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Effects of Interventions Based on the Theory of Planned Behavior on Sugar-Sweetened Beverage Consumption Intentions and Behavior

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Abstract

There is increasing concern about the health risks of added dietary sugar, perhaps particularly when consumed in beverages that contain no essential nutrients (e.g., sodas). The purpose of this experiment was to examine the relative and combined efficacy of three interventions based on the theory of planned behavior (TPB) for motivating reductions in sugar sweetened beverage (SSB) consumption. Four-hundred-thirty undergraduates were randomised in a 2*2*2 factorial design. Participants received either information designed to increase awareness of the risks of SSB consumption or control information, and received either information about SSB consumption norms or no norms information, and either made plans to reduce their SSB consumption or engaged in a control planning task. Results demonstrated that the interventions, separately and in conjunction, resulted in greater intentions to reduce SSB consumption in the future, and there was evidence that these effects were mediated by the effects the interventions had on the TPB constructs. Further, the risks information resulted in more behaviors indicative of preparations to alter SSB consumption and those who engaged in the SSB planning task reported significantly lower SSB consumption at follow-up compared to controls. The three interventions utilized showed promise for altering SSB consumption intentions and behavior and, given their brevity and low cost, have potential to be developed into large scale community-based interventions that may lead to meaningful public health benefits.

Keywords

risks information; normative feedback; planning task; theory of planned behavior; sugar-sweetened beverage consumption; implementation intentions

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Sugar consumption has been linked to variety of health risks such as obesity (Bray, Nielsen, & Popkin, 2004; Harrington, 2008), Type 2 diabetes (Malik, Popkin, Bray, Despres, & Hu, 2010) cardiovascular disease (Anand et al., 2015; Malik et al., 2010), and cancer (Larsson, Berkvist, & Wolk, 2006). Many foods that have significant sugar content, such as fruits, also provide necessary nutrients. One way to decrease sugar consumption without simultaneously decreasing nutrient intake is by reducing or eliminating sugar-sweetened beverage (SSB) consumption. SSBs are the largest contributor of added sugar intake and a significant source of calories in the United States (Huth, Fulgoni, Keast, Park, & Auestad, 2013) and around the world (Popkin & Nielson, 2003). The habitual consumption of SSBs has been linked with an increased risk for diabetes, heart disease, stroke, obesity, and pancreatic cancer (Imamura et al., 2016; Larson, Bergkvist, & Wolk, 2014; Larsson et al., 2006; Malik et al., 2010). Thus, interventions that motivate reductions in SSB consumption have the potential for significant public health impact. Although lack of knowledge that there are health risks of SSB consumption would be a significant barrier to behavior change, simply increasing awareness is not likely to provide sufficient motivation to produce changes in behavior (Corace & Garber, 2014; Fishbein & Ajzen, 2010). To develop interventions that are maximally beneficial, and potentially generalizable to other health domains, it is important that interventions are grounded in theory.

Theory of Planned Behavior

A prominent health behavior theory is the Theory of Planned Behavior (TPB; Ajzen, 1991). The TPB suggests that the most proximal predictor of behavior is the intention to perform that behavior. The intention to perform a particular behavior is determined by the following three components: attitudes toward a particular action, subjective norms, and perceived behavioral control. Attitudes are composed of the individual's beliefs regarding the consequences of the action (e.g., "If I decrease my sugar-sweetened beverage consumption it will improve my health.") and his/her evaluations of that consequence (e.g., "Having good health is important to me"). The subjective norms component of the TPB is comprised of a person's normative beliefs (i.e., perceptions of what other people think about a particular behavior) and motivations to comply with those norms. Perceived behavioral control (PBC) refers to the perceived ease or difficulty of performing a particular behavior.

Most of the research on the TPB has been non-experimental, examining interrelationships among the TPB cognitions and behavior in cross-sectional designs (Armitage & Connor, 2002; Godin & Kok, 1996; McDermott et al., 2015a; McDermott et al., 2015b; McEachan, Conner, Taylor, & Lawton, 2011). Several systematic reviews have generally found attitudes, subjective norms, and PBC to have moderate associations with intentions and behaviors, particularly among college student participants and when subjective measures of behavior are used (McDermott et al., 2015a; McEachan et al., 2011). Experimental work examining the TPB, or interventions informed by the theory, have been relatively rare (see Hardeman et al, 2002 for a review) and there appears to be only one previous experiment in which interventions based on each of the primary cognitions of the TPB were manipulated in a full factorial design (Sniehotta, 2009). Sniehotta (2009) utilized three persuasive messages designed to address university students' attitudes, normative beliefs, and PBC regarding

regular physical exercise at the University sports and recreation facility. Participants were randomly assigned to one of eight conditions in a 2 (attitude message vs no message) $\times$ 2 (norms belief message vs no message) $\times$ 2 (PBC message vs no message) design. Intentions to exercise were assessed immediately following the interventions, and attendance at the sports and recreation facility was recorded over the subsequent two months. The results demonstrated that only the normative beliefs message predicted intentions to engage in physical activity, and the information designed to increase PBC was the only intervention that changed actual behavior. Although Sniehotta (2009) reported no significant three-way interaction on exercise behavior, the condition that received all three interventions was not specifically compared to all other conditions. Thus, the possibility of an additive effect particularly benefitting those who received all three interventions was left unexamined.

There has been some debate about the practical utility of the TPB (Ajzen, 2014; Sniehotta, Presseau, & Araújo-Soares, 2014). However, to adequately address this issue more experimental tests of the theory and of interventions informed by the theory are needed. Also, given that the theory suggests that attitudes, subjective norms, and PBC all affect intentions, comparing the cell in a factorial design that includes interventions based on all three cognitions to all other cells helps to determine whether the interventions have additive effects and can yield important information relevant to assessing the utility of the theory.

Overview of Present Experiment

The experiment reported here investigated the separate and combined efficacy of three interventions, guided by the TPB, for decreasing SSB consumption intentions and behaviors of college students. This is the first experiment focused on SSB consumption to attempt to impact all three TPB cognitions. Also, given the limited success of previous interventions (Hardeman et al., 2002), the interventions we utilized were designed to be more impactful than the written information provision often utilized in previous interventions based on the TPB. The first intervention was designed to produce positive attitudes about SSB reduction and consisted of information about the health consequences of consuming SSBs as well as an activity to increase the salience of the sugar content of a typical SSB. The second intervention was designed to alter perceived subjective norms and consisted of information stating that peers approve of drinking fewer SSBs (injunctive norm) and are making efforts to decrease SSB consumption (descriptive norm). The final intervention was designed to increase perceived behavioral control and consisted of having participants plan when, where, and how to reduce their SSB consumption and how to resist SSBs in tempting situations. Participants were randomly assigned to one of eight conditions in a 2 (risks information intervention: control vs SSB risks) $\times$ 2 (normative information intervention: no norms vs SSB norms) $\times$ 2 (planning intervention: control vs SSB) between subjects design. Intentions to decrease SSB consumption and measures of attitudes, subjective norms, and perceived behavioral control were assessed immediately following the interventions. Behaviors indicative of preparations to alter SSB consumption, self-reported SSB consumption, and behavioral intentions were assessed at an unannounced 2-week follow-up. It was expected that each of the interventions would favorably impact SSB intentions and behavior compared to the respective control condition. Moreover, the primary hypothesis was that those who received all three interventions (risk information, social norms, and SSB planning) would

report the greatest SSB consumption reduction intentions and behaviors relative to those in any of the other seven conditions. Finally, it was expected that any observed effects of the three interventions on subsequent SSB reduction intentions and behaviors would be mediated by the intervention effects on participants' attitudes, subjective norms, and PBC beliefs.

