The Effect of Graphic Warnings on Sugary Drink Purchasing

Authors:
Grant E. Donnelly[1]*
Laura Y. Zatz[2]*
Dan Svirsky[3]
Leslie K. John[3]

[1]Marketing Unit, Harvard Business School
[2]Departments of Nutrition and Social & Behavioral Sciences, Harvard T.H. Chan School of Public Health
[3]Negotiation, Organizations and Markets Unit, Harvard Business School

*Grant E. Donnelly and Laura Y. Zatz contributed equally to this article.

Supplemental Material

Study 1 Fountain Drink Purchases

Our intervention included warning labels on a soda fountain machine, and we tested whether our results replicated for these drinks. For fountain drinks however, purchase data only included the size of the fountain cup purchased, not the flavor or type of beverage. To solve this problem, we measured changes in the amount of syrup used for each drink type by weighing the boxes of syrup once a week. Hence, if the box of Coca-Cola syrup saw a drop of 14 pounds, but the box of Diet Coke syrup saw a drop of 21 pounds, we could conclude that more Diet Coke syrup was dispensed.

Each drink used a unique ratio of water to syrup when dispensing a drink, written on the fountain machine itself. We used this ratio to convert the weight of syrup dispensed into number of fluid ounces dispensed. Finally, using data on number of fountain cups purchased, we divided the total number of fluid ounces by the average cup size purchased (21.8 ounces) to construct a proxy for the units of each drink that were purchased.

Fig. S6 shows the estimated proportion of sugary fountain drinks versus non-sugary fountain drinks purchased for the baseline period and each intervention period. We found the same results as for bottled beverage purchases. During the baseline period, 58% of the drinks purchased were sugary drinks. This was roughly unchanged during the calorie label intervention (57%, $p = .76$) and during the text warning label intervention (54%, $p = .23$). By contrast, the proportion of sugary drinks purchased dropped to 50% during the graphic warning labels intervention, a statistically significant drop when compared to baseline ($p = .01$) and the calorie warning label intervention ($p = .02$) but not the text warning label intervention ($p = .20$). This change during the graphic warning label period represents a 14% drop from baseline, almost precisely mirroring the drop in bottled sugary drinks purchased.

Consumer Support for Label: Pre-Test with Convenience Sample

The nationally representative survey reported in the main text is a replication of pre-test which we conducted with a convenience sample ($N = 254$; 44.1% female; 83.5% White). Specifically, as in the nationally representative sample, participants rated the extent to which they supported each label using the same scale. Participants were randomized to view and rate only one of the three labels (separate evaluation condition), or to view and rate all three (in which case order of presentation was randomized between-participants; joint evaluation condition). As in the nationally representative survey reported in the main text, for half of participants, effectiveness information accompanied the label (for the other half, effectiveness information was not provided).

Joint evaluation. A repeated-measures ANOVA using label type as a within-subjects factor and effectiveness information as a between-subjects factor revealed a significant main effect of label type, $F(1.72, 106.33) = 6.08$, $p = .005$, no effect for effectiveness information, $F(1, 62) = 0.14$, $p = .71$, but a significant interaction, $F(1.72, 106.33) = 10.55$, $p < .001$. [1] Follow-up tests revealed that when effectiveness information was provided, people were equally accepting of graphic warning labels relative to both calorie, $t(30) = 1.92$, $p = .07$, and text warning labels, $t(30) = 1.03$, $p = .31$. However, in the absence of such information, people were less accepting of graphic warning labels relative to text warning labels, $t(32) = 5.65$, $p < .001$,

[1] Mauchly's test indicated that the assumption of sphericity had been violated for the main effect of label type, $\chi^2(2) = 11.09$, $p = .004$. There was greater variance in support for the graphic label relative to the calorie and text warning label. Therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .86$).

and equally accepting to calorie labels, $t(32) = 1.69$, $p = .10$. In sum, in the absence of effectiveness information, consumers were neutral about graphic warning labels; however, this indifference can be turned into support by providing effectiveness information.

