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Research report

A test of different menu labeling presentations ☆

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ABSTRACT

Chain restaurants will soon need to disclose calorie information on menus, but research on the impact of calorie labels on food choices is mixed. This study tested whether calorie information presented in different formats influenced calories ordered and perceived restaurant healthfulness. Participants in an online survey were randomly assigned to a menu with either (1) no calorie labels (No Calories); (2) calorie labels (Calories); (3) calorie labels ordered from low to high calories (Rank-Ordered Calories); or (4) calorie labels ordered from low to high calories that also had red/green circles indicating higher and lower calorie choices (Colored Calories). Participants ordered items for dinner, estimated calories ordered, and rated restaurant healthfulness. Participants in the Rank-Ordered Calories condition and those in the Colored Calories condition ordered fewer calories than the No Calories group. There was no significant difference in calories ordered between the Calories and No Calories groups. Participants in each calorie label condition were significantly more accurate in estimating calories ordered compared to the No Calories group. Those in the Colored Calories group perceived the restaurant as healthier. The results suggest that presenting calorie information in the modified Rank-Ordered or Colored Calories formats may increase menu labeling effectiveness.

Introduction

Poor diet and obesity are major public health concerns in the United States (Flegal, Carroll, Ogden, & Curtin, 2010). Obesity reduces quality of life and life expectancy and increases medical costs by at least $100 billion per year in the United States (Sturm, 2002). The role of calorie information is to provide consumers with the information needed to make healthier food choices if they are motivated to do so (Taylor & Wilkening, 2008). However, whereas American consumers can find calorie information on most packaged foods that they buy in stores today as a consequence of the Nutrition Labeling and Education Act (Nutrition Labeling and Education Act of 1990. Public Law 101–533, 104 Stat 2353.), this information is generally unavailable in restaurants or not prominently displayed (Roberto, Agnew, & Brownell, 2009). Therefore, with the overall goal of promoting healthier food choices, a recent policy designed to better equip consumers with nutrition information when making their food choices in restaurants is menu labeling, a mandate included in the Patient Protection and Affordable Care Act of 2010 ("Questions and Answers", 2011). Menu labeling requires chain restaurants with 20 or more locations to post the calorie information of items on their menus and menu boards so that it is visible at the point-of-purchase. As of June 2012, the FDA was continuing to solicit suggestions for implementing the law ("New Menu", 2011).

Existing research on the efficacy of menu labeling has produced mixed findings. Some studies have shown no or minimal impact of calorie labels (Downs, Loewenstein, & Wisdom, 2009; Elbel, Kersh, Brescoll, & Dixon, 2009; Finkelstein, Strombotne, Chan, & Krieger, 2011; Harnack et al., 2008; Tandon et al., 2011; Vadiveloo, Dixon, & Elbel, 2011), others have found a moderate decrease in calories ordered (Bassett et al., 2008; Bollinger, Leslie, & Sorensen, 2011; Burton, Creyer, Kees, & Huggins, 2006; Chu, Frongillo, Jones, & Kaye, 2009; Pulos & Leng, 2010; Tandon, Wright, Zhou, Rogers, & Christakis, 2010) and consumed (Roberto, Larsen, Agnew, Baik, & Brownell, 2010), and one has found that calorie labels decreased calories ordered in some but not all restaurants surveyed (Dumanovsky et al., 2011). These studies differed on a variety of factors, suggesting that more research is necessary to understand which factors account for the different findings (Blumenthal & Volpp, 2010; Girz, Polivy, Herman, & Lee, 2011; Harnack & French, 2008; Swartz, Braxton, & Viera, 2011). These mixed findings also suggest that there may be more effective ways to present calorie information to increase the policy's impact, and indeed, a recent study found that presenting calorie information in the form of exercise equivalents for sugar-sweetened beverages was more

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influential with teens than presenting calorie information alone (Bleich, Herring, Flagg, & Gary-Webb, 2011).

Currently, menu labeling legislation requires the presentation of calorie information and a suggested daily caloric intake statement, but the way in which the information is presented could potentially be improved. For example, research on price presentation has found that organizing unit price information on a unit price list from low to high unit prices led consumers to spend less money (Russo, 1977). Therefore, organizing menu items on a menu from low to high calories may lead consumers to order fewer calories. Such an ordering effect could emerge by facilitating comparisons on the given attribute dimension (price in the case of Russo (1977) and calories in the case of the present article), leading consumers to consider this attribute more when making choices. This effect could also emerge because people may be more likely to order items towards the top of the menu (lower calorie items in the case of the present article). For instance, Koppell and Steen (2004) found that candidates listed first on a ballot received a greater proportion of votes than candidates listed elsewhere on a ballot, and Dayan and Bar-Hillel (2011) found that people tend to order food items at the top and bottom of menu lists more than items at the middle of menu lists.

