News Coverage and Sales of Products with Trans Fat

Effects Before and After Changes in Federal Labeling Policy

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Introduction: The Food and Drug Administration mandated that food products list the amount of trans fat per serving on nutrition facts labels by January 1, 2006. There have been no coordinated efforts to raise awareness about trans fat since the policy went into effect, but news coverage may promote informed decisions about food purchases. This paper assesses whether news coverage influenced sales of products containing trans fat, between December 13, 2004, and June 24, 2007, both before and after the labeling policy went into effect.

Methods: Sales data for products containing trans fat from a major grocery store chain with stores throughout Los Angeles County were merged with news coverage data from LexisNexis® and ProQuest. Cross-sectional time–series regression was conducted in 2008 to assess the effect of news coverage on weekly unit sales volume for seven trans-fat products across 11,997 store-weeks.

Results: News coverage effects were apparent for sales of two of the seven trans-fat products in the year before the trans-fat nutrition facts labeling policy went into effect ($p<0.05$ with Bonferroni correction). News coverage effects were observed for sales of six of the seven trans-fat products in the post-labeling period ($p<0.05$ with Bonferroni correction). For most products, effects were strongest at concurrent and 1-week lags, and they dissipated over time.

Conclusions: News coverage about trans fat, combined with labeling information, appears to influence consumer behavior in the short term. News coverage and product labeling may not be sufficient to promote sustained changes in trans-fat purchases.

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Introduction

The consumption of trans fatty acids (trans fat), found in partially hydrogenated oils, is associated with substantially increased risk of coronary heart disease (CHD).[1,2] Efforts to reduce trans-fat consumption in the U.S. have used two approaches. The first approach attempts to reduce trans-fat levels in the food supply through legislation that forces the food industry to replace trans fat with more healthful liquid vegetable oils.[3,4] New York City, Philadelphia, and California have banned the use of trans fat in foods prepared in restaurants, and several other states are considering similar laws.[5–7]

The second approach, championed by the U.S. Food and Drug Administration (FDA) and the USDHHS, attempts to reduce trans-fat consumption by raising public awareness of its harmful effects. To this end, the USDHHS 2005 Dietary Guidelines for Americans recommend that trans-fat consumption be "as low as possible."[2] The FDA mandated that the amount of trans fat per serving be listed on the nutrition facts label for all conventional foods and dietary supplements.[8] Effective January 1, 2006, all food products are required to list the amount of trans fat if it exceeds 0.5g per serving.

Despite this apparent commitment to informed decisions about diet, there is modest public knowledge about the health effects of trans fat.[7,9,10] There have been no coordinated efforts to raise awareness about trans fat since the labeling policy went into effect. A recent study concluded that nutrition facts labels on foods are unlikely to produce informed decisions about trans-fat purchases in the absence of broader consumer education programs.[7]

At the same time, many newsworthy events about trans-fat research and policy have occurred. Tiburon CA became the first trans fat–free city in the U.S. in May 2005. January 2006 witnessed the final implementation of the FDA's trans-fat labeling mandate. A

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scientific review of the evidence about trans fat and CHD was published in April 2006.[1] The proposal and passage of trans-fat bans in New York City and Philadelphia occurred between late 2006 and 2007.[5,6] Many of these events received media attention and, implicitly or explicitly, conveyed information about the harmful effects of trans fat.

News coverage has led to changes in several health-related behaviors.[11–18] Trans-fat news coverage may promote informed decisions about purchasing related products in the absence of a coordinated campaign.[19,20] The current study assessed the impact of news coverage on sales of seven products with trans fat before and after the nutrition facts labeling policy went into effect.

Methods

Grocery Store Sales Volume and Price Data

Weekly sales data for trans-fat products were obtained from a major grocery store chain in Los Angeles County (LAC) between January 1, 2005, and June 24, 2007 (129 weeks). This location was chosen because (1) it is served by a single major newspaper (the *Los Angeles Times*); (2) the area was likely to have substantial trans-fat news coverage due to pending legislation to ban trans fat in California; (3) the grocery store chain has a substantial market share with stores throughout LAC; and (4) LAC represents an economically and ethnically diverse population, with 16.7% living below the poverty line, 47% of Hispanic origin, 13% Asian, and 10% African American.[21] The data contained weekly unit sales and price data for seven trans-fat products in each store (n=11,997 store-weeks if no missing cases) and total weekly sales (across all products) for each store.

