Menu-Labeling Formats and Their Impact on Dietary Quality

Nadia A. Streletskaya
Ph.D. Candidate
Charles H. Dyson School of Applied Economics and Management
B05 Warren Hall, Cornell University, Ithaca, NY 14853
Email: nas245@cornell.edu

Wansopin Amatyakul
Trade Officer, M.S.
Department of Foreign Trade, Ministry of Commerce, Government of Thailand
563 Nonthaburi Road, Nonthaburi, 11000 Thailand
Email: wansopina@moc.go.th

Pimbucha Rusmevichientong
Assistant Professor
Department of Health Science
California State University, Fullerton
KHS 135, 800 N. State College Blvd, Fullerton, CA 92834
Email: prusmevichientong@fullerton.edu

Harry M. Kaiser
Gellert Family Professor,
Charles H. Dyson School of Applied Economics and Management
340C Warren Hall, Cornell University, Ithaca, NY 14853
email: hmk2@cornell.edu

Jura Liaukonyte
Dake Family Assistant Professor
Charles H. Dyson School of Applied Economics and Management
340B Warren Hall, Cornell University, Ithaca, NY 14853
email: Jurate@cornell.edu

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Nadia A. Streletskaya is a Ph.D. candidate in the Charles H. Dyson School of Applied Economics and Management, Cornell University. She received her B.A. in international economics from the Moscow State Institute of International Relations (MGIMO-University), Russia in 2011. Her current research interests are in the fields of behavioral and experimental economics, consumer preferences, labeling, nutrition and marketing.

Wansopin Amatyakul received her M.S. the Charles H. Dyson School of Applied Economics and Management, Cornell University in 2013. She is currently a Trade Officer in the Department of Foreign Trade, Ministry of Commerce of Thailand.

Pimbucha Rusmevichientong is an Assistant Professor in the Department of Health Science of the California State University, Fullerton. She received her Ph.D. (2015) and M.S. (2007) from the Charles H. Dyson School of Applied Economics and Management, Cornell University. Her research interests include health economics, behavioral and experimental economics, applied microeconomics and international trade.

Harry M. Kaiser is the Gellert Family Professor in the Charles H. Dyson School of Applied Economics and Management, Cornell University. He earned his Ph.D. (1985) and M.S. (1981) from University of Minnesota. He teaches and conducts research in the areas of price analysis, marketing, industrial organization, policy, and quantitative methods.

Jura Liaukonyte is the Dake Family Assistant Professor in the Charles H. Dyson School of Applied Economics and Management, Cornell University. She received her Ph.D. (2009) and B.A. in economics from University of Virginia. Her research interests lie in economics of advertising, quantitative marketing, industrial organization, food marketing and labeling and behavioral economics.

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ABSTRACT

The impact of three menu-labeling formats on changes in dietary quality of an away-from-home meal is measured. The analysis is based on a lunchtime experiment using 232 student participants, with a control group and three treatments: (1) a calorie-content posting, (2) a complete nutrition-facts panel, and (3) health-related claims. We find that the calorie content posting lead to the highest calorie reduction, but it was also the only treatment associated with a significant reduction in the fiber content of the meal. The complete nutrition-facts panel treatment resulted in most sizable decreases in problematic nutrient content such as empty calories and calories from fat and added sugar. The health-related claims treatment led to a reduction in carbohydrates and calories from fat. The nutrient density of selected meals remained mostly unchanged across all treatments, but the empty calories proportion of total calories was reduced in the nutrition-facts and health related claims treatments, with the latter also leading to some reduction in added sugar density.

1. INTRODUCTION

Obesity is a tremendous social problem in the United States. In 2012, the World Health Organization categorized over 34% of the U.S. population as obese and over 67% as overweight (World Health Organization, 2012). This problem, which has become substantially more prevalent in the past two decades, is associated with significant health problems such as cardiovascular disease, diabetes, and certain types of cancer. These diseases, in turn, have increased health care costs to approximately $150 billion per year (Lillis, 2010). Obesity also has a negative impact on the labor market by decreasing the probability of employment and lowering wages and productivity for those employed (Cawley and Maclean, 2012).

