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RESEARCH ARTICLE

Health Warning Labels Correct Parents' Misperceptions About Sugary Drink Options

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Introduction: Noncarbonated sugar-sweetened beverages, such as fruit drinks, sports drinks, and sweetened teas are increasingly promoted to and consumed by youth. These beverages may be perceived as healthier options than soda. To educate consumers about beverages high in added sugar, several cities and states have proposed policies mandating health warning labels on sugar-sweetened beverages.

Methods: In 2015, a total of 2,381 parents were randomized to a no label, calorie label, or warning label condition. An online survey asked about the healthfulness of different beverages, and asked parents to select a beverage for their child in a choice task. Regressions compared the warning and calorie label groups to the control group and measured mediating effects of health beliefs on beverage choice. Data were analyzed in 2016.

Results: Parents viewed fruit drinks, sports drinks, and sweetened teas as healthier and less likely to cause disease than soda. Compared with no label, warning labels significantly increased parents' risk perceptions for all beverages except soda. Warning labels significantly reduced the odds of selecting fruit drinks for the child (OR=0.42, 95% CI=0.32, 0.56), and this effect was mediated by changes in health beliefs and risk perceptions.

Conclusions: Fruit drinks, sports drinks, and sweetened teas are increasingly promoted to youth. Parents believe these beverages are healthier and less likely to cause disease than soda, and warning labels may correct these misperceptions.

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INTRODUCTION

Sugar-sweetened beverages (SSBs) are consumed by the vast majority of youth. On any given day, two thirds of children consume SSBs, which account for approximately 7% of daily energy intake.[1] Research has linked SSB consumption to increased risk of dental caries, cardiometabolic risk factors, early menarche, weight gain, and obesity in children and adolescents.[2–8] Although there have been recent declines in youth consumption of soda, intake of other SSBs is rising.[1,9] Between 2003–2004 and 2013–2014, the proportion of youth consuming sports drinks daily increased from 7.2% to 8.5% among children and 8.9% among adolescents.[9] Heavy consumption (500 kcal or more/day) of energy and sports drinks tripled among adolescents between 1999 and 2008, during which time fruit drinks surpassed soda as the most heavily consumed SSB among youth.[10]

One reason soda intake is declining, whereas consumption of other sugary drinks has plateaued or increased, may be because parents view certain sugary beverages as healthier options than soda.[11–13] Parents influence what children drink,[14] and although parents may know soda is not healthy, they may not realize that

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other beverages often have as much sugar. To better educate parents about beverages high in added sugar, several localities have proposed policies mandating health warning labels on SSB packages or advertisements. In 2014, California was the first state to introduce such a bill,[15] and Washington, Hawaii, New York, and the city of Baltimore have introduced similar bills. In 2015, San Francisco passed a law requiring that outdoor SSB advertisements carry a health warning label; however, this decision was overturned by a federal appeals court.[16–18]

Prior studies have found that SSB warning labels reduced parents' and adolescents' intent to purchase sugary drinks and increased perceptions that such beverages were unhealthy.[19–21] However, it is not clear whether warning labels change perceptions and intentions for all products, or only some. Expectancy disconfirmation theory is a psychological theory positing that behavior is influenced by the degree to which a product or message deviates from initial expectations.[22] This theory could be applied to food and beverage choices in various ways. For example, people are more likely to change their attitudes towards marijuana when anti-marijuana messages come from an unexpected communicator; the same behavioral tendency may be true for sugary drinks.[23] In studies of consumer behavior, satisfaction is higher and people are more likely to repurchase a product when the person's expectations about the product are exceeded compared with when expectations are met.[24,25] By contrast, greater differences between expected and experienced acceptability of a product reduce satisfaction and future purchase intentions.[26] Based on this theory, SSB warning labels would be most influential when placed on products for which consumers hold false beliefs. If that is true, warning labels would have little effect on decision making when on a bottle of Coca-Cola, which most consumers code as less healthy, but would influence decision making when on a bottle of Powerade, which many people view as healthy. This paper has two goals: (1) to describe and compare parents' perceptions about the healthful qualities and risks of different categories of sugary drinks when no warning label is present, and (2) to test whether expectancy disconfirmation theory can help explain how warning labels influence parents' beverage perceptions and hypothetical choices for their children. The specific research questions are: (1) Do parents believe certain SSBs—particularly sports drinks, fruit drinks, and sweetened tea—are healthier or less disease-promoting options for their children than soda? (2) Are SSB health warning labels more likely to influence beliefs and purchase intentions of sweetened beverages mistakenly viewed more positively than soda? (3) For sugary beverages viewed more positively than soda, is the effect of health warning labels on beverage choice mediated by changes in health beliefs and risk perceptions?

