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TRENDS AND OUTCOMES OF A SCHOOL-BASED CAMPAIGN TO REDUCE SUGAR-SWEETENED BEVERAGE CONSUMPTION AMONG RACIALLY AND ETHNICALLY DIVERSE STUDENTS IN MIDDLE SCHOOL

by

Roya Amirniroumand

A Dissertation Presented to the College of Psychology
of Nova Southeastern University
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APPROVAL PAGE

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Statement of Original Work

I declare the following:

I have read the Code of Student Conduct and Academic Responsibility as described in the Student Handbook of Nova Southeastern University. This dissertation represents my original work, except where I have acknowledged the ideas, words, or material of other authors.

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Roya Amirniroumand

December 21, 2021

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ABSTRACT

Reducing sugar-sweetened beverage (SSB) consumption has been identified as a chronic disease prevention strategy in children and adolescents (Muth et al., 2019; USDA & HSS, 2015) and promoting healthier alternative beverage options has become an important focus for public health policy and educational efforts. Community-driven school-based health initiatives targeting SSB consumption have shown promising outcomes however, few studies have explored these strategies for middle school students and less is known about the potential benefits of these efforts with racial/ethnic minority youth.

The present study examined whether racial/ethnic differences in SSB consumption existed in a sample of 419 students at one middle school. Additionally, we explored whether student's exposure to a community-driven and school-based initiative targeting SSB and water consumption predicted changes in beverage consumption and the differential effects of the campaign for certain student subgroups. Participants completed surveys about their SSB and water consumption prior to the one-month "30-day water challenge" and again post-campaign. In addition, direct lunchtime observations provided qualitative information of kinds of SSBs most frequently consumed by students.

Our findings highlighted significant racial/ethnic disparities in SSB consumption. Pre and post-test comparisons of SSB and water consumption revealed no statistically significant changes, however, determinants of change in consumption following the one-month campaign were observed. Clinical implications and future directions are discussed.

Chapter I: Statement of the Problem

It is well-documented that dietary choices and habits established during childhood and adolescence influence future health. In the American diet, added sugar intake is particularly high among youth and is attributed to excessive consumption of sugar-sweetened beverages (SSBs; Bowman et al. 2018; Rosinger et al., 2017). While dietary recommendations for added sugar and SSBs vary, many heath organizations advise that intake amounts should be limited for children and adolescents. In fact, lower SSB consumption has been a public health priority given growing evidence linking frequent SSB consumption to various health problems. Despite growing evidence that high amounts of added sugars and other additives found in SSBs may yield long-lasting and detrimental health effects, youth remain the largest group of consumers of SSBs in the US. These concerns were recently addressed in a joint statement from the American Heart Association (AHA) and American Academy of Pediatrics (AAP; Muth et al., 2019) which called for more public policy efforts and legislative changes targeting SSB consumption.

While a downward trend in added sugar and SSB consumption has occurred over the last decade, the latest data indicates that nearly two-thirds of youth drink SSBs on any given day (Rosinger et al., 2017) and many continue to exceed recommendations for limited intake (Vos et al., 2017). Additionally, studies report significant racial/ethnic disparities in SSB intake (Mendez et al., 2019). This is particularly concerning given known health disparities and increased risk for disease impacting racial and ethnic minorities. In recent years, researchers are increasingly using community-led approaches to design interventions aimed at reducing SSB intake in communities with diverse youth.

There is evidence that this approach can be effective in a school-based setting, especially with older (high school-aged) youth. However, more research is needed to examine the potential benefit of these strategies with younger children.

The present study developed out of a larger program evaluation of a community-led and school-based health initiative to lower SSB intake among adolescents attending a local middle school. The central aim of the present study is to evaluate beverage consumption trends, including factors that may contribute to possible racial/ethnic disparities in SSB intake. Furthermore, this study evaluates the impact of a community-led and school-based health initiative to decrease SSB consumption and increase water consumption.

Chapter II: Literature Review

Health behaviors that develop in childhood and adolescence are critical for normal growth and development, to promote health in childhood, and to reduce future risk for chronic disease (Forrest & Riley, 2004). Positive health behavior change during adolescence can lead to healthy lifelong habits and reduce risks for future chronic disease (Hochberg, 2011; Todd et al., 2015). For example, studies following youth through adulthood indicate that unhealthy food choices and sedentary lifestyle are associated with increased risk of adult morbidity and mortality (Hancoax et al., 2004; Ness, 2005; Pachucki, 2012). Specifically, high caloric diets that lack essential nutrients during childhood and adolescence have been linked to adverse health outcomes during childhood, adolescence, and later in adulthood (Birch et al., 2009; Law, 2000; Maynard, 2003; Vos et al., 2017).