The energy imbalance between calorie intake and calories expended is the primary reason for the widespread obesity in the United States (Rickard *et al.*, 2013). One possible contributor to the higher calorie intake is the increase in the consumption of away-from-home food, which increased from 25.9 in 1970 to 43.1 in 2012 (Economic Research Service, USDA). This type of food is typically more processed and contains more calories, fat, sodium, and added sugar while having lower dietary fiber and other essential nutrients (Asfaw, 2011). Research also shows that the "supersizing" of food and beverages in fast food restaurants and consumers' underestimation of the actual caloric contents of foods in restaurants has attributed to an escalation of the obesity in the United States (Kuo *et al.*, 2009; Roberto *et al.*, 2010). The average portion sizes of soda, French fries, and hamburgers offered at fast food establishments have increased by 49, 68, and 97 calories respectively since the 1970s (Nielsen and Popkin, 2003); and within the same chain operations, the portion sizes for sale in the United States are larger than those in Europe (Young and Nestle, 2007). The larger portion sizes of these away-from-home foods encourage over-consumption. For instance, a study by Paeratakul et al. (2003) shows that when eating out, adults and children consume, on average, 205 and 155 calories per day more than when eating at home. Moreover, most consumers are not aware of how much they eat as they tend to underestimate the calorie content of their food purchases. This underestimation increases with the meal's size (Burton *et al.*, 2009).

Given the increases in food consumed away from home in the United States and the rise in obesity rates over time, both local and national governments have begun to enact mandatory menu-labeling laws. In 2010, health care reform legislation was signed into law in the U.S., mandating, among other things, that restaurants and similar retail food establishments with 20 or more locations post calorie-content information on their restaurants' menus (FDA, 2010). More stringent menu-labeling laws have been passed and implemented in three cities (New York City, NY; Nashville, TN; and Philadelphia, PA), six counties (King County, WA; Montgomery, MD; Multnomah County, OR; Ulster County, NY; Westchester County, NY; and Suffolk County, NY), and four states (California, Maine, Massachusetts and Oregon) (FoodCalc, 2014). But does menu-labeling impact consumer choice? The purpose of this study is to measure the objective changes in the dietary quality of selected meals as a result of several menu-labeling alternatives.

Various national and state or county polls indicate that Americans are in favor of menu-labeling policies (see Friedman, 2008), however little is known about the comparative effectiveness of different menu-labeling standards in leading to healthier selections. In theory, most menu-labeling formats should reduce consumers' search costs and improve their understanding of nutrition information, thereby removing optimistic bias (such as calorie underestimation) and encouraging healthier selections (Berman and Lavizzo-Mourey, 2008; Dumanovsky et al. 2010).

The current literature on the effects of menu labeling on consumer choices and preferences is mixed. For example, Cranage et al. (2004) and Chu et al. (2009) estimated that posting calorie content and limited nutritional information about entrée items led to a 47-67% drop in the number of high-fat and high-calorie entrées selected. Webb et al. (2011) found that 74% of customers considered nutritional information useful to their selection process. Webb et al. (2011) displayed nutrition information for all menu items in a hospital cafeteria and found that 74% of customers considered the information useful to their selection process; moreover, the posting of such information corresponded with a significant increase in the sales volume of healthier side dishes and snacks, whereas no corresponding change in the sales volume of main entrées was observed. By contrast, Harnack et al. (2008), Finkelstein et al. (2011) and Elbel et al. (2009) found no significant difference in the calories consumed by participants selecting from menus with and without calorie-content information. Yamamoto et al. (2005) reported similar results based on an experimental study of adolescents exposed to calorie- and fat-content labeling. Similarly, Downs et al. (2009) found insignificant and conflicting correlations between posted calorie values and number of calories purchased, suggesting that for some people calorie-content postings could have a perverse effect, actually promoting items with higher fat and calorie content.

Studies focusing on menu-labeling formats that go beyond basic calorie- and nutritional-content information are less common. The current literature is rich on the effects of calorie-content postings on consumer choices and preferences, but, to our knowledge, no study prior to this one has attempted with internal consistency to assess the effects of a variety of menu-labeling formats, including non-calorie information, on a consumer's overall dietary decisions. One reason such a study is important is that anti-obesity policies may be less effective owing to a "spillover" effect: for example, when a consumer decreases his or her soda consumption due to a high calorie label, he might offset this decision by purchasing a chocolate cookie, or eat a bigger portion of the main entree, in which case the net effect on calorie and nutrient consumption is ambiguous. Likewise, a switch to a healthier entrée might be offset by an increase in consumption of dessert or snack items. A comprehensive analysis of menu-item labeling and actual caloric and nutritional content of selected meals allows us to more thoroughly explore the impact of menu labels on the dietary behavior of consumers.

