Did Implementing Nutrition Labeling and Education Act (NLEA) of 1990 Improve Diet?

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Abstract: Nutrition labeling, in the words of the then FDA commissioner, David Kessler, was to "help millions of Americans make more informed, healthier choices." Although the NLEA primarily focused on standardizing the nutrition facts label, its implementation also involved an informational and educational campaign on how to use the new nutrition facts label and the benefits of using it. Evidently label use more than doubled between 1989-91 and 1994-96.

Most of the studies provide evidence of the effects of nutrition label use by comparing label users against non-users using data after NLEA was in effect. Using pseudo-panel data method, we find that implementing NLEA did not improve diet quality but use of labels did. Further, label usage showed no improvement in diet quality within a cohort but it did reveal significant differences among or between cohorts. We also test for differences in diet quality between the two periods by comparing individuals of similar characteristics using a non-parametric approach, the Mahalnobis distance matching technique. Differences across the two periods would be tested at different quantiles of the diet quality with an emphasis on label use and education levels.

Introduction

In the 1980s and early 1990s, increasing awareness among consumers of the diet-health relationships created a need for consistent, usable and understandable nutrition information on food products to help Americans make more informed, healthier choices. Before the Nutrition Labeling and Education Act (NLEA), the food label carried information on non-standardized serving size and amount of total calories, and grams of protein, carbohydrates and fats. The NLEA required nutrition facts panel to have information on standardized serving size, servings per package, and the amount of calories from an entire serving (total), and from fats, saturated fats, and cholesterol[1]. Calories were to be in amount and percent of reference daily intake for a 2000-calorie diet. In this study, we attempt to answer the question: did implementing NLEA improve diet? This is of utmost importance because this nutrition facts panel is the only source of nutrition information available at the point-of-purchase.

Studies in general have found positive effects of both the comprehension of the new labels (Moorman, 1996) and in its impact on healthful choices. Although the Nutrition Labeling and Education Act (NLEA) primarily focused on standardizing the nutrition facts label, its implementation also involved an informational and educational campaign on how to use the new nutrition facts label and the benefits of using it. Therefore, NLEA implementation might not have affected the dietary choices of the label users alone but would also have increased the awareness of better nutrition in general and in particular increased label use. Evidently label use more than doubled between 1989-91 and 1994-96. Therefore, it is important to know the impacts of both the standardization of nutrition labels and the informational campaign.

[1] Other information such as, sodium is not discussed here.

Mathios (2000) observed a significant five percent drop in sales of high fat salad dressings post-NLEA after they were required to disclose nutrition content. Calories from fat, saturated fat and cholesterol decreased among label users (Kim, Nayga, and Capps, 2000; Neuhouser, Kristal and Patterson, 1999)). Those who looked for information on added sugars in the label showed decreased added sugars' consumption Weaver and Finke (2003).

There are some limitations in the literature. Most of the studies provide evidence of the effects of nutrition label use by comparing label users against non-users using data after NLEA was in effect. Thus they ignore the improvements, if any, among new label users or they combine all label users which would not show how prior label users have benefited. Moorman, Du and Mela (2005) found that behavior change is observed mostly among those who were familiar with label information. It also ignores the impact of the information campaign carried out in different states through media. We address these concerns and therefore better estimates of the impact of NLEA. This paper adds to the existing literature by answering the question: did the implementation of NLEA improve diet quality by comparing before and after its implementation?

A Brief History of Food Labeling

In this section, I provide some history of NLEA. Food labeling, based on the regulations of the Food and Drug Administration (FDA) in 1973, was voluntary but mandatory if fortified by proteins, minerals or vitamins. The NLEA enacted in 1990 was the next major step which required all processed food products to display standardized nutrition information. As a result, 96% of the processed foods had label in 1996, an increase from about 60% in 1990 (Brecher et al, 1997). <to be completed>

Methods

An ideal estimate should tell how a label user benefited from the NLEA in the post-NLEA (1994-96) compared to the pre-NLEA (1989-91) in a panel framework. There are, however, no nationally representative panel survey data with diet behavior and nutrition information during those periods. We use two cross-sectional data that had similar objectives and were of similar design. The respondents in both surveys were selected independent of each other. Therefore, the following three methods are employed: a) pseudo panel data method; b) difference-in-difference strategy; and c) a media content analysis.

