Customer Responses to Mandatory Menu Labeling at Full-Service Restaurants

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Background: In 2010, Philadelphia enacted a menu-labeling law requiring full-service restaurant chains to list values for calories, sodium, fat, and carbohydrates for each item on all printed menus.

Purpose: The goal of the study was to determine whether purchase decisions at full-service restaurants varied depending on the presence of labeling.

Methods: In August 2011, this cross-sectional study collected 648 customer surveys and transaction receipts at seven restaurant outlets of one large full-service restaurant chain. Two outlets had menu labeling (case sites); five outlets did not (control sites). Outcomes included differences in calories and nutrients purchased and customers' reported use of nutrition information when ordering. Data were analyzed in 2012.

Results: Mean age was 37 years; 60% were female; 50% were black/African-American and reported incomes ≥$60,000. Customers purchased food with approximately 1600 kcal (food plus beverage, 1800 kcal); 3200 mg sodium; and 35 g saturated fat. After adjustment for confounders, customers at labeled restaurants purchased food with 151 fewer kilocalories (95% CI=−270, −33); 224 mg less sodium (95% CI=−457, +8); and 3.7 g less saturated fat (95% CI=−7.4, −0.1) compared to customers at unlabeled restaurants (or 155 less kilocalories from food plus beverage, 95% CI=−284, −27). Those reporting that nutrition information affected their order purchased 400 fewer food calories, 370 mg less sodium, and 10 g less saturated fat.

Conclusions: Mandatory menu labeling was associated with better food choices among a segment of the public dining at full-service restaurants. Consumer education on the availability and use of nutrition information may extend the impact of menu labeling.
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Introduction

Over the past 25 years, U.S. obesity prevalence has doubled,[1] and Americans are consuming more meals away from home.[2] Nutrition labeling on menus aims to help consumers make healthier dining decisions. In 2008, the New York City Board of Health implemented regulations mandating that restaurant chains include calorie information on menus.[3] Many other U.S. localities have since implemented similar policies, and the U.S. Patient Protection and Affordable Care Act (ACA) will require menu labeling at all restaurant chains with 20 or more locations nationally.[4]

Consumer surveys suggest widespread support for nutrition labeling on restaurant menus, but research to date has observed mixed or limited consumer response in fast-food settings.[5] For example, one large study found that purchased calories decreased (approximately 100 kcal) among those who self-reported using the labels,[6] but another study found no difference.[7] Overall, when sampled customers were viewed as a whole, differences in fast-food calories purchased before and after mandatory labeling were not significant[6–8] or were of small magnitude (i.e., 38 calories[9] or even less[10]).

To date, the only field-based study of menu labeling at full-service restaurants used sales data and customer surveys to examine purchases at six independent

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restaurants in Pierce County WA before and after the restaurants voluntarily posted calories, sodium, fat, and carbohydrates for most items on printed menus.[11] High proportions of patrons reported seeing the labels and using the information when deciding what to order. However, self-reports did not align with sales data, which showed little difference in average calories purchased for entrées (15 calories). More field-based studies of full-service restaurants are needed, particularly at restaurant chains, which currently dominate the full-service restaurant industry[12] and may soon be subject to mandatory menu labeling.[4]

In January 2010, Philadelphia PA enacted a menu-labeling ordinance requiring restaurant chains to post calorie information on menu boards and to list calories, sodium, saturated fat, trans fats, and carbohydrates for each item on all printed menus.[13] This study examined customer behavior in response to nutrition information disclosure on menus at a full-service restaurant chain. The chain had restaurants in Philadelphia where menus were labeled (cases) and restaurants outside Philadelphia where menus were not labeled (controls). The hypothesis was that relative to customers at control sites, customers at case sites would purchase foods that were lower in calories, sodium, carbohydrates, and fats.