One of the reasons why childhood behavior may be predictive of lifelong health is that it predicts adult heath behavior. Evidence from previous research suggests that habits formed during childhood and adolescence may persist into adulthood (Mikkilä et al., 2005; Nicklas, 1995; Kelder et al., 1994; Scaglioni et al., 2018). Various studies have shown, for example, that the presence of health-promoting behaviors during adolescence such as nutritious food choices are associated with higher levels of these same behaviors in adulthood (Lau et al., 1990). Craigie and colleagues (2011) systematically reviewed longitudinal research that followed children over five to 55 years of their lives. Their review found that dietary behaviors and physical activity levels are maintained from childhood into adulthood. For example, findings from several studies indicated that the likelihood of remaining physically active between five to eight years from adolescence was significantly weaker than the likelihood of remaining sedentary.

Adolescence is viewed as an especially important period for forming and maintaining health behaviors given the variety of challenges that are present during this stage of development (World Health Organization & Regional Office for Europe, 2012). Adolescents have increased autonomy in decision-making regarding eating and physical activity, they experience greater psychological stress, and they experience more intense peer pressure (McNeely & Blanchard, 2009). These unique challenges during adolescence have been linked to poor dietary behavior patterns and unhealthy weight gain which may persist into adulthood (e.g., Craigie et al., 2011). In one study by Lytle and colleagues (2000), the eating patterns of third-grade students were followed into eighth grade. The authors reported a decline in the consumption of breakfast, fruits, vegetables, and milk. Furthermore, the proportion of beverages consumed that were soft drinks tripled over the five years of the study.

Added Sugars in the American Diet

Added sugars account for a significant portion of the American diet. The term ‘added sugars’ was first used by the U.S. Department of Agriculture (USDA) and Department of Health and Human Services (HHS) in the 2000 Dietary Guidelines for Americans (DGA) to describe ingredients in foods and beverages that were nutrient-poor and high in calories (Garza et al., 2000). Sucrose (a blend of fructose and glucose that is also known as “table sugar”) and high-fructose corn syrup (HFCS) are the most popular added sugars in the U.S. food supply. Added sugars can be used to enhance the palatability of foods, help with preservation, and contribute to other attributes like viscosity and color (USDA & HSS, 2015). In making dietary recommendations for children and adults (age two and older), the 2015-2020 DGA (USDA & HSS, 2015), AHA (Muth et al., 2019; Vos et al., 2017), AAP (Muth et al., 2019), and the Institute of Medicine's (IOM) Dietary Reference Intakes (DRI; 2005) recommend that intake of added sugars be limited.

While public health organizations have called for a reduction in the consumption of added sugars, specific recommendations regarding added sugar consumption vary widely. These recommendations are often made in terms of limiting added sugars to a proportion of total energy intake. For older children and adolescents (age nine and older), the USDA (2015) estimates energy needs to range from 1,600 to 2,400 calories per day. In 2005, the IOM's DRI recommended consuming no more than 25% of energy from added sugars. However, 10 years later, the Dietary Guidelines Advisory Committee (DGAC; 2015) recommended that calories from added sugars and solid fats not exceed 10% of a person's total energy intake. In the same report, the committee noted that essential nutritional needs are met for most individuals who consume 4 to 6% of total energy intake from added sugar. Similarly, the World Health Organization (WHO; 2015) reported that there may be additional health benefits when intake of all free sugars (including both added and naturally-occurring sugars) are limited to less than 5% of total energy intake. As opposed to the proportion of total energy consumed from added sugars, recommendations from the AHA are based on calories or teaspoon equivalents. More specifically, in a recent statement, the AHA (2017) recommended that children and adolescents consume no more than 100 calories (approximately 6 teaspoons) or 25 grams of added sugars each day (Vos et al., 2017).

While most health organizations assert that small amounts of sugar may be consumed as part of a healthy diet, many youth do not adhere to the recommended intake of added sugars (Vos et al., 2017). Recent food patterns from the 2015-2016 National Health and Nutrition Examination Survey (NHANES; Bowman et al., 2017) indicate that calories from added sugars remain high in the American diet and contribute 14% of total calories (16.6 tsp. eq.) in children (ages 6 to 11) and 15% of total calories (18.3 tsp. eq.) in adolescents (12-19). In response to high intakes of added sugars, the U.S. Food and Drug Administration (FDA) announced an updated Nutrition Facts label in May of 2016. The new label distinguishes added sugars from naturally-occurring sugars. It is intended to help consumers identify products that support a healthy diet and “to spur food manufacturers to add less sugar to their products” (Center for Science in the Public Interest [CSPI], 2016, para. 3). Although many foods consumed daily contain added sugars (e.g., desserts, cereals), a significant source of added sugars in the American diet is liquid beverage consumption (USDA & HSS, 2015).

