Investigating the Cost of National School Lunch Program Lunches versus the Full, Time-Inclusive Cost of Home-Packed Lunches

Keely R. O'Keefe

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Human Nutrition, Foods, & Exercise

Elena L. Serrano

Alisha R. Farris

George C. Davis

Madlyn I. Frisard

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ABSTRACT

Background: National School Lunch Program (NSLP) meals have been found to be of higher dietary quality than home-packed lunches.

Objective: To explore the cost, including time, of NSLP versus different categories of home-packed lunches.

Methods: Data from pre-kindergarten and kindergarten lunches from three schools in southwest Virginia were used for this study. Each lunch item was priced, and a direct cost was assigned based on the lunches' contents. Time assessments were conducted to determine the amount of time to prepare each lunch, with a monetary value for time computed based on average salary of the respective county. A non-parametric Kruskal Wallis test was used to compare the direct cost, time, time cost, and the full cost of the meals. Medians were computed based on outlier data.

Results: The lowest median direct cost was found for homemade packed lunches ($1.55), followed by homemade school lunches ($2.11), then convenience packed lunches ($2.12), and then NSLP lunches ($2.15). When incorporating preparation time, the NSLP lunch cost the least ($2.15), followed by convenience packed lunches ($2.56), then homemade packed lunches ($2.92), and then homemade school lunches ($11.32). Seventy-six percent (n=414) of home-packed lunches contained sugar-sweetened beverages and/or dessert food items, accounting for almost one-quarter (21.8%) of the cost of all home-packed lunches.

Conclusion: When time is computed as part of the total cost of NSLP versus home-packed lunches, the NSLP is the least expensive option. In conjunction with the nutritional benefits of the NSLP, this time-cost data may help shift purchasing and consumption patterns.

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ABSTRACT

Background: National School Lunch Program (NSLP) meals served at school have been found to be healthier than home-packed lunches.

Objective: To investigate the differences in cost, including time, among NSLP lunches and different categories of home-packed lunches.

Methods: Data from pre-kindergarten and kindergarten lunches from three schools in southwest Virginia were used for this study. Each lunch item was priced, and a direct cost was given based on the items in each lunch. Researchers then made each lunch or recorded packaging preparation times to determine the amount of time to prepare each lunch, with a value for time given in dollar form based on average salary of the respective county. A non-parametric Kruskal Wallis test was used to compare the direct cost, time, time cost, and the full cost (i.e. direct cost + time cost) of the meals. The data is based on medians to give a better representation of the data.

Results: The lowest median direct cost was found for homemade packed lunches ($1.55), followed by homemade school lunches ($2.11), then convenience packed lunches ($2.12), and then NSLP lunches ($2.15). When incorporating preparation time, the NSLP lunch cost the least ($2.15), followed by convenience packed lunches ($2.56), then homemade packed lunches ($2.92), and then homemade school lunches ($11.32). Seventy-six percent (n=414) of home-packed lunches contained sugar-sweetened beverages and/or dessert food items, accounting for almost one-quarter (21.8%) of the cost of all home-packed lunches.

Conclusion: These results show an interesting difference in lunch cost based on category when considering cost and time. Given the research on the health benefits of NSLP meals over home-packed lunches, the cost data may help shift purchasing and eating patterns among parents of school-age children.

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Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

With or in the nutrition field, researchers generally focus on the nutritional attributes of food or strategies to encourage healthier eating through increased nutrition knowledge. Time is not always considered as a factor guiding food choices, even though research shows that people view time as one of the most precious commodities that drives all of decision making.[1] Most analyses have not considered the value of time when calculating the cost of food.[1] Time, in addition to cost, are two of the most important factors people consider when deciding what to eat.[1] Including time in the cost of a food may have important implications when comparing foods based on their cost.[1] The purpose of this research study was to explore the value of time in a setting that is familiar to almost all school-age children—eating lunch at school.

When school lunch standards were improved at the start of the 2012-2013 school year, as a result of the Healthy, Hunger-Free Kids Act (HHFKA) of 2010, research studies compared the nutritional quality of home-packed lunches to National School Lunch Program (NSLP) lunches.[2] School lunches, which must adhere to federal nutrition standards, were shown to be more nutritious than home-packed lunches.[3,4] School lunches must offer five components, a meat/meat alternative, grains, fruits, vegetables, and milk, and require limits in sodium, saturated fat, and trans-fat.[5] Home-packed lunches have no such standards to follow and have been shown to contain more sugar-sweetened beverages (SSBs), desserts, and chips but less fruits, vegetables, dairy, and whole grains.[4,6] Only a few research studies have compared the direct cost of school lunches to the direct cost of home-packed lunches, and have shown that home-packed lunches typically cost more than school lunches.[4,6,7] Food preparation time and motivators of home food preparation have been investigated, but in settings unrelated to school.[1,8,9] To date, no studies have been published to examine the cost of home-packed lunches compared to school lunches, including preparation time,

which is often considered a barrier to home food preparation. This study aimed to determine the roles of cost and time when making lunch choices.

Three important terms to understand in this research study are direct cost, time cost, and full cost. Direct cost is the cost or expenses required to purchase a lunch or ingredients for a lunch.[1] Time cost is a monetary value for the preparation time required to make a lunch.[1] This value can be determined by establishing a cost per second value of time using the median or mean income documented by the Bureau of Labor Statistics (BLS) in a particular location (i.e. county, city, state).[10] This cost per second value can then be multiplied by the number of seconds required to make a meal, resulting in the time cost. Adding the direct cost and the time cost together gives the full cost, or time-inclusive cost, of a meal.[1]

This study was designed to explore the cost of NSLP lunches versus the full, time-inclusive cost of home-packed lunches. The study aimed to determine if the cost of NSLP lunches is lower than the full, time-inclusive cost of home-packed lunches; if the direct cost of NSLP lunches is lower than the direct cost of home-packed lunches; and the additional cost of SSBs and desserts in home-packed lunches. It was anticipated that the cost of home-packed lunches would be significantly higher than NSLP lunches when considering the time to prepare them.

During the 2012-2013 school year, elementary school lunches in Montgomery County, Virginia cost $2.15 for a student to purchase.[11] School lunches have no time cost for a parent or student because they do not have to prepare the meal. This means the direct cost and the full cost of school lunches are the same, $2.15, unless the family lives near or below the poverty line, which qualifies a student for a free or a reduced-price school lunch. Home-packed lunches, on the other hand, have completely variable costs depending on the direct cost of food items in a lunch and the amount of time it takes to prepare those food items.

Results from this research study can be used to inform social marketing and awareness campaigns, as well as interventions, to better inform parents and even children about the full "cost" of the different meals. This study may help school nutrition personnel encourage more participation in the NSLP, which has been declining nationally.

Chapter 2: Literature Review

National School Lunch Program (NSLP)

Number and Proportion of Children Participating in the NSLP

The National School Lunch Program (NSLP) provides school lunches to over 31.6 million children each day and has served more than 224 billion lunches since its creation in 1946.[12] Every day over 50 million children, adolescents, and teens attend elementary, middle, and high school in the United States (U.S.).[13] Students spend an extensive amount of time at school, approximately 40 hours each week or more depending on after school activities. Students consume 1/3 to 1/2 of their daily calories at school during the week between breakfast, lunch, and snacks.[7] Approximately 40% of students bring home-packed lunches while about 60% of students participate in the NSLP at least once per week.[14]

Food security is a serious issue in high-poverty and limited income areas. One in five children in America are considered food insecure, "being without reliable access to a sufficient quantity of affordable, nutritious food."[15] Nutrition assistance programs, including the NSLP and National School Breakfast Program (NSBP), help children struggling with food security and poor nutrition by providing healthy meals on weekdays. Children from families with incomes at or below 130 percent of the poverty level are eligible for free school lunch meals.[16] Those with incomes between 130 percent and 185 percent of the poverty level are eligible for reduced-price meals, which is a meal for 40 cents or less.[16] Children from families with incomes over 185 percent of the poverty level must pay full price for school lunches.[16] Local school food authorities set their own full-price lunch costs but must operate their meal services as non-profit programs.[12] Afterschool snacks are also provided to children on the same income eligibility basis as school

meals, however, schools that have a 50% or greater eligibility rate for free or reduced lunches can serve all snacks for free.[12]

Research has shown higher rates of food insecurity over the summer, when school breakfast and lunch are no longer being provided.[17] It has been estimated that food insecurity is reduced almost 4% with reduced-price school lunches and that school breakfasts decrease marginal food insecurity in low income homes.[17] The NSLP also helps improve dietary quality while reducing food insecurity, and has been shown to reduce obesity rates.[17] Overall, there is substantial evidence on the benefits of school breakfast and lunch programs for food insecure students.

Standards and nutritional requirements have been a part of the program since its creation, but the NSLP has undergone policy revisions many times, typically to align with the Dietary Guidelines for Americans. The most recent revisions occurred with the passing of the Healthy, Hunger-Free Kids Act (HHFKA) of 2010, which went into effect during the 2012-2013 school year.[2] These changes increased fruits, vegetables, and whole grains and reduced sodium, saturated fat, and trans-fat.[5] The new guidelines also required calorie limits by age group and portion sizes for food components.

Dietary Quality of NSLP Lunches

The more robust nutritional standards implemented as a result of the HHFKA 2010 have resulted in significant changes to the nutrient profile of school meals.[5] For energy requirements, school meals must provide 550 to 650 calories per lunch in grades kindergarten through fifth, 600 to 700 calories per lunch for grades sixth through eighth, and 750 to 850 calories per lunch for grades ninth through twelfth. This helps to ensure that children are receiving the appropriate energy and nutrients for their respective ages and needs. Additionally, the NSLP must offer five

components in their lunches: meat/meat alternative, grains, fruits, vegetables, and milk. For a school lunch to be reimbursable, a child must take at least three components, and the lunch must include either a fruit or a vegetable. This requirement is designed to increase fruit and vegetable exposure and consumption. Additionally, a variety of vegetables must be served throughout the week, including dark green, red/orange, legumes, starches, and other vegetables. In total, the NSLP provides at least half a cup of fruit per lunch to grades K-8 and provides 1 cup a day for grades 9-12. Three-fourths a cup of vegetables are provided to K-8 each day and one cup per day for grades 9-12 in the NSLP.

Related to other food groups, one ounce of grains and one ounce of meat are provided for grades K-8 and two ounces of grains and two ounces of meat are provided for grades 9-12 each day under the NSLP standards.[5] One cup of milk is provided to every grade each day under NSLP standards.[5] The new standards required half of grains be whole grains by 2012-2013 and then for all grains to be whole grains by 2014-2015.[5] Milk can be flavored or non-flavored but must be low fat or fat free.[5]

The NSBP requires 350-500 calories per breakfast for grades K-5, 400-500 calories for grades 6-8, and 450-600 calories for grades 9-12.[5] School breakfast provides three components to each school breakfast: grains (1 ounce/day), fruit (1 cup/day), and milk (1 cup/day).[5]

The nutrition standards also require limits in sodium, saturated fat, and trans-fat.[5] Sodium limits are being phased over time, with the following requirements:[18] Sodium limits for all lunches during the 2014-2015 school year are <1230mg (K-5), <1360mg (6-8), and <1429mg (9-12); sodium limits for all lunches during 2017-2018 school year are <935mg (K-5), <1035mg (6-8), and <1080mg (9-12); and sodium limits for all lunches during 2022-2023 school year are the final target which must be <640mg (K-5), <710mg (6-8), and <740mg (9-12). Saturated fat must be

limited to less than 10% of total calories and trans-fat must be 0 grams per serving (excluding naturally occurring trans fats).[5]

Price of NSLP Lunches

In Montgomery County, Virginia, during the 2012-2013 school year, school lunch prices were $2.15 for elementary school and $2.25 for secondary school.[11]

NSLP Food Waste

After the USDA implemented new school lunch standards, one of the biggest concerns was food waste due to bigger portions and fruit or vegetable requirements.[19] Previous experience with an attempt to increase fruit and vegetable consumption during the 1980 "Offer vs. Serve" policy left sceptics wary of this new implementation. "Offer versus Serve" required students to take three of the five food components (fruit, vegetable, grain, dairy, and meat) with one component being either a fruit or a vegetable instead of requiring students to take any three of the five food components. One concern with the new standards and rule was the potential food waste as a result of requiring children to receive a fruit and vegetable that they may not consume.

After the new NSLP meal regulations went into effect during the 2012-2013 school year, a food waste study was conducted by researchers who wanted to determine if more food was being wasted.[2] Result showed that fruit selection increased by approximately 15% (54% to 71% in 2013 and to 66% in 2014) after the new guidelines went into effect, but vegetable selection decreased (68% to 62% in 2013 and to 52% in 2014). Milk selection stayed the same at around 50% and entrée selection increased to almost 100% selection. Although vegetable selection decreased, vegetable consumption between 2012 and 2014 increased from 45% to 64%. Entrée consumption also increased between 2012 and 2014 from 71% to 84%. Consumption of fruit and milk remained

constant at ~67% and ~50% respectively. Results also showed that adding variety to fruit offered was shown to increase selection of fruit and schools that offered more than one fruit option increased fruit selection by 9.3% for every increase in fruit servings. Overall, plate waste after new NSLP regulations went into effect was observed to be 45% (although there was not a baseline food waste study to draw comparisons from).

A second study aimed to determine if food selection, consumption, and waste changed after new lunch standards were in effect by doing a study before and after school lunches changed.[19] Food consumption was measured using plate waste study methods on two days before the new NSLP standards and on two days after the new NSLP standards. Samples of pre-consumed food were weighed. Each students' lunch tray was given a number and food components were noted. When students were finished, their food components were weighed separately. This method determined how much each child was consuming. Results showed no significant differences in entrée and vegetable selection before and after implementation, but fruit selection increased 23% while milk selection decreased 25%. Entrée consumption increased 15.6% and vegetable consumption increased 16.2%. Fruit waste did not increase but since fruit selection increased it can be concluded that fruit consumption also increased. Milk consumption decreased 10%.

Although limited, these studies indicate that the new NSLP guidelines have led to positive shifts in intake with declines in plate waste.

Home-Packed Lunches

Number and Dietary Quality of Home-Packed Lunches

In the United Stated, approximately 41% of students bring their own lunch to school and 45% of students bring a snack.[20] While the HHFKA 2010 provides guidance to the NSLP and

NSBP, it does not provide oversight or requirements for the nutritional quality of home-packed lunches, despite their nutritional shortcomings. Based on research, some factors that influence home-packed lunches are taste preferences, cost, food allergies, limited menu options, lunch service capacity, time allotted for eating, parents desire to provide lunch for their children, the perception that home-packed lunches are of a better nutritional quality than school lunches, or a perceived social stigma for free/reduced-price lunches.[3]

A study conducted at eight elementary and four intermediate schools in Houston, Texas during the 2011-2012 school year, assessed the quality and cost of lunches brought from home compared to the new NSLP guidelines.[4] Lunch observations for 242 elementary school students and 95 intermediate students who brought lunch from home were observed once per week at assigned schools. Lunches brought from home met NSLP guidelines in 3 categories: percent of energy from saturated fat, minimum ounces of meat/meat alternative, and minimum ounces of total grains. On average, home-packed lunches contained more sodium but less fruit, vegetables, whole grains, and milk while 90% of home-packed lunches contained items prohibited by the NSLP including desserts, snack chips, and sugar-sweetened beverages (SSBs).

Another study published in the Journal of the Academy of Nutrition and Dietetics aimed to evaluate the quality of home-packed lunches and snacks brought by students and compared lunches to NSLP standards and snacks to the Child and Adult Care Food Program (CACFP) requirements.[20] Pictures of lunches and snacks from 626 third and fourth grade students in six public school districts in eastern Massachusetts were taken and each item was recorded on an inventory checklist. Forty-eight percent of students brought lunch from home and 97% of those students brought a snack. Most students brought two food items and a beverage. The most common lunch foods were sandwiches (59%), snack foods (42%), fruit (34%), and dessert (28%). Less

common foods were leftovers (17%), dairy foods (17%), and vegetables (11%). Seventy-three percent of lunches contained a beverage with the most common being water (28%), followed by SSBs (24%). Only about one-quarter, 27%, of lunches, met at least three of five NSLP standards.