In addition, research examining the effectiveness of labels on the front of packaged foods finds that a "traffic light" labeling system, which uses red, green, and yellow traffic light symbols on packages to indicate fat, saturated fat, sugar, and salt levels, can help consumers identify healthier food choices (Hawley et al., 2012). Therefore, using such a color scheme on menus might also direct consumers to healthier choices. This suggestion is supported by the findings of a recent field study, in which researchers coded foods and beverages with traffic light colors and found that this intervention increased sales of green-coded items and decreased sales of red-coded items (Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012).

Given the mixed findings regarding the effectiveness of menu labeling and research suggesting that the presentation of calorie information can be improved, the aim of the current study was to examine the influence of different calorie label presentation formats on calories ordered.

Methods

Participants

Participants were 456 consumers in an online database of approximately 20,000 consumers; the database was hosted by the business school of a university located in the northeastern United States. Consumers join the database by registering at the school's eLab website, and then log in periodically to see a list of studies for which they are eligible. This study was listed as a consumer research study, and participants were given a 1/50 chance to win a $20 Amazon.com gift card as compensation. The study was programmed and hosted through Qualtrics, an online survey tool, and was administered from November 12, 2010 to November 21, 2010. Analyses were conducted in 2011 and 2012. The study was approved by the university's Human Subjects Committee.

Procedure

After participants read the informed consent form and provided informed consent, they were presented with filler questions about their dining and restaurant layout preferences to conceal the study purpose. Participants were then randomly assigned to view one of four restaurant menus and asked to click on the menu to select all items they would order for themselves for dinner. The four menu conditions were: (1) A restaurant menu with no calorie labels (No Calories); (2) A restaurant menu with items labeled with calories and a label stating, "The recommended daily caloric intake for an average adult is 2,000 calories" (Calories); (3) A restaurant menu with calorie labels appearing next to items that were ordered from low to high calories and the daily caloric intake statement (Rank-Ordered Calories); (4) A restaurant menu with calorie labels, items ordered from low to high calories, the daily caloric intake statement, and green or red circles indicating lower and higher calorie choices (green: ⩽750 calories for entrees; ⩽250 calories for appetizers, sides, or desserts; 0 calories for beverages; red: >750 calories for entrees; >250 calories for appetizers, sides, or desserts; >0 calories for beverages) (Colored Calories). These calorie cutoff criteria are used by Healthy Dining, a marketing and consulting company for the restaurant industry, to determine whether a menu item qualifies for listing on its website as a healthier option ("Nutrition Criteria", n.d.). They use a 750-calorie limit for entrees because it represents approximately 37% of 2,000 calories, the reference level for nutrition labeling, which they define as reasonable "because a restaurant meal is generally the largest of the day".

All menu food items were from the chain restaurant Chili's Grill and Bar and beverages were from Applebee's. Chili's was selected because it is a well-known chain restaurant with a wide range of low and high calorie items and provides calorie information on its website. The Applebee's drink menu was included because unlike Chili's, its website has calorie information for beverages. Menu items selected included all appetizers, salads, sandwiches, burgers, grilled and battered items, desserts, and selected side dishes. When there were several variations on the same food, one was randomly selected for inclusion. When there were both regular and healthy versions of the same product, the healthy version was selected to increase the diversity of the menu. Entrees were included with specific side dishes if indicated on the Chili's menu, and side salads were listed along with different salad dressing options. The final menu contained 71 items, and 24 of the items qualified for the green label for the Colored Calories menu. Prices were obtained from the restaurant websites for franchise locations in Connecticut and appeared in a column labeled "Price" to the right of the menu item. Calories, when present, appeared in a column labeled "Calories" to the right of the price column.

After making their meal selections, participants were also given the option to make any side dish substitutions if they had ordered items with side dishes already included. The rationale for allowing participants to make side dish substitutions is that it more accurately captures the ordering experience in the real world, in which customers are able to make such substitutions. This inclusion allowed us to test whether different formats of calorie labels alter consumer food choices through making healthier substitutions. Participants then estimated how many calories they had ordered in their meal, indicated how hungry they were prior to the survey on a scale from 1 = *not at all hungry* to 7 = *extremely hungry*, how often they use nutrition labels on a scale from 1 = *never* to 5 = *always*, and how healthy they thought the restaurant was from 1 = *very unhealthy* to 7 = *very healthy*. They also answered questions, detailed in the "Other measures" section below, on their opinions about menu labeling and the format of calorie information. Finally, they completed demographic questions regarding age, gender, race/ethnicity, education and income level, height, and weight.