Our analysis is based on a lunchtime experiment using 232 student participants, with a control group and three treatments: (1) a calorie-content posting, (2) a complete nutrition-facts panel, and (3) health-related claims. A difference-in-difference regression model is employed to evaluate the relative effectiveness of each these menu-labeling formats within the same setting.

Our results indicate that all treatments significantly impacted the dietary composition of selected lunches. Total calories, calories from fat and total carbohydrates consumed were consistently reduced by all treatments; empty calories[1] were most significantly reduced by the nutrition-facts panel, which explicitly labeled various fats and added sugars. Similarly, while saturated fat content was cut by both the calorie-posting and nutrition-facts panel labeling, the latter treatment had the strongest effect, likely because of the explicit labeling of fat content. Finally, the calorie-posting treatment was the only treatment associated with a significant reduction in the fiber content of the meal.

In addition to examining the total energy and nutrient content of the selected lunches, we explored the potential changes in the nutrient density of the selected meals. We find that the overall dietary quality, expressed as nutrient density per total calories consumed, mostly does not change under any of the studied menu-labeling formats. The health-related claims treatment had the most impact on the dietary quality through slightly reducing the added sugar density and the proportion of empty calories among total calories selected; the empty calories part of total energy content was likewise reduced in the nutrition-facts panel treatment.

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[1] Empty Calories are the calories from solid fats and added sugars in foods and beverages, definition used by both FDA and USDA.

2. EXPERIMENTAL DESIGN

A total of 232 university students participated in the experiment, which was held at noon to coincide with lunch. All participants were recruited through online ads on the university's experimental lab platform, and subjects were randomly assigned to the treatments and control groups. The observed individual characteristics were sufficiently balanced across the treatments with the exception that the health-related claims treatment had significantly more females, who were less educated than the rest of the treatments or control. We tested whether the dependent variables (measures for nutrient content or nutrient density) were statistically significantly different for the participants of different gender in this treatment, and found no such significance. Subjects received a single $15 cash payment for their participation and in addition received a $10 voucher that could be spent exclusively on food items selected from menus provided in the experiment. Each participant took part in one session only, making two selections: a control selection from the menu with no labeling, and the treatment selection from a labeled menu. The menu used always had the same items and prices offered across all sessions, with labeling varying in the second selection depending on the treatment. A list of menu items offered, as well as their prices and caloric content (shown only for the calorie-content treatment) is provided in Table 1.

<Insert Table 1 here>

Once seated, subjects were given an overview of the experiment. Participants were informed that spending more than the given $10 endowment on their menu choices was permitted, but would result in the excess being deducted from their $15 participation payment. If, however, a participant spent less than the $10 voucher, s/he would not receive the difference back in cash. The reason we imposed this limit was to preclude participants from increasing their participation reward by ordering only inexpensive snacks or not ordering anything at all (that is, essentially not participating). The $10 endowment was originally set to reflect a representative total lunch cost including a beverage and a desert or snack item in the cafeteria used for the experiment, and the menu offered was developed accordingly. Even though subjects could spend up to $10 on their lunch, a significant number of participants (35%) spent well under $10 and around 11% of the participants spent more than $10[2]. People opting to minimize their cognitive load and revert to patterns typically used in food choice settings would explain the fact that a significant number of participants underspent their endowment (Kahnemann, 2011). Just and Payne (2009) specifically looked at food purchasing behavior, and argued that heuristics and rules of thumb are commonly used in food selection decisions. The behavior observed in this study seems to confirm that a significant number of people, even when under a strong incentive to spend all $10 of the endowment, will underspend, possibly in accordance to their lunch habits.

Subjects were told that one of the menus had been randomly drawn before the start of the experiment, and the choices on that menu would become binding for the subjects, i.e., subjects would use that menu for their lunch selection. This implied that either one of the two set of menu selections had the same probability of becoming the participant's actual meal, and provided an incentive to treat item selection from both menus seriously and carefully consider all information available at the time of the selection. Thus, participants had the incentive to complete each menu as if it would be the one chosen, revealing their true preferences.