Trans-Fat Product Selection

The analysis examined six products that listed trans fat on their nutrition facts labels as of July 1, 2007, and a seventh that included trans fat until January 27, 2007 (Crisco original vegetable shortening). Seven product domains identified by the FDA as major sources of trans fat were selected.[22] From each of the seven product domains, a single product that contained a small number of missing cases (specific weeks in specific stores for which unit sales data were unavailable) was selected for analysis: (1) Pop Secret Buttered Popcorn (6g trans fat per serving, n=11,308 store-week observations); (2) Crisco Original, 48 oz (4g, n=9080 between January 1, 2005, and December 31, 2006); (3) Pillsbury Grands! Buttermilk Biscuits (3g, n=10,544); (4) I Can't Believe It's Not Butter Stick Margarine (2.5g, n=11,882); (5) Pillsbury Big and Flaky Crescent Rolls (1.5g, n=11,234); (6) E.L. Fudge Sandwich Cookies (1.5g, n=10,547); and (7) Oscar Mayer Regular Beef Franks (1g, n=11,689).

Dependent Variables: Logged Unit Sales Volume

The dependent variables were unit sales volume for each product. Values varied by week and store. A natural log transformation was used because the distribution of weekly unit sales was positively skewed.

Trans-Fat News Coverage Data

Sales data were merged with trans-fat news coverage data identified using the LexisNexis® and ProQuest databases. The search terms *trans fat(s)*, *transfat(s)*, *trans fatty acid*, and *hydrogenated oil(s)* were used to identify news stories that ran between December 13, 2004 (3 weeks before the first week of available grocery store data to test lagged effects), and June 24, 2007. In all, 361 stories were identified during the observational period, from the following sources: the *Los Angeles Times* (93); the Associated Press (AP) domestic wire service (71); and transcripts of news programs for the major broadcast TV networks (ABC: 50; CBS: 75; and NBC: 72). These sources, highly correlated (Cronbach's α=0.76), were used to estimate broader patterns of trans-fat news coverage in LAC. Newspaper, wire, and national TV stories often shape the content of other news sources such as local TV, radio, and websites.[23–26]

Each retrieved article or transcript was examined for relevance. Although a formal content analysis was not performed, recurring themes included the relationship between trans-fat consumption and CHD risk, replacement of "artery clogging" trans fat–containing oils by fast-food chains, and reports about bans on trans-fat use by restaurants. Few stories focused on specific recommended quantities of trans fat. Reports about nutrition labeling changes were limited mostly to the time period immediately surrounding the new FDA mandate.

Several articles contained a single mention of trans fat or related terms. Stories about nutrition or food were retained for the analysis. For example, a story about the fast-food chain El Pollo Loco that mentioned that it "doesn't cook its French fries in artery clogging trans-fat oils" was retained.[27] Stories that mentioned trans fat in passing but had a different focus were excluded (n=17). For example, a story about baseball player Barry Bonds stated that "despising a pro athlete for using performance-enhancing drugs is like hating a chef for cooking with trans fats."[28]

Independent Variable: Trans-Fat News Coverage Volume

The independent variable was the average number of stories per week across the five news outlets (trans-fat news). Trans-fat news varied substantially over the observation period (M=0.46, SD=0.68) and was greater in late 2006/early 2007 relative to 2005/early 2006 (Figure 1). Values were merged with the grocery store data concurrently (no lag) and with 1-, 2-, and 3-week lags. Although some previous studies of media effects on health behavior have utilized cumulative or half-lived measures, preliminary analyses revealed that concurrent and lagged measures were stronger predictors of weekly unit sales volume.[12,29,30]

Control Variables

Time-varying measures. A linear time trend was included to account for secular trends in product-purchase patterns. The linear time trend also likely captured long-term, cumulative effects of public information about trans fat. An indicator for each month (summer months as referent) was included to account for seasonal variation in purchases and to control for possible confounding of the relationship between news and purchases (Figure 2).[31]