This research can help policymakers better predict how warning labels might influence decision making, with implications for modeling the impact and cost effectiveness of such policies.

METHODS

Study Sample

This paper is a secondary analysis of data analyzed in a prior publication. The participant recruitment strategy and methods have been described in detail elsewhere,[19] but are summarized here. In 2015, primary caregivers of a child aged 6–11 years were recruited through Survey Sampling International using a three-stage randomization process (N=3,136). Participants were sampled to reflect the educational make-up of the U.S., based on the 2010 Census. Hispanic and black caregivers were oversampled based on higher average consumption of SSBs and greater risk for obesity among children in these racial/ethnic groups.[27] Participants were asked to complete a survey, and those who did not finish the survey (n=644) or did not answer data integrity questions correctly (n=111) were excluded. This analysis, conducted in 2016, is based on 2,381 adult caregivers (Appendix Figure 1, available online).

Surveys were administered electronically, and adult caregivers who consented to participate were randomly assigned to one of six labeling conditions: a control condition (control), in which participants did not see any labels; a calorie label condition (calorie label), in which participants saw a calorie per bottle label identical to the American Beverage Association's Clear on Calories label displayed on the front of all beverages[28]; and one of four health warning label conditions (warning label), which were displayed on qualifying SSBs. The initial study was designed to compare the degree to which these theoretically informed warning label messages influenced consumers (Appendix Figure 2, available online).[15,19] The Harvard T.H. Chan School of Public Health IRB approved the study protocol.

Measures

Participants were shown images of 20 popular, 20-ounce SSBs and non-SSBs in random order and were instructed to select one beverage they would choose for their child (Appendix Table 1, available online).

For a subset of 14 SSBs and non-SSBs from the vending machine choice task, participants were asked a series of questions regarding their purchase intentions, health beliefs, risk perceptions, and nutrition knowledge. The disease-risk questions were based on other published studies in marketing.[29–31] Participants were shown images of each beverage and asked, on a scale from 1 (not at all) to 7 (extremely): (1) *How likely are you to…* (i) *buy this product for your child in the next 4 weeks?* or (ii) *allow your child to drink this product in the next 4 weeks?* (2) *How healthy do you think this product is for your child?*

Participants were also asked how strongly they agreed or disagreed with the following statements, on a scale from 1 (strongly disagree) to 7 (strongly agree): (1) *Drinking this product often would…* (i) *make my child feel energized* or (ii) *help my child*

focus at school. (2) *Drinking this product often would…*[32] (i) *lead to weight gain* or (ii) *increase my child's risk of heart disease* or (iii) *increase my child's risk of diabetes* or (iv) *help my child live a healthier life*.

Participants estimated how many calories were in each beverage, and rated the amount of added sugar on a scale from 1 (none) to 4 (a lot). All questions were pilot tested in a separate sample of adults, who were recruited from Amazon Mechanical Turk and not included in the analysis.

Table 1 displays the demographic and health variables collected. To control for past beverage purchases, participants reported how often they had purchased each beverage included in the survey for their child over the last month (zero, one, two to six, seven to 11, 12–16, 17–21, 22–26, 27–31, or >31 times). Responses were averaged across SSBs and non-SSBs to create two variables.

Statistical Analysis

Beverages were grouped into four SSB and four non-SSB subcategories based on groupings used in previous national surveys.[10,14] SSB subcategories included soda, sports drinks, fruit drinks, and sweetened tea. Non-SSB subcategories included unflavored water and seltzer, 100% fruit juice, diet soda, and other low-calorie beverages. Minute Maid Lemonade was unintentionally omitted from the fruit drink category for the "help child focus" question, and was missing option "6" for the health belief questions in the control condition; thus, this beverage was excluded for all the Likert scale questions, but was an option in the vending choice task.

