Energy, Saturated Fat, and Sodium Were Lower in Entrées at Chain Restaurants at 18 Months Compared with 6 Months Following the Implementation of Mandatory Menu Labeling Regulation in King County, Washington

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ABSTRACT

Background Policies on menu labeling have been proposed as a method to improve the food environment. However, there is little information on the nutrient content of chain restaurant menu items and changes over time.

Objective To evaluate the energy, saturated fat, and sodium content of entrées 6 and 18 months post-implementation of restaurant menu labeling in King County of Washington State for items that were on the menu at both time periods, and across all items at 6 and 18 months and to compare energy content to recommendations provided by the 2005 Dietary Guidelines for Americans.

Setting Eligible restaurants included sit-down and quick-service chains (eg, burgers, pizza, sandwiches/subs, and Tex-Mex) subject to King County regulations with four or more establishments. One establishment per chain was audited at each time period.

Statistical analyses Hypothesis one examined entrées that were on the menu at both time periods using a paired *t* test and hypothesis two compared quartiles at 6 months to the distribution at 18 months using a Mantel-Haentzel odds ratios and 95% CIs, and a Cochrane-Armitage test for trend. The content of entrées at 18 months was compared with one-third (assuming three meals per day) of the nutrient intake recommendations for adults provided by the 2005 Dietary Guidelines for Americans.

Results The audit included 37 eligible chains of 92 regulated chains. Energy contents were lower (all chains −41, sit down −73, and quick service −19; paired *t* tests $P<0.0001$) for entrées that were on the menu at both time periods. There was a significant trend across quartiles for a decrease in energy, saturated fat, and sodium for all entrées at sit-down chains only. At 18 months entrées not designated for children exceeded 56%, 77%, and 89% of the energy, saturated fat, and sodium guidelines, respectively.

Conclusions Modest improvements in the nutrient content of sit-down and quick-service restaurant entrées occurred but overall levels for energy, saturated fat, and sodium are excessive.

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ENVIRONMENTAL APPROACHES THAT ADDRESS SOURCES of excess energy are a promising option to address the obesity epidemic.[1,2] Studies have reported associations between various aspects of the away-from-home food environment and obesity, including a positive association between the frequency of consumption of fast food and obesity,[3] increases in body weight, [4–6] and increases in total energy and percent fat intake[4] and between the frequency of consumption of fast food that is primarily burgers and french fries and overweight and obesity.[7] In addition, children who eat more fast food have a higher intake of energy compared with children who do not consume fast food.[8] Theories that link food eaten away from home to obesity often focus on large portion sizes contributing to excess energy intake,[8–12] but there are inconsistencies in study results possibly due to observational study designs and lack of controls. Recommendations for labeling at the point of purchase are based on the assumption that increased awareness will lead to healthier choices which, through sales patterns, will influence the energy value of menu items.[2,13–17] Public health agency jurisdictions, including King County, Washington; New York City; and others were early implementers of regulations requiring the posting of energy content and other nutrient information in national restaurant chains. Subsequently menu labeling became a federal mandate as part of the Patient Protection and Affordable Care Act.[18]

Table 1. Energy, saturated fat, and sodium levels used in the paired analysis for entrées present on menus at 37 chain restaurants[a] at both 6 mo (May to July 2009) and at 18 months (May to July 2010) postimplementation of menu labeling regulation in King County, Washington