Separate evaluation. As noted, the other half of our sample evaluated only one label. A 2x2 ANOVA revealed a marginal main effect of label, $F(2, 184) = 3.84$, $p = .02$, as well as a significant main effect of effectiveness information, $F(1,184) = 3.97$, $p = .048$. Importantly however, these main effects were qualified by a marginally significant interaction, $F(2, 184) = 2.80$, $p = .06$. Pairwise comparisons revealed that in the absence of effectiveness information, support for the graphic warning was lower relative to both the calorie label, $t(56) = 2.05$, $p = .045$, and marginally lower than the text warning label, $t(64) = 1.70$, $p = .09$. However, when effectiveness information was provided, respondents were just as supportive of the graphic warning as they were the calorie label, $t(66) = -0.58$, $p = .63$, although support was still significantly lower than the text warning, $t(61) = 2.02$, $p = .048$. These results are broadly consistent with those of the joint evaluation condition; therefore, in the main study to maximize power (and reduce costs, since the nationally-representative survey was conducted through a survey panel company which charged per respondent), all participants rated all three labels (i.e., we only ran the joint evaluation mode conditions).

Supplemental Figures and Tables

Fig. S1. Study 1: Bottled beverage cooler with sugary drinks on the top left during the calorie label intervention, and non-sugary drinks on the right and bottom shelves.

Fig. S2. Study 1: Bottled beverage cooler depicting the sugary drinks during the graphic warning label intervention.

Fig. S3. Study 1: Fountain drink machine depicting sugary drinks during the text warning label treatment and non-sugary drinks.

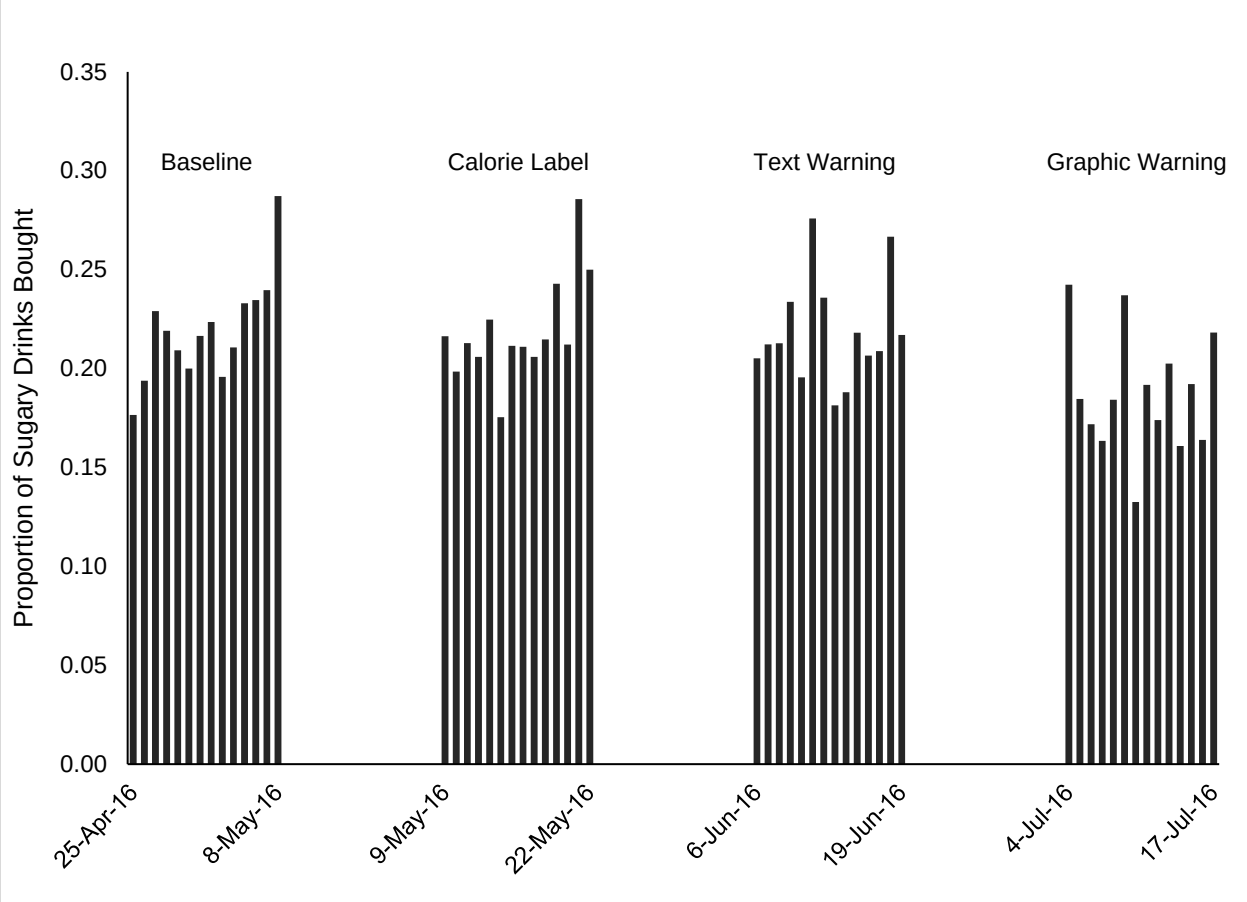

Fig. S4 Proportion of bottled drinks purchased per day that were sugary drinks, by condition, in Study 1.