First, means and frequencies for responses to survey questions among control group participants (n=404) were calculated. Binomial tests compared the proportion of parents selecting an SSB for their child to the proportion selecting another beverage, and compared the proportion selecting soda compared with other beverages. T-tests compared mean responses to survey questions between soda and other beverages. Soda was chosen as the comparison group because it was expected that parents would have the strongest negative perceptions of this beverage. If this prediction is correct, the warning labels should be least effective for soda, but would influence beliefs and choices for other beverages viewed as more healthful and less likely to cause disease.

Next, differences across labeling conditions were assessed using multiple linear regressions for continuous outcomes and logistic regressions for dichotomous outcomes. The primary independent variable was the labeling condition (control, calorie label, or warning label), and dependent variables were responses to the vending machine choice task, as well as purchase intentions, health beliefs, risk perceptions, and nutrition knowledge questions (calorie estimates were entered into the regression as log-transformed values). Regressions controlled for frequency of purchasing SSBs and non-SSBs in the past month.

To assess whether changes in health beliefs and risk perceptions mediate the effect of health warning labels on beverage choice, a health beliefs and risk perceptions index ranging from 7 to 49 was created by summing responses to the "help child focus," "make child feel energized," healthfulness, and risk perceptions questions for each SSB subcategory. Responses to questions about diabetes, weight gain, and heart disease were reverse coded, so higher scores on the index indicate stronger positive perceptions of the product. A decomposition regression model developed by Karlson et al.[33] for binary non-linear probability models was used to measure the indirect (i.e., mediating) effect of health beliefs and risk perceptions on the association between label condition and beverage choice. This method compares coefficients across linear and non-linear models that are unaffected by the scale parameter, while controlling for confounding variables.[33] To account for multiple testing, significance was measured at $p<0.001$. Analyses used Stata, version 13.1.

RESULTS

Parents in the control arm were significantly more likely to report allowing their child to drink fruit drinks, sports drinks, sweetened teas, water, 100% juice, and other low-calorie drinks, but significantly less likely to allow their child to drink diet soda than regular soda (Figure 1). Parents rated all beverages except diet soda as healthier than regular soda, and were more likely to think regular soda consumption would increase their child's risk of diabetes. These responses were reflective of parents' general attitudes towards fruit drinks, sports drinks, and sweetened teas, which were estimated to have fewer calories and less added sugar than soda. Parents also believed regular consumption of these beverages was less likely to lead to heart disease (Appendix Table 2, available online) and would be better able to help their child focus compared with soda. Parents rated fruit drinks and iced tea as less likely to lead to weight gain, and sports drinks as more likely to lead to weight gain, than soda. Parents rated sports drinks as more likely to make the child feel energized than soda, but there were no differences between soda and other beverages for this question. Regular soda was the second most frequently chosen beverage in the vending machine choice task (19.6%), after fruit drinks (22.8%).

Compared with no label, neither health warning labels nor calorie labels influenced parents' choices, health beliefs, or risk perceptions about regular soda. Warning labels, however, significantly reduced the number of parents choosing fruit drinks in the vending machine task and reduced purchase intentions for these beverages. Warning labels also increased knowledge of added sugars, increased risk perceptions, and decreased health beliefs for fruit drinks (Table 2). Warning labels increased risk perceptions of heart disease and diabetes and increased knowledge of added sugars for sports drinks and sweetened tea. Warning labels also reduced parents' likelihood of allowing their child to drink sweetened tea and led to increased risk perceptions of weight gain and reduced beliefs about the tea's likelihood of helping their child live a happy life and focus. By contrast, calorie labels only improved one of the 12 outcomes for regular soda and sports drinks (improved

Table 1. Characteristics of Parents Recruited for an Online Survey in 2015, by Label Condition

