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## The Effect of Pre-Selection and Visual Cues on Food Item Selection by Middle School

Children

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# **ABSTRACT<sup>1</sup>**

This study examines the role that the right behavioral cues can play in changing lunchroom habits and transitioning children towards healthier eating habits. We accomplish this by encouraging middle school children to pre-select their meals using a web-based software program where they are nudged by visual behavioral cues to make healthier food choices during pre-ordering. Our research design allows us to separate the effect of pre-selection from the effect of nudging on eating habits. We predict that pre-selecting lunch via the web based program with in-built behavioral cues will result in an increase in the weekly selection of fruits, vegetables, and low fat dairy.

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## I. INTRODUCTION

In recent years, childhood obesity has emerged as a significant health problem in developed countries. The Centers for Disease Control and Prevention (CDC) find that approximately 17% of children and adolescents in the United States are obese (CDC 2013a). This rate has tripled from a generation ago (CDC 2013a). The increase in the rate of childhood obesity is particularly concerning because individuals that are obese during their adolescence are more likely to be obese as adults and thus at a higher risk of obesity related diseases such as cardiovascular problems, certain cancers and type 2 diabetes (CDC 2012). Much of the high rates of obesity have been traced back to the low amount of nutrients and high amounts of calories that are consumed by adolescents (CDC 2013b). According to the National Institutes of Health (NIH) (2013), a child between the ages of 9 and 13 needs 1600 to 2200 calories a day to maintain a healthy energy balance. A healthy energy balance promotes growth in children without excess weight gain (NIH 2013). If calorie intake does not equal calories burned, it is considered to be an unhealthy balance and can lead to obesity in adolescents (Karnik and Kanekar 2012). Adolescents also need to consume the right types of calories, such as fruits, vegetables and dairy. The CDC states that schools are an important tool in combating childhood obesity and improving childhood nutrition through the use of policies and practices (2013a).

A growing body of research that applies behavioral economics principles, such as precommitment and nudging suggests that subtle behavioral cues can go a long way in changing eating habits. The main objective of this study is to investigate the effects of behavioral nudges and pre-ordering on selection of fruits, vegetables, and low-fat dairy among participating elementary and middle school children in the Alachua County School District in Florida. This study builds on previous research that explores potential benefits of pre-selection of meal items and the effect of visual behavioral cues on food choices, and applies pre-selection and visual behavioral nudges to young school going children (Garber et al. 2000; Just et al. 2007). Unlike the study conducted by Ammerman (2012), our approach allows the participating children to pre-select each meal item, rather than simply pre-ordering a set meal. Children in our study are also given visual behavioral cues, nudges, while pre-selecting their meals. These nudges are designed to encourage them to make healthier choices. More specifically, our study employs a pre-ordering computer program that utilizes a combination of messages, labels and the United States Department of Agriculture (USDA) MyPlate information to nudge children into making healthier choices. Thus, our approach incorporates the main benefit of pre-selection - avoiding temptation in the cafeteria, and also goes one step further by nudging children towards healthier choices by using behavioral cues. We predict that pre-selecting lunches via the web based program with built in behavioral cues will result in an increase in the weekly selection of fruits, vegetables, and low fat dairy among participating children.

This study also accomplishes three secondary objectives: 1) development of a simple food selection software (with visual behavioral cues) that can be utilized in schools after the completion of the study; 2) less waste in the cafeteria as students move towards pre-selection and thus cafeterias better match preparations with demand; and 3) healthy eating habits in children that might extend into the home (King 1988).

This study took place over the course of four weeks in High Springs Community School in Alachua County, Florida. In the first two weeks, baseline information on students' selection of fruits, vegetables and low fat dairy were collected for all students, grades 4-7, who purchased a school lunch. In the final two weeks, students that enrolled in the study pre-ordered their lunches in the morning via a web-based computer program. A total of 83 5<sup>th</sup> and 6<sup>th</sup> graders participated

in the study. Data collection concluded at High Springs on May 30<sup>th</sup> 2013. Conclusions and results will be updated once data coding and analysis are complete.

The remainder of the paper is structured in the following manner. In the next section, a review of the relevant literature is presented. Section III, discusses the experimental design and methods. Section IV states the conclusions.

