UNDER EMBARGO UNTIL MAY 7, 2013, 12:01 AM ET

Menu Labeling Regulations and Calories Purchased at Chain Restaurants

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Background: The federal menu labeling law will require chain restaurants to post caloric information on menus, but the impact of labeling is uncertain.

Purpose: The goal of the current study was to examine the effect of menu labeling on calories purchased, and secondarily, to assess self-reported awareness and use of labels.

Design: Single-community pre–post–post cross-sectional study. Data were collected in 2008–2010 and analyzed in 2011–2012.

Setting/participants: 50 sites from 10 chain restaurants in King County, Washington, selected through stratified, two-stage cluster random sampling. A total of 7325 customers participated. Eligibility criteria were: being an English speaker, aged $\geq$14 years, and having an itemized receipt. The study population was 59% male, 76% white non-Hispanic, and 53% aged $<$40 years.

Intervention: A regulation requiring chain restaurants to post calorie information on menus or menu boards was implemented.

Main outcome measures: Mean number of calories purchased.

Results: No significant changes occurred between baseline and 4–6 months postregulation. Mean calories per purchase decreased from 908.5 to 870.4 at 18 months post-implementation (38 kcal, 95% CI=−76.9, 0.8, p=0.06) in food chains and from 154.3 to 132.1 (22 kcal, 95% CI=−35.8, −8.5, p=0.002) in coffee chains. Calories decreased in taco and coffee chains, but not in burger and sandwich establishments. They decreased more among women than men in coffee chains. Awareness of labels increased from 18.8% to 61.7% in food chains and from 4.4% to 30.0% in coffee chains (both $p<0.001$). Among customers seeing calorie information, the proportion using it (about one third) did not change substantially over time. After implementation, food chain customers using information purchased on average fewer calories compared to those seeing but not using (difference=143.2 kcal, $p<0.001$) and those not seeing (difference=135.5 kcal, $p<0.001$) such information.

Conclusions: Mean calories per purchase decreased 18 months after implementation of menu labeling in some restaurant chains and among women but not men.

(Am J Prev Med 2013;44(6):595–604)

Introduction

Americans consume 400 additional daily calories relative to the year 1970, contributing to a high obesity prevalence.[1] Requiring chain restaurants to post calorie information on menus may help reduce caloric intake.[2,3] Menu labeling regulations have been adopted in 21 U.S. jurisdictions[4] and will soon be required nationwide at large chain restaurants.[5]

Studies[6,7] of menu labeling regulations consistently demonstrate increased customer awareness and use of calorie

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0749-3797/$36.00
http://dx.doi.org/10.1016/j.amepre.2013.01.031

information. Evidence from most survey and experimental studies[8–15] suggests that provision of nutrition information on menus leads to healthier purchases. Real-world evaluations of restaurant menu labeling regulations soon after implementation have yielded mixed results regarding the impact on calories purchased, but these studies[6,7,16–19] were conducted within 1 year after menu labeling was implemented.

In the current study, a longer-term evaluation was conducted of menu labeling in King County to test the hypotheses that customer awareness and use of calorie information would be higher and the number of calories purchased would be lower 6 and 18 months after implementation. An evaluation also was made of whether the impact varied across restaurant neighborhood SES, restaurant type, demographic characteristics of customers, and customer awareness of menu labels.

Methods

In King County, chain restaurants with 15 or more sites nationally were required to post calorie information on their menus or menu boards by January 1, 2009.[20]

Study Design

The study was a single-community pre–post–post cross-sectional natural experiment that included the same regulated fast-food and coffee restaurants at three time points from Fall 2008 through Spring 2010: baseline (1–3 months prior to regulation implementation); Post 1 (4–6 months after); and Post 2 (16–18 months after).