Of the 616 snacks analyzed, 325 were from participants who brought only a snack and planned to buy their lunch at school. The other 291 snacks were from participants who also brought lunch. Overall, the median number of items brought for snack was 2 (range=1 to 7), consisting of 1 food (range=1 to 6) and 1 beverage (range=1 to 3). The typical snack consisted of an SSB, with a snack food or a dessert. Snack foods (62%), desserts (35%), and SSBs (35%) were more common than fruits (30%), dairy foods (10%), and vegetables (3%). Overall, 4.2% of snacks met at least 2 of 4 CACFP standards. Among the 291 participants who brought a lunch and snack, 78 (27%) met three of five NSLP standards. Only 3 of these 78 participants (4%) brought a snack that met two of four CACFP standards.

In a study that compared the nutrient content of home-packed lunches (n=333, 15%) versus NSLP lunches at four elementary schools in northern Texas during the 2006-2007 school year, found that home-packed lunches contained significantly fewer calories, more sodium, and less vitamin A, calcium, iron, and dietary fiber than NSLP meals.[7]

A similar study was conducted after the implementation of the HHFKA 2010 over the course of five consecutive days among pre-kindergarten and kindergarten students in Appalachian Virginia.[3] With a total of 1314 total observations, 562 students (42.8%) brought home-packed lunches and 752 students (57.2%) bought school lunches. After observations, researchers examined the nutritional quality of home-packed lunches compared to school lunches. Home-packed lunches were shown to have significantly higher energy, fat, saturated fat, sugar, vitamin C, and iron contents while having significantly lower protein, sodium, fiber, vitamin A, and

calcium contents than school lunches. Based on food groups, home-packed lunches contained less fruit (54% vs 67%), vegetables (17% vs 61%), no sugar added juice (10% vs 22%), and milk (20% vs 96%) compared to NSLP meals. Home-packed lunches also contained more savory snacks like chips and crackers (57% vs 5%) and SSBs (41% vs 0%). In addition, 61% of the home-packed lunches contained a dessert item and 17% contained more than that one dessert item. The NSLP does not provide SSBs or dessert items to students. Before the implementation of the new NSLP standards, home-packed lunches were typically of higher nutritional quality than school lunches. Based on this study with new NSLP standards, it was concluded that home-packed lunches were of lower nutritional quality than school lunches.

The above study also included research comparing the differences in the nutritional quality of home-packed lunches to NSLP lunches by the presence or absence of sugar-sweetened beverages (SSBS), desserts, and fruit/vegetable items brought by pre-kindergarten and kindergarten elementary school children.[3] Of the 561 home-packed lunch observations, 41.7% contained no fruit or vegetable, 41.2% contained an SSB, and 61.1% contained a dessert. Home-packed lunches with a fruit or vegetable had a nutrient profile with significantly higher levels of carbohydrate, fiber, sugar, vitamin A, and vitamin C. Home-packed lunches that contained an SSB had significantly higher levels of sugar and vitamin C and significantly lower levels of protein, fiber, vitamin A, calcium, and iron. Home-packed lunches with a dessert had significantly higher levels of energy, carbohydrate, fat, saturated fat, sodium, sugar, vitamin C, and iron, and significantly lower levels of vitamin A.

Overall, these studies suggest that home-packed lunches typically contain less fruits, vegetables, and dairy but contain more fat, saturated fat, sodium, and sugar than school lunches.

Cost of Home-Packed Lunches

Research assessing the cost of home-packed lunches is limited and has been significantly neglected compared to research on various dietary studies related to the NSLP. One of the few studies in this area was conducted at eight elementary and four intermediate schools in Houston, Texas during the 2011-2012 school year.[4] Two researchers collected food costs from three grocery stores in the school district. The average cost per food item was used to calculate the total cost of a meal brought from home. They found that, based on 2011-2012 data, elementary and intermediate school students in the participating schools who purchased a reimbursable NSLP lunch paid $1.80 and $2.05, respectively. The average cost for meals brought from home for elementary school students was $1.93 and $1.76 for intermediate school students. Students who attended lower-income intermediate schools had significantly higher-cost lunches from home ($1.94) than their middle-income peers ($1.63). Home-packed lunch costs ranged from $0.69 to $4.78 for elementary and $0.63 to $3.91 for intermediate school students. Results showed that average cost differed by sex, grade level, and school socioeconomic status.

Another study published in The Journal of Child Nutrition and Management compared prices of school lunches to home-packed lunches in Illinois, Michigan, Minnesota, Ohio, and Wisconsin.[6] School lunch prices were collected by district, through email, and categorized by USDA regions. Home-packed lunch prices were collected for single-serving items from six supermarkets in Michigan, and the mean price for each item was calculated. Components of home-packed lunches were combined to fit USDA calorie levels for both elementary (664 kcal), middle (825 kcal), and high school (825 kcal). School lunch prices were significantly different by region with southeast region prices being the lowest and Midwest prices being highest. Home-packed lunches were significantly more expensive than school lunches regardless of region. The mean

Midwestern elementary school lunch (n=158) price was $1.70 (±.31), while home-packed lunch (n=20) prices averaged $3.10 (±.77). Midwest middle school lunch (n=157) prices were $1.92 (±.37), while home-packed lunch (n=18) prices averaged $3.43 (±.63). The mean Midwestern high school lunch price (n=157) was $1.95 (±.36), with home-packed lunch (n=18) prices averaging $3.43 (±.63). These results show that school lunch prices are less expensive than home-packed lunches.

In another study conducted in four elementary schools in northern Texas during the 2006-2007 school year, researchers examined the cost of 333 home-packed lunches (15% of students), based on food prices at three local supermarkets.[7] Mean cost of home-packed lunches ($1.52 to $1.80) was less than the sales price for the reimbursable school lunches ($2.00 to $2.25) at all four schools but was only significantly less at three of the four schools. It is important to note that the cost of the home-packed lunches in this study did not include the cost of labor or any other non-food items, such as plastic bags, which would also affect the calculated cost.

Overall, these studies show an interesting variation in the cost of home-packed lunches based on differences in location, grade level, sex, and school socioeconomic status. These results show that home-packed lunch costs can vary greatly depending on the food items packed in students' lunches.

Food Preparation Time

Many factors influence food choices, with food price/money and convenience consistently considered leading factors. Few studies take into consideration measuring the price of food with considering the value of time, however, convenience has an implicit time component. For example, research shows that time is an important factor preventing individuals from meeting SNAP

nutritional recommendations. [1] In fact, Gary Becker, Nobel Prize winner, stated that combining direct cost and time cost can provide the "full price" of an item. This is denoted as a "time-inclusive price."[1]

In one study conducted in 2015, time-inclusive prices were compared with time-exclusive prices for two types of home foods: home recipes versus processed recipes.[1] Processed recipes refer to ready-to-eat food that requires little to no preparation. This study considered time-inclusive items to include the direct price of the item and the value of time in the food item, while time-exclusive items only considered the direct price. Time only considered active preparation time like chopping, washing, mashing, etc. and did not include cooking or other more passive preparation activities if the person preparing the meal could participate in other activities during that time.

The value of time in this study was calculated through the market substitution approach, which values household labor at the rate in which the same activity could be purchased on the market. The Bureau of Labor Statistics for Food Preparation and Serving-Related Occupations showed that the median hourly wage was $9.15 and had a range of $6.96 between the 10^{th} and 90^{th} percentiles.[1] A sensitivity analysis on wage distribution was then utilized because of the uncertainty of which value to use.[1] The calculated value of time-inclusive prices was obtained from 1000 wage observations. These calculations are based on MyPlate recommendations for daily servings.

Additionally, food preparation and/or processing were also incorporated into the analysis by accessing the recipe database created by the North American Branch of the International Life Science Institute. The web-based application, Food Value Analysis, was used within the analysis. This application allows users to see the direct cost and time associated with producing foods along with time-inclusive and time-exclusive comparisons of selected foods. One hundred recipes from

the U.S. Department of Agriculture (USDA) Food and Nutrition Database for Dietary Studies or the USDA National Nutrient Database for Standard References were selected. These recipes can range from one to many ingredients but are all prepared at home. For comparison, 143 "processed recipes" were chosen to match the home recipes (ranging from partially processed to entirely prepared foods). Food preparation and cooking time for recipes was obtained from the Betty Crocker Cookbook, Better Homes and Gardens New Cookbook, and FoodNetwork.com's "Recipes and Cooking." Food preparation and cooking time for processed food was obtained from package instructions. Processed foods without these instructions were prepared in a test kitchen to measure times. Clean-up time was not included in any calculations.

The results indicated that time-exclusive prices were only significantly different in the vegetable category, meaning the prices of processed/unprocessed foods in the other four food groups (fruit, grain, dairy, and protein) were extremely close in price. On the other hand, time-inclusive prices showed processed foods to be a cheaper alternative to home recipes (except for dairy and the others group). Home recipes showed greater preparation time than their processed counterparts and averaged 18 times more preparation time, which was statistically significant.

Overall, the recipes categorized as "processed" were always cheaper than home prepared recipes in terms of time-inclusive price. Home recipes showed a greater difference between time-inclusive and time-exclusive price then processed recipes.

In another study, convenience foods were more frequently purchased and consumed in large families, where time was a bigger factor.[8] Time was also shown to play a role among people who had different time constraints.[9] For example, people with high time preference focus more on instant gratification rather than future rewards while people with low time preference valued future rewards over instant gratification. Overall, the individuals with high time preference presented less

willingness to delay gratification, cared less about health claims and sustainability, and did not care about organic foods and calorie content as much as their low time preference counterparts.

Motivators of Home Food Preparation

Many factors contribute to preparing and consuming meals at home, including cooking skills and food preparation knowledge. Many populations in the western world have limited abilities in these areas and therefore rely on prepared, processed food or meals outside the home.[21] Cooking skills and time are two of the most important factors to consider when researching fruit and vegetable consumption.[21] Studies show that working women prefer to spend less than 15 minutes to prepare meals and college students may prioritize studying over preparing meals.[21] Eating outside of the home becomes the alternative to these populations.[21]

In a study aimed at identifying motivators and barriers to preparing food at home versus buying prepared meals or eating at restaurants, 239 college students of diverse backgrounds were recruited to participate in focus groups.[21] Extensive food lists were provided to the participants and they were asked to answer questions like "Do you ever eat this food? Do you know how to make it? Have you ever made it? If you do not prepare the item, what are the reasons?" A list of motivators and barriers was created based on their answers.

Motivators for preparing meals at home were: a desire to save money, having a parent who modeled food preparation, familiarity with cooking techniques, available equipment, kitchen access and basic ingredients, desire for healthier food, enjoyment of cooking, like having control or food preparation, interest in foods they consume, pride in preparing food, time organization to grocery shop efficiently, and time to plan and organize meals and clean up after. Time was most consistently mentioned as a motivational factor.

Barriers to preparing food at home were not having enough time, not having a kitchen, not having knowledge or skills to prepare foods, and the convenience of the university cafeteria. Not having enough time to shop and cook foods was the most frequently mentioned barrier.

Time was also a factor among parents of elementary school children in choosing between home-packed and school lunches with low and high free and reduced school lunch availability.[3] In an online survey of parents from four elementary schools in a rural county of Virginia (n=516) 55.2% from schools with higher free and reduced lunch eligibility rates (n = 285) and 44.8% from schools with lower rates, the most frequent motivational factors for NSLP participation were convenience and saving time. Motivational factors for packing were variety, nutritional quality, taste/food preferences, and providing organic or sustainable foods.

Improving Home-Packed Lunch Dietary Quality

Although it is recognized that home-packed lunches are nutritionally inferior to school lunches, few studies have been published that focus on improving the dietary profile of home-packed lunches. *Lunch is in the Bag* was a five-week behavioral nutrition intervention aimed at increasing fruit, vegetable, and whole grains packed by parent for their child's lunches. [22] Six hundred and thirty-three families from 30 Early Care and Education centers (15 control and 15 intervention) in Austin, San Antonio, and Houston, Texas participated in the study.[22] Baseline data was collected before the intervention and six weeks later, post-intervention data was collected. At 22 weeks, pre-booster data was collected and then post-booster data was collected at 28 weeks. Vegetable servings increased by 0.17 and whole grain servings increased by 0.30 six weeks after the intervention. Whole grain servings maintained their increase at 0.34 28 weeks after the intervention. Fruit servings did not have any significant changes after the intervention and remained at 1.40 servings. Packing of sweets decreased by 0.43 servings after the intervention.

This shows that further interventions and strategies could improve home-packed lunches of school age children.

Sugar-Sweetened Beverages and Desserts in Home-Packed Lunches

SSBs and desserts are prohibited in NSLP lunches but are packed in 90% of lunches brought from home.[4] One hundred and ninety billion dollars are spent on obesity-related conditions in the United Stated each year, which accounts for 21% of all U.S. health care costs.[23] Almost 24 million children are overweight (31.8%) and of these children, 12.7 million are obese.[23] SSBs include soda, sports drinks, sweetened waters, sweetened teas, energy drinks, and fruit drinks and are the primary source of added sugar in American diets. SSB consumption has increased 500% over the past 50 years in the U.S. and exceeds the Dietary Guidelines for Americans (DGAs) recommended daily calorie allowance of added sugars, which is less than 10% of total calories from added sugars/day.[23,24] U.S. children and teens consume 14% of total calories from added sugars (326 kcal/day) and SSBs are the leading category of caloric intake in children.[23,25] Childhood obesity is positively correlated with increased consumption of sugar-sweetened beverages. Since SSBs do not lead to satiety, they are considered to be more fattening than solid foods since a child will typically consume the same foods in addition to SSBs, which leads to weight gain.[26]

The top sources of energy among children aged 2 to 18, based on the National Health and Nutrition Examination Survey are grain desserts (138 kcal/day), pizza (136 kcal/day), and soda (118 kcal/day), with SSBs (including soda and fruit drinks combined) providing 173 kcal/day.[27] Almost 40% of total energy consumed (798 of 2,027 kcal/day) by these 2 to 18-year-olds was from empty calories, with 433 kcal from solid fat and 365 kcal from added sugars.[27] Consumption of

these empty calories far exceeds the recommended calorie allowance and half of empty calories came from six foods: soda, fruit drinks, dairy desserts, grain desserts, pizza, and whole milk.[27]

Summary

The NSLP provides school lunches to over 31.6 million children each day.[12] Every day, over 50 million children, adolescents, and teens attend elementary, middle, and high school in the U.S., where they consume 1/3 to 1/2 of their daily calories.[7,13] Approximately 40% of students bring home-packed lunches while about 60% of students participate in the NSLP at least once per week.[14] Overall, the more robust nutritional standards implemented as a result of the HHFKA 2010 have resulted in significant improvements to the nutrient profile of school meals and a reduction of plate waste.[5,19]

In comparison, home-packed lunches have been shown to be nutritionally inferior and contain less fruits, vegetables, whole grains, and dairy and more fat, saturated fat, sodium, and sugar than school lunches. [3,4,7,20] In addition, 90% of home-packed lunches have been shown to contain items prohibited by the NSLP including desserts, snack chips, and SSBs.[4]

Time plays a crucial role in food choices and effects what consumers purchase to a significant degree but is a variable that is often ignored in research when measuring food decisions.[1,8,9,28] Placing emphasis on the importance of time, or lack thereof, when determining why consumers choose certain foods is imperative. Eating and/or preparing foods at home should include many factors such as purchased food, income, time spent preparing food, eating, and cleaning up. This emphasizes time as a factor to predict food demand along with the price of food.

Research suggests that foods requiring greater preparation time at home are less likely to be purchased and consumed than convenience and readily consumed foods.[29] It is also

hypothesized when the decision to cook and prepare food has been made, price is a much smaller factor since labor and time have already been committed to the goal of eating.

Overall, many factors are important to consider when preparing meals at home or choosing to eat school lunches. Parents with more food preparation knowledge and free time may be more inclined to prepare lunches at home or, on the other hand, parents who believe it is cheaper to pack lunch themselves regardless of health knowledge may pack processed/prepared lunches for their children. Parents that choose to have their children purchase school lunches may believe the school lunches are nutritionally adequate or may just not have enough time or skills to prepare lunches for their children. These factors are important to consider when determining motivators for preparing lunches at home for children.