#### **II. LITERATURE REVIEW**

Malnutrition among children takes two distinct forms: under-nutrition and overweight. Approximately 104 million children worldwide are considered underweight, while 1.5 billion children worldwide are overweight (WHO 2013). While under-nutrition is caused by a diet lacking adequate calories or protein, a child consuming adequate calories but not the right mix of foods to constitute a healthy diet and thus consuming inadequate levels of essential nutrients is also considered malnourished. In a study conducted in 1996, Rockett et al. (2001) find that adolescents consumed less than the USDA recommended number of servings of all food groups except dairy, when compared to the USDA Food Pyramid. More recent data taken from the National Health and Nutrition Examination Survey (NHANES) 2003-2004 show that 99.9% of adolescents between ages 12 to 18 consume fruits and vegetables, but only 0.9% meet the USDA recommended amounts of fruits and vegetables (Kimmons et al. 2009). The National Fruit and Vegetable Alliance (2010) published data indicating that adolescents aged 13-17 decreased their consumption of fruits and vegetables by 2% and 6%, respectively, over a recent five year period (2005-2010).

A wide variety of nutrition related interventions are being used to combat malnutrition among children. However, systematic reviews of the literature that focus on evaluating the effectiveness of these interventions largely indicate that these interventions have not been very successful in generating positive effects, such as a reduction in body mass index (BMI) or lowering obesity rates (Flodmark et al. 2006). Heitmann et al. (2009) found that only 3 out of 22 controlled preventative intervention studies discussed in the reviewed published articles were effective in changing body composition in children. However, the studies reviewed by Heitmann et al. (2009) were primarily nutrition education interventions and did not involve the use of behavioral cues. Following the initial implementation period, as nutrition education programs continue, lack of training and understanding on the part of those who deliver the education can hinder the effectiveness of these programs in the long run (Fahlman et al. 2010). In contrast to Heitmann et al. (2009), Doak et al. (2006) reviewed school based interventions and found that 17 out of 25 of these interventions were effective in preventing obesity in school children. Collectively, the findings of previous studies suggest that focusing on changing one behavior at a time, such as eating habits or physical activity rather than both, tends to lead to more robust results.

Furthermore, prior research pertaining to interventions that focuses on behavioral changes suggests that short-term interventions can lead to long-term increases in fruit and vegetable consumption. Steptoe et al. (2003) performed a study to determine the effect of behavioral dietary counseling on low income adults in Great Britain. In their study, behavioral dietary counseling focused on motivation and social learning to encourage changes in behavior. They find that 12 months after an eight-week intervention average consumption of fruits and vegetables was 1.5 servings per day higher than pre-intervention consumption. In another study that focuses on twins, the twins who participated in a one-time intervention with behavioral reinforcement increased their consumption of fruit and vegetable two servings per day on

average, when compared to twins that did not receive the intervention (Faith 2006). Each set of twins had one twin in the control group and the other twin in the treatment group. The intervention occurred over the course of two visits and suggests an increase in consumption can occur with behavioral reinforcement over a short intervention period. Ammerman (2002) reviews behavioral interventions since 1975 and reports that 77% of published studies aimed at increasing the intake of fruit and vegetable found significant results. In addition, on average, reviewed interventions increased consumption of fruits and vegetables by 0.6 servings per day.

New techniques based on the principles of behavioral economics have emerged as a promising avenue to influence food choice behavior in stores, at home, and in the lunchroom. Behavioral economics uses psychology to focus on ways to change people's behavior. Unlike education interventions, behavioral interventions offer an opportunity to change habits without the use of education material and required training. Furthermore, behavioral intervention, such as product placement or labeling, are often less expensive to implement than education programs.

Behavioral interventions frequently use nudging to influence choices made by individuals without taking away their freedom of choice (Thaler and Sunstein 2009). A nudge can take the form of specific placement of items or the use of colors and labels to affect choice. Many marketing companies use color choices and placement of items on the shelf as a means to influence consumer choice. Hanks et al. (2012a) study the effect that convenience has on food purchases in the lunchroom. By placing items in inconvenient locations they find that high school students are less likely to consume those items. In their study, placement of subs and low fat dairy in the convenience line led to a 28% decrease in selection of unhealthy foods, such as a nudge to increase consumption of healthier food items in school lunchrooms. Companies such as

Google are already using various nudges to encourage their employees to eat healthier (Kuang 2012). In a study conducted by Dr. Thorndike, foods were labeled to indicate their level of healthiness with red (unhealthy), yellow or green (healthy). She found an increase in selection of 4.5% in green-labeled foods and a 9.2% decrease in red labeled foods (Park 2012).

