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Impact of San Francisco, CA's Sugar-Sweetened Beverage Health Warning on Consumer Reactions: Implications for Equity from a Randomized Experiment

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Abstract

Background: In 2020, San Francisco, CA amended an ordinance requiring warning labels on advertisements for sugary drinks to update the warning message. No studies have evaluated consumer responses to the revised message.

Objectives: To evaluate responses to the 2020 San Francisco sugary drink warning label and to assess whether these responses differ by demographic characteristics.

Design: Randomized experiment.

Participants/setting: In 2020, a convenience sample of US parents of children ages 6 months-5 years ($n=2,160$ included in primary analyses) was recruited via an online panel to complete a survey. Oversampling was used to achieve a diverse sample (49% Hispanic/Latino(a), 34% non-Hispanic Black, 9% non-Hispanic White).

Intervention: Participants were randomly assigned to view a control label (“Always read the Nutrition Facts Panel”) or the 2020 San Francisco sugary drink warning label (“SAN

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FRANCISCO GOVERNMENT WARNING: Drinking beverages with added sugar(s) can cause weight gain, which increases the risk of obesity and type 2 diabetes.”). Messages were shown in white text on black rectangular labels.

Main outcome measures: Participants rated the labels on thinking about health harms of sugary drink consumption (primary outcome) and perceived discouragement from wanting to consume sugary drinks. The survey was available in English and Spanish.

Statistical analyses performed: Ordinary least squares regression.

Results: The San Francisco warning label elicited more thinking about health harms (Cohen’s $d=.24$, $p<0.001$) than the control label. The San Francisco warning label also led to more discouragement from wanting to consume sugary drinks than the control label ($d=.31$, $p<0.001$). The warning label’s impact on thinking about harms did not differ by any participant characteristics, including age, gender, race/ethnicity, education, income, or language of survey administration (all p -values for interactions >0.12).

Conclusions: San Francisco’s 2020 sugary drink warning label may be a promising policy for informing consumers and encouraging healthier beverage choices across diverse demographic groups.

Keywords

Sugary drinks; sugar-sweetened beverages; warnings; policy; randomized experiment

Introduction

Consumption of drinks with added sugar (“sugary drinks”) remains well above recommended levels among both children and adults in the US.¹⁻³ Sugary drink consumption is associated with obesity, tooth decay, type 2 diabetes, and heart disease.⁴⁻⁸ One promising policy for reducing sugary drink consumption in both children and adults is requiring health warning labels on sugary drink advertisements and product packaging. In 2015, San Francisco, California became the first US jurisdiction to adopt a sugary drink warning label policy when it passed an ordinance requiring warning labels on sugary drink advertisements displayed in the city.⁹ In 2020, the city revised the message to be displayed on the warning label in response to court challenges.¹⁰⁻¹² The 2020 warning message reads, “SAN FRANCISCO GOVERNMENT WARNING: Drinking beverages with added sugar(s) can cause weight gain, which increases the risk of obesity and type 2 diabetes.”⁹ This language differs from other proposed warning labels in the US¹²⁻¹⁷ in its causal language (using “can cause” and “increases the risk of” instead of “contributes to”), its inclusion of weight gain and exclusion of tooth decay as possible consequences of sugary drink consumption, and its two-part construction linking weight gain to other health outcomes. Prior research suggests that these differences could affect how consumers respond to the warning labels,^{18,19} but no research has empirically evaluated the 2020 San Francisco warning message.

Warning labels are considered ‘compelled’ commercial speech (i.e., the government is mandating that companies display the warning label) and can be challenged on First

Amendment grounds. Typically, courts will apply the Zauderer test to determine whether warning labels can be compelled.¹¹ Among other criteria, this test requires that warning labels must be “reasonably related” to government interests such as informing consumers or improving public health.²⁰ Studies of other warning labels proposed in the US have generally found that warning labels inform consumers about the risks of sugary drinks and discourage sugary drink consumption.²¹⁻³⁰ In anticipation of possible legal challenges and to inform potential sugary drink warning label legislation in other jurisdictions, more research is needed to understand whether the 2020 San Francisco warning label exerts similar effects.

Sugary drink consumption and its negative impacts are inequitably distributed by race/ethnicity, education, and income,^{1,31-36} and researchers and advocates therefore want to know whether the effects of sugary drink warning labels differ across key demographic groups.³⁷⁻⁴⁰ If warning labels have larger beneficial impacts for already-advantaged groups, warning label policies could exacerbate underlying health disparities. In contrast, one modeling study found that if warning labels are similarly effective across diverse populations, warning label policies could reduce sociodemographic disparities in obesity prevalence.²⁷ To date, however, no studies have evaluated the impact of the 2020 San Francisco warning label across different demographic groups.