Finally, SSBs, desserts, and many "empty calorie" food items consumed in home-packed lunches are not permitted to be a part of school lunches through the NSLP. Research has supported the stance that these food items contribute to the childhood obesity epidemic and should therefore be limited and replaced with wholesome, natural food.

Chapter 3: Manuscript

Introduction

The National School Lunch Program (NSLP) provides school lunches to over 31.6 million children each day and has served more than 224 billion lunches since its creation in 1946.[12] Every day over 50 million children, adolescents, and teens attend elementary, middle, and high school in the United States (U.S.).[13] Students spend an extensive amount of time at school and consume 1/3 to 1/2 of their daily calories at school during the week.[7] Approximately 40% of students bring home-packed lunches while about 60% of students participate in the NSLP at least once per week.[14]

When school lunch standards were improved at the start of the 2012-2013 school year, as a result of the Healthy, Hunger-Free Kids Act (HHFKA) of 2010, research studies compared the nutritional quality of home-packed lunches to NSLP lunches.[2] School lunches, which must adhere to federal nutrition standards, were shown to be more nutritious than home-packed lunches.[3,4] School lunches must offer five components, a meat/meat alternative, grains, fruits, vegetables, and milk, and require limits in sodium, saturated fat, and trans-fat.[5] Home-packed lunches do not have national standards and have been shown to contain more sugar-sweetened beverages (SSBs), desserts, and chips but less fruits, vegetables, dairy, and whole grains.[4,6] NSLP participation has been on the decline since 2008, despite the improvements in dietary quality.[30]

Only a few research studies have compared the direct cost of school lunches to the direct cost of home-packed lunches, and results have shown that home-packed lunches typically cost more than school lunches.[4,6,7] Food preparation time and motivators of home food preparation have been investigated, but in settings unrelated to school.[1,8,9] To date, no studies have been published to examine the cost of home-packed lunches compared to school lunches, including preparation

time, which is often considered a barrier to home food preparation. In this chapter, the cost of NSLP lunches are compared to three potential lunches options from home, including: convenience packed lunches, homemade packed lunches, and homemade school lunches. Cost is compared across three dimensions: a direct cost, a time cost, and a full cost (i.e. direct + time cost).

Methods

Recruitment of Schools

During the 2012-2013 school year, elementary schools in rural Virginia were contacted via e-mail and telephone to participate in a larger observational study on nutritional differences in school and home-packed meals; three of the eight schools (37.5%) agreed to participate in the study. The County Public School Research Office and each individual school administrator/principal provided consent. No child or parental consent was required; no IRB approval was required. No identifying or personal information for any student was collected, only observational data regarding meal selection.

Setting and Participants

Three elementary schools included in the study spanned two counties: Montgomery (2) and Giles (1). During the 2012-2013 school year, Montgomery County had a population of 95,194 with the following ethnic/racial composition: white (87.9%), black (4.1%), and Hispanic/ Latino (2.9%) individuals. [31] Giles County had a population of 16,928 with the following composition: white (97%), black (1.5%), and Hispanic/Latino (1.3%) individuals.[31] The three schools had free and reduced-price school lunch participation rates of: School 1 - 46.6% (Montgomery), School 2 - 33.3% (Montgomery), and School 3 - 52.7% (Giles).[31] Pre-kindergarten and kindergarten

students were selected because young ages represent a malleable time to promote food acceptance.[32-35]

Observer Training, Reliability, and Instruments

Undergraduate and graduate nutrition students were recruited and trained as observers in direct observation to assess lunch contents, specifically visual item identification and portion size estimation. The training was conducted by a doctoral-level registered dietitian. For checklist reliability testing, the researchers conducted observations of five premeasured sample home-packed lunches, for a total of 24 items. Food and beverage items selected represented commonly found items in elementary home-packed lunches. School lunches were not chosen during training because of their uniformity and ease of recording. Accuracy was determined by dividing the number of items accurately recorded by the total number of items (item identification 93.8%; portion estimation 92.1%). Interobserver reliability was assessed with average pairwise percent agreement tests (JMP, version 11, SAS Institute, Inc, Cary, NC, 2013). Observers demonstrated 90.7% agreement for item identification and 86.8% agreement for portion estimation. This was consistent with previous research showing that trained observers with prior nutrition knowledge can accurately and reliably assess home-packed lunch contents and intake by direct observation in an elementary school setting.[36]

NSLP menus need to meet nutritional requirements over the course of one week. Therefore, observational data were collected in each elementary school for five consecutive school days.[18] All pre-kindergarten and kindergarten students in each school were served NSLP meals consisting of similar portion sizes. An observational checklist reflecting the meal components of the day's specific school lunch menu and commonly consumed items from home-packed lunches were used to record data on the presence of all food and drinks selected by students participating in the NSLP

and brought from home. Write-in sections for additional foods brought in home-packed lunches that did not appear on the observational checklist were provided. Food items were recorded for item and portion size from every student (results published here: Farris, Alisha R., et al. Nutritional comparison of packed and school lunches in pre-kindergarten and kindergarten children following the implementation of the 2012–2013 national school lunch program standards. *J Nutr Educ Behav*. 46.6 (2014): 621-626.).

Home-packed meals were separated into their individual components and grouped into food categories. Nutrition students were trained in cost estimation by a doctoral-level registered dietitian faculty member. Researchers were trained to collect brand name (if specified) or store brand (if not specified) food item prices, to select items with the lowest cost per unit size, and to calculate the per-serving costs for individual food items (if needed). Inter-observer reliability was assessed using three food categories: beverages, bread and convenience, and meat and dairy, at one local grocery store. Researchers were asked to collect cost information for foods in the three categories over a one-week period. Percent agreement for cost estimation at grocery stores during price collection training was 61.1% for beverages, 66.7% for bread and convenience, and 60% for meat and dairy. Disagreement occurred when researchers recorded items sold in different sizes and different brands.

Direct Cost

In Montgomery County, Virginia, during the 2012-2013 school year, purchasing a lunch from school through the NSLP cost $2.15 for elementary school students.[11] Students who brought a home-packed lunch and purchased milk from the cafeteria were classified as a home-packed lunch observation. Students who participated in the NSLP but also brought food from home (n = 5; 0.007% of total observations) were excluded. All food and beverage items in home-packed

lunches and all food and beverage items selected by students who participated in the NSLP were entered into an Excel spreadsheet. Items in home-packed lunches were then priced by previously trained researchers in a two-week period during June 2016 at three local supermarkets, and the average price was determined for each item. Lunch items that were selected by students who participated in the NSLP were priced by researchers in a two-week period the following year (July 2017) at three local supermarkets, and the average price was determined for each item. The NSLP lunches were priced at local grocery stores to determine the cost of a school lunch if a parent were to prepare the same, nutritionally identical meal their child purchased from school, but at home. These average prices were used to determine the direct cost of each home-packed lunch and each homemade school lunch. The brand information was used to record item prices when available. If the item was not identified by a brand, the store brand food item with the lowest unit price per serving was recorded. This was done to ensure the lowest-cost possible if no brand was provided.

The Consumer Price Index from 2012 was used to deflate the cost of home-packed lunch items and homemade school lunch items collected in 2016 and 2017, respectively, to its 2012 sticker price.[37] Each home-packed lunch and homemade school lunch was given a direct cost based on the food items it contained. The direct cost of home-packed lunches was then compared to the direct cost of homemade school lunches and to the sales price of a reimbursable NSLP lunch. Often, SSBs and desserts are included in many home-packed lunches but are prohibited by the NSLP. The direct cost of SSBs and desserts in each home-packed lunch was collected, giving a monetary value for including nutritionally inferior food items in home-packed lunches.

Time Cost

Purchasing a lunch from school through the NSLP has a time cost of $0.00 since parents and children do not have to do any food preparation. For home-packed lunches, each lunch was

divided into one of two categories: convenience or homemade (home-packed lunches composed of leftovers or fast food were excluded from data analysis n=18; 3.2% of total home-packed lunches). Convenience packed lunches were defined as any lunch that did not involve preparation of a main course food item, such as Lunchables™ and Uncrustables™, (n=187, 34.3%) and homemade packed lunches were defined as any lunch that did involve preparation of a main course food item, such as a sandwich, chicken nuggets, or a hot dog, (n=358, 65.7%). A researcher purchased lunch items from both convenience packed lunches and homemade packed lunches, then prepared items from each category to determine the amount of time each home-packed lunch required. In addition, a researcher purchased lunch items selected by students who participated in the NSLP, then prepared those items to determine the amount of time each school lunch would take to prepare if it were made at home. When possible, preparation and cooking times found on food boxes or in online-cooking instructions were utilized in lieu of researcher food preparation. The total preparation time per lunch was calculated by combining the individual preparation times for each meal item.

A monetary value for time was given to the lunches based off the average income in Montgomery or Giles County.[10] In 2012, the average incomes in Montgomery County and Giles County were $18.60/hour and $17.88/hour, respectively.[10] This amount was then broken down to a cost/minute value and then a cost/second value. The number of seconds each food item took to prepare was multiplied by the cost/second value, providing a time cost for each food item. The time costs of every food item in a lunch were added together to provide the total time cost of each lunch. The full cost of each lunch was calculated by adding together time cost and direct cost. For comparison, a Kruskal-Wallis test was used to compare the full cost of home-packed lunches, both

convenience and homemade, to the full cost of homemade school lunches, to the full cost of reimbursable NSLP lunches.

Table 1: Income by County

Average Income 2012	**Montgomery County**	**Giles County**
Income/hour	$18.60	$17.88
Income/minute	$0.31	$0.30
Income/second	$0.0052	$0.0050

Statistical Analysis

The data were analyzed and found not to be normally distributed. As a result, the data did not satisfy the requirements for an ANOVA procedure, which assumes that the dependent variable is normally distributed and there is approximately equal variance on the scores across groups. As a result, the non-parametric Kruskal-Wallis test was used. The Kruskal-Wallis test can be used for both continuous and ordinal level dependent variables. The distribution of the Kruskal-Wallis test statistic approximates a chi-square distribution, with k-1 degrees of freedom, if the number of observations in each group is 5 or more. The calculated value of the Kruskal-Wallis test was greater than the critical chi-square value, therefore rejecting the null hypothesis and concluding that the samples differ across categories.

Additionally, because of the outliers, it was determined that medians would give a better representation of the centermost value of a set of scores when extreme cases are present. Medians are insensitive to extreme scores, whereas the mean is not. The only data set that was normally distributed was direct cost; in this case, the mean rather than the median was used to evaluate the direct cost of SSBs and dessert items in home-packed lunches.

Results

A total of 1,289 student lunches were observed for five consecutive school days from three elementary schools: School 1 (n=559, 43.4%), School 2 (n=452, 35.0%), and School 3 (n=278, 21.6%). School lunches comprised the largest category of lunches (n=744, 57.7%), followed by homemade packed lunches (n=358, 27.8%), then convenience packed lunches (n=187, 14.5%).

Direct Cost

The lowest direct cost was found for homemade packed lunches at $1.55. The direct costs for homemade school lunches and convenience packed lunches were very similar at $2.11 and $2.12, respectively. The direct cost of a lunch purchased from school through the NSLP was the highest at $2.15, shown as a red dotted line in Figures 1 and 2. The lowest direct cost of a lunch prepared at home was from School 2 at $1.70. The direct cost of a lunch prepared at home from School 1 was $2.04, and the highest direct cost of a lunch prepared at home was from School 3 at $2.41.

Figure 1: Direct Cost of Lunches by Category

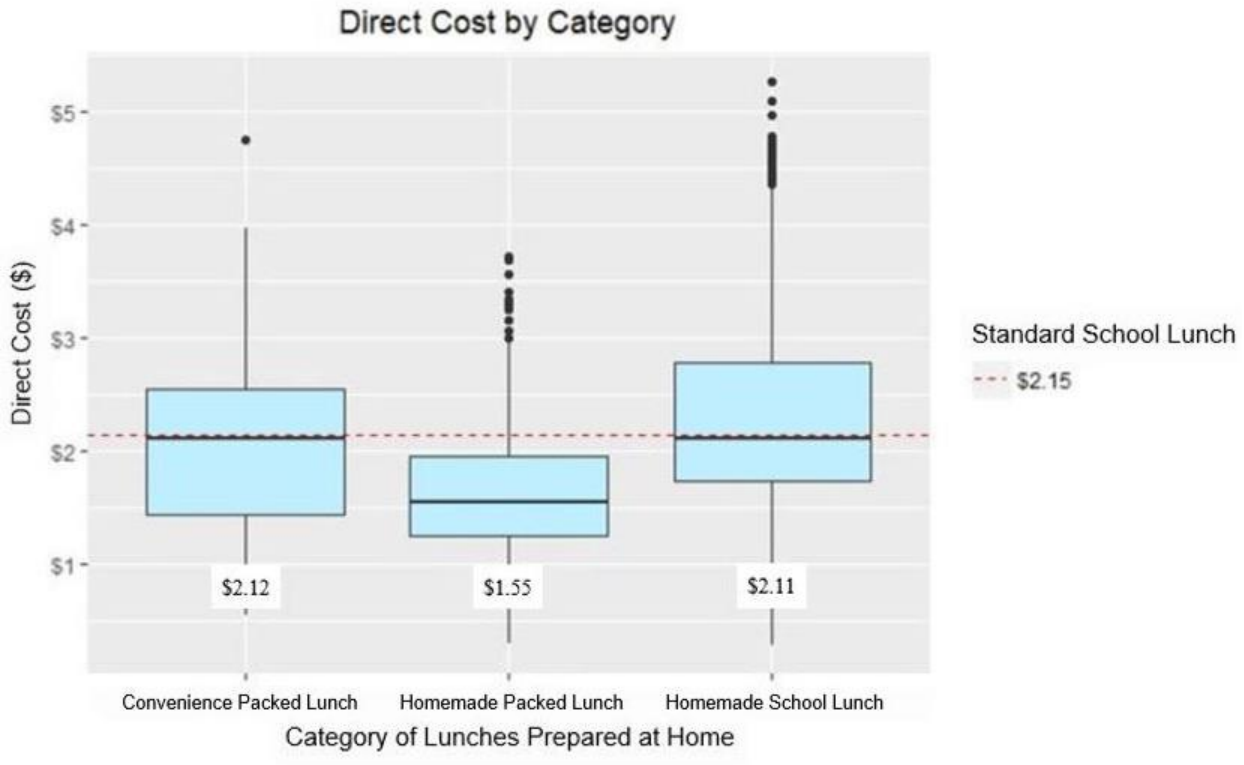
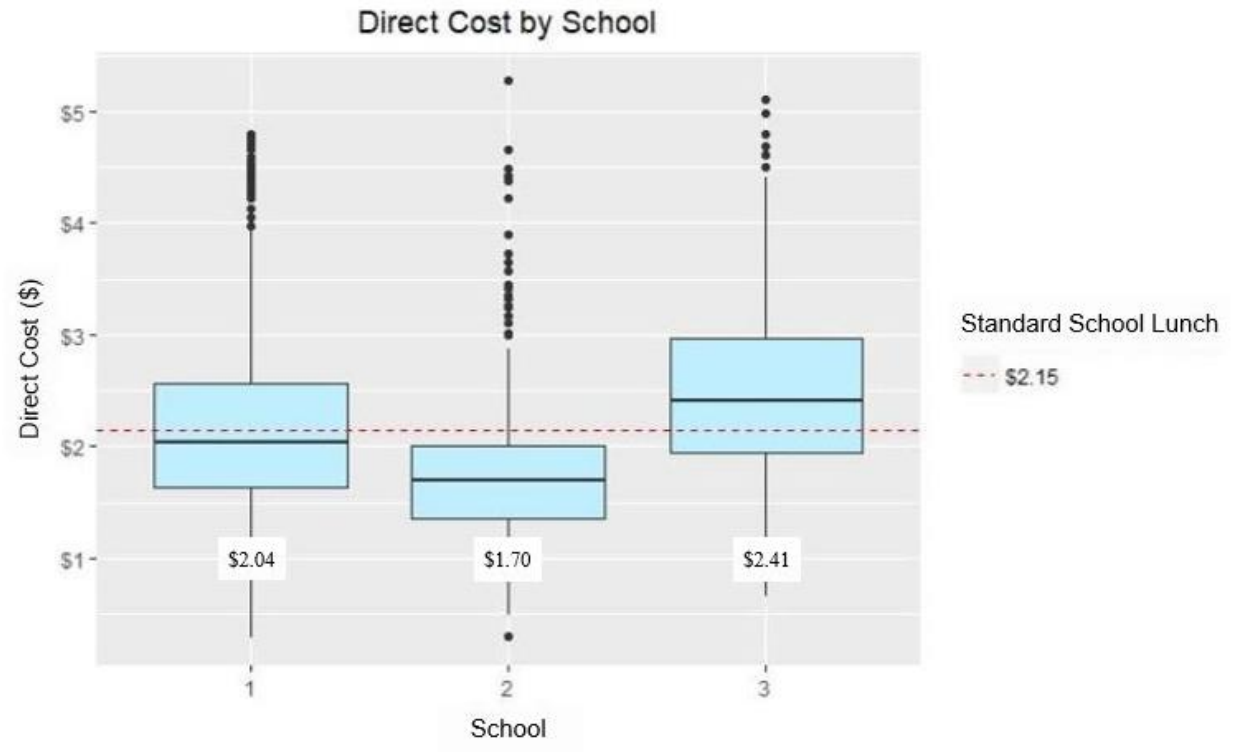


Figure 2: Direct Cost of Lunches by School



Time

The preparation time for a lunch purchased from school through the NSLP was zero seconds, shown as a red dotted line in figures 3 and 4. The preparation time of a homemade school lunch was nearly 30 times that of a convenience packed lunch, at 1,811 seconds (30.18 minutes) and 75 seconds (1.25 minutes), respectively. The preparation time of a homemade packed lunch was 240 seconds (4 minutes). The preparation time of a lunch prepared at home from School 1 and School 2 were 310 seconds (5.17 minutes) and 380 seconds (6.33 minutes), respectively, while the preparation time of a lunch prepared at home from School 3 was significantly higher at 1,783 seconds (29.7 minutes).