Fig. S5 Example of stimulus for Study 2, experimental condition.

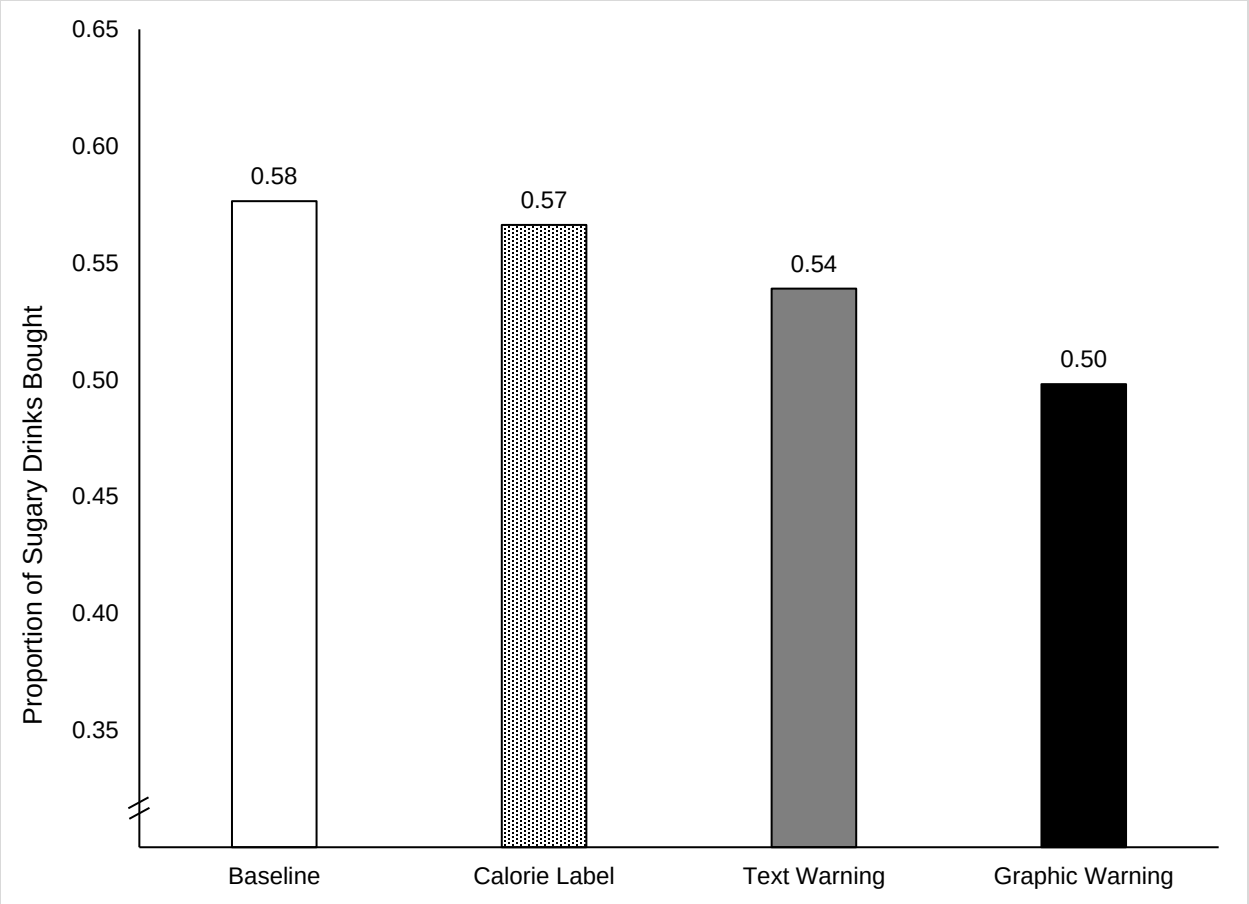

Fig. S6. Sugary drink fountain purchases by condition in Study 1.
The proportion of all fountain drinks purchased that were sugary drinks. Fisher's exact tests were used to assess statistical significance, where the unit of observation is a proxy for total drinks purchased: total ounces divided by the average drink size, in ounces. The graphic warning label period resulted in a statistically significant drop relative to baseline (p = .01) and the calorie warning label (p = .02), but not the text warning label (p = .20). No other comparisons are statistically significant (calorie label to baseline: p = .76; text warning label to baseline: p = .23, calorie label to text warning label: p = .38

Table S1A
Effect of interventions on daily proportion of sugary drinks purchased, unadjusted and controlling for seasonality (Study 1).

