

COMPARISON OF COSTS BETWEEN SCHOOL AND PACKED LUNCHES

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ABSTRACT

PURPOSE/OBJECTIVES: Although meals offered through the National School Lunch Program (NSLP) have been found to be of higher dietary quality than packed lunches, roughly 40% of students bring packed lunches for a variety of reasons, including cost. The purpose of this study was to explore costs, including time, of NSLP and packed lunches.

METHODS: Data from the lunches of 1,289 pre-kindergarten and kindergarten students enrolled in three schools in southwest Virginia were used for this study, and categorized as homemade packed lunches, convenience packed lunches, replicated school lunches, and NSLP lunches. Each lunch was assigned a food cost based on retail purchase of lunch contents. Each lunch was also assigned a time cost by evaluating the amount of time to prepare each lunch, with a monetary value for labor computed. A full-cost for each lunch was determined by combining food cost and time cost. Non-parametric tests were used to compare the food cost, time cost, and the full cost of the meals. Medians were computed and compared due to outliers in the data. Descriptive statistics were used to calculate the median food cost of sugar-sweetened beverages and desserts in packed lunches.

RESULTS: Statistically significant differences in median food costs were found between homemade packed lunches (\$1.55) and replicated school lunches (\$2.11), convenience packed lunches (\$2.12), and NSLP lunches (\$2.15). The homemade packed lunch provided a statistically significant reduction in food cost compared to NSLP. When incorporating preparation time (full cost), all one-sided pairwise comparisons of lunch cost were found to be statistically significant (p-values less than .0001) in terms of their median values: NSLP (\$2.15), convenience packed lunches (\$2.56), homemade packed lunches (\$2.92), and replicated school lunches (\$11.32). Seventy-six percent (414 of 545) of packed lunches contained sugar-sweetened beverages and/or dessert food items, accounting for one-fifth (median of 20.07%) of the food cost of all observed packed lunches.

APPLICATIONS TO CHILD NUTRITION PROFESSIONALS: When time is computed as part of the total cost of NSLP versus packed lunch options, including homemade packed lunches, replicated school meals, and convenience lunch options, the NSLP is the least expensive choice. In conjunction with the nutritional benefits of the NSLP, time-cost data may be used to develop interventions or campaigns on the benefits of participating in the NLSP.

KEYWORDS: National School Lunch Program, packed, food cost, time cost

INTRODUCTION

Every day over 50 million children, adolescents, and teens attend public school in the United States (U.S. Department of Agriculture [USDA], National Center for Education Statistics [NCES], 2017). These students spend an extensive amount of time at school, where they may consume up to half of their daily calories (Johnson, Bednar, Kwon, & Gustof, 2008). In a nationally represented sample of K-12 students, it was found that approximately 40% of students brought packed lunches from home while over 60% of students participated in the National School Lunch Program (NSLP) (Gordon et al., 2009).

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 packed lunches and NSLP lunches (Schwartz, Henderson, Read, Danna, & Ickovics, 2015; Caruso & Cullen, 2014; Farris et al., 2014; Johnson et al., 2008). NSLP reimbursable lunches, which must adhere to federal nutrition standards, were found to be more nutritious than packed lunches. NSLP qualifying school lunches must offer five components, a meat/meat alternative, grains/grain equivalents, fruits, vegetables, and milk, and meals must meet required limits for calories, sodium, saturated fat, and trans-fat (HHFKA, 2010). Packed lunches do not have to meet these standards and research has shown these to contain more sugar-sweetened beverages (SSBs), desserts, and chips, but less fruits, vegetables, dairy, and whole grains (Caruso & Cullen, 2014; Farris et al., 2014; Johnson et al., 2008). NSLP participation has declined since 2008, with sharper declines in 2012-2014. The decline, despite improvements in nutritional quality, may be due to the rising cost of school meals as a result of compliance with standards. Since 2011, smaller districts and those located in rural areas have reported increases in meal prices as a result of new rules for USDA meals programs (Ralston & Newman, 2015).

Only a few studies have compared the food cost of NSLP lunches to the food cost of packed lunches, with results showing that packed lunches typically are costlier (Caruso & Cullen, 2014; Johnson et al., 2008; Rainville, 2005). However, only considering the food cost and ignoring time inputs can provide misleading results in terms of cost effectiveness (Davis & Serrano, 2016; Yang, Davis, & Muth, 2015). Though food preparation time and motivators of home food preparation, such as health, sustainability, and child preferences have been investigated, (Marchi, Caputo, Nayga, & Banterle, 2016; Yang, Davis, & Muth, 2015; Farris et al., 2014) to date, no studies have examined the full cost of packed lunches compared to NSLP lunches, including preparation time, which is often a barrier for students in bringing lunches from home (Marchi, Caputo, Nayga, & Banterle, 2016; Yang, Davis, & Muth, 2015).

The present study was part of a larger research project conducted in 2012-2013, which compared the nutritional quality of packed lunches to NSLP meals. The goal of this study was to compare food costs, time cost, and full cost (defined as food + time cost) of NSLP lunches to three potential lunch options from home: convenience packed lunches, homemade lunches, and replicated school lunches (defined in Table 1).