Figure 3: Preparation Time of Lunches by Category

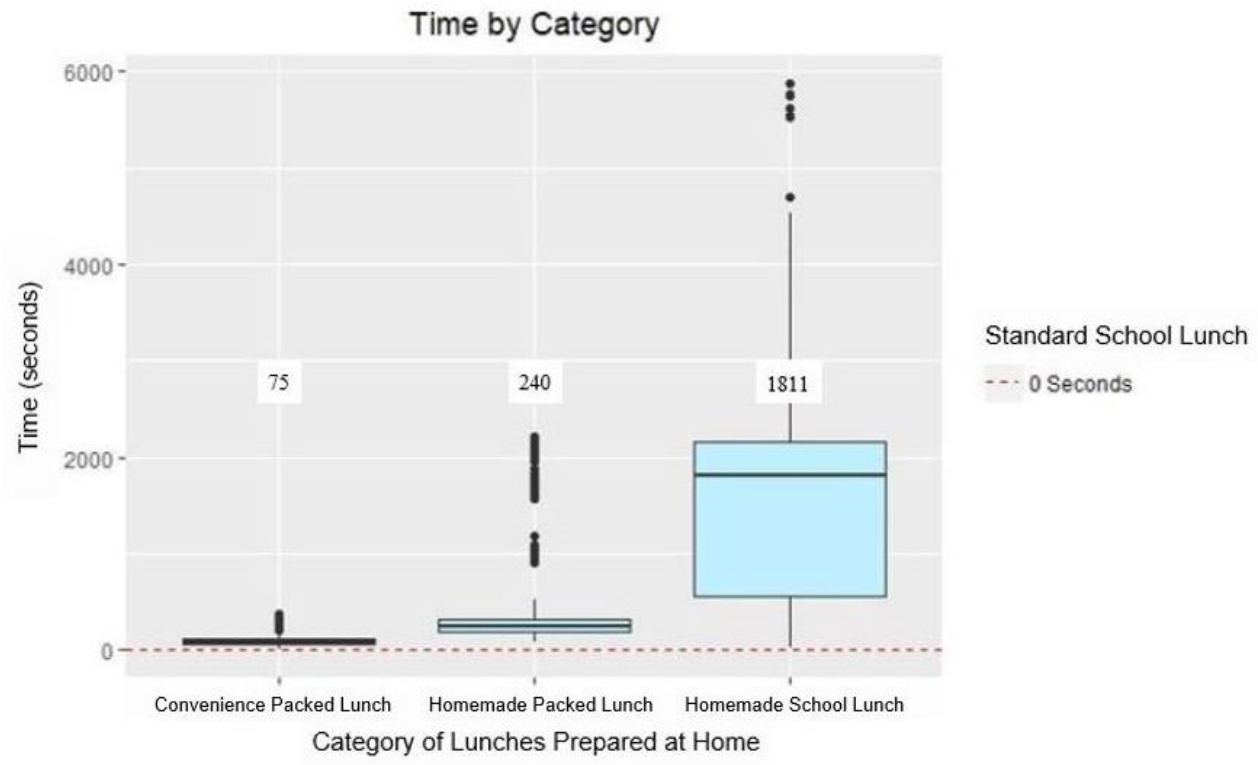
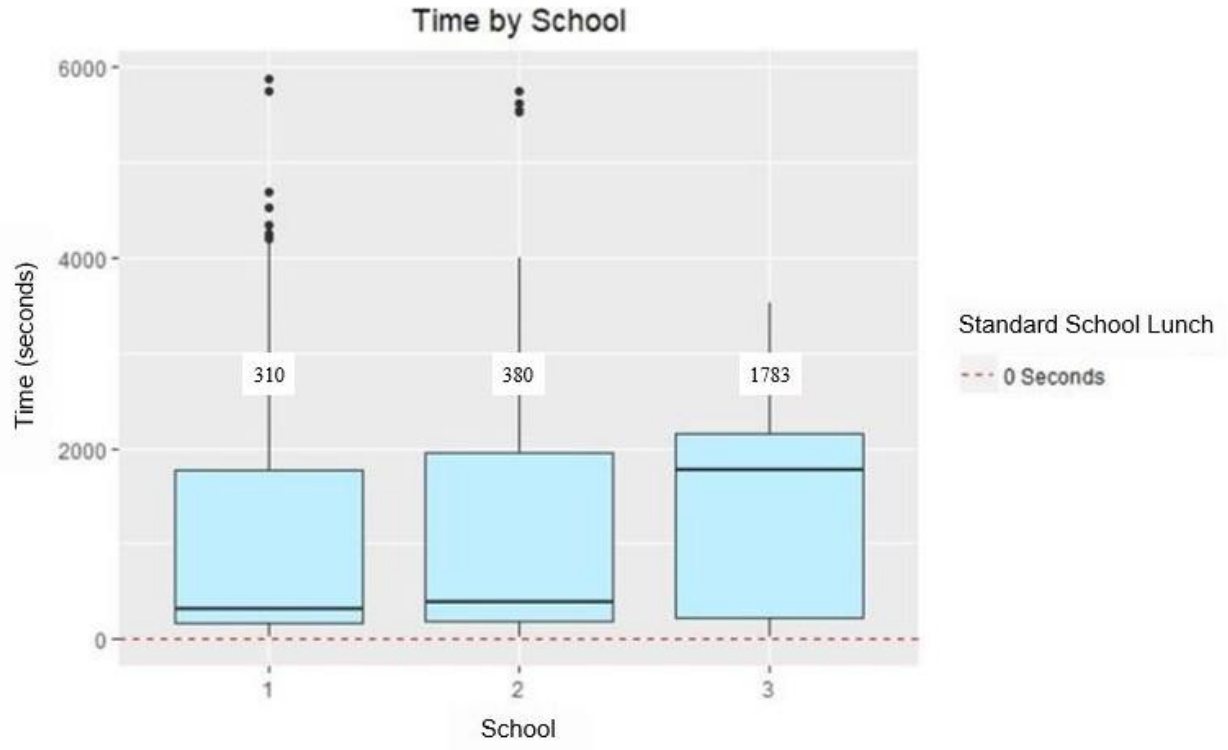


Figure 4: Preparation Time of Lunches by School



Time Cost

The time cost of a lunch purchased from school through the NSLP was the lowest at $0.00, shown as a red dotted line in figures 5 and 6. For lunches prepared at home, the time cost of a convenience packed lunch was the least expensive at $0.39, followed by a homemade packed lunch at $1.24. The time cost of a homemade school lunch was the highest at $9.13, over 23 times more expensive than a convenience packed lunch and over 7 times more expensive than a homemade packed lunch. The time cost of a lunch prepared at home from School 1 was $1.60, from School 2 was $1.97, and from School 3 was $9.21.

Figure 5: Time Cost of Lunches by Category

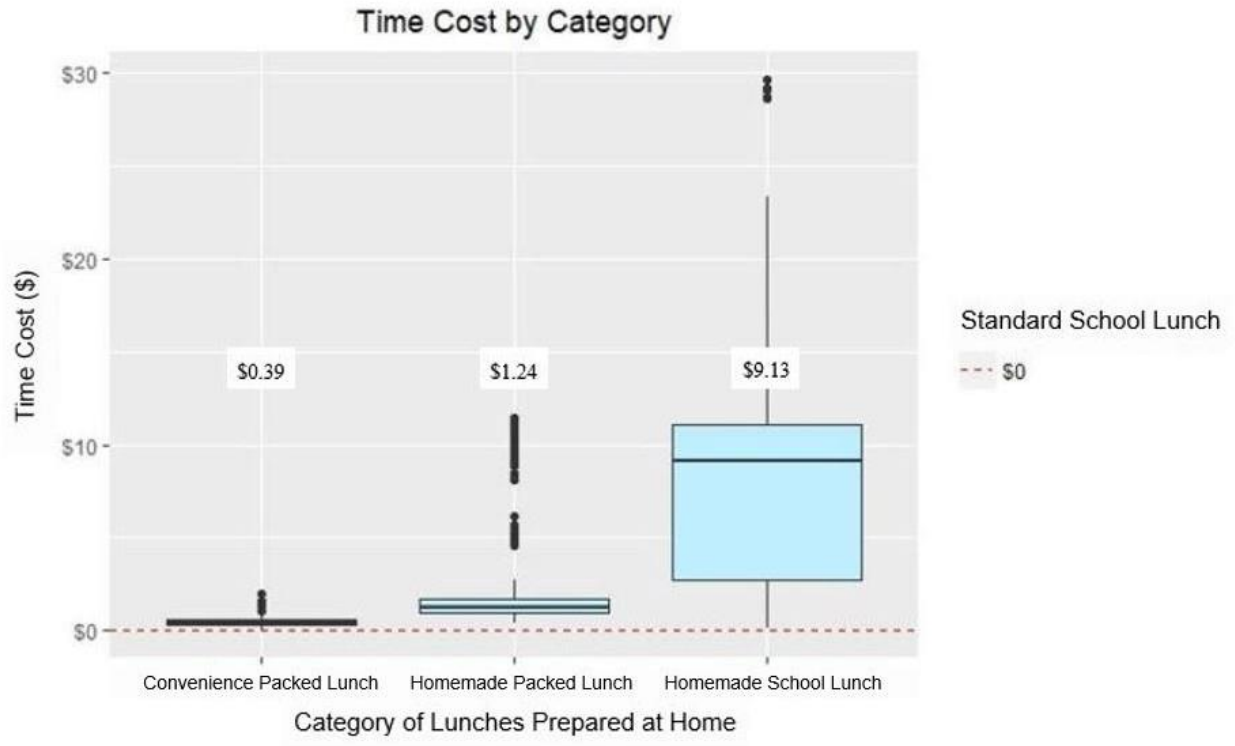
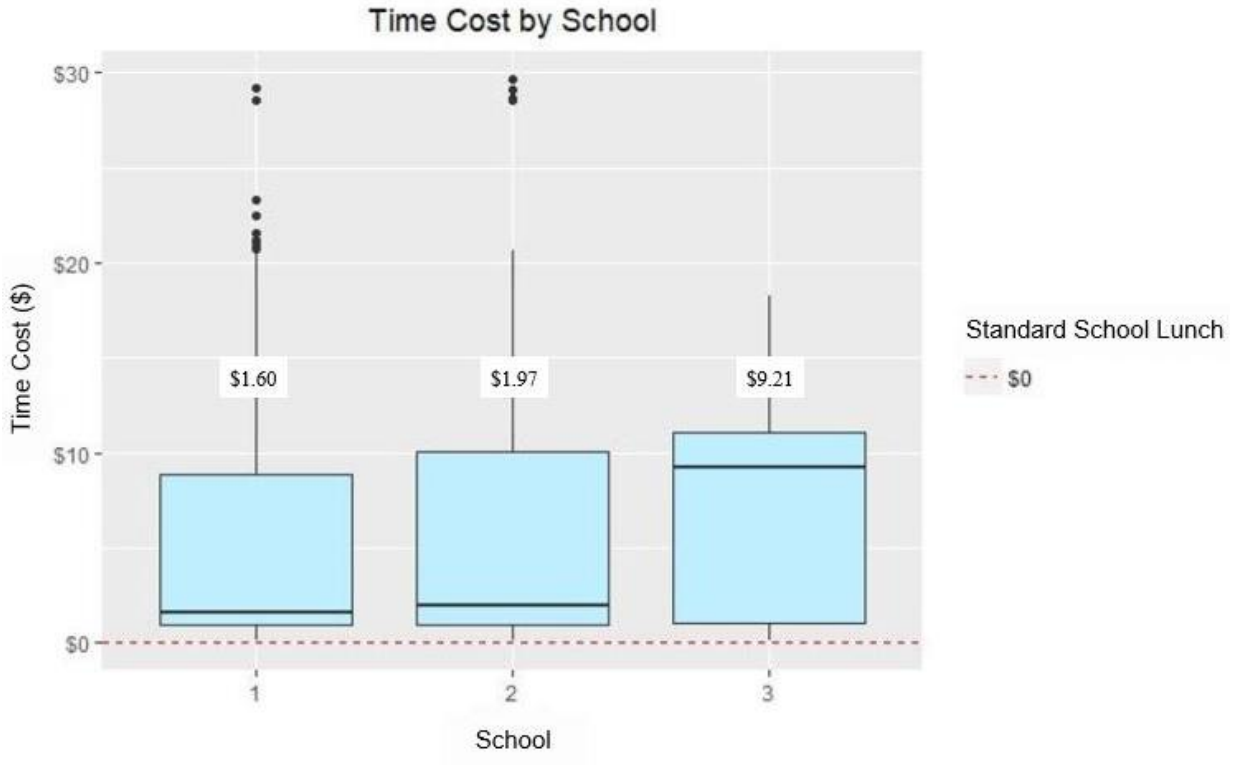


Figure 6: Time Cost of Lunches by School



Full Cost

The full cost of a lunch purchased from school through the NSLP was the lowest at $2.15, shown as a red dotted line in figures 7 and 8. For lunches prepared at home, the full cost of a convenience packed lunch was the least expensive lunch option at $2.56, followed by a homemade packed lunch at $2.92, with the highest full cost coming from homemade school lunch at $11.32. The full cost of a lunch prepared at home from School 1 was $4.58, from School 2 was $4.29, and from School 3 was $11.32.