Method

Participants

Participants were 430 (72.9% female) undergraduate students, attending either the University of California, San Diego (UCSD; $n = 224$) or California State University San Marcos (CSUSM; $n = 206$). Sample size was based on power analyses utilizing effect sizes (Cohen's d ; Cohen, 1969) obtained or calculated from previous research that compared risks information (Adams, Hart, Gilmer, Lloyd-Richardson, & Burton, 2014; Bleakley et al., 2015; Kothe & Mullan, 2014; Rosas et al., 2017; Sharps & Robinson, 2016), social norms information (Kothe & Mullan, 2014; Pliner & Mann, 2004; Rosas et al., 2017; Sharps & Robinson, 2016), or a planning task (Adriaanse et al., 2010; Ames et al., 2014; Conner, Sandberg, & Norman, 2010; Gholami et al., 2013; Kothe & Mullan, 2014) respectively, to a control condition. The average d s (.48 for risks information, .59 for social norms, and .41 for planning) suggested a need for 100 participants per condition to obtain a power of .80 (for the risks and planning manipulations). Thus, to allow sufficient power for possible interaction effects, it was decided to recruit at least 200 participants at each location (See Table 1 for demographic characteristics as a function of location).

Conditions

Information intervention.—SSB risks information was presented via a four page 8.5" × 11" booklet that included messages and images regarding the potential health risks associated with SSB consumption (e.g., obesity, Type 2 diabetes, cardiovascular disease, cancer). In addition to the stereotypical SSBs (e.g., soda, fruit juices), the information and images in the booklet were designed to increase awareness of the heavy sugar content of beverages such as sports drinks and coffee drinks (e.g., Frappuccino's) that are ubiquitous on college (and high school) campuses. The information booklet was expanded from one used in a previous study (Rosas et al., 2017). In order to produce favorable SSB reduction attitudes, consistent with previous TPB interventions in other health contexts (See Fishbein & Ajzen, 2010; Hardeman et al., 2002), the risks information intervention was designed to both inform and convince participants that SSBs pose a significant health risk. In order to increase the salience and impact of the information provided in the booklet, we also had *participants* perform a visual demonstration of the proportion of a typical SSB that is comprised of sugar. That is, after reading the risks card, participants were presented with a tray containing sugar cubes and a 24-oz clear plastic Starbucks cup. They were informed that the typical 24-oz SSB contains 88 grams of sugar which is equivalent to ~22 sugar cubes, and they were asked to place 22 sugar cubes into the cup. Next, they were asked to take a few moments to carefully examine the cup and notice how much of the volume is taken up by the sugar cubes. Control group participants read an 8.5" × 11" booklet that

provided information and images regarding study habits of successful students (e.g., taking notes during class, find a study group, ask questions).

Correction of misperceived social norms intervention.—Personalized normative feedback (PNF) was employed to correct misperceived descriptive and injunctive social norms regarding SSB consumption. We targeted both injunctive and descriptive norms given that the subjective norms construct in the current TPB framework includes both “...the desires and actions of important [referents]” (Fishbein & Ajzen, 2010, pg. 131). In previous work, we have demonstrated that such PNF was successful in convincing students that important people in their lives would want them to minimize their SSB consumption (Rosas et al., 2017). The PNF consisted of a direct comparison of participants’ own perceptions (assessed at baseline; described below) of typical college students’ approval of avoiding SSB consumption (injunctive norm) and efforts to minimize SSB consumption (descriptive norm) against the actual normative values. The PNF was delivered to each participant via a personally customized feedback sheet that contained feedback for two injunctive and one descriptive norm items. The participant’s own baseline perception of each norm was handwritten and contrasted with the true norm (measured in a survey of 280 undergraduates several months prior to the present study). For example, the descriptive norm feedback stated, “You thought that _____ % of college students try to avoid consuming sugar sweetened drinks. On average actually 90% of college students try to avoid consuming sugar-sweetened drinks.” Participants were asked to carefully review the feedback sheet and compare their perceptions with the actual normative values. The control group did not receive any normative information.

Planning intervention.—In order to produce in participants the belief that they are capable of reducing their SSB consumption without too much difficulty (i.e., produce PBC), we utilized a planning intervention. It would be expected that making specific plans regarding when and how to reduce SSB consumption should enhance the belief that it is doable and increase PBC (Fishbein & Ajzen, 2010). The SSB planning intervention was based closely on tasks used in previous literature (Adriaanse et al., 2011) and altered to reflect SSB consumption (Luszczynska et al., 2007). Participants spent several minutes writing their action plans regarding healthy beverage consumption (i.e., “...what, when, where, and how will you drink beverages without added sugar in the next two weeks?”), and an if-then plan regarding how they would resist tempting situations (e.g., when someone offers them a sugary drink). Control participants completed an action and if-then plan regarding their studying habits.

Procedure

At each of the two locations, participants were recruited via the Psychology Department’s Human Participant Pool (HPP) and received course credit. The study was identified only by a number to minimize self-selection and to avoid development of biases about the study.

Intervention session.—To increase the plausibility of the cover story for the behavioral measure of intervention efficacy (detailed below), upon entrance to the laboratory, participants were escorted into a conference room bedecked as though a graduation party

had recently taken place (e.g., a “Congratulations” sign, empty pizza boxes, paper plates, etc.). The experimenter apologized for the mess and gave the participant a consent form to read and sign. Next, participants were escorted into a separate room where they completed demographic information, baseline measures of beverage consumption, and estimates of their peers’ SSB consumption.

Thereafter, depending upon condition, participants read information regarding either study habits (control) or SSB risks (and completed the sugar task). Next, those assigned to receive the social norms information received the PNF sheet, and then participants completed either the control planning or SSB planning task. Following the planning task, all participants completed measures of their intentions to reduce their SSB consumption, attitudes about SSBs, subjective norms regarding SSBs, perceived behavioral control, and several manipulation checks (described below). Finally, they were thanked for their participation and a behavioral measure of the intervention efficacy was obtained. That is, as each participant exited the lab they passed by a counter with a variety of drink bottles (e.g., Coke, Diet Coke, tea, and water) arranged haphazardly to appear as though someone was emptying a nearby ice chest. The experimenter casually invited the participant to take a drink if they wanted one and stated that “we have a lot left over.” After issuing the invitation, the experimenter left the area to minimize the possibility that the participant would feel pressure to select a certain drink (i.e., one without sugar). To further bolster the cover story regarding a party with too many drinks left over, during the experiment participants “overheard” a sham phone call the experimenter received, ostensibly from the principle investigator (P.I.) of the lab, during which the experimenter reported to the P.I. that clean-up from the party had begun and asked, “what should we do with all these left-over drinks?” Only the experimenter’s side of the phone call was “overheard.”