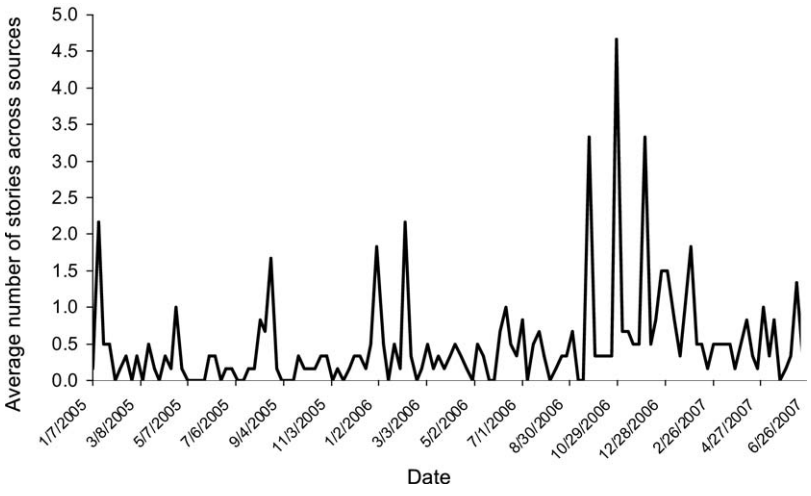

Figure 1. Weekly variation in the average number of news stories in major news sources about trans fat

Store- and time-varying measures. All multivariate analyses controlled for total weekly sales volume (log transformed) in each store. This variable was used as a proxy for overall store size and also likely captured LAC-wide grocery store chain advertising campaigns that led to temporal spikes in total sales volume across stores.

Store-, time-, and product-varying measures. All multivariate models also included a variable to capture the effects of price (log transformed) on trans-fat product sales. This variable also likely captured product-specific advertising campaigns, because price discounts are often advertised with coupons in newspapers and noted with signs in grocery store aisles.

Missing Data Sensitivity Analysis

Sensitivity analyses were conducted to assess the impact of nonrandom missing cases on substantive interpretation of results by comparing (1) multivariate models that assumed all missing cases were missing at random to (2) multivariate models that assumed all missing cases reflected zero unit sales. Results were substantively equivalent under each assumption for each product; hence all subsequent analyses exclude missing cases.

Analytic Approach

Cross-sectional time–series regression was conducted in 2008 to assess news effects on trans-fat product sales. Stata 9.2 xtregar command was used to account for sources of correlated errors associated with the data structure.[32] An autoregressive term (AR-1) was included to account for temporal autocorrelation.[33–35] Repeated observations were accounted for with store-level fixed effects.[36] A random-effects model with robust SEs was also tested to assess the data's sensitivity to alternate specifications. Results were substantively equivalent regardless of whether fixed or random effects were used.

Three sets of models were estimated for each product, and a Bonferroni correction was used to account for multiple comparisons.[37] The first set examined the relationship between news coverage and logged unit sales for each product in the year before the labeling policy went into effect (Table 1). The second set examined the relationship between news coverage and logged unit sales for each product in the 1.5 years after the labeling policy went into effect (Table 2). In support of a news coverage effect, a significant negative association between news volume and logged unit sales was hypothesized. These effects were expected to be strongest in the concurrent or 1-week lagged measures and to weaken at longer lags.

The third set of models included the entire observation period and tested for the presence of interactions between trans-fat news and the post-labeling time period on logged unit sales. News measures with a 1-week lag were used for these interactions to provide (1) a single test for each product and (2) a news measure that clearly preceded grocery purchases, to allow for causal inferences. Interactions were expected to be negative and significant for each product.

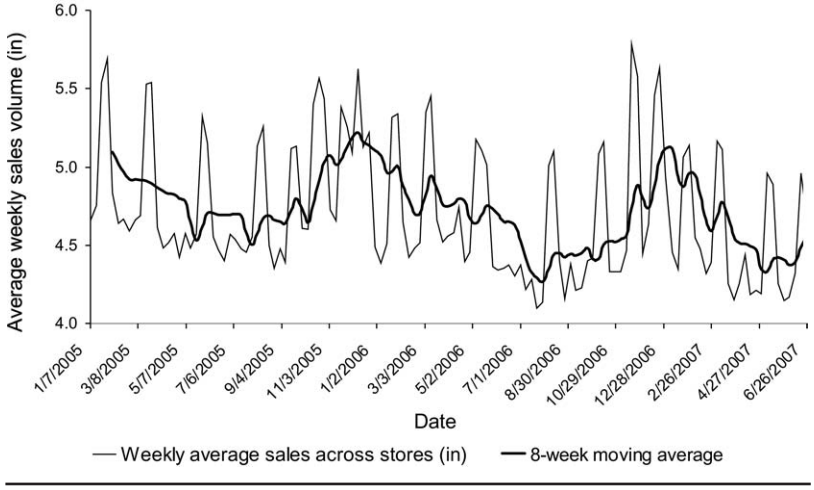

Figure 2. Weekly variation in averaged logged sales volume across stores, for stick margarine