The experiment began with the unlabeled menu being presented to the subjects on their computer screens and each subject indicating next to each item's description the number of servings (if any) of that item that s/he would like. The total cost of the selected items was

[2] The endowment limit and rules pertaining to the limit were the same across all the treatments and the control. Therefore, if there was any bias introduced by the structure of the compensation, it is differenced out in our estimation.

then automatically calculated and displayed at the bottom of the menu. (Item prices were identical to those charged by the local cafeteria that provided the items.) The menus included items actually offered at the university cafeteria and featured food ranging from relatively healthy (e.g., fresh fruit and vegetables) to unhealthy (e.g., bacon cheese burger or peperoni pizza).

The experiment included a short television break between the first and second menu-selection phases in order to minimize boredom and to discourage subjects from making "automatic" or unrealistic choices. After completing their control selection, subjects were then shown a six-minute video of excerpts from the television show "Portlandia," a comedy series that airs on the Independent Film Channel. The first 3.25 minutes of this video were taken from an episode entitled "One Moore Episode" (2012) and the remaining 2.30 minutes were from an episode entitled "Mayor is Missing" (2011). After the television break, the same menu was presented to subjects, but now with the various labels depending on the treatment, which included:

1. **Calorie-content posting treatment.** The menu included, in parentheses, the caloric content of each item (see Table 1).
2. **Full nutrition-facts panel treatment.** The menu featured a table of standard nutrition information for each menu item, based on the Food and Drug Administration's Nutrition Labeling and Education Act (see Table 2).
3. **Health-related claims treatment.** The menu contained certain health-related claims about one or more nutrients present in the items (see Table 3).
4. **Control group**. The menu remained unlabeled and identical to the first menu.

At the end of the experiment, subjects completed a computerized questionnaire regarding their general health habits, and certain socio-demographics. The prices for the food items were constant across the control and the three treatment groups.

3. ECONOMETRIC MODEL

To investigate the effect of each menu-labeling treatment, we assessed the total caloric and nutritional content, and nutrient density of each meal in both the first and second selection for each participant. We used Food-A-Pedia[3], a USDA online nutrition-information database, for all non-beverage items, whereas the nutrition information for the beverages was obtained from the relevant manufacturers' official websites, or, in cases where such information was not available online, directly from the nutrition label on the bottle. The information of interest in this study included: total calories, calories from fat, saturated fat, empty calories, cholesterol, protein, carbohydrates, added sugar, sodium, and fiber—i.e., nutrients and other factors typically identified as having an impact on consumers' weight.

The design of the study affords pre- and post-treatment observations on every participant in both the control and treatment groups, allowing for a true difference-in-difference approach in treatment-effects estimation. We base our analysis on two models, first, focusing on the changes in the total energy and nutrient content of selected lunches, and the other, estimating the effect on the nutrient density per gram of the meal.

The models we estimate focus on changes in the overall nutritional content of items selected from the labeled and unlabeled menu. The dependent variables are the differences between the nutritional or caloric content of the selections made from the control menu and those made from the labeled menu: a negative (positive) value is a decrease (increase) in the

[3] Food-A-Pedia can be accessed at https://www.supertracker.usda.gov/foodapedia.aspx

nutrient content of the items selected on the first menu compared to those selected on the second menu, while a zero value signifies no change.

The basic equation for analyzing treatment effects is

$$\Delta Y_i = \beta_0 + \sum_{j=1}^{4} \beta_j TREAT_j + \beta_5 X_i + \varepsilon_i,$$

where ΔY_i is the difference in content or density of nutrient Y from menu 1 to menu 2 for individual i, $TREAT_j$ is a series of treatment dummies from 1 to 3, β_j is the estimated coefficients of $TREAT_i$, or treatment effects, and X_i is a vector of socio-demographic characteristics[4] of individual i, (included to control for any potential demographic composition differences across the control and treatments) and β_5 is a vector of estimated coefficients of X_i. The basic caloric and nutritional measures used were in accordance with the Dietary Guidelines to Americans, 2010 and Dietary Guidelines Advisory Committee Report, 2010 (ARS, 2010a, 2010b). The prices used in the experiment were not set by the experimenters and were taken directly from the university cafeteria; in most cases, changing the menu selection involved a change in the total items purchased, and hence, the price of the total meal. We do not include the change in the unspent balance as a control in our estimation, since the change in the total cost of the menu is endogenous to the treatment.

In addition to the calorie and nutrient content of the meal selections, we examine the changes in the ratio of empty calories to the total energy content of the meal within the same framework. We define the nutrient density as the content of selected nutrient per calorie content of the meal following the current literature (Drewnowski 2009, Streletskaya et al. 2014). We also include beverages in our density measures, given some of the drinks on our menu are a significant source of calories, empty calories, sodium, added sugars, and carbohydrates.