Sugar-Sweetened Beverages

Liquid beverages that are sweetened with added sugars are referred to as sugar-sweetened beverages (SSBs). Beverages that are commonly considered SSBs include regular sodas, juice drinks or fruitades (less than 100% fruit juices), sweetened or flavored milk, sports drinks, energy drinks, and sweetened coffees and teas. The recently published 2015-2020 DGA found that almost half (47%) of added sugars consumed in the American diet come from SSBs. The DGA guidelines recommend a number of strategies targeting SSB consumption such as reducing portion of SSBs consumed, decreasing frequency of SSB consumption, and drinking beverages with no added sugars such as water. The DGA also recommends drinking 100% fruit juice in place of SSBs within a recommended amount (USDA & HSS, 2015). These beverages are often described as a source of "empty" calories because they provide significant energy, but few to no essential nutrients. Consequently, there is broad consensus in the public health community that youth should limit intake of SSBs.

The AHA recommends that children and adolescents limit intake of SSBs to no more than one 8-oz serving per week (Vos et al., 2017). However, a single 12-oz serving of the most popular SSBs often exceeds the daily recommended amount of added sugars (see Appendix). This is true of most energy and fruit drinks (or fruitades). According to the Rudd Center for Food Policy and Obesity, this is also true regarding most brands of regular soda (Harris et al., 2014). In their analysis of 167 soda products, the median sugar per 8-oz serving ranges from 27 to 31 grams for the majority of soda brands and in some brands up to 43 grams in each serving. Other SSBs including flavored water, sports drinks, and iced tea/coffee contain lower amounts of added sugar (approximately 10 to 14 grams). While sports drinks typically contain less added sugar than soda, the AAP Committee on Nutrition and Council on Sports Medicine and Fitness (COSMF; 2011) discourage the consumption of sports drinks outside of the context of "intense physical activity" (p. 1188).

It is important to note that, in addition to high levels of added sugars, energy drink consumption by children and adolescents is not advised due to high levels of caffeine and other stimulants in these beverages (AAP Committee on Nutrition & COSMF, 2011). The caffeine content of many 12 oz servings of soda falls below the FDA limit of 65 mg. The average caffeine content in an energy drink can range from 80 to 140 mg per 8 oz serving, and many energy drinks are packaged at high volumes with some brands providing 320 mg of caffeine in one 32 oz container (Pomeranz et al., 2013).

Unlike sports and energy drinks, 100% fruit juice is not considered an SSB. However, it is notable that some studies have examined fruit juices and SSBs together due to the high concentration of natural sugars found in fruit juice. Moreover, findings in the existing literature indicate that when consumed in excess, even 100% fruit juice can lead to health consequences that are associated with SSB consumption (see Guasch-Ferre & Hu, 2019). Fruit juices in moderation, however, do not pose the same health risks associated with SSBs (Xi et al., 2014). Although guidelines for limiting fruit juice consumption exist, fruit juices may offer some nutritional benefits like vitamins, calcium, and potassium and promote dietary quality in children and adolescents (Heyman & Abrams, 2017; Maillot et al., 2018; USDA & HSS, 2015). Moreover, while 100% fruit juice and the average SSB contain the same amount of overall sugar, findings from one study show that the acidity of most SSBs may contribute to oral health problems that were not associated with consumption of 100% fruit juice (Evans et al., 2013). SSB consumption, including consumption of sodas, fruit drinks, and sports/energy drinks with added sugars, is of significant interest because of the consistent evidence that it leads to negative health effects (Bleich & Vercammen, 2018).

Health Concerns Related to SSB Consumption

High intake of added sugars from SSBs is concerning, given its associated health consequences. Recent findings from two cohort studies link higher SSB consumption to increased risk of all-cause and cardiovascular disease (CVD) mortality (Collin et al., 2019; Malik et al., 2019). There is consistent evidence demonstrating a link between

SSBs and risky metabolic processes which may lead to various health conditions, including fatty liver, hypertension, insulin resistance, diabetes, and obesity (Basaranoglu et al., 2013; Bleich & Vercammen, 2018; Lustig et al., 2012).

Metabolic effects

Many studies examining the contributions of SSBs to risky metabolic and cardiovascular factors have focused on the metabolism of fructose, a common sweetener used in SSBs. Existing studies using animal models, as well as clinical studies with both children and adults, have examined the cardiometabolic effects of fructose metabolization (Moore et al., 2014). Their findings suggest that some of the adverse health effects related to high SSB consumption may be due to the body's processing of fructose (Tappy & Le 2010; Hochuli et al. 2014; Vos and Lavine 2013). Fructose has different metabolic effects compared to other sugars, in part because it is less regulated by the body's metabolic processes and will continue to be metabolized "even when energy status is high" (Kolderup & Svihus, 2015).