Pre-ordering can help resolve issues related to self-control and potentially increase purchases of healthier food items, such as fruits and vegetables. Just (2010) hypothesizes that allowing children to preselect their meals before mealtime may result in more nutritious selections. Pre-ordering ties into the concept of convenience and how it can affect food choices in different environments. Pre-ordering, as indicated in previous literature can cut down on waste and increase consumption. Just et al. (2010) indicates that going to grocery stores hungry can increase probability of consuming unhealthy foods. For this reason pre-ordering has been used with Supplemental Nutrition Assistance Program (SNAP) recipients to increase consumption of fresh fruits and vegetables. Preordering can pre-empt hunger based choices and change behavior by eliminating spontaneous decisions (Hanks 2012b).

In this study, the use of web-based software program to pre-order school lunches combines convenience and nudging to incentivize adolescents in the treatment group to select healthier meals. Students participating in the study pre-ordered their lunches in homeroom shortly after arriving at school, thus the temptation of giving in to impulsive hunger-driven selections is likely reduced. The software program developed for this study has a fixed cost associated with its development and does not require any additional implementation costs aside from the time required for pre-plating. Thus, this is a low cost intervention that can be utilized with low start up cost in any school. Given the prevalence of childhood obesity and its serious health consequences, more research is needed to develop new low-cost strategies that can lead to prevention of childhood obesity. Behavioral interventions offer an opportunity to change habits by the use of cost-effective sustainable solutions that do not require development of detailed educational materials and expensive training.

## **III.METHODOLOGY**

## **Data Collection:**

This pilot took place at High Springs Community School in the Alachua County School District (Florida) over the course of four weeks from May 6<sup>th</sup> 2013 to May 30<sup>th</sup> 2013. Students from 4<sup>th</sup> and 7<sup>th</sup> grade acted as the control group and participating students from 5<sup>th</sup> and 6<sup>th</sup> grade constituted the treatment group. High Springs Community School is a pre-K through 8<sup>th</sup> grade school offering the unique opportunity to use 4<sup>th</sup> graders as a control group for 5<sup>th</sup> graders and 7<sup>th</sup> grade students as a control group for 6<sup>th</sup> graders within the same school. The first two weeks of the study were dedicated to collecting baseline data and the intervention was implemented in the last two weeks of the study period. Prior to starting the study, Institutional Review Board (IRB) approval was requested and received. Children in grades 5 and 6 that signed the consent form and provided their PIN (Personal Identification Number) were permitted to pre-order their lunches and were randomly assigned into one of the two treatment groups. In accordance with IRB regulations, children participating in the study had the option to withdraw at any time during the intervention period.

During the two-week intervention period, students enrolled in 5<sup>th</sup> and 6<sup>th</sup> grade that had consented to participate in the study pre-ordered their lunches in the mornings on days they planned to purchase a school lunch. The students pre-ordered using a software program designed

specifically for this study<sup>2</sup>. At lunchtime the students picked up their pre-plated meals in the lunch line and paid for them as usual. At this time, the participating students could also purchase additional a la carte items. Alachua County schools participate in the National School Lunch Program (NSLP) and must follow the rules of the program. Thus children that pre-ordered were prompted to select at least three items if they did not do so while pre-ordering. NSLP guidelines stipulate that three components (e.g., meat/meat alternative, fruit, vegetable, grain, or dairy item) must be taken to be considered a reimbursable meal. Further, if they ordered more than one item from any category, they were reminded that they would need to pay extra for each additional item. All these prompts were created, after discussions with school cafeteria staff and by observing the process in the school cafeteria for a few days, to replicate the prompts that children usually hear in the lunchroom.

Baseline data were collected to have comparison data on the fruit, vegetable and dairy selection prior to the intervention. Alachua County schools do not record the fruit, vegetable, and dairy selections made by children; instead the cafeteria cashiers only record the meat/meat alternative and a la carte items purchased. For this reason, cameras were set up to record the complete meals that were selected and purchased by the students. Purchase logs were obtained from the school cafeteria; these logs indicate the meat/meat alternative selected and a la carte items purchased by each child on a daily basis. The video recordings were matched to the purchase log to create a database of meals purchased for every child that ate in the cafeteria during the study. Individual students were tracked across days via their PIN used to complete transactions in the lunchroom.