[4] The controls used include gender, race, education and income levels of the participants.

Finally, since participants make item-based choices, they are selecting a bundle of nutrients by selecting a single item, for example a choice of pizza corresponds to a specific bundle of calorie, protein, carbohydrate levels and so on. Thus, to control for the possible correlations in the error terms among the individual regressions, we employ the seemingly unrelated regressions (SUR) estimation approach for both the total content and nutrient density models discussed above.

4. RESULTS

<Insert table 4 here>

A total of 232 university students were randomly assigned to either a control group or one of three menu-labeling treatments as follows: 43 participants in the control group, 57 in the calorie-posting treatment, 67 in the nutrition-facts panel treatment, and 65 in the health-related claims treatment.

The average amount of total calories was around 554 calories, with the standard deviation of 292 calories, in selections from the unlabeled menu, and 539 calories (standard deviation of 275 calories) in the second selections, including both control and treatment groups. On average, experiment participants spent $8.22 on their first selection, and $8.49 on their second selection. Around 35% of participants (37.5% of participants for control selection, and 32.2% in second selection) spent $9 or less on their lunches, while approximately 11% of all participants spent more than $10 (and 7% spent more than $11) on their selections. Further detail on the socio-demographic characteristics of participants and the sample statistics are presented in table 4.

Estimation Results

<Insert Table 5 here>

We present the estimation results for changes in the total energy and nutrient content of the selected meals for all participants in table 5. The total calorie content was reduced in two out of three treatments, and their impact was statistically significantly different from zero at the 5% level. The calorie-posting labeling led to a 144 calorie reduction, or approximately 20%, and was significant at the 5% level (all percentage changes estimates cited in the text are based on a comparison to the content of nutrient in question in the second selection of the control group). The nutrition-facts panel labeling, similarly significant at the 5% level, lowered the total calorie content by around 120 calories, or 17%.

Empty calorie content provides us with information on the nutritional value of the meal beyond satisfying energy requirements. The nutrition fact panel treatment was the only one to reduce the empty calories content, by an approximate 28%, or 65 empty calories, which was significant at the 5% level. It was also the only treatment to affect the added sugar content, leading to an average decrease of 9 grams of added sugars, or 32%, significant at the 10% level.

All treatments significantly reduced the calories from fat content. Calories from fat are often considered to be an indicator of a less healthy diet. The nutrition-facts panel had the strongest effect, reducing it by almost 78 calories (a 32.5% decrease), significant at the 1% level. The calorie-posting treatment, significant at 5%, lowered the calories from fat content by 58 calories, or 24%, and the health-related claims treatment had the lowest impact at the estimated decrease of 53 calories, or 22 %, significant at the 10% level.

Total carbohydrates content was also reduced by all menu-labeling treatments. The calorie-posting label had the strongest impact of around 22 grams, or an estimated reduction of 26%, significant at the 5% level. The nutrition-facts panel and the health-related claims labeling treatments' effect estimates were significant at the 10% level, and led to a 15 grams (17.8%) and 15.3 grams (18.2%) reduction, respectively.

Two of the three treatments significantly reduced saturated fat intake. The nutrition-facts labeling led to a decrease of the saturated fats content by an average of 3 grams (significant at the 1% level), equivalent to a decrease of approximately 30%. Saturated fats content was also lowered through the use of calorie-posting labeling, though to a lesser extent. The treatment reduced saturated fats by around 2 grams, or 20%, significant at the 10% level.

Finally, fiber content was only negatively affected by the calorie posting treatment. The average decrease of fiber in this treatment was estimated at around 1 gram, or 25% (at the 5% significance level). Cholesterol, protein and sodium contents were not affected by any of the treatments in the study in any significant way.

To provide a different evaluation of the dietary quality of selected meals, a nutrient density analysis was also conducted. Nutrient dense diets are generally associated with healthier dietary patterns (ARS 2010) and may lessen the feeling of hunger, leading to weight loss and improved health over time (Fuhrman et al. 2010). Accordingly, when evaluating the dietary quality of the meal, it is important to consider not only changes in total energy and nutrient content, but also changes in nutrient density.