Figure 7: Full Cost of Lunches by Category

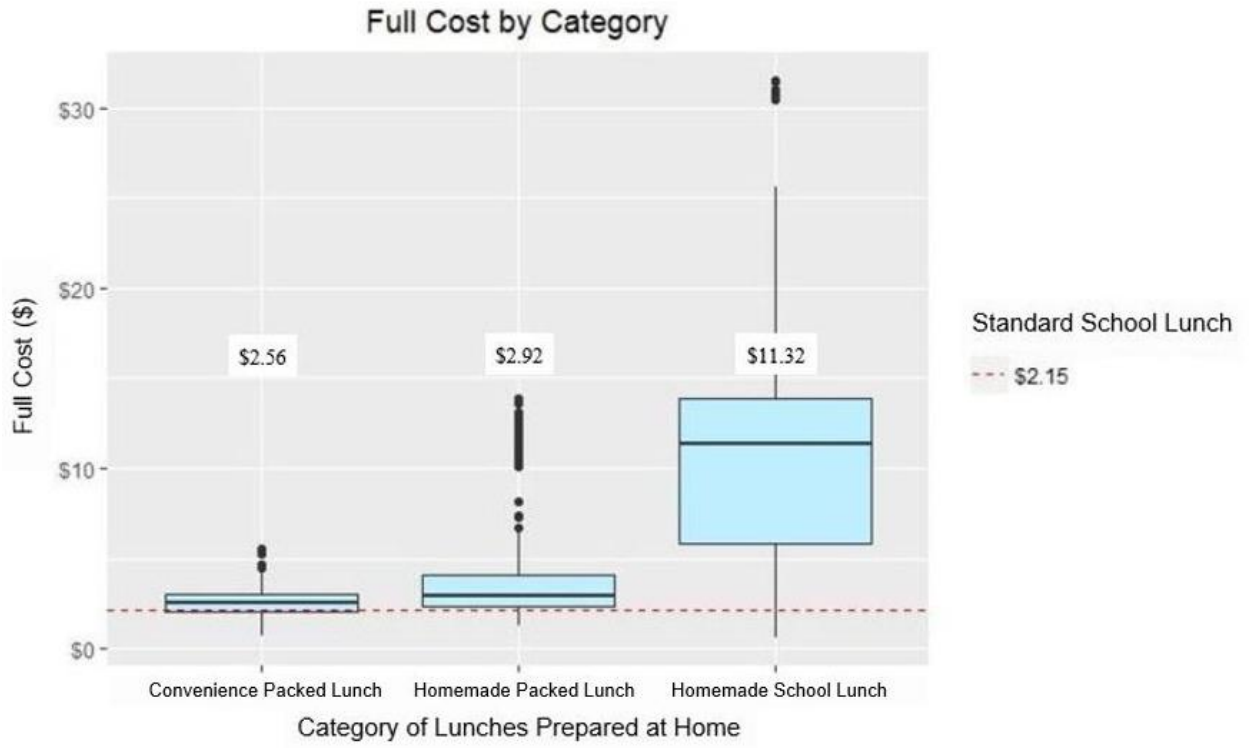
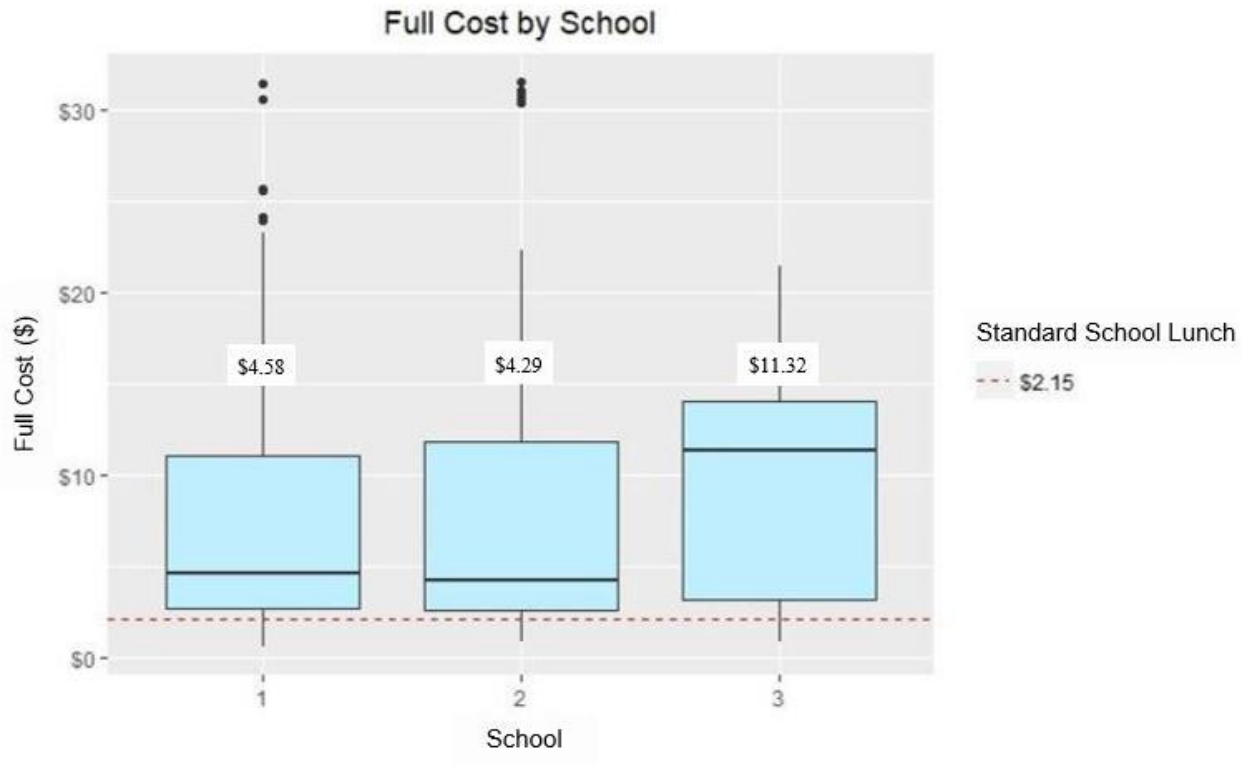


Figure 8: Full Cost of Lunches by School



Sugar-Sweetened Beverage and Dessert Cost

Approximately three-quarters, 76.0% (n=414), of home-packed lunches contained SSBs and/or dessert food items. The mean cost of SSBs and dessert items found in all home-packed lunches, convenience packed lunches, and homemade packed lunches was $0.39, $0.49, and $0.35, respectively. Compared to the mean direct cost of all home-packed lunches (mean= $1.79), the mean cost of SSBs and desserts accounted for almost one-quarter of all home-packed lunches: 21.8% of the cost of all home-packed lunches; 23.7% of convenience packed lunches (mean= $2.07); and 21.3% of homemade packed lunches (mean= $1.64). Since direct cost was normally distributed, the mean, rather than the median, was used to compared SSB and dessert cost.

Discussion

The purpose of this study was to investigate the differences in cost and preparation time among lunches consumed by pre-kindergarten and kindergarten students. Research has shown that school lunches are more nutritious than home-packed lunches.[3,4,7,20] Specifically, home-packed lunches have been shown to contain less fruits, vegetables, whole grains, and dairy and more fat, saturated fat, sodium, and sugar than school lunches. In addition, school lunches must follow federal nutrition guidelines and cannot often serve SSBs or desserts to meet those guidelines, whereas home-packed lunches do not have any guidelines to follow.[18] This research study aimed to compare and contrast cost and preparation time among different lunch options at school: NSLP lunches, convenience packed lunches, homemade packed lunches, and homemade school lunches.

When examining only direct cost—costs or expenses required to purchase the lunch or ingredients for the lunch—across the different lunch categories, homemade packed lunches were shown to have the lowest direct cost ($1.55) of any lunch, and school lunches purchased from school through the NSLP were shown to have the highest direct cost ($2.15). However, when incorporating preparation time, school lunches purchased from school through the NSLP had a much lower full cost—direct cost and time cost combined— ($2.15), since a school lunch requires no preparation time from parents or students, and homemade school lunches (school lunches prepared at home) had the highest full cost ($11.32).

Additionally, the full cost of homemade packed lunches ($2.92) was higher than both convenience packed lunches ($2.56) and school lunches purchased from school through the NSLP ($2.15) when including preparation time. Homemade packed lunches typically contained food items that required more preparation time than convenience packed lunches, such as a turkey sandwich or a PB&J, whereas convenience packed lunches contained food items that required little

preparation time, such as Lunchables™ or Uncrustables™. Homemade packed lunches took over three times longer to prepare than convenience packed lunches, 4 minutes compared to 75 seconds, respectively. Since convenience packed lunches are "convenient" and have an implicit time saving factor, it makes sense that this category would have the lowest time cost of a lunch prepared at home.

Homemade school lunches were overall more expensive than other lunch choices and were over five times more expensive than school lunches purchased from school through the NSLP because of the ~30 minutes of preparation time required to prepare traditional school lunch items such as chicken fajitas, bean burritos, Asian chicken, or pork and gravy. Americans in general are consuming fewer home-cooked meals, and children in particular are consuming half of all energy from fast food in the home.[29] The NSLP is providing home-cooked, nutritionally balanced meals daily, but eliminating the cost for parents associated with time, maximizing both time and health.

However, parent attitudes toward school meals and home-packed lunches are also important to consider. A recent a questionnaire assessing parent perceptions of NSLP lunches and home-packed lunches showed the most frequent motivational factors for NSLP participation were convenience and saving time.[3] Factors influencing packing lunches were variety, nutritional quality, taste/food preferences, and providing organic or sustainable foods.[3] Additionally, home-packed lunches could be selected because of social norms; school lunches may have a negative stigma in some areas or at some schools for a variety of reasons, affecting lunch choices. Finally, some parents value packing lunches for their children and view making lunches as part of being a good parent, which could be an aspect of choosing to pack lunches.

The high time, time cost, and full cost associated with lunches from school 3 should also be addressed. School 3 had the highest free and reduced-price school lunch participation rates of

the three schools, (52.7% compared to 46.6% and 33.3%).[31] Therefore, because of the free and reduced-price lunch eligibility, most students from School 3 purchased a school lunch (67.3%) rather than packing a lunch. As seen in the results, homemade school lunches took much longer to prepare than traditional home-packed lunches, skewing upward time, time cost, and full cost for School 3. For future research, it would be important to consider why students choose some school lunch meals over other school lunch meals. Although preference obviously plays a role in food choice, students may select meals from school that they do not typically eat at home. It is possible that at schools with higher free and reduced-price eligibility rates, parents do not have as much time to regularly prepare "elaborate" meals at home, and therefore children at these schools select more time-intensive lunch options such as Asian chicken, pork and gravy, tacos, etc.

This research study highlights three of the four determinants of food choices: cost, time, and dietary quality. The only factor not addressed is preference, an important characteristic. Based on the results of this research study, as well as studies on nutritional value, the NSLP should be recognized as more cost, time, and nutritiously-effective than home-packed lunches. If parents and/or children implicitly know this, then the decision is ultimately attributed to preference. In other words, having control over what food and beverage options are provided to children outweighs any cost, time, and/or nutrition attributes.

For example, 76.0% of students brought SSBs and/or desserts in their home-packed lunches. SSBs and desserts are not typically allowed within NSLP meals, which could be why children desire to pack their own lunch. Further, the direct cost of SSBs and/or dessert food items in home-packed lunches accounted for 21.8% of the cost of each home-packed lunch. The preference to allow these items within packed lunches may be more important to the parent and the child than the other factors, especially since, according to the National Health and Nutrition

Examination Survey, the two top sources of energy among children and adolescents are SSBs (173 kcal/day) and grain desserts (138 kcal/day).[27] Almost 40% of total energy consumed (798 of 2,027 kcal/day) by 2 to 18-year-olds are from empty calories, with 433 kcal from solid fat and 365 kcal from added sugars. [27] Consumption of these empty calories exceeds the recommended calorie allowance.[27] If families' goals were to save money, time, and improve the overall nutritional profile of the lunch, they could eliminate these items from home-packed lunches or purchase school lunches through the NSLP. Decisions to offer home-packed meals may be due to lack of knowledge, warranting awareness campaigns for families that address cost, time, dietary quality, and options available through the NSLP.

Limitations

Several assumptions were made when collecting food item prices at grocery stores. Although researchers visited three local chain grocery stores, including one big box store, and averaged the price of food items from the stores, parents may shop at different grocery stores. Additionally, some food items were not in season or not sold at the visited grocery stores. If the brand was not specified, researchers selected and priced store brand items sold in bulk for low priced food items. Finally, a condensed food list was created from common home-packed lunch items since there were thousands of different food items recorded in the initial dataset.

Other limitations include the time-period difference between the observational lunch data collection and food price data collection. Price deflation utilizing the Consumer Price Index from the Bureau of Labor Statistics was used to account for any price differences.[37] Additionally, home-packed lunch preparation time can vary depending on food preparation skills. Finally, time cost may not be accurate for all individuals. A monetary value for time was given to lunches based off

the average income in Montgomery or Giles County in 2012, although individuals may value their time more or less than what was pre-assigned for the study.[10]

Implications

Results from this research study can be used to inform social marketing and awareness campaigns, as well as interventions, to better inform parents and even children about the real "cost" of the different meals. This study could help parents make more informed choices to save money, save time, and improve the nutritional quality of their child's lunch. Additionally, this study may help school nutrition personnel encourage more participation in the NSLP, which has been declining nationally. Overall, school lunches should be viewed as the most nutritious and economical lunch choice once time cost is considered.

Chapter 4: Discussion and Conclusions

School lunches are a convenient, time-saving lunch option for parents of school-age children. Cost and time are often noted as the most important factors when making food choices.[1,3] Due to a decreasing amount of free time, technological innovations such as the microwave, changing household structures, changing values and norms, and decreasing food preparation knowledge and skills, the demand for convenience food products is on the rise.[38] In addition to saving time, important aspects of convenience food options are the minimal physical and mental efforts associated with planning, preparing , and cleaning up meals.[38]

Research shows that convenience food choices are selected more often when individuals do not enjoy cooking, in large households, in younger individuals, and in males.[38] Additionally, individuals who work over 30 hours per week are more likely to select convenience items than those who work less than 9 hours per week.[38] Convenience foods, which have an implicit time saving factor, also tend to be more expensive than unprepared foods, and consumers of these products are willing to pay extra for the convenience factor.[38] Based on the school lunch research study, purchasing a convenient meal with a higher direct cost, such as a school lunch or a convenience packed lunch, would likely have a lower full cost than a homemade, unprepared meal, when considering the time cost of preparing that meal.

Over the past several decades, dietary patterns have shifted remarkably.[39] This includes changes in the foods individuals eat, where individuals eat, the number times individuals eat per day, and who individuals are eating with.[39] Behind these changes lie massive shifts in food shopping and restaurant choices as well as food production, processing, and distribution systems.[39] Research suggests that people are consuming more calories from energy dense, nutrient poor foods at a greater rate of occurrence throughout the day.[39] In addition, more meals are consumed away

from the home at restaurants or fast food chains, which tend to serve larger portion sizes with higher energy densities.[39] This type of eating behavior leads to overweight and obesity as well as diet-related non-communicable diseases.[39]

The U.S. is the largest market for convenience foods, and is projected to continuing growing due to the decline of at-home cooking trends.[40] Convenience food products continue to evolve to meet the needs of our "on-demand" world.[41] Meal kits, including fully or partially prepared food items, that can be sent to individuals homes have gained popularity in the recent years.[41] In addition, online grocery shopping is a growing food trend determined to meet the expectations of our convenience food culture.[41]

Overall, the need for convenient and healthy food options is growing in the U.S. and worldwide. While most people value their time, few people establish a price or cost for their time. Future research studies could investigate the dietary quality and full cost of school and home-packed lunches in middle and high school, where students have more freedom and input in their lunch choices. Additionally, the opportunity for a longitudinal study following students who mainly purchase school lunches versus students who mainly bring home-packed lunches could provide insight into the nutritional status of students throughout their time in elementary, middle, and high school. This could help determine if specific lunch choices increase the risk of overweight and obesity, type 2 diabetes, and diet-related non-communicable diseases. Another research study could investigate variations in the dietary quality and full cost of similar meals from different outlets, including: meals prepared at home, convenience meals sold at the grocery store, meal kit meals delivered to the home, and meals from fast food or fast casual restaurants.

Due to the increasing demands of the modern world, including school, studying, work, parenting, exercising, socializing, etc., individuals have less time to devote to preparing and

cooking meals. This is especially true for parents of school-age children, who must decide where to dedicate their limited free time. Increasing the number of food choices that are convenient and healthy, such as National School Lunch Program lunches, can help individuals save time, money, and feel confident in their food choices.