One of the primary organs involved in metabolizing fructose (and other sugars) is the liver (Akram & Hamid, 2013. Unregulated hepatic fructose uptake can lead to a process known as de novo lipogenesis (DNL), converting excess carbohydrates into lipids (Basaranoglu, et al. 2013). This process can lead to the development of fatty liver and risky CVD factors (e.g., hypertension, elevated triglycerides, and atherosclerosis; Kolderup & Svihus, 2015). Now considered the most common type of liver disease in youth, Nonalcoholic Fatty Liver Disease (NAFLD) has been positively associated with fructose intake from habitual SSB consumption in children and adolescents (see review by Jensen et al., 2018). Welsh, Karpen, and Vos (2013) report that the number of adolescents between ages 12 and 19 with NAFLD has more than doubled over the past three decades and currently affects 11% of adolescents and one-half of obese males (Body Mass Index [BMI] >85th percentile).

In addition, to an increase in lipids, fructose metabolism has also been shown to elevate systolic blood pressure independent of lipid production and BMI (Jalal et al., 2010). When fructose is metabolized, several changes take place in sodium, in uric acid, and in nitric oxide which independently contribute to elevated blood pressure (DiNicolantonio & Lucan, 2014; Klein & Kiat, 2015). In fact, nationally representative data of US adolescents (ages 12 to 18) has demonstrated independent associations between SSB consumption and systolic blood pressure, which researchers hypothesize may be due, in part, to fructose consumption (Nguyen et al., 2009).

In addition to the specific effects of fructose, glycemic effects associated more broadly with SSBs have also been observed. SSBs have a high glycemic index (GI), meaning that they are quickly digested and cause rapid spikes in blood glucose and insulin levels. Excess buildup of glucose overtime can tire the pancreas leading to insulin resistance and type 2 diabetes (T2D), independent of adiposity (Imamura et al., 2015; Ludwig, 2002). Studies indicate that higher SSB consumption lowers insulin sensitivity in adults with both low and high BMIs (Stanhope et al., 2009; Aeberli et al., 2013; Lana et al., 2014). In a cross-sectional analysis using 1999-2004 NHANES data with adolescents between 12 and 19, Bremer, Auginer, and Byrd (2009) found that higher SSB consumption was positively associated with increased HOMA-IR scores (a common measure of insulin resistance), systolic blood pressure, waist circumference, and BMI. In another study by Welsh and colleagues (2011), increased insulin resistance was positively associated with higher intake of added sugars among overweight/obese adolescents, but not among normal-weight adolescents. However, increased risk for CVD factors were observed among all adolescents, regardless of body size.

Caloric intake and obesity

Existing literature suggests that added sugars and SSB consumption contribute to weight gain and obesity in youth and adults (Te Morenga et al., 2012). The increasing prevalence of metabolic syndrome, CVD, and T2D in the U.S. has been linked to excess calories and the rising prevalence of overweight/obesity (Scharf and DeBoer, 2016). While excess calories consumed from SSBs may be partly responsible for these trends, studies have linked SSB intake to increased metabolic and cardiovascular risk factors among adolescents, independent of weight gain and obesity. Support for these findings come from studies that controlled for BMI and/or total energy intake (Vos et al., 2017; see also review by Malik & Hu, 2012).

The association between added sugar consumption and weight gain is believed to be mediated by an energy imbalance which occurs when energy intake exceeds energy expenditure (Hu, 2013; Malik et al., 2006; Te Morenga et al., 2013). In particular, several studies suggest that SSBs lead to low satiety and poor energy compensation which can result in increased energy intake at subsequent meals (e.g., DiMeglio & Mattes, 2000; see also review by Shearrer et al., 2016). There are many potential factors in the literature including sensory characteristics of beverages (DiMeglio & Mattes, 2000; McCrickerd et al., 2014; Zijlstra et al., 2008), the lack of dietary fiber (Ambrosini, 2014), the fact that they are consumed quickly (Zijlstra et al., 2008**)**, and have rapid gastric emptying rates (Cassady et al., 2012; Juvonen et al., 2009) which may make them poor at influencing satiety. Moreover, appetite suppression from consumption is likely influenced by consumers' satiety-related beliefs (i.e., consumers may not expect SSBs to satisfy hunger; Hogenkamp et al., 2012; McCrickerd et al, 2014;). In a nationally represented sample of children and adolescents, Wang and colleagues (2009) found that SSB consumption contributed to an increased 106 total kilocalories at subsequent meals (in addition to the calories consumed in the SSBs themselves). In comparison, they did not observe any changes in energy intake after consumption of non-caloric beverages such as water and diet drinks.