<Insert Table 6 here>

The estimation results for changes in the nutrient density of the selected meals are presented in table 6. While the total energy and nutrient content were affected by the labeling treatments, the nutrient density composition did not change significantly. The health-related claims treatment reduced the added sugars content by 1.8 grams per 100 calories of the meal, equivalent to a decrease of almost 40% compared to the added sugar density in the second selection of the control group. However, this estimate is only significant at the 10% level.

The ratio of empty calorie content to total calorie content of the meal was the only other affected density measure. Both the nutrition-facts panel and the health-related claims treatments had a significant at the 10% level impact, leading to 7 (or 22.5% less) and 9 (29% less) fewer empty calories per 100 total calories respectively.

5. CONCLUDING REMARKS

The main objective of this research was to examine the impacts of several menu-labeling formats on nutritional composition of meals selected away from home. We used a laboratory experiment with a difference-in-difference design to estimate the effects of the three menu-labeling policies (calorie posting, nutrition-facts panels, and health-related claims) on nutrient composition and density of selected meals, measured across nine different nutrients or nutrient groups, including empty calories, calories from fat, saturated fat, cholesterol, added sugar, carbohydrates, protein, fiber and sodium.

The main finding of this research is that menu-labeling has a statistically significant impact on several caloric and nutrient content measures. All three menu-labeling alternatives reduced calories from fat and carbohydrate content. The calorie-posting treatment led to the highest reduction in total calorie content of the selected meal, while the nutrition-facts panel was most successful at reducing empty calories, calories from fat content and saturated fat content. The nutrition-facts panel labeling was the only treatment to reduce added sugars content, and, not surprisingly, the only treatment that provided participants with explicit information on added sugar and saturated fats content of selected items. Saulais (2012), Variyam et al. (2001) and Chandon and Wansink (2007) highlight that people tend to lack objective knowledge about food dietary quality, so it is not surprising that the type of labeling format had a strong influence over the actual changes in caloric and nutrient content. The calorie posting treatment provided no information on any other nutrients, and led to a reduced fiber content, while full nutrient-facts panel labeling, which provided information on fiber content of the menu items, avoided this problem. The health-related claims panel relied on participants' pre-existing knowledge of caloric and nutrient composition of most foods, and failed to impact the saturated fat content that was affected by the other two labeling treatments.

While the total energy and nutrient content was significantly affected by the labeling treatments, the nutrient densities were largely unchanged and resulted only in several small statistically significant changes. In other words, while the treatments reduced calories and some nutrients, the nutrient composition of the meals per calorie consumed remained mostly unchanged. Both the nutrition-facts panel and the health-related claims treatments reduced the share of calories from solid fats and added sugars, or empty calories, in the total energy content of the meal. The health-related claims treatment, which was the least effective in reducing total calorie content, was the only one to lead to a significant decrease in added sugar density. Previous research indicates generally low knowledge about added sugars content and its adverse effects on health (Variyam et al. 2001): this labeling treatment explicitly outlined the potential problems with added sugars consumption, and might have led people to qualitatively change their dietary composition, opting out of items they thought had added sugars.

In general, while calorie postings led to most dramatic decrease of calorie content, treatments that provided more information about the dietary composition or quality of the lunch items, especially the nutrition-facts panel, seemed to have more of a comprehensive effect on dietary quality.

One caveat with respect to our own study's results concerns the magnitude of the estimated impact, as our study was conducted in a laboratory setting (Levitt and List, 2007). In a laboratory study such as ours, menu-labeling information is inevitably presented to participants differently from how it would be in an actual cafeteria or restaurant. We offered our participants a computerized menu instead of an actual menu (or menu board), and the additional information made available to the treatment groups was salient. Also, the study estimated only a one-shot impact, i.e., the effects of menu-labeling on treatment participants over the course of just one session, with two different menus, which may not accurately depict the long-term effects of menu-labeling initiatives.

Despite these limitations, this study contributes meaningfully to the existing literature on the effectiveness of menu labeling on consumer purchasing behavior and dietary choices. Although there have been numerous prior studies that have evaluated the impact of various menu-labeling formats separately, to our knowledge the *relative* effectiveness of the three menu-labeling formats (calorie posting, nutrition-facts panels, and health-related claims) has not been investigated in an internally consistent and comparable framework. In particular, the difference-in-difference design of the experiment allowed for a detailed examination of participants' choices in a controlled laboratory environment. Finally, using objective measures of nutrient content for the whole meal allowed us to evaluate the changes in the dietary composition of the meals even in cases of health halos, where switching to one healthier item leads to an increase in consumption of side dishes or high calorie drinks (Chandon and Wansink, 2007).