	Model 1	Model 2	Model 3
Calorie Label	-0.001 (0.010)	0.002 (0.009)	-0.007 (0.012)
Text Warning	-0.001 (0.010)	-0.010 (0.012)	-0.006 (0.021)
Graphic Warning	-0.034** (0.010)	-0.059** (0.023)	-0.063** (0.022)
Calendar Week	---	1.265 (0.927)	0.811 (1.042)
Heat Index	---	--	-0.001 (0.001)
Constant	0.219*** (0.01)	-0.041 (0.007)	0.112 (0.248)
Observations	56	56	56
Adj. R-squared	0.21	0.22	0.22

Note. Each column presents a linear regression estimating the daily proportion of sugary drinks purchased out of all bottled drinks purchased. Robust standard errors are in parentheses. Model 1 is unadjusted. Model 2 controls for calendar week effects. Model 3 further controls for daily heat index. ** $p < .01$, *** $p < .001$

Table S1B

Effect of interventions on daily unit sugary drink purchases (number of bottles), unadjusted and controlling for seasonality (Study 1).

	Model 1	Model 2	Model 3	Model 4
Calorie Label	5.64 (14.22)	5.64 (4.63)	0.79 (5.82)	0.58 (6.85)
Text Warning	-4.71 (13.23)	-4.71 (5.25)	-14.52 (8.16)	-14.82 (9.61)
Graphic Warning	-12.36 (13.77)	-12.36† (7.01)	-19.45* (9.39)	-19.77† (10.96)
Holiday or Weekend Day	--	-69.70*** (3.45)	-69.70*** (3.48)	-69.75*** (2.88)
Calendar Week	--	--	0.13† (0.07)	0.13† (0.075)
Heat Index	--	--	--	-0.01 (0.17)
Constant	77.64*** (9.87)	97.55*** (4.33)	32.92** (36.70)	34.30* (36.64)
Observations	56	56	56	56
Adj. R-squared	-0.02	0.81	0.82	0.82

Note. Each column presents a linear regression estimating the units of sugary drinks purchased each day. Robust standard errors are in parentheses. Model 1 is unadjusted. Model 2 controls for whether it is a weekday versus holiday or weekend day. Model 3 adds a control for calendar week effects. Model 4 further controls for daily heat index.

† $p < .10$; * $p < .05$; ** $p < .01$, *** $p < .001$

Table S2
Descriptive Statistics of Nationally Representative Sample for Study 3 (N = 402)

Demographic Characteristic	Categories	Percentage of Respondents
Age (years)	18 – 24	13.4
	25 – 34	17.9
	35 – 44	16.2
	45 – 54	19.2
	55 – 64	15.9
	65 and older	17.4
Gender	Female	49.8
	Male	50.2
Ethnicity	White	74.6
	Black	13.4
	Asian	5
	Other	7
Hispanic	Yes	18.4
	No	81.6
Income	Less than $25,000	25.6
	$25,000 - $49,999	26.1
	$50,000 - $74,999	17.9
	$75,000 - $99,999	11.2
	$100,000 - $149,999	8.7
	$150,000 or more	10.4
Education	Less than high school	6.7
	High school degree	31.1
	Associates degree	19.2
	Some college	9.7
	College degree	20.6
	At least some graduate school	12.7
Political Ideology	Democrat	37.3
	Republican	26.6
	Independent	27.9
	Other	2.2
	No preference	6
Sugary Drink Consumption	Never	16.7
	1 time per month	7.7
	2 – 3 times per month	11.7
	1 – 2 times per week	13.7
	3 – 4 times per week	13.7
	5 – 6 times per week	8.2
	1 time per day	7.2
	2 times per day	10.2
	3 or more times per day	10.9
BMI (kg/m^2, WHO Classification)	Less than 18.49 (underweight)	4.3
	18.5 – 24.9 (normal)	30.9
	25 – 29.9 (over weight)	31.6
	30 – 34.9 (moderately obese)	17.5
	35 – 39.9 (severely obese)	7.9
	40 and above (very severely obese)	7.8