Follow-up.—Experimenters contacted participants by phone two-weeks after their lab participation. Participants were not aware of the follow-up in advance (i.e., no mention of a possible follow-up was made at the initial session) and provided oral informed consent at the time of phone contact. Measures of SSB consumption, preparations to change SSB consumption, and intentions to alter SSB consumption in the future (all described below) were obtained. Participants were then probed for suspicion and fully debriefed.

Measures

Baseline SSB consumption and beliefs about peer consumption.—SSB consumption was assessed via a beverage checklist (Hendrick et al., 2012). Participants were asked to indicate the number of ounces of each of the listed beverages they had consumed the day prior. The total number of ounces of SSBs consumed at baseline was computed for analyses. See Table 1 for the means and standard deviations for baseline measures as a function of location. Perceived injunctive norms were assessed with two items. One item stated, “The typical college student believes that avoiding sugar-sweetened drinks is:”, and response options ranged from 1 (*extremely bad*) to 7 (*extremely good*). The other had the same opening statement but the response options ranged from 1 (*extremely unimportant*) to 7 (*extremely important*). One item was used to assess perceived descriptive norms. Specifically, participants were asked to estimate the percentage of college students who try

to avoid consuming sugar-sweetened drinks. Both injunctive norms and the descriptive norm were underestimated by 93.5%, 98.0%, and 100% of participants, respectively. In keeping with prior research (e.g., Reid & Aiken, 2013), even those few participants who were accurate in their normative beliefs were included in the analyses involving these variables.

Attitudes.—An 18-item scale was utilized to assess attitudes about minimizing SSB consumption (Zoellner, Estabrooks, Davy, Chen, & You, 2012). Example items are “How likely it is that drinking less than 1 cup of SSB each day would reduce your chances of disease” (1 = *extremely unlikely* to 7 = *extremely likely*), and “For you, drinking less than 1 cup of sugar sweetened drinks each day would be (1 = *extremely harmful* to 7 = *extremely beneficial*). The items were reversed scored as necessary and summed to create an *attitudes* index (Cronbach’s $\alpha = .86$) for analyses (higher values indicate more positive attitudes toward decreasing SSBs).

Subjective norms.—Fifteen items were used to assess perceived subjective norms regarding SSB consumption (Zoellner et al., 2012). For example, “Most people who are important to you want you to drink less than 1-cup of sugar-sweetened drinks each day” (1 = *strongly agree*; 7 = *strongly disagree*); “Your friends would approve of you drinking less than 1 cup of sugar sweetened drinks each day” (1 = *completely untrue*; 7 = *completely true*). The 15-items displayed good internal consistency ($\alpha = .81$) and were therefore summed into a *subjective norms* index for analyses (higher values indicate greater subjective norms in the direction of decreased SSB consumption).

Perceived behavioral control.—Nine items were used to assess perceived behavioral control over limiting SSB consumption (Zoellner et al., 2012). For example, “You have complete personal control over limiting your sugar-sweetened drinks to less than 1 cup each day, if you really wanted to” (1 = *strongly disagree*; 7 = *strongly agree*); “How easy it would be for you to limit your sugar-sweetened drinks to less than 1 cup each day, if you wanted to, even if sugar-sweetened drinks were much cheaper than non-sugary drinks?”; (1 = *Extremely Difficult*; 7 = *Extremely Easy*). The 9-items had good internal consistency ($\alpha = .81$) and were summed into a *perceived behavioral control* index for analyses (higher values indicate greater PBC for decreasing SSB consumption).

Intentions.—Eight items were used to assess intentions to minimize SSB consumption (Rosas et al., 2017). An example item is “I plan to avoid consuming sugar sweetened drinks entirely” (1 = *Strongly Disagree*; 7 = *Strongly Agree*). Internal consistency was high ($\alpha = .84$) and the items were averaged into an *SSB intentions* index for analyses (higher values indicate greater intentions to decrease SSB consumption).

Manipulation checks.—We utilized a number of measures to determine whether participants attended to/processed the information provided by the interventions and that the information provided was not common knowledge or part of existing beliefs (Ajzen, 2014). Specifically, six items assessed recall of the information that was provided in the risks booklet or the sugar task. In an open-ended item, the participants were asked to recall the number of sugar cubes (i.e., 22) contained in a typical Starbucks Frappuccino. Then participants checked the appropriate answers to the following questions: “Sugar-sweetened

drink consumption is a ____ (minor; moderate; major) contributor to weight gain and obesity”; “How long would the average person have to jog to burn the calories in one soda?” (5 minutes; 10 minutes; 30 minutes; 1 hour; 3 hours); “Has regular soda consumption has been linked to aging?” (“yes” or “no”); “Which cancer, if any, has been linked to high consumption of sugar-sweetened drinks?” (Melanoma, Pancreatic, None); “Is there any evidence that water can help fight infections?” (“yes” or “no”). The six recall items were coded as either correct (“1”) or incorrect (“0”) and were summed into a total recall index for further analyses.

Three items served as manipulation checks for the social norms information. Specifically, participants were asked to report the information they had received regarding the percentage of college students who reported that they sought to avoid consuming sugar-sweetened drinks in an open-ended response, and rated the extent to which they believed the typical college student believes it is important to avoid consuming sugar-sweetened drinks (1 = *extremely unimportant*; 7 = *extremely important*), and separately, the extent to which they believed that the typical college student believes avoiding sugar-sweetened drinks is 1 = *extremely bad*; 2 = *quite bad*; 3 = *slightly bad*; 4 = *neither bad nor good*; 5 = *slightly good*; 6 = *quite good*; 7 = *extremely good*.

The manipulation checks for the planning task consisted of 4-items assessing whether participants perceived themselves to have made plans to limit their SSB consumption (e.g., “I have made plans concerning ‘when’ I am going to limit my sugar-sweetened drinks to less than 1 cup each day”). Level of agreement with each item was rated on a 7-point Likert-type scale (1 = *Strongly Disagree*; 7 = *Strongly Agree*). As in previous work (Zoellner et al., 2012), Cronbach’s alpha for these items was high ($\alpha = .92$), and they were summed into a *planning manipulation check* index for analyses.