Variable	Control	Calorie label	Warning label
n	404	411	1,566
Women, n (%)	287 (71.0)	297 (72.3)	1,092 (69.7)
Age, years, M (SE)	36.2 (0.45)	36.3 (0.42)	36.2 (0.22)
BMI, M (SE)	27.2 (0.41)	26.8 (0.43)	27.2 (0.21)
Number of children, M (SD)	2.3 (0.06)	2.4 (0.06)	2.4 (0.03)
Hispanic, n (%)	124 (30.7)	118 (28.7)	497 (31.7)
Race, n (%)			
White	268 (66.3)	280 (68.1)	1,059 (67.6)
African American	125 (30.9)	115 (28.0)	431 (27.5)
Asian	2 (0.5)	4 (1.0)	18 (1.2)
Native American	11 (2.7)	4 (1.0)	25 (1.6)
Hawaiian	1 (0.3)	1 (0.2)	2 (0.1)
Other	18 (4.5)	20 (4.9)	75 (4.8)
Education, n (%)			
Less than high school	19 (4.7)	17 (4.1)	76 (4.9)
High school degree	134 (33.2)	124 (30.2)	502 (32.1)
Associate's degree	32 (7.9)	40 (9.7)	144 (9.2)
Some college	85 (21.0)	100 (24.3)	398 (25.4)
College degree	81 (20.1)	91 (22.1)	287 (18.3)
At least some graduate school	53 (13.1)	39 (9.5)	159 (10.2)
Household income, n (%)			
≤$25,000	68 (16.8)	76 (18.5)	269 (17.2)
$25,001–$50,000	115 (28.5)	121 (29.4)	482 (30.8)
$50,001–$75,000	98 (24.3)	96 (23.4)	361 (23.1)
$75,001–$100,000	63 (15.6)	59 (14.4)	227 (14.5)
$100,001–$125,000	26 (6.4)	28 (6.8)	93 (5.9)
$125,001–$150,000	18 (4.5)	17 (4.1)	74 (4.7)
>$150,000	16 (4.0)	14 (3.4)	60 (3.8)
Marital status, n (%)			
Never married	59 (14.6)	67 (16.3)	234 (14.9)
Married	268 (66.3)	262 (63.8)	1,044 (66.7)
Living with significant other	43 (10.6)	40 (9.7)	153 (9.8)
Separated	10 (2.5)	11 (2.7)	39 (2.5)
Divorced/widowed	24 (5.9)	31 (7.5)	96 (6.1)
Political party, n (%)			
Republican	87 (21.5)	75 (18.3)	348 (22.2)
Democrat	181 (44.8)	201 (48.9)	659 (42.1)
Independent	136 (33.7)	135 (32.9)	559 (35.7)
Relationship with weight, n (%)			
Trying to lose weight	186 (46.0)	205 (49.9)	759 (48.5)
Trying to maintain weight	129 (31.9)	123 (29.9)	492 (31.4)
Trying to gain weight	16 (4.0)	23 (5.6)	73 (4.7)
Not trying to gain or lose weight	73 (18.1)	60 (14.6)	242 (15.5)
Has a doctor ever said your child is overweight? n (%)			
No	326 (80.7)	324 (78.8)	1,268 (81.0)
Currently	69 (17.1)	82 (20.0)	247 (15.8)
Not currently, but in the past	9 (2.2)	5 (1.2)	51 (3.3)
Has a doctor ever said your child has type 2 diabetes? n (%)			
No	377 (93.3)	388 (94.4)	1,467 (93.7)
Currently	25 (6.2)	20 (4.9)	73 (4.7)
Not currently, but in the past	2 (0.5)	3 (0.7)	26 (1.7)