Restaurant and Participant Selection

A restaurant was eligible if it was from one of the ten most common regulated chains in the county. Pizza restaurants were excluded because most customers order by telephone and do not see the menu board. To ensure that larger chains (e.g., Starbucks and Subway) did not dominate the sample and that the sample included restaurants in low-income/diverse areas (census tracts with at least 35% of residents below 200% of the federal poverty level and 30% people of color), chains were first sorted into three groups based on the number of locations in the county. Then restaurants were sampled randomly in each group with probability proportionate to the number of establishments such that one third of the sample was from each group, and 25 restaurants were from each of the two income/diversity areas (Figure 1).

Customers were eligible if they were English-speaking, aged $\geq$14 years, and had an itemized receipt. If a participant made a purchase for another person(s) aged $<$19 years, both were included. Fifty customers were recruited at each restaurant.

Data Collection

Interviewers visited restaurants every day of the week, generally during hours of greatest customer volume (between 11AM and 4PM for food chains and between 9AM and 2PM for coffee chains).[14] Interviewers asked all customers entering the restaurant if they would save their receipts and participate in an exit survey. Interviewers collected receipts and administered a brief survey to eligible participants prior to exit. The survey queried about awareness and use of menu labels, knowledge of daily caloric needs, demographics, and details of items purchased (including beverage flavor and customizations such as cheese). Each participant received $2 for participation. Interviewers recorded the number of walk-in customers, eligibles, and refusals, in order to allow calculation of a participation rate. The University of Washington IRB approved the study.

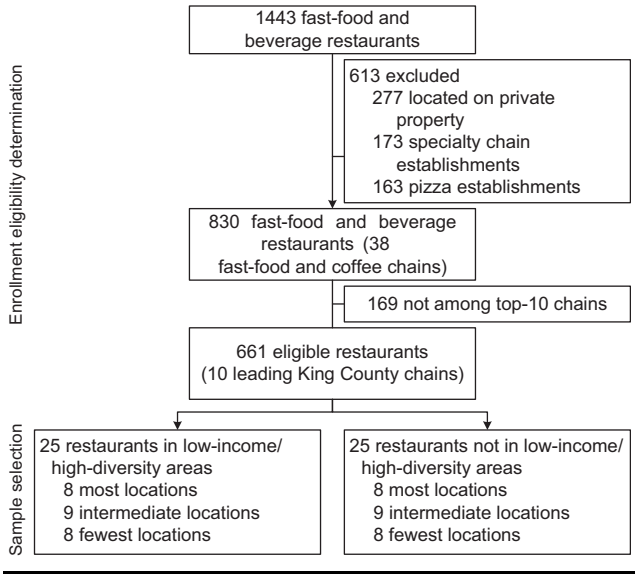

Figure 1. Restaurant sampling flow chart

Note: The 10 most common fast-food chains represent 80% of burger, sandwich, taco, and coffee chain sites on public property in King County WA. The ten chains were sorted into three groups (most to fewest) based on the number of sites in the county. Chains with the most sites (i.e., Starbucks and Subway) represented 48% of eligible restaurants. Chains with a moderate number of locations (i.e., Tully's, Jack in the Box, McDonald's, and Quizno's) represented 26% of eligible restaurants. Chains with the fewest locations (i.e., Burger King, Taco Time, Taco del Mar, and Taco Bell) represented 26% of eligible restaurants. Restaurants were randomly sampled with probability proportionate to number of sites such that one third of the sample was from each group and 25 restaurants were included from each of the two income/diversity levels. The sampling strategy resulted in a diverse set of chains not dominated by chains with the most locations in the county.

Measures and Analysis

The main outcome measure was the mean of calories purchased by participants, accounting for customizations. The menu item caloric content was ascertained from information published by each chain at the time of each data collection wave. When food receipts had insufficient details to assign calorie values, the most frequent/main nondiet version for the item within that category was used. Secondary outcomes were seeing calorie information in the restaurant and using calorie information when making a purchase. Food and coffee chains were analyzed separately because of the difference between them in availability of calorie information and mean calories per purchase. At coffee chains, analysis was limited to barista-prepared beverages, as food and bottled beverages were not listed on menu boards and so were not subject to the regulation.

