

UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Healthy Beverage Initiative (HBI) Institutional Responsibility: Sugar-Sweetened Beverages: Factors that Influence Motivation and Consumption, Correlates, and Interventions among University Students Ashley Lee, David Yu, Josh Whang, Qian

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PSYC 321

Food, Wellbeing

April 30, 2018

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ABSTRACT

The consumption of sugar-sweetened beverages (SSBs) has been linked to negative consequences such as obesity, type II diabetes, elevated blood pressure, and coronary heart disease (5). Moreover, young adults consume the most SSBs compared to any other age group (3). These negative consequences and the high rates of SSB consumption among young adults show the need for interventions targeted at reducing SSB consumption. In order to facilitate these interventions, this study sought to examine what factors influence university students' motivation and consumption of SSB. We distributed an online survey to 105 undergraduate students from the University of British Columbia (UBC) through social media platforms and in-person administration. Results demonstrate that seventy-eight students indicated *taste* as their primary motivator for SSB consumption while fourteen students indicated *convenience/ease of access*. Few students chose *caffeine* (n=4), *nutritional content* (n=2), and *price* (n=2) as their primary motivator. Moreover, students who consumed SSBs primarily for the taste had the highest levels of SSB consumption compared to any other condition. Correlates were also observed and there was a significant positive relationship between stress level and SSB consumption, a significant negative relationship between sleep duration and SSB consumption, and a nonsignificant relationship between perceived ill effects of SSB consumption and SSB consumption.

INTRODUCTION

Excess weight and obesity in all age groups continue to be at high levels in Canada with 62% of Canadians having excess weight or obesity (15). The transition to college appears to be a challenging period and reducing additional weight gain during these years can be an important tool for fighting against the increasing obesity rates in Canada (8, 18). One major determinant of weight gain among young adults is the consumption of sugar sweetened beverages (3). Young adults consume the most calories from sugar sweetened beverages (SBBs) of any age (330 calories a day on average) and approximately 15% of total daily calorie intake of Canadian adults comes from sugar (3). This exceeds the 2015 WHO recommendation to limit free sugar consumption to 10% of total energy intake to reduce the risk of overweight, obesity, and tooth decay (20). Based on a 2000 calorie diet, 10% of total energy intake equates to 50 grams of free sugar and a single can (250 mL) of sugar sweetened soda can contain up to 40 grams (20). With the consumption of foods like fruits and honey, people can easily exceed this 10% limitation.

SSB consumption is an issue that requires a lot of attention; evidence that supports the relationship between SSB consumption and negative health outcomes is growing. A meta-analysis of 88 studies reported there was a clear and consistent correlation between SSB consumption and increased caloric intake (17). Many studies have found evidence supporting the relationship between body weight and intake of SSBs in both children and adults (9, 10, 11, 17). Besides its association with excess weight, SSB consumption has been associated with decreased dietary nutrients, elevated blood pressure, increased coronary heart disease, and increased risk of type 2 diabetes (5). The prevalence of SSB consumption among young adults and the relationship between SSB consumption and negative health outcomes show the need for successful interventions to reduce SSB consumption among college students.

RESEARCH QUESTION AND HYPOTHESIS

This current study seeks to investigate this question: what factors influence university students' motivation and consumption of sugar sweetened beverages? Our study defines SSB as pre-packaged beverages that include any form of sugar added during the manufacturing process. We hypothesize: (1) the highest level of SSB consumption will occur in the group that chooses taste as primary motivator for SSB consumption; (2) taste will be the primary motivator for SSB consumption followed by price, caffeine, convenience, and nutritional content; (3) a positive correlation between stress level and SSB consumption; and (4) a negative correlation between sleep duration, perceived ill effects of SSB and SSB consumption. Our first and third hypotheses are motivated by the finding from a study that demonstrated that sugar consumption may activate a metabolic negative feedback pathway, which may shut off stress responses and reinforce habitual sugar overconsumption (16). This means that one craves sugar to reduce stress responses in the brain.