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Appendices

Appendix A: Additional Boxplots

Appendix B: Confidence Interval Graphs

Appendix C: Sample Lunch Observational Checklist

Appendix D: Home-Packed Lunch Item Grocery Store Checklist

Appendix E: School Lunch Item Grocery Store Checklist

Appendix A: Additional Boxplots

Figure 9: Direct Cost vs Lunch Category by School

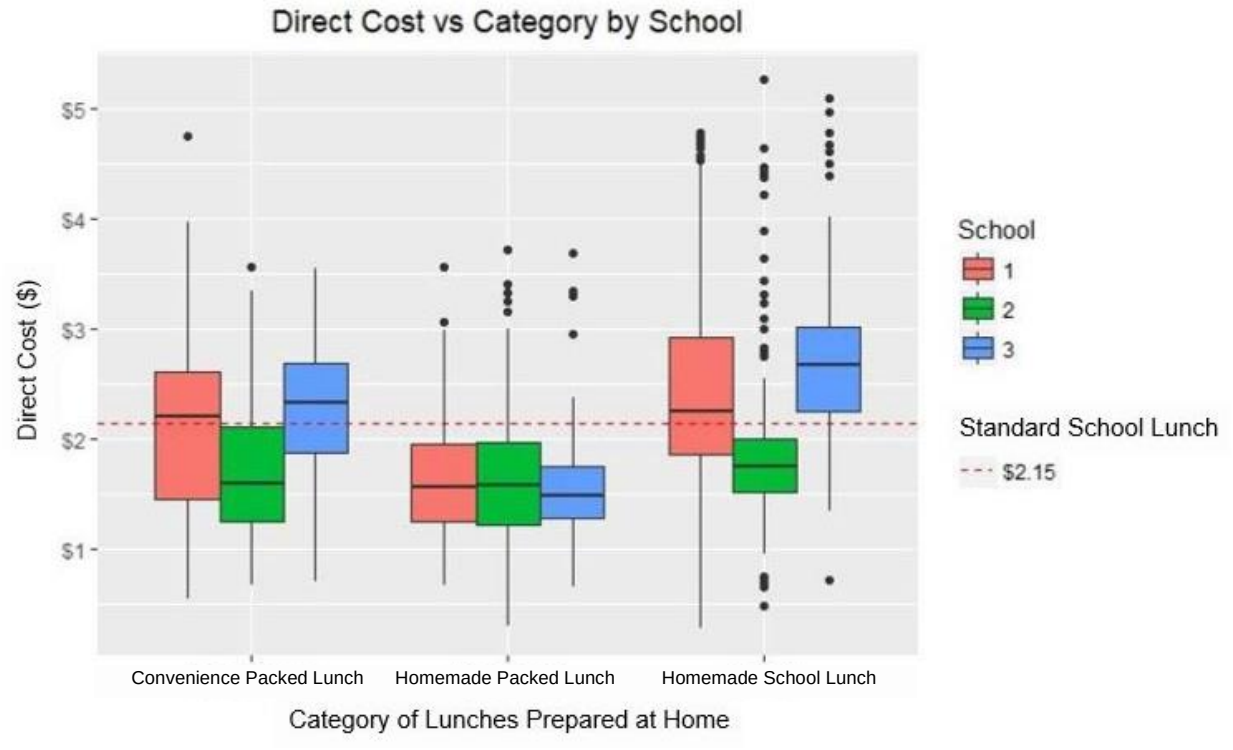


Figure 10: Preparation Time vs Lunch Category by School

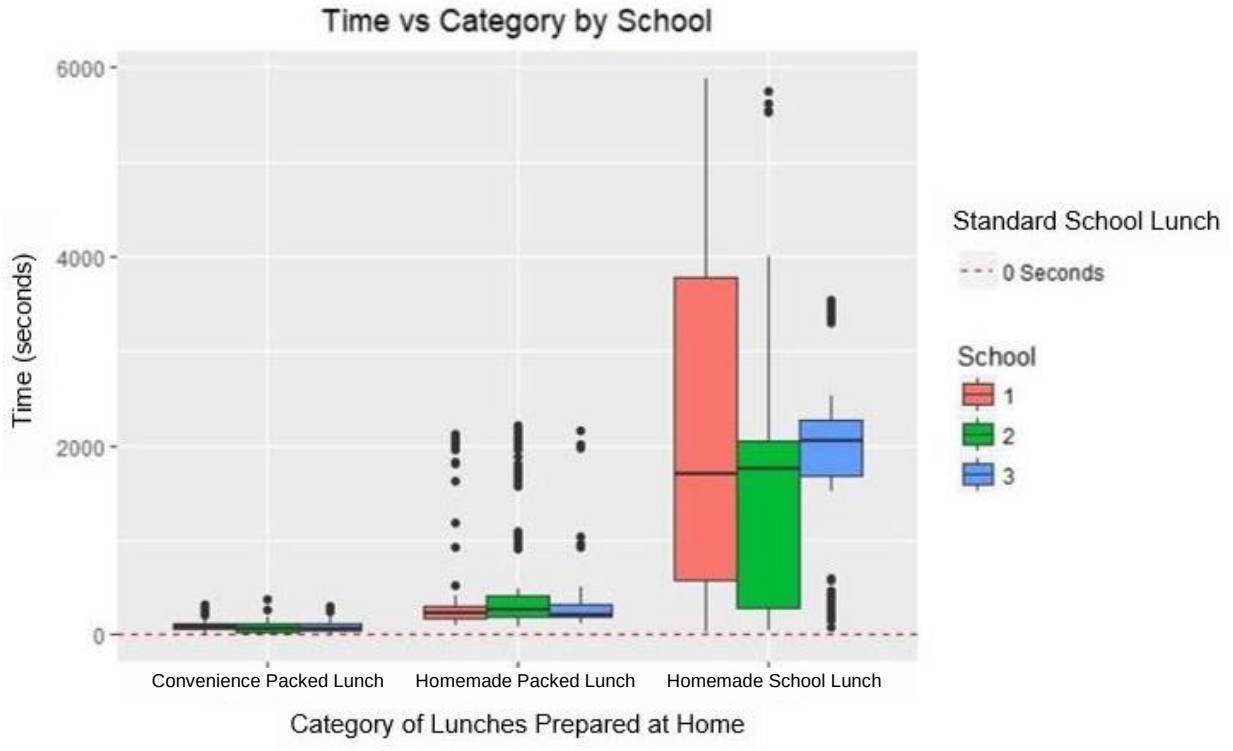


Figure 11: Time Cost vs Lunch Category by School

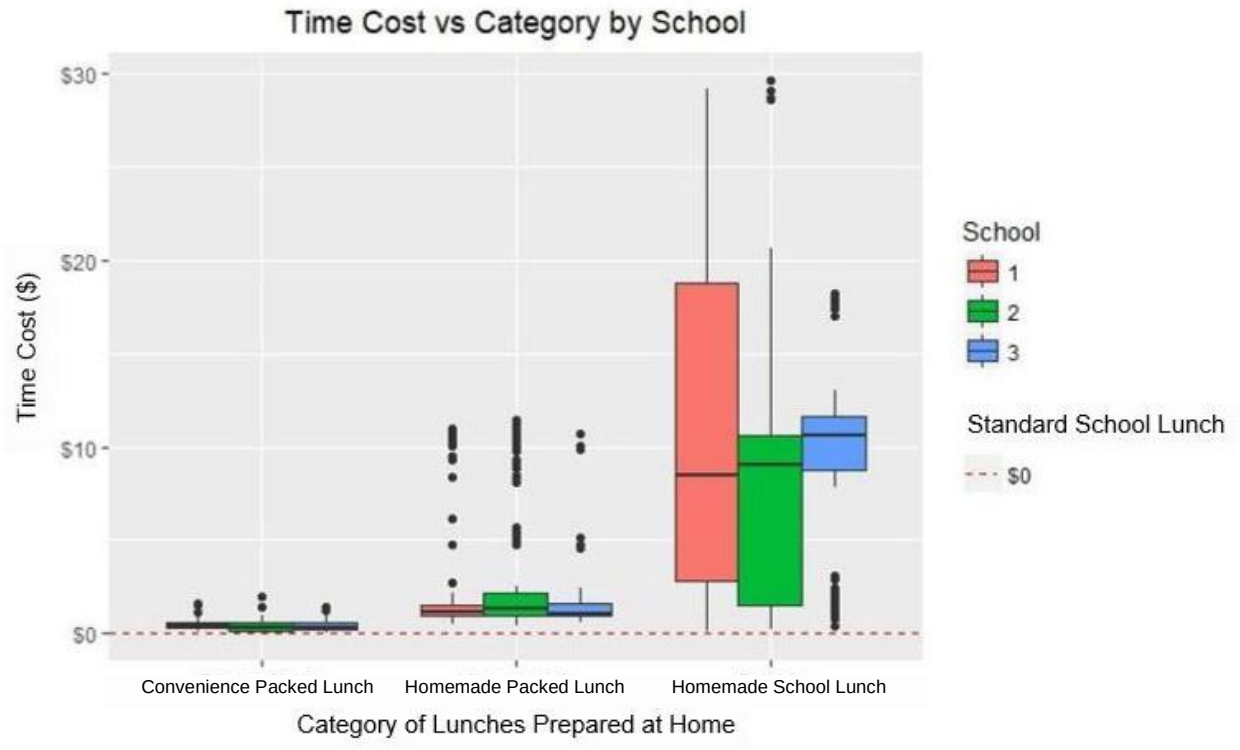
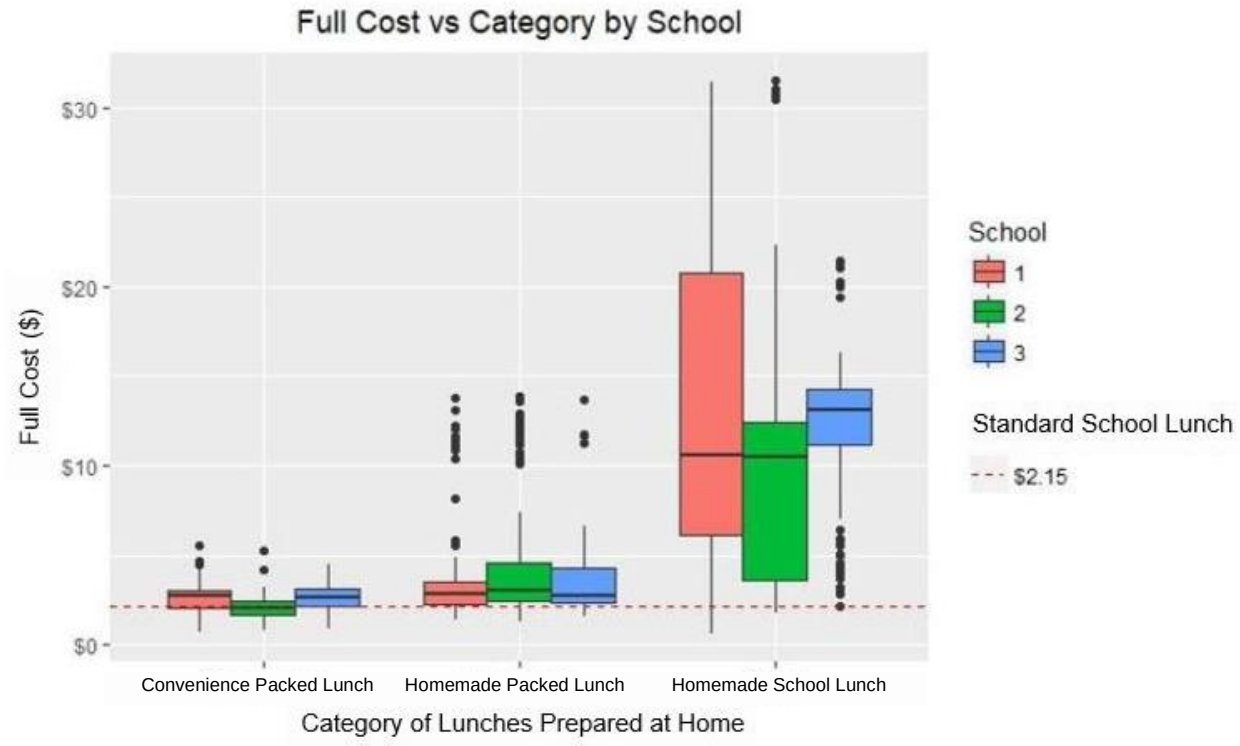


Figure 12: Full Cost vs Lunch Category by School



Appendix B: Confidence Interval Graphs

The following graphs show the confidence intervals for direct cost, time, time cost, and full cost by lunch category and school. The confidence intervals are for the average rank of cost, time, time cost, and full cost. Rank is found by ordering cost, time, time cost, and full cost, respectively, from lowest to highest. In every graph, the lower bounds of each interval do not overlap with the upper bounds of the others. Overall, the confidence intervals show that the median cost, time, time cost, and full cost of lunches are significantly different for all lunch categories and schools. For the confidence intervals, a test of the mean of the ranks is a test of the difference of the medians.