Participant age was dichotomized into those aged <40 years and ≥40 years for descriptive analyses and included as a continuous variable in regression models. Race/ethnicity was dichotomized into white, non-Hispanic and nonwhite and/or Hispanic. Sample sizes of individual nonwhite race groups and Hispanics were too small to analyze.

Survey-weighted analyses were performed using Stata 10.1. A study size of 2000 participants per wave has 80% power to detect a difference between waves of 59 calories, with alpha set at 0.05 and design effect at 3.1. To compare differences in continuous variables across time points, *t* tests were used; chi-squared tests were used for categoric variables. Least-squares regression models were employed to examine interaction effects (between time point and chain or customer characteristics); the influence of covariates (gender, chain type, age, race, location) on mean calories; and for the significance of difference-in-differences in changes of mean calories over time between groups.

Given the similarity of participants across waves and the small differences in calorie changes between adjusted and unadjusted analyses (coefficient of wave variable did not change substantially in models with and without other covariates), the latter are primarily reported. Significance was defined as $p < 0.05$. Unweighted least-squares regression detected 36 influential observations using studentized residuals >3, Cook's D >4/n, and DFBETA >1, but results were similar with and without influential observations. Findings are reported for the full sample. Analysis was conducted in 2011–2012.

Results

Study Population

The final restaurant sample consisted of Subway (11); McDonald's (6); Taco del Mar (8); Taco Time (5); Starbuck's (5); Quizno's (4); Tully's (5); Jack in the Box (4); Burger King (4); and Taco Bell (1) establishments. Restaurants that had closed (n=2) or were unwilling to participate (n=1) in later waves were replaced with a randomly selected restaurant with matching characteristics.

Interviewers engaged more than 90% of all walk-in customers at 40 food and 10 coffee chain locations to assess eligibility; 85% were eligible, and 61% of those eligible participated. Assuming equivalent eligibility rates among customers screened and not screened for eligibility, 57% of all eligible customers participated. Excluded from the analysis were 34 respondents, due to age ineligibility, 144 coffee chain respondents who purchased food or bottled beverages only, and eight respondents whose receipts did not list any food items. The final study sample included 6125 food chain and 1200 coffee chain patrons.

Participants were similar across waves (Table 1), except that more food restaurant participants were aged ≥40 years in the second post-period relative to the other waves. Compared to King County Behavioral Risk Factor Surveillance System[21] respondents who reported eating at these chains, study participants were significantly more likely to be black (5.2% vs 1.7%); less likely to be white (76.6% vs 82.8%); and more likely to be male (59.4% vs 49.4%) but were otherwise similar (data not shown).

Changes in Seeing and Using Calorie Information

At baseline, interviewers observed that 24/50 restaurants had some nutritional information on site, although it was visible at point of purchase in only eight (three on menu boards and five on signs in the queue). At both post data collection points, 90% had calories posted on menu boards. Sandwich chain patrons saw information more frequently at baseline than did patrons of other chains (31% vs 4%–7%, data not shown), primarily because it was present more commonly at sandwich sites (87% vs 31% at other chains) and posted more often on menu boards or signs in the queue (40% vs 6%). The proportion of food chain customers seeing calorie information increased from 18.8% pre-regulation to 58.3% at 6 months postregulation and to 61.7% at 18 months. In coffee chains, the proportions were 4.4%, 31.2%, and 30.0%, respectively ($p<0.001$ for increase relative to baseline in both food and coffee chains; Table 2).

Among customers seeing calorie information, the proportion using it (about 36% in food chains and 28% in coffee chains) did not change substantially over time. More women than men reported seeing information (65.6% women vs 57.7% men; p=0.01) and using it (46.8% women vs 34.1% men; p=0.04) at Post 2, but there were no use differences by race/ethnicity or age.