To address these gaps and inform ongoing policy and legal debates about sugary drink warning labels, this study aimed to evaluate reactions to the revised 2020 San Francisco sugary drink warning label among US parents of young children, and to examine whether these reactions differed across key population groups relevant for warning labels’ impacts on health equity. Parents are a particularly important group to address in warning label research, as their diet-related behaviors influence both their own and their children’s health.⁴¹ Parents of young children (i.e., under age five) are an especially important population because dietary habits in early childhood are predictive of both diet and health outcomes later in childhood and into adolescence.⁴²⁻⁴⁵ This study focused on the extent to which the 2020 San Francisco warning label led consumers to think more about the harms of sugary drinks and discouraged them from wanting to consume sugary drinks because previous studies have found that changes in thinking about health effects^{46,47} and perceived message effectiveness⁴⁸⁻⁵⁵ are associated with actual behavior change. Thus, these measures have predictive value as to the 2020 San Francisco warning label’s potential to elicit behavior change.

Methods

Prior to data collection, we pre-registered study hypotheses and statistical analyses on [AsPredicted.org](https://aspredicted.org) (<https://aspredicted.org/blind.php?x=zq7qa4>). The only deviations from this plan were that (1) we conducted an unplanned moderation analysis examining whether the warning label’s effect differed by income, based on peer reviewer feedback, and (2) analyses excluded participants who completed the survey implausibly quickly (i.e., completion time <7.5 minutes [approximately half of the median completion time in the soft launch of the survey]; this exclusion did not affect the pattern of results).

Participants

This study used a national convenience sample of 2,164 adults recruited by Dynata, a survey technology company commonly used by researchers. Dynata provides access to pools of millions of participants the company has recruited through recruitment campaigns, direct emails, and online marketing channels. Prior research shows that online convenience samples yield highly generalizable findings for experiments like the one used in this study.⁵⁶ Participants in this experiment were recruited as part of a larger, multipart survey study that examined behavior and decision-making in response to experimental stimuli and real-world events. Participants were eligible for the survey if they were age 18 or older, lived in the US, and were a parent or caregiver (hereafter ‘parent’) to at least one child ages six months to five years. Because sugary drink consumption varies by race and ethnicity,¹ we established recruitment quotas to ensure that at least 25% of participants would identify as Hispanic or Latino(a) and at least 25% would identify as Black (not mutually exclusive).

Dynata recruited participants to complete the multipart survey by sending email invitations to individuals in their online panel. Email invitations contained only generic information about the survey’s length and incentive amount and a hyperlink to complete the survey; no information was provided about the topic or goals of the survey. Interested participants could complete the survey online by following the hyperlink.

The primary study in the multipart survey focused on parents’ reactions to health and school-readiness messages embedded in children’s storybooks. For that study, we established a target sample size of ~2,100 participants with complete data. Recruitment began on May 8, 2020 and continued until May 25, 2020, when the target sample size was achieved. The Harvard Longwood Campus Institutional Review Board approved this study Institutional Review Board approved this study (IRB Protocol #19-1790).

Procedures

The present experiment was embedded in a multipart survey study programmed in Qualtrics. In the survey, participants first provided informed consent and answered one screening question to determine whether they had a child in the target age range. Next, participants answered survey items that were conceptually unrelated to the present experiment, including an experiment about storybook messages, survey questions about reading to their children, and survey questions about their vaccination behaviors and intentions.⁵⁷ Participants then completed the experiment described in the present study. Finally, participants reported demographic characteristics. The median response time for the entire multipart survey was 14.4 minutes. Dynata provided participants who completed the survey with previously agreed upon incentives in the form of reward points redeemable for gift cards, charitable contributions, or partner products and services; Dynata determined the amount of each participant’s incentive based on the length of the survey and the participant’s characteristics (i.e., the mutually agreed upon incentives may have varied across participants). Participants could choose to take the survey in English or Spanish. A professional translation company translated survey items and experimental stimuli from English to Spanish.