Chain category	Entrées (n)	6-mo post	18-mo post	Difference[b]
		← mean±standard deviation →		
Energy (kcal)				
All	1,771	818±407	777±388	−41±156*
Sit down	704	1,044±438	970±425	−73±217*
Quick service	1,067	668±304	650±300	−19±91*
Burger	217	748±360	739±348	−10±60***
Pizza	212	624±241	622±248	−2±77
Sandwich/sub	347	628±217	605±220	−23±106*
Tex-Mex	291	690±367	657±359	−33±97*
Saturated fat (g)				
All	1,641	14.3±9.9	13.7±10.0	−0.7±3.8*
Sit down	703	17.8±11.3	16.4±11.3	−1.4±4.8*
Quick service	938	11.8±7.7	11.6±7.6	−0.1±2.7
Burger	196	10.9±7.3	10.5±6.9	−0.5±3.0***
Pizza	189	16.2±9.3	16.1±9.2	−0.1±2.9
Sandwich/sub	307	10.3±5.4	10.3±5.4	0.1±2.5
Tex-Mex	246	10.8±8.1	10.7±7.9	−0.2±2.6
Sodium (mg)				
All	1,669	1,841±1,038	1,733±965	−108±541*
Sit down	703	2,134±1,226	1,905±1,138	−231±727*
Quick service	966	1,628±813	1,608±796	−18±2
Burger	200	1,378±581	1,346±546	−35±166**
Pizza	211	1,841±1,177	1,865±1,126	24±445
Sandwich/sub	308	1,656±656	1,642±674	−12±300
Tex-Mex	247	1,614±715	1,562±695	−47±310***

[a]All chains n=37, sit down chains n=11, quick-service chains n=26, burger chains n=6, pizza chains n=9, sandwich/sub n=6, and Tex-Mex n=5.
[b]Difference calculated as values at 18 mo minus values at 6 mo; thus, a negative value indicates the entrée's energy content decreased during the study period.
*$P<0.0001$.
**$P<0.01$.
***$P<0.05$.

The effectiveness of menu labeling in restaurants is uncertain and preliminary evaluations have yielded mixed results.[19–25] However, many studies have focused solely on customer choices (eg, through receipt data collection) and the corresponding energy or other nutrient content of these choices, without examining whether the restaurants changed the availability and energy content of their menu items over time, perhaps in response to menu labeling. To our knowledge, no evaluation of the effect of restaurant menu labeling on menu nutrition content has been conducted.

To address this gap in the literature, we conducted an audit of menu items to describe changes that occurred following implementation of menu labeling regulation in King County. Our study assessed changes in energy, saturated fat, and sodium in entrées 6 months and 18 months postimplementation of the regulations to test two hypotheses. First, individual menu items would be reformulated to improve their nutrient profiles with less energy, less saturated fat, and less sodium, and second that the nutrient profiles of overall menus would improve through both reformulation and menu changes. These hypotheses were tested across restaurant chains. The study also examined the distribution of energy in entrées related to a national reference standard.

METHODS

Study Design

We compared entrée items available at one establishment of eligible national restaurant chains at two time periods (6 months and 18 months) following the implementation of mandatory menu labeling at the point of purchase. This research was exempt from Institutional Review Board review.

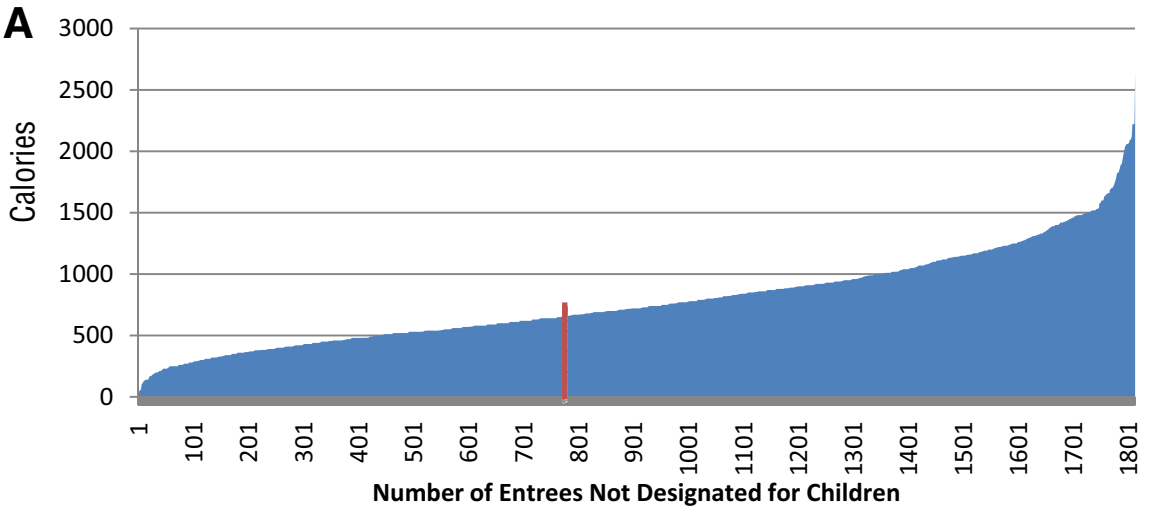
Table 2. Quartile distributions for energy, saturated fat, and sodium levels for all entrées at 37 chain restaurants[a] at 6 mo (May to July 2009) and 18 mo (May to July 2010) postimplementation of labeling regulation in King County, Washington

