study are Dawn Earnesty, MS, RDN and Dr. Lorraine Weatherspoon (Department of Food Science and Human Nutrition) at Michigan State University. Dawn Earnesty can be reached at 989-758-2514 or Dr. Lorraine Weatherspoon at 517-353-3328.If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact the Michigan State University Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 4000 Collins Rd, Suite 136, Lansing, MI 48910.

Do you agree to participate?
If there is anything that you do not want recorded, please let me know and I will be glad to pause the digital recorder. Do you have any objections to my recording our discussion? (if no, terminate interview)

The discussion will last between 45 minutes and an hour. We will not take any formal breaks, but please feel free to get up at any time to stretch or use the restroom.
Once again, thank you for taking your time to talk with us today. Do you have any questions before we get started?

Interview Sequence
Opening Questions:
1. How long have you been working with children?
2. What is your favorite thing about working with children?

Part 1. General Overview
From your experience as a child care provider, we are going to be talking about the food and beverages you serve to children in your home.
a) What can you tell us about the kinds of beverages/drinks that you serve?
Prompt: Juice? How do you know if 100% juice? Milk? Flavored milk? Water?, Kool-Aid?, Sports drinks? Other examples of beverages you serve?

- What makes it easy to serve these beverages?
- What makes it difficult to serve beverages that you would like to give to the children?

- What helps you decide what beverages that you actually serve?

Prompts: Cost? Flavor/appearance of food? Past trainings received? Age of child? Child's food preferences? Food waste? Availability at local stores?

b) What can you tell us about the fruits and vegetables that you serve?

Prompt: For example apples, watermelon, strawberries, corn, broccoli, carrots, salad? What are a few examples of fruits and vegetables that you serve?

- What makes it easy to serve fruits and vegetables?
- What makes it difficult to serve fruits and vegetables?
- What helps you decide what fruits and vegetables that you actually serve?

Prompts: Cost? Flavor/appearance of food? Past trainings received? Age of child? Child's food preferences? Food waste? Availability due to the season or access at local stores?

c) What can you tell us about starchy foods that are not vegetables that you serve?

Prompt: Oatmeal, popcorn, brown rice. Whole wheat bread, plain cheerios, What are examples of starchy foods you serve?

- What makes it easy to serve these starchy foods?
- What makes it difficult to serve these starchy foods?
- What helps you decide what starchy foods that you actually serve?

Prompts: Cost? Flavor/appearance of food? Past trainings received? Age of child? Child's food preferences? Food waste? Food Label? If they say wholegrain then ask them "how do you determine if it is whole grain?"—prompt do you read labels? What do you look for on labels that help you to be sure that it is wholegrain?

h) What can you tell us about the type of yogurt you serve?
Prompt: Brand, flavor, consideration of sugar or sweetness? What are examples of the kinds of yogurt you serve?

- What makes it easy to serve these kinds of yogurt?
- What makes it difficult to serve these kinds of yogurt?
- What helps you decide what kind yogurt you actually serve?

Prompts: Cost? Flavor/appearance of food? Amount of sugar? Past trainings received? Age of child? Child's food preferences? Food waste? Food Label? Availability at store?

i) What can you tell us about the breakfast cereal you serve?
Prompt: Brand? Flavor? Types? Sugar content? What are examples of the kinds of cereals you serve?

- What makes it easy to serve these kinds of cereal?
- What makes it difficult to serve these kinds of cereal?
- What helps you decide what cereal you actually serve?

Prompts: Cost? Flavor/appearance of food? Past trainings received? Age of child? Child's food preferences? Food waste? Food Label?
What about the food label makes you choose these cereals?

j) What can you tell us about the kinds of desserts/snacks/sweet treats that you serve?
Prompt: For example granola bars, cookies, cake and toaster pastries?

- Can you give us some examples?
- What helps you decide on the desserts/snacks/sweet treats that you actually serve?

Prompts: Cost? Flavor/appearance of food? Past trainings received? Age of child? Child's food preferences? Food waste? Availability? Reward for children?

k) What can you tell us about how you prepare foods?