Experiment

In the present experiment, participants were randomly assigned to view a control label or the San Francisco warning label. The control message read “Always read the Nutrition Facts Panel,” similar to a previous study²⁸ (Figure 1). The San Francisco warning message was identical to the message in San Francisco’s 2020 ordinance.¹⁰ Messages were shown in white text on black rectangular labels. Randomization was implemented using Qualtrics survey software using simple randomization in a 1:1 allocation ratio. Random assignment in the present experiment about warning labels was independent of assignment to experimental conditions in the prior experiment about storybook messages, and there were no interactions between participants’ group assignment in the two experiments for the primary or secondary outcomes (p -values for interactions > 0.45).

Measures

Participants rated their randomly assigned label using measures adapted from previous studies. The primary outcome was thinking about the health harms of sugary drink consumption, assessed with a single item adapted from previous studies,^{28,58,59} “How much does this label make you think about the health problems caused by sugary drinks?” The secondary outcome was perceived message effectiveness, also assessed with a single item adapted from previous studies,^{28,60} “How much does this label discourage you from wanting to drink sugary drinks?” Both measures used a 5-point response scale, ranging from 1 (Not at all) to 5 (A great deal). We selected these outcomes because they are sensitive to differences in message design and predictive of actual behavior change.^{46-48,50,51} Moreover, a stated goal of most sugary drink warning label policies proposed in the US is to promote consumer understanding of sugary drinks’ health harms.^{10,13-17} Warning labels that increase thinking about health harms could help inform consumers by keeping these harms at top of mind as they make purchase decisions.⁶¹

The survey also assessed standard demographic characteristics (e.g., age, gender, race/ethnicity). Survey measures appear in Table 1 (online only).

Statistical Analysis

The analytic sample included 2,160 participants who completed the survey, had data on the primary outcome, and passed a quality control check to exclude those with improbably fast completion times (Figure 2 [online only]).

We predicted that the San Francisco warning label would elicit more thinking about health harms and higher perceived message effectiveness than the control message. Analyses used ordinary least squares linear regression models to test these predictions. Models regressed the outcome on an indicator variable for message arm (San Francisco warning label vs. control). To allow for comparison of effects across outcomes, we report treatment effects both as unstandardized regression coefficients (Bs) and as standardized mean differences (Cohen’s d s). Cohen’s d s of 0.20, 0.50, and 0.80 are considered small, medium, and large, respectively.⁶²

Analyses also examined whether six participant characteristics (age, gender, race/ethnicity, educational attainment, income, and language of survey administration) moderated the relationship between message arm and the primary outcome by adding an interaction term between the moderator and message arm to the linear regression model described above. We focused on these characteristics because they are predictive of sugary drink consumption^{1,35,36} and are relevant for understanding warning labels' potential to affect sociodemographic disparities in diet-related diseases.^{31-34,63} Analyses estimated separate models for each moderator and calculated marginal effects (i.e., treatment effects) at each level of the moderator.

Analyses used a critical alpha of 0.05 and two-tailed tests. Analyses were conducted in Stata MP version 16 (StataCorp, LLC, College Station, TX) in 2021.

Results

A total of 2,160 participants were included in primary analyses (1,088 in the control arm and 1,072 in the warning label arm). Participants' average age was 30.2 years (SD 9.3). The sample was diverse in terms of race/ethnicity, income, and other characteristics. Nearly half (49%) identified as Hispanic/Latino(a), 34% identified as non-Hispanic Black or African American, 9% identified as non-Hispanic White, and 7% identified as non-Hispanic multiracial or another race (Table 2). Half of participants reported a household income of less than \$50,000 per year, and 43% reported participating in the Supplemental Nutrition Assistance Program (SNAP) in the past 12 months. Most (89%) participants completed the survey in English. Compared to both the general San Francisco population and the US adult population, participants in the study sample were younger, more likely to be female, and more likely to identify as Hispanic/Latino(a), among other differences (Table 3 [online only]). Participant characteristics did not differ by treatment arm (all p s>0.28).

Among participants exposed to the control label, mean thinking about the health harms of sugary drinks was 3.45 (SE=0.04) (Figure 3). Among participants exposed to the San Francisco warning label, mean thinking about the health harms of sugary drinks was 3.77 (SE=0.04). Exposure to the warning labels elicited significantly more thinking about health harms than the control message (B=0.31, p <0.001). This difference was small in magnitude (d =0.24, 95% CI: 0.16, 0.33). Similarly, the San Francisco warning label was also perceived to be more effective than the control label (B=0.40, p <0.001). This effect was also relatively small in size (d =0.31, 95% CI: 0.22, 0.39).

In moderation analyses, the effect of the San Francisco warning label on thinking about health harms did not differ by any of the six participant characteristics examined (i.e., age, gender, race/ethnicity, education, income, or survey language; p >0.12 for all interactions; Table 4 [online only]).