In the pseudo panel data method individuals are grouped to make cohorts based on criteria that do not change from year to year such as birth year, gender and race. Some advantages of using pseudopanel method are that it reduces the bias caused by measurement error and eliminates attrition bias (Deaton, 1985). More importantly, creating cohort allows us to incorporate dynamics in label use within cohorts across time which is not possible if observations are defined at individual level. This is because label use is a binary variable at the individual level. There are, however, disadvantages due to presence of cohort fixed effect which may not be random and therefore bias the estimates. We, therefore, estimate both the within (fixed effects) and the between estimators. The fixed effects estimator yields consistent and unbiased estimates but only at the cohort level.

In the econometric model with diet quality as the dependent variable, the coefficient on label use would indicate the change in diet quality owing to the increase in label usage within a cohort, while the coefficient on the time dummy variable would include the effect of NLEA and any time trend on diet quality that changed over time but not within each cohort. Furthermore the interaction term between label use and time would capture the effect of increased label use mostly because of the informational campaign.

The second method, difference-in-difference strategy has been used to estimate the effect of label use on diet. Variyam (2007) used the exemption of food-away-from-home (FAFH) from labelling requirement as the identification strategy. Although many of the foods consumed at-home (FAH) do carry labels, many of the fresh fruits and vegetables do not. We do a more careful selection of food items that carry labels or would most likely carry labels based on the NLEA regulations. For instance, fresh vegetables from a store would most likely be not labelled but canned vegetables do carry labels. So we combine information on source of food and place of consumption to arrive at a better separation of labelled and non-labelled products.

Further, we estimate the differences at specific categories such as, beverage group, fruits and vegetables, and grains (breakfast cereals and other grains). We do the same for the pre-NLEA period. We create categories of labeled and non-labelled food products using the labeling requirements prior to NLEA. One important regulation was that those foods that were fortified with protein, minerals or vitamins or make a nutrition claim were required to be labelled but other had been voluntary.

In the third method, we use county-level variation in the media campaign regarding nutrition labels to find if the informational campaign had an effect on the diet quality of individuals.

Diet quality is defined, in this study, as the healthfulness of diet measured by Healthy Eating Index (HEI), and the proportion of saturated fat and cholesterol in diet.

Data

The datasets are the Continuing Survey of Food Intakes of Individuals (CSFII) conducted in 1989-91 and 1994-96. Since the NLEA was in effect starting May 1994, the two periods cover the period before (pre-NLEA) and after (post-NLEA) its implementation. Both CSFII datasets have similar objectives and were of similar design and therefore are pooled.

The Centre for Nutrition Policy and Promotion (CNPP), USDA constructed the Healthy Eating Index (HEI) to measure the healthfulness of the diet of individuals based on the macronutrient composition in their diet in adherence to the dietary guidelines. The HEI is constructed using the nutrition information in the respective datasets. A higher score implies a better diet or a healthier diet. Other than HEI, we use the proportion of calories from fats, as other indicators of diet quality.

The Continuing Survey of Food Intakes by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS) were two nationwide surveys conducted by Agricultural Research Service (ARS), USDA, from 1994-96. These surveys were designed to measure the different types of food and their respective amounts eaten by Americans as well as their attitudes and knowledge about diet and health. The DHKS was the first national survey of attitudes and knowledge on diet and health. Unfortunately, there has not been one after that. Therefore, CSFII/DHKS is the most recent publicly and freely data available for such analysis. The target population of these surveys was noninstitutionalized individuals in all 50 states and Washington, DC.