Methods

Restaurant Selection and Participant Recruitment

At the time of this study, seven full-service restaurant chains in Philadelphia displayed calories, sodium, saturated fat, trans fat, and carbohydrates on their menus. Of those, one large, midpriced national chain had a sufficient number of outlets inside and outside Philadelphia and menus that clearly displayed nutrition information (see details below). The chain was among the top 20 in the U.S. in 2010, reporting more than $1 billion in sales nationwide.[14] A convenience sample of the chain's outlets was recruited: the two outlets in Philadelphia (case sites, "labeled restaurants") and five outlets within a 130-mile radius from the center of Philadelphia that agreed to participate in the evaluation (located in Delaware, Maryland, and New Jersey; control sites, "unlabeled restaurants"). In Philadelphia and in the surrounding areas, the chain's outlets were in commercial centers or strip malls. Customer demographics were collected to assess comparability of customers at case and control sites, as described below.

Menus at the outlets inside and outside Philadelphia were identical except that menus in Philadelphia displayed labels next to all food-item descriptions and prices: calories and nutrients were abbreviated alongside their corresponding value and unit of measurement (e.g., "1030 cals./9g sat. fat/1g trans fat/95g carbs/2300mg sod"). At the chain's Philadelphia outlets, alcoholic beverages were labeled, but only 40% of non-alcoholic drinks were labeled (i.e., calories for brand-name soft drinks were not displayed on the menu). Menus at the outlets inside and outside Philadelphia displayed the chain company's "healthier choice" tags, indicating a lower-calorie option (on less than 15% of menu items). Dietary reference values were not displayed on menus despite being required by Philadelphia's menu-labeling regulations. Menus and labels did not change during the data collection period.

Transaction receipts and surveys were collected in August 2011, from customers exiting the restaurants between 6PM and 9PM on Sundays and Tuesday–Thursday. These days/hours were selected to maximize customer volume and minimize heterogeneity of customer demographics and food/beverage orders.[15] Details of data collection methods are reported in Appendix A (available online at www.ajpmonline.org). Approximately 50% of dining parties exiting the restaurants participated in the survey, which aligns with other restaurant intercept survey response rates.[6]

Survey

The customer questionnaire used items from previous surveys,[8,16–19] including whether respondents saw nutrition information in general and for each component listed on all menu items, and whether calorie and sodium information affected what was ordered. Because customers at unlabeled restaurants may have seen the chain's "healthy choice" calorie tag, they were allowed to respond that they saw information for "some of the items." The questionnaire also asked about demographic characteristics (Table 1) and whether a health professional had recommended limiting any of the listed nutrients. Study staff members were trained to record the participant's approximate body size using a body silhouette chart[20–22] (see Appendix A, available online at www.ajpmonline.org). Customers participated anonymously, providing verbal consent. The IRB of the Philadelphia Department of Public Health approved this study.

Analytic Sample

A priori power analyses for the main study questions suggested that 300 customers were required in each group. To compensate for nonresponse, the study over-enrolled by 20%. Ultimately, 721 customers completed the survey; 73 were excluded because of missing information on the primary analysis variables or covariates, leaving 648 for analyses. The only difference found between included versus excluded customers was that a lower proportion of women were included compared to those surveyed (60% vs 76%).

Data Processing and Analysis

Customer receipts and the restaurant chain's calorie and nutrient information were entered into a database. Descriptive statistics were used to examine comparability of customer characteristics and nutrition values between (1) customers at labeled and unlabeled sites and (2) customers at the labeled sites who said they used nutrition information when ordering ("labeling users") versus other customers.

Eight linear regression models were used to separately examine mean differences between purchases at labeled and unlabeled restaurants for: (1) total food and beverage calories; (2) food calories; (3) sodium; (4) carbohydrates; (5) saturated fat; (6) calories from all beverages; (7) calories from alcoholic beverages; and (8) calories from non-alcoholic beverages.

Table 1. Customer characteristics: total, at labeled restaurants, at unlabeled restaurants; full-service restaurant chain; N=648, *n* (%), unless otherwise indicated