Table 1. Definitions of Lunch Categories used to Compare Costs

| Lunch Categories | Definitions |
|-------------------------------------|--|
| National School Lunch Program Lunch | Lunches that are served at public school as part of the National School Lunch Program |
| Replicated School Lunch | School lunch meal items not prepared at school (simulation of meals at home by researchers) |
| Packed Lunch | This encompasses any lunch brought from home. Subcategories of Convenience Packed Lunch and Homemade Packed Lunch. |
| Convenience Packed Lunch | Packed lunches involving a main course that did not require preparation by a caregiver (e.g. Lunchables) |
| Homemade Packed Lunch | Packed lunches involving a main course prepared by a caregiver |

METHODOLOGY

SETTING

Three elementary schools included in the 2012-2013 larger study spanned two counties in one state with a combined population of 112,122 that is comprised of white (87.9-97.0%), black (1.5-4.1%), and Hispanic/ Latino (1.3-2.9%) individuals (U.S. Census Bureau 2014ab.) Participating schools were initially recruited using convenience sampling. The three schools had free and reduced-price participation rates of: 46.6%, 33.3%, and 52.7% (Schools 1, 2, and 3, respectively). The Institutional Review Board for Virginia Tech approved the study and did not require consent from parents or school administrators due to the observational nature of data collection.

FOOD COST

Observational NSLP and packed lunch data were collected for five consecutive days during 2012-2013, with food cost information collected in 2016-2017. An observational checklist reflecting meal components of the NSLP menu and packed lunches was used to record the presence of all foods and drinks, as well as portion sizes of items. All items in the packed lunches (defined as any lunch brought from home) and all menu items selected by students who participated in the NSLP were entered into an Excel spreadsheet. Items were categorized into the following categories: beverages, bread and convenience items (i.e., peanut butter, hummus, granola, etc.), meat and dairy, fruits and vegetables, snacks, and dessert, based upon how items were grouped in a typical grocery store layout. Researchers collected cost, serving size, and quantity data for all items at three local, independent supermarkets over a two-week period in June 2016 and July 2017. One set of data was collected per store with prices between the stores averaged into a final cost per food item to reflect market changes. Brand information was used when available, otherwise the store brand food item with the lowest unit price per serving was recorded. When an item was not available in the store, a comparable food item was used. For example, if a Lunchables Sub Sandwich with a Fruit Smoothie was unavailable, a comparable Lunchables Sub Sandwich with a Fruit Juice was substituted. The NSLP item prices were used to determine cost if the same meal was prepared at home, defined as a replicated school lunch. For example, if a student chose pizza, an apple, and corn as their meal components during the study period, the cost, serving size, and quantity data for those ingredients and items would be collected and used to determine a direct cost for that meal, as if it was prepared at home and not

at school. Replicated school lunches were included as a comparison to packed lunches for the purpose of identifying costs for caregivers wishing to replicate a balanced nutritional meal at home. The Consumer Price Index was used to deflate the cost of items to a 2012 sticker price (U.S. Department of Labor, 2017a).

A final food cost per lunch was assigned to each packed and replicated school lunch based on the food items each lunch contained. The food cost of packed lunches was then compared to the food cost of replicated school lunches and to the price of a reimbursable NSLP meal. In Virginia, during 2012-2013, the full price when purchasing a NSLP meal on average was \$2.15 (Virginia Department of Education, 2012).

TIME COST

Time cost of a NSLP meal was set at \$0.00 for the parent. Packed lunches were divided into two categories: convenience or homemade. Convenience lunches (n=187, 34.3%) were defined as involving a main course that did not require preparation by the caregiver, such as any packaged or ready-prepared product (i.e., chips, fruit snacks, Lunchables and Uncrustables), while homemade lunches were defined as involving a main course that required preparation, such as sandwiches, chicken nuggets, or hot dogs, (n=358, 65.7%). To determine the time cost of each packed lunch, researchers purchased and prepared items from both categories. To determine the time cost should parents/caregiver replicate a NSLP meal at home to send to school (i.e. pizza, corn and apple), researchers purchased and prepared items selected by NSLP participants. Preparation and cooking times found on food boxes or online were utilized when available. Entrée items were considered to be made from basic ingredients while secondary items such as milk cartons, applesauce, and bread rolls were considered to be convenience items.

A monetary value for time inputs of parents/caregivers to prepare these replicated meals was calculated based off average income, which is a standard way to value time in economics (Davis & Serrano, 2016). In 2012, the average incomes in both counties were \$18.60/hour and \$17.88/hour (U.S. Department of Labor, 2017b). This amount was broken down to cost per minute (\$0.31/minute and \$0.30/minute), and cost per second (\$0.0052/second and \$0.0050/second). The number of seconds each food item took to prepare was multiplied by the average cost per second value, providing a time cost for each food item.

The full cost of each lunch was calculated by adding together food and time costs (Davis & Serrano, 2016; Yang, Davis, & Muth, 2015). This was done for each of the four types of lunches in the study.