Prompt: Pan fried, deep fat fried, baked, microwave? What are examples of things you prepare and how do you prepare them?

- What food preparation methods are easier to use at your home for the children? Why?
- What food preparation methods are difficult to use? Why?
- What helps you decide what food preparation method you should use for the foods for the children?

Prompts: Cost? Flavor/appearance of food? Past trainings received? Age of child? Child's food preferences? Food waste? Type of equipment? Availability of Ingredients?

Part 2

1) What helps you decide what foods and beverages you will serve to the children you care for?
2) What do you know about government nutrition expectations?
3) Are there any recommendations you have that will help child care providers serve foods and beverages that meet government nutrition expectations?
4) Are there any challenges that you may have that prevent you from serving foods and beverages that you think would meet government nutrition expectations?
5) What are examples of helpful information you have received about foods and beverages that should be served to the children you care for?

Prompts: Was this info readily available, sent to you or did you have to search for it? How was it helpful? Can you give me some examples?

6) What are examples of information that was not as helpful?

Prompt: From Whom?

7) Where and from whom have you received information about types, kinds and amounts of foods and beverages you should serve to children in your care?

Prompts: Can you name any specific organizations or groups that give you information? Internet? Friends? Relatives, Magazines, TV, social media?

8) What kinds of things have you learned from this information that you received about foods and beverages?

Prompts: In general? For children?

9) What types of information or resources would make it easier for you and other day care providers to serve foods and beverages that meet government nutrition expectations?

Prompt: Shopping on a budget? How to prepare quick and easy healthy meals? Reimbursement programs? Trainings?

Part 3: Conclusion

We are about done. Is there anything else you would like to add about the foods and beverages you serve to children you care for in your home?

Is there anything else you would like to share that has not been covered already?

I have a few additional questions to confirm information that we collected in the previous study.

Demographics

7) What county is your child care home located in?
8) How many children do you care for in the home?
9) Are you licensed?
10) What are the ages of the children you care for?
11) Do you participate in CACFP (Child and Adult Care Food Program) (food program)?
12) Which of the following best describes you: White, Black, Asian, Alaskan Native, and American Indian, Native Hawaiian, Middle Eastern or another race?
13) Would you say that you are also Hispanic?
14) What about the children you care for? Are they mainly White, Black, Asian, Alaskan Native, American Indian, Native Hawaiian, Middle Eastern or another race? Or are they a mixture?
15) Would you say any are Hispanic?

Do you have any questions?

Thank You for your time today.

APPENDIX J: Qualitative Telephone Recruitment Script

Hello, my name is Dawn Earnesty and I am a graduate student with MSU and work for MSU Extension. Today, I am calling you because you have previously participated in a child care provider observation where we came into your home. We are recruiting in-home child care providers from that observation to take part in a one-hour interview to help us gain a better understanding of your views regarding the foods and beverages you serve to preschool aged children (2-5 years) who attend your child care. You will receive a $20 electronic gift card for your participation. Is this something you might be interested in participating in?
No response: Thank them for their time
Yes response: Great! I have a few questions to ask you to make sure you are eligible to participate.

Eligibility questions:

- How many children do you care for currently in your home?
- Do you serve food and beverages to preschool ages children (2-5 years of age) in your home? If so, how many children are between the ages of 2-5 years?
- Do you have access to a computer, tablet or mobile device that you can use to participate in a one-hour virtual interview?

If all answers are yes, let them know that they are eligible and just need to ask a few questions to schedule the interview.

- What is your e-mail address?
- Do you prefer to receive the meeting code to join the virtual meeting via text message or email?
- What time of day and what day of the week can you participate in a one-hour interview?

- (Schedule interview day and time) I will be emailing or texting you a zoom link which is a web-based platform used to host webinars (online meetings) and phone meetings, as well as a call-in phone number to access the virtual meeting. I will also be sending you a copy of a consent form that I will read to you at the beginning of the recorded interview that is scheduled for _____ at _____ time. If you need to reschedule or have connection issues, feel free to call my office at 989-758-2514.

BIBLIOGRAPHY

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