Characteristics	Labeled restaurants, *n* = 327	Unlabeled restaurants, *n* = 321	*p*-value[a]
Gender			
Female	192 (59)	199 (62)	0.4
Male	135 (41)	122 (38)	
Age (years)			
18–24	87 (27)	58 (18)	0.01
25–39	130 (40)	126 (39)	
≥40	110 (34)	137 (43)	
Race/ethnicity			
White	100 (31)	153 (48)	< 0.0001
Black/African-American	182 (56)	142 (44)	
Hispanic and other[b]	45 (14)	26 (8)	
Income ($)			
<35,000	92 (28)	65 (20)	0.004
35,000–<60,000	101 (31)	84 (26)	
≥60,000	134 (41)	172 (54)	
Educational attainment			
High school or less	78 (24)	79 (25)	0.8
Technical or 2-year associate's degree	51 (16)	58 (18)	
Bachelor's degree	133 (41)	121 (38)	
Graduate school	65 (20)	63 (20)	
Cautioned about diet[c]			
No	257 (79)	255 (79)	0.8
Yes	70 (21)	66 (21)	
Body size[d]			
Thin, average	190 (58)	158 (49)	0.07
Overweight	101 (31)	118 (37)	
Severe overweight	36 (11)	45 (14)	
Dines at sit-down chain restaurant, times per week			
<1	204 (62)	177 (55)	0.06
≥1	123 (38)	144 (45)	
Seeing nutrition information affected order[e]			
No	166 (51)	60 (19)	< 0.0001
Yes	84 (26)	19 (6)	
Didn't see nutrition information	77 (24)	242 (75)	

(continued on next page)

Covariates in each regression model were customer demographics (gender, age, race, income, education); body size; day of the week; and frequency of eating at full-service restaurant chains. The study was powered to test the main effect of labeling, but not labeling's effect by customer subgroups. Nevertheless, to explore demographic and behavioral characteristics associated with self-reported use of nutrition information, logistic regression was used to model the probability of self-reported labeling use among only Philadelphia customers (Appendix C, Table C-1, available online at www.ajpmonline.org). Analyses were conducted in 2012 using SAS 9.2.

Results

The mean age of the survey participants was 37 years (SD=14, range=18–82); 60% of the sample was female, and about half self-identified as black/African-American (Table 1). Mean educational attainment was 15 years, and nearly half had incomes ≥$60,000. About 40% of participants dined at full-service restaurant chains at least once a week; virtually all customers dined in the past 12 months at a full-service restaurant chain other than the chain included in this study. About 20% of customers reported being cautioned by a health professional about their diet, and 13% were classified as severely overweight. Relative to unlabeled restaurants, labeled restaurants had younger customers; more African Americans (56% vs 44%); and fewer customers with higher incomes (>$60,000; 41% vs 54%; $p \leq 0.01$).

On average, customers purchased two or three food items costing about $15 (on average, at labeled restaurants, customers ordered 0.3 fewer items and spent $1 less). Food purchased

Table 1. *(continued)*

Characteristics	Labeled restaurants, $n = 327$	Unlabeled restaurants, $n = 321$	p-value[a]
Selected item with "healthy choice" label			
Yes	36 (11)	49 (15)	0.1
Ordered an alcohol beverage			
Yes	118 (36)	118 (37)	0.9
Ordered a non-alcoholic beverage			
Yes	177 (54)	172 (54)	0.5

[a]Test for significant difference (χ^2 or t-test)
[b]Race/ethnicity categories were combined because of small numbers: 36 Hispanic, 16 Asian, 19 Native American/Pacific Islander/Other.
[c]Customers self-reported that a health professional told them to be careful about eating (1) too many calories; (2) too much sodium; (3) too much saturated fat and trans fatty acids; and (4) too much sugar. To minimize over-reporting, participants were classified as having been "cautioned about diet" if they responded affirmatively to all four.
[d]Staff assigned body size via observational methods (see Appendix A, available online at www.ajpmonline.org).
[e]Explicitly asked about seeing calories or sodium information

at the labeled sites contained on average 1556 calories, 3111 mg sodium, 34 g saturated fat, and 115 g carbohydrates, in contrast with 1690 calories, 3315 mg sodium, 37 g saturated fat, and 131 g carbohydrates at the unlabeled sites (unadjusted differences shown in Table 2).

Differences in nutrition values for food purchases at the labeled vs unlabeled sites persisted after adjustment for age, gender, race/ethnicity, income, education, body size, day of the week, and frequency of dining at full-service restaurant chains (Table 3). Relative to the unlabeled sites, customers at labeled sites purchased 151 fewer food calories (95% CI=−270.0, −32.6); 224 mg less sodium (95% CI=−457, +8); 4 g less saturated fat (95% CI=−7.4, −0.1); and 15 g less carbohydrates (95% CI=−25.8, −3.6).