The order of the second hypothesis is influenced by several studies. First, two studies found that among college students, taste and price were the most important factors in choosing beverages but price was secondary to taste (1, 2). Therefore, we place taste before price. Next, research has found that through its dependency effects, the addition of low concentration of caffeine can significantly increase consumption of SSB (7). However, a report demonstrated that in young adults, most caffeine is consumed through coffee so we hypothesize that caffeine would come in third (13). Convenience is placed fourth because a study conducted on students from a private university in Bangladesh found that only 8% of students chose convenience as the primary motivator for SSB consumption (1). We anticipate that nutritional content will be the

least popular motivator because a study conducted on 250 students at the University of Cambridge found that the perceptions of risk of SSB was not correlated to consumption (19). Our fourth hypothesis is motivated by a study by which found that short sleep duration is associated with greater intake of SSBs (12).

METHODS

Participants:

Our study engaged 105 participants, all of whom are undergraduate students at UBC. Of these, 6 students indicated that they do not drink SSBs. There were 39 third year students, 34 fourth year students, 16 second year students, 9 students who are fifth year and above, and 7 first year students. We had 48 female participants, 53 males participants, 3 participants who prefer not to reveal their gender, and 1 participant who stated that their gender was not listed.

Conditions

In order to test our second hypothesis about the main motivators for SSB consumption, we asked, “Why do you drink SSBs?” and listed 5 options (taste, nutritional content, price, convenience, and caffeine; *independent variables*). Other questions about sleep duration (“How many hours of sleep do you get?”), stress level (“Rate your stress level on a scale of 1-5”), and perceived ill effects of SSB consumption (“In your opinion, how often do you think people need to drink SSB for it to cause ill health?”) were asked in an effort to find correlations of variables to SSB consumption. Demographic questions about gender and year level were asked in the form of multiple choice. The survey also included asking students to indicate their level of support for specific interventions targeted at reducing SSB consumption (see *figure 1* in results section for interventions). Participants indicated their support using a 1-5 Likert Scale that ranged from “extremely supportive” to “extremely unsupportive.”

Measures

In the form of multiple choice question, the survey asked about “how often” SSB was consumed (ranging from never to 2 times per day) and “how much” was consumed (ranging from 250 mL to 1L). They were asked to determine the SSB consumption level (*dependent variable*). SSB consumption (mL/day) was calculated by converting “how often” into units per day and then multiplying it by “how much” in mL. See Appendix B for specific conversions.

Procedure

We posted the survey link on Facebook groups (Class of 2021, 2020, 2019), sent survey links to our friends, and encouraged our friends to share with their UBC schoolmates. Our link was also posted on the announcements page of our course (PSYC 321). Data was also collected in-person (via online survey) by members of our team who reached out to students in the Nest, Irving Barber Library, and the Kenny Building. Researchers stood away from participants in order to reduce the impact of Hawthorne Effect. Participants read a consent form before completing survey, which consisted of 14 questions. At the start of the survey, SSB was defined and common SSBs were listed. Data collection took place from March 1st –March 15th 2018.

RESULTS

There was a statistically significant difference ($p < 0.05$) in mean SSB consumption between the groups as determined by one-way ANOVA ($F(4,94) = 2.66, p = 0.0375$). Therefore,

the null hypothesis ($\mu_{\text{taste}} = \mu_{\text{nutritional content}} = \mu_{\text{convenience}} = \mu_{\text{price}} = \mu_{\text{caffeine}}$) was rejected. See *figure 1E* in Appendix E for the mean SSB consumption and standard deviation in each condition. Since, nutritional content (n=4), price (n=2), and caffeine (n=2) conditions had small sample sizes, this study focused only on the taste (n=78) and convenience (n=13) conditions to perform the post hoc tukey test. This test revealed that SSB consumption is statistically significantly lower in the convenience condition compared to the taste condition ($p < 0.05$). There was also a statistically significant negative relationship between SSB consumption and sleep duration ($r = -0.477$; $p < 0.05$), a significant positive relationship between SSB consumption and stress level ($r = 0.566$; $p < 0.05$), and a significant negative relationship between sleep duration and stress level ($r = -0.507$; $p < 0.05$), and a non-significant negative relationship between perceived ill effects of SSB consumption and SSB consumption ($r = -0.013$; $p > 0.05$).