Nutrient	Nutrient values	% Distribution at 6 mo post-implementation	% Distribution at 18 mo post-implementation	Odds ratio	95% CI
Energy (kcal)					
Sit down					
Quartile 4	≥1,310	25	19	0.63	0.48–0.84*
Quartile 3	1,011–1,309	25	23	0.79	0.60–1.05
Quartile 2	715–1,099	25	27	0.90	0.69–1.19
Quartile 1	<715	25	30	1.00	
Quick service					
Quartile 4	≥840	25	24	0.84	0.67–1.05
Quartile 3	620–839	26	25	0.83	0.66–1.03
Quartile 2	460–619	25	24	0.86	0.69–1.08
Quartile 1	<460	24	27	1.00	
Saturated fat (g)					
Sit down					
Quartile 4	≥25.0	25	21	0.66	0.50–0.87*
Quartile 3	16.5–24.0	25	21	0.67	0.51–0.89
Quartile 2	10.0–16.4	25	26	0.83	0.63–1.09
Quartile 1	<10.0	25	31	1.00	
Quick service					
Quartile 4	≥15.3	25	21	1.00	0.78–1.29
Quartile 3	10.0–15.2	28	21	1.01	0.79–1.29
Quartile 2	6.0–9.9	26	26	1.01	0.79–1.30
Quartile 1	<6.0	21	31	1.00	
Sodium (mg)					
Sit down					
Quartile 4	≥2,685	25	20	0.63	0.48–0.84*
Quartile 3	1,926–2,684	25	21	0.69	0.52–0.92
Quartile 2	1,236–1,925	25	28	0.90	0.69–1.18
Quartile 1	<1,236	25	31	1.00	
Quick service					
Quartile 4	≥2,050	25	26	1.03	0.81–1.30
Quartile 3	1,480–2,049	25	27	1.07	0.85–1.36
Quartile 2	1,050–1,479	25	22	0.91	0.72–1.16
Quartile 1	<1,050	25	25	1.00	

[a]All chains n=37, sit down chains n=11, and quick service chains n=26.
*Trend test $P<0.01$.

Study Sample

The study sample was limited to chain restaurants that were subject to the King County Board of Health restaurant menu labeling regulation implemented January 1, 2009, and amended May 2010.[26] The regulations applied to any restaurant chain that had 15 or more establishments in the United States and at least $1 million in annual sales. The King County regulations excluded foods displayed in a case. Of the 92 regulated chains there were a total of 41 quick-service (QS) chains, 26 sit-down (SD) chains, and 25 specialty chains. Among these chains, the audit included SD and QS chains with four or more establishments in King County. Among the QS