Discussion

Sugary drink warning labels are an increasingly popular policy tool for informing consumers and encouraging healthier beverage choices. Our study, the first to examine the warning message in San Francisco's 2020 ordinance, found that this warning label elicited more

thinking about harms than a control message. The 2020 San Francisco warning label was also perceived to be more effective at discouraging sugary drink consumption than the control label. Prior studies of sugary drink and tobacco warning labels have demonstrated that both thinking about health harms^{46,47} and perceived message effectiveness^{48,50,51} are predictive of actual behavior change. Our results thus provide important early evidence that the 2020 San Francisco warning label holds promise for encouraging healthier beverage choices. Our study also suggests that the San Francisco warning label could increase informed choice by helping consumers keep sugary drinks' health harms at top of mind when making purchase decisions.⁶¹ These findings speak directly to evaluations of the ordinance in potential First Amendment challenges, as the results suggest that the San Francisco warning label would advance government interests of informing consumers and helping them make healthier choices.

The impact of the 2020 San Francisco warning label on thinking about health harms was statistically significant but relatively small ($d=0.24$), smaller than the effect found in a meta-analysis of experimental studies ($d=0.65$),²¹ but similar to the effect observed in an experiment with Australian young adults ($d=0.21$ for text-only warnings vs. control).²⁴ The 2020 San Francisco warning label's effect on perceived message effectiveness was also relatively small ($d=0.31$), in line with the average effect of a nutrient warning (i.e., "WARNING: High in added sugar," $d=0.27$) in an experiment with US adults, but smaller than the average effect of a health warning in that study ($d=0.53$).²⁸ The differences in effect sizes observed across studies could be explained by differences in experimental design, amount of exposure to the warning, measurement, study setting, or label characteristics. Although the San Francisco warning label exerted small effects in this study, small effects can yield large health benefits when policies are implemented at the population level.^{27,64} Moreover, prior research suggests that even modest changes in thinking about harms and perceived message effectiveness may be accompanied by meaningful changes in behavioral intentions and actual behavior.^{24,47,65} For example, Billich and colleagues found that text and graphic sugary drink warning labels had small effects on thinking about harms ($d_s=0.21$ and 0.25 for text and graphic warnings, respectively) and larger effects on participants' likelihood of choosing a sugary drink in a choice task ($d_s=-0.38$ and -0.84 , respectively).²⁴

The impact of the San Francisco warning label did not differ across demographic groups, including for adults younger versus older than age 35, adults with different gender identities, adults with lower versus higher educational attainment and income, adults with different racial/ethnic identities, and English versus Spanish speakers. These results suggest that the San Francisco warning label is unlikely to exacerbate disparities in sugary drink consumption by these demographic characteristics, consistent with prior studies that have found limited differences in sugary drink^{22,23,28,66-68} and tobacco^{69,70} warning labels' impacts across demographic groups. Further, one simulation modeling study found that if warning labels exert similar impacts across demographic groups, warning label policies could reduce sociodemographic disparities in obesity prevalence.²⁷

The 2020 San Francisco warning label ordinance requires that warning labels appear in the same language as the sugary drink advertisement on which they are displayed.¹⁰ To our knowledge, ours is the first US study to examine reactions to warning labels that have

been translated to a language other than English. Results of our study did not indicate differences in consumers' responses to warning labels by language; however, care should be taken to ensure that warning labels benefit consumers regardless of their preferred language. Emerging evidence indicates that adding icons or pictures to warnings written in English enhances their efficacy, particularly among adults with low English proficiency.⁷¹ Future studies should examine whether icons and pictures similarly boost the effectiveness of warnings written in other languages, particularly for non-English speakers.