Changes in Calories Purchased

No significant changes in calories purchased occurred between baseline and Post 1 in either food or coffee chains. Unadjusted mean calories decreased from baseline to Post 2 by 38 kcal in food chains (p=0.06, 95% CI=−76.9, 0.8) and by 22 kcal in coffee chains (p=0.002, 95% CI =−35.8, −8.5; Table 3). The Cohen's d value for both food and coffee chains was −0.1. Calories purchased at taco restaurants declined by 113 kcal ($p<0.001$, 95% CI=−164.1, −61.6); at sandwich restaurants by 10 kcal (p= 0.73, 95% CI=−64.5, 45.5); and at burger restaurants by 13 kcal (p=0.80, 95% CI=−110.4, 84.7) between baseline and Post 2. The difference in the decreases between taco and burger chains was 100.1 kcal (p=0.07, 95% CI=−8.0, 208.1) and between taco and sandwich chains was 103.4 kcal (p=0.01, 95% CI=30.5, 176.2).

Food chain customers using information (pooled across Post 1 and 2, with similar results when waves were analyzed separately) purchased fewer calories

Table 1. Participant characteristics at surveyed chain restaurants pooled across all time points

	Food chains		Coffee chains[b]	
	n	%[a] (95% CI)	*n*	%[a] (95% CI)
Total	6125	100	1200	100
Age group (years)[c]				
<40	3335	57.2 (53.3, 61.0)	491	39.8 (32.6, 47.5)
≥40	2746	42.8 (39.0, 46.7)	703	60.2 (52.5, 67.4)
Gender				
Female	2221	38.1 (34.7, 41.6)	559	49.5 (42.4, 56.6)
Male	3889	61.9 (58.4, 65.3)	641	50.5 (43.4, 57.6)
Race/ethnicity				
White, non-Hispanic	4395	75.2 (71.5, 78.7)	889	77.1 (68.1, 84.2)
Nonwhite or Hispanic	1638	24.8 (21.3, 28.5)	294	22.9 (15.8, 31.9)
Chain location				
Elsewhere in King County	2836	67.9 (59.9, 74.9)	806	82.6 (54.8, 94.9)
Low-income/diverse area	3289	32.1 (25.1, 40.1)	394	17.4 (5.1, 45.2)
Food chains				Not applicable
Burger	2089	24.1 (14.5, 37.2)		
Sandwich	2244	49.3 (37.6, 61.0)		
Taco	1792	26.7 (18.7, 36.5)		

Note: *n*=unweighted number of respondents, which may not sum to total number of unweighted respondents because of missing data
[a]Weighted to account for sampling design
[b]Limited to purchases of beverages prepared behind the counter (barista-prepared beverages) regardless of whether the beverage contained coffee
[c]Pearson χ^2 test for differences across survey waves: only age among food chain customers differed across waves (p=0.01).

than those seeing but not using (143.2 kcal less, $p<0.001$, 95% CI=−186.1, −100.3) and fewer calories than those not seeing (135.5 kcal less, $p<0.001$, 95% CI=−189.5, −81.5), after adjusting for chain type, gender, race/ethnicity, age, and geographic location of store). Customers seeing labels purchased fewer calories than those not seeing, although this difference was not significant (39.2 kcal less, p=0.10, 95% CI=−85.7, 7.3). Analysis in coffee chains showed a similar pattern, although no differences were significant.

There were no differences in calories purchased between baseline and Post 1 in any subgroup (gender, age, race/ethnicity, geographic area; Table 3). Between baseline and Post 2, calories purchased in food chains declined significantly among women and younger patrons and in non-low-income/diverse areas. In coffee chains, calories declined significantly among women, customers of all ages, white/non-Hispanics, and in all areas. The decrease among female customers of coffee chains was larger than that observed among men (36.6 kcal more, p=0.02, 95% CI=−67.6, −5.6).

Other differences in differences were not significant (see footnotes in Table 3). For example, no difference in differences was detected in the impact of labeling on calories purchased in food chains in low-income/diverse areas compared to other areas of the county among food (p=0.24, 95% CI=−33.4, 132.9) and among coffee chain patrons (p=0.10, 95% CI=−93.4, 8.2).