DATA ANALYSIS

For the data analysis, we wanted to compare the measures of center of food cost, time cost, and full cost across the four different lunch types: NSLP, replicated school lunch, convenience packed lunch, and homemade packed lunch. We used one-way ANOVA models to compare each mean cost value against the lunch categories; unfortunately, the models failed the normality of the residuals assumption. Both square root and log transformations on the responses did not solve the issue of non-normality of the residuals (due to some extremely high cost values). Thus, Kruskal-Wallis tests were used to analyze the data. The major difference of these non-parametric tests is that they compare the median costs of the different lunch categories. We conducted one-sided pairwise comparisons using the non-parametric analogous Wilcoxon rank sum and Wilcoxon signed rank tests. For each of the Wilcoxon tests, the alternative hypothesis was selected based on the observed medians of the two groups. Comparisons were made across each possible lunch configuration. While not formally tested, percent increase/decrease based on the

observed medians are reported for all statistically significant non-equal medians. Lastly, the calculated food cost of SSBs and desserts in each packed lunch was included in all analyses as described above, but also analyzed separately, to give a monetary value for including nutritionally inferior food items in packed lunches.

RESULTS

A total of 1,289 student lunches were observed at School 1 (n=559, 43.4%), School 2 (n=452, 35.0%), and School 3 (n=278, 21.6%). For lunch composition, 57.7% were NSLP lunches, (n=744), 27.8% homemade packed lunches (n=358), and 4.5% from convenience packed lunches (n=187).

FOOD COST

Based on 2012 food prices, the observed median food costs for homemade packed lunches, replicated school lunches, and convenience packed lunches were \$1.55, \$2.11, and \$2.12 respectively (Figure 1). The Kruskal-Wallis test showed a significant difference between the three medians (p-value <.0001) (Table 2). Homemade packed lunches were less expensive than convenience lunches and the replicated school lunches with p-values below .0001. As shown in Table 2, replicated school lunches were not found to have a lower median food cost compared to convenience packed lunches. This is likely due to the large number of outliers in the data from the replicated school lunches and may warrant further investigation. We conducted Wilcoxon signed rank tests to compare median food costs to the \$2.15 purchase price of the NSLP meal. These tests, whose alternative hypothesis was that the NSLP meal cost more, produced p-values of less than .0001 (homemade packed lunch), .0993 (replicated school lunch), and .0543 (convenience packed lunch). The observed median food cost for homemade packed lunches (\$1.55) was 27.9% lower than the average cost for NSLP (\$2.15).