Further avenues of related research might be to examine the long-term effects of different menu-labeling policies, including the nutritional effects on all meals in a day for an extended period of time, and explore the difference between perceived and actual changes in dietary quality of the meals.

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TABLES

Table 1. List of items offered on the lunch menu, their respective prices and caloric content

Food Menu Items	Prices ($)	Calories
Diet Pepsi	2	0
Pepsi	2	250
Gatorade Low Calorie	2.33	45
Mountain Dew	2	290
Unsweetened Iced Tea LIPTON	2.15	0
Original Iced Tea LIPTON	2.15	150
Lemonade Tropicana	2.59	300
Bottled Water	1.95	0
Green Salad with Sesame Oriental/Balsamic Dressing	7.03	137
Green Salad with Tuna with Sesame Oriental/Balsamic Dressing	7.03	316
Veggie Cup with Hummus or Light Ranch	4.32	84
Cheese Pizza (personal pan 6")	5.18	517
Pepperoni Pizza (personal pan 6")	5.83	530
Local Bacon Cheeseburger	7.52	683
Lean Turkey Whole Grain Sandwich	6.16	329
Macaroni & Cheese	4.53	491
Doritos Nacho Cheese	1.55	294
Fresh Apple	1	72
Fresh Banana	1	105
Fresh Orange	1	62
Chocolate Chip Cookies	2.2	108
Brownie Bar	1.94	224

Table 2: An example of a pop-up nutrition table

Nutrition Fact: Diet Pepsi	
Calories	0
Calories from Fat	0
Total Fat (g)	0
Sat Fat (g)	0
Tran Fat (g)	0
Cholesterol (mg)	0
Sodium (mg)	60
Total Carb (g)	0
Dietary Fiber (g)	0
Sugar (g)	0
Protein (g)	0
Vitamin A (μg RAE)	0
Vitamin C (mg)	0
Calcium (mg)	0
Iron (mg)	0

Table 3. A list of all pop-up health claims associated with items offered on the lunch menu

Food menu	Health-related claims
Pepsi, Mountain Dew, Original Iced Tea LIPTON, Lemonade Tropicana	Sugary beverages increase the risk of developing diabetes. Drinking less than two sugary drinks daily leads to a 27% higher risk of developing diabetes. Sugary beverages also contain a high level of sodium, which raises blood pressure and increases risk of developing heart disease and stroke (Malik et al. 2010; Johnson et al. 2009).
Green Salad with Sesame Oriental/Balsamic Dressing, Veggie Cup with Hummus/Ranch, Lean Turkey Whole Grain Sandwich, Fresh Apple	Fiber maintains the health of the digestive tract and lowers the risk of certain cancers, heart disease, and diabetes. Fiber is useful for weight management, as it helps control the appetite (Physicians Committee for Responsible Medicine, 2012).
Green Salad with Tuna with Sesame Oriental/Balsamic Dressing	Regular consumption of EPA and DHA, which are Omega-3 fatty acids, is associated with reduced cardiac deaths among individuals with and without pre-existing cardiovascular disease (MacKay, 2012).
Cheese Pizza, Pepperoni Pizza, Local Bacon Cheeseburger, Macaroni & Cheese, Doritos Nacho Cheese	Consumption of cholesterol and saturated fatty acids causes higher blood cholesterol levels, which is one of the risk factors for heart disease. High sodium contained in this product raises blood pressure, which increases the risk of heart disease and stroke (American Heart Association, 2012; U.S. Food and Drug Administration, 2013).
Fresh Banana, Fresh Orange	Dietary potassium can lower blood pressure, reduce risk of developing kidney stones and decrease bone loss (USDA, 2012).
Chocolate Chip Cookies, Brownie Bar	This product contains added sugar, which increases caloric intake without providing any nutrient adequacy. The sodium contained in this product raises blood pressure, which increases the risk of heart disease and stroke (USDA, 2010; U.S. Food and Drug Administration, 2013).