The full regression model that included chain type, gender, race/ethnicity, age, and location of store as covariates yielded results similar to the unadjusted findings. In these fully adjusted analyses, between baseline and Post 2, calories in food chains decreased by 35.5 kcal (p=0.08, 95% CI=−75.5, 4.4) and by 26.3 kcal in coffee chains ($p<0.001$, 95% CI=−40.0, −12.7).

Discussion

Calories purchased at some chain restaurants and among women in King County decreased 18 months after implementation. No change was apparent 6 months after implementation, similar to other evaluations of menu labeling.[7,18,19] Eighteen months after implementation,

Table 2. Percentage of customers at regulated chain restaurants reporting seeing and using calorie information

	Survey wave						*p*-value[b]
	Baseline (2008) (1–3 months prior)		Post 1 (2009) (4–6 months post)		Post 2 (2010) (16–18 months post)		
	n	%[a] (95% CI)	*n*	%[a] (95% CI)	*n*	%[a] (95% CI)	
FOOD CHAINS[c]		(N=1969)		(N=1955)		(N=2006)	
Seeing calorie information	266	18.8 (14.2, 24.7)	1128	58.3 (52.6, 63.7)	1195	61.7 (56.9, 66.3)	<0.001
Seeing on menu board[d]	52	18.1 (10.4, 29.6)	906	79.5 (72.1, 85.4)	1042	84.8 (78.3, 89.6)	<0.001
Using calorie information[d]	64	36.6 (29.1, 44.8)	324	31.0 (26.6, 35.7)	445	39.5 (33.5, 45.8)	0.05
Using calorie information[e]	64	4.1 (2.4, 6.9)	324	17.3 (14.7, 20.3)	445	23.9 (20.1, 28.3)	<0.001
COFFEE CHAINS[f]		(N=395)		(N=370)		(N=397)	
Seeing calorie information	13	4.4 (2.6, 7.4)	110	31.2 (26.4, 36.3)	107	30.0 (23.3, 37.7)	<0.001
Seeing on menu board[d]	0	—	97	85.8 (77.3, 91.5)	98	90.5 (85.2, 94.0)	<0.001
Using calorie information[d]	NA	—	30	26.7 (15.4, 42.2)	33	29.2 (19.1, 41.9)	0.66
Using calorie information[e]	NA	—	30	7.8 (4.4, 13.6)	33	8.8 (5.1, 14.5)	<0.001

Note: *n*=unweighted number of respondents
[a]Weighted to account for sampling design
[b]Pearson chi-square test for differences across survey waves
[c]Excluded missing data for food chains as follows: 74 respondents at baseline, 83 respondents at Post 1, 38 respondents at Post 2
[d]Among customers reporting seeing calorie information
[e]Among all customers
[f]Limited to purchases of beverages prepared behind the counter (barista, prepared beverages) regardless of whether the beverage contained coffee and excluded missing data for coffee chains as follows: 14 respondents at baseline, 24 respondents at Post 1
NA, not available, fewer than five respondents

mean calories per purchase decreased by 22 kcal (p=0.002, 95% CI=−35.8, −8.5) in coffee chains and by 38 kcal (p=0.06, 95% CI=−76.9, 0.8) in food chains. Awareness of calorie information increased, consistent with prior research.[6,7,19] The present study is the first to examine influences of a menu labeling regulation requiring posting of calories on menu boards or menus more than 1 year after implementation.

Changes in Calories Purchased

Among food establishments, caloric declines were significant among taco restaurants; taco customers may have been more likely to respond to calorie information because they made the highest-calorie purchases prior to labeling. Customers tend to underestimate caloric content of higher-calorie items, and labeling may have greater impact on these items.[22] In addition, taco chains give customers more opportunities to customize orders and therefore use calorie information than do other food chains. Finally, King County taco restaurants decreased caloric content of entrée menu items between 6 and 18 months post-implementation to a greater extent than other types of chains.[23]

The significant decrease in calories of beverages purchased at coffee establishments may have been driven in part by the same high degree of customization available in taco restaurants. In addition, because coffee beverages may be viewed as providing "non-essential" calories, consumers may be more responsive to caloric information. Finally, fewer coffee restaurant customers saw labels at baseline compared to those at food restaurants, perhaps making it more likely that an effect would be seen.

