Calorie Label Formats: Using Numeric and Traffic Light Calorie Labels to Reduce Lunch Calories

Eric M. VanEpps, Julie S. Downs, and George Loewenstein

In a field experiment involving online workplace lunch orders, this study examines the impact of numeric and traffic light calorie labels on calorie intake. Employees of a large corporation ordered lunches through a website of the authors' design, on which they were presented menus with numeric calorie labels, traffic light labels, or both together, and the authors compared the calorie content of the ordered lunches with that of diners randomized to receive no calorie information. Each label type reduced lunch calories by approximately 10%. Nutrition knowledge was not improved by any menu format. Traffic light labels achieved meaningful reductions in calories ordered even in the absence of numeric information, and the authors found no apparent benefit or detriment of combining label types. These findings suggest that consumers may benefit most from help in identifying relatively healthier choices but rely little on information about the exact caloric content of items.

Keywords: calorie labeling, traffic light labeling, nutrition, online decision making, field experiment

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Though the overall prevalence of obesity in the United States has plateaued in recent years (Flegal et al. 2012), obesity rates remain high (Ogden et al. 2013), with negative consequences for morbidity and mortality (Flegal et al. 2013) and medical costs (Finkelstein et al. 2009). Legislative and regulatory interventions to address the problem have focused primarily on the provision of nutrition information for consumers (Pomeranz and Brownell 2008). For example, U.S. Food and Drug Administration (FDA) requirements to be implemented in 2016 mandate numeric calorie labeling for food prepared on-site at all chain restaurants, movie theaters, and convenience stores with 20 or more locations, in accordance with the Patient Protection and Affordable Care Act of 2010 (Pub L No 111–148).

Thus far, the evidence on whether calorie labels reduce calorie intake has been mixed (Harnack and French 2008; Swartz, Braxton, and Viera 2011; Kiszko et al. 2014; Long et al. 2015). Research has documented substantial consumer awareness of labeling, indicating that the measures have had some success in getting the information to the population (Kiszko et al. 2014). Some studies have also shown that calorie labels reduce consumption, but with the exception of one prominent study conducted at Starbucks (Bollinger, Leslie, and Sorensen 2010), most of the studies yielding positive findings have involved hypothetical choices (Burton et al. 2006; Burton, Howlett, and Tangari 2009; Dowray et al. 2013; Kiszko et al. 2014) or parents' choices for their children (Tandon et al. 2010). In contrast, most field studies involving adults making real decisions for their own consumption have revealed small or null effects (Swartz, Braxton, and Viera 2011; Kiszko et al. 2014; for a meta-analytic review, see Long et al. 2015).

Our focus in this study is on the provision of numeric or graphic (traffic light) calorie labeling on workplace lunches ordered via the Internet. Ordering both prepared foods (mostly lunch) and groceries via the Internet is a rapidly growing phenomenon (IBISWorld 2014; Kimes 2011). Pizza and sandwich delivery services have benefited from online ordering for years, websites like GrubHub.com and Seamless.com have emerged to provide online ordering and delivery services for restaurants, and even Starbucks has launched a web-based app to facilitate Internet ordering (Wong 2014). Such Internet orders will also be subject to the new FDA mandate (FDA 2014; Federal Register 2014). However, the extant literature has not yet investigated whether calorie labels affect real food choices made over the Internet.

Although existing legislative approaches require nutrition information to be presented as numeric calorie labels, greater traction may be gained from more intuitive, nonnumeric—e.g., graphic—labels, which have been shown to improve usability (Andrews, Burton, and Kees 2011; Grunert and Wills 2007; Schulte-Mecklenbeck et al. 2013) and, in preliminary field research, to change behavior (Downs, Wisdom,

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and Loewenstein 2015). Among its benefits, Internet ordering permits the provision of calorie information in such novel formats.

Traffic light labels are almost certainly the most common type of nonnumeric labels. Designed to provide easily understood information about whether an item contains a healthy (green), marginal (yellow), or unhealthy (red) level of a given nutrient, traffic light labels have been shown to be especially helpful for consumers lacking the numeracy or domain expertise to make use of raw calorie numbers (Burton and Kees 2012; Hawley et al. 2013; Rothman et al. 2006).

Traffic light labels have been implemented, albeit on a voluntary basis, on packaged foods in the United Kingdom (Food Standards Agency 2007). Applied to multiple nutrient levels (fat, saturated fat, sugar, salt, and calories), these labels have been found to guide consumers more consistently to healthful products, compared with numeric and other label types (Andrews et al. 2014; Hawley et al. 2013; Hersey et al. 2013), and appear to be particularly helpful for consumers with low self-control (Koenigstorfer, Groeppel-Klein, and Kamm 2014). Again, however, few field experiments have examined the impact of traffic light labels. One study conducted in a hospital cafeteria in the United States, for example, did not examine traffic light labels applied to calories, but labeled food items with a traffic light that summarized the overall nutrient value (not specifically calories) of menu options. In this study, purchases increased for items labeled as green and decreased for items labeled as red (Thorndike et al. 2012).

In the two studies closest to the current study, Ellison, Lusk, and Davis (2013, 2014) examine the impact of numeric calorie labels and of numeric labels coupled with traffic light calorie labels, compared with no calorie information, in a full-service restaurant. Neither study indicates that numeric calorie information has a significant impact on calorie intake, but in both studies, adding traffic lights to numeric labels reduced total calorie consumption. Indeed, the second study indicates that introducing traffic light labels has a larger effect than does a moderately high (10%–15%) tax on high-calorie foods or equivalent subsidies on low-calorie foods (Ellison, Lusk, and Davis 2014). However, neither of these studies examines the impact of traffic light labels without numeric labels, so they were unable to address whether traffic light calorie labels are effective on their own or whether they interact with numeric calorie information to affect behavior. Such an interaction effect might occur if traffic light labels provide prescriptive information that directs attention toward the numeric information.

The current study aims to disentangle the effects of numeric and traffic light calorie labels and to study online food orders in a workplace consumer setting. This combination of features includes several advances relative to previous studies. First, we focus on individual consumers' choices rather than on choices made by groups of diners ordering and eating together (as in Ellison, Lusk, and Davis 2013, 2014), whose presence and behavior might affect one another's choices (De Castro and Brewer 1992; Herman, Roth, and Polivy 2003). Second, we are able to assign participants to experimental treatments at an individual level. Prior studies (e.g., Thorndike et al. 2012) introduced experimental manipulations at a group level and at different points in time, which introduces potential history confounds. Third, we collected repeated observations from individual consumers in a longitudinal design in which individuals could place multiple orders over the space of several weeks. Doing so provides increased statistical power as well as the opportunity to explore whether the effects of labels change after repeated exposure to the labels. Fourth, by shifting the ordering decision online, we provided consumers with nutritional information in a setting in which they had the time and cognitive resources to use that information. Fifth, the online setting enhanced control over the intervention, eliminating, for example, other encouragements for healthy eating (e.g., signs advertising low-calorie items) that are common in cafeterias, as well as transient influences, such as the food's smell or visual appearance (Burton, Howlett, and Tangari 2009; Burton and Kees 2012; Glanz et al. 1998; Harnack et al. 2008).