Strengths of this study include the large, diverse sample of US adults, experimental design, assessment of outcomes predictive of behavior change, and examination of warning labels' effects across demographic groups. One limitation of this study was the use of a convenience sample that differed in several sociodemographic characteristics compared to the San Francisco, CA population and to US adults overall. In particular, this study oversampled Hispanic/Latino(a) and non-Hispanic Black adults to enable examination of the warnings' impacts by race/ethnicity and to ensure adequate numbers of people of color, who are often underrepresented in research studies.⁷² Prior studies indicate that online convenience samples provide similar experimental results as probability samples,^{56,73,74} and this study did not find differences in warnings' impacts by race/ethnicity, suggesting that this study's results may generalize to other populations. Still, additional studies in other populations (e.g., adolescents, adults who are not parents, individuals with high sugary drink consumption) are warranted. Another limitation is that this study focused on parents' discouragement from consuming sugary drinks. Future studies will be needed to determine whether the 2020 San Francisco warning label also discourages parents from serving sugary drinks to their children, as has been documented for the 2015 version of the San Francisco warning message.²² Additionally, outcomes were self-reported, so we cannot rule that results were driven by demand characteristics, including social desirability. To reduce this possibility, recruitment materials and survey questions did not reveal the study's purpose and participants provided information anonymously via an online survey.^{75,76} Moreover, other online experiments have found no influence of other types of prominent nutrition labels (e.g., calorie labels,²²⁻²⁴ traffic light labels,⁷⁷ health star rating labels⁷⁸), suggesting that demand characteristics and social desirability do not always exert strong pressure on participants to respond in a certain way in these settings. Finally, while thinking about harms and perceived message effectiveness are predictive of behavior change, we did not assess behavioral outcome. Additional research is needed to evaluate the 2020 San Francisco warning label's impact on parents' actual sugary drink purchases, both for their personal consumption and to serve to their children.

Conclusions

This randomized experiment with a large sample of US parents suggests that the warning message in San Francisco's 2020 ordinance holds promise for informing consumers and discouraging sugary drink consumption across diverse segments of the population. Future studies will clarify impacts in real-world settings.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Research Snapshot

Research Questions:

Does the revised 2020 San Francisco sugary drink warning label inform consumers about the health harms of sugary drinks and discourage sugary drink consumption? Do consumers' reactions to the warning label differ across population groups relevant for warnings' impacts on health equity?

Key Findings:

In a randomized experiment, the revised 2020 San Francisco sugary drink warning label led consumers to think more about the harms of sugary drinks compared to the control message ($p<0.001$). The warning label also elicited higher perceived effectiveness for discouraging sugary drink consumption ($p<0.001$). Warning label impacts did not differ by age, gender, race/ethnicity, education, income, or language preference.



Figure 1.
Control label and San Francisco warning label used in the online randomized experiment

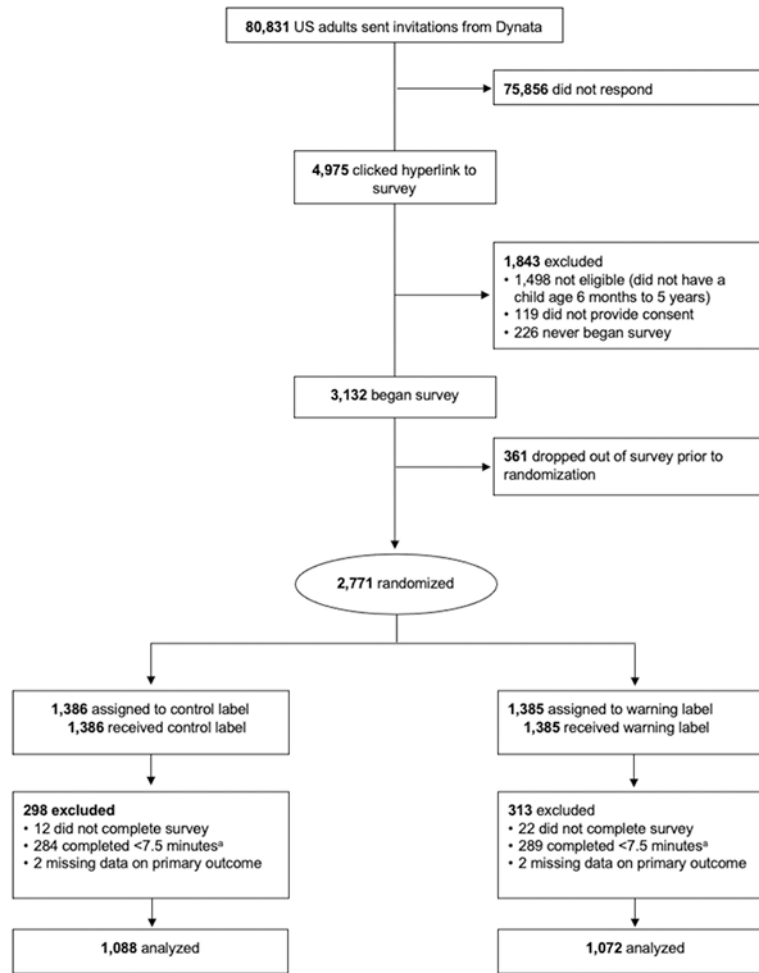


Figure 2. CONSORT flow diagram for an online randomized experiment evaluating the 2020 San Francisco sugary drink warning label

^aLess than half of median response time in a soft launch of the survey.