A
Calories
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2500
2000
1500
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1
101
201
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601
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1401
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1601
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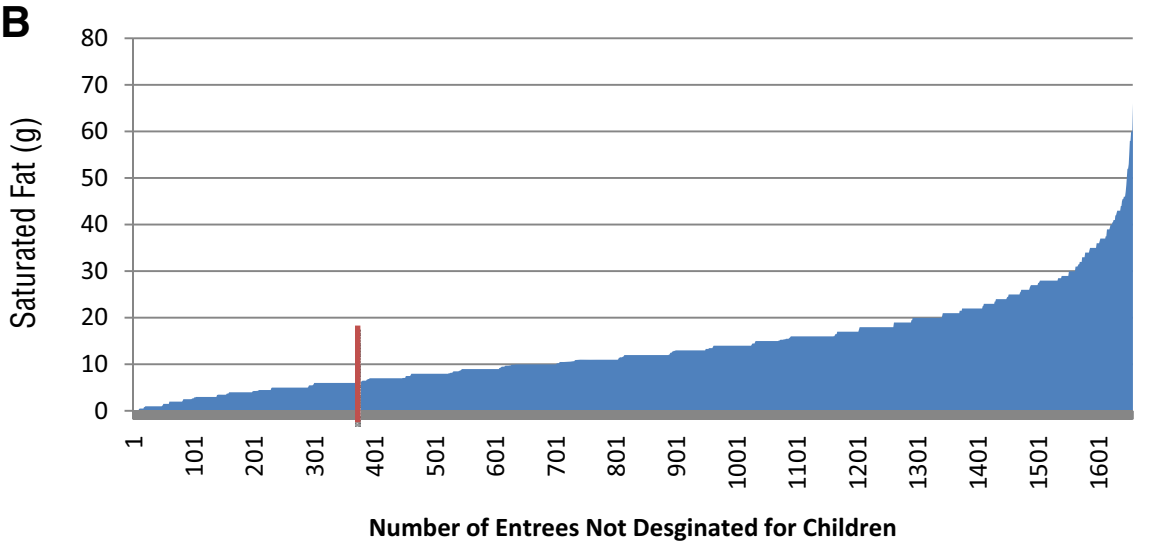
Number of Entrees Not Designated for Children


B
Saturated Fat (g)
80
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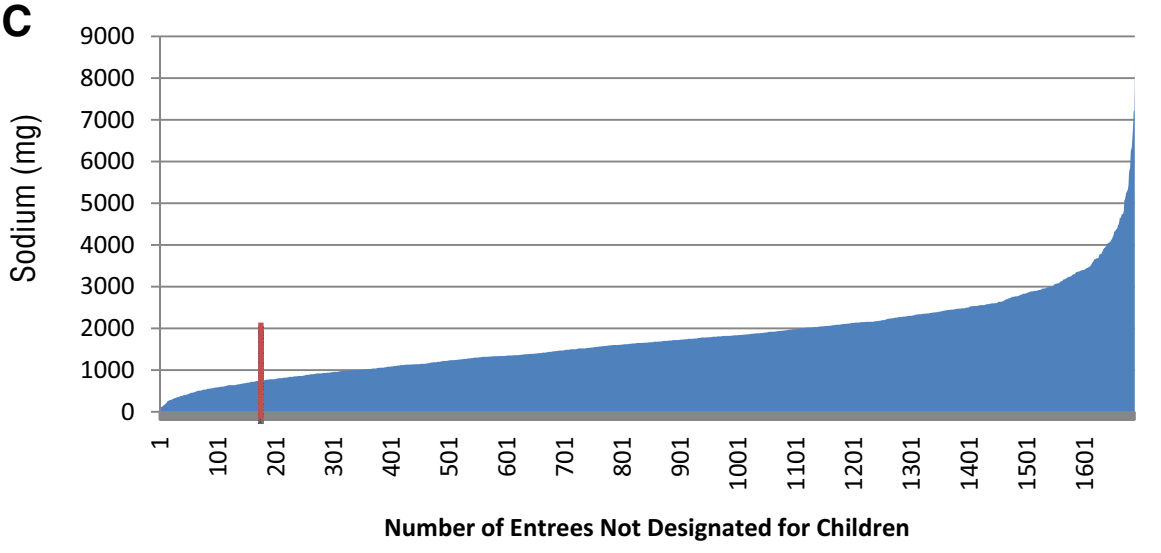
Number of Entrees Not Desginated for Children