Dependent measures

Calories ordered

The total number of calories ordered was calculated by summing the calorie values for all food and beverage items selected by each participant. Because calories ordered was positively skewed, all statistical analyses used log-transformed data. However, for ease of interpretation, Fig. 1 reports untransformed mean values.

Accuracy of estimating calories ordered

The absolute value of the difference between the calories ordered and the calories participants estimated ordering was used to measure calorie estimation accuracy. In addition, the percentage of participants who overestimated, underestimated, and were accurate at estimating calories ordered (defined as providing the exact estimate) was calculated.

Perceptions of restaurant healthfulness

After participants ordered food, they were also asked how healthy they thought the restaurant was on a scale anchored 1 = *very unhealthy* to 7 = *very healthy*.

Other measures

Calorie format preferences

At the end of the survey, participants were also asked: (a) how much they liked the format of the calorie information (1 = *dislike extremely*, 9 = *like extremely*), (b) how easily understandable they found the calorie information (1 = *very difficult*, 7 = *very easy*) and (c) how salient and noticeable the calorie information was (1 = *not at all salient or noticeable*, 7 = *very salient or noticeable*).

Statistical analyses

For all statistical analyses, p-values less than .05 were considered significant, and p-values from .05 to .10 were considered marginally significant. A one-way analysis of variance (ANOVA) was performed to assess whether the four menu conditions differed by age, body mass index (BMI; measured in kg/m^2), hunger prior to the survey, and frequency of nutrition label use (see Table 1).

Three planned comparisons and a Cohen's d (adjusted; calculated using adjusted group means and raw group standard deviations) for each comparison (Cohen, 1988) were conducted to compare each of the three different calorie label conditions to the no calories control condition on calories ordered and accuracy of estimating calories ordered. Planned comparisons were conducted rather than ANOVAs because we had specific a priori hypotheses regarding the effects of each calorie group (O'Brien, 1983; Rosenthal, Rosnow, & Rubin, 2000; Rosnow & Rosenthal, 1989; Rutherford, 2011; Wilcox, 1987). We hypothesized that presenting calorie information would decrease calories ordered and increase calorie estimation accuracy in all three calorie label conditions relative to the control condition, but that the effect sizes would be larger for the Ordered and Colored Calorie comparisons. We limited the analyses to three planned comparisons, because it is recommended that the maximum number of planned comparisons one conducts should not exceed the value of df_{BG}, which in this case is three (Sheskin, 2004). Gender, BMI, frequency of nutrition label use, and hunger prior to the survey were included as covariates in the planned comparisons to control for individual differences that are known to affect calories ordered and/or attention to calorie information. A Chi-squared analysis was conducted to examine underestimation and overestimation of calories ordered by menu condition.

Finally, an exploratory one-way ANOVA was performed to assess whether different calorie formats on a menu change perceived healthfulness of the restaurant. This significant exploratory overall ANOVA test was followed by post-hoc Least Significant Difference (LSD) tests to examine differences between menu conditions, and a Cohen's d was calculated for each comparison (Cohen, 1988).

Results

Participants

Four-hundred and fifty-six people completed the study, but 37 were excluded because they did not order any menu items. The majority (69.5%) of participants were female, and the following education levels were reported: 36.3% had a four-year college degree, 27.4% had attended some college, 17.7% had a graduate degree, 9.8% had a high school/GED degree only, 7.9% had a two-year college degree, and 1.0% did not complete high school. An additional participant was excluded from the analysis of accuracy of calorie estimation because the participant's estimate of 100,000 calories ordered made him an extreme outlier. Some participants left several questions blank, so they were excluded from the statistical analyses involving those questions. Participants who provided invalid height and weight information were excluded from the analyses for BMI. There were 418 responses for