Figure 1. Comparison of Food Cost by Type of Lunch Prepared at Home

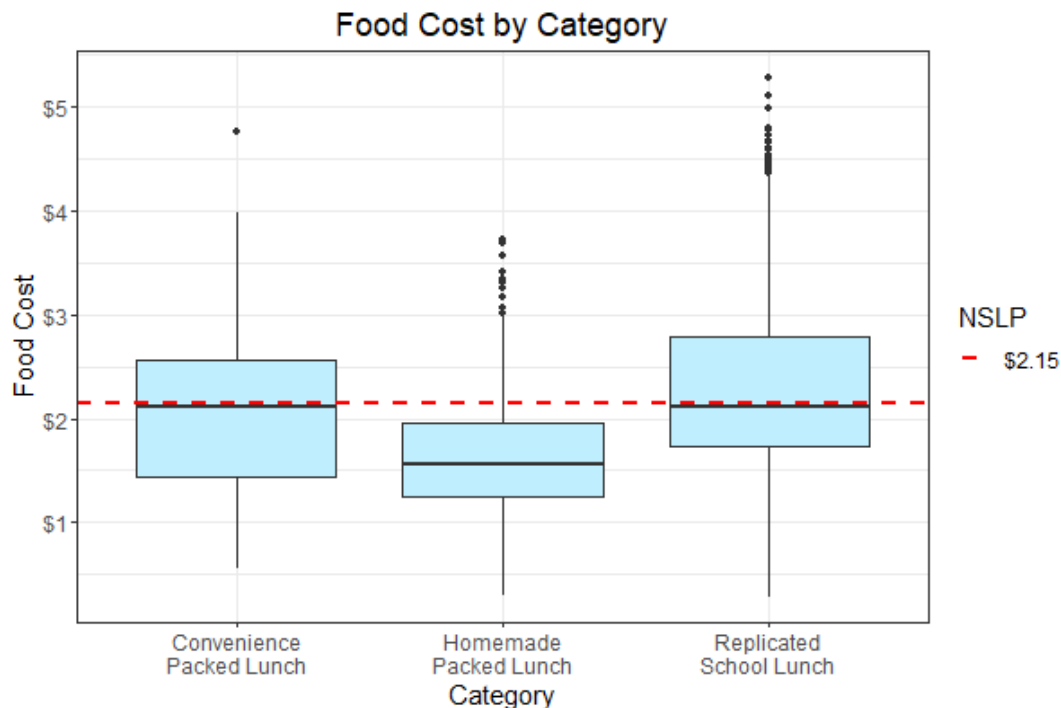


Table 2. P-values for Cost Comparison Tests

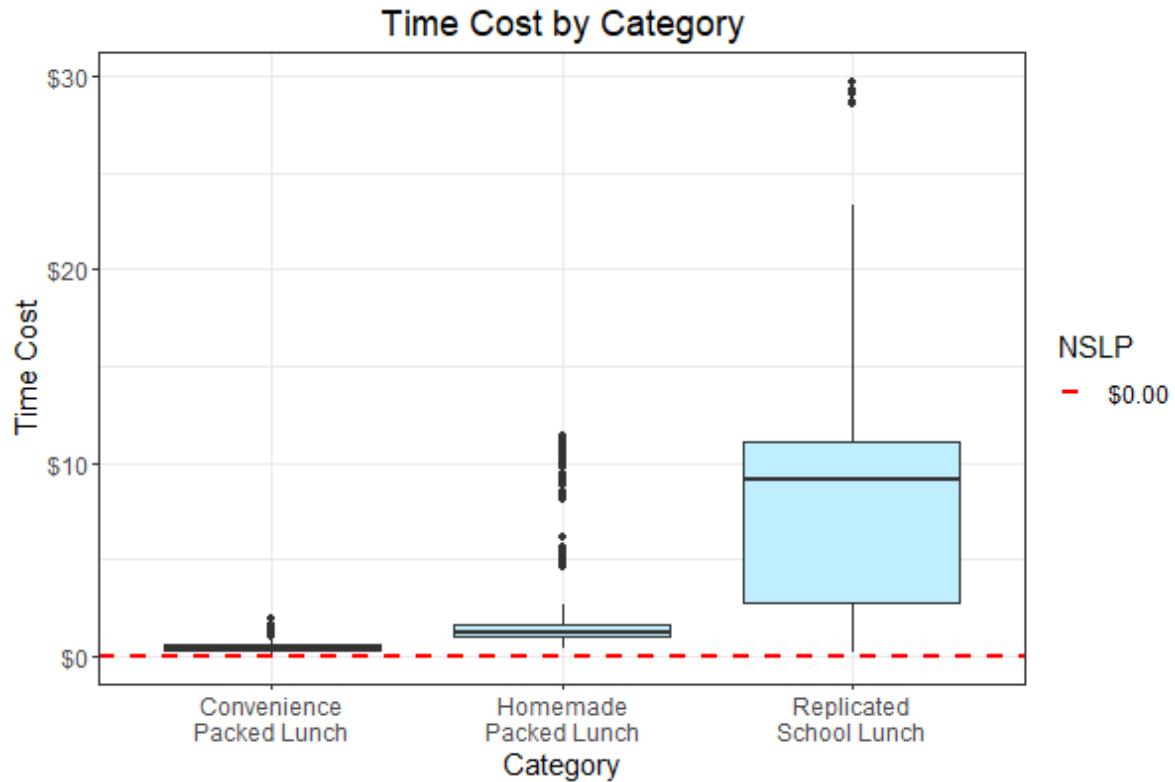
| Comparisons | P-value | | |
|---|-------------------------|-------------------------|-------------------------|
| | <u>Food Cost</u> | <u>Time Cost</u> | <u>Full Cost</u> |
| Homemade Packed Lunch vs. Replicated School Lunch vs. Convenience Packed Lunch ^a | <.0001 | <.0001 | <.0001 |
| Homemade Packed Lunch vs. Replicated School Lunch ^b | <.0001 | <.0001 | <.0001 |
| Homemade Packed Lunch vs. Convenience Packed Lunch ^b | <.0001 | <.0001 | <.0001 |
| Replicated School Lunch vs. Convenience Packed Lunch ^b | .9948 | <.0001 | <.0001 |
| Homemade Packed Lunch vs. NSLP ^c | <.0001 | <.0001 | <.0001 |
| Replicated School Lunch vs. NSLP ^c | .0993 | <.0001 | <.0001 |
| Convenience Packed Lunch vs. NSLP ^c | .0543 | <.0001 | <.0001 |

a. Kruskal-Wallis test. b. Wilcoxon rank sum test. c. Wilcoxon signed rank test.

TIME COST

The median preparation time of a replicated school lunch was nearly 30 times that of a convenience packed lunch, at 30.18 minutes and 1.25 minutes respectively, while a homemade packed lunch was 4 minutes. A NSLP meal required zero preparation time from parents or caregivers of the student. Thus, the time cost of a NSLP meal was lowest at \$0.00, which was also statically less than the medians of the alternatives (Figure 2). For lunches prepared at home, a convenience packed lunch was least expensive in terms of time with a median cost of \$0.39, followed by homemade packed lunch at \$1.24. The median time cost of a replicated school lunch was 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. All median time costs were found to be statistically significant in the one-sided Wilcoxon tests with p-values of less than .0001 (Table 2).