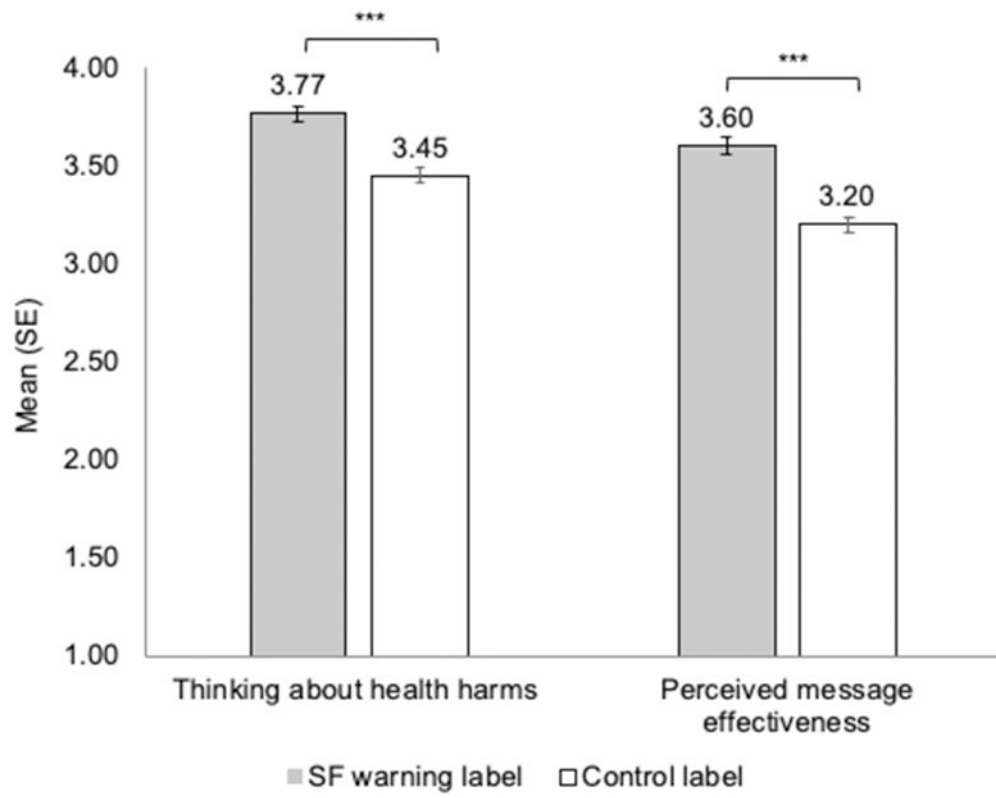


Figure 3. Impact of San Francisco warning on thinking about health harms and perceived message effectiveness in an online randomized experiment of US adults
*** $p < 0.001$

Table 1.

Survey items used in online randomized experiment evaluating the impact of the 2020 San Francisco sugary drink warning label

Construct	Item	Response scale	Source
San Francisco Warning Label Experiment			
Prompt 1	The city of San Francisco and five U.S. states have proposed requiring warning labels on sugary drinks like sodas, fruit drinks, sports drinks, sweetened teas and coffees, and energy drinks. On the next page, you will look at a label for sugary drinks and answer questions about the label.		
Prompt 2	Please read the label closely. Then answer the questions below.		
Stimuli	[Randomly assign participants to 1 or 2 conditions 1 = Control condition showing a rectangle reading "Always read the Nutrition Facts Panel" 2 = Warning condition showing a rectangle reading, "SAN FRANCISCO GOVERNMENT WARNING: Drinking beverages with added sugar(s) can cause weight gain, which increases the risk of obesity and diabetes."].		
Thinking about the health harms of sugary drinks *	How much does this label make you think about the health problems caused by sugary drinks?	1 = Not at all 2 = Very little 3 = Somewhat 4 = Quite a bit 5 = A great deal	Adapted from prior studies ^{58,59,66}
Perceived message effectiveness **	How much does this label discourage you from wanting to drink sugary drinks?	1 = Not at all 2 = Very little 3 = Somewhat 4 = Quite a bit 5 = A great deal	Adapted from prior studies ^{60,66}
Demographics & Health Behaviors			
Prompt	The next questions are about you and your household.		
Annual household income	Which of the following categories best describes your total household income in the last 12 months? It's fine to make your best guess.	1= Less than \$10,000 2= \$10,000 to \$14,999 3= \$15,000 to \$24,999 4= \$25,000 to \$34,999 5= \$35,000 to \$49,999 6= \$50,000 to \$74,999 7= \$75,000 to \$99,999 8= \$100,000 to \$149,999 9= \$150,000 to \$199,999 10= \$200,000 or more	Population Assessment of Tobacco and Health Study ⁷⁹
Number of household members who depends on this income (household size)	How many people depend on this income, including you?	# of people [restricted to 1-20]	USDHHS 2016
Number of children	How many children under the age of 18 live in your household?	# of children [restricted to 0-20]	NA
SNAP participation	In the last 12 months, did you or any member or your household receive Supplemental Nutrition Assistance Program (SNAP) benefits? These benefits are sometimes also called Food Stamps.	0=No 1=Yes	National Health and Nutrition Examination Survey ⁸⁰
WIC participation	In the last 12 months, did you or any member or your household receive benefits from the Women, Infants, and Children (WIC) program?	0=No 1=Yes	National Health and Nutrition Examination Survey ⁸⁰