Our result demonstrate that our first hypothesis that the highest level of consumption will occur in the group that chooses taste as primary motivator was supported. The post hoc tukey test revealed that SSB consumption is significantly lower in the convenience condition compared to the taste condition ($p < 0.05$). Our second hypothesis that taste will be the primary motivator for SSB consumption followed by price, caffeine, convenience/ease of access, and then nutritional content was partly supported. As seen in the ANOVA table (see *figure 1E*), the primary motivator was taste (n=78), followed by convenience/ease of access (n=13), nutritional content (n=4), and tie between price (n=2) and caffeine (n=2). Our third hypothesis was supported as there was a significant positive correlation between SSB consumption and stress. And our fourth hypothesis that there was a negative correlation between sleep duration and perceived ill effects of SSB and SSB consumption was partly supported. Although there was a significant negative correlation between sleep duration and SSB consumption, there was a non-significant correlation between knowledge about health impacts of SSB and SSB consumption.

Although not in the hypothesis, we examined the support students had for different interventions (see *figure 1* for interventions). There was a statistically significant difference ($p < 0.05$) in mean support between these six interventions as determined by one-way ANOVA ($F(5,623) = 2.23$, $p = 0$). The post hoc tukey test revealed for mean support of interventions was in decreasing order: $\mu_{\text{intervention 3}} > \mu_{\text{intervention 5}} > \mu_{\text{intervention 4}} > \mu_{\text{intervention 1}} > \mu_{\text{intervention 2}} = \mu_{\text{intervention 6}}$. The test revealed a significant difference between interventions 1, 3, 4, and 5 ($p < 0.05$) and a non-significant difference between intervention 2 and 6 ($p = 0.99$). Please see *figure 4E* in Appendix E for mean support and standard deviation for each intervention.

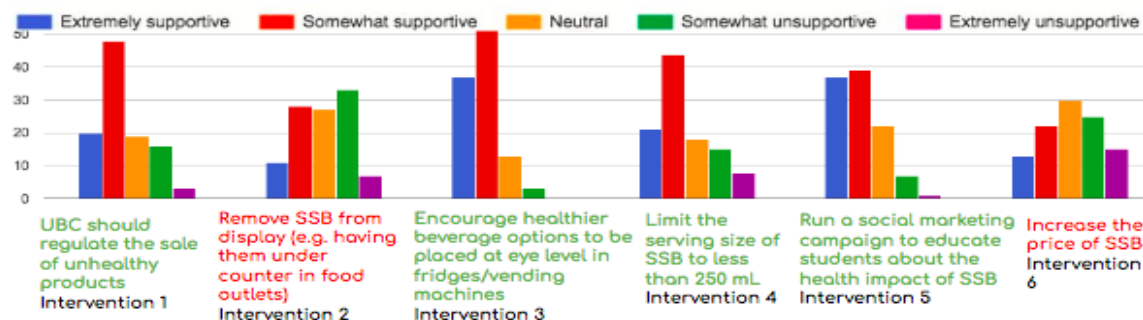


Figure 1: Student support for the six interventions. Green text represents the top 4 interventions that were supported. The red text represents the 2 interventions that were the least supported.

DISCUSSION

The prevalence of SSB consumption among UBC students is apparent as only 6 out of 105 students indicated that they did not drink SSB. This is not surprising given that sugar

consumption is the greatest in young adults than any other age group (3). The results indicate that the primary motivators for these 99 students were taste and convenience but convenience was secondary to taste. Moreover, the group of students that drank SSB primarily for the taste had the highest consumption levels. Stress could be the underlying mechanism as to why students drink SSBs as sugar activates pleasure centers of the brain, reduces the stress hormone cortisol (16), and increases habitual overconsumption (16). Future studies should look at whether students are willing to switch over to drinks that are sweetened by 0 calories sweeteners (ex. stevia, swerve, aspartame) and if these drinks also reduce stress responses in the same way sugar does. Other studies can also examine what is it about the taste that drives students to consume SSBs (ex. fizziness, sugary taste, refreshing...etc.).