No change in calories was found for items purchased at sandwich or burger restaurants. In fact, 6 months after implementation, mean calories increased in sandwich restaurants nonsignificantly and then decreased significantly 1 year later, yielding a small and nonsignificant net decline. This pattern may have resulted from unrelated

Table 3. Unadjusted mean differences in caloric content (kcal) of customer purchases before and after implementation of menu labeling regulation

	Survey wave									
	Baseline (2008) (1–3 months prior)		Post 1 (2009) (4–6 months post)		Post 2 (2010) (16–18 months post)		Post 1, baseline		Post 2, baseline	
Characteristic	*n*	M[a] (95% CI)	*n*	M[a] (95% CI)	*n*	M[a] (95% CI)	Diff	*p*-value[b]	Diff	*p*-value[b]
FOOD CHAINS										
Overall	2043	908.5 (875.9, 941.1)	2038	921.0 (887.8, 954.1)	2044	870.4 (842.0, 898.8)	12.5	0.51	−38.1	0.06
Gender										
Female	750	804.4 (758.7, 850.0)	738	821.5 (777.3, 865.7)	733	738.9 (702.9, 775.0)	17.1	0.50	−65.4	0.01
Male	1282	976.5 (946.4, 1006.7)	1296	982.3 (944.2, 1020.4)	1311	952.4 (919.4, 985.4)	5.8	0.77	−24.2	0.30
Age groups (years)										
<40	1159	958.9 (919.2, 998.6)	1146	957.3 (917.7, 996.8)	1030	906.3 (863.3, 949.3)	−1.6	0.94	−52.5	0.05
≥40	869	836.4 (796.1, 876.7)	874	863.9 (825.6, 902.2)	1003	828.3 (791.8, 864.7)	27.5	0.26	−8.2	0.74
Race/ethnicity										
White, non-Hispanic	1464	900.3 (861.9, 938.8)	1473	898.6 (861.4, 935.8)	1458	862.7 (838.1, 887.3)	−1.7	0.94	−37.6	0.07
Nonwhite/Hispanic	545	933.4 (890.8, 975.9)	530	987.0 (946.1, 1027.9)	563	893.5 (831.1, 956.0)	53.7	0.06	−39.9	0.32
Site geographic location										
Elsewhere in King County	946	906.4 (864.8, 947.9)	941	908.8 (865.5, 952.2)	949	852.4 (818.4, 886.3)	2.5	0.91	−54.0	0.03
Low-income/diverse area	1097	913.0 (857.5, 968.4)	1097	946.4 (894.8, 998.1)	1095	908.7 (856.1, 961.3)	33.5	0.32	−4.2	0.90
Food chain type										
Burger	694	904.7 (830.0, 979.4)	699	895.3 (834.1, 956.5)	696	891.9 (831.4, 952.5)	−9.4	0.76	−12.8[c]	0.79
Sandwich	747	871.5 (824.2, 918.7)	749	906.8 (866.3, 947.4)	748	862.0 (819.8, 904.1)	35.4	0.20	−9.5[d]	0.73
Taco	602	979.6 (936.4, 1022.7)	590	971.0 (885.3, 1056.7)	600	866.7 (815.9, 917.5)	−8.6	0.80	112.9	<0.001
COFFEE CHAINS[e]										
Overall	409	154.3 (43.0, 165.5)	394	143.7 (119.4, 168.0)	697	132.1 (117.1, 147.1)	−10.6	0.38	−22.1	0.002

(continued on next page)