<sup>&</sup>lt;sup>2</sup> The software was developed by Perq advertising Pvt. Ltd. (<u>http://www.perq.in/</u>) with direction from the researchers.

The students who agreed to participate in the study were randomly assigned into one of two treatment groups by PIN. Participants were randomized into treatment groups prior to using the pre-ordering software. Each student remained in the same treatment group for the duration of the study.

Two versions of the pre-ordering software were developed which corresponded with the two treatment groups. The first treatment group (treatment 1) consisted of students who preordered using the software program with no behavioral cues. In both versions, each food was listed in the category in which it belonged, such as broccoli as a vegetable and apple wedges as a fruit (Figure 1). This was to ensure that the students knew which category each item was considered so they knew when they would be charged extra. The students assigned to the second treatment group (treatment 2) received nudges while pre-ordering. In the version of the software with behavioral nudges (treatment 2), the students selected their meals and if their meal did not contain all five components - main entrée<sup>3</sup>, grain, fruit, vegetable and dairy- they received a message stating: "Your meal does not look like a balanced meal." In addition to the message a plate was shown with highlighted areas that corresponded to the items that they did not select. They were then given the option to change their order (Figure 2). The computer program recorded the first set of choices made by the individual and the final set of choices. In keeping with USDA guidelines, in both versions of the program, the student received a message telling them that their meal will charged as a la carte if less than 3 items were ordered. Figure 3 shows the message that they received if they order only two items, main entrée and grain in this case.

<sup>&</sup>lt;sup>3</sup> The MyPlate guidelines use protein, grain, fruit, vegetable and dairy as the component names. The NSLP guidelines are very similar with meat/meat alternative being used instead of protein. The cafeteria staff at High Springs referred to the meat/meat alternative as main entrée. The program employed the terminology used by the High Springs' personnel to avoid confusion for the students participating. In this paper, we use meat/meat alternative when referencing the NSLP guidelines, protein when referencing the MyPlate and main entrée when referring to the intervention/program.

The message states: "Please select a fruit, vegetable or dairy. Otherwise you will be charged for each item separately".

#### **Econometric Model:**

Food selection data from the baseline period were recorded and grouped into five categories including: main entrée, grain, vegetable, fruit, and dairy. Additional a la carte purchases were noted as well. This provided a baseline of the servings of fruit, vegetables and dairy that each child selected prior to the start of the intervention. The computer program recorded the items that were selected for pre-order during the intervention phase. No additional survey data were collected on the students aside from their PIN while ordering. These PIN were used to match their race, gender and grade level with the school information.

The treatment had a total of 83 students participate over the course of 8 days. Overall there were 300 observations for students who participated in the intervention<sup>4</sup>. Prior to determining the control group for each treatment a t-test was performed. This determined which grade was most similar to 5<sup>th</sup> and 6<sup>th</sup> graders to ensure that any changes observed were a result of the intervention. Data on food choices was collected on grades 4 through 7 during the course of the intervention, including any 5<sup>th</sup> and 6<sup>th</sup> graders that did not participate in the intervention.

To determine the impact of the intervention on selection of fruits, vegetables and low fat dairy, equation 1 is estimated using a difference in difference approach. This same methodology is followed for fruits, vegetables and dairy to determine if an increase was identified in any of these food groups compared to the pre-intervention period. The equation is estimated separately for 5<sup>th</sup> and 6<sup>th</sup> grades. We utilize 4<sup>th</sup> graders as a control group for 5<sup>th</sup> graders and 7<sup>th</sup> graders as a

<sup>&</sup>lt;sup>4</sup> Each student did not participate in the study every day

control for 6<sup>th</sup> graders. In total, 6 equations are estimated to determine the change in selection habits for each of the three food categories and the two grades.

$$y = \beta_0 + \beta_1 D + \beta_2 T + \beta_3 (DT) + \beta_4 r + \beta_5 g + \beta_6 p + \varepsilon$$
(1)

where *y* is defined as the average weekly selection of fruits, vegetables and dairy depending on the equation. *T* indicates the treatment. *T* takes a value of 0 for all 4<sup>th</sup> graders (7<sup>th</sup> graders) and any 5<sup>th</sup> (6<sup>th</sup> graders) who did not participate and 1 for any 5<sup>th</sup> grader (6<sup>th</sup> grader) who participated in the intervention. *D* is a dummy variable for the second time period, to control for any time differences, 0 in the first two weeks and 1 in the second two weeks. The variable of interest then becomes  $\beta_3$  which is simply the multiplication of the two variables with differences to create an interaction term. Additional variables that are taken into consideration include race (r), gender (g), and status of participation in the NSLP (p). Status of participation in the NSLP corresponds to the students' categorization as free, reduced or paid. This information is provided by the school.