In each of the three survey years, 1994-96, the sample of individuals were "asked to provide food intakes for two non-consecutive days through the administration of in-person, 24-hour dietary recalls spaced 3-10 days apart." The above formed the CSFII database. DHKS was administered to one adult from each of the CSFII household of at least 20 years old who had participated in at least one of the two days of survey. The overall average day-1 and day-2, response rates were 80.0 and 76.1 %, respectively. The overall average DHKS response rate was

73.5 %. Of the total sample persons completing day-1 (total of 16,103) and day-2 (total of 15,303), a sample of 5765 participated in the DHKS.

Remainder of this section discusses the data in general and provides relevant summary statistics of the variables used in the analysis. CSFII contains information on serving sizes of the different food categories and not calories. The amount of calories from these food groups is the product of serving sizes and the average calories obtained from it.

The DHKS includes people of 20 years or above and therefore this analysis is limited to this age group. Table 1 shows averages for the various covariates used in the econometric models. Several other variables were included such as, employment, year of survey (1994-1996), region, age, race, gender, urbanization of the residence place, and height of the respondent. Most of the regressors were dummy variables except for age, percent above poverty (pctpov), dietary habit score, and height. Different people have different caloric needs which vary by height, employment types, activities performed and other factors. One variable to control for the caloric needs of a person but still not endogenous, i.e., predetermined, was the height. Body Mass Index (BMI) includes both height and weight which renders it unsuitable because of potential endogeneity of the weight variable.

These variables account for several factors that could potentially alter or affect caloric needs. For example, an employed individual would have a higher caloric need, men have a higher caloric requirement compared to women, and older people have lower caloric requirement. Culture also plays an important role in the food habits of individuals. Therefore, race and ethnicity variables were included. The race variable has three sub-category namely, whites, blacks and others. But the ethnicity variable distinguished only between Hispanic and non-Hispanic. A more complete variable should include sub-categories within each group. But a lack of it compels us to use only race and ethnicity. About 81 % of the sample were white and only 12 % were black with the remainder were put in the other race category. The proportion of females was about 0.55.

The survey was conducted in a three year period, 1994-96. Therefore, a dummy was included for year 1995 and one for year 1996 to capture any time changing preference relative to 1994. In addition to accounting for different caloric needs, the employment variable also captured the survey participant's or household's adjustment to temporary shocks. Only 58 % were employed either in a short-term (temporary) jobs or long-term jobs. A variable indicating different levels of exercise was included to control for the extra energy expenditure due to physical activity levels. This variable is discrete and the value is ranked in the descending order of the intensity of exercise[5]. A mean of 3.9 indicates that the activity level was close to once a week in the sample. But standard error was about two points for a mean of about 4 points implying high variability within the sample. The mean age was 50 years but with a standard deviation of 17. Square of the age was included to allow the marginal effect of age to vary with the level of age.

Percent Above Poverty, according to CSFII, "is the annual income expressed as % of the poverty level based on CPI adjusted income and household size." Since the income is capped at $100,000, the highest Percent Above Poverty is 300 % which is simply 300 % of the poverty level. It is adjusted and is therefore preferred over level of income. Some consumer demand studies have preferred this variable (for example, Weaver and Finke, 2003). Income in this sample was on average 215 % above poverty level. About 44 % of the sample had a year of college or more and 34 % were only high school graduates.

Region indicator variables were included for Northeast, Midwest, South and West to control for regional differences. A majority were from south (35%) and the least from the north-east region (19%). While the region variable captures differences in prices of goods and time across region, the urbanization level captures these price differences among the broad categories of urban (city), suburbs, and rural areas. These differences could influence "household consumption decisions and thereby dietary practices. Only 26 % of the survey respondents said that they lived in rural area while 44 % lived in suburban areas. In terms of using nutrition label, only 56 % of the sample used it in general. Based on previous research, use of label influences the consumption of food products (for example, Kim, Nayga, and Capps, 2001).