Figure 13: Confidence Interval for Direct Cost of Lunches by Category

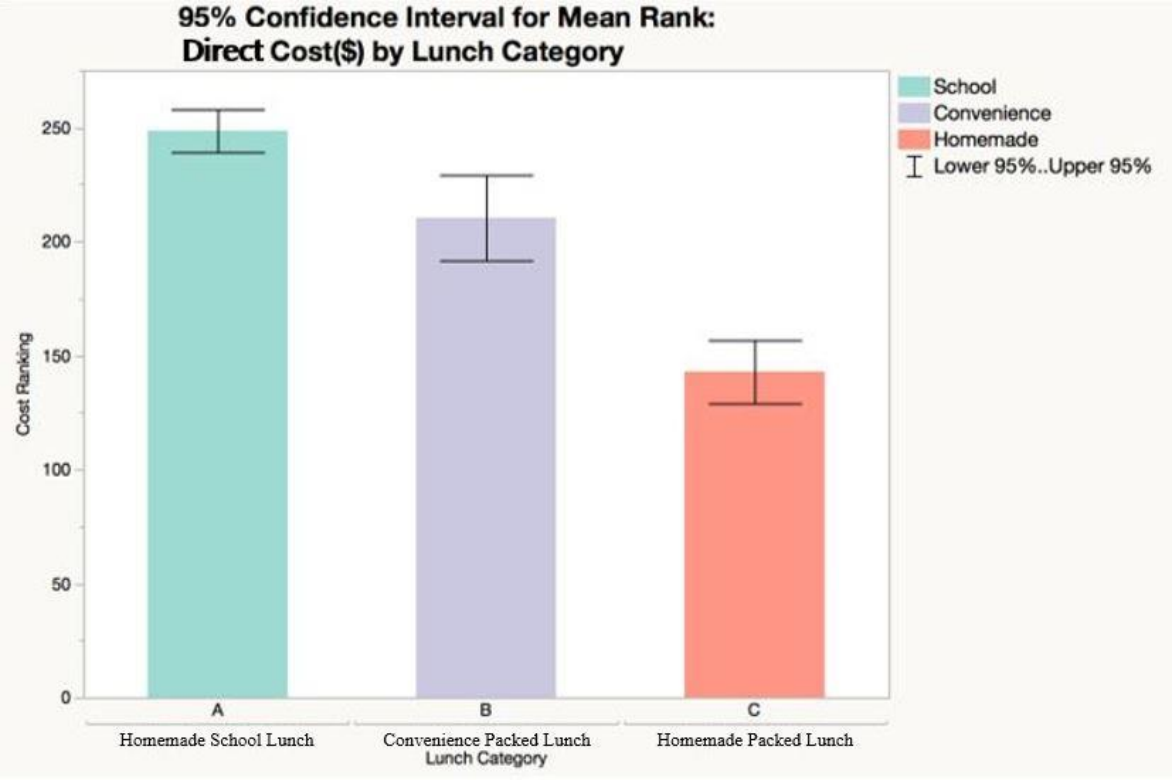


Figure 14: Confidence Interval for Direct Cost of Lunches by School

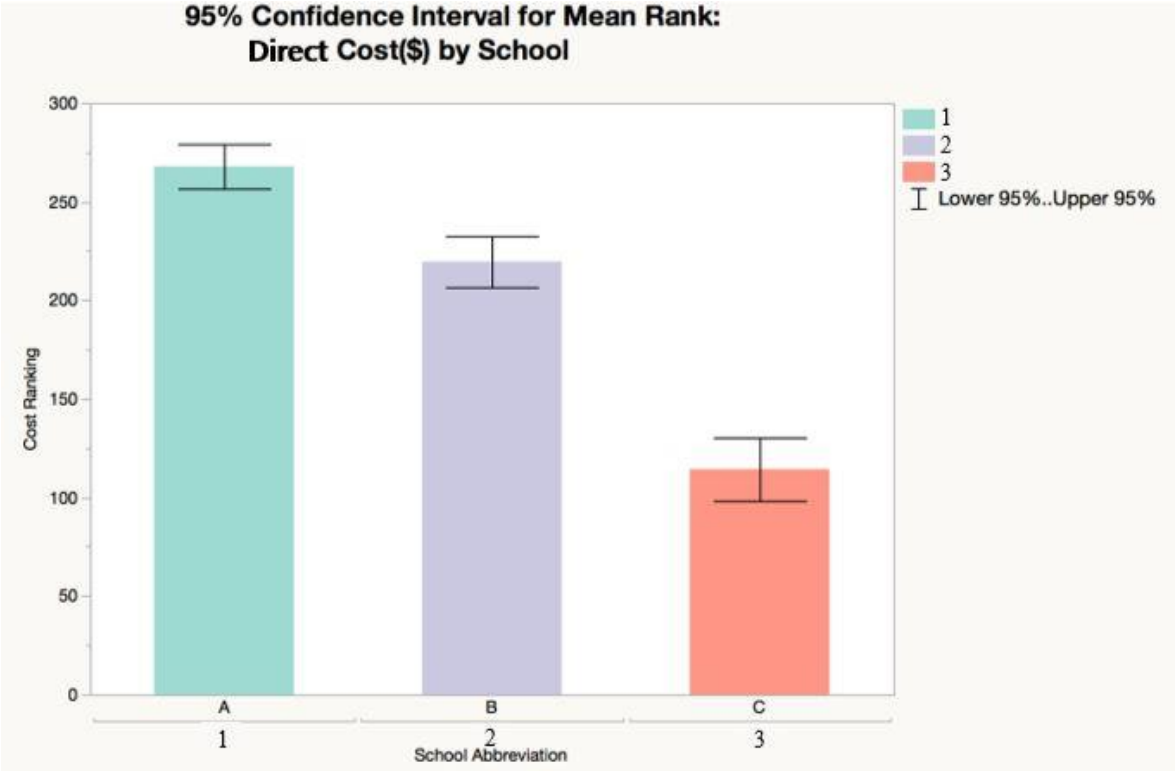


Figure 15: Confidence Interval for Preparation Time of Lunches by Category

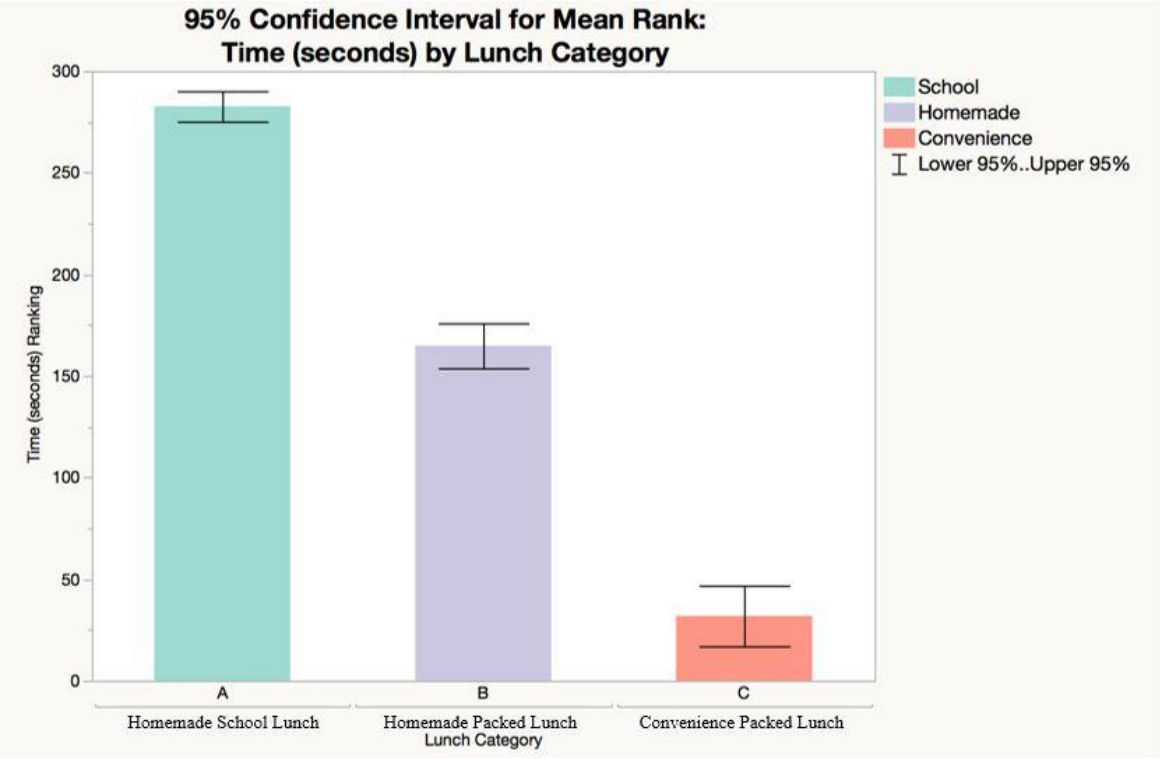


Figure 16: Confidence Interval for Preparation Time of Lunches by School

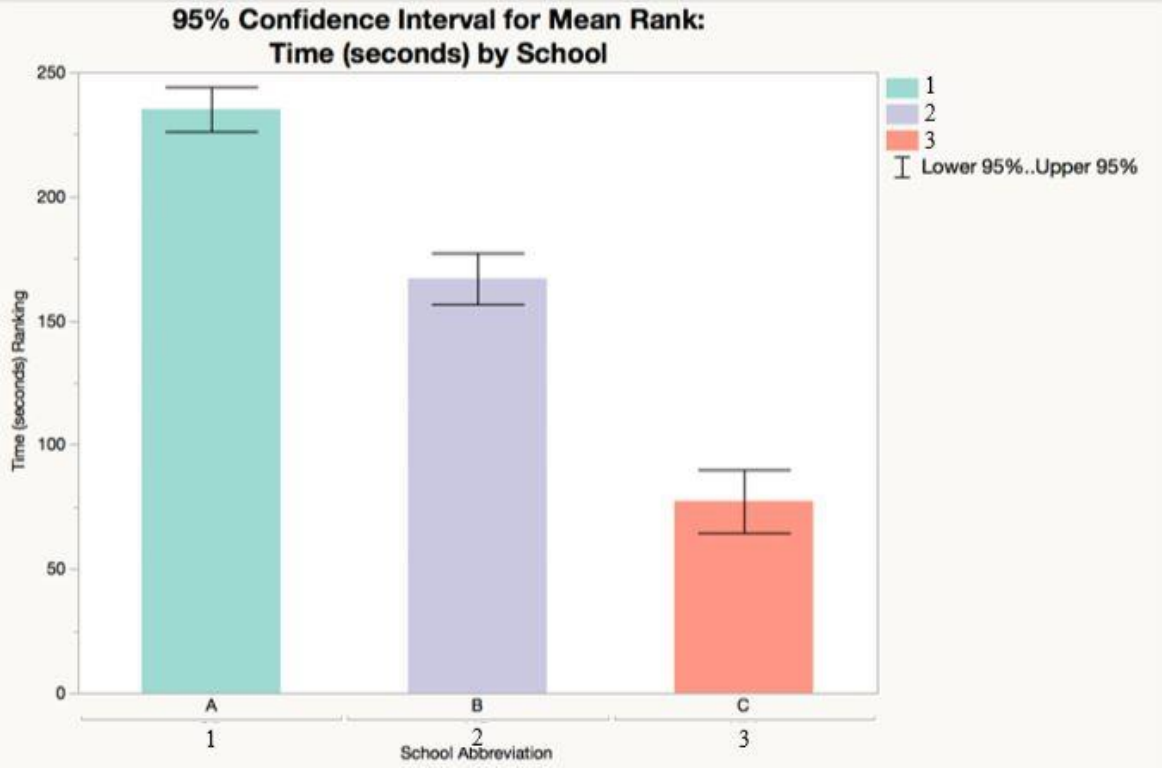


Figure 17: Confidence Interval for Time Cost of Lunches by Category

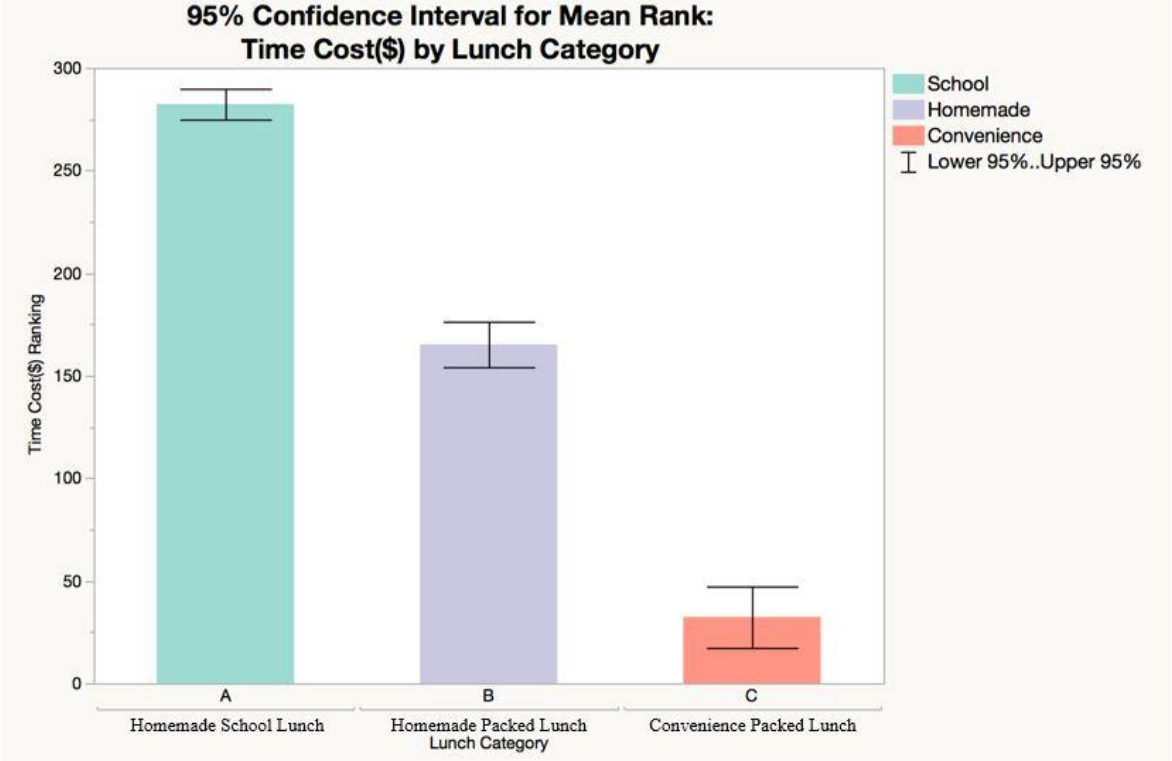


Figure 18: Confidence Interval for Time Cost of Lunches by School

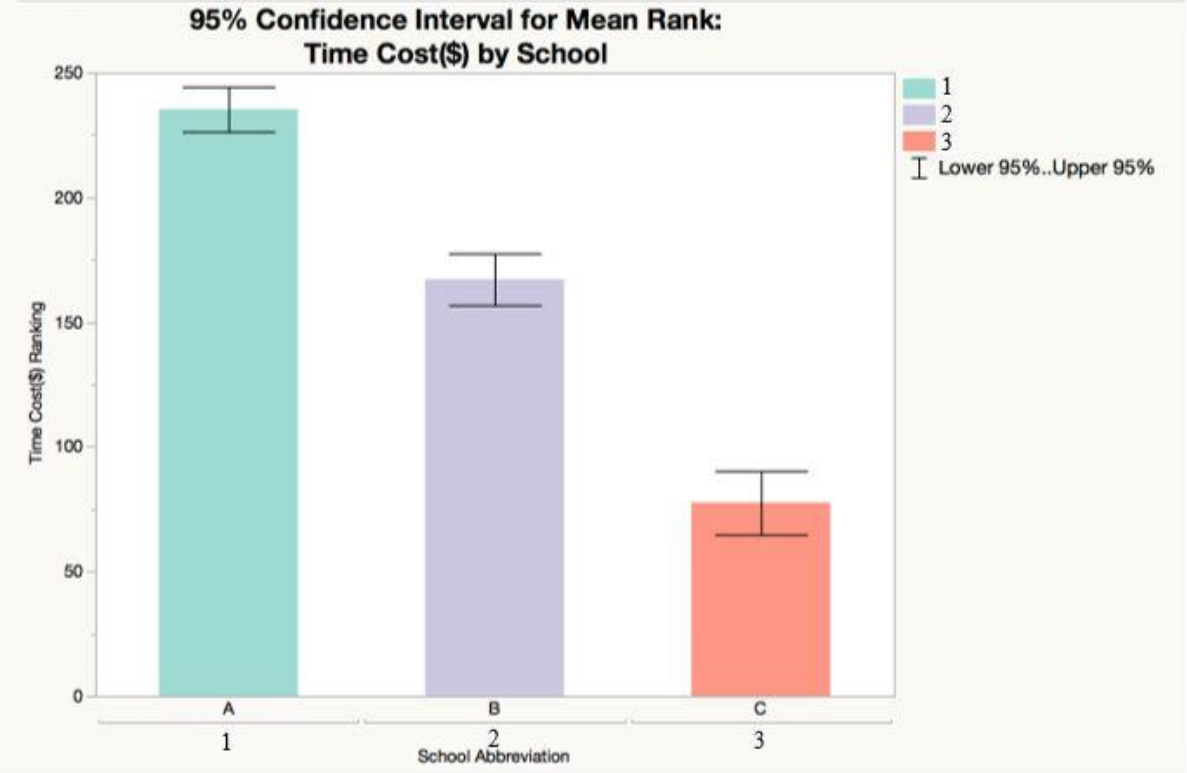


Figure 19: Confidence Interval for Full Cost of Lunches by Category

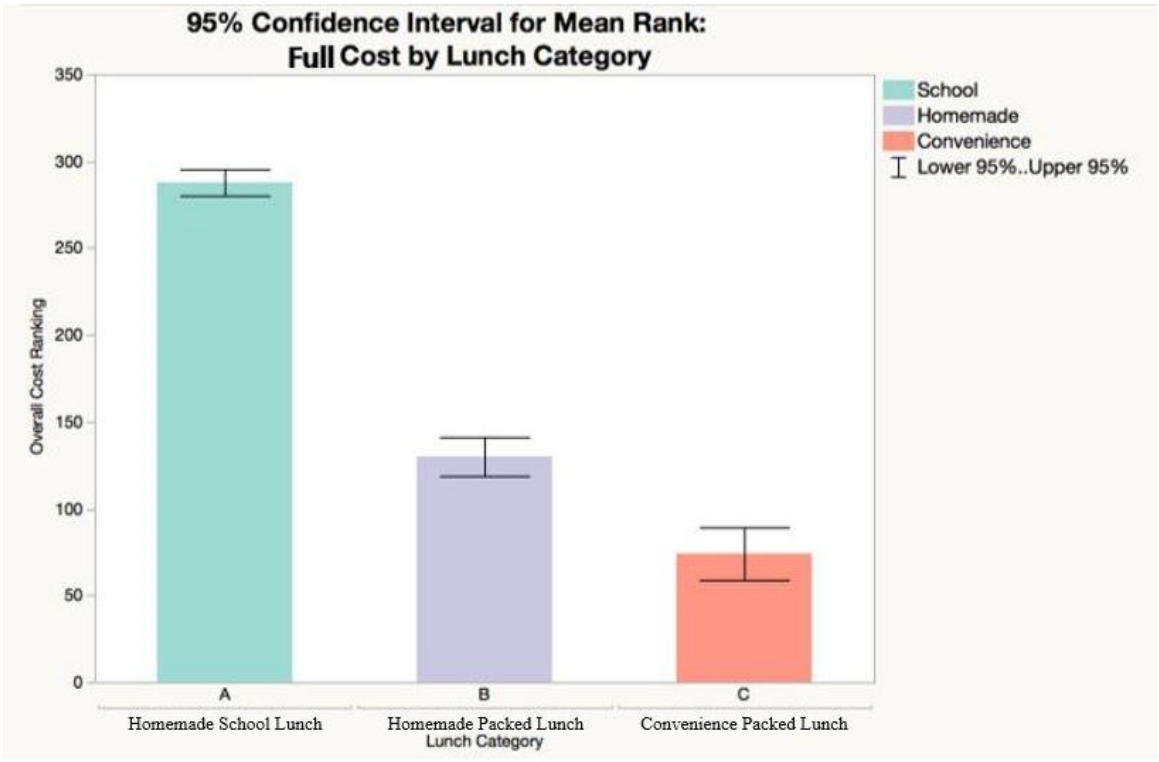
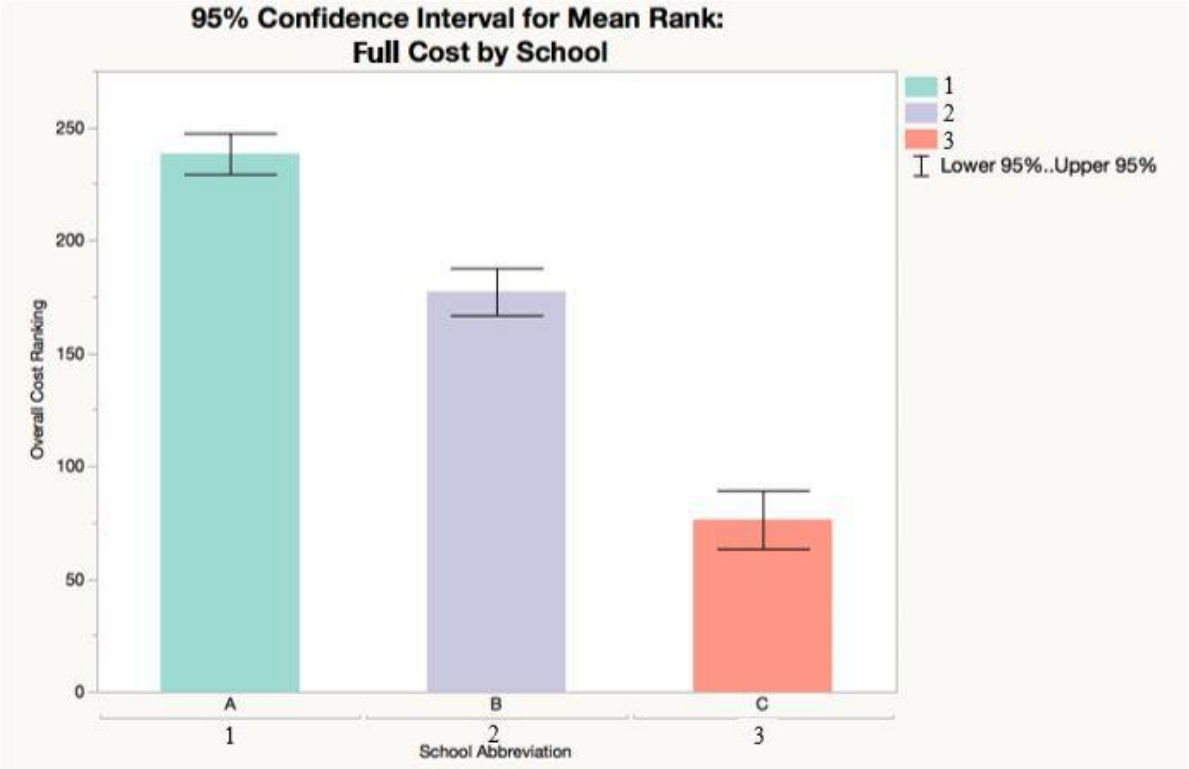


Figure 20: Confidence Interval for Full Cost of Lunches by School



Appendix C: Sample Lunch Observational Checklist

Circle: Male Female Identifier: _____

Date: ___3/4/12____
Recorder:_____

Number in Class: _____
School Lunches: _____
Packed Lunches: _____

Grade: _____
Male: _____ Female: _____
Male: _____ Female: _____

Instructions: Please view each child on your tables' lunch and mark with an **X** the foods that child has. If 2 boxes, mark quantity, if 3 boxes - for fruits and vegetables only, use coding guidelines to determine consumption.

Packed Lunch

Sandwich	X
PB & J on WHITE	
PB & J on WHEAT	
Grilled Cheese on WHITE	
Grilled Cheese on WHEAT	
Turkey on WHITE	
Turkey on WHEAT	
Ham on WHITE	
Ham on WHEAT	
Bologna on WHITE	
Bologna on WHEAT	
Tuna on WHITE	
Tuna on WHEAT	
Toppings	
Lettuce	
Tomato	
Cucumbers	
Cheese (not Gr Cheese)	
Mayo	
Mustard	
LunchAbles/Food Kits	
Crackers/HAM/Cheese	
Crackers/Turkey/Cheese	
Pizza Kit	
Nachos Kit	
Chicken Nuggets Kit	
BumbleBEE Tuna Kit	
Leftovers	
Pizza – Cheese	
Pizza – Pepperoni	
Pasta (red sauce/noodles)	
Mac & Cheese	

Fruit	X	Amt	Code
Grapes			
Apple – Whole			
Apple – Slices			
Applesauce Cup			
Orange – Whole			
Orange – Slices			
Orange – Mandarin Cup			
Banana – Whole			
Banana – Half			
Strawberries			
Raisins			
Mixed Fruit Cup			
Vegetable			
Carrots			
Celery			
Cucumbers			
Cherry Tomatoes			
Ranch Dip for Veggies			

Sides	X	
Yogurt Tube		
Yogurt Cup		
Yogurt – Activa		
Chips – Baked (pkg)		
Chips – Harvest Grain (pkg)		
Chips – Dorito (pkg)		
Chips – BBQ (pkg)		
Chips – Cheetos (pkg)		
Chips – Regular (pkg)		
Pretzels (pkg)		
Goldfish (pkg)		
Cheez-its (pkg)		
Cheese Stick		
Nutri-Grain Bar		
Crackers & Cheese		
Crackers & Cheese Dip (pkg)		
Popcorn (pkg)		
Mixed Nuts		
Trail Mix (mnm's, etc)		
Almonds		
Peanuts		
Beverages		
Milk Box – Horizon 1% Plain		
Milk Box– Horizon 1% Vanilla		
Milk Box– Horizon Chocolate		
Milk – Cup from Home (White)		
Milk – Cup from Home (Choc)		
Capri Sun		
FruitAbles		
MinuteMaid		
Hi-C		
Juicy Juice		
Kool-Aid Jammer		
Fruit Punch from Home		
Sprite		
Coke		
Danimals (any flavor)		
Water		

Dessert	X	
Jello Pudding – Chocolate		
Jello Pudding – Vanilla		
Jello Pudding – Butterscotch		
Jello Cup		
Jello w/ Fruit Cup		
Rice Krispies (pkg)		
Gummy Bears		
Mini Candy Bar		
Fruit Snacks (pkg)		
Cookies – Oreo		
Cookies – Choc Chip		

Other items and quantity:

School Lunch

Main Tray	X
Taco	
Veggie Wrap	
Chef Salad	
PB & J	

	X	Code
Refried Beans		
Corn		
Raw Broccoli		
Ranch Dip		
Fruit _____		
Fruit _____		

Beverages	X
Milk – White FF (TruMoo)	
Milk – White (1%) (PET)	
Milk – Choc FF (TruMoo)	
Milk – Straw FF (TruMoo)	
Juice – Apple (SunCup)	
Juice – Orange (PET)	

Other items and quantity:

_____

Appendix D: Home-Packed Lunch Item Grocery Store Checklist

Fruits & Vegetables

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serving Size	Servings per Container	Comments
apple						
applesauce cup						
applesauce drink pouch						
banana						
blackberries						
blueberries						
canned fruit						
cantaloupe						
celery						
cherry tomatoes						
clementines						
craisins						
cucumber						
cutie						
fruit bar						
fruit leather						
grapes						
green beans						
kiwi						
lettuce						
mandarin orange						
mandarin orange cup						
melon						
mini raisins						
mixed fruit cup						
olives						
onion						
orange						
peach cup						
peaches						
pear						
pear cup						
peas						
pepper strips						
pineapple						
pineapple cup						

potato
raisins
rasberries
spinach
strawberries
sweet potato
tomato
watermelon
yogurt covered raisins

Meat and Cheese

Store Type: _____
Date: _____
Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serv Size	Servings per Container	Comments
bacon						
baked beans, canned						
bologna, deli						
chicken nuggets						
egg						
ham, deli						
hot dog						
jerky						
pepperoni						
popcorn shrimp breaded						
roast beef, deli						
salami, deli						
sausage links						
tuna, canned						
turkey, deli						
american cheese, sliced						
babybell mini						
cheddar cheese, block						
cheese stick						
cream cheese						
milk box 1% horizon plain						
milk box horizon 1% vanilla						
milk box horizon chocolate						
milk box, chocolate shamrock farms						
milk box, strawberry organic lowfat						
milk box, trumoo chocolate						

milk, chocolate
milk, white
yogurt cup, lowest cost brand
yogurt cup, stonyfield
yogurt cup, yoplait
yogurt tube
yogurt, activia
yogurt, chobani cup
yogurt, danimals
yogurt, gogo squeeze
yogurt, gogurt

Bread & Convenience

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serv Size	Servings per Container	Comments
bagel						
croissants						
soft pretzel						
sub bread						
tortilla						
wheat bread						
wheat bread, honey						
wheat flatbread						
wheat tortilla, large						
white bread						
white bread ,french						
white flatbread						
white roll						
beanie weani spaghetti (mixed)						
BumbleBEE tuna kit (to-go pack)						
cheese pizza (frozen)						
corn dog (frozen)						
Lunchable (4 items, small)						
Lunchable (juice pouch)						
Lunchable (smoothie)						
Lunchable (sub sandwich, juice)						
Lunchable (sub sandwich, smoothie)						
mac and cheese cup						
pb uncrustable						

pepperoni and sausage pizza, frozen
pepperoni pizza, frozen
pizza poppers