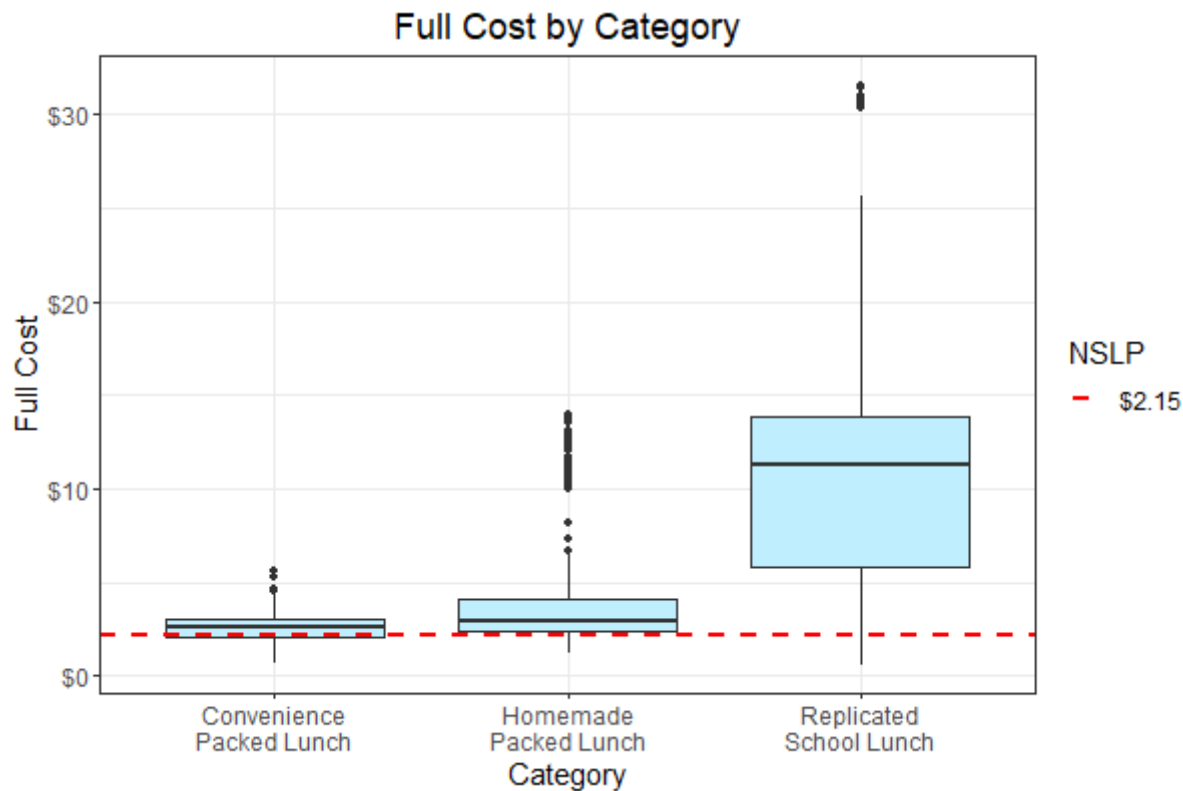
Figure 2. Comparison of Time Cost by Type of Lunch Prepared at Home



FULL COST

The median full cost (food + time cost) of a NSLP meal was the lowest of the four meal costs compared, at \$2.15 (Figure 3). For lunches prepared at home, a convenience packed lunch was the least expensive at \$2.56, followed by a homemade packed lunch at \$2.92, with the highest full cost coming from replicated school lunch at \$11.32. The medians of the four full cost categories were found to be significantly different (p-values <.0001) (Table 2). From our data, the median full costs of convenience packed, homemade packed, and replicated school lunches are 19%, 35%, and 527% higher than the median full cost of a NSLP meal at \$2.15.

Figure 3. Comparison of Full Cost by Type of Lunch Prepared at Home



SUGAR-SWEETENED BEVERAGE AND DESSERT COST

Approximately three-quarters, 76.0% (n=414), of sampled packed lunches contained SSBs and/or dessert food items, while NSLP lunches did not contain any of these items during the study period. The median costs of SSBs and dessert items found in convenience packed lunches and homemade packed lunches were \$0.47 and \$0.26, respectively. SSBs and desserts accounted for close to one-fifth of all packed lunch cost: 21.6% of convenience packed lunches (median=\$2.17); and 18.3% of homemade packed lunches (median = \$1.55). Both median costs for SSBs/desserts are significantly greater from \$0.00 (the NSLP cost) as well as from each other (all with p-values <.0001).

DISCUSSION

This study is the first to investigate differences in food costs and preparation time by comparing NSLP meals, homemade packed lunches, convenience packed lunches, and replicated school lunches. When examining only food cost based on 2012 prices, those costs or expenses required to purchase the lunch or ingredients for the lunch, homemade packed lunches had the lowest median food cost. However, when incorporating preparation time, NSLP meals had a much lower full cost to the caregiver—food cost and time cost combined—than either of the packed lunch options, and, replicated school lunches (school lunches prepared at home) had the highest full cost.