Construct	Item	Response scale	Source
Education	What is the highest level of school you have completed?	1=Less than high school or U.S. high school equivalent (GED) 2=High school diploma or U.S. high school equivalent (GED) 3=Some college 4=2-year college degree 5=4-year college degree 6=Master's degree, graduate degree, or more	
Race of participant	What is your race? Please check all that apply.	[Select all that apply] 1=White 2=Black or African American 3=American Indian or Alaska Native 4=Asian 5=Pacific Islander 6=Another race: _____	
Hispanic ethnicity of participant	Are you of Hispanic, Latino, or Spanish origin?	0 = No 1= Yes	2010 Census
Age of parent/ caregiver	What is your age?	_____	
Parent/caregiver gender	What is your gender?	1=Man 2=Woman 3=Transgender 4=Nonbinary 5=Another option not listed: [Text box]	

Note. Only questions relevant to the present study are shown.

* Primary Outcome

** Secondary Outcome

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Table 2.

Participant characteristics, $n=2,160$ parents of children ages 6 months to 5 years participating in an online randomized experiment evaluating the 2020 San Francisco sugary drink warning label

Characteristic	N	%
Age		
18-24 years	610	29%
25-34 years	922	44%
35-44 years	463	22%
45-54 years	70	3%
55 years or older	44	2%
Gender		
Male	599	28%
Female	1,489	69%
Transgender, nonbinary, or another gender identity	68	3%
Educational attainment		
Less than high school	123	6%
High school diploma or GED	434	20%
Some college	411	19%
College degree or more	1,187	55%
Race/ethnicity		
Non-Hispanic White	199	9%
Non-Hispanic Black or African American	736	34%
Hispanic or Latino(a)	1,064	49%
Non-Hispanic other race or multiracial	154	7%
Language selected for survey administration		
English	1,929	89%
Spanish	231	11%
Household size		
1	198	9%
2	434	20%
3	570	26%
4 or more	958	44%
Annual household income		
Less than \$25,000	558	26%
\$25,000-\$49,999	525	24%
\$50,000-\$74,999	356	17%
\$75,000-\$99,999	283	13%
\$100,000 or more	434	20%
Participation in Supplemental Nutrition Assistance Program (SNAP) in past 12 months	923	43%
Participation in Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in past 12 months	826	38%

Note. Characteristics are reported for the primary analytic sample and exclude $n=4$ participants with missing data on the primary outcome. Missing data on demographic characteristics ranged from 0.0% to 2.4%. Participant characteristics did not differ by message condition.

Table 3.

Comparison of characteristics of the study sample ($n=2,160$ US parents of children ages 6 months to 5 years participating in an online randomized experiment evaluating the 2020 San Francisco sugary drink warning label) to San Francisco, CA and national estimates