Predictions

In parallel with previous studies examining numeric and nonnumeric calorie labels, our primary predictions focus on the impact of these labels on calories ordered, with our first prediction addressing the effect of numeric calorie labels alone:

> H_1: Numeric calorie labels will lead participants to reduce the number of calories in their orders, compared with the baseline (unlabeled) condition.

Similarly, traffic light labels for calorie content provide clear prescriptive guidance, which customers should find salient and useful when making decisions on the Internet. Thus we make the corresponding prediction about their potential impact on food choices:

> H_2: Exposure to traffic light labels, even in the absence of numeric information, will lead to a reduction in calories compared with the baseline (unlabeled) menus.

Finally, the combination of traffic light labels and numeric calorie labels should garner at least the benefits of either intervention alone, and may possibly further improve the healthfulness of diners' decisions by increasing the attention paid to labels and the interpretability of the information communicated. In line with findings reported by Ellison, Lusk, and Davis (2013, 2014) regarding the beneficial impact of a combined label, we predict:

> H_3: The combination of traffic light and numeric calorie labels will lead participants to reduce the number of calories in their orders, compared with the baseline (unlabeled) condition and compared with the conditions with a single type of calorie label.

Study Overview

In collaboration with an on-site corporate restaurant, we developed an Internet-based system through which employees could place lunch orders they would then pick up at a central location. The novelty of the system for this restaurant and for these employees enabled us to present participation in the study as a pilot testing period for the online system, without drawing attention to calories or nutrition, thus

Table 1. Descriptive Statistics of Participants, by Initial Menu Condition

	Total	Baseline	Numeric Label	Traffic Light Label	Combined Label
Full Sample (N = 249)		49%	15%	17%	19%
Sex[a]					
Female	60%	61%	63%	60%	57%
Male	39%	38%	34%	40%	43%
Not reported	1%	1%	3%	0%	0%
Race[a]					
African American	6%	5%	7%	5%	6%
Asian	6%	6%	0%	9%	6%
Hispanic	1%	2%	3%	0%	0%
White	81%	81%	82%	79%	85%
Other	2%	0	5%	5%	0%
Not reported	4%	6%	3%	2%	3%
Income[a]					
$25,000–$50,000	8%	6%	8%	12%	9%
$50,001–$75,000	13%	17%	11%	10%	6%
$75,001–$100,000	21%	24%	13%	19%	22%
$100,001–$150,000	21%	16%	32%	21%	24%
$150,001+	18%	19%	18%	19%	17%
Not reported	19%	18%	18%	19%	22%
Dieting Status[a]					
Dieting to lose weight	34%	35%	29%	40%	30%
Dieting to maintain weight	3%	3%	0%	10%	0%
Dieting for other reason	2%	2%	0%	2%	2%
Not dieting	60%	59%	71%	48%	66%
Not reported	1%	1%	0%	0%	2%
Age[a]	40.57 (11.09)	40.28 (11.23)	43.91 (11.32)	37.97 (10.43)	40.97 (10.78)
Body Weight, in pounds[a]	178.53 (45.39)	177.98 (42.43)	177.56 (50.33)	182.41 (53.39)	177.05 (41.81)
Body Mass Index[a]	27.51 (6.19)	27.57 (6.16)	27.79 (7.15)	27.83 (6.82)	26.74 (4.73)

[a]Mean values, with standard deviations in parentheses where appropriate.

reducing possible demand effects.[1] The study compares the effects of numeric versus traffic light calorie labels, individually and in combination, to determine the effect of such labeling on participants' caloric choices at these meals.

Method

Participants

We sent an initial recruitment e-mail to 1,440 randomly selected employees of Humana, a large health care company. Drawing on previous experience in this setting, we chose this recruitment size to obtain 80% power for our analyses to detect a reduction of 50 calories per order. This daily calorie reduction, when extrapolated, would produce an annual calorie deficit equivalent to approximately five pounds, or 3% of body weight for the median participant (Guth 2014). We anticipated a sample of approximately 385 active participants who would collectively place approximately 1,500 total orders in the first four weeks of the study. Participants received $5 for registering and completing a short entrance survey of demographics, a $3 discount on each lunch ordered through the study (up to three lunch orders per week), and $5 for completing an exit survey.

In total, 453 (31%) invitees enrolled in the study, of whom 249 (55%) placed at least one order. Of the 205 (45% of) registrants who never placed an order, most (87%) never logged into the site, and thus were not randomized to an experimental condition. Among those who logged in, the fraction who submitted a lunch order (90% overall) did not differ across conditions, $\chi^2(3) = 2.92$, $p = .40$; nor were there any demographic differences between those who logged in and those who registered but chose not to log in during the study, all $p > .10$. Analyses were restricted to those who placed at least one order.

The final sample was 60% female, 81% white, 34% reporting dieting, with a median age of 40 (range 22–67 years), a median self-reported body weight of 170 pounds (range 93–328), a median body mass index (BMI) of 26 (range 16–55), and a median household income reported in the category $75,000–$100,000 (see Table 1). There were no significant differences across conditions for any of the demographic variables (all $p > .10$).

Materials

Upon registering for the study, participants completed a survey eliciting demographic information: sex, age, race, household income, weight and height, current dieting status

[1]Though there were no formal measures of demand effects, open communication was maintained with participants via e-mail reminders and responses to any complaints, and no participant mentioned suspicion that the study was about calorie labels or the calorie content of orders.

and exercise frequency, and frequency of snacking and ordering meals online via existing services. We used self-reported height (in inches) and weight (in pounds) to calculate BMI scores for each individual. We also determined the individualized recommended daily calorie intake value for each participant, for input as a covariate in analyses. To calculate this value, we used Mifflin-St. Jeor equations (Frankenfield, Roth-Yousey, and Compher 2005) to translate height, weight, and age into individualized daily intake recommendations, further taking account of weight-loss intention by subtracting 500 calories for those who reported dieting to lose weight. Entering this variable into analyses as a covariate enabled us to statistically control for different calorie needs among participants.

Participants also completed three short numeracy questions (Schwartz et al. 1997; 71% of participants answered all questions correctly) and rated the importance of nine factors when ordering a meal (price, calories, fat content, health benefits, portion size, trying something new, taste, convenience, and familiarity). No stable factor emerged from a factor analysis of these importance ratings, so we considered each rating independently in all analyses.