Table 3. *(continued)*

	Survey wave									
	Baseline (2008) (1–3 months prior)		Post 1 (2009) (4–6 months post)		Post 2 (2010) (16–18 months post)		Post 1, baseline		Post 2, baseline	
Characteristic	*n*	M[a] (95% CI)	*n*	M[a] (95% CI)	*n*	M[a] (95% CI)	Diff	*p*-value[b]	Diff	*p*-value[b]
Gender										
Female	187	173.7 (157.3, 190.1)	189	146.9 (125.7, 168.0)	183	132.9 (121.9, 143.9)	−26.8	0.02	40.8[d]	<0.001
Male	222	135.6 (115.1, 156.0)	205	140.6 (105.8, 175.4)	214	131.4 (107.2, 155.6)	5.0	0.79	−4.2	0.73
Age groups (years)										
<40	161	177.8 (161.5, 194.1)	170	151.7 (119.5, 184.0)	160	152.1 (129.0, 175.2)	−26.0	0.04	−25.7	0.01
≥40	246	139.7 (124.6, 154.7)	220	136.8 (109.6, 164.1)	237	118.5 (107.0, 130.0)	−2.8	0.84	−21.1	0.01
Race/ethnicity										
White, non-Hispanic	309	157.1 (145.1, 169.2)	293	138.9 (114.4, 163.4)	287	124.9 (114.1, 135.8)	−18.3	0.14	−32.2	<0.001
Nonwhite / Hispanic	93	144.1 (117.1, 171.2)	97	163.4 (130.1, 196.6)	104	146.9 (111.8, 182.1)	19.2	0.27	2.8	0.90
Site geographic location										
Elsewhere in King County	280	148.8 (138.2, 159.4)	264	143.7 (114.0, 173.3)	262	134.0 (116.3, 151.6)	−5.2	0.72	−14.9	0.01
Low-income/diverse area	129	181.2 (159.8, 202.7)	130	143.9 (106.9, 181.0)	135	123.8 (91.3, 156.2)	−37.3	<0.001	−57.5	0.03

Note: n=unweighted number of respondents
[a]Weighted to account for sampling design
[b]*p*-values compare mean differences within category across survey waves
[c]$p<0.10$ for difference in mean differences across waves of caloric content of purchases: burger versus taco food chains
[d]$p<0.05$ for difference in mean differences across waves of caloric content purchases: women versus men at coffee chains; sandwich versus taco food chains
[e]Limited to purchases of beverages prepared behind the counter (barista-prepared beverages) regardless of whether the beverage contained coffee
Diff, difference

temporal trends. Subway restaurants voluntarily had posted calorie labels prior to the regulation, with labels present in 87% of sandwich restaurants at baseline, thus blunting the impact of the regulation. The initial increase in calories postregulation may have been driven in part by the introduction of $5 foot-long sandwiches, an industry-changing promotion.[24,25] The observed differences in the impact of menu labeling across chain types also may have been due to differences in customer demographics and their intentions to purchase lower-calorie meals.

Menu labels had different effects on men than on women. Women saw and used labels more than men. A significant decrease in calories occurred among women, but not among men, in both food and coffee establishments. From baseline to Post 2, the decrease in calories purchased by women at coffee establishments was significantly larger than that observed among men. This finding is consistent with most, but not all, published studies.[7,17,26–28]

No difference in differences was found in the impact of labeling on calories purchased in low-income/diverse areas compared to other areas of the county. Within geographic strata, although number of calories did not decrease significantly among patrons of food chains located in low-income/diverse areas, they did in food chains elsewhere. Among patrons of coffee chains, calories declined significantly in both types of communities by Post 2. The current study thus does not offer definitive findings regarding the concern that menu labeling may have less of an impact on low-income and diverse communities.

Changes in Awareness and Use

Awareness of calorie information increased within 6 months of implementation and remained at that level 18 months post-implementation. More food chain than coffee chain customers reported awareness. Although there was no change in the proportion among those seeing calories who used this information (about one third), the higher proportion of awareness translates into a greater overall number of patrons seeing and using calorie information. Those seeing menu labels purchased fewer calories than those not seeing them, and those seeing and using them had the lowest mean number of calories purchased.