Follow-up measures.—Approximately two-weeks later ($M = 17.91$, $SD = 4.11$ days) experimenters, who were blind to condition, contacted 86% of the original participants by telephone (60 participants could not be reached despite multiple attempts over the course of 2 weeks) to assess SSB consumption by asking participants to list all of the beverages they had consumed on the previous day. To increase accuracy, participants were given pressure-free time to recall what they drank and were encouraged to think chronologically (e.g., “Take a moment to think about yesterday...”; “What was the first thing you had to drink after you woke up?”; etc.). The total number of ounces of SSBs consumed was utilized for analyses.

Additionally, to potentially capture an intermediate step in the process of behavior change we include a measure of preparations to change. That is, it has been argued that change in risk behavior does not occur all at once but rather progresses through a series of stages (Prochaska & DiClemente, 1986): precontemplation (no awareness that change is necessary and no intention to change), contemplation (seriously considering altering the target behavior), preparation (preparing to take action), action (currently modifying some aspect of the target behavior), and maintenance (continuation of the modified behavior). Given the difficulty of changing habitual behaviors, particularly when the target behavior involves avoiding foods that compromise health (McDermott et al., 2015b), it is important to assess

whether interventions at least motivate contemplation or preparation to change the target behaviors. The measure utilized consisted of 8 items designed to assess the frequency with which participants had engaged in various behaviors that might indicate contemplation/preparation to alter their SSB consumption (e.g., “During the past 2-weeks, how frequently did you read the labels on the drinks you were considering purchasing to see whether they contained added sugar?”; 0 (*not at all*) to 4 (*very frequently*)). As in previous work (Rosas et al., 2017), the items displayed acceptable internal consistency ($\alpha = .75$), and thus were combined into a *preparations* index for analyses (higher numbers indicating more frequent preparatory behaviors). Finally, the participants were asked the eight intentions items assessed at the initial session to assess their intentions to alter their future SSB consumption. The items displayed good internal consistency ($\alpha = .85$), and thus were combined into an *SSB Follow-up Intentions* index for analyses.

Statistical Analyses

The analytic strategy involved 2 (risks information intervention: control vs. SSB risks info) $\times$ 2 (social norms information intervention: no norms vs. SSB norms) $\times$ 2 (planning intervention: control vs. SSB) analyses of variance (ANOVAs) for all randomization checks (with the exception of categorical variables for which chi-square was used), proposed mediators, and dependent variables with the exception of SSB consumption at follow-up which was analyzed controlling for baseline SSB consumption (i.e., using analysis of covariance (ANCOVA)). Also, to assess the questions and hypotheses regarding the additive effects of the three interventions a planned contrast comparing the condition that received the SSB risks information, the social norms information, and the SSB planning task against all other conditions combined was conducted for each dependent variable. Finally, to examine whether each of the proposed mediators (attitudes, subjective norms, perceived behavioral control, initial intentions) mediated any obtained effects of any of the interventions on follow-up intentions and/or behaviors, the Hayes’ (2012) bootstrapping procedure and corresponding SPSS PROCESS Macro was used. In any instance where one of the three interventions (i.e., risks, norms, planning task) affected both the dependent variable and one of the proposed mediators (i.e., attitudes, subjective norms, PBC, or SSB reduction intentions assessed at the initial session) a mediation analysis was conducted. For each analysis, five thousand bootstrapping resamples were performed.

Results

Preliminary Analyses

CSUSM versus UCSD samples.—Initially, ANOVAs including location (CSUSM vs. UCSD) as a fourth factor were performed on each of the demographic variables (χ^2 was used for ethnicity and gender), baseline SSB consumption, and each dependent variable. The results indicated no significant differences across location in age and gender (p s $> .234$). However, the two samples did differ in terms of year in college, ethnicity, and baseline SSB consumption. In particular, there were more freshman at CSUSM (30.6%) than at UCSD (18.3%), whereas there were more participants in their senior year at UCSD (33.0%) than at CSUSM (7.3%). The percentage of sophomores and juniors were similar across campuses. The ethnic differences across campus were observed primarily for Asians and Caucasians.

That is, there were more students that self-identified as Asian at UCSD (37.5%) than at CSUSM (7.3%), whereas there were fewer Caucasians at UCSD (21.0%) than at CSUSM (39.8%). There were similar proportions of Pacific Islanders, African-Americans, Hispanics, Mixed-ethnicities, and those who identified as “Other” across both campuses. In addition, there were baseline SSB differences observed across campus. Specifically, CSUSM students consumed more ounces of SSBs ($M=19.74$, $SE=1.13$) at baseline than did students at UCSD ($M=15.63$, $SE=1.08$).¹

In terms of the dependent variables, there were main effects of location on attitudes, perceived behavioral control, and whether participants selected an SSB when offered a drink on the way out of the lab. That is, participants at CSUSM exhibited more positive attitudes about low SSB consumption ($M=95.53$, $SE=.97$) than did UCSD ($M=92.42$, $SE=.93$) participants, $F(1, 409) = 5.33$, $p=.022$, $\eta_p^2 = .01$. Also, CSUSM participants exhibited higher perceived behavioral control ($M=47.14$, $SE=.65$) than did UCSD ($M=44.46$, $SE=.62$) participants, $F(1, 411) = 8.96$, $p=.003$, $\eta_p^2 = .02$, and yet they more often selected an SSB when offered a free drink on their way out of the lab (22.0%) than did UCSD students (11.7%), $F(1, 414) = 8.22$, $p=.004$, $\eta_p^2 = .02$. However, despite these few main effects of location, there were no significant interactions involving location for any of the dependent measures (all $ps > .067$). Thus, given that the patterns of the intervention effects on the outcome measures were the same across location, the data for the CSUSM and UCSD samples were combined for all analyses described below.

Group equivalence.—There were no significant differences in age, gender, ethnicity, education level, or reported SSB consumption at baseline as a function of condition ($ps > .142$). Thus, it appears that participants were effectively randomized to condition.

Risk information manipulation checks.—Participants who received the SSB risks information answered significantly more of the manipulation check questions correctly ($M=5.69$, $SE=.05$) than did participants in the control information condition ($M=3.59$, $SE=.05$), $F(1, 419) = 757.94$, $p < .001$, $\eta_p^2 = .64$. Thus, in general, it appears that participants paid attention to the risks information and that the information is not common knowledge. It was also the case that those in the norms condition answered slightly but significantly more of the manipulation checks correctly ($M=4.74$, $SE=.05$) than did those who had not received the norms information ($M=4.53$, $SE=.05$), $F(1, 419) = 7.34$, $p=.007$, $\eta_p^2 = .02$. There was also a significant risks by norms interaction effect, $F(1, 419) = 4.05$, $p=.045$, $\eta_p^2 = .01$, which showed that regardless of risks condition those who received the norms information answered more questions correctly, however, the difference was slightly larger among those who had not received the risks information ($Ms = 3.77$ vs 3.41 , for norms vs no norms respectively) than those who had received the risks information ($Ms = 5.71$ vs 5.66 , for

¹CSUSM students also reported drinking more non-sugar sweetened beverages (i.e., water) as well. Thus, it seems that CSUSM students drank more beverages in general than did UCSD students. This is possibly because CSUSM is inland where the temperature is typically 10 degrees warmer than the coastal community where UCSD is located.

norms vs no norms respectively). No other main effects or interactions were significant ($ps \geq .187$).