Convenience/ease of access was the second most popular factor in choosing SSB and this can be due to a variety of reasons. One explanation is that although water can be accessed for free at drinking fountains, students need to carry around a water bottle in order to sip water throughout the day. SSBs come in cans or plastic bottles, which makes it more convenient as they can be easily thrown away after consumed. Second, convenience could also refer to the close proximity of sugary drink vendors on campus. SSBs is easily accessible in residence cafeterias, vendors in the Nest, and vending machines scattered throughout the campus. Another convenience could be that many restaurants on the UBC campus such as the Nest (ex. Emporium Noodle, Iwana Taco, Pie R² Pizza) and the Village (ex. My Home Cuisine, Black Pearl) all offer set deals where students can get a pop or bubble tea with a meal. The reduced price and convenience can demotivate students from combining their meals with alternative healthier drinks like milk or tea. Further studies can examine what makes SSBs so convenient to students (ex. Is it the set deals, the prevalence of vending machines, hassle of carrying a bottle...etc.?)

Nutritional content, price, and caffeine were not popular reasons. As mentioned in the introduction, we hypothesized that nutritional content and caffeine would not be popular reasons due to past research. However, it was unexpected that price would be one of the least chosen motivators. Price may have been a non-popular factor in choosing SSB because bottled waters cost similar to a 375mL can of SSB (2). In fact, college students reported that given the similar price of water and SSB, they would choose SSB because they would want more flavor (2).

The significant positive correlation between stress and SSB consumption supports the possibility that stress can motivate students to choose SSB over non-sweet drinks. To have better insight to the direction of this relationship, future studies can include questions that ask students about their mood and/or stress level after SSB consumption (How do you feel after drinking SSBs?) or questions that directly ask if they believe that sugar helps them feel less stressed. Moreover, the significant positive correlation of stress and sleep indicates that sleep, stress, and SSB consumption may be interrelated. In fact, one study showed that inadequate sleep increases cortisol levels (stress) and makes people inclined to crave sugar (6). The third correlation we looked at was between SSB consumption and perceived ill effects of its consumption. There was a nonsignificant correlation which demonstrates that knowledge about health impacts has limited influence of consumption. One study that interviewed students reported that most students "cited their youth as a factor in their disregard for potential health dangers of sugar-sweetened beverage consumption" (2). Future studies can examine whether students have accurate perceptions of the ill effects of SSB consumption. Our study also examined 6 interventions for reducing SSB consumption and specific recommendations will be outlined in the next section.

As with all studies, our study is not without limitations. One limitation was the small sample size in the taste, nutritional content, and caffeine conditions so we could not compare all

groups on SSB consumption level. Another limitation is that we provided students with only 5 motivators to choose from when asking why they consumed SSB. There may have been other motivators that we failed to examine. Also, to measure SSB consumption levels, we used retrospective questions regarding “how often” and “how much” they consumed. It cannot be guaranteed that their reported SSB consumption levels are accurate. Moreover, we cannot determine a causal relationship between SSB consumption and sleep duration as well as stress level; future studies can create an experimental design to examine these effects. Other limitations include that it was conducted only on undergraduate students in UBC and they were conveniently sampled so it may not be representative of the UBC community at large. Nevertheless, our study provides important insight on what drives SSB consumption in young adults and correlates of SSB consumption such as stress and sleep level, which can facilitate success of interventions designed to decrease college students’ consumption of SSB.

RECOMMENDATIONS

Our results demonstrate that many students support UBC regulating unhealthy products (see figure 1 and *figure 4E*). Our study found that the intervention that was most supported was placing healthier beverage options at eye levels in stores and vending machines. We recommend that our clients work with cafeterias on campus to design the layout of drinks displayed so that more healthier drinks (naturally sweetened smoothies, milk, sparkling water...etc.) are placed at eye level. And if feasible, UBC should monitor the number of SSBs in vending machines and include healthier drinks such as naturally sweetened drinks and place these at eye level. In fact, one study found a significant positive association between availability of SSBs in vending machines and its consumption (14). The second most popular intervention was running a social marketing campaign to educate students about health impacts. Our results showed that perceived ill effects of SSB consumption and SSB consumption did not correlate. A possible explanation for this is that student believe that they are not vulnerable or immune to these ill effects because they are still young (2). We recommend that our clients work with UBC Communications to create campaigns that inform college students that all age groups are vulnerable to the negative consequences of SSB consumption. One study found that to reduce high SSB intake, students felt that intervention using shocking visual images would be most effective (2).