The incomplete awareness and use of labels suggests that the current format of menu labeling, consisting of numeric display of calories, calorie ranges for many items, and provision of recommended daily caloric intake, may not be optimal.[29–31] Only 30% of respondents from coffee chains (where items not listed on menu boards, such as pastries, were exempt) and 62% from food chains saw labels, suggesting that improved visibility might increase awareness. Of those seeing the labels, about one third used them. Customers may not use caloric information due to lack of interest or limited customer understanding because of low literacy and numeracy.[31–34] Simpler labels, such as color-coded symbols or listing menu items in order of caloric content (starting with the lowest), might increase impact.[15,35,36]

Strengths and Limitations

The study has some notable strengths. Its 18-month follow-up period is longer than any previously published evaluation of menu labeling. It took place in a real-world setting after implementation of a menu labeling ordinance. It included multiple chains representative of chains found across the nation. Calorie estimation took into account customizations.

This study also has several limitations. A stronger study design might have included multiple pre-implementation data collection waves or a comparison group, but resources were not available to implement such designs. However, calories purchased in similar communities without menu labeling did not decline. Customers of similar restaurants in nearby Multnomah County OR did not purchase fewer calories between Spring and Fall 2009 (M. Boles, personal communication, 2012). Calories purchased by customers of one northwest regional taco chain at its restaurants outside of King County between January 2008 and January 2010 did not change.[18]

The cross-sectional design raises the possibility that the pre- and post-regulation samples differed on unmeasured characteristics related to the impact of menu labeling. Asking participants prior to purchase to keep their receipts may have led subjects to choose healthier items, although this Hawthorne effect likely would be equal pre- and post-regulation.

Although the observed decrease in calories purchased is consistent with a menu labeling effect, the analyses cannot exclude other factors affecting menu choices, such as temporal trends in customer purchasing behavior, changes in marketing promotions, menu item reformulation concurrent with the study period,[23,37,38] price changes, decreased patronage by more health-conscious customers who may have chosen to avoid fast-food restaurants after labeling, and increased purchases of higher-calorie items by customers seeking to maximize calories purchased.

Similar to previously published studies in real-world settings, no measure was taken of total daily caloric intake among participants. Thus, it was not possible to determine if patrons who reduced caloric consumption at restaurants compensated with higher consumption

elsewhere. In addition, calories purchased are not necessarily calories consumed, although other studies have shown a correlation between them.[39,40] The necessity to minimize data collection meant that it was not possible to address whether customer weight status, presence of chronic diseases, and other customer characteristics modify the effect of labeling. No information was collected about dinner purchases, which tend to be higher in calories than daytime purchases.

Conclusion

The causes of the obesity epidemic are multiple and complex. No single intervention will reverse the epidemic. A modest decrease was observed in caloric content of foods and beverages purchased, particularly among women and patrons of taco and coffee chains, following implementation of a menu labeling regulation in King County WA. These findings, in combination with the results of other evaluations of menu labeling, suggest that menu labeling has potential to contribute to obesity prevention. Implementation of similar regulations nationwide could reach millions of Americans, given the large number of restaurant patrons and the high frequency of eating out.[41]

James Krieger and Nadine Chan had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

This study was funded by Healthy Eating Research (Grants 65233 and 67291), a national program of the Robert Wood Johnson Foundation. The authors acknowledge Barbara Bruemmer, PhD, RD, University of Washington, for her contribution to the study design; Eric M. Ossiander, PhD, MS, Washington State Department of Health, for his contributions to developing the restaurant sampling and analytic weights for the study; Chuan Zhou, PhD, Seattle Children's Research Institute, for his guidance on the statistical analyses; and Mike Smyser, MS, Public Health – Seattle and King County, for his analysis of Behavioral Risk Factor Surveillance data. None received compensation for their contributions. All authors have no potential conflict of interest, including relevant financial interests, activities, relationships, and affiliations.

No financial disclosures were reported by the authors of this manuscript.

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