Researchers have also explored the association between additives in SSBs and weight gain (Al-Shaar, et al., 2017; Keast et al., 2011). One controversial additive found in many SSBs is caffeine. Findings from existing research indicate that caffeine may promote energy consumption by increasing individuals' preference for sweetness (Keast et al., 2015). Moreover, dependence on SSBs may be reinforced by efforts to alleviate caffeine-related withdrawal symptoms (Harris & Munsell, 2015).

Researchers have suggested that SSB consumption may lead to inappropriate weight gain by increasing energy intake through the paths described above (i.e., low satiety, poor energy compensation, additives that increase preference for sweetness). However, unhealthy behaviors tend to cluster together and may attenuate associations between SSBs and total energy consumption (Malik et al., 2006). Further, total energy consumption may mediate the associations between SSB consumption and weight gain which makes the unique influence of SSB consumption unclear in some studies (see review by Rippe & Angelopoulous, 2016). In their recent review of studies examining the association between SSBs and weight gain, Luger and colleagues (2017) report that total energy intake was controlled in a majority of prospective cohort studies, but in no randomized controlled trials (RCTs). However, studies suggest that intake of added sugars in liquid form may increase weight and energy intake in children (Briefel, et al., 2013) and uniquely affect body fat distribution (e.g., Lee et al., 2015).

In 2001, Ludwig, Peterson, and Gortmaker published the first longitudinal study examining the association between SSB intake and changes in adiposity. In their study, the authors followed 548 ethnically diverse school-age children for 19 months and found that both baseline consumption of SSBs and change in SSB consumption independently predicted body mass changes after controlling for potentially confounding variables (e.g., anthropometric measures at baseline, physical activity, and time spent in sedentary activities). In addition, the study found that for each additional daily serving of SSB, the odds ratio of becoming obese increased 1.6 times. Similarly, in a more recent study by Martin-Calvo and colleagues (2014), a dose-response relationship between SSB consumption and obesity risk was found in adolescents who consumed four or more servings per week. Furthermore, randomized studies have shown a decrease in weight gain and BMI after reducing SSB consumption among adolescents (see review by Hu, 2013). For example, Ebbeling and colleagues (2012) randomly assigned adolescents (BMI $\geq$85th percentile) who regularly consume SSBs (at least one 12 oz serving per day) to an intervention or control group. The participants in the intervention group were provided with water and diet beverages (artificially sweetened) to replace SSBs. At the one year follow-up, the intervention group had significant declines in BMI and weight gain compared to the control group. While the intervention group continued to have lower weight than the control group at the 2-year follow up, differences in BMI were no longer statistically significant.

Concerns about the association between SSB consumption and obesity are not limited to weight gain. Obesity in childhood and adolescence has been linked to a variety of comorbid medical conditions including CVD, T2D, asthma, polycystic ovarian syndrome, fatty liver disease, and orthopedic problems (see review by Pulgaron & Delamater, 2014). As noted above, these comorbid conditions are impacted by metabolic processes and can be problematic for children regardless of size. Social consequences of obesity have also been documented including weight-based stigmatization which may increase risk for psychological distress, low self-esteem, and reduced quality of life (Pont et al., 2017). Because of these associated health concerns, reducing SSB consumption has been one of the primary targets of many public health interventions addressing childhood obesity (Muth et al., 2019; Rahman, et al., 2018).

Other related health effects

The association between SSB consumption and poor oral health is well-documented (Bovi, 2017; Gupta et al., 2013; Marshall et al., 2003; Mishra & Mishra, 2011; Sohn et al., 2006). In particular, the contribution of SSB consumption to the development of dental caries has been well-established in studies with children (Evans et al., 2013; Kolker, et al., 2007; Lim et al., 2009; Sohn et al., 2006; Wilder et al., 2016). Sugar is an ideal substrate for oral bacteria, which then lower pH (measure of hydrogen ion concentration or acidity) levels in the mouth and promotes pathways that can lead to the development of dental caries. In addition, frequent consumption of citric or phosphoric acids in SSBs may lead to irreversible dental erosion (Taji & Snow, 2010).

The pH of these beverages is primarily responsible for oral health problems associated with frequent consumption of SSBs. Reddy and colleagues (2016) evaluated the pH of 379 beverages categorized as either water and sport drinks, juices and fruit drinks, sodas, or energy drinks, teas, and coffee. Second to lemon juice, different types and flavors of soda (pH ranging 2.25 to 2.39) were among the most acidic beverages and considered 'extremely erosive' (pH less than 2.4).

In addition to its role in contributing to dental disease, poor oral health may reduce overall quality of life (Holicky, 2016) and increase risk for CVD. Studies exploring pathways between oral infections and CVD risk factors implicate the spread of oral bacteria from inflammatory responses in oral infections (Kebschull et al., 2010; Li et al., 2000). More recently, studies have begun to link SSBs to other adverse health consequences, including increased risk of overall cancer, breast cancer (Chazelas et al., 2019), and chronic kidney disease (Rebholz et al., 2019).