Eighty-six percent of customers purchased a beverage. Between labeled and unlabeled sites, no calorie differences were found for alcohol, but customers at labeled sites purchased more non-alcohol beverage calories (32 kcal, 95% CI=2, 62). When food and beverages were considered together, relative to the unlabeled sites, customers at labeled sites purchased 155 fewer total calories (food and beverages combined, 95% CI=−284, −27). Price of purchased food is correlated with food calories; thus, it is endogenous to the process being studied and food cost would be inappropriate as a control variable. In addition, item cost was consistent across case and control menus, and labeling users had higher incomes than non-users, making it unlikely that the influence of price was systematically stronger for labeling users (Table 4; Appendix Table C-1, available online at www.ajpmonline.org).

Sensitivity to imperfect covariate balance by treatment status (Table 1) was assessed using propensity score weights as described elsewhere[23–25] (Appendix Table B-1, available online at www.ajpmonline.org). Results were slightly stronger though substantively similar. For example, 170.2 fewer food calories (95% CI= −281.7, −58.7) and −266.2 mg less sodium (95% CI=−487.3, −45.2).

Among customers at labeled restaurants who said they saw menu labels (76% or n=250), 98% reported seeing calories; about 70% reported seeing information other than calories (sodium, saturated or trans-fat, carbohydrates); and 50% reported seeing sodium information (not shown in tables). Twenty-six percent of all customers at labeled restaurants (84/327) and 34% of customers who saw labels (84/250) reported that nutrition information influenced their ordering decisions. Among users of calorie and sodium labels (n=84), nearly all said calories influenced their decision, but only 24% said so about sodium (n=20). Customers who reported that they saw sodium (n=122) and that it affected their order (n=20) were similar to people who were more likely to see and use any nutrition information; thus, results for this small subgroup are not reported separately.

Purchased calories were highly correlated with purchased saturated fat, sodium, and carbohydrates (Pearson >0.70). When regressions were repeated using nutrient density per 1000 calories, no differences were found in purchases between labeled and unlabeled sites for sodium, saturated fat, and carbohydrates (not shown).

Only 6% of customers at unlabeled restaurants said that seeing a "healthier choice" tagged item (indicating a lower-calorie option) affected their ordering decision, whereas 26% of labeled restaurant customers said seeing the detailed labels for all food items on the menu affected their ordering decision (Table 1). Of this latter group, 58% purchased a tagged item (Table 4). Overall, 13% of customers said they purchased a "healthier choice" tagged item (Table 1).

Table 2. Unadjusted distribution of nutrition values for customer purchases by labeling status, M (SD), unless otherwise indicated

	Total sample, N=648	Labeled restaurants, *n*=327	Unlabeled restaurants, *n*=321	*p*-value[a]
NUTRITION VALUES OF PURCHASED MEALS				
Total beverage and food				
Calories[b]	1834 (807)	1778 (824)	1891 (785)	0.07
Beverages, alcoholic drinks				
Calories	386 (291)	388 (293)	385 (289)	0.9
Beverages, non-alcoholic drinks				
Calories	133 (140)	157 (153)	109 (123)	0.001
Food				
Calories	1623 (740)	1556 (733)	1691 (743)	0.02
Saturated fat (g)	35.0 (23.0)	33.5 (22.1)	36.5 (23.9)	0.01
Trans fat (g)	0.8 (1.2)	0.7 (1)	0.9 (1.3)	0.04
Carbohydrates (g)	123 (69)	115 (64)	131 (72)	0.002
Sodium (mg)	3213 (1427)	3111 (1460)	3315 (1389)	0.07
COST OF FOOD PURCHASED ($)[c]	15.00 (5.70)	14.60 (5.20)	15.50 (6.00)	0.04
NUMBER OF ITEMS OF FOOD ORDERED	2.4 (1.3)	2.2 (1.2)	2.5 (1.4)	0.01