C
Sodium (mg)
9000
8000
7000
6000
5000
4000
3000
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1
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201
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801
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1101
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1301
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1501
1601
Number of Entrees Not Designated for Children

chains, the audit was limited to those whose product line was primarily burgers (eg, McDonalds, Burger King), pizza (eg, Pizza Hut, Dominos), sandwich/sub (eg, Subway, Blimpie), or Tex-Mex (eg, Taco Time, Taco del Mar). Other chain types; that is, specialty (eg, coffee, ice cream), QS other than the four specified subtypes (eg, chicken), and chains with fewer than four establishments in King County were not evaluated. The QS restaurant types that were not included in one of the four (ie, burger, pizza, Tex-Mex, and sandwich/sub) only had one chain within a food type such as one chicken chain (ie, KFC) or one fish chain (eg, Ivar's). Coffee chains were not included in the audit because the food at those chains is displayed in cases and thus exempt from the regulations. Thus, our analysis included 37 of the 92 total regulated chains in King County. Menu data were collected at one establishment per chain. The establishment was selected by a convenience sample because no difference in energy content was found between establishments of similar size during a pilot study. The audit was conducted during two time periods: at 6 months postimplementation (May to July 2009) and again at 18 months (May to July 2010) postimplementation. The study staff made every effort to audit the same establishment at both time points unless the establishment had closed or the establishment manager requested that the data collectors not gather information at that site (n=1). If the original establishment could not be used, the next closest establishment within the chain by geographic proximity was then selected (n=1).

The King County regulations specify that restaurants must provide, for menu items available for >90 days, energy content, grams of saturated fat, and milligrams of sodium at the point of purchase. For QS chains the point of purchase for energy was specified as the menu board where the item name and price were displayed or on a separate board visible at the point of purchase. Information on saturated fat and sodium content could be provided in a brochure or on another display board separate from the menu board as long as the information is available where the customer orders. For SD chains the point of purchase was defined as either on the menu with the food description and price, an appendix at the back of the menu, on a separate brochure present where food is ordered, or on a kiosk where food is ordered.

The regulations specified that nutrient values for combination meals would display the range of energy for high and low values of possible modifications, such as diet beverage or options for sides. Information on other nutrients was not required to be provided for combination meals.

Data Collection

Study personnel visited selected establishments and recorded the energy content per item/combo meal as posted. The study personnel obtained information on the other nutrients as available at the point of purchase. When the energy information was posted but the other nutrients were not available, the chain's website was used to obtain the values for saturated fat and sodium where there was a match for the item name and energy found at both the establishment and on the website. Study staff were trained on data collection methods by the first author; had a trial period for collection; and the collection at 18 months was based on detailed data entry forms that captured the display sequence, nutrient data, and other variables for systematic data recording.

In addition to the menu item name and nutrient content, staff members categorized the type of menu item as an entrée, entrée salad, side salad, appetizer, side, soup, dessert, beverage, condiment, or other. Additional variables included: combination meal (yes/no); a designation indicating a customer group (not specified, kids, seniors); price, meal (not specified, breakfast, breakfast-all day, lunch, dinner), size (varied by item type such as diameter of pizza, ounces for beverage), and whether the item was designated by the chain as healthy (yes/no). All items were considered single serving with the exceptions: 1 serving pizza was defined as two slices of a medium pizza, and 1 serving pasta was defined as one-half of a pasta order at QS pasta chains where the pasta was served family style.

An entrée was defined as any of the following: an item designated as an entrée on a menu, an item that includes a side, a combination meal, a breakfast combo that was offered all day, a salad that was not titled side, and where the price of the salad was similar to other entrées, and a signature sandwich that is typical of the QS chain type, which may be a burger, sandwich, two slices of pizza, or a burrito sold without a side. Entrée salads did not include nutrient values for the salad dressing unless a dressing was specified in the item descriptor (eg, a chicken ranch salad in which case the ranch dressing was added to the value for the salad without the dressing).