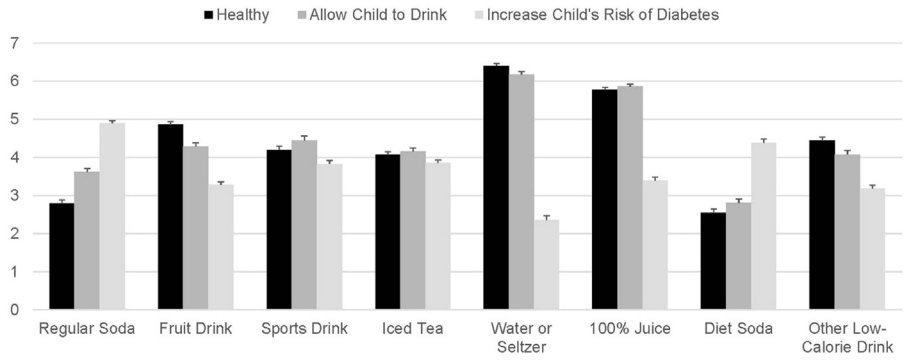

Figure 1. Beverage health beliefs, purchase intentions, and risk perceptions.
Note: Figure reflects responses to the questions: (1) *How healthy do you think this product is for your child?* and (2) *How likely are you to allow your child to drink this product in the next 4 weeks?* rated on a scale from 1 (not at all) to 7 (extremely) and agreement with the statement: *Drinking this product often would increase my child's risk of diabetes* rated on a scale from 1 (strongly disagree) to 7 (strongly agree) for beverage sub-categories in a demographically and educationally diverse sample of parents assigned to the control condition of an online labeling study in 2015 (n=404). Regular soda included: Coca-Cola, Mountain Dew, and Ginger Ale; sports drinks included: Mountain Berry Blast Powerade; fruit drinks included: Pom Coconut and Purity Organic Peach Paradise; and iced tea included Nestea and Arizona Green Tea. Unflavored water/seltzer included: Dasani Water; 100% fruit juice included: Tropicana Orange Juice; diet soda included: Diet Coca-Cola; and other low-calorie drinks included: Honest Green Tea and Power-C Dragonfruit Vitamin Water. Student's t-tests were used to compare responses for soda to responses for each other beverage sub-category for each question. Mean responses for each question displayed in this figure were statistically significantly different from soda at $p<0.001$ for all beverages.

calorie estimation accuracy) and two of 12 for fruit drinks (improved calorie and sugar estimation accuracy).

Compared with no labels, health warning labels significantly reduced the odds of selecting an SSB (OR=0.45, 95% CI=0.36, 0.57), and this association was mediated by a decline in the health beliefs and risk perceptions index, which accounted for 25% of the total effect (Table 3). When stratified by SSB subcategory, warning labels significantly reduced the odds of selecting a fruit drink (OR=0.42, 95% CI=0.32, 0.56), mediated by a decline in the health beliefs and risk perceptions index (31% of the total effect), but did not reduce the odds of selecting other beverages. There was no effect of calorie labels on parents' beverage choice.

DISCUSSION

In this study, parents' health beliefs and risk perceptions of beverage options for their children varied significantly by beverage type. Compared with soda, parents viewed sports drinks, fruit drinks, and sweetened teas as healthier and less likely to lead to disease development. These findings are consistent with other studies, which have found that such beliefs are correlated with child consumption.[11–13] Parents viewed diet soda as less healthy than regular soda, suggesting that low-calorie beverages may not be obvious substitutes for SSBs.

There are many possible explanations for these findings. For one, children's fruit drinks and sports drinks are advertised as healthier options, often featuring nutrient and "natural" claims that influence parents' product perceptions.[34,35] These beliefs may work to the beverage industry's advantage, particularly in the face of increasing pressure to limit soda available to youth. For example, in recent efforts to improve the nutritional quality of kids' meals, many restaurants have removed soda from children's menus and replaced it with other SSBs.[36] Statewide policies to remove soda from schools may have caused similar unintended consequences. In 2010, students living in states prohibiting soda but allowing other SSBs in schools consumed more daily servings of non-soda SSBs than students in states without school SSB policies.[37]

Findings from this study suggest that health warning labels may be one way to correct these misperceptions about certain SSBs and protect against the promotion of other sugary drink options as consumption of regular soda declines. As predicted, health warning labels had the strongest influence on parents' health beliefs, risk perceptions, and purchase intentions when displayed on beverages that parents viewed as healthier and less likely to cause disease. The effect of warning labels on fruit drink selection, but not soda selection, was significantly mediated by a change in health beliefs and perceptions of disease risk. This suggests that, in line with expectancy disconfirmation theory, warning labels may reduce the likelihood of selecting a sugary beverage mistakenly viewed as more healthful or less risky for the child, in part, through disconfirmation of expectations—parents are faced with an unexpected negative message about the healthfulness and risks of consuming the beverage. However, changes in perceptions accounted for only