Results

Models Predicting Logged Volume of Trans-Fat Product Unit Sales in the Pre-Labeling Period

Model results provide little support for news effects on trans-fat product unit sales in the pre-labeling period (Table 1). Of 28 tests (four lags by seven products), seven were significant and negative (as hypothesized), but six were significant and positive (contrary to hypotheses). Two products showed the expected pattern of strong concurrent and 1-week-lagged effects and dissipated effects at longer lags: stick margarine and hot dogs. The remaining five prod-

Table 1. Cross-sectional time–series regression models predicting logged volume of trans-fat product unit sales in the pre-labeling period

	Product						
	Buttered popcorn (6g)	**Crisco original (4g)**	**Buttered biscuits (3g)**	**Stick margarine (2.5g)**	**Crescent rolls (1.5g)**	**Sandwich cookies (1.5g)**	**Hot dogs (1g)**
MODEL VARIABLES							
Average number of trans-fat news stories							
Concurrent	−0.08	0.04	0.08	−0.08**	0.08*	−0.01	−0.12**
1-week lag	0.01	0.00	0.06	−0.07**	−0.04	0.06	−0.13**
2-week lag	0.00	−0.17**	0.01	−0.02	−0.10**	0.29**	−0.03
3-week lag	0.06	0.09**	0.12**	0.05*	0.20**	0.00	−0.08**
Linear time trend (10-week intervals)	0.02	0.03	−0.12	0.13**	−0.11	−0.51**	0.16**
Price (ln)	−1.66**	−1.30**	−1.34**	−1.65**	−1.69**	−1.20**	−1.97**
Total store sales volume (ln)	0.19**	0.35**	0.18**	0.70**	0.20**	0.40**	0.23**
SUMMARY DATA							
Number of observations	4488	4548	3828	4645	4453	4156	4710
Overall r^2	0.34	0.22	0.27	0.51	0.37	0.27	0.47

Note: Cells present b parameter estimates for multivariate models that also included an AR-1 term, store-level fixed effects, and seasonal controls using indicator variables for month of the year (summer months as comparison group). The substantive interpretation of the models was equivalent when store-level random effects with robust SEs were used.
*$p<0.05$ using a Bonferroni correction to account for repeated tests across seven products; **$p<0.01$ using a Bonferroni correction
ln, natural log

ucts showed no discernible pattern. There were no clear trends in unit sales across products: The two products that showed the expected pattern of news effects on reduced unit sales volume exhibited significant linear trends toward greater unit sales volume over time. One product, sandwich cookies, showed reduced sales volume over the pre-labeling period. For the rest, sales volume changes were not significantly different from zero. Price and total store sales volume were each strong, significant predictors of unit sales for all seven trans-fat products.

Models Predicting Logged Volume of Trans-Fat Product Unit Sales in the Post-Labeling Period

Model results provide strong support for news effects on trans-fat product unit sales in the post-labeling period (Table 2). Of 28 tests, 15 were significant and negative, whereas only one was significant and positive. Five products showed the expected pattern of having the strongest news effects at concurrent or 1-week lags and dissipated effects at longer lags. The sixth product, sandwich cookies, exhibited significant, negative effects

Table 2. Cross-sectional time–series regression models predicting logged volume of trans-fat product unit sales in the post-labeling period

	Product						
	Buttered popcorn (6g)	**Crisco pre-2007 (4g)**	**Buttered biscuits (3g)**	**Stick margarine (2.5g)**	**Crescent rolls (1.5g)**	**Sandwich cookies (1.5g)**	**Hot dogs (1g)**
MODEL VARIABLES							
Average number of trans-fat news stories							
Concurrent	0.00	−0.06**	−0.06**	−0.05**	−0.05**	−0.06**	0.04**
1-week lag	−0.06**	−0.07**	−0.03	−0.05**	−0.03	−0.06**	0.00
2-week lag	−0.03	−0.02	−0.03*	−0.02*	0.01	−0.15**	0.01
3-week lag	−0.01	−0.01	−0.03*	−0.03**	0.00	−0.09**	0.00
Linear time trend (10-week intervals)	−0.07**	0.04	0.02*	−0.03**	0.00	−0.01	−0.04**
Price (ln)	−1.58**	−6.35**	−1.36**	−1.73**	−2.06**	−1.08**	−2.12**
Total store sales volume (ln)	0.18**	0.83**	0.12**	0.67**	0.29**	0.05	0.24**
SUMMARY DATA							
Number of observations	6727	4439	6624	7144	6689	6298	6887
Overall r^2	0.35	0.17	0.25	0.45	0.40	0.14	0.43