Social norms manipulation checks.—As expected, a significant social norms condition main effect was obtained on each of the three questions assessing recall of the social norms information, ($F(1, 420) = 1518.61, p < .001, \eta_p^2 = .78$ for participants' estimates of the percentage of their peers who report that they try to avoid SSB consumption; $F(1, 421) = 318.12, p < .001, \eta_p^2 = .43$, for ratings of the extent to which the typical college student believes that avoiding SSBs is bad/good; and $F(1, 422) = 400.92, p < .001, \eta_p^2 = .49$ for ratings of the extent to which the typical college student believes that avoiding sugar-sweetened drinks is important). As one would expect, those in the condition who had received social norms information provided reliably higher estimates in response to each of these questions ($M = 89.2\%, SE = .99; M = 6.53, SE = .05; M = 6.56, SE = .07$, respectively) than did those in the control condition ($M = 35.1\%, SE = .98; M = 5.36, SE = .05; M = 4.64, SE = .07$, respectively). Thus, it appears that participants processed the social norms information and that the information was not part of the existing beliefs held by this sample. For the estimates of their peers who try to avoid SSB consumption there was also a main effect for risks condition, $F(1, 420) = 4.10, p = .044, \eta_p^2 = .01$. Those in the control condition estimated a slightly higher percentage ($M = 63.56, SE = .98$) than did those in the risks condition ($M = 60.75, SE = .98$). No other main effects or interaction effects were significant for any of the 3 questions ($ps \geq .129$).

Planning intervention manipulation checks.—Consistent with expectations, those participants in the SSB planning condition indicated that they had engaged in more SSB planning ($M = 24.41, SE = .36$) than did participants in the control condition ($M = 20.87, SE = .36$), $F(1, 422) = 48.91, p < .001, \eta_p^2 = .10$. However, unexpectedly the results also demonstrated that participants who read the SSB risks information reported that they had engaged in significantly more SSB planning ($M = 23.14, SE = .36$) than did the participants in the control information condition ($M = 22.15, SE = .36$), $F(1, 422) = 3.84, p = .050, \eta_p^2 = .01$. There were no other significant main effects or interactions ($ps \geq .153$).

Primary Analyses

Descriptive information for each outcome as a function of condition can be found in Table 2.

Proposed Mediators.

Attitudes. Contrary to expectation, there was no significant main effect of risks information condition on the SSB attitudes index, $F(1, 417) = .29, p = .589, \eta_p^2 = .00$. However, the results demonstrated a significant main effect of social norms condition, $F(1, 417) = 5.19, p = .023, \eta_p^2 = .012$. The pattern of the effect showed that participants who received the social norms information reported more positive attitudes about low SSB consumption ($M = 95.44, SE = .96$) than did those who had not received the norms information ($M = 92.36, SE = .95$).

Also, there was a significant main effect for planning condition, $F(1, 417) = 8.99, p = .003, \eta_p^2 = .02$, such that those who completed the SSB planning task exhibited more positive attitudes about low SSB consumption ($M = 95.93, SE = .96$) than did those who completed the control planning task ($M = 91.87, SE = .95$). There were no significant interactions ($ps \geq .334$). A planned contrast demonstrated that those in the condition that received all three interventions reported more positive attitudes about low SSB consumption relative to participants in all other conditions, $t(417) = 2.84, p = .005, \eta_p^2 = .02$.

Subjective norms.: The results for subjective norms were quite similar to those for attitudes. Specifically, there were significant main effects both for social norms condition, ($F(1, 403) = 8.89, p = .003, \eta_p^2 = .02$) and for planning condition ($F(1, 403) = 16.86, p < .001, \eta_p^2 = .04$) on the perceived subjective norms index. As expected, those participants who received the social norms information showed higher perceived subjective norms ($M = 71.88, SE = .86$; i.e., that their friends and others who are important in their lives would want them to reduce their SSB consumption) than did those who did not receive the norms information ($M = 68.25, SE = .86$). Also, those who completed the SSB planning task reported higher perceived subjective norms ($M = 72.57, SE = .87$) than did those in the control condition ($M = 67.56, SE = .86$). No other main effects or interactions were significant ($ps \geq .314$). However, those who received all three interventions, relative to all other conditions, were significantly more likely to report that their friends/family would want them to reduce SSB consumption, $t(403) = 2.08, p = .038, \eta_p^2 = .01$.

Perceived behavioral control.: Contrary to prediction, there was no significant main effect for the planning condition on PBC, $F(1, 419) = .67, p = .412, \eta_p^2 = .00$. However, there was a significant main effect for social norms condition, $F(1, 419) = 10.79, p = .001, \eta_p^2 = .03$. The pattern of the effect showed that those who received the social norms information exhibited higher PBC ($M = 47.19, SE = .64$) than did those who did not receive this information ($M = 44.24, SE = .63$). In addition, there was a significant three-way interaction between risks, norms, and the planning condition on PBC, $F(1, 419) = 4.37, p = .037, \eta_p^2 = .01$. Posthoc comparisons showed that the condition that received none of the interventions reported the lowest PBC relative to all other conditions that received at least one of the interventions ($p < .001$). Also, participants who had received all three interventions expressed significantly higher PBC relative to those in all other conditions, $t(419) = 2.41, p = .017, \eta_p^2 = .01$.

Initial intentions.: Finally, analysis of participants' intentions to decrease their SSB consumption (assessed immediately following the interventions) demonstrated significant main effects for all three interventions, $F(1, 420) = 3.99, p = .046, \eta_p^2 = .01$ (risks information), $F(1, 420) = 3.96, p = .047, \eta_p^2 = .01$ (social norms), and $F(1, 420) = 5.77, p = .017, \eta_p^2 = .01$ (planning intervention). That is, those who received the risks information, those who received the norms information, and those who were in the planning

condition, each reported greater intentions to limit their SSB consumption than did those participants in their respective control conditions. Finally, there was also a significant interaction between the risks information and norms information conditions, $F(1, 420) = 5.10$, $p = .024$, $\eta_p^2 = .01$ (See Figure 1). Specifically, those participants who did not receive either the risks or the normative information expressed lower intentions to reduce SSB consumption relative to those in the other three conditions. Although no other main effects or interactions were significant ($ps \geq .181$), a planned contrast demonstrated that, relative to all other conditions combined, those in the condition that received all the three interventions reported marginally greater intentions to reduce their SSB consumption, $t(420) = 1.66$, $p = .098$, $\eta_p^2 = .01$.

Outcome measures.