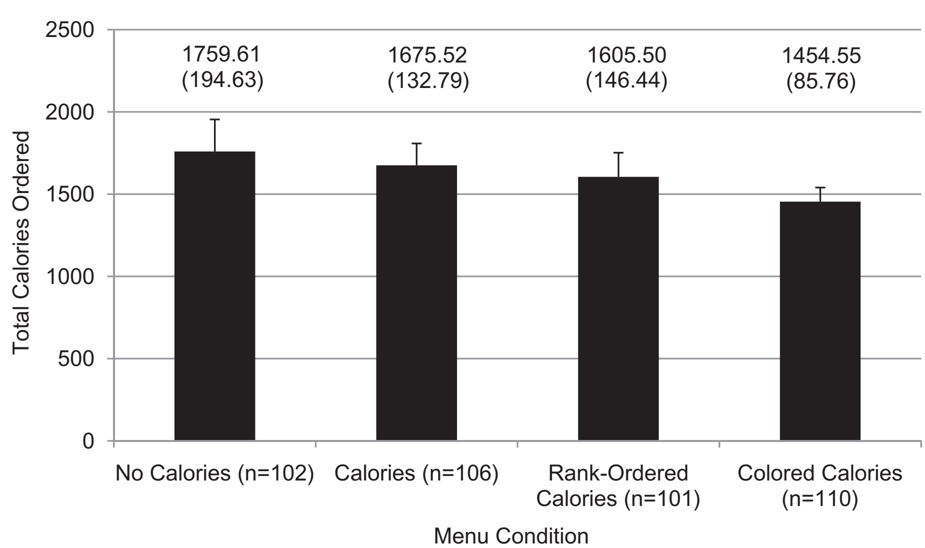

Fig. 1. Calories ordered as a function of menu condition. *Note:* Statistical analyses were conducted with log-transformed data, whereas raw means and standard errors are reported in this figure. One thousand calories on this figure equals 1000 kcal (4.184 MJ).

Table 1
Means and standard deviations for demographic and eating practice variables of participants randomly assigned to four menu label conditions.[a]

	No calories	Calories	Rank-ordered calories	Colored calories	Test statistic (χ^2 or F)	P
# of participants	102	106	101	110	0.48	0.92
Age, y[b]	38.07 ± 12.71	35.74 ± 13.77	34.71 ± 11.53	38.14 ± 13.18	1.82	0.14
BMI, kg/m[2c]	26.43 ± 6.80	24.09 ± 5.75	25.08 ± 8.34	25.27 ± 6.75	1.97	0.11
Hunger prior to survey[d]	3.10 ± 1.68	3.14 ± 1.69	3.45 ± 1.69	3.06 ± 1.71	1.10	0.35
Frequency of nutrition label use[e]	3.55 ± 1.02	3.34 ± 0.87	3.17 ± 1.08	3.33 ± 1.01	2.50	0.06
Perceived healthfulness of restaurant[f]	3.48 ± 1.15	3.72 ± 1.09	3.72 ± 1.14	4.05 ± 1.19	4.38	0.01

[a] Table values are mean ± SD and F values for continuous variables and n and χ^2 for categorical variables.
[b] Age in years; No Calories (n = 101), Calories (n = 105), Rank-Ordered Calories (n = 98), Colored Calories (n = 110).
[c] BMI = body mass index; No Calories (n = 101), Calories (n = 106), Rank-Ordered Calories (n = 98), Colored Calories (n = 110).
[d] Hunger prior to survey measured on a scale anchored 1 = *not at all hungry*, 7 = *extremely hungry*.
[e] Frequency of nutrition label use measured on a scale anchored 1 = *never*, 5 = *always*.
[f] Perceived healthfulness of restaurant measured on a scale anchored 1 = *very unhealthy*, 7 = *very healthy*.

the analysis of calories ordered (102 in the No Calories condition, 106 in the Calories only condition, 101 in the Rank-Ordered Calories condition, and 110 in the Colored Calories condition). One-way ANOVAs detected no significant differences between menu conditions in terms of age (36.7 ± 12.9), BMI (25.2 ± 7.0), or any of the other eating practices variables. [See Table 1.].

Total calories ordered

Without including any covariates, the planned comparisons for total calories ordered were not significant (No Calories condition versus Calories only condition: $F(1, 415) = 0.13$, $p = 0.715$; No Calories condition versus Rank-Ordered Calories condition: $F(1, 415) = 1.13$, $p = 0.288$; No Calories condition versus Colored Calories condition: $F(1, 415) = 1.22$, $p = 0.270$). The proposed covariates were then tested (frequency of nutrition label use, hunger prior to the survey, BMI, and gender), revealing that all proposed covariates with the exception of BMI were significantly associated with total calories ordered, justifying their inclusion as covariates. Therefore, planned comparisons including frequency of nutrition label use, hunger prior to the survey, and gender as covariates were run. BMI was not included, although the results do not change meaningfully if BMI is included.

Including covariates, a planned comparison comparing the No Calories condition to the Calories only condition on total calories ordered was not significant, $F(1, 412) = 1.27$, $p = 0.262$, $d = 0.08$, although the means trended in the predicted direction. See Fig. 1 for mean calories ordered across menu conditions. A second planned comparison, including covariates, between the No Calories condition and the Rank-Ordered Calories condition was significant, $F(1, 412) = 6.27$, $p = 0.013$, $d = 0.16$, such that people who saw the Rank-Ordered Calories menu ordered fewer calories than people who saw the menu without calorie information. Finally, a planned comparison, including covariates, between the No Calories condition and the Colored Calories condition was marginally significant, $F(1, 412) = 2.81$, $p = 0.095$, $d = 0.15$, such that people who saw the Colored Calories menu ordered fewer calories than people who saw the menu without calorie information. In addition to being statistically significant, these differences in calories ordered between conditions could be clinically significant, given that consuming an extra 100 calories per day can lead to gaining an extra ten pounds per year (Beebe, 2009).