While replicated school lunches were not observed in this study, and only used for the purpose of identifying costs for caregivers wishing to replicate a balanced nutritional meal at home, replicated school lunches were overall more expensive than other lunch choices and were over

five times more expensive than NSLP meals because of the ~30 minutes of preparation time required to prepare traditional school meal items. The homemade packed lunches in this study also typically contained food items that required more preparation time, taking over three times longer to prepare than the convenience packed lunches, which represented almost 15% of the lunches analyzed. Americans in general are consuming fewer home-cooked meals, and children in particular are consuming half of all energy from fast food (Smith, Ng, & Popkin, 2013), indicating a caregiver desire for quick and convenient meal options. A previous study assessing caregivers' perceptions of NSLP meals and packed lunches showed motivational factors for NSLP participation were convenience and saving time (Farris et al., 2014). In fact, limited time for cooking has been cited as a barrier for engaging in healthy dietary behaviors (Marchi, Caputo, Nayga, & Banterle, 2016; Monsivais, Aggarwal, & Drewnowski, 2014), and easy to prepare items such as pizza and macaroni and cheese are commonly served even among caregivers who report valuing healthy family meals (Devine et al., 2009). This study suggests, the NSLP removes limited time as barrier to providing home-cooked meals, by offering convenient home-cooked meal options with the lowest time cost to caregivers.

Research has shown that school lunches generally are more nutritious than packed lunches (Caruso & Cullen, 2014; Farris et al., 2014; Hubbard, Must, Eliasziw, Folta, & Goldberg, 2014; Johnson et al., 2008). However, caregivers' attitudes toward school meals and packed lunches are also important to consider. Motivational factors reported by caregivers for packing lunches include: variety, nutritional quality, and taste/food preferences. In this study, 76.0% of students brought SSBs and/or desserts in their packed lunches. These food items are not typically allowed in NSLP meals, which could be why children desire to bring their own lunch. Further, the food cost of SSBs and/or dessert food items in packed lunches accounted for 21.8% of the cost. The preference to allow these items within packed lunches mirrors current dietary behaviors 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) (Reedy & Krebs-Smith, 2010). If families' goals were to save money, time, and improve the overall nutritional profile of the lunch, they could eliminate these items from packed lunches or purchase NSLP meals. The NSLP offers convenient and nutritionally balanced meals daily for caregivers, maximizing both the caregivers' time and the students' health.

CONCLUSIONS AND APPLICATION

This research study highlights three important and established determinants of food choices: cost, time, and dietary quality (Glanz, Basil, Maibach, Goldberg, & Snyder, 1998). Based on the results of this study, as well as others focused on nutritional value, generally, the NSLP is more cost, time, and nutritious than packed lunches.

RECOMMENDATIONS FOR PRACTICE

This study may help caregivers make more informed choices to save money, save time, and improve the nutritional quality of their child's lunch. These results suggest the NSLP maximizes savings to the caregiver as the full cost of the NSLP meal was less than the full cost of all packed lunch options. Social marketing and awareness campaigns for families that address cost, time, dietary quality, and the options available through the NSLP are warranted in order to, inform caregivers and children about the real "cost" of the different meals, and provide education on how NSLP meals can optimize both time and health considerations. Additionally, this study may help school nutrition personnel encourage more participation in the NSLP, which has been declining nationally. Increased participation in the NSLP would lead to more program funds, which would allow for bulk purchasing of nutritious and appealing foods.

In addition to focusing on the cost effectiveness of the NSLP, other participation determinants must also be addressed, such as food preferences and social stigma. Past initiatives such as farm-to-school and garden initiatives, taste tests of menu items, student and caregiver involvement in menu development, rewards for trying food items, and using media to influence participation and consumption have successfully altered taste and food preferences for children and are potential strategies for encouraging NSLP participation (Burgess-Champoux, Marquat, Vickers, & Reicks, 2006; Lakkakula et al., 2011; Perlman et al., 2012). Additionally, environmental changes which have been successful with school breakfast participation, such as eating meals in the classroom or providing grab-and-go meal options, might also impact school lunch participation rates positively (Conklin, Bordi, & Schaper, 2004 & Farris, Roy, Serrano & Misyak, 2019). Other strategies, such as the removal of competitive lunch choices and reducing cafeteria line wait times, have previously been shown to increase NSLP participation (Bhatia, Jones, & Reicker, 2011).

Potential social stigma associated with NSLP meals can be addressed with more schools providing lunch as a free benefit to all students regardless of income, as part of the Community Eligibility Provision (Bhatia, Jones, & Reicker, 2011; Freeman, Macias, Narayna, Ng, & Yang, 2012). School nutrition directors can work with school administrators, school board members, school food service staff and others to determine eligibility and apply for the provision, removing further barriers to NSLP participation. School nutrition directors can use the results of this study and other NSLP dietary studies to tailor messages to the public on the benefits of school meals as a low-cost, convenient, nutrient-rich option. Additionally, the methods in this study could be replicated at the regional or district level to provide a stronger case for the benefits of participating in the NSLP.

LIMITATIONS AND FUTURE RESEARCH

This study is not without limitations. Several assumptions were made when collecting food prices. Although researchers visited three local grocery stores, including one big box store, and averaged the price of food items from the stores, caregivers may shop at different locations. Additionally, some food items were not in season or not sold at the visited grocery stores, and a comparable food item was used.