Table 4. Some demographic characteristics of participants by experimental conditions

	Control	Treatments		
		Calorie-content posting	Nutrition-facts panel	Health-related claims
Composition of the selected meal	Calories (st. dev.)			
Average calories, control selection	615.698 (263.892)	558.123 (294.702)	574.507 (317.968)	487.754 (274.15)
Average calories, treatment selection	701.070 (212.551)	503.175 (278.678)	547.284 (271.512)	457.923 (271.886)
Price of selection	$ (st. dev.)			
Average lunch price, control selection	8.980 (1.945)	8.588 (3.310)	7.770 (2.998)	7.868 (3.696)
Average lunch price, treatment selection	9.359 (1.048)	8.381 (3.329)	8.226 (2.917)	8.293 (3.284)
Gender	% (n)			
Male	39.5 (17)	42.1 (24)	52.2 (35)	16.9 (11)
Female	60.5 (26)	57.9 (33)	47.8 (32)	83.1 (54)
Age (years)	% (n)			
21 or less	62.8 (27)	54.4 (31)	47.8 (32)	50.8 (33)
More than 21	37.2 (16)	45.6 (26)	52.2 (35)	49.2 (32)
Ethnicity	% (n)			
Caucasian	39.5 (17)	38.6 (22)	43.3 (29)	47.7 (31)
Asian/Asian American	44.2 (19)	38.6 (22)	37.3 (25)	35.4 (23)
African American	11.6 (5)	15.8 (9)	7.4 (5)	9.2 (6)
Hispanic/Latino	4.7 (2)	1.7 (1)	6.0 (4)	6.2 (4)
Others	0.0 (0)	5.3 (3)	6.0 (4)	1.5 (1)
Education level	% (n)			
High school	79.1 (34)	42.1 (24)	61.2 (41)	16.9 (11)
College graduate or higher	20.9 (9)	57.9 (33)	38.8 (26)	83.1 (54)
Number of subjects	N			
	43	57	67	65

Table 5. SUR Estimation Results for Total Energy and Nutrient Content

	Energy and Nutrient Content									
Treatments:	Calories	Empty Calories	Calories from fat	Cholest. (mg)	Added Sugar (g)	Protein (g)	Carbo-hydrates (g)	Fiber (g)	Sodium (mg)	Saturated Fat (g)
Calorie-content posting	-144.006**	-50.212	-57.836**	-6.416	-6.891	-1.866	-22.138**	-1.053**	-142.375	-2.095*
	(58.664)	(30.525)	(27.940)	(8.378)	(5.016)	(3.467)	(8.666)	(0.515)	(119.827)	(1.221)
Nutrition-facts panel	-119.680**	-65.292**	-77.691***	-10.436	-9.087*	-0.289	-14.956*	-0.373	-125.977	-3.003***
	(54.617)	(28.419)	(26.013)	(7.800)	(4.670)	(3.228)	(8.068)	(0.480)	(111.560)	(1.137)
Health-related claims	-92.190	-38.807	-52.860*	-3.341	-7.444	0.558	-15.322*	-0.711	-49.623	-1.904
	(60.583)	(31.524)	(28.854)	(8.652)	(5.180)	(3.581)	(8.950)	(0.532)	(123.746)	(1.261)
R-squared	0.1258	0.1636	0.1243	0.105	0.1076	0.0837	0.0826	0.0606	0.1103	0.1426

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; # of observations = 232. Controls include gender, race, education and income.

Table 6. SUR Estimation Results for Nutrient Density

	Densities of Nutrients								
Treatments:	Empty Calories	Calories from fat	Cholest. (mg)	Added Sugar (g)	Protein (g)	Carbo-hydrates (g)	Fiber (g)	Sodium (mg)	Saturated Fat (g)
Calorie-content posting	-0.037	-0.002	0.005	-0.004	0.004	-0.006	0.001	0.175	-0.001
	(0.046)	(0.004)	(0.012)	(0.010)	(0.006)	(0.014)	(0.002)	(0.218)	(0.001)
Nutrition-facts panel	-0.071*	(-0.002)	0.005	-0.011	0.008	0.002	0.002	0.119	-0.002
	(0.043)	(0.004)	(0.011)	(0.010)	(0.006)	(0.013)	(0.002)	(0.203)	(0.001)
Health-related claims	-0.090*	(-0.002)	0.007	-0.018*	0.008	-0.016	0.0003	0.169	-0.002
	(0.046)	(0.004)	(0.012)	(0.011)	(0.006)	(0.015)	(0.002)	(0.225)	(0.001)
R-squared	0.1541	0.0683	0.077	0.101	0.0665	0.0707	0.0786	0.0519	0.1139

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; # of observations = 232. Controls include gender, race, education and income.