Overall, 44 participants made food substitutions. Of those, 31 were judged to be side dish substitutions (e.g., rice instead of fries) by a researcher blind to each participant's menu condition. The remaining 13 responses were not judged to be side dish substitutions (e.g., fish instead of hamburger, no peppers). Analyses were re-run taking into account changes in calories ordered due to side dish substitutions and results remained the same. The average calories ordered by each menu condition did not change by more than ±5.5 calories (complete data not shown). Therefore, we did not find evidence that different formats of calorie labels alter consumer food choices by leading them to substitute lower calorie side dishes. [See Fig. 1].

To investigate how calorie information influenced the pattern of ordering, we conducted an exploratory analysis to examine differences in the number of items ordered across menu conditions. These data were log-transformed to address a positive skew. A one-way ANOVA did not reveal any significant differences in items ordered, $F(3, 415) = 0.17$, $p = 0.917$. This suggests that participants in the Rank-Ordered Calories condition and the Colored Calories condition were ordering lower calorie menu items rather than simply ordering fewer menu items.

Finally, we examined whether the percentage of lower and higher calorie menu items ordered differed among conditions for entrees, sides, desserts, and beverages. Menu items were classified as lower calorie menu items if they met the calorie cutoff criteria used for the Colored Calories menu (⩽750 calories for entrees; ⩽250 calories for appetizers, sides, or desserts; 0 calories for beverages) and were otherwise considered higher calorie menu items. All appetizers were categorized as higher calorie items and thus were not included in these analyses. Chi-squared tests were performed to determine whether the percentage of lower and higher calorie menu items ordered differed among menu conditions. None of the overall Chi-squared tests were significant (entrees: $\chi^2(3) = 3.99$, $p = 0.263$; sides: $\chi^2(3) = 5.38$, $p = 0.146$; desserts: $\chi^2(3) = 4.44$, $p = 0.218$; beverages: $\chi^2(3) = 1.93$, $p = 0.588$). However, additional exploratory Chi-squared tests between menu groups revealed that the percentage of lower calorie desserts ordered was higher in the Rank-Ordered Calories condition than in the Calories only condition (59.3% vs. 32.3%; $\chi^2(1) = 4.25$, $p = 0.039$). Two marginally significant differences also emerged in the entrees category. Compared to the No Calories condition, the percentage of lower calorie entrees was higher in the Calories only condition (52.8% vs. 42.2%; $\chi^2(1) = 2.69$, $p = 0.100$), and the Colored Calories condition (53.7% vs. 42.2%; $\chi^2(1) = 3.12$, $p = 0.077$).

Accuracy of estimating total calories ordered

Without including any covariates, a planned comparison comparing accuracy of estimating total calories ordered between the No Calories condition and the Calories only condition was marginally significant, $F(1, 414) = 2.97$, $p = 0.086$, such that people who saw the Calories only menu were more accurate at estimating how many calories they ordered than people who saw the control menu. See Fig. 2 for mean accuracy across menu conditions. A second planned comparison between the No Calories control condition and the Rank-Ordered Calories condition was significant, $F(1, 414) = 4.85$, $p = 0.028$, such that people who saw the Rank-Ordered Calories menu were more accurate at estimating how many calories