In the exit survey, participants rated the study menu's variety and the variety of options selected in their meals and indicated how similar their orders were to their typical lunches, how often they chose not to use the online system because they wanted something not on the menu, the forethought they put into their order before visiting the website, and whether they noticed nutrition information on the menu. (Though we did not hypothesize any differences among conditions to these questions, we included these questions to collect information about customer satisfaction and use of the online ordering system for our corporate partners. We report the responses, broken down by condition, in the Web Appendix.) All participants (irrespective of experimental condition) were asked to describe what red, yellow, and green traffic light labels on a menu mean and to estimate the calorie content of several popular menu items. We selected particularly popular choices for estimation, including the first item to appear on the menu, to increase the chance that participants had an opportunity to see and consider the nutrition information for those items. Because these survey responses were only collected at the end of a participant's study eligibility as part of a relatively short exit survey, we did not collect calorie estimates for each specific item or meal participants ordered. (We report exit survey responses, including calorie estimates of items, in the Web Appendix.)

For lunch orders, participants were required to select exactly one meal and then had the option to add as many drinks, snacks, and desserts as they wanted. There were 13 meal options (sandwiches with side dishes, wraps with side dishes, and entrée-sized salads, presented in ascending order of price), 23 snacks and desserts of varying nutrition content (e.g., chips, fresh fruit, brownies), and 30 drink options (including sodas, juices, teas, and water). We assigned traffic light labels to each item according to its caloric content, in line with U.S. Department of Agriculture (USDA) guidelines for recommended daily calorie consumption at 2,000 calories and based on empirical lunch-order data indicating the average proportion of lunch calories accounted for by the meal itself, snacks, desserts, and drinks. Light thresholds separating green from yellow lights and yellow from red lights for meals were set at 400 and 550 calories, respectively; thresholds for all other items were set at 100 and 200 calories. Our menu was developed to provide a range of options in each traffic light category at a range of prices: 4 green-light meals (ranging from 170 to 400 calories), 4 yellow-light meals (400–550 calories), and 5 red-light meals (550–950 calories); 4 green-light snacks and desserts (60–100 calories), 4 yellow-light snacks and desserts (100–200 calories), and 15 red-light snacks and desserts (200–420 calories); 16 green-light drinks (0–100 calories), 4 yellow-light drinks (100–200 calories), and 10 red-light drinks (200–290 calories).[2]

Procedure

We included a control condition of participants who were given no calorie labels and compared orders from that condition with those from three experimental conditions with calorie labels: numbers only, traffic lights only, and numbers and traffic lights (see Figure 1 for examples of menu labels). In Phase 1, we randomly assigned participants to one of these four menu conditions, which they would experience unchanged for a four-week period. In Phase 1 we overweighted assignment to the control arm at 49% (relative to 17% in each of the other three conditions) to allow a within-subject comparison among controls for two extra weeks in Phase 2. For this second phase, control participants were given the opportunity to remain in the study for an additional two weeks, at which point they were again randomly assigned to one of the four conditions. Of the 123 individuals invited to continue, 40 (33%) accepted and placed at least one order in Phase 2.

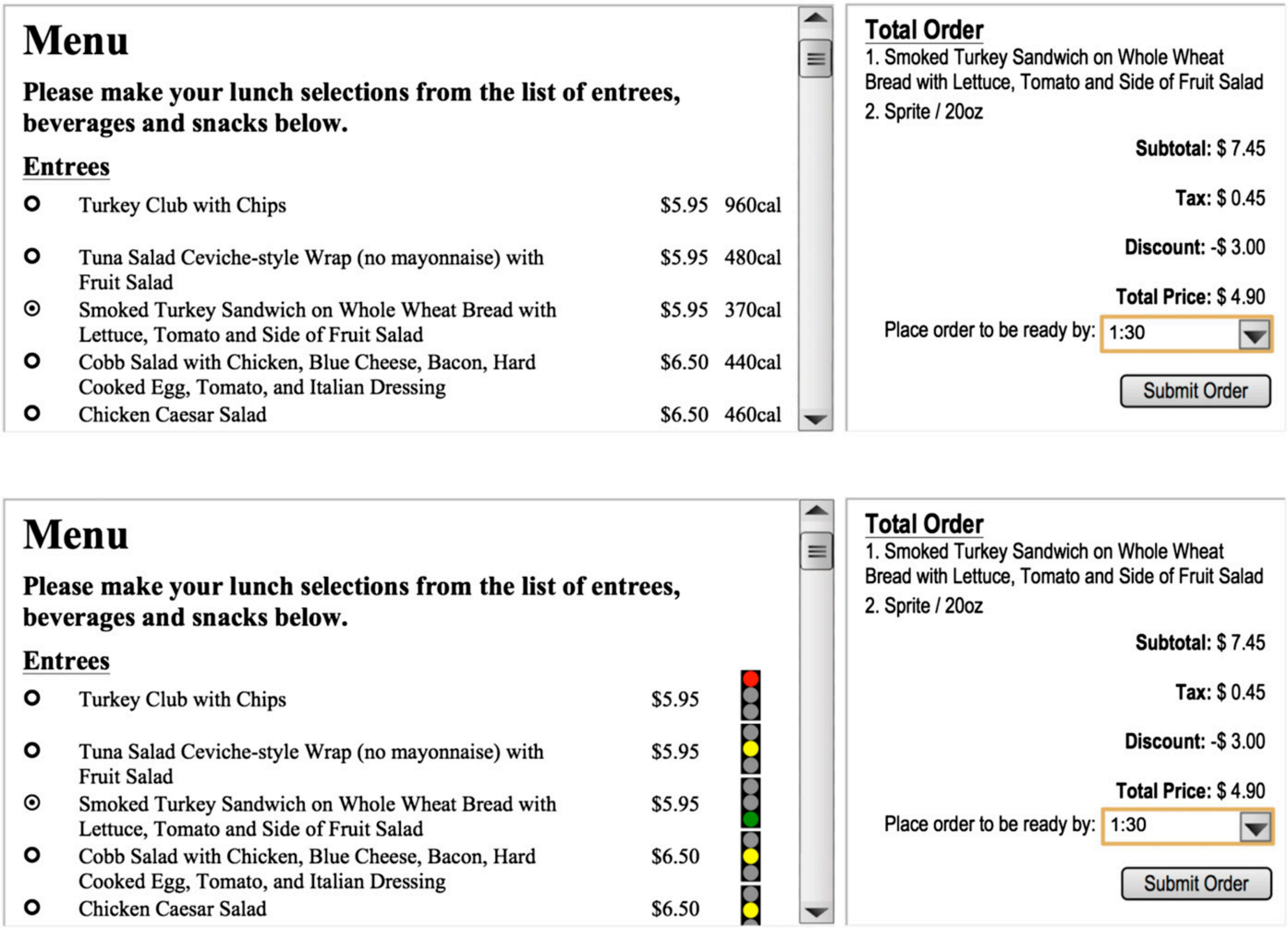
On Monday and Wednesday mornings of each study week, participants received an e-mail reminding them of the study and the discount and providing the link to the website. Each weekday, participants could log in, make a selection, add any customizations (e.g., substituting Italian for ranch salad dressing), and pick up their lunch at the discounted price.