[a]Test for significant difference (χ^2 or t-test)
[b]According to daily recommended intakes described in the U.S. Dietary Guidelines, most adults each day should consume no more than 2000 calories; 2300 g sodium; 20 g saturated fat (10% of calories); and no/negligible trans fat. Source: Dietary Guidelines for Americans, 2010
[c]Price information was only available for food, and total cost was not available.
g, grams; mg, milligrams

Table 3. Eight linear regression models showing adjusted mean differences between purchases at labeled and unlabeled restaurants

Model no.	Outcome variable	*n*	Adjusted[a] mean difference (95% CI) between labeled and unlabeled	*p*-value
1	Calories in purchased food and beverages	648	−155 .0 (−284.0, −27.0)	0.018
2	Calories in food purchased	648	−151.0 (−270.0, −32.6)	0.013
3	Sodium in food purchased (mg)	648	−224.0 (−457.0, 8.0)	0.059
4	Saturated fat in food purchased (g)	648	−3.7 (−7.4, −0.1)	0.047
5	Carbohydrates in food purchased (g)	648	−14.7 (−25.8, −3.6)	0.01
6	Calories in beverages (alcoholic and non-alcoholic)	556[b]	11.5 (−32.0, 55.0)	0.605
7	Calories in alcoholic beverages	236[c]	−17.0 (−93.1, 59.1)	0.662
8	Calories in non-alcoholic beverages	349[d]	32.1 (2.4, 61.7)	0.035

[a]Linear regression adjustment variables: age, gender, race/ethnicity, income, education, day of the week, frequency of dining out at sit-down chain restaurant, and body size
[b]Model includes only those who ordered a beverage: 86% of the sample.
[c]Model includes only customers that ordered an alcoholic beverage: 36% of the sample.
[d]Model includes only customers that ordered non-alcoholic beverages: 53% of the sample. Nutrition labels were not displayed on any menus for brand-name fountain drinks (see Appendix A, available online at www.ajpmonline.org.
g, grams; mg, milligrams

Table 4. Nutrition information affected order, unadjusted distributions of customer characteristics and purchases at labeled restaurants

		Nutrition information affected order[a]			
		No	Yes	Didn't see nutrition information	
	n	Row percentages			*p*-value[b]
TOTAL	327	**51**	**26**	**24**	
Gender					
Female	192	49	29	22	0.3
Male	135	53	21	25	
Age (years)					
18–24	87	66	11	23	0.0002
25–39	130	51	24	25	
≥40	110	39	39	22	
Race/ethnicity[c]					
White	100	46	39	15	0.0006
Black/African-American	182	56	17	27	
Hispanic and other[b]	45	40	31	29	
Income ($)					
<35,000	92	62	9	29	<0.0001
35,000–<60,000	101	48	22	31	
≥60,000	134	46	40	14	
Educational attainment					
High school or less	78	64	9	27	<0.0001
Technical or 2- year associate's degree	51	45	22	33	
Bachelor's degree	133	53	26	21	
Graduate school	65	34	49	17	
Cautioned about diet[d]					
No	257	51	25	25	0.6
Yes	70	50	30	20	
Body size[e]					
Thin, average	190	49	26	25	0.9
Overweight	101	51	27	22	
Severe overweight	36	56	22	22	
Dines at sit-down chain restaurant					
<1 time per week	204	53	26	21	0.4
≥1 times per week	123	47	25	28	
Selected item with "healthy choice" label					
Yes	36	28	58	14	<0.0001

(continued on next page)

Table 4. Nutrition information affected order, unadjusted distributions of customer characteristics and purchases at labeled restaurants *(continued)*