Table 2. Sugar-Sweetened Beverage Purchase Intentions, Health Beliefs, Risk Perceptions, and Nutrition Knowledge by Label Condition (n=2,381)

	Control					Calorie label					Warning label				
Variable	**All SSBs**	**Regular soda**	**Fruit drink**	**Sports drink**	**Iced tea**	**All SSBs**	**Regular soda**	**Fruit drink**	**Sports drink**	**Iced tea**	**All SSBs**	**Regular soda**	**Fruit drink**	**Sports drink**	**Iced tea**
Purchase intentions															
Vending machine choice, n (%)	242 (59.9)	79 (19.6)	92 (22.8)	39 (9.7)	32 (7.9)	219 (53.3)	59 (14.4)	68 (16.6)	52 (12.7)	40 (9.7)	**633 (40.4)**	234 (14.9)	**177 (11.3)**	127 (8.1)	95 (6.1)
Purchase intention (1–7)	3.77 (0.08)	3.48 (0.09)	3.94 (0.10)	4.29 (0.11)	3.76 (0.09)	3.73 (0.07)	3.44 (0.08)	3.74 (0.09)	4.50 (0.10)	3.77 (0.10)	**3.38 (0.04)**	3.16 (0.05)	**3.38 (0.05)**	4.06 (0.06)	3.38 (0.05)
Allow child to drink (1–7)	4.03 (0.08)	3.62 (0.09)	4.29 (0.10)	4.45 (0.11)	4.16 (0.09)	4.0 (0.07)	3.61 (0.08)	4.13 (0.09)	4.57 (0.10)	4.13 (0.09)	**3.58 (0.04)**	3.30 (0.05)	**3.66 (0.05)**	4.21 (0.05)	**3.61 (0.05)**
Health beliefs															
Healthy (1–7)	3.81 (0.07)	2.80 (0.08)	4.86 (0.08)	4.20 (0.10)	4.07 (0.08)	3.72 (0.07)	2.75 (0.09)	4.53 (0.09)	4.24 (0.10)	4.08 (0.08)	**3.34 (0.04)**	2.62 (0.05)	**4.02 (0.05)**	3.83 (0.05)	**3.50 (0.05)**
Make child feel energized (1–7)	4.53 (0.06)	4.37 (0.08)	4.70 (0.07)	4.99 (0.09)	4.36 (0.08)	4.44 (0.07)	4.25 (0.08)	4.57 (0.08)	5.05 (0.08)	4.28 (0.08)	4.29 (0.04)	4.23 (0.04)	**4.33 (0.04)**	4.78 (0.05)	4.10 (0.04)
Help child focus (1–7)	3.78 (0.07)	3.11 (0.08)	4.55 (0.08)	4.11 (0.09)	3.83 (0.08)	3.58 (0.07)	2.96 (0.08)	4.22 (0.08)	4.01 (0.09)	3.66 (0.08)	**3.33 (0.04)**	2.87 (0.05)	**3.80 (0.04)**	3.71 (0.05)	**3.35 (0.05)**
Healthy life (1–7)	3.83 (0.06)	2.96 (0.08)	4.78 (0.08)	4.12 (0.09)	4.02 (0.08)	3.74 (0.06)	2.89 (0.08)	4.58 (0.07)	4.17 (0.08)	3.96 (0.08)	**3.42 (0.04)**	2.76 (0.04)	**4.11 (0.04)**	3.86 (0.05)	**3.50 (0.04)**
Risk perceptions															
Weight gain (1–7)	4.47 (0.06)	5.07 (0.06)	3.47 (0.08)	5.57 (0.15)	4.02 (0.08)	4.21 (0.06)	4.92 (0.07)	3.67 (0.08)	**3.72 (0.09)**	3.93 (0.08)	4.59 (0.03)	5.12 (0.04)	**4.07 (0.04)**	**4.28 (0.05)**	**4.46 (0.04)**
Heart disease (1–7)	3.97 (0.07)	4.66 (0.07)	3.24 (0.08)	3.79 (0.09)	3.75 (0.08)	3.98 (0.06)	4.61 (0.07)	3.49 (0.08)	3.54 (0.09)	3.73 (0.08)	**4.37 (0.03)**	4.88 (0.04)	**3.89 (0.04)**	**4.10 (0.05)**	**4.25 (0.04)**
Diabetes (1–7)	4.10 (0.06)	4.90 (0.06)	3.28 (0.08)	3.83 (0.09)	3.86 (0.08)	4.15 (0.06)	4.90 (0.07)	3.58 (0.08)	3.62 (0.09)	3.86 (0.08)	**4.55 (0.03)**	5.11 (0.04)	**4.01 (0.04)**	**4.22 (0.05)**	**4.42 (0.04)**
Health beliefs and risk perceptions index (7–49)	27.63 (0.25)	22.71 (0.32)	33.06 (0.34)	29.80 (0.41)	28.77 (0.32)	27.14 (0.24)	22.42 (0.33)	31.51 (0.32)	30.59 (27.57)	28.91 (0.29)	**24.87 (0.15)**	21.38 (0.18)	**28.83 (0.18)**	**27.57 (0.20)**	**25.88 (0.17)**
Nutrition knowledge															
Amount of added sugar (1–4)	2.82 (0.03)	3.32 (0.03)	2.23 (0.04)	2.60 (0.04)	2.79 (0.03)	2.87 (0.02)	3.39 (0.03)	**2.43 (0.04)**	2.48 (0.04)	2.72 (0.03)	**3.05 (0.01)**	3.42 (0.01)	**2.66 (0.02)**	**2.79 (0.02)**	**3.01 (0.02)**
Calories	170 (8.0)	211 (9.7)	130 (8.0)	153 (9.9)	156 (8.2)	**191 (6.6)**	**232 (7.7)**	**178 (5.5)**	**153 (9.4)**	159 (7.0)	198 (5.7)	227 (6.2)	**176 (6.1)**	176 (5.9)	188 (5.9)