<details on CSFII 1989-91 to be completed)

Results

NLEA and diet quality

Preliminary results from the pooled OLS model suggest that the diet quality declined post-NLEA but that the education had a positive effect on diet quality. Pseudo panel data method which corrects for errors-in-variables suggests that the increase in label use did improve diet quality but the NLEA variable was not significant. The interaction terms of different education levels and NLEA suggest that the diet quality of even the college graduates declined post-NLEA. However, the main effect of college graduates was positive and nearly double the magnitude of its interaction with NLEA. Although label usage showed no improvement in diet quality within a cohort, it did reveal big differences among or between cohorts. One of the reasons for such differences among individuals is that the educational campaign had not reached all people. For instance, Byrd-Bredbenner and Kiefer (2001) report that only one in three women recall receiving labeling education in any form. Allen (1995) found, using media content analysis, that the labeling information was insufficiently comprehensive to understand and use nutrition labels.

(More results after complete analysis)

Conclusion

(To follow after complete analysis)

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Table 1: Descriptive statistics and description of the variables.

	1989-91		**1994-96**	
	Mean	***SD***	**Mean**	***SD***
HEI	64	*13*	63	*12*
Label Use	0.35	*0.48*	0.57	*0.50*
Education				
Less than HS	0.32	*0.47*	0.21	*0.41*
HS	0.36	*0.48*	0.34	*0.47*
Some College	0.18	*0.38*	0.21	*0.41*
College grad	0.14	*0.35*	0.23	*0.42*
Smoke	0.82	*0.38*	0.26	*0.44*
Age	49	*18*	51	*17*
Race				
White	0.83	*0.38*	0.82	*0.38*
Black	0.14	*0.34*	0.12	*0.32*
Other	0.04	*0.19*	0.06	*0.24*
Gender	0.80	*0.40*	0.50	*0.50*
Emp (FT/PT)	0.44	*0.50*	0.55	*0.50*
Percent poverty	253	*236*	216	*94*
Region				
Northeast	0.19	*0.39*	0.19	*0.39*
Midwest	0.24	*0.43*	0.26	*0.44*
West	0.19	*0.40*	0.20	*0.40*
South	0.38	*0.48*	0.35	*0.48*
Urbananization				
City	0.31	*0.46*	0.30	*0.46*
Suburb	0.43	*0.50*	0.44	*0.50*
Rural	0.26	*0.44*	0.27	*0.44*
Height	65	*4*	170	*10*

Table 2: Robust estimates of HEI model

Variable	Variable names	(1)	(2)	(3)	(4)	(5)
Luse	Label use	0.906‡	3.721*	2.893*	1.045†	1.094†
		(0.473)	(0.300)	(0.255)	(0.440)	(0.441)
NLEA	Post-NLEA = 1			-10.92*	-12.28*	-12.83*
				(1.976)	(1.991)	(2.011)
NLEA*Luse					2.752*	2.651*
					(0.535)	(0.537)
High school (HS)		1.634*	1.955*	2.085*	2.070*	1.119†
		(0.583)	(0.422)	(0.341)	(0.341)	(0.527)
Some College (Scoll)		4.281*	2.637*	3.490*	3.424*	3.202*
		(0.723)	(0.482)	(0.400)	(0.400)	(0.649)
College grad(Collgrad)		6.332*	5.277*	6.153*	6.070*	4.795*
		(0.835)	(0.501)	(0.423)	(0.423)	(0.743)
HS*NLEA						1.541†
						(0.657)
Scoll*NLEA						0.459
						(0.776)
Collgrad*NLEA						1.859†
						(0.838)
Smoke		-0.948	-4.248*	-3.355*	-3.280*	-3.243*
		(0.601)	(0.338)	(0.296)	(0.296)	(0.297)
Age		0.219*	-0.0346	0.0445	0.0400	0.0364
		(0.0797)	(0.0503)	(0.0429)	(0.0428)	(0.0428)
Age square		0.000131	0.00156*	0.00124*	0.00129*	0.00132*
		(0.000767)	(0.000486)	(0.000413)	(0.000413)	(0.000413)
Black		-2.992*	-3.532*	-3.390*	-3.385*	-3.392*
		(0.706)	(0.477)	(0.396)	(0.396)	(0.396)