		Nutrition information affected order[a]			
		No	Yes	Didn't see nutrition information	
	n	Row percentages			*p*-value[b]
Ordered an alcohol beverage					
Yes	118	49	25	26	0.7
Ordered a non-alcoholic beverage					
Yes	172	55	23	22	0.3
NUTRITION VALUES OF PURCHASED MEALS		**M (SD)**	**M (SD)**	**M (SD)**	***p*-value[b]**
Beverages and food					
Calories		1960 (833)	1391 (746)	1801 (770)	<0.0001
Beverages, alcoholic					
Calories		380 (303)	336 (233)	452 (322)	0.3
Beverage, non-alcoholic					
Calories		192 (150)	95 (139)	140 (155)	0.002
Food[f]					
Calories		1719 (757)	1231 (666)	1551 (648)	<0.0001
Saturated fat (g)		38.0 (23.1)	23.1 (17.4)	34.9 (21.2)	<0.0001
Trans fat (g)		0.8 (1.1)	0.5 (0.9)	0.8 (1.1)	0.03
Carbohydrates (g)		126 (66)	95 (60)	110 (62)	0.001
Sodium (mg)		3324 (1523)	2796 (1356)	3017 (1384)	0.02
COST OF FOOD PURCHASED, DOLLARS		15.26 (5.37)	13.18 (5.05)	14.40 (4.87)	0.01
NUMBER OF ITEMS OF FOOD ORDERED		2.2 (1.2)	2.3 (1.3)	2.1 (1.1)	0.4

[a]The three columns report on whether the customer reported seeing nutrition values for calories or sodium. Column 1 is saw nutrition information but did not use the information when ordering, $n=166$; Column 2 is saw nutrition information and used the information when ordering ("labeling users"), $n=84$; Column 3 is did not see nutrition information, $n=77$.
[b]Test for significant difference (χ^2 or *t*-test)
[c]Hispanic, Asian/South Asian, and other race/ethnicity were combined because of small numbers.
[d]Customers self-reported that a health professional told them to be careful about eating: (1) too many calories; (2) too much sodium; (3) too much saturated fat and trans fatty acids; and (4) too much sugar. To minimize over-reporting, participants were classified as having been "cautioned about diet" if they responded affirmatively to all four.
[e]Staff members assigned body size via observational methods (see Appendix A, available online at www.ajpmonline.org).
[f]According to daily recommended intakes described in The U.S. Dietary Guidelines, most adults each day should consume no more than 2000 calories; 2300 g sodium; 20 g saturated fat (10% of calories); and no/negligible trans fat. Source: Dietary Guidelines for Americans, 2010
g, grams; mg milligrams

Discussion

A large overall adjusted difference was found in purchased calories between customers at labeled and unlabeled restaurants, with about 155 fewer calories purchased, representing a relative difference of 9%. Almost 80% of customers at labeled restaurants reported seeing labels, whereas 26% of all customers reported using them when deciding what to order. These customers drove the labeling effect: on average, they purchased 400 fewer calories than others (representing a relative difference of 20%). Pulos et al.[11] conducted the only other field experiment on menu labeling at full-service restaurants; similar to the present study, menus displayed calories and nutrients and a high proportion of customers saw the labels (70%). Compared to the present study, they found a higher proportion of customers reporting label use (42% vs 26%); however, they did

not find a substantively significant difference in purchased food calories (15-calorie difference). Differences in study design, intervention, and setting may account for differences in results, including that study restaurants were neither part of a chain nor mandated to display labels.

In comparison with the present study, intercept surveys conducted at fast-food establishments after menu labeling found that a smaller proportion of customers noticed labels (about 60% vs 76% in the present study), and a smaller overall proportion of customers were label users ($\leq$22% vs 26% in the present study).[6,7,9] Nevertheless, in two of the larger fast-food customer studies to date,[6,9] significant differences in purchased calories were found when comparing label users to others, but much smaller differences than in the present study ($<$140 calories or relative difference $<$15% vs 400 calories or relative difference 20%). Differences between this study and the fast-food studies may be due to full-service customers purchasing more calories (1830 kcal vs $\leq$900 kcal), spending more time reading menus and deciding what to order,[26] and including higher-income and higher-education groups who generally are more likely to use labels.[27]

At labeled restaurants, customers purchased slightly more non-alcoholic beverage calories; however, non-alcoholic beverages were inconsistently labeled and this study was not specifically designed to test the effect of labels on beverages. No calorie differences were observed for alcoholic beverages, a finding that aligns with results from a small companion study[28] that suggested that customers were largely disinterested in utilizing menu labels for alcoholic beverages.