Note: Values are mean (SE), unless otherwise indicated. Boldface indicates difference from control is statistically significant at $p<0.001$. Raw means are displayed. Statistical tests are regressions controlling for self-reported frequency of purchasing SSBs and non-SSBs. Analyses of estimated calories were conducted on log-transformed estimates. In the vending machine choice task, regular soda included: Coca-Cola, Mountain Dew, Canada Dry Ginger Ale, and 7 Up; sports drinks included: Mountain Berry Blast Powerade; fruit drinks included: Pom Coconut, Tropicana Lemonade, Purity Organic: Peach Paradise, Minute Maid Lemonade, and Old Orchard Ruby Red Grapefruit Juice; iced tea included: Nestea and Arizona Green Tea. For all other questions, regular soda included: Coca-Cola, Mountain Dew, and Canada Dry Ginger Ale; sports drinks included: Mountain Berry Blast Powerade; fruit drinks included: Pom Coconut and Purity Organic: Peach Paradise; and iced tea included: Nestea and Arizona Green Tea. Health beliefs and risk perceptions were measured as an index ranging from 7 to 49, with higher scores indicating belief that product is healthier and less disease-promoting. Values displayed here differ from previously published values due to a small coding error that did not impact results.
SSB, sugar-sweetened beverage.

Table 3. Effect of Labeling and Indirect Effects of Health Beliefs/Risk Perceptions on Beverage Choice (n=2,381)

Label condition	All SSBs		Regular soda		Fruit drink		Sports drink		Iced tea	
	Total	Indirect	Total	Indirect	Total	Indirect	Total	Indirect	Total	Indirect
No label	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Calorie label	0.77 (0.57, 1.03)	0.98 (0.91, 1.05)	0.68 (0.46, 1.00)	1.00 (0.93, 1.09)	0.67 (0.47, 0.96)	0.91 (0.84, 0.99)	1.40 (0.90, 2.21)	1.08 (0.97, 1.20)	1.32 (0.81, 2.15)	1.02 (0.96, 1.07)
Warning label	**0.45 (0.36, 0.57)**	**0.82 (0.75, 0.89)**	0.76 (0.56, 1.02)	0.93 (0.86, 1.01)	**0.42 (0.32, 0.56)**	**0.77 (0.69, 0.85)**	0.84 (0.57, 1.23)	0.85 (0.76, 0.95)	0.77 (0.50, 1.17)	0.98 (0.81, 0.97)