Note: Cells present b parameter estimates for multivariate models that also included an AR-1 term, store-level fixed effects, and seasonal controls using indicator variables for month of the year (summer months as comparison group). The substantive interpretation of the models was equivalent when store-level random effects with robust SEs were used.
*$p<0.05$ using a Bonferroni correction to account for repeated tests across seven products; **$p<0.01$ using a Bonferroni correction
ln, natural log

with each news lag and the strongest effects at a 2-week lag. The product with the least amount of trans fat per serving, hot dogs, showed an unexpected positive association with concurrent news coverage and no effects at subsequent lags.

There were linear trends toward reduced unit sales for three products: buttered popcorn, stick margarine, and hot dogs. A single product, buttered biscuits, showed a significant linear trend toward greater unit sales volume over time. With one exception (total store volume with sandwich cookie unit sales), price and total store sales volume were strong, significant predictors of unit sales for all products.

Models Testing for Differences in Trans-Fat News Effects in the Pre- and Post-Labeling Periods

News effects on trans-fat product sales were significantly stronger for two of seven products after the labeling policy went into effect. Interactions between trans-fat news (1-week lag) and unit sales were negative and significant ($p<0.05$ with Bonferroni correction) for buttered popcorn and Crisco, the two products with the highest trans-fat content per serving. Interactions were not significant for the other five products.

Discussion

This study provides evidence that news coverage influenced short-term consumer purchases of trans-fat products in LAC in the 1.5 years following the launch of the federally mandated labeling policy, but not before. News effects on purchases of products with high trans fat per content (4g or more) were stronger after the labeling policy went into effect. In the post-labeling period, the strength of association between trans-fat news coverage and product purchases did not vary by the amount of trans fat in the product (with the exception of hot dogs). Thus, results suggest that consumers may respond to trans-fat news coverage by avoiding products with any trans fat but not by discriminating among products with differing amounts of trans fat.

The hot dog exception may reflect consumers' recognition that natural trans fat in meat from cows possesses no documented health risk.[1] Alternatively, this exception may indicate that consumers who buy hot dogs are simply unresponsive to health information in the news. Hot dogs account for a lower percentage of fat intake in the U.S. than do the other studied product classes, suggesting that those who buy hot dogs may differ from those who purchase other sources of trans fat.[38] However, these speculative explanations remain a topic for future study.

Results suggest mixed implications for public health. On the one hand, trans-fat news coupled with labels that identify products with 0.5g or more trans fat per serving appears to influence food purchases in the absence of a coordinated campaign. News effects were strong and significant during the week of their publication and/or a week after they appeared in broadcast or print for six of seven trans-fat products. On the other hand, effects dissipated completely after 3 weeks for half of these products. It is unclear whether trans-fat research and policy will remain a newsworthy topic. Results thus suggest that trans-fat news may not be sufficient to promote sustained reductions in trans-fat purchases in the U.S. Progress toward reducing health consequences of trans-fat consumption will likely require both policy changes to reduce the amount of trans fat in the food supply and a coordinated and sustained campaign to catalyze health behavior change.[7,39]

The current findings also add to the literature on news coverage effects on health behavior. Although many studies demonstrate news coverage effects on health-related behaviors, many of these studies have used self-reported measures rather than objective indicators of behavior such as product sales.[11,12,14] This study extends that literature by using a measure of aggregate behavior that is not subject to the memory and social desirability limitations of self-reports. In addition, this study sheds light on the conditional nature of news effects on some behaviors. There was no evidence of trans-fat news effects during the period of observation in which consumers did not have access to information about trans-fat content at the point of product selection. This finding provides support for the FDA's labeling mandate, which enables consumers to put public health information into practice.

Higher prices were consistently associated with lower unit sales, but readers are cautioned from drawing conclusions about the promise of price increases to reduce trans-fat purchases. Grocery store chains typically place a limited number of items on sale each week, usually a subset of items within a larger product domain (e.g., one brand of margarine is on sale while others remain at regular prices). A customer is thus likely to have been able to choose one high–trans fat product when another was at full price. The price variable also likely captured the effects of product-specific advertising campaigns, which tend to accompany price discounts in grocery stores.