The unique provisions of Philadelphia's menu-labeling law (requiring nutrient values for sodium, saturated fat, trans fat and carbohydrates in addition to calories) made it possible to look at differences in the purchase of nutrients in addition to calories. On average, customers at labeled restaurants purchased less sodium, saturated fat, and carbohydrates than customers at unlabeled restaurants. As noted, other nutrient content was correlated with calorie content, so isolating the effects of providing this information is difficult. Additionally, although nearly all label users said they considered calories, only 24% reported considering sodium. Sodium labeling deserves consideration in determining future policy, as studies have found consumers severely underestimate sodium in prepared foods[29,30]; sodium content in this study averaged 2000 mg per entrée on the menu[31] and exceeded 3200 mg per order.

In the current study, 66% of customers at labeled restaurants reported seeing nutrition information but not using it. Some of these customers may have been disinterested in nutrition information, which tends to rank lower than other motivators such as taste and price.[28,32] In addition, nutrition information may not be supported by the restaurant's environment and messaging; for example, in-restaurant marketing tends to feature higher-priced appetizers/entrées that are also larger in portion size and higher in calories and saturated fat.[11,33,34]

Even among customers who may be receptive to nutrition information, low prior knowledge can make it challenging to interpret and hence unusable.[28] In the current study, even the label users purchased oversized meals that provided 70% of a day's worth of calories and at least 115% of a day's worth of saturated fat and sodium (approximated 1400 kcal, 23 g saturated fat, and 2800 mg sodium[35]). Most consumers do not know recommended dietary reference intakes (DRIs),[17] and, in the present study, menus did not display DRIs despite requirements in Philadelphia's menu-labeling regulations.[13] Educating consumers about DRIs may motivate label use among non-users and elicit a stronger response among label users.[36] Nevertheless, it is well known that knowledge alone does not drive food choice.[37,38] Changes in the nutritional quality of restaurant menu items—in particular, reductions in portion sizes by restaurant chains[31]—could help to reduce customers' caloric intake irrespective of whether customers use nutrition labels.[39]

The study did not collect prelabeling data and was limited to the cross-sectional comparison of customer purchases collected from a convenience sample of case and control restaurant outlets located in diverse urban and suburban environments. Nevertheless, the study was conducted in one region of the U.S. during 1 month of the year, at restaurant outlets owned by one large full-service restaurant chain with the same menu offerings at labeled and unlabeled outlets. The study design effectively held constant a number of broad contextual factors (region, economic conditions) as well as restaurant-level factors such as item price, menu offerings, and restaurant chain marketing and promotions (which typically change each month).

Although labeled restaurants had younger customers, more African Americans, and lower/mid-range income, these characteristics are known to be associated with worse dietary profiles[40] and lower likelihood of using nutrition information[27]; thus, results reported here may be lower than the "true" labeling association. Indeed, results from analyses using inverse probability treatment weighting were substantively similar and slightly stronger, suggesting that substantive results reported here are robust to selection bias. No information was collected to assess whether labeling users compensated later in the evening for calorie reduction,[41] nor whether customers ate all of what they purchased; however, U.S. consumers tend to eat portions as served.[42,43]

Because a single restaurant chain was used, this study was unable to examine the effect of various labeling

displays[28,44] or responses across a wide variety of restaurant settings. Nevertheless, the nutrition profile of the menu resembled menu offerings at many mid-priced, full-service restaurant chains in the Philadelphia area,[31] and participants were not uniquely loyal to the restaurant chain used in this study.

Conclusion

This study suggests that mandatory menu labeling is a promising strategy for improving the nutrient content of meals purchased by full-service restaurant customers. The need to educate customers regarding the nutrition content of restaurant foods is acute as restaurants continue to serve growing portions of energy-dense and sodium-filled foods,[39] consumers increasingly eat away from home,[2] and rates of obesity and other diet-related diseases continue to rise.[45] In some settings, menu labeling may be a prerequisite for consumers to make healthier food choices, and increasing the number of nutrition indicators displayed on print menus may increase the visibility of nutrition information and heighten awareness among some consumers. However, not all customers will use the information. Even among label users, purchases were oversized and exceeded what could be considered a "healthy" meal. More needs to be done to enable consumers to eat sensibly and to encourage portion control.

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Appendix

Supplementary Data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.amepre.2013.07.014.

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