#### **IV. CONCLUSION**

Evidence from a systematic literature review of behavioral economics and nutrition literature suggests that subtle nudges can go a long way in impacting habits in the lunchroom. This study uses a combination of previously tested techniques to develop a web-based intervention that focuses on increasing fruit, vegetable and low fat dairy selection among 5<sup>th</sup> and 6<sup>th</sup> graders. Field trial for this study took place from May 6<sup>th</sup> 2013 to May 30<sup>th</sup> 2013 at High Springs Community School in Alachua County. We are in the process of coding and analyzing the data collected. Estimation results and conclusion will be updated once the data analysis is complete.

Behavioral economics is still a developing field and has room for further research. If this field trial provides evidence that nudging during pre-ordering can influence food selection behavior, it will pave the way for exploring similar strategies that utilize pre-ordering to improve eating habits among school going children.

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# VI. APPENDIX

MAIN ENTRÉE	<ul> <li>Oven Fried Chicken with</li> <li>Whole Grain Roll</li> <li>Chef Salad with Fruit Cup and Saltines</li> </ul>	□ Philly Cheesesteak on Whole Grain Bun
EGETABLE		☐Potato Smiles with Ketchup
AIRY	⊡No Fat Chocolate Milk	□Low Fat White Milk
RUIT	□Apple Wedges	☐Honeydew/Cantaloupe
	Apple Wedges	□Honeydew/0

Figure 1: First Screen for Both Versions

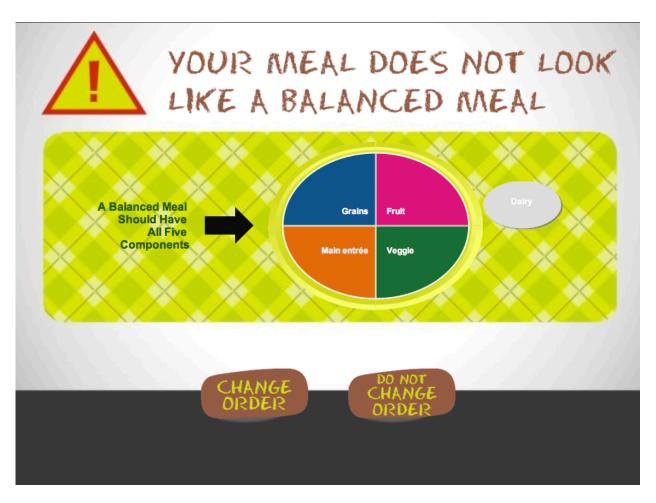


Figure 2: Behavioral Nudge for Treatment Group 2

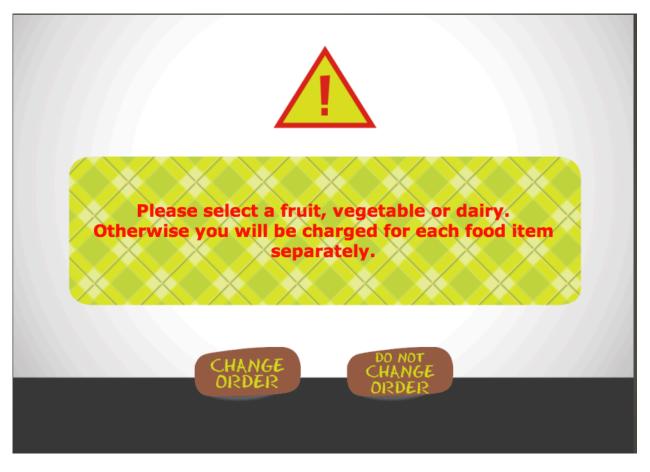


Figure 3: Prompt Given if Less Than Three Items are Ordered