Took SSB.: Recall that, as a behavioral measure of the impact of the intervention, participants were invited to select a free beverage while exiting the lab. For those participants who did choose to take a beverage ($n = 252$) there was a significant main effect of risks information condition on the likelihood of choosing an SSB, $F(1, 244) = 5.28$, $p = .022$, $\eta_p^2 = .02$. That is, fewer of the participants in the risks information condition (22.1%), relative to the control condition (35.2%), selected an SSB. There was also a significant interaction between the risks information and SSB planning condition, $F(1, 244) = 5.09$, $p = .025$, $\eta_p^2 = .02$. As can be seen in Figure 2, only 13.0% of participants who received *both* the risks information and the planning task took an SSB when offered a free drink, whereas between 31.4% and 38.9% of those in the other three conditions took an SSB drink.² No other main effects or interactions were significant ($ps \geq .347$). However, a planned contrast demonstrated that significantly fewer of those participants in the condition that received all three interventions took an SSB when offered a free drink than those in all the other conditions combined, $t(244) = -2.33$, $p = .020$, $\eta_p^2 = .02$.

Intentions at follow-up.: Similar to the results of the intentions measure assessed immediately after the interventions, each of the three interventions produced follow-up intentions to limit future SSB consumption that were significantly greater than those in the respective control conditions, $F(1, 362) = 5.49$, $p = .020$, $\eta_p^2 = .02$ (risks information), $F(1, 362) = 6.58$, $p = .011$, $\eta_p^2 = .02$ (social norms), $F(1, 362) = 4.53$, $p = .034$, $\eta_p^2 = .01$ (planning intervention). No interactions were significant ($ps \geq .107$). Also, as expected, those participants in the condition that received all three interventions expressed greater intentions to reduce their SSB consumption in the future than did those in all the other conditions combined, $t(362) = 2.06$, $p = .039$, $\eta_p^2 = .01$.

²It should be noted that analyzing this data with logistic regression produced largely the same pattern of effects as the ANOVA, and showed that participants who received the risks information and engaged in the SSB reduction planning were 1.58 times less likely to select an SSB than those in the other conditions.

Given that both the social norms information intervention and the planning intervention significantly affected both follow-up SSB reduction intentions and attitudes about low SSB consumption, separate tests were conducted to determine whether attitudes may have mediated the effects of both the norms and the planning interventions on SSB reduction intentions at follow-up. The results revealed that there was a significant indirect effect of the social norms information on participants' follow-up SSB intentions via their attitudes towards SSBs ($b = .48$, $SE = .28$, 95% CI [0.01, 1.16]), as the confidence interval does not include zero. Similarly, the results demonstrated that there was a significant indirect effect of the planning task on participants' follow-up intentions via their attitudes towards SSBs ($b = .71$, $SE = .28$, 95% CI [0.28, 1.39]). Figure 3 provides a graphical depiction of the above models, including the statistics measuring the significance of each predictive pathway. These findings suggest that the effect that both the social norms intervention and the planning task exerted on participants' intentions to reduce their SSB consumption (assessed at follow-up) were mediated by the effects that each of these interventions produced on attitudes toward SSB consumption.

Similar mediation analyses also demonstrated that subjective norms significantly mediated both the effect of the social norms information ($b = .44$, $SE = .23$, 95% CI [0.08, 1.04]) and, separately, the effect of the planning task ($b = .80$, $SE = .29$, 95% CI [0.34, 1.49]) on participants' follow-up SSB reduction intentions (See figure 4). Also, perceived behavioral control was a significant mediator of the effect of the norms manipulation on follow-up intentions to alter SSB consumption, $b = .77$, $SE = .32$, 95% CI [0.23, 1.46] (See Figure 5).

Preparations to alter consumption. The ANOVA performed on the index of behaviors indicative of preparations to alter SSB consumption demonstrated, as predicted, a significant main effect for risks information condition, $F(1, 361) = 11.26$, $p < .001$, $\eta_p^2 = .03$. The pattern of the effect showed that participants who read the SSB risks information reported more frequently engaging in preparatory behaviors ($M = 12.16$, $SE = .43$) than did those who did not receive this information ($M = 10.11$, $SE = .44$). Contrary to expectations the social norms intervention and the planning task intervention main effects were not significant ($ps > .113$). Also, there were no significant interactions ($ps = .334$). However, the preparatory index scores of those in the condition that received all three interventions were significantly higher than those in all other conditions combined, $t(361) = 2.43$, $p = .015$, $\eta_p^2 = .02$.

Given that the risks information affected both participants' initial intentions and their preparatory behaviors, initial intentions were examined as a possible mediator between risks information and preparations to alter SSB consumption. However, the results demonstrated that initial intentions did not significantly mediate the effect of the risks information intervention on preparations to alter SSB consumption, $b = .02$, $SE = .01$, 95% CI [-0.03, 0.46].

SSB consumption. As one would expect, participants who reported consuming more SSBs at baseline continued to report greater SSB consumption at follow-up ($p < .001$). More interesting, there was a significant main effect for planning condition, $F(1, 360) = 4.04$, $p = .$

045, $\eta_p^2 = .011$. That is, the participants who completed the SSB planning task reported significantly lower SSB consumption at follow-up ($M = 12.02$, $SE = 1.07$) than did participants who completed the control planning task ($M = 15.09$, $SE = 1.08$). However, no other main effects or interactions were significant ($ps \geq .230$). Also, contrary to the hypothesis, the results demonstrated no significant differences in SSB consumption between those participants in the condition that received all three interventions and those in all the other conditions combined, $t(360) = -.39$, $p = .698$, $\eta_p^2 = .00$.

Finally, there was no evidence that either perceived behavioral control ($b = -.27$, $SE = .29$, 95% CI $[-1.12, 0.12]$) or initial SSB reduction intentions ($b = -.57$, $SE = .37$, 95% CI $[-1.54, 0.01]$) significantly mediated the effects of the planning intervention on participants' subsequent SSB consumption.

Discussion

This appears to be only the second study to develop and experimentally examine the efficacy of three separate interventions based on each of the three primary components of the TPB. Further this is the first to do so in the context of SSB consumption, and the first to examine the relative efficacy of combining interventions informed by each of the primary components of the theory versus interventions based on just one or two of the components. Each of the interventions developed for this experiment demonstrated significant promise for motivating reductions in SSB consumption. The TPB posits that the most proximal determinant of a change in a particular health behavior is the *intention* to alter that behavior. In this experiment, each of the interventions immediately resulted in greater intentions to reduce SSB consumption in the future, and participants in the condition that received all three interventions expressed the greatest SSB reduction intentions. Further, the higher SSB reduction intentions produced by the interventions persisted, at least through the two-week follow-up.