Added Sugar Consumption Trends

Due to the significant health consequences associated with SSB consumption, multiple nationally representative surveys have examined trends related to added sugar intake and SSB consumption since the 1970s. Overall intake of added sugars and the percentage of calories consumed from added sugars in SSBs both increased significantly for children and adults in the U.S. through the beginning of the 21st century (Nielsen & Popkin, 2004; Powell et al., 2016; Wang et al., 2008). In fact, Neilsen and Popkin (2004) found that calories from SSBs (soft drinks and fruit drinks) nearly tripled for all individuals ages two and older between 1977 and 2001. This finding was associated with more consumers drinking SSBs overall, as well as consumers drinking larger portion sizes and more servings of SSBs each day. There was an associated decline in milk consumption among the 2 to 18 age group. The highest intake of soft drinks in the study occurred among young adults between 19 and 39 years of age. The widespread popularity of high fructose corn syrup (HFCS; a sweeter and cheaper alternative to sucrose), heavy marketing of SSBs, and the substantial increase in the average portion size of SSBs may have contributed to the substantial increases in SSB consumption during this time period (Welsh et al., 2013).

Studies have shown a decline in soda consumption among youth in the last decade (Bleich et al., 2018; Han & Powell, 2013; Kit et al., 2013; Mendez et al., 2019; Rosinger et al., 2017). The latest data show that for children and adolescents, added sugars contribute nearly 15% of total energy intake (Bowman et al., 2017) and more than one third (38%) of added sugar consumption comes from SSBs (Powell et al., 2016). Between 2011 and 2014, 62.9% of youth consumed at least one SSB on a given day as assessed by 24-hour dietary recalls (Rosinger et al., 2017). Moreover, consumption of sports and energy drinks has tripled in the same time period (Han & Powell, 2013). Despite growing evidence regarding the health consequences of SSBs, more youth report intake of sport and energy drinks which may be due to advertising influences and misperceptions about their potential health benefits (Visram et al., 2016).

Trends of SSB consumption also reveal marked differences across gender and racial/ethnic groups, with the greatest intake of SSBs occurring in males, low-income children, and non-Hispanic Black and Mexican youth (Beck et al., 2013; Bleich et al., 2018; Bremer et al., 2011; DeBoer et al., 2013; Dodd, et al., 2013; Han & Powell, 2013; Kit et al., 2013; Mendez et al. 2019; Wang et al., 2008). Using national data between

1988 and 2004, Bremer and colleagues (2011) examined SSB consumption trends among an ethnically diverse sample of adolescents (ages 12-19). Results of the study showed that between 1988 and 1991, the overall amount of SSBs consumed per day was highest among Hispanic youth (approximately 26oz vs 22oz for non-Hispanic youth). By 2004, daily intake of SSBs significantly increased for non-Hispanic Black “high-consumers” (equivalent to an increase from 4.6 to 24.2 teaspoons of added sugars) and for Mexican “medium-consumers” (from 0.8 to 4.5 teaspoons). National cut-off scores were used to define low and medium quintiles in SSB intake ($> 20^{th}$ to 80^{th} and $\geq 80^{th}$ percentile, respectively). In a cross-sectional analysis of the 2003-2009 California Health Interview Survey, Beck and colleagues (2013) found that the number of all children (between ages 2 and 11) consuming any SSBs decreased during this time period, but that Hispanic and African-American children between 6 and 11 years of age had the highest odds of SSB consumption.

Compounded with the increased consumption of SSBs in racial/ethnic minority children is evidence that the health impact of high SSB consumption may differ for low-income and racial/ethnic minority youth. Health disparities have been consistently documented in the health conditions most associated with SSB and added sugar consumption such as CVD and diabetes (CDC; Centers for Disease Control and Prevention, 2013). These populations are also at greater risk for limited health literacy, are less likely to receive preventive care, and are more likely to live in geographic locations known as “food deserts” in which access to affordable and healthy foods are limited thereby increasing consumption of less expensive energy-dense food (Hilmers et al., 2012; Pitt et al., 2017; National Academies of Sciences, Engineering, & Medicine, 2017). It is also well-documented that racial/ethnic minorities have a higher risk burden for CVD, including the presence of diabetes, hypertension, and high cholesterol (Bonow et al., 2005; Carnethon et al., 2017; Kurian & Cardarelli, 2007). According to the recent AHA (2019) report on heart disease and stroke in the U.S., Hispanics and Non-Hispanic Blacks tend to have a lower prevalence of meeting criteria for ideal cardiovascular health. In children specifically, 53% of Non-Hispanic Whites, 48% of Non-Hispanic Asians, 40% of Hispanics, and 36% of Non-Hispanic Blacks had at least five or more metrics at ideal levels (AHA, 2019). While national trends in health statistics of the U.S. population have improved over the past two decades, underserved and racial/ethnic minorities continue to carry the highest burden of risk for CVD, T2D, and other chronic health risks (Vos et al., 2017).