Statistical Analyses

For each order, we measure calories ordered rather than calories consumed, a metric that has been demonstrated to be a very close proxy of consumption (Rolls, Roe, and Meengs 2006; Schwartz et al. 2012). To determine appropriate covariates for analysis, we calculated bivariate correlations between total calories purchased and each entrance survey response (i.e., demographics, meal attribute ratings, and numeracy scores) as well as each calculated covariate (BMI and recommended daily intake). Of all the covariates, the following emerged as significantly related to the dependent variable and were thus included in the full analysis: age, gender, household income category (scale from 1 = less than $25,000 to 6 = more than $150,000), dieting status (whether the participant was currently on a weight-loss diet),

[2]Due to a technical error, the calorie information provided by the on-site restaurant for one meal differed substantially from the actual calorie content. (Chosen in fewer than 2% of orders, this item was reported as containing 620 calories but actually contained only 300.) Because the current study involves the effects of labeling, we used the calorie count as labeled rather than actual calorie count in our primary analyses.

Figure 1. Sample Images of the Menu for Participants Assigned to the Numeric Calorie Label Condition and the Traffic Light Calorie Label Condition, Respectively



whether the participant reported ordering a meal online at least once a month, recommended daily calorie intake (a continuous variable), and six of the nine importance factors (fat, price, calories, health benefits, portion size, and item familiarity, each on a scale from 0 to 8); (see the Web Appendix). Of note, BMI did not emerge as significantly related to meal calories and thus we did not include it as a covariate in the analyses reported. Results are, however, unchanged if we include BMI. We conducted all analyses both with and without covariates; the same patterns and significance levels hold in both models.

To assess the robustness of the effects of calorie label formats across populations, we also tested for interactions between each label type and several key demographic variables, including gender, dieting status, BMI, number of orders previously placed in the study, a dummy for whether the order was the participant's first order, number of numeracy questions answered correctly, and week of order placement.

Participants placed 803 orders during Phase 1. The frequency of orders diminished over time, ranging from 299 orders placed in the first week down to 141 in the fourth week. An additional 98 orders were placed in Phase 2. For each order, we calculated total calories, with and without customizations (for which we could not label calorie information in real time). We report total calories ordered without customizations, but the same patterns and significance levels emerge when accounting for the calorie content of customizations. To control for multiple orders by individual participants, we use linear mixed model regressions with maximum likelihood estimation, examining the effect of each treatment condition individually relative to controls. In these regressions, the unit of analysis is each order placed, nested within participants, predicting the total number of calories in each order. We had intended to compare the effects of our manipulations in Phase 1 and Phase 2, but due to a lower-than-anticipated number of orders, we lacked sufficient power to perform comparisons across phases. Thus, we include all observations from both phases in one analysis to obtain the number of observations required to power our test for a reduction of 50 calories per meal, which was identified in our initial power calculations as a minimally clinically meaningful calorie reduction. The same patterns of results emerged when analyzing each phase separately, although some comparisons are not significant when examined separately.

Results

Hypothesis Tests

An initial comparison of baseline (unlabeled) menus and calorie-labeled (whether numeric, traffic light, or a combination) menus revealed a significant reduction in calories ordered among those exposed to labels (β = –67.54, p = .001). To test whether each label type led to a reduction in calories ordered, each of the three label formats was included simultaneously as a dummy variable in a mixed model regression. Table 2 presents the main regression results, with and without covariates, and reveals significant effects of all three treatments compared with controls. These effects were robust to inclusion of covariates.

Compared with the baseline (unlabeled), participants ordered fewer total calories when exposed to numeric calorie labels (β = –60.06, $p < .05$), consistent with H_1, or traffic light labels (β = –78.28, $p < .05$), consistent with H_2. We observed partial support for H_3; the combined numeric + traffic light label condition reduced calories ordered compared with the baseline condition (β = –64.93, $p < .05$; see Figure 2 for mean calories ordered by condition), but simple effects tests revealed no additional benefit of the second piece of information, whether adding numeric information compared with traffic light labels alone (β = 13.35, p = .73) or adding traffic light labels compared with numeric information alone (β = –4.87, p = .90).

The same pattern of results held for the primary meals ordered by participants, independent of snacks, desserts, or drinks. Compared with the unlabeled condition, we found significant reductions in meal calories across all labeled conditions: numeric (β = –68.11, $p < .05$), traffic light (β = –75.52, $p < .01$), and combined labels (β = –79.56, $p < .01$).

Table 2. Total Lunch Calories Ordered as Function of Numeric and Traffic Light Calorie Labels, Plus Covariates (Standard Errors in Parentheses)

	Main Effects	Main Effects + Covariates
Numeric labels only	–62.77* (31.10)	–60.06* (30.00)
Traffic light labels only	–69.42* (32.84)	–78.28* (30.93)
Numeric + traffic light labels	–72.51* (33.46)	–64.93* (31.90)
Male (dummy)		–13.21 (40.14)
Age (in years)		–.01 (1.31)
Dieting status (dummy)		–48.54 (37.28)
Household income (in $25,000 increments)		–15.03 (12.07)
Order online monthly or more (dummy)		95.25** (28.06)
Recommended daily calories		.05 (.07)
Importance of fat		–8.56 (9.21)
Importance of price		10.17 (11.14)
Importance of calories		–11.67 (9.99)
Importance of health benefits		–16.32 (13.48)
Importance of portion size		–12.10 (11.54)
Importance of familiarity		15.50† (8.23)
Intercept (unlabeled)	601.22 (18.30)	723.49 (181.84)
Orders placed (observations)	901	889
Order leve1 R^2	.02	.12
Participants	249	246
Participant level R^2	.02	.26

†$p < .10$.
*$p < .05$.
**$p < .01$.

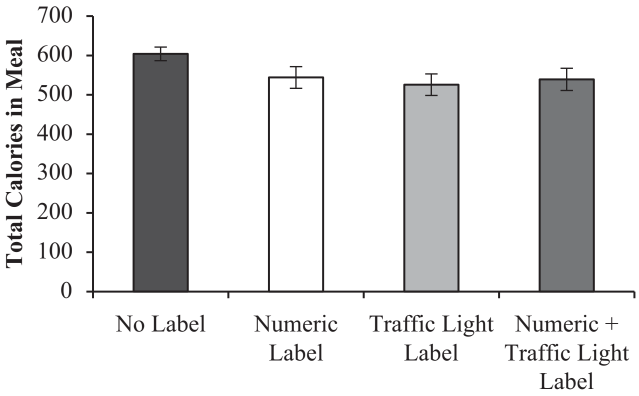
Additional Tests

Across conditions, participants ordered an average of 1.40 items per lunch. There were no effects of numeric (β = .09, p = .20), traffic light (β = –.05, p = .51), or combined labels (β = .13, p = .12) on number of items purchased. In addition, there were no effects of any type of label on snack or dessert calories, beverage calories, total price of lunch orders, or selection of zero-calorie beverages (all $p > .10$). Finally, the effects of labeling conditions did not vary by any of the other individual difference measures or longitudinal measures (e.g., week of order placement) collected for robustness checks (all $p > .10$).