A single value for energy in a combination meal was calculated as the average of the high and low values presented. The exception was combination meals at burger chains where the total energy, saturated fat, and sodium levels were calculated as a total of the specific burger, the default french fries, and the default size beverage. For example, if a burger chain showed a combination meal with a burger, small french fries, and a specific-size beverage the values for those individual items were added to the values for the burger. The default beverage was a sweetened soft drink as portrayed at the point of purchase. Cheese was only included in burgers when named in the item.

Entrées and combination meals were compared with one third (assuming three meals per day) of the values for adults as specified in the King County regulations that required that the following statement be posted at all establishments: "The Dietary Guidelines for Americans recommend limiting saturated fat to 20 grams and sodium to 2,300 milligrams for a

Figure. Distribution of energy, saturated fat, and sodium for entrées at 37 chain restaurants at 18 months (May to July 2010) postimplementation of labeling regulation in King County, Washington. Reference values based on the Dietary Guidelines 2005 for an adult per day were 2,000 kcal, 20 g saturated fat, and 2,300 mg sodium. These estimated needs may not be appropriate for all adults. (A) The distribution of energy across entrées with available information (n=1,814). The red line indicates the cut point at 667 kcal indicating 56% of these entrées exceeded one third of the recommended daily value. (B) The distribution of saturated fat across entrées with available information (n=1,658). The red line indicates the cut point at 6.7 g indicating 77% of these entrées exceeded one third of the recommended daily value. (C) The distribution of sodium across entrées with available information (n=1,689). The red line indicates the cut point at 767 mg indicating 89% of these entrées exceeded one third of the recommended daily value.

typical adult eating 2,000 calories daily. Recommended limits may be higher or lower depending upon daily calorie consumption."[26] These values were based on the 2005 Dietary Guidelines for Americans.[27] Thus, entrées and combination meals, not designated for children, were evaluated as above or below 667 kcal, 6.7 g saturated fat, and 767 mg sodium.

Data from the two study periods were merged by chain and item name to determine items that remained on the menu, items that were added, and items that were dropped. Overall the establishments were compliant with the regulations. However, there were 100 items that had nutrition information at 6 months but not at 18 months.

Statistical Analysis

Descriptive statistics were generated on nutrient profiles by chain type (QS or SD) and by QS type (eg, burger, pizza, sandwich/sub, and Tex-Mex). Statistical tests evaluated differences across chains and across QS subtypes but not by individual chains. To test the first hypothesis that items would be reformulated, paired *t* tests were used to compare changes for items that were on the menu at both time periods. To test the second hypothesis, that the nutrient content of menus would improve overall, an analysis based on quartile distributions at 6 months were compared with the distribution at 18 months. Specifically, energy, saturated fat, and sodium levels at 6 months were categorized by quartiles. The distribution of energy, saturated fat and sodium levels at 18 months was then aligned with the baseline quartiles to examine a shift between quartiles and across quartiles. Mantel-Haentzel odds ratios and 95% CIs were generated to compare each quartile to the lowest quartile. A Cochrane-Armitage test for trend was conducted to evaluate trend across quartiles that compared the distribution at 6 months with that at 18 months. The 100 entrées that did not have energy information at 18 months were excluded from the paired analysis but the 6-month data were included in the analysis by quartiles. Data were analyzed using Statistical Analysis Software (version 9.2, 2010, SAS Institute Inc). Statistical significance was set at a value of $P<0.05$.