Efforts to Reduce SSB Intake

National, state, and local level policies can have a significant impact on health outcomes, and those targeting SSB consumption are promising (e.g., Lee et al., 2019; see also Muth et. al., 2019). There have been considerable public health efforts targeting SSB consumption and other unhealthy dietary behaviors over the past two decades. For example, the implementation of the Smart Snacks in School nutrition standards, part of the 2010 Healthy, Hunger-Free Kids Act (HHFKA), has provided youth from low-income families with greater access to healthy meals and established nutrition standards for all foods sold in school during the day. These standards restrict the sales of SSBs, with the exception of flavored milk drinks, and require the availability of free drinking water during school meals. The HHFKA requires high-nutrient, low-calorie meals consistent with the most recent DGA (USDA, 2013). Findings from existing research, including longitudinal intervention studies, indicate that school wellness policies and the HHFKA can lead to small, yet significant, improvements in food consumption behaviors and nutrient intake among U.S. school-aged children (see Mansfield & Saviano, 2017). Micha and colleagues' (2018) systematic review evaluating the impact of school food environment policies, including studies also conducted outside of the U.S., found that in-school food policies decreased daily intake of SSBs by 0.18 servings, increased daily fruit and vegetable consumption (0.27 and 0.04 servings, respectively), and resulted in increased water intake (a trend that was not statistically significant in the study).

As of 2014, 34 states as well as the District of Columbia have implemented a soda tax as one state mandated policy measure to curb SSB consumption (Chriqui et al., 2014). Statewide policies have been of interest because some studies have found that in-school policies limiting SSB availability in schools may not significantly reduce overall SSB consumption (Taber et al., 2012; Terry-McElrath et al., 2013). Health organizations such as the AAP and AHA (Muth et al., 2019) assert that soda taxes may also reduce health and socioeconomic disparities and tax revenue can be used to support initiatives to promote good health. While state-level data on soda tax and SSB intakes suggests that children who are African-American, heavier, from lower-income families, or watch an increased amount of television may be more sensitive to a higher tax on soda, especially if available in school (Sturm et al., 2010), some ethical implications about raising taxes on SSBs have been raised (Barnhill & King, 2013),

Beyond existing policy efforts, the school environment has been recognized as a critical setting for influencing dietary behaviors and weight status for children and adolescents (Driessen et al., 2014; Fox et al., 2009). Students spent an extended period of their day in school, which is a setting that presents with unique opportunities to target SSB intake. A majority of the existing school-based interventions aiming to reduce SSB intake use educational/behavioral techniques such as disseminating nutritional messages in the curriculum (e.g., health risks associated with SSB consumption and benefits of drinking water; Vézina-Im et al., 2017). Other behavioral strategies include goal setting (e.g., to reduce SSB consumption and/or increase water intake) and self-monitoring behaviors (e.g., tracking SSB consumption daily). Schools can also influence dietary behaviors by selecting food and beverages available and offered within the school such as banning SSBs and/or increasing access to palatable water options (Briefel et al., 2013; Loughridge & Barratt, 2005; Patel et al., 2011). In fact, schools and local communities promoting water consumption have reported significant declines in SSB intake among children and adolescents (Malik & Hu, 2015; Vargas-Garcia et al., 2017).

The school environment also provides opportunities to incorporate peers in health promotion activities. Research indicates that health promotion messaging with peer interactions can effectively promote healthy lifestyle behavior changes (Petosa & Smith, 2014). Peer mentoring, including peer coaching and modeling of healthy behavior changes, is also considered an effective strategy to reduce SSB consumption in the high school setting (Smith & Holloman, 2014; Tipton, 2016). This is not surprising given that significant social, lifestyle, developmental, and environmental changes from childhood to adolescence can impact dietary behaviors and diet quality (Contendo et al., 2006; Hassan et al., 2018; Salvy et al., 2012; Story et al., 2002). For example, studies have shown that youth SSB consumption may be influenced by perceptions of SSB consumption in peers (Perkins et al., 2018; see also review by Paes et al., 2015). Student mentors may help encourage sustainable health behavior changes by matriculating younger mentees into a health coaching role within their school (Petosa & Smith, 2014; Smith & Petosa, 2016).