The third most supported intervention was the limiting serving size of SSB to less than 250 mL. We recommend that cafeterias and vendors on campus get rid of SSBs larger than 375mL (a regular can size) so that portion sizes are reduced. Majority of students were not supportive of removing SSBs from view or increasing the price (see figure 1 and *figure 4E*); therefore, these interventions are not recommended. Also, many students reported that price was not a primary motivator and this could be possibly be due to bottled water and SSBs (375 mL) having similar prices. Reducing the cost of bottled water may incentivize students to choose water as SSBs will be comparatively more expensive.

Our results also show the interrelatedness of sleep, stress, and SSB consumption. We recommend interventions that aim to increase sleep and reduce stress in students. For example, educational campaigns can include tips on how to get a good sleep or how to cope with stress. Since taste was the primary factor for SSB consumption in 74% of our sample, we recommend introduction of drinks sweetened with 0 calorie sweeteners. Convenience was also a common motivator for SSB consumption and we recommend that there should be a reduction in the number of SSBs sold on campus. For example, SSBs can be eliminated from cafeterias and cafes/restaurants where students can use their UBC flex dollars or meal plans.

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Why do you drink sugar sweetened beverages? *

- Taste
- Nutritional content (minerals/vitamins)
- Price
- Convenience/easy of access
- Caffeine

Condition 1: Motivators (conditions) for SSB Consumption. Mean SSB consumption levels and number of students in each condition were examined.

In your opinion, how often do you think people need to drink sugar-sweetened beverages for it to cause ill health?

- 1-2 times per month
- 1-2 per week
- 1 time per day
- 2 times per day
- 3 times per day
- I don't believe it causes ill health

Condition 2: Question asked to examine perceived ill effects of SSB Consumption. SSB consumption and perceived ill effects of SSB consumption were correlated. The perceived ill effects answer choices were converted to per day. Therefore, 1-2/month was coded as 1.5/30 (0.05), 1-2/week as 1.5/7 (0.214), 1/day as 1, 2/day as 2, 3/day as 3, and I don't believe it causes ill health as 0.

How many hours of sleep do you get per day? *

- Less than 5 hours of sleep
- 5-6 hours of sleep
- 7-8 hours of sleep
- more than 8 hours of sleep

Condition 3: Question asked to examine sleep duration. SSB consumption and sleep duration were correlated. For the ranges, 5-6 hours of sleep was coded as 5.5 hours and 7-8 hours of sleep was coded as 7.5 hours.

Rate your current stress level of scale of 1-5 *

1 2 3 4 5

Low Stress High Stress

Condition 4: Question asked to measure stress level. Stress level was correlated with SSB consumption level.

APPENDIX B: MEASURES

Please indicate how often you drank sugar sweetened beverage in the past month *

- Never 0
- 1 time/week 1/7
- 2-3 times/week 2.5/7
- 4-6 times/week 5/7
- 1 time/day 1
- 2 times/day 2

Please indicate the approximate amount of sugar sweetened beverage you drank each time *

- 250 mL (a standard size glass) 250 mL
- 250-400 mL (a regular can of soft drink is 375 mL) 375 mL
- 400-800mL (a regular soft bottle drink if 600 mL) 600 mL
- 800mL-1000mL 900 mL
- 1 Litre bottle 1000 mL

SSB Consumption=

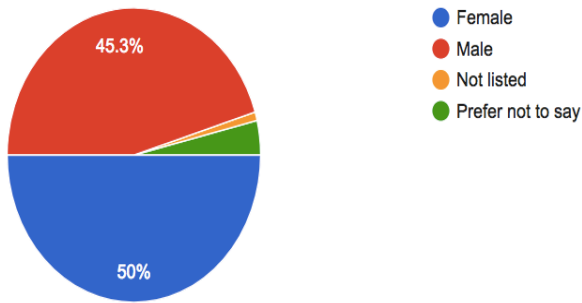
"How often" (in units of per day) x "how much" (in units of mL)