Variable	Variable names	(1)	(2)	(3)	(4)	(5)
Other		0.758	2.406*	2.289*	2.321*	2.362*
		(1.245)	(0.631)	(0.570)	(0.570)	(0.570)
Gender	Female=1	5.693*	2.027*	3.545*	3.471*	3.443*
		(0.716)	(0.413)	(0.354)	(0.354)	(0.354)
Employed	Full / Part time	0.0946	-0.835†	-0.195	-0.173	-0.214
		(0.525)	(0.349)	(0.291)	(0.290)	(0.290)
Pctpov		0.00410*	0.0140*	0.00583*	0.00589*	0.00626*
		(0.00116)	(0.00182)	(0.000896)	(0.000895)	(0.000926)
Midwest		-1.417†	-0.660	-0.915†	-0.914†	-0.888†
		(0.703)	(0.434)	(0.374)	(0.373)	(0.373)
West		-0.133	-0.241	-0.169	-0.173	-0.162
		(0.730)	(0.463)	(0.395)	(0.395)	(0.395)
South		-1.753*	-2.121*	-1.956*	-1.882*	-1.870*
		(0.649)	(0.410)	(0.351)	(0.350)	(0.350)
Suburb		-0.00837	-0.520	-0.218	-0.201	-0.194
		(0.548)	(0.352)	(0.299)	(0.298)	(0.298)
Rural		-0.526	-2.180*	-1.661*	-1.603*	-1.581*
		(0.611)	(0.397)	(0.335)	(0.335)	(0.335)
Height		0.113	0.0301	0.0740*	0.0761*	0.0731*
		(0.0835)	(0.0200)	(0.0192)	(0.0192)	(0.0192)
Intercept		39.46*	50.05*	50.55*	51.12*	51.85*
		(6.157)	(3.769)	(1.822)	(1.823)	(1.853)
Observations		2775	5617	8392	8392	8392
R-squared		0.166	0.205	0.178	0.180	0.181

Standard errors in parentheses.; ‡ significant at 10%; † significant at 5%; * significant at 1%. Full model estimates are available upon request.

Table 3: Pseudo-panel estimate of the HEI model.

	POLS	FE	BE	RE
Luse	3.40	4.25	3.38	3.53
	(1.12)*	(1.73)**	(1.50)**	(1.12)*
NLEA	-8.31	-14.98	11.87	-9.40
	(7.29)	(10.38)	(12.62)	(7.15)
HSedn	1.45	2.01	0.62	1.50
	(1.35)	(1.91)	(1.90)	(1.35)
Colledn	1.57	0.95	2.57	1.60
	(1.62)	(2.27)	(2.32)	(1.61)
Collgrad	6.66	10.35	3.07	6.94
	(1.94)*	(2.99)*	(2.43)	(1.93)*
Smoke	-3.99	-4.66	-3.60	-4.18
	(1.43)*	(2.10)**	(1.88)***	(1.42)*
Age	0.13	1.14	0.06	0.14
	(0.10)	(1.07)	(0.12)	(0.10)
Agesq	0.00	-0.01	0.00	0.00
	(0.00)	(0.00)**	(0.00)	(0.00)
Brace	-4.46	0.00	-4.36	-4.43
	(0.82)*	(0.00)	(1.04)*	(0.84)*
Orace	2.15	0.00	1.63	2.24
	(1.01)**	(0.00)	(1.27)	(1.03)**
gender	2.82	0.00	1.17	2.91
	(0.92)*	(0.00)	(1.41)	(0.92)*
emp	1.30	1.21	2.04	1.34
	(1.19)	(1.83)	(1.59)	(1.20)
pctpov	-0.00	-0.01	-0.00	-0.00
	(0.00)	(0.01)	(0.01)	(0.00)
MWreg	1.20	4.53	-0.65	1.51
	(1.74)	(2.39)***	(2.54)	(1.73)
Wreg	-0.68	3.74	-4.00	-0.30
	(1.60)	(2.39)	(2.23)***	(1.60)
Sreg	1.73	4.44	-2.56	2.05
	(1.49)	(2.06)**	(2.22)	(1.49)
suburb	1.38	1.51	2.66	1.47
	(1.32)	(1.88)	(1.81)	(1.31)
rural	-4.91	-3.52	-5.88	-4.79
	(1.45)*	(2.14)	(1.95)*	(1.45)*