The fact that the three interventions resulted in greater intentions to reduce SSB consumption is consistent with previous literature that manipulated only one or two of the TPB components (e.g., Adams et al., 2014; Bleakley et al., 2015; Crocker, Whitaker, Cooke, & Wardle, 2009; Kothe & Mullan, 2014; Kothe et al., 2012; Rosas et al., 2017). There is only one other study that attempted to separately manipulate all three constructs of the TPB (Sniehotta, 2009). Contrary to the findings of the present experiment which demonstrated that all three interventions significantly impacted intentions to alter behavior, in the Sniehotta (2009) experiment only the normative belief intervention increased college students' intentions to engage in physical activity. There are a number of possible reasons for the greater efficacy of the risks information intervention and the planning task in this experiment relative to the analogous manipulations utilized by Sniehotta (2009). For example, in this study efforts were made to enhance the risks information by adding the sugar task and information about how to make healthier beverage options more palatable. In addition, the planning task utilized in this study required the participants to actually come up with an action plan and think about how they could avoid temptations, and thus may have been more involving and engaging than the written information utilized by Sniehotta (2009).

It is, of course, also possible that the differences in intervention efficacy between our study and Sniehotta's (2009) may be due to differences in the nature of the particular behaviors (physical activity vs. SSB consumption) and/or the complexity/energy investment in changing them.

In addition to producing changes in SSB consumption intentions, both the SSB risks information intervention and the planning intervention produced some promising effects on measures of behavior. For example, when offered a free beverage, fewer participants who received the risks information selected an SSB (22.1%) in comparison to those who received the control information (35.2%). Also, those participants who received all three interventions were significantly less likely to take an SSB drink than those in the other seven conditions who received two or fewer interventions.

The risks information intervention also demonstrated promising effects at the two-week surprise follow-up, with those who received the risks information reporting more behaviors indicative of preparations to alter their SSB consumption (e.g., reading drink labels checking for sugar content) than did the control group. Also, those participants who received all three interventions reported the highest preparatory behaviors compared to those in the other seven conditions combined. Furthermore, those who engaged in the SSB planning task during the initial experimental session in the lab reported significantly lower SSB consumption 2-weeks later than did those who completed the control planning task. In addition, the fact that the planning task was the only intervention in the present experiment that resulted in significantly lower reported SSB consumption is consistent with the results of the only previous experiment that tested the efficacy of interventions based on all three TPB constructs (Sniehotta, 2009). That is, Sniehotta (2009) found that the control beliefs (PBC) intervention was the only one to actually change participants' physical activity levels.

Theoretical Implications

This experiment also provides some information regarding the mechanisms through which the three interventions impacted intentions and behavior. Based on the TPB, the interventions utilized in this experiment were expected to be effective for altering SSB consumption intentions and behavior to the extent that they had a positive impact on participants' SSB-related attitudes, subjective norms, and perceived behavioral control. The results demonstrated that, although the risks information intervention did not significantly affect any of the TPB constructs, consistent with the results of Sniehotta (2009), the social norms intervention had a beneficial effect on all three of the TPB constructs and the planning task positively impacted both SSB-related attitudes and subjective norms. Also, the condition in which participants received all three interventions produced more positive attitudes, perceived subjective norms, and perceived behavioral control than all other conditions. Although we had not a priori predicted whether the intervention effects would be additive for these three constructs, this result is compatible with the TPB which includes the assumption that changes in one of the cognitions can affect the others (see Fishbein & Ajzen, 2010, pg. 337).

Further, there was a good deal of evidence that the TPB constructs mediated the obtained intervention effects on participants' intentions to reduce their SSB consumption assessed at

2-week follow-up. Specifically, attitudes about lower SSB consumption, perceived subjective norms, and perceived behavioral control each significantly mediated the effects of the social norms intervention on follow-up intentions. Also, the effect of the planning task on follow-up intentions was significantly mediated by both attitudes and subjective norms. However, in contrast to the extensive evidence of the mechanisms through which the interventions impacted SSB reduction intentions (assessed at follow-up), there was no evidence that the effect of the risks intervention on preparatory behaviors, or the effect of the planning task on reported SSB consumption, were mediated by participants' attitudes, perceived subjective norms, perceived behavioral control, or immediate intentions. Of course, null results are always difficult to interpret and the failure of the measures of the TPB constructs to mediate the effects of the interventions on behavior could be due to flaws in the measures of the constructs and behavior as well as other issues (see Fishbein & Ajzen, 2010). However, it should be noted that the only other published experiment that utilized a full factorial design to examine the efficacy of interventions based on the primary TPB components also failed to find any evidence that the effects of the message designed to impact PBC was mediated by any of the TPB cognitions (Sniehotta, 2009).

Practical Implications

Regardless of the mechanisms through which the interventions affected behavior, if the results of this experiment are replicated, and the effects are demonstrated to be lasting, these interventions have the potential to make important public health contributions. The risks information and the social norms interventions are both primarily written and together required only 6 minutes to administer. Thus, these interventions could be easily disseminated widely in a variety of settings (e.g., healthcare, community, and academic settings). It is possible that even the key message of the sugar task could be incorporated into the written information by including pictures of various sized drinks (cups or bottles) filled with sugar (or sugar cubes) to show the proportion of typical SSBs that consist of sugar.

In addition, perhaps the action planning to reduce SSB consumption and the personalized normative information could be disseminated through smart phone applications. There are already many applications that help individuals to track a variety of health-related behaviors (e.g., sleeping, walking and exercise, caloric intake). Incorporating a beverage intake app may assist individuals to notice their beverage consumption patterns, and the app could also include encouragement/prompts to make action plans and plans to resist temptations. Also, corrected normative feedback could perhaps be conveyed through an interactive app where people answer questions about their perceived norms regarding SSB consumption and then the next screen displays their answer(s) compared to the true descriptive and injunctive norms of a referent group.

Methodological/interpretive issues

This study had a number of methodological strengths including the full factorial manipulation of interventions based on the three TPB constructs and the fact that several demographic variables and baseline SSB consumption were assessed to ensure that the random assignment was effective. Also, this experiment went beyond the assessment of immediate intentions by including a behavioral measure and by assessing reported SSB

consumption at a two-week follow-up. Further the measure of SSB consumption at follow up was perhaps better than much of the previous work, in that it consisted of a drink frequency measure (similar to a food frequency measure) rather than more general questions about whether participants had decreased their SSB consumption. In addition, the experimenters who conducted the two-week follow-up were blind to condition, making experimenter expectancy an unlikely explanation for the findings. Furthermore, participants were not aware in advance that a follow-up would occur, thus rendering it implausible that they altered their SSB consumption practices in anticipation of the follow-up.