RESULTS

The audit included 37 chains. There were 11 SD chains and 26 QS chains (ie, 6 burger, 9 pizza, 6 sandwich/sub, and 5 Tex-Mex). Across both time periods there were 3941 menu items that included 2,300 entrées, 155 appetizers, 491 beverages, 329 desserts, 494 sides, and 172 condiments/add-ons. There were 932 entrées at SD chains and 1,368 at QS (22% of these entrées were available at burger chains, 24% at pizza, 29% at sandwich/sub, and 24% at Tex-Mex). Very few entrées were labeled by a chain as healthy (2% at 6 months and 3% at 18 months). At the 18-month follow-up, 7% of entrées that were available at 6 months had been dropped from the menu, 13% were new, 41% had the same energy content, 13% had an increase in energy content (mean 101±141 kcal, median 50.0 kcal), and 26% had a decrease in energy content (mean −171±188 kcal, median −94.5 kcal). Of the 2,300 entrées, 207 were combination meals with a mean of the posted midpoint of combination energy content at 961 (range 187 to 2,650 kcal) and 912 (range 200 to 2,650 kcal) at 6 months and 18 months, respectively.

The paired analysis for entrées (n=1,641 to 1,771 depending on the nutrient) available at both time points indicated a significant decrease in energy when analyzed for all chains, for SD only, for QS only, and for each type of QS chains with the exception of pizza chains (Table 1). Saturated fat and sodium levels also decreased significantly across all chains and SD chains. The change in sodium and saturated fat was not significant across all QS subtypes, but there was a decrease for saturated fat at burger chains, and sodium at burger and Tex-Mex chains.

An analysis of the overall change between 6 months and 18 months in the distribution of energy and nutrients for all entrées available at either time point found significant shifts from higher quartiles to lower quartiles at SD chains for energy, saturated fat, and sodium (Table 2). In contrast there was no shift for energy, saturated fat, or sodium across quartiles for QS chains overall or for QS subtypes (data not shown).

Of entrées not designated for children, there was a slight shift between the proportion exceeding one third of the adult daily nutrient guidelines between 6 months and 18 months. The proportion of entrées that exceeded the recommended energy decreased from 60% to 56%, saturated fat 79% to 77%, and sodium 91% to 89%. The Figure presents a graphic display of the distribution at 18 months. The average excess above the recommendation at 18 months was 157% for energy, 250% for saturated fat, and 245% for sodium. A comparison limited to combo meals, not designated for children, found 93%, 84%, and 98% exceeded the guidelines for energy, saturated fat, and sodium, respectively.

DISCUSSION

Our study examined the energy, saturated fat, and sodium provided by entrées and combination meals at national chain restaurants subject to menu labeling regulation soon after the implementation of the regulation. There was evidence of a decrease in energy, saturated fat, and sodium content between the two study periods following implementation of menu regulation for menu items that were present at both time periods with the exception of menu items at pizza chains. These changes in the same menu items represent reformulation through either decreased portion size, substitution of ingredients, or both. Whereas these findings are consistent with the initial hypothesis, the actual decrease in energy was quite modest, particularly in the QS chains. Among SD type chains, the average decrease in the paired analysis was approximately 7% of the baseline average energy level.

Overall the majority of entrées were high in energy, grams of saturated fat, and milligrams of sodium compared with the recommendations of the Dietary Guidelines 2005 for adults. Between 6 and 18 months there were some improvements at both SD and QS restaurants for the same entrées presumably due to reformulation. However, the overall comparison for energy and nutrients at the two time periods only found improvements at SD restaurants. The overall comparison included items that were available at each time period plus the deletion of items that were no longer available and the addition of new items. A visual examination of the shift between quartiles suggests an increase in items in the lowest quartile for energy and each nutrient but the redistribution was inconsistent between quartiles and only significant for SD chains. Specific changes noted in the comparison of items at both time periods may not have been reflected in the overall analysis, such as energy and sodium in burgers and Tex-Mex

items, possibly because the decrease was small but items did not move much across quartiles. More changes and more substantive changes across the postregulation time period were observed for SD restaurants, but these restaurants also had entrée energy, saturated fat, and sodium at higher absolute levels than seen for QS chains. This finding is consistent with the work of Yamamoto and colleagues.[28]

The strengths of our study include the consistent findings based on the paired analysis and the overall (quartile) analysis, the systematic approach to the collection of audit data, and the unique opportunity to examine this natural experiment in a community with early implementation of menu regulation.