Study Limitations

This study's independent variable is an indirect measure of media influence. The sampled outlets exclude some major news sources (local TV news, news websites), and it is impossible to know the extent to which the trans-fat news stories were actually read or viewed by those who shop at the LAC grocery store chain. The reliance on aggregate sales data prevents the study from

examining cognitive mediators of news influence, such as trans-fat knowledge, beliefs about trans fat, or social norms surrounding trans-fat consumption. Grocery store data provide information about trans-fat purchases only, not consumption. Using data from a particular grocery store chain in a specific geographic area limits the degree to which study results are generalizable.

More broadly, this study does not capture news or policy effects on changes in product composition. Many food producers have voluntarily removed trans fat from their products (e.g., Crisco),[40] presumably in response to labeling policy, news coverage, and increased awareness about trans fat. Hence, the focus on consumer purchases may understate the effects of labeling policy and news coverage on the ultimate goal of reducing trans-fat consumption.

Conclusion

This study provides evidence that trans-fat news coverage influenced short-term grocery purchasing patterns for trans-fat products in LAC following the launch of the federally mandated trans-fat labeling policy. No such effects were apparent in the year prior to the labeling policy's implementation. News coverage about trans-fat research and policy, in the absence of broader changes in food policy and public education, may be insufficient to produce sustained reductions in trans-fat purchases and consumption in the U.S.

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References

1. Mozaffarian D, Katan MB, Ascherio A, Stampfer MJ, Willett WC. Trans fatty acids and cardiovascular disease. N Engl J Med 2006;354:1601–13.
2. USDHHS, U.S. Department of Agriculture. Dietary guidelines for Americans, 6th ed. Washington DC: U.S. Government Printing Office, 2005.
3. American Public Health Association. Restricting trans fatty acids in the food supply [policy statement #200711, November 6, 2007]. www.apha.org/NR/rdonlyres/160F07EF-931B-4FA1-8023-04046F8B8C37/0/D5TransFatFinal61807.pdf.
4. Lichtenstein AH, Appel LJ, Brands M, et al. Diet and lifestyle recommendations revision 2006: a scientific statement from the American Heart Association nutrition committee. Circulation 2006;114:82–96.
5. New York City Department of Health and Mental Hygiene. Board of health votes to phase out artificial trans fat from New York City's restaurants [press release #114-06, December 5, 2006]. www.nyc.gov/html/doh/html/pr2006/pr114-06.shtml.
6. Philadelphia City Council. Amending section 6-307 of The Philadelphia Code, entitled "Foods containing artificial trans fats," by exempting certain bakeries from the provisions prohibiting the use of articifial trans fats, under certain terms and conditions [press release, October 10, 2007]. http://webapps.phila.gov/council/detailreport/?key=7421.
7. Howlett E, Burton S, Kozup J. How modification of the nutrition facts panel influences consumers at risk for heart disease: the case of trans fat. J Public Policy Mark 2008;27:83–97.
8. U.S. Food and Drug Administration. HHS to require food labels to include trans fat contents [press release, July 9, 2003]. www.hhs.gov/news/press/2003pres/20030709.html.
9. Hess S, Yanes N, Jourdan P, Edelstein S. Trans fat knowledge is related to education level and nutrition facts label use in health-conscious adults. Top Clin Nutr 2005;20:109–17.
10. Lin CT, Choiniere C. Fats and carbs: a snapshot of consumer knowledge from a recent FDA survey. August 2005. www.cfsan.fda.gov/~comm/crnutri2.html.
11. Pierce JP, Gilpin EA. News media coverage of smoking and health is associated with changes in population rates of smoking cessation but not initiation. Tob Control 2001;10:145–53.
12. Smith K, Wakefield M, Terry-McElrath Y, et al. Relationship between newspaper coverage of tobacco issues on perceived smoking harm and smoking behavior among American teens. Tob Control 2008;17:17–24.
13. Fan DP, Holway WB. Media coverage of cocaine and its impact on usage patterns. Int J Public Opin Res 1994;6:139–62.
14. Fan DP. Impact of persuasive information on secular trends in health-related behaviors. In: Hornik RC, ed. Public health communication: evidence for behavior change. Mahwah NJ: Lawrence Erlbaum, 2002: 251–64.
15. Yanovitzky I, Stryker J. Mass media, social norms, and health promotion efforts: a longitudinal study of media effects on youth binge drinking. Commun Res 2001;28:208–39.
16. Yanovitzky I, Blitz CL. Effect of media coverage and physician advice on utilization of breast cancer screening by women 40 years and older. J Health Commun 2000;5:117–34.
17. Stryker JE. Media and marijuana: a longitudinal analysis of news media effects on adolescents' marijuana use and related outcomes, 1977–1999. J Health Commun 2003;8:305–28.
18. Yanovitzky I, Bennett C. Media attention, institutional response, and health behavior change—the case of drunk driving, 1978–1996. Commun Res 1999;26:429–53.
19. Chapman S. The news on tobacco control: time to bring the background into the foreground. Tob Control 1999;8:237–9.
20. Winett LB, Wallack L. Advancing public health goals through the mass media. J Health Commun 1996;1:173–96.
21. U.S. Census Bureau. State and county quick facts: Los Angeles County California. Washington DC: U.S. Census Bureau, 2006. http://quickfacts.census.gov/qfd/states/06/06037.html.
22. U.S. Food and Drug Administration. Revealing trans fats. Washington DC: USDHHS, 2003. www.fda.gov/FDAC/features/2003/503_fats.html.
23. Fan DP. Predictions of public opinion from the mass media. New York: Greenwood Press, 1988.
24. Stryker JE. Measuring aggregate media exposure: a construct validity test of indicators of the national news environment. Commun Methods Measures 2008;2:115–33.
25. Project for Excellence in Journalism. State of the news media. Washington DC: Project for Excellence in Journalism, 2008.
26. Chapman S. Advocacy for public health: a primer. J Epi Community Health 2004;58:361–5.
27. Hirsch J. Will East Coast go loco for an expanding El Pollo? Los Angeles Times, November 28, 2006.
28. Zirin D. Behind the Barry-bashing: as the slugger closes in on the home run record, the anti-Bonds club is practicing an ugly double standard. Los Angeles Times, May 20, 2007.
29. Niederdeppe J, Farrelly MC, Wenter D, Thomas K, Weitzencamp D. Newspaper coverage as indirect effects of a health communication intervention: the Florida tobacco control program and youth smoking. Commun Res 2007;34:382–405.
30. Wakefield MA, Durkin S, Spittal MJ, et al. The impact of tobacco control policies and mass media campaigns on monthly adult smoking prevalence. Am J Public Health 2008;98:1443–50.