The experiment also had some methodological limitations. First, the sample was largely female, generally between the ages of 18 to 25 years, and consisted exclusively of college students, which raises the question of whether these findings would generalize to males, older or younger individuals, and individuals who do not have a college education. However, efforts were made to increase the generalizability of the study by recruiting participants from two college campuses that vary considerably in ethnic composition. Moreover, college students may be a particularly appropriate population for SSB reduction interventions given that college students are heavy SSB consumers (Huffman & West, 2007; West et al., 2006) who often intentionally infuse sugar and caffeine to cope with long hours of studying. Also, the college years are often a time when individuals are making independent health behavior choices for the first time in their lives, and many lifelong health habits are being established (Downes, 2015; Hubert, Eaker, Garrison, & Castelli, 1987). Another limitation of this experiment is that there was only one follow-up, thus we do not know if the obtained effects would last beyond the two-weeks. It also should be mentioned that this study only assessed one day's worth of self-reported beverage consumption, at both baseline and follow-up. Multiple day beverage calendars might produce more reliable and valid assessments of SSB consumption, as would a beverage consumption tracking app that might include uploading a picture of each beverage consumed. Finally, 60 participants were not reached at follow-up, raising concerns that those who did not complete the follow-up may have been systematically different from those who did. However, generally those who were not reached at follow-up were equally distributed across conditions ($p > .80$), and the comparison of baseline measures and demographics of those who did and those who did not complete the follow-up showed no differences.

Conclusions

The TPB has received extensive research attention since it was first proposed nearly 30 years ago (Ajzen, 1991), and yet this is only the second experiment in any health context that has examined the effects of interventions based on all three of the primary constructs associated with the TPB in a full factorial design. Further, this is the first experiment to examine the impact of the *combined effects* of interventions informed by all three components. Thus, the present experiment makes a significant contribution to the literature seeking to determine the utility of the TPB for altering health risk behaviors. Nevertheless, there is obviously a need for more research examining the independent and combined effects of efforts to manipulate attitudes, subjective norms, and PBC in a variety of health risk contexts. It will also be important for future work to more fully explore the mechanisms through which such interventions impact intentions and behavior, and to determine the longevity of the effects.

In addition to theoretical contributions, the research reported here has identified three interventions that, separately and in conjunction, showed promise for altering SSB consumption intentions and behavior. The interventions are also relatively brief and inexpensive and could likely be developed into large-scale community-based interventions. Given accumulating evidence of the health risks of sugar consumption, and the fact that consumption of sugary beverages with little to no nutritional content has doubled across all age groups over the last 30 years (Brownell et al., 2009), these interventions have the potential to lead to meaningful public health benefits.

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Figure 1. Intentions scores to reduce sugar-sweetened beverage consumption as a function of the information intervention and the social norms intervention. *Note.* $p = .024$. Standard errors are represented by the error bars attached to each line.

Figure 2.

Percentage of participants who selected a sugar sweetened soda, when offered a free beverage, as a function of information conditions.

Figure 3. Coefficients for mediation analyses examining attitudes as mediator between social norms, and separately planning intervention, and follow-up intentions. *Note.* β represents unstandardized regression coefficients.

Figure 4.

Coefficients for mediation analyses examining subjective norms as mediator between social norms, and separately planning intervention, and follow-up intentions. *Note.* β represents unstandardized regression coefficients.

Figure 5.

Coefficients for mediation analysis examining perceived behavioral control as a mediator between social norms, and follow-up intentions. *Note.* β represents unstandardized regression coefficients.

Table 1.

Baseline and demographic characteristics as a function of location.

Characteristic	CSU San Marcos (N = 206)	UC San Diego (N = 224)	Combined (N = 430)
Gender			
% Male	24.3%	29.6%	27.1%
% Female	75.2%	70.4%	72.9%
% Did not Answer	0.5%	0.4%	0.5%
Year in College			
% Freshman	30.6%	18.3%	24.2%
% Sophomore	23.8%	21.9%	22.8%
% Junior	37.4%	25.9%	31.4%
% Senior	7.3%	33.0%	20.7%
% Other	1.0%	0.9%	0.9%
Ethnicity			
% Asian	7.3%	37.5%	23.0%
% Pacific Islander	1.0%	0.0%	0.5%
% African-American	3.4%	1.8%	2.6%
% Hispanic	31.1%	20.1%	25.3%
% Caucasian	39.8%	21.0%	30.0%
% Mixed	17.5%	17.9%	17.7%
% Other	0.0%	1.8%	0.9%
Age Range	18–53	18–31	18–53
Mean (SE) years	20.43 (0.29)	20.50 (0.14)	20.47 (0.16)
Baseline SSBs Range	0–98	0–128	0–128
Mean (SE) ounces	19.74 (1.17)	15.63 (1.02)	17.59 (0.78)

Table 2.

Means (and Standard Errors) for Initial and Follow-Up Outcome Measures as a Function of Condition.

Measure	Information							
	Control				Risks			
	No Norms		SSB Norms		No Norms		SSB Norms	
	Control Planning	SSB Planning	Control Planning	SSB Planning	Control Planning	SSB Planning	Control Planning	SSB Planning
Attitudes								
n	53	53	56	49	50	58	54	52
M	89.85	93.66	93.91	96.71	91.62	92.36	94.06	99.02
SE	(1.91)	(1.91)	(1.86)	(1.99)	(1.97)	(1.83)	(1.89)	(1.93)
Subjective Norms								
n	53	51	51	48	48	56	53	51
M	65.75	70.37	69.75	74.25	64.65	69.48	72.79	73.43
SE	(1.70)	(1.73)	(1.73)	(1.78)	(1.78)	(1.65)	(1.70)	(1.73)
Perceived Behavioral Control								
n	53	52	56	49	51	58	55	53
M	41.79	47.69	44.75	46.10	45.51	46.40	44.91	48.58
SE	(1.28)	(1.29)	(1.24)	(1.33)	(1.30)	(1.22)	(1.25)	(1.28)
Initial Intentions								
n	54	53	57	49	51	57	54	53
M	36.82	43.01	38.97	41.66	39.77	41.04	44.22	43.15
SE	(1.32)	(1.33)	(1.28)	(1.38)	(1.36)	(1.28)	(1.31)	(1.33)
% Took SSB								
n	37	32	27	27	31	36	28	34
M	.38	.25	.41	.37	.29	.33	.14	.12
SE	(.07)	(.08)	(.09)	(.09)	(.08)	(.08)	(.09)	(.08)
Follow-up Intentions								
n	46	44	49	42	46	47	49	47
M	36.15	42.40	39.29	41.37	39.60	41.55	43.71	43.65
SE	(1.40)	(1.43)	(1.35)	(1.46)	(1.40)	(1.38)	(1.35)	(1.38)
Preparation Behaviors								
n	46	44	49	41	46	47	49	47
M	8.88	10.42	11.01	10.22	11.29	12.01	12.14	13.07
SE	(0.86)	(0.88)	(0.84)	(0.91)	(0.86)	(0.85)	(0.84)	(0.85)
SSB consumption								
n	46	44	49	42	45	47	49	47
M	18.58	13.23	12.39	11.85	12.90	13.96	11.84	13.71
SE	(2.15)	(2.20)	(2.09)	(2.26)	(2.18)	(2.13)	(2.09)	(2.13)

Note. Condition *ns* for the Took SSB measure reflect only those *Ps* who took a beverage. The sugar-sweetened beverage (SSB) consumption condition means are adjusted for baseline SSB consumption.