pizza rolls
spaghetti os
carmel
granola
hummus
jelly
ketchup
mayo
mustard
nutella
peanut butter
ranch

Beverages

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serv Size	Servings per Container	Comments
apple juice, 10 oz bottle						
barrel juice						
belly washer						
capri sun, pouch						
coke, 12 oz bottle						
crangrape juice, small bottle						
dr pepper, 12 oz bottle						
gatorade, small						
hawiian punch, small bottle						
juice box						
juice box, Apple and Eve						
juice box, clifford juice						
juice box, fruit punch						
juice box, fruitables						
juice box, HI-C						
juice box, juicy juice						
juice box, minutemaide						
juice box, V8 fusion						
kool aid (jammer)						
mini water bottle						

orange juice, small bottle
tea, small bottle
tummy yummies
yoohoo, box

Salty Snacks

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serv Size	Servings per container	Comments
almonds						
biscuits						
cashews						
cheese n sticks pkg						
cheese popcorn						
chips, baked, single serv						
chips, bbq, single serve						
chips, bugles						
chips, corn tortilla						
chips, harvest grain						
chips, pita						
chips, pretzels						
chips, ruffles, single serv						
chips, veggie sticks						
crackers, 6 pck, PB						
crackers, butter						
crackers, cheese, 6 pck, Kroger						
crackers, cheez its						
crackers, Lance 6 pck, PB						
crackers, ritz						
crackers, saltines						
crackers, wheat ritz						
crackers, wheat thins						
doritos, single serv						
goldfish						
goldfish bunnys						
peanuts						
pickles						
pistachios						
popcorn						
popcorn, pirates booty, single serv						
pringles, can						

rice crackers
tator tots, frozen
trail mix

Dessert

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serv Size	Servings per container	Comments
air head, small						
andes mint, small						
animal cracker cookies						
animal crackers, frosted						
blueberry muffin						
brownie						
brownie, grasshopper						
bunny grahams, chocolate						
candy bar, mini						
candy bar, regular size						
candy corn						
cheerios, honey nut						
cheerios, regular						
chocolate balls (whoppers)						
chocolate chips						
christmas cakes with frosting						
cinnamon roll						
cookie with frosted icing (in bakery)						
cookie, sugar						
cookies skooby doo, choc chip						
cookies, biscotti						
cookies, choc chip (mini pkg)						
cookies, coconut						
cookies, fudge strip						
cookies, fudge stripe (100 cal snack pk)						
cookies, ginger snaps						
cookies, iced, chocolate						
cookies, mini, white						
cookies, no bake oatmeal/choc, small						
cookies, peanut butter						
cookies, vanilla cream						
cupcake, chocolate						
donuts, choc, mini						
fiber one choc bar cookie						

fig newtons
fruit by the foot
fruit gushers
fruit loops
fruit roll up
fruit snack, curious george
fruit snacks
fruit snacks, angry birds
fruit snacks, bunny organic
fruit snacks, kellogg
fruit snacks, welchs
fudge round
fundip
graham crackers
granola bar organic
granola bar, chewy
gummy bears
hersheys kiss
hostess cake
jello cup
jello pudding, chocolate
jelly beans
jr mints
larabar
lucky charms cereal bar
maamoul bar
marshmellows
mini hostess cake
muffins, blueberry, mini
muffins, hostess, mini
nature valley bar
nerds
nutrigrain bar
nutterbutter cookies
nutty bar choc
oatmeal cream pie, little debbies
oreos
oreos, mini
pecan pinwheel
peeps
pinwheel cookies
pop tarts mini crisp
poptarts
pound cake
pretzels, choc covered
reeces pieces
rice cake

rice krispies
santa cake
skooby doo crackers
smarties
strawberry banana crisps (freeze dried fruit)
sunbelt bakery choc chip bar
sweet and salty bar
sweet tarts
swiss cake, chocolate
swiss roll
teddy grahams
thin mints
tootsie roll
twinkie, chocolate
vanilla wafers
york patty
zebra cakes
Zoo Animal Crackers, chocolate

Appendix E: School Lunch Item Grocery Store Checklist

Entree

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serving Size	Servings per Container	Comments
Asian Chicken (chicken and seasoning)						
BBQ Sandwich						
Bean Burrito						
Bean Taco						
Biscuit, Ham						
Cheese Pizza						
Cheese Quesadilla						
Cheese sticks w/dip						
Chicken Fajita Salad						
Chicken Fajitas (chicken, tortilla, peppers, seasoning)						
Chicken Filet						
Chicken Filet sandwich						
Chicken Strips						
Chili (for hot dog)						
Fish Nuggets						
Grilled Cheese						
Hamburger (wheat bun and patty)						
Hot Dog						
Italian Dunkers (with Sauce)						
Mac & Cheese						
PB & J						
Pork and Gravy						
Quiche						
Salad, Chef						
Sub, Ham						
Taco						
Taco Salad (salad, taco meat, seasoning)						
Turkey and cheese sand						
Veggie Wrap						
Wrap, Turkey and Cheese						

Side Items

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serving Size	Servings per Container	Comments
Apple						
Apple, sliced						
Apples w/ cinnamon, baked						
Applesauce						
Baked Beans (canned)						
Banana						
Carrot sticks						
Carrots, savory						
carrots/celery sticks with dip						
Celery Sticks						
Chinese Veggies						
Coleslaw						
Collard Greens (canned)						
Corn						
Cucumber						
Garlic Broccoli						
Grapes						
Great Northern Beans						
Green Beans						
Green Peas						
Hamburger toppings						
Mandarin Oranges (cup)						
Mashed Potatoes						
Mixed Fruit						
Orange slices						
Peaches (canned)						
Pears (canned)						
Pickles (jar)						
Pineapples (canned)						
Pinto Beans						
Plum						
Potato Medley						
Potato Spears						
Potatoes Au Gratin						
Ranch dip						
Raw Broccoli						
Red Pepper Strips						
Refried Beans						
Roll, wheat						

Saltine Crackers, 5
Side salad with tomato
Side Salad/tossed salad (and dressing)
Spinach
Strawberries
sweet potato fries
Sweet Potatoes
Three bean salad
Tomato Juice
Vegetable Beef Soup

Drinks

Store Type: _____

Date: _____

Researcher: _____

Food Item	Price	Quantity per price (piece or pound)	Brand	Serving Size	Servings per Container	Comments
Juice, Apple (SunCup)						
Juice, Orange, (PET)						
Milk, Chocolate FF, TruMoo						
Milk, Plain 1%, PET						
Milk, Strawberry FF, TruMoo						
Milk, White FF, TruMoo						