	POLS	FE	BE	RE
hgt	0.04	0.08	-0.12	0.05
	(0.07)	(0.08)	(0.12)	(0.07)
Constant	52.31	15.51	66.71	51.26
	(5.71)*	(51.53)	(9.54)*	(5.63)*
Observations	607	607	607	607
R-squared	0.294	0.159	0.415	

Standard errors in parentheses

Table 4: Pseudo-panel estimate of the HEI model with interaction term.

	POLS	FE	BE	RE
Luse	0.32	3.00	-3.45	0.53
	(1.68)	(2.46)	(2.63)	(1.67)
nlea	-9.78	-15.28	14.45	-10.74
	(7.28)	(10.40)	(12.47)	(7.17)
nleaLuse	5.51	2.17	11.20	5.30
	(2.24)**	(3.02)	(3.57)*	(2.22)**
HSedn	1.26	1.84	0.75	1.30
	(1.35)	(1.93)	(1.88)	(1.34)
Colledn	1.02	0.76	1.68	1.06
	(1.63)	(2.29)	(2.31)	(1.62)
Collgrad	6.34	10.14	2.96	6.56
	(1.93)*	(3.01)*	(2.40)	(1.93)*
smoke	-3.57	-4.39	-3.52	-3.73
	(1.43)**	(2.14)**	(1.86)***	(1.43)*
age	0.11	0.98	0.04	0.12
	(0.10)	(1.10)	(0.11)	(0.10)
agesq	0.00	-0.01	0.00	0.00
	(0.00)	(0.00)***	(0.00)	(0.00)
brace	-4.42	0.00	-4.47	-4.40
	(0.82)*	(0.00)	(1.02)*	(0.84)*
orace	2.28	0.00	1.31	2.36
	(1.00)**	(0.00)	(1.26)	(1.03)**
gender	2.60	0.00	0.09	2.70
	(0.92)*	(0.00)	(1.43)	(0.92)*
emp	1.25	1.27	1.58	1.30
	(1.19)	(1.83)	(1.57)	(1.19)
pctpov	-0.00	-0.01	-0.00	-0.00
	(0.00)	(0.01)	(0.01)	(0.00)
MWreg	0.64	4.48	-2.58	0.96
	(1.75)	(2.40)***	(2.58)	(1.74)
Wreg	-0.69	3.69	-3.46	-0.38
	(1.59)	(2.39)	(2.21)	(1.59)
Sreg	1.84	4.51	-2.35	2.10
	(1.49)	(2.06)**	(2.19)	(1.48)
suburb	1.53	1.53	3.08	1.59
	(1.31)	(1.88)	(1.79)***	(1.31)

	POLS	FE	BE	RE
rural	-4.76	-3.37	-5.96	-4.66
	(1.45)*	(2.15)	(1.92)*	(1.45)*
hgt	0.04	0.08	-0.19	0.05
	(0.07)	(0.08)	(0.12)	(0.07)
Constant	53.43	23.09	74.16	52.40
	(5.70)*	(52.65)	(9.70)*	(5.63)*
Observations	607	607	607	607
R-squared	0.301	0.161	0.434	

Standard errors in parentheses.; ‡ significant at 10%; † significant at 5%; * significant at 1%.