Note: Values are OR (95% CI). Health beliefs and risk perceptions were measured as an index ranging from 7 to 49, with higher scores indicating belief that product is healthier and less disease-promoting. All regressions controlled for frequency of purchasing SSBs and non-SSBs. In the vending machine choice task, regular soda included: Coca-Cola, Mountain Dew, Canada Dry Ginger Ale, and 7 Up; sports drinks included: Mountain Berry Blast Powerade; fruit drinks included: Pom Coconut, Tropicana Lemonade, Purity Organic: Peach Paradise, Minute Maid Lemonade, and Old Orchard Ruby Red Grapefruit Juice; iced tea included: Nestea and Arizona Green Tea. For all other questions, regular soda included: Coca-Cola, Mountain Dew, and Canada Dry Ginger Ale; sports drinks included: Mountain Berry Blast Powerade; fruit drinks included: Pom Coconut and Purity Organic: Peach Paradise; and iced tea included: Nestea and Arizona Green Tea. Boldface indicates difference from control is statistically significant at $p<0.001$.
SSB, sugar-sweetened beverage.

25% of the effect of warning labels on purchase intentions, suggesting there may be other mechanisms through which warning labels influence beverage choice, beyond merely providing new information. For example, warning labels might simply serve as a reminder of one's health goals or make already known health risks more salient at the point of purchase. The labels might also trigger automatic negative associations that dissuade consumers. By contrast, calorie labels appear to be doing what, at a minimum, they were designed to do—increase consumer knowledge of calorie information—but they had no influence on purchase intentions. If the public health goal is to reduce purchases of SSBs, calorie labels alone may be unlikely to lead to meaningful reductions in purchases, and warning labels might be more effective. Because many other factors influence purchases, warning labels would likely need to be combined with other SSB policies (e.g., taxes) to ultimately influence health.

Limitations

This study has several limitations. First, black and Hispanic parents were oversampled, which provides data on the populations with the highest sugary drink consumption, but means the study sample does not reflect the exact racial and ethnic composition of the U.S.[9] The study was conducted online, and choices in a vending machine choice task may not be reflective of behaviors in real-world retail settings, in which pricing, requests from children, and other factors may influence beverage choice. Additionally, participants only viewed one type of beverage in one size, but some vending machines display popular beverages multiple times in various sizes. Another limitation is that participants were forced to make a beverage choice, not capturing participants who might be dissuaded altogether from buying a beverage. Further, the size of calorie labels and warning labels was enlarged for this study because participants were viewing beverages online and seeing warning labels for the first time. This presentation may alter risk perceptions by increasing salience of the information.[38] However, warning labels and calorie labels were shown in identical fashion, and warning labels outperformed calorie labels on nearly all measures compared with the control, suggesting an effect independent of label prominence. Lastly, longer-term studies of calorie labels on restaurant menu boards and warning labels on cigarette packages have found that the salience of messages deteriorates over time.[38,39] Longer-term studies in real-world settings are needed to examine how labels influence choice in the presence of other food cues, whether effects are sustained over time, and how choices influence child consumption, both at point of purchase and in future compensatory behaviors. Strengths of this study include a large sample, a randomized experimental design, and a demographically and educationally diverse sample of parents.

CONCLUSIONS

This study found that parents view fruit drinks, sports drinks, and sweetened teas more positively than sweetened soda. By defying expectations, SSB health warning labels may correct these misperceptions and subsequently influence parents' health beliefs, risk perceptions, and selection of beverages for their children. Despite beverage industry claims that the Clear on Calories label provides point of purchase information sufficient for consumers to make educated beverage choices, warning labels outperformed calorie labels on nearly all measures,

in particular for SSBs other than soda, which are increasingly promoted to youth.

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https:/doi.org/10.1016/j.amepre.2018.04.018.

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