Including all covariates in the primary regression simultaneously (see Table 2) revealed a significant effect of typical online order frequency on total calories ordered. Specifically, those who reported placing online orders at least once a month ordered significantly more calories than those who reported less frequent online ordering (β = 95.25, $p < .01$). No other covariate was statistically significant (all $p > .05$).

With regard to the answers participants gave when asked to estimate the calorie content of a few popular menu items at the completion of their study eligibility, no type of label led to

Figure 2. Mean Total Calorie Content of Lunches Ordered



Notes: Error bars indicate ± 1 SE.

any improvement in accuracy (all $p > .10$; see Web Appendix). To compare the effects of labeling across important subgroups of our sample, we split four variables (sex, dieting status, BMI, and numeracy) into predefined categories and conducted separate mixed model regressions for each variable. Although we lacked sufficient power to detect interactions between these individual difference variables and labeling (all $p > .13$), given the importance of such potential interactions, we report the patterns of each population subset results as exploratory analyses subsequently.

Compared with orders made in the absence of labels, male participants ordered significantly fewer calories when exposed to numeric labels or traffic light labels, whereas female participants ordered marginally fewer calories in the presence of combined labels (see the Web Appendix). Similarly, nondieters ordered marginally fewer calories when exposed to numeric labels or traffic light labels, whereas dieters ordered significantly fewer calories in the presence of combined labels (see the Web Appendix). Perhaps unsurprisingly, sex and dieting status are significantly correlated to each other ($r = -.16$, $p = .01$); that is, women are more likely than men to be on a weight-loss diet.

As shown in Table 3, each of the labeling conditions led to substantial reductions in the calorie content of orders placed by those with BMI scores higher than 30 (i.e., those who were obese). Compared with the unlabeled condition, obese consumers ordered significantly fewer calories when exposed to numeric ($\beta = -144.28$, $p < .05$), traffic light ($\beta = -144.68$, $p < .05$), or combined labels ($\beta = -169.49$, $p < .01$). In contrast, the effects of labels for orders placed by those with BMI scores between 25 and 30 (i.e., those were overweight but not obese), though directionally consistent with overall effects, were smaller: numeric labels: $\beta = -57.91$, $p = .19$; traffic light labels: $\beta = -63.73$, $p = .31$; and combined labels: $\beta = -62.81$, $p = .29$. The effects for those with a BMI less than 25 (i.e., those who were underweight or normal weight) were smaller still: numeric labels: $\beta = -29.30$, $p = .57$; traffic light labels: $\beta = -32.59$, $p = .49$; and combined labels: $\beta = -12.45$, $p = .81$. Needless to say, this pattern of effects is desirable.

With respect to numeracy, the pattern of results is more nuanced (see Table 4). For those with high numeracy scores (i.e., those who answered all three numeracy questions correctly), numeric ($\beta = -81.87$, $p < .05$) and combined ($\beta = -80.12$, $p = .05$) labels led to decreases in calories ordered compared with the unlabeled condition, but traffic light labels ($\beta = -51.17$, $p = .18$) produced a smaller effect. For those with lower numeracy scores (i.e., those who missed at least one numeracy question), traffic light labels ($\beta = -128.00$, $p < .05$) were particularly more likely to reduce calories ordered than the unlabeled condition, but the effects of numeric ($\beta = -15.45$, $p = .79$) and combined labels ($\beta = -56.51$, $p = .33$) did not approach statistical significance. The greater impact of numeric information for the more numerate and the greater impact of traffic light labels for the less numerate is intuitively expected and lends preliminary support to the justification often provided for nonnumeric labels—that they will have a greater impact on the behavior of people who are less numerate.

Discussion

In this study, the first to our knowledge to systematically separate and compare traffic light calorie labels with numeric information for real-world meal choices, each type of calorie labeling led to significant reductions in calories ordered. These effects are robust over repeated orders and multiple weeks. The combination of promising effects and high external validity of this study suggests that online ordering may be a favorable setting for implementing nutrition labels, including simplified traffic light labels that lack exact numeric calorie counts.

Traffic light labels appear to be just as effective on their own as they are in combination with exact calorie numbers, which implies that detailed numeric information may not contribute much to one's decision-making process when ordering, beyond providing a simple signal regarding which menu options are relatively healthier than others. The current results contrast with previous studies that have found that traffic lights add value to numeric calorie posting (e.g., Ellison, Lusk, and Davis 2013, 2014). These same studies, in contrast to ours, found smaller, and sometimes null, effects of the numeric information alone. This inconsistency with our results may result from differences between the environments in which the choices were made. Although consumers in a full-service restaurant might require traffic light (or other prescriptive) labels to guide them to choose more healthful

Table 3. Total Lunch Calories Ordered as Function of Numeric and Traffic Light Calorie Labels (Standard Errors in Parentheses) for BMI < 25 vs. 25 < BMI < 30 vs. BMI > 30 Participants

	BMI < 25	25 < BMI < 30	BMI > 30
Numeric labels only	–29.30 (51.82)	–57.91 (44.08)	–144.28* (66.36)
Traffic light labels only	–32.59 (47.51)	–63.73 (63.25)	–144.68* (64.62)
Numeric + traffic light labels	–12.45 (51.38)	–65.81 (62.67)	–169.49** (62.34)
Intercept (unlabeled)	590.22 (29.18)	584.37 (31.07)	646.96 (35.54)
Orders placed (observations)	343	286	272
Order level R^2	–.002	.01	.09
Participants	95	77	77
Participant level R^2	–.02	.01	.22

*$p < .05$.
**$p < .01$.

Table 4. Total Lunch Calories Ordered as Function of Numeric and Traffic Light Calorie Labels, Plus Covariates (Standard Errors in Parentheses) for Low-Numeracy vs. High-Numeracy Participants

	Low Numeracy	High Numeracy
Numeric labels only	–15.45 (58.41)	–81.87* (36.52)
Traffic light labels only	–128.00* (64.96)	–51.17 (37.88)
Numeric + traffic light labels	–56.51 (57.91)	–80.12* (40.82)
Intercept (unlabeled)	604.22 (33.39)	601.55 (21.79)
Orders placed (observations)	233	668
Order level R^2	.04	.02
Participants	73	175
Participant level R^2	.10	.02

*$p < .05$.

items, the current study shows that consumers can use both numeric-only and graphic-only labels to choose lower-calorie meals when placing orders online. Whereas research in restaurant environments has painted a pessimistic picture of the efficacy of numeric calorie labeling for reducing calorie consumption, our results demonstrate that both numeric and traffic light calorie labels can have promising effects when ordering food online.