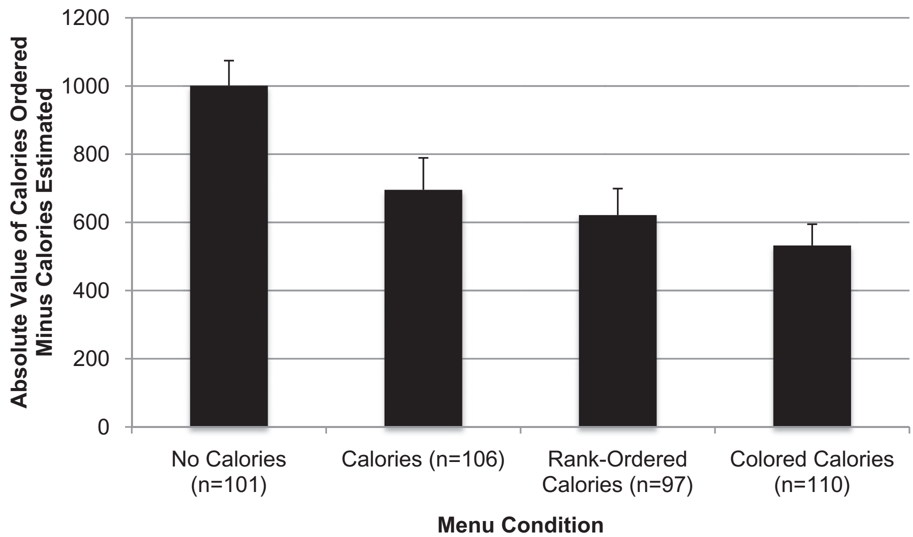

Fig. 2. Accuracy of calorie estimation as a function of menu condition. *Note:* Higher bars indicate less accuracy of calorie estimation. One thousand calories on this figure equals 1000 kcal (4.184 MJ).

they ordered than people who saw the control menu. Finally, a planned comparison between the control condition and the Colored Calories condition was significant, $F(1, 414) = 7.16$, $p = 0.008$, such that people who saw the Colored Calories menu were more accurate at estimating how many calories they ordered than people who saw the control menu. Therefore, people in all three calorie conditions (calories only, rank-ordered, and colored) estimated more accurately than people in the control condition. The proposed covariates (frequency of nutrition label use, hunger prior to the survey, BMI, and gender) were then tested for association with accuracy of calorie estimation, and with the exception of frequency of nutrition label use, all were significantly associated with accuracy of calorie estimation, justifying their inclusion as covariates. Therefore, planned comparisons including hunger prior to the survey, BMI, and gender as covariates were run. Frequency of nutrition label use was not included, although the results do not change meaningfully if it is included.

Including covariates, a planned contrast comparing the No Calories control condition to the Calories only condition on the absolute value of calories ordered minus calories estimated was significant, $F(1, 407) = 6.85$, $p = 0.009$, $d = 0.26$, such that people who saw the Calories only menu were more accurate at estimating how many calories they ordered than people who saw the control menu. See Fig. 2 for mean accuracy across menu conditions. A second planned comparison, also including covariates, between the No Calories control condition and the Rank-Ordered Calories condition was significant, $F(1, 407) = 7.98$, $p = 0.005$, $d = 0.34$, such that people who saw the Rank-Ordered Calories menu were more accurate at estimating how many calories they ordered than people who saw the control menu. Finally, a planned comparison, including covariates, between the control condition and the Colored Calories condition was significant, $F(1, 407) = 9.23$, $p = 0.003$, $d = 0.37$, such that people who saw the Colored Calories menu were more accurate at estimating how many calories they ordered than people who saw the control menu. Therefore, people in all three calorie conditions (calories only, rank-ordered, and colored) estimated more accurately than people in the control condition. [See Fig. 2]. In addition to being statistically significant, the improvements in accurately estimating calories ordered, which occurred in the calorie label conditions, could be clinically meaningful for those trying to reduce their daily caloric intake. Improving consumer ability to estimate the calories in meals might assist individuals in making food choices throughout the day, based on the number of calories they have already consumed.

Fifty-nine percent of participants underestimated calories ordered, 34% overestimated calories ordered, and 7% accurately estimated calories ordered, but this did not significantly differ across menu label conditions ($\chi^2(6) = 10.13$, $p = 0.119$). However, when the control group was compared to all three calorie label groups collapsed into one group, there was a significant difference ($\chi^2(2) = 9.15$, $p = 0.010$) such that those in the control condition were more likely to underestimate calories compared to the calorie label groups. [See Table 2].

Perceived healthfulness

The menu conditions differed significantly based on perceived healthfulness of the restaurant [see Table 1]. There were significant differences between the No Calories condition and the Colored Calories condition ($p < 0.001$; $d = 0.48$), between the Calories condition and the Colored Calories condition ($p = 0.036$; $d = 0.21$), and between the Rank-Ordered Calories condition and the Colored Calories condition ($p = 0.041$; $d = 0.21$). In each of these comparisons, people who saw the Colored Calories menu perceived the restaurant as healthier.

Opinions on menu labeling and label preferences

After selecting menu items and estimating calories ordered, participants were asked their opinions about menu labeling and their label preferences. The majority of participants, 79.7%, felt that all chain restaurants should offer calorie information on their menus, 11.2% felt they should not, and 9.1% had no opinion. When asked about their opinions on calorie labeling on all restaurant menus rather than just chain restaurant menus, 71.8% of participants felt that all restaurants should offer calorie information on their menus, 17.4% felt they should not, and 10.7% had no opinion. The majority of participants, 75.2%, felt that restaurants should label the healthier choices on their menus with a special symbol, 12.9% felt they should not, and 11.9% had no opinion. There were no differences in label perceptions across menu conditions.