31. Romer D. Time series models. In: Romer D, Kenski K, Waldman P, Adasiewicz C, Jamieson KH, eds. Capturing campaign dynamics: the national Annenberg election survey. New York: Oxford, 2004:117–89.
32. StataCorp LP. Stata longitudinal/panel data reference manual, release 9. College Station TX: Stata Press, 2005.
33. Sanders D, Ward H. Time-series techniques for repeated cross-section data. In: Dale A, Davies RB, eds. Analyzing social and political change: a casebook of methods. Thousand Oaks CA: Sage, 1994:198–223.
34. Watt JH. Detection and modeling of time-sequenced processes. In: Lang A ed. Measuring psychological responses to media messages. Hillsdale NJ: Lawrence Erlbaum, 1994:181–207.
35. Ostrom CW. Time series analysis: regression techniques, 2nd ed. Beverly Hills CA: Sage, 1990.
36. Allison PD. Fixed effects regression methods for longitudinal data. Cary NC: SAS Institute, 2005.
37. Abdi H. Bonferroni and Sidak corrections for multiple comparisons. In: Salkind NJ, ed. Encyclopedia of measurement and statistics. Thousand Oaks CA: Sage, 2007.
38. Cotton PA, Subar F, Friday JE, Cook A. Dietary sources of nutrients among U.S. adults, 1994 to 1996. J Am Diet Assoc 2004;104:921–30.
39. Kozup J, Burton S, Creyer EH. The provision of trans fat information and its interaction with consumer knowledge. J Consum Aff 2006;40:163–76.
40. Health Canada. Trans fat monitoring program: second set of trans fat monitoring data. Ottawa, Ontario: Bureau of Nutritional Sciences, Food Directorate, Health Products and Food Branch, Health Canada. 2008. www.hc-sc.gc.ca/fn-an/nutrition/gras-trans-fats/tfa-age-eng.php.