Though each type of calorie label reduced calories ordered, accuracy in estimation of item calories was not changed by exposure to any label format, consistent with prior research in which calorie labeling did little to improve the accuracy of calorie estimates (Downs et al. 2013; Taksler and Elbel 2014). The similar effect of traffic light and numeric labeling suggests that labels may merely facilitate comparisons between menu items, enabling consumers to select relatively more healthful items at the point of purchase without leading to retention, or possibly registry in the first place, of verbatim knowledge about the items' calorie content.

As noted previously, the effects of menu labeling on total calories ordered were driven primarily by a reduction in meal calories, rather than by a reduction in the number of items chosen or calories from supplemental items. These results are similar to those of Wisdom, Downs, and Loewenstein (2010), who found that sandwich calories, but not side order or drink calories, decreased when calorie information was provided. In this prior study, in fact, providing calorie information actually led to an increase in side order and drink calories, which the authors interpreted as a kind of compensation effect for the reduced sandwich calories (see also Chandon and Wansink 2007 for evidence of such compensatory effects). In the present study, in contrast, we do not find evidence of such counterbalancing effects; there were no significant effects of labeling on either the total number of items or the calorie content of additional snacks, desserts, or beverages. However, it is important to note that this study was not designed to distinguish between entrées and side dishes, given that most meals included both an entrée (e.g., sandwich) and side dish (e.g., fruit salad) as a single item. As a result, additional items were largely unpopular on our menu: across all conditions, only 32% of orders added a snack, dessert, or beverage to the meal.

Implications for Public-Health Policy and Food Marketers

Despite mixed empirical evidence, many policy makers and firms have already begun posting numeric calorie labels on restaurant menus. In the current study, we find results that are more promising than most field studies about the potential for numeric calorie information to affect real food choices. The greater impact of calorie labeling in our study, as compared with previous studies, could be due to the greater experimental control, and statistical power, of our field experiment, or could indicate that something about online ordering enhances the impact of informational interventions. We also find that simple traffic light labels can achieve similar benefits in this online setting, with or without the accompanying numeric information. These results suggest that the FDA-mandated calorie labeling may be particularly effective at reducing consumer calorie intake from online orders.

These results are consistent with other research suggesting that people are not performing arithmetic calculations or retaining information in a numeric format when using nutrition labels (Drichoutis, Lazaridis, and Nayga 2006). Our current sample was relatively well educated; the majority (71%) answered all three numeracy questions correctly, which could potentially account for the observed benefits of numeric calorie information in this study. Less numerate populations struggle more to use and comprehend numeric nutrition information (Rothman et al. 2006), and future studies might oversample from these less numerate populations to observe their responses to various labeling formats such as the traffic light labels tested in the present study. In contrast to numeric labels, traffic light labels might help communicate basic "eat this, not that" information regardless of consumers' understanding of the underlying nutrients or ability to use numeric information.

The quick and direct communication conveyed by traffic lights could reduce any perceived need for the provision of recommended daily calorie consumption information, which in prior research did not enhance the impact of numeric calorie labels (Downs et al. 2013). The new FDA guidelines mandate that menus include a statement communicating the general recommendation to consume approximately 2,000 calories a day (FDA 2014). Such numeric information is intended to help customers put an item's calories in the context of their daily consumption, but traffic light labels could express such prescriptive information to a much broader population.

As calorie labeling becomes ubiquitous across chain restaurants, marketers may feel the need to dramatically change their menus to attract customers. Indeed, evidence regarding menu offerings at fast-food restaurants from 2005 to 2011 shows that restaurant chains voluntarily increased the number of healthful entrée options on their menus if they were subject to calorie-labeling legislation (Namba, Auchincloss, and Leonberg 2013). This motivation to change menu offerings in response to calorie labeling is consistent with what has been termed the telltale heart effect

(Loewenstein, Sunstein, and Golman 2014), which occurs when the disclosers of information (in this case, restaurateurs) overestimate the extent to which consumers will respond to the disclosure and change their offerings in accordance with these mispredictions.

In our study, consumers did respond to calorie labeling on menus by switching to lower-calorie meals, but we found no impact of this labeling on the number of items ordered or the price of orders placed. Although we observed a shift in consumer choices in response to calorie labels, this shift had no impact on our restaurant partner's revenue. Food manufacturers and marketers may choose to provide more low-calorie items as a way to benefit from mandated disclosure, but to the extent that some lower-calorie items already exist on their menus, restaurant chains may not suffer the losses in business that, no doubt, motivated previous opposition to labeling (Farley et al. 2009).

Limitations and Suggestions for Further Research

The simplicity of a single traffic light for the calorie content of an item is potentially beneficial because it provides clear and actionable guidance to consumers. However, nutritional content is multifaceted, and a simple calorie label—whether numeric or traffic light—could mislead consumers to overgeneralize about the nutritional quality of an item (e.g., neglecting sodium; Howlett et al. 2012). Although the menu used in the current study had a relatively intuitive relationship between calories and nutrient density—low-calorie foods were also more nutritious, on average—some menus may feature items low in calories that simultaneously have poor nutritional content. Additional research is needed to demonstrate how people use traffic light labels when the expected relationships between calorie content and different nutrients are weakened or reversed.

All the meals on this study's menu contained fewer than 1,000 calories, compared to entrées at many popular chain restaurants that exceed 2,000 calories. With higher-calorie options, shifts in entrée choices could create even larger calorie reductions, although a simple traffic light labeling strategy might not highlight that potential, but the combination of a numeric label and a traffic light label could do so. For example, at one chain, fish and chips contains 1,920 calories and chicken piccata has 1,280 calories, allowing for the possibility of a massive calorie reduction if an intervention caused people to switch between options that both would have been labeled with red lights in the current study. Research in environments with dramatically different choice sets is necessary to determine the extent to which people might benefit from traffic light calorie labeling and whether traffic light labels are similarly effective when the proportion and distribution of items in each light category are changed.

Another important feature of this study is the workplace setting. The participants worked for a health-care company and were relatively affluent and well educated, which could potentially reduce the generalizability of these results. However, the workplace setting, as well as the online setting, is of increasing importance, as more food decisions are made away from the home than ever before (Economic Research Service 2012).

Concluding Remarks

Given the promising effects of calorie labeling in this study, researchers may want to contemplate ways to "supercharge" such labeling and achieve additional calorie reductions, perhaps extending the effects beyond item substitution. With technological advancements improving the speed and availability of user feedback and information provision, static nutrition labels can be compared with more dynamic approaches, particularly for decisions made in the online context.

For instance, although item-level numeric and traffic light labeling guides consumers to more healthful substitutions, lunch-level numeric information or traffic light labels—calculated in real time and presented before submitting an order—might better communicate total calorie consumption to consumers and improve choices. Similarly, before confirming an order, websites could offer recommendations about more healthful alternatives that could be ordered in lieu of, or in addition to, the current order. Much as Amazon.com and other websites can recommend additional consumer goods on the basis of a consumer's previous purchasing history or recent browsing, ordering websites could highlight healthful options that are likely to fit with or replace the items currently selected. If these additional options come with a calorie label of their own, people can make quick comparisons between similar items rather than searching through an entire menu.