Among the 317 participants assigned to a menu with calorie information, 35.3% reported that calorie information on the menu influenced their food choices, 57.7% reported that it did not, and

Table 2
Percentage of participants who underestimated, overestimated, and accurately estimated calories ordered across four menu label conditions.

	Percentage who underestimated calories ordered	Percentage who overestimated calories ordered	Percentage who accurately estimated calories ordered
No calories ($n = 102$)	67.6	31.4	1.0
Calories ($n = 106$)	54.7	34.9	10.4
Rank-ordered calories ($n = 100$)	57.0	34.0	9.0
Colored Calories ($n = 110$)	55.5	37.3	7.3

Note: A Chi-squared test did not reveal significant differences across menu label conditions ($p = 0.119$), but when calorie label groups were collapsed into one group and compared to the No Calories condition, the groups were significantly different ($p = 0.010$).

6.9% reported not seeing calorie information on the menu. Overall, the 295 participants who saw and reported seeing calorie information on the menu liked the format of the calorie information on the menu (rating of 6.58 ± 1.85 out of 9), felt it was easily understandable (rating of 5.96 ± 1.08 out of 7), and felt it was salient and noticeable on the menu (rating of 5.41 ± 1.62 out of 7). A one-way ANOVA did not detect significant differences between the three calorie conditions on any of these measures.

Discussion

Although the Nutrition Labeling and Education Act of 1990 mandated that calorie information be provided on most packaged foods that consumers purchase in stores, the recently passed Patient Protection and Affordable Care of Act of 2010 extended this mandate to restaurants. However, as of June 2012, the FDA was continuing to solicit suggestions for implementing the law ("New Menu", 2011). Given that one implied goal of this law is to increase healthier choices, the findings from this study suggest that presenting menu items with calorie information ordered from low to high values might be more likely to lead consumers to make healthier choices than presenting the information in no particular order. It might also be more beneficial to highlight healthy and less healthy choices with red and green colors, rather than presenting calorie information alone. However, given that perceptions of the restaurant's healthfulness increased when colored calorie labels were on the menu, future research should examine whether this could inadvertently lead diners to consume more calories at the meal. In addition, because some research suggests that people perceive healthier food as tasting worse (Raghunathan, Naylor, & Hoyer, 2006), future research should examine the effects of different menu presentations on meal satisfaction, perceived tastiness, and likelihood of returning to the restaurant.

One limitation of this study is that it is an online survey that measures hypothetical rather than actual choices. However, the reductions in calories ordered observed in the current study were similar to the calorie reductions reported in another study (Roberto et al., 2010), which measured actual food choices and consumption. Nonetheless, future research should test how different calorie label presentations affect ordering and consumption in real-world settings. Another limitation is that this study tested only one type of restaurant menu, limiting the generalizability of the findings to other restaurants. Finally, the generalizability of these findings to different populations is limited by the use of a convenience sample, the majority of which was female, white, and had at least some college education.

This study adds to the existing literature by identifying and testing possible ways to improve the effectiveness of menu labeling. In addition, this study has built upon previous research on calorie labeling by evaluating a family-style chain restaurant menu, as opposed to fast-food restaurants, which have been the subject of much of calorie labeling research. These sit-down restaurants often offer very high-calorie items. As some have suggested, menu labeling might be especially impactful when a consumer's expectations of a food are violated, which might be more likely to occur at restaurants serving very high calorie foods (Burton et al., 2006). The data from this study partially support this hypothesis. Two independent coders, who were not aware of the caloric values of the menu items, coded whether they thought each menu item should be classified as green (⩽750 calories for entrees; ⩽250 calories for appetizers, sides, or desserts; 0 calories for beverages) or red (>750 calories for entrees; >250 calories for appetizers, sides, or desserts; >0 calories for beverages). The two coders' responses demonstrated sufficient agreement (Krippendorf's Alpha = 0.72), and remaining disagreements were resolved through discussion between the coders. Based upon the two coders' responses, all menu items were classified as either (1) red items incorrectly coded as green items ($n = 3$), (2) green items incorrectly coded as red items ($n = 5$), (3) red items correctly coded ($n = 44$), or (4) green items correctly coded ($n = 19$). Then, each participant's order was coded for the presence or absence of having ordered a red item that was coded as a green item (i.e., more caloric than expected). An overall Chi-squared test revealed a significant difference between conditions, $\chi^2(3) = 9.13$, $p = 0.028$, such that a smaller percentage of participants in the modified menu label formats ordered these items compared to the Control condition (No Calories condition: 11.8%, Calories only condition: 9.4%, Rank-Ordered Calories condition: 4.0%, Colored Calories condition: 2.7%). Next, each participant's order was coded for the presence or absence of having ordered a green item that was coded as a red item (i.e., less caloric than expected). An overall Chi-squared test did not reveal a significant difference between conditions, $\chi^2(3) = 1.06$, $p = 0.788$. Thus, although the small sample size of incorrectly classified items is a limitation of these analyses, the data from this study suggested that menu labeling in the modified formats, especially the Colored Calories format, might keep some consumers from ordering items that are higher in calories than they expect.