Other limitations include the time-period difference between the observational food price data collection. Price deflation utilizing the Consumer Price Index from the Bureau of Labor Statistics 2012 sticker price was used to account for any price differences. Additionally, packed lunch preparation time can vary depending on food preparation skills, and food prices can vary due to seasonal differences, especially for produce. 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 2012, although individuals may value their time more or less than what was pre-assigned for this study. Finally, while costs will vary depending on geographic location and correspondingly price of food and median salaries; likely costs would be proportional to those found in this study.

In light of this study and others, continued research is needed to understand to a greater depth why students and/or caregivers choose to send packed lunches over participating in the NSLP. Research is also needed to determine appropriate strategies for communicating meaningful messages to caregivers about the benefits of NSLP participation. However, this study provides preliminary information that could be used to develop nutrition education interventions or campaigns on the benefits of participating related to cost, time, nutrition, and other identified barriers.

REFERENCES

- Bhatia, R., Jones, P., & Reicker, Z. (2011). Competitive foods, discrimination, and participation in the National School Lunch Program. *American Journal of Public Health, 101*(8),1380-1386. [doi:10.2105/AJPH.2011.300134](https://doi.org/10.2105/AJPH.2011.300134)
- Burgess-Champoux, T., Marquart, L., Vickers, Z., & Reicks, M. (2006). Perceptions of children, parents, and teachers regarding whole-grain foods, and implications for a school-based intervention. *Journal of Nutrition Education and Behavior, 38*(4), 230–237.
- Carlson, S. M. (2014). Student and parent perceptions of the lunches served under the revised guidelines for the National School Lunch Program. (Electronic Thesis or Dissertation). Retrieved from https://etd.ohiolink.edu/!etd.send_file?accession=kent1397165529&disposition=inline
- Caruso, M. L., & Cullen, K. W. (2015). Quality and Cost of Student Lunches Brought From Home. *JAMA Pediatrics, 169*(1), 86. [doi:10.1001/jamapediatrics.2014.2220](https://doi.org/10.1001/jamapediatrics.2014.2220)
- Conklin, M. T., Bordi, P. L., & Schaper, M. (2004). Grab ‘n’ Go Breakfast Increases Participation in the School Breakfast Program. *Journal of Child Nutrition Management, 28*(1).
- Davis, G.C., & Serrano, E.L. (2016). *Food & Nutrition Economics: Fundamentals for Health Sciences*. New York, NY: Oxford University Press.
- Devine, C.M., Farrell, T.J., Blake, C.E., Jastran, M., Wethington, E., Bisogni C.A. (2009). Work conditions and the food choice coping strategies of employed caregivers. *Journal of Nutrition Education and Behavior, 41*(5), 365-370.
- Farris, A. R., Misyak, S., Duffey, K. J., Davis, G. C., Hosig, K., Hosig, K., Atzaba-Poria, N., McFerren, M., & Serrano, E. (2014). 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. *Journal of Nutrition Education and Behavior, 46*(6), 621-626. [doi:10.1016/j.jneb.2014.07.007](https://doi.org/10.1016/j.jneb.2014.07.007)
- Farris, A., Misyak, S., Duffey, K., Atzaba-Poria, N., Hosig, K., Davis, G.C., McFerren, M., & Serrano E. (2016). Elementary Parent Perceptions of Packing Lunches and National School Lunch Program. *Journal of Child Nutrition & Management, 40*(1), 1-10.
- Farris, A., Roy, M., Serrano E., & Misyak S. (2019). Impact of Breakfast in the Classroom on Participation and Food Waste. *Journal of Nutrition Education and Behavior, 51*:893-898. doi.org/10.1016/j.jneb.2019.04.015
- Freeman, D., Macias, A., Narayan, A., Ng, R., & Yang, L. (2012). Under-enrollment and underparticipation in Vermont’s school lunch program: An analysis of causes and solutions. Hanover, NH: The Nelson A. Rockefeller Center Policy Research Shop.
- Glanz, K., Basil, M., Maibach, E., Goldberg, J., & Snyder, D. (1998). Why Americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association, 98*(10), 1118-26. [DOI: 10.1016/S0002-8223\(98\)00260-0](https://doi.org/10.1016/S0002-8223(98)00260-0)