The current work suggests a potential opportunity to align health and profit incentives for employers who provide both meals and health care to their employees. Employers may be more willing than restaurateurs to subsidize more healthful food options—or at least sacrifice some degree of profit—to improve their employees' health. In the present work, we demonstrate a relatively low-cost intervention that achieves a 10% to 13% reduction in lunch calories ordered. Although workplace interventions are by necessity somewhat limited in their reach, they could potentially encompass approximately one-quarter of all meals for full-time employees who eat five lunches per week at work. The current study demonstrates the potential benefits of both traffic light labeling and of the online setting for achieving calorie reductions. Alternative information-provision methods and contexts may well lead to even greater reductions.

References

Andrews, J. Craig, Scot Burton, and Jeremy Kees (2011), "Is Simpler Always Better? Consumer Evaluations of Front-of-Package Nutrition Symbols," *Journal of Public Policy & Marketing*, 30 (2), 175–90.

———, Chung-Tung Jordan Lin, Alan S. Levy, and Serena Lo (2014), "Consumer Research Needs from the Food and Drug Administration on Front-of-Package Nutritional Labeling," *Journal of Public Policy & Marketing*, 33 (1), 10–16.

Bollinger, Bryan, Phillip Leslie, and Alan Sorensen (2010), *Calorie Posting in Chain Restaurants. No. w15648*. Washington, DC: National Bureau of Economic Research.

Burton, Scot, Elizabeth H. Creyer, Jeremy Kees, and Kyle Huggins (2006), "Attacking the Obesity Epidemic: The Potential Health

Benefits of Providing Nutrition Information in Restaurants," *American Journal of Public Health*, 96 (9), 1669–75.

———, Elizabeth Howlett, and Andrea Heintz Tangari (2009), "Food for Thought: How Will the Nutrition Labeling of Quick Service Restaurant Menu Items Influence Consumers' Product Evaluations, Purchase Intentions, and Choices?" *Journal of Retailing*, 85 (3), 258–73.

——— and Jeremy Kees (2012), "Flies in the Ointment? Addressing Potential Impediments to Population-Based Health Benefits of Restaurant Menu Labeling Initiatives," *Journal of Public Policy & Marketing*, 31 (2), 232–39.

Chandon, Pierre and Brian Wansink (2007), "The Biasing Health Halos of Fast-Food Restaurant Health Claims: Lower Calorie Estimates and Higher Side-Dish Consumption Intentions," *Journal of Consumer Research*, 34 (3), 301–14.

De Castro, John M. and E. Marie Brewer (1992), "The Amount Eaten in Meals by Humans is a Power Function of the Number of People Present," *Physiology & Behavior*, 51 (1), 121–25.

Downs, Julie S., Jessica Wisdom, and George Loewenstein (2015), "Helping Consumers Use Nutrition Information: Effects of Format and Presentation," *American Journal of Health Economics*, 1 (3), 326–44.

———, ———, Brian Wansink, and George Loewenstein (2013), "Supplementing Menu Labeling with Calorie Recommendations to Test for Facilitation Effects," *American Journal of Public Health*, 103 (9), 1604–09.

Dowray, Sunaina, Jonas J. Swartz, Danielle Braxton, and Anthony J. Viera (2013), "Potential Effect of Physical Activity Based Menu Labels on the Calorie Content of Selected Fast Food Meals," *Appetite*, 62 (1), 173–81.

Drichoutis, Andreas C., Panagiotis Lazaridis, and Rodolfo M. Nayga (2006), "Consumers' Use of Nutritional Labels: A Review of Research Studies and Issues," *Academy of Marketing Science Review*, 9 (9), 1–22.

Economic Research Service, USDA, Food Expenditures (2012), "Food-Away-From-Home," (accessed December 23, 2015), [available at http://www.ers.usda.gov/topics/food-choices-health/food-consumption-demand/food-away-from-home.aspx].

Ellison, Brenna, Jayson L. Lusk, and David Davis (2013), "Looking at the Label and Beyond: The Effects of Calorie Labels, Health Consciousness, and Demographics on Caloric Intake in Restaurants," *International Journal of Behavioral Nutrition and Physical Activity*, 10 (21), [DOI: http://www.ijbnpa.org/content/10/1/21].

———, ———, and ——— (2014), "The Impact of Restaurant Calorie Labels on Food Choice: Results from a Field Experiment," *Economic Inquiry*, 52 (2), 666–81.

Farley, Thomas A., Anna Caffarelli, Mary T. Bassett, Lynn Silver, and Thomas R. Frieden (2009), "New York City's Fight Over Calorie Labeling," *Health Affairs*, 28 (6), w1098–109.

FDA (2014), "Overview of FDA Labeling Requirements for Restaurants, Similar Retail Food Establishments and Vending Machines," (accessed December 23, 2015), [available at http://www.fda.gov/Food/IngredientsPackagingLabeling/LabelingNutrition/ucm248732.htm].

Federal Register (2014), "Food Labeling; Nutrition Labeling of Standard Menu Items in Restaurants and Similar Retail Food Establishments," (December 1), (accessed December 23, 2015), [available at https://federalregister.gov/a/2014-27833].

Finkelstein, Eric A., Justin G. Trogdon, Joel W. Cohen, and William Dietz (2009), "Annual Medical Spending Attributable to Obesity: Payer- and Service-Specific Estimates," *Health Affairs*, 28 (5), w822–31.

Flegal, Katherine M., Margaret D. Carroll, Brian K. Kit, and Cynthia L. Ogden (2012), "Prevalence of Obesity and Trends in the Distribution of Body Mass Index among US Adults, 1999–2010," *Journal of the American Medical Association*, 307 (5), 491–97.

———, Brian K. Kit, Heather Orpana, and Barry I. Graubard (2013), "Association of All-Cause Mortality with Overweight and Obesity Using Standard Body Mass Index Categories: A Systematic Review and Meta-Analysis," *Journal of the American Medical Association*, 309 (1), 71–82.

Food Standards Agency (2007), "Front-of-Pack Traffic Light Signpost Labelling—Technical Guidance," (Issue 2), (accessed December 23, 2015), [available at http://www.food.gov.uk/multimedia/pdfs/frontofpackguidance2.pdf].

Frankenfield, David, Lori Roth-Yousey, and Charlene Compher (2005), "Comparison of Predictive Equations for Resting Metabolic Rate in Healthy Nonobese and Obese Adults: A Systematic Review," *Journal of the American Dietetic Association*, 105 (5), 775–89.

Glanz, Karen, Michael Basil, Edward Maibach, Jeanne Goldbert, and Dan Snyder (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 (October), 1118–26.

Grunert, Klaus G. and Josephine M. Wills (2007), "A Review of European Research on Consumer Response to Nutrition Information on Food Labels," *Journal of Public Health*, 15 (5), 385–99.

Guth, Eve (2014), "Healthy Weight Loss," *Journal of the American Medical Association*, 312 (9), 974.