Limitations of the study include the lack of a control community without menu regulation. Although these changes occurred between the two periods the study design does not allow for a causal interpretation given the lack of a control group in a community without regulation and no preregulation data. Thus, these changes could be attributed to either the implementation of menu labeling, or general trends in the marketplace. Other limitations include incomplete information on sources of additional energy such as addition of dressings to salads. We were unable to examine other common sources of food eaten away from home, specifically food served at coffee chains, due to the specific language of the King County regulations, which provide an exemption for those foods. No information was available on sales figures for menu items thus the magnitude of these changes on the total energy and nutrient burden to the community could not be evaluated. The study was not able to evaluate nutrient content before regulation implementation because nutrient information was rarely posted and only a few chains had their menus available on their website or in brochures. Thus, we could not fully evaluate every aspect of menu labeling because chains might have altered their menu offerings in anticipation of consumer reactions. This study instead focused on the observable changes that occurred after nutrient information was available at the point of purchase comparing early implementation to 1 year later with the intent of capturing response in the marketplace.

Assumptions regarding serving sizes, such as pizza slices, may not represent actual intake patterns. Comparison across chain types is limited where entrées at SD chains do not include beverages. Other challenges include the classification of menu items as entrées, the identification of items continued on the menu based on the item title, and the inability to relate the absolute number of items vs the size of the chain and consumption patterns. This analysis focused on changes in entrée items but appetizers, desserts, and sides were not included. Items that were on the menu for $<$90 days were not included in the analysis because chains were not required to post nutrient content for those items.

The 2005 Dietary Guidelines for Americans provide a reference that may not apply to all adults given the range of energy requirements and nutrient needs. Other standards may be appropriate, such as a lower sodium level for older adults. These standards should not be used for individuals who are ill or have certain chronic diseases. Thus, our comparison of entrées to 2005 guidelines does not capture the gap between the energy, saturated fat, and sodium in these foods compared with the needs of many adults.

Environmental approaches may lead to a moderation of energy intake by several pathways. Among consumers who notice nutrition information, some will select a more moderate choice. However among consumers who either do not notice the nutrition information or do not make a selection based on menu labeling, their actual selection may be improved if restaurants make changes to their menus through reformulations and improved additions. Thus, environmental changes may lead to a decrease in energy intake for both active and passive users of the posted information.

Additional research is needed to examine the utility of posting a range of energy for combination meals. It is not known how consumers interpret their actual selection when default values are not apparent. Future research would also benefit from conducting an assessment 3 to 5 years after the implementation of mandatory labeling, which would allow chain restaurants adequate time to develop, test, distribute, and launch new items. Amy Myrdal Miller, MS, RD, of the Culinary Institute of America, estimated that the time for development of a new menu item, from concept to launch, is between several months and up to 5 years depending on the chain type and size (personal communication, August 23, 2011). Although the distribution patterns suggested a change in energy affected the other nutrients, it will be important to follow trends to determine whether reformulations lead to an increase in sodium as a compensation for taste changes related to a decrease in added sugars and fat.

Food and nutrition practitioners who work with communities and policy makers need information on the food environment to design, implement, and evaluate public health policy. Those professionals who work with individuals may better assess high risk situations, provide insight into the use of menu labeling, and be better prepared to probe clients' reported food behaviors given more information on food eaten away from home. There is a need for food and nutrition practitioners to design relevant public health messages on how to navigate an environment that is energy heavy while balancing personal energy needs.

Early assessment of menu labeling suggests a trend toward provision of lower energy, lower saturated fat, and lower sodium items, especially at SD restaurants. Ultimately research needs to examine trends in energy consumption from food eaten away from home and relate these trends to body weight and the prevention of obesity and obesity-related chronic diseases.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

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