Characteristic	Study Sample	San Francisco, CA Estimate ^a	National Estimate ^b
	%	%	%
Age ^c			
Under 18 years	-	13%	-
18-24 years	29%	7%	12%
25-34 years	44%	23%	18%
35-44 years	22%	16%	16%
45-54 years	3%	13%	16%
55 years or older	2%	27%	38%
Gender ^d			
Male	28%	51%	49%
Female	69%	49%	51%
Transgender, nonbinary, or another gender identity	3%	-	-
Educational attainment ^e			
Less than high school	6%	12%	11%
High school diploma or GED	20%	12%	28%
Some college	19%	17%	22%
College degree or more	55%	59%	39%
Race (any ethnicity)			
White	32%	45%	74%
Black or African American	44%	6%	12%
American Indian or Alaska Native	4%	0.4%	1%
Asian or Pacific Islander	3%	35%	6%
Other or Multiracial	16%	14%	7%
Hispanic or Latino(a) ethnicity (any race)	49%	15%	16%
Language selected for survey administration or spoken at home ^f			
English	89%	58%	67%
Spanish	11%	10%	21%
Household size ^g			
1	9%	-	0%
2	20%	-	5%
3	26%	-	26%
4 or more	44%	-	69%
Annual household income			
Less than \$25,000	26%	14%	14%
\$25,000-\$49,999	24%	10%	19%

Characteristic	Study Sample	San Francisco, CA Estimate ^a	National Estimate ^b
	%	%	%
\$50,000-\$74,999	17%	10%	17%
\$75,000-\$99,999	13%	8%	14%
\$100,000 or more	20%	58%	37%
Participation in Supplemental Nutrition Assistance Program (SNAP) in past 12 months ^h	43%	-	21%
Participation in Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in past 12 months ⁱ	38%	-	-

^aSan Francisco, CA estimates are from the 2019 American Community Survey (ACS) 1-year estimates for San Francisco County, as reported in Social Explorer.⁸¹

^bNational estimates are survey-weighted prevalence estimates from the 2019 ACS Public Use Microdata (ACS PUMS).⁸² To maximize comparability to the study sample, we derived national estimates of individual characteristics (e.g., age, gender) among adults ages 18-99 participating in the ACS, and derived national estimates for household characteristics (e.g., household size, income) for households with at least one child under the age of 6 participating in the ACS.

^cThe study sample and the national estimates included adults ages 18 or older only, so no estimates are reported for the proportion under age 18.

^dThe ACS reports sex in two categories (male, female), so no estimates are reported for the proportion of individuals who identify as transgender or another gender for San Francisco or the US.

^eSan Francisco estimates are for individuals age 25 and older.

^fSan Francisco estimates show the proportion of individuals age 5 and older who speak English only at home and the proportion who speak Spanish at home (regardless of English proficiency). National estimates show the proportion of households reporting English and Spanish as their primary household language. Proportions for San Francisco and national estimates do not sum to 100% because we do not report the proportion who use languages other than English and Spanish at home.

^gThe proportion of households with only one member is 0% in the national data because we examined only households with at least one child (and thus all households had a least 2 members); in contrast, we did not require that participants in the study sample be living with their young children, so some participants in the study sample had a household size of one. County-level information on proportion of households with 1, 2, 3, and 4 or more members was not available, so no estimates are reported for San Francisco.

^hCounty-level information on SNAP participation was not available, so no estimates are reported for San Francisco.

ⁱThe ACS does not include data on WIC participation, so no estimates are reported for San Francisco or the US.

Table 4.

Interaction of message arm and participant characteristics on thinking about harms in an online randomized experiment of the 2020 San Francisco sugary drink warning label, $n=2,160$ parents of children ages 6 months to 5 years

Participant Characteristics	Impact of San Francisco warning ^a		<i>p</i> for interaction ^b
	B	(95% CI)	
Age			
18-34 years	0.29	(0.16, 0.42)	0.60
35 years or older	0.35	(0.1, 0.56)	
Gender			
Male	0.21	(0.003, 0.41)	0.44
Female	0.37	(0.2, 0.50)	
Transgender, nonbinary, or another gender identity	0.24	(-0.3, 0.86)	
Race/ethnicity			
Non-Hispanic White	0.37	(0.0, 0.73)	0.54
Non-Hispanic Black or African American	0.26	(0.0, 0.44)	
Hispanic or Latino(a)	0.37	(0.2, 0.52)	
Non-Hispanic other or multiracial	0.07	(-0.3, 0.48)	
Educational attainment			
Some college or less	0.27	(0.11, 0.43)	0.44
Two-year college degree or more	0.36	(0.2, 0.51)	
Household income			
Less than \$50,000/year	0.27	(0.1, 0.43)	0.53
\$50,000/year or more	0.34	(0.1, 0.50)	
Language selected for survey administration			
Spanish	0.06	(-0.27, 0.40)	0.12
English	0.34	(0.2, 0.46)	

^aDifference in predicted mean level of thinking about health harms between San Francisco warning label and control arms at each level of the moderator

^b*p* for interaction is for Wald tests of joint significance of the coefficients on all interaction terms