Harnack, Lisa J. and Simone A. French (2008), "Effect of Point-of-Purchase Calorie Labeling on Restaurant and Cafeteria Food Choices: A Review of the Literature," *International Journal of Behavioral Nutrition and Physical Activity*, 5 (51), 1–6.

———, ———, Michael J. Oakes, Mary T. Story, Robert W. Jeffery, and Sarah A. Rydell (2008), "Effects of Calorie Labeling and Value Size Pricing on Fast Food Meal Choices: Results from an Experimental Trial," *International Journal of Behavioral Nutrition and Physical Activity*, 5 (63), [DOI: 10.1186/1479-5868-5-63].

Hawley, Kristy L., Christina A. Roberto, Marie A. Bragg, Peggy J. Liu, Marlene B. Schwartz, and Kelly D. Brownell (2013), "The Science on Front-of-Package Food Labels," *Public Health Nutrition*, 1 (1), 1–10.

Herman, C. Peter, Deborah A. Roth, and Janet Polivy (2003), "Effects of the Presence of Others on Food Intake: A Normative Interpretation," *Psychological Bulletin*, 129 (6), 873–86.

Hersey, James C., Kelly C. Wohlgenant, Joanne E. Arsenault, Katherine M. Kosa, and Mary K. Muth (2013), "Effects of Front-of-Package and Shelf Nutrition Labeling Systems on Consumers," *Nutrition Reviews*, 71 (1), 1–14.

Howlett, Elizabeth, Scot Burton, Andrea Heintz Tangari, and My Bui (2012), "Hold the Salt! Effects of Sodium Information Provision, Sodium Content, and Hypertension on Perceived Cardiovascular Disease Risk and Purchase Intentions," *Journal of Public Policy & Marketing*, 31 (1), 4–18.

IBISWorld (2014), *Online Grocery Sales in the US. Industry Report OD5085*, (accessed December 23, 2015), [available at http://clients1.ibisworld.com/reports/us/industry/default.aspx?entid=5085].

Kimes, Sheryl E. (2011), "The Current State of Online Food Ordering in the U.S. Restaurant Industry," *Cornell Hospitality Report*, 11 (17), 6–18.

Kiszko, Kamila M., Olivia D. Martinez, Courtney Abrams, and Brian Elbel (2014), "The Influence of Calorie Labeling on Food Orders and Consumption: A Review of the Literature," *Journal of Community Health*, 39 (6), 1–22.

Koenigstorfer, Joerg, Andrea Groeppel-Klein, and Friederike Kamm (2014), "Healthful Food Decision Making in Response to Traffic Light Color-Coded Nutrition Labeling," *Journal of Public Policy & Marketing*, 33 (1), 65–77.

Loewenstein, George, Cass R. Sunstein, and Russell Golman (2014), "Disclosure: Psychology Changes Everything," *Annual Review of Economics*, 6, 391–419.

Long, Michael W., Deirdre K. Tobias, Angie L. Cradock, Holly Batchelder, and Steven L. Gortmaker (2015), "Systematic Review and Meta-Analysis of the Impact of Restaurant Menu Calorie Labeling," *American Journal of Public Health*, 105 (5), e11–24.

Namba, Alexa, Amy Auchincloss, Beth L. Leonberg, and Margo G. Wootan (2013), "Exploratory Analysis of Fast-Food Chain Restaurant Menus Before and After Implementation of Local Calorie-Labeling Policies, 2005–2011," *Preventing Chronic Disease*, 10, E101.

Ogden, Cynthia L., Margaret D. Carroll, Brian K. Kit, and Katherine M. Flegal (2013), "Prevalence of Obesity among Adults: United States, 2011–2012," *NCHS Data Brief*, 131, 1–8.

Pomeranz, Jennifer L. and Kelly D. Brownell (2008), "Legal and Public Health Considerations Affecting the Success, Reach, and Impact of Menu-Labeling Laws," *American Journal of Public Health*, 98, 1578–83.

Rolls, Barbara J., Liane S. Roe, and Jennifer S. Meengs (2006), "Reductions in Portion Size and Energy Density of Foods are Additive and Lead to Sustained Decreases in Energy Intake," *American Journal of Clinical Nutrition*, 83 (1), 11–17.

Rothman, Russell L., Ryan Housam, Hilary Weiss, Dianne Davis, Rebecca Gregory, Tebeb Gebretsadik, Ayumi Shintani, and Tom A. Elasy (2006), "Patient Understanding of Food Labels: The Role of Literacy and Numeracy," *American Journal of Preventive Medicine*, 31 (5), 391–98.

Schulte-Mecklenbeck, Michael, Matthias Sohn, Emanuel de Bellis, Nathalie Martin, and Ralph Hertwig (2013), "A Lack of Appetite for Information and Computation. Simple Heuristics in Food Choice," *Appetite*, 71, 242–51.

Schwartz, Janet, Jason Riis, Brian Elbel, and Dan Ariely (2012), "Inviting Consumers to Downsize Fast-Food Portions Significantly Reduces Calorie Consumption," *Health Affairs*, 31 (2), 399–407.

Schwartz, Lisa M., Steven Woloshin, William C. Black, and H. Gilbert Welch (1997), "The Role of Numeracy in Understanding the Benefit of Screening Mammography," *Annals of Internal Medicine*, 127 (11), 966–72.

Swartz, Jonas J., Danielle Braxton, and Anthony J. Viera (2011), "Calorie Menu Labeling on Quick-Service Restaurant Menus: An Updated Systematic Review of the Literature," *International Journal of Behavioral Nutrition and Physical Activity*, 8 (1), 135.

Taksler, Glen B. and Brian Elbel (2014), "Calorie Labeling and Consumer Estimation of Calories Purchased," *International Journal of Behavioral Nutrition and Physical Activity*, 11 (1), 91.

Tandon, Pooja S., Jeffrey Wright, Chuan Zhou, Cara Beth Rogers, and Dimitri A. Christakis (2010), "Nutrition Menu Labeling May Lead to Lower-Calorie Restaurant Meal Choices for Children," *Pediatrics*, 125 (2), 244–48.

Thorndike, Anne N., Lillian Sonnenberg, Jason Riis, Susan Barraclough, and Douglas E. Levy (2012), "A 2-Phase Labeling and Choice Architecture Intervention to Improve Healthy Food and Beverage Choices," *American Journal of Public Health*, 102 (3), 527–33.

Wisdom, Jessica, Julie S. Downs, and George Loewenstein (2010), "Promoting Healthy Choices: Information Versus Convenience," *American Economic Journal. Applied Economics*, 2 (2), 164–78.

Wong, Venessa (2014, October 20). "Use Starbucks's Order-Ahead App and Get Your Name Spelled Right," *Bloomberg Business*, (accessed December 23, 2015), [available at http://www.bloomberg.com/bw/articles/2014-10-20/how-starbucks-order-ahead-app-will-work].