APPENDIX C: DEMOGRAPHIC QUESTIONS AND DEMOGRAPHIC FIGURES

What is the gender you identify with? *

- Female
- Male
- Not listed
- Prefer not to say

Demographic Question 1: Gender

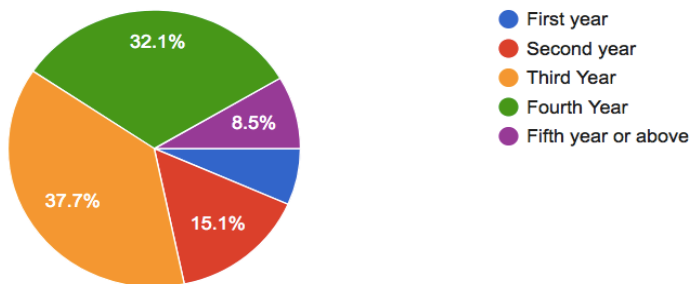


Demographic Figure 1: Gender

What year are you in? *

- First year
- Second year
- Third Year
- Fourth Year
- Fifth year or above

Demographic Question 2: Year Level



Demographic Figure 2: Year Level

APPENDIX D: INTERVENTIONS

Please indicate how supportive or unsupportive you would be of the of the following measures on campus

	Extremely supportive	Somewhat supportive	Neutral	Somewhat unsupportive	Extremely unsupportive
UBC should regulate the sale of unhealthy products on its campuses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remove sugar-sweetened beverages from display (e.g. having them under counter in food outlets)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Encourage healthier beverage options to be placed at eye level in fridges and vending machines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
limit the serving size of sugar-sweetened beverages to less than 250 mL in all outlets and machines on campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Run a social marketing campaign to educate staff and students about the health impact of sugar-sweetened beverages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increase the price of sugar-sweetened beverages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX E: FINDINGS

SUMMARY				
Groups	Count	Sum	Average	Variance
Taste	78	17516.07143	224.5650183	105721.6726
Nutritional content	4	776.7857143	194.1964286	15857.51488
Ease of access	13	1946.428571	149.7252747	16583.67674
Price	2	107.1428571	53.57142857	0
Caffeine	2	1853.571429	926.7857143	1525006.378

Figure 1E: Summary table on the conditions, the number of students in each condition, average SSB consumption, and variance.

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1121196.963	4	280299.2408	2.658164351	0.03752165621	2.468533034
Within Groups	9912151.831	94	105448.4237			
Total	11033348.79	98				

Figure 2E: One way ANOVA single factor summary table with F critical, df , and p -value. There is a significant difference between the conditions ($p < 0.05$).

Correlations (r)	Categories	t-value	p value
-0.477009608	Hours of sleep and SSB Consumption	-5.50816858	2.68247E-07
0.566413522	Stress level and SSB Consumption	6.975272019	3.02032E-10
-0.506639582	Stress level and Sleep hours	-5.963907392	3.49907E-08
-0.012846231	Belief about ill effects of SSB and SSB Consumption	-0.130385763	0.896515539

Figure 3E: Correlations, t -values, p -values and their corresponding categories. All correlations significant except for belief about ill effects of SSB and SSB consumption ($p = 0.8965$).

SUMMARY				
Groups	Count	Sum	Average	Variance
I1	105	381	3.628571429	1.101098901
I2	105	317	3.019047619	1.268864469
I3	105	437	4.161904762	0.5600732601
I4	105	371	3.533333333	1.385897436
I5	105	421	4.00952381	0.8364468864
I6	105	303	2.913461538	1.497292756

Figure 4E: Summary table of the 6 interventions indicating the number of students who voted (count), the sum of the support, the average support, and variance for each intervention. (I1= UBC should regulate sale of unhealthy products; I2= remove SSNs from display, I3= encourage healthier beverage options to be placed at eye level in fridges/vending machines; I4= limit the serving size to less than 250 mL; I5= run a social marketing campaign on health impacts of SSB

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	133.8898917	5	26.77797833	24.17538824	0	2.22848817
Within Groups	690.0687729	623	1.107654531			
Total	823.9586645	628				

Figure 5E: One way ANOVA single factor summary table with F critical, df , and p -value. There is a significant difference in support between the 6 interventions ($p < 0.05$).

Survey link: <https://goo.gl/forms/4hTAFbwVf668ZkTz1>