- Gordon, A. R., Cohen, R., Crepinsek, M. K., Fox, M. K., Hall, J., & Zeidman, E. (2009). The Third School Nutrition Dietary Assessment Study: Background and Study Design. *Journal of the American Dietetic Association*, 109(2). [doi:10.1016/j.jada.2008.10.057](https://doi.org/10.1016/j.jada.2008.10.057)
- Healthy, Hunger-Free Kids Act of 2010, 42 U.S.C. § 1751 et seq. (2010).
- Hubbard, K. L., Must, A., Eliasziw, M., Folta, S. C., & Goldberg, J. (2014). Whats in Children's Backpacks: Foods Brought from Home. *Journal of the Academy of Nutrition and Dietetics*, 114(9), 1424-1431. [doi:10.1016/j.jand.2014.05.010](https://doi.org/10.1016/j.jand.2014.05.010)
- Johnson, C., Bednar, C., Kwon, J., & Gustof, A. (2009). Comparison of Nutrient Content and Cost of Home Packed and Reimbursable School Lunches. *Journal of Child Nutrition & Management*, 33(2). Retrieved from <https://schoolnutrition.org/5--News-and-Publications/4--The-Journal-of-Child-Nutrition-and-Management/Fall-2009/Volume-33,-Issue-2,-Fall-2009---Johnson;-Bednar;-Kwon;-Gustof/>
- Lakkakula, A., Geaghan, J.P., Wong, W.P., Zanovec, M., Pierce, S.H., & Tuuri, G. (2011). A cafeteria-based tasting program increased liking of fruits and vegetables by lower, middle and upper elementary school-age children. *Appetite*, 57(1), 299-302. [doi:10.1016/j.appet.2011.04.010](https://doi.org/10.1016/j.appet.2011.04.010)
- Lambert, L., Conklin, M., & Johnson, J. (2002). Parental beliefs toward the National School Lunch Program related to elementary student participation. *Journal of Child Nutrition Management*, 26(2).
- Marchi, E. D., Caputo, V., Nayga, R. M., & Banterle, A. (2016). Time preferences and food choices: Evidence from a choice experiment. *Food Policy*, 62, 99-109. [doi:10.1016/j.foodpol.2016.05.004](https://doi.org/10.1016/j.foodpol.2016.05.004)
- Monsivais, P., Aggarwal, A., & Drewnowski, A., (2014). Time spent on Home Food Preparation and Indicators of Healthy Eating. *American Journal of Preventative Medicine*, 47(6), 796-802. doi.org/10.1016/j.amepre.2014.07.033
- Perlman SE, Nonas C, Lindstrom LL, Choe-Castillo J, McKie H, Alberti PM. (2012). A menu for health: Changes to New York City School food, 2001 to 2011. *Journal of School Health*. 82(10), 484-491. [doi:10.1111/j.1746-1561.2012.00726.x](https://doi.org/10.1111/j.1746-1561.2012.00726.x)
- Rainville, A. (2005). School Lunch Prices Compared to the Cost of Lunches Brought from Home and Fast Food Prices. *Journal of the American Dietetic Association*, 105(8), 50. [doi:10.1016/j.jada.2005.05.171](https://doi.org/10.1016/j.jada.2005.05.171)
- Ralston, K., and Newman C. (2015). School Meals in Transition, EIB-143, U.S. Department of Agriculture, Economic Research Service. Retrieved from https://www.ers.usda.gov/webdocs/publications/44003/53569_eib143_summary.pdf?v=0
- Reedy, J., & Krebs-Smith, S. M. (2010). Dietary Sources of Energy, Solid Fats, and Added Sugars among Children and Adolescents in the United States. *Journal of the American Dietetic Association*, 110(10), 1477-1484. [doi:10.1016/j.jada.2010.07.010](https://doi.org/10.1016/j.jada.2010.07.010)

- Schwartz, M. B., Henderson, K. E., Read, M., Danna, N., & Ickovics, J. R. (2015). New School Meal Regulations Increase Fruit Consumption and Do Not Increase Total Plate Waste. *Childhood Obesity, 11*(3), 242-247. [doi:10.1089/chi.2015.0019](https://doi.org/10.1089/chi.2015.0019)
- Smith, L. P., Ng, S. W., & Popkin, B. M. (2013). Trends in US home food preparation and consumption: Analysis of national nutrition surveys and time use studies from 1965–1966 to 2007–2008. *Nutrition Journal, 12*(1). [doi:10.1186/1475-2891-12-45](https://doi.org/10.1186/1475-2891-12-45)
- U.S. Department of Education, National Center for Education Statistics. (2017). Fast Facts. Back to School Statistics. Retrieved from <https://nces.ed.gov/fastfacts/display.asp?id=372>
- U.S. Census Bureau. (2014, August 25a). Quickfacts. Retrieved from <https://www.census.gov/quickfacts/fact/table/montgomerycountyvirginia,US/PST045218>
- U.S. Census Bureau. (2014, August 25b). Quickfacts. Retrieved from <https://www.census.gov/quickfacts/fact/table/gilescountyvirginia,montgomerycountyvirginia,US/PST045218>
- U.S. Department of Labor, Bureau of Labor Statistics. (2017a). Consumer Price Index. Retrieved from <https://www.bls.gov/cpi/>
- U.S. Department of Labor, Bureau of Labor Statistics. (2017b). Consumer Price Index. Retrieved https://data.bls.gov/cew/apps/table_maker/v4/table_maker.htm?type=1&year=2015&qtr=A&own=0&ind=10&supp=0
- Virginia Department of Education, School Nutrition Program (2012). Retrieved from http://www.doe.virginia.gov/administrators/superintendents_memos/2012/082-12b.pdf
- Yang, Y., Davis, G. C., & Muth, M. K. (2015). Beyond the sticker price: Including and excluding time in comparing food prices. *American Journal of Clinical Nutrition, 102*(1), 165-171. [doi:10.3945/ajcn.114.101444](https://doi.org/10.3945/ajcn.114.101444)

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