Finally, the effects of menu labeling in sit-down restaurants versus fast-food restaurants may also differ because a sit-down restaurant presents calorie information on a paper menu in front of the consumer rather than on a menu board, which can be difficult for some patrons to see, and because patrons of sit-down restaurants may have the opportunity to spend more time evaluating the menu than patrons at fast-food restaurants.

More research is needed to examine ways to improve the effectiveness of menu labeling. In addition, the impact of menu labeling should be studied in both fast-food and casual sit-down chain restaurant patrons. Future research should also examine how different demographic variables moderate the effectiveness of calorie information. This research is important for informing possible public health education and marketing campaigns about menu labeling. Future studies should also test marketing strategies to draw consumer attention to the calorie information. For instance, table signs reinforcing the 2000-calorie daily guideline might better cue people's attention and increase the effectiveness of menu labeling.

Of note, 7.0% of participants in this study who were exposed to menus with calorie information reported not seeing calorie information. There are many potential reasons why menu labeling has not made the impact on calories ordered that policy makers expected. One reason may be that some people do not pay attention to calorie information on menus. Attention is a scarce resource, and it is important to understand how people allocate their attention, both for predicting and improving ordering behavior. Among the aspects of attention that may be important to measure are where consumers' attention is drawn, for how long it is drawn, and in what order it is drawn. To capture these process measures, a method that can be used in future menu labeling studies is eye tracking. Using this method, eye fixation locations and durations are recorded while individuals scan information on a screen, or in this case, a menu (Patalano, Juhasz, & Dicke, 2010). This eye tracking method simulates natural information search (Lohse & Johnson, 1996) and could capture consumers' natural ordering behavior. This technique could be used to investigate several important questions, including whether consumers whose ordering choices are affected by calorie labels display longer fixation durations at calorie information locations and whether changing the format or placement of calorie information on a menu board changes attention to calorie information.

Although the majority of participants in the three calorie label conditions reported that they saw calorie information, participants in these conditions still underestimated the number of calories they ordered by over 500 calories on average. There are many potential reasons why participants greatly underestimated the number of calories they ordered even after reporting that they saw the calorie information. One possibility is that some participants remembered seeing calorie information on the menu but did not examine the calorie information long enough or with enough focus to accurately recall how many calories were in the items they ordered. Another possibility is that participants took note of calorie information for some items (e.g., entrees) but not others (e.g., sides, drinks), such that their calorie estimates became more accurate but were still underestimates of the actual calorie counts of their meals. Although our data does not enable us to answer this question, future research should examine why although calorie information improved people's estimates of the calories ordered, some consumers still underestimated the number of calories even after reporting that they saw the calorie information.

Overall, the findings from this study suggest that changing the format of calorie information can lead consumers to choose lower calorie meals when ordering from a casual chain restaurant menu. In addition, presenting calorie information as is currently mandated by federal legislation may not be as effective as the altered formats presented in this article. Finally, in agreement with past research (Roberto, Schwartz, & Brownell, 2009), this article found that a high percentage of participants in the study sample were in favor of menu labeling both in fast-food and regular restaurants, suggesting public support for the policy. It is possible that restaurants would agree to re-order their menu items based on the number of calories if they would not lose profits (or if they would be more profitable). Although restaurants might be concerned about the costs of re-doing menu formats, the implementation of digital menu boards is becoming increasingly common, especially in light of menu labeling legislation. In addition, there is growing consumer desire for healthier foods and greater attention to the restaurant industry's contributing role to the obesity epidemic. Therefore, restaurants might want to engage in these kinds of strategies to demonstrate that they can be part of the solution and stave off government mandates. Finally, restaurants might also be willing to re-design menu formats if they are received favorably by consumers.

Author contributions

P. J. Liu originated the study idea and design, acquired the data, performed data analysis, and led the writing. C. A. Roberto assisted with study design and data analysis, and provided critical feedback on the drafts of the article. L. J. Liu assisted with menu design and data cleaning and provided critical feedback on the drafts of the article. K. D. Brownell provided critical feedback on the drafts of the article.

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