Despite policy and school-based interventions described here and general declines in SSB consumption, intake levels remain higher than recommended for some youth (Mendez et al., 2019). While promising, traditional interventions have not been widely disseminated or have not been shown to affect existing health disparities (e.g., Sharkey et al., 2011). Reasons for this include the lack of consideration to racial and ethnic differences that may underlie SSB consumption (Kirkpatrick et al., 2018) and the differential impact of environmental interventions targeting SSB intake among children with distinct backgrounds (Kremers et al., 2007; van de Gaar et al., 2017). Studies also suggest that sociodemographic disparities in tap water consumption (Patel et al., 2013) may be due to distinct attitudes and behaviors surrounding tap water in some racial/ethnic groups (Gorelick et al., 2011).

Determinants of health are highly complex. Effective interventions should be culturally sensitive and contextually relevant. Given significant racial/ethnic and socioeconomic disparities in SSB consumption and its potential health consequences, policies and interventions should especially consider their effectiveness in at risk communities. A growing literature has used community-partnered research to better understand the norms, attitudes, and culturally relevant factors that exist in communities where policy efforts have not been effective. Community-led research is considered a critical part of developing culturally relevant and tailored interventions that promote health equity (Israel et al., 2010; NASEM; National Academies of Sciences, Engineering, and Medicine, 2017).

Community-Based Participatory Research & Health Promotion Efforts

Community-Based Participatory Research (CBPR) has been used in a growing number of studies and adapted to work with a variety of populations. Unlike traditional research methods, CBPR emphasizes the participation and shared decision making between researchers and community members. A CBPR approach considers the social and cultural context of a given community by examining the unique challenges that exist and build upon the community's strengths. Considered a valued approach to address public health issues and disparities, CBPR is particularly useful in working with diverse communities that are distrustful of researchers (Teufel-Shone et al., 2006).+

Israel and colleagues (2005) outlined core principles of CBPR that have guided researchers working to improve the health of disparate communities and include: (1) recognizes the community as a unity of identity; (2) builds on community strengths and resources; (3) facilitates equitable and collaborative partnerships in all phases of the research; (4) fosters co-learning and capacity building among all partners; (5) integrates and achieves a balance between knowledge generation and intervention for mutual benefit of all partners; (6) focuses on the public health problems concerning the community and understanding and addressing the multiple determinants of health; (7) uses a cyclical and iterative process; (8) disseminates results to all partners and involves them in the dissemination process; and (9) involves a long-term process and commitment to sustainability.

The active and meaningful engagement of community members is vitally important throughout the research process from first identifying the issues that are faced by the community to the development of community programs (Israel et al., 2005). Many existing CBPR studies involve a community advisory board and/or working committees to help design and facilitate the success of the project. Participants of the advisory board often include key stakeholders in the community, researchers affiliated with an academic institution, and representatives from community-based organizations and/or local officials (e.g., the local health department).

Many CBPR studies in the U.S. have been conducted with racial/ethnic minority groups and rural communities (e.g., Coughlin & Smith, 2016; Gehlert & Coleman, 2010; Rhodes, et al., 2013), however, few studies have focused on child and adolescent populations. In recent years, however, more researchers have worked with youth in various phases of the research process including in developing research questions, assisting in data collection methods, and disseminating information/findings (Jacquez et al., 2013). With support and expertise from both researchers and key community stakeholders, youth participatory research methods ensure that interventions consider youths' norms and attitudes. Given the complex developmental and social dynamics experienced in childhood and adolescence, youth can offer key insights into the unique experiences and challenges that influence SSB intake.

More recently, CBPR has been used to develop health initiatives within the school setting. Consistent with CBPR in other community settings, stakeholders help researchers identify areas of concern, design relevant health intervention projects, implement strategies, and disseminate findings. Shared decision-making principles allow for a collaborative and trusting relationship to develop between researchers and key stakeholders within the school, including teachers, administrators, parents, and students. To ensure that health efforts meet the needs of youth, some CBPR studies have also involved students in health promotion efforts. With support of key stakeholders in the school, students have been recruited into youth advisory boards similar to the adult-led community advisory boards and working committees that drive most CBPR. Youth advisory members help develop age-appropriate and relevant campaigns as well as disseminate and encourage peer participation in various health promotion initiatives. Specifically, a growing number of studies have used CBPR approaches to engage communities where intake of SSBs remains high (e.g., Lane et al., 2018; Smith & Holloman, 2014; Smith et al., 2012).

Using a CBPR approach to identify and develop a school-based initiative at two high-schools, Smith and Holloman (2014) described the development of teen advisory boards in two high schools. In their study, youth participants tailored campaign materials, encouraged peer participation, and disseminated information about health effects of SSBs and benefits of water consumption in school. Following the intervention, a majority of students consumed SSBs less than three days a week (65%) and only 7.2% of students reported daily consumption. The study found that SSB drinkers reduced daily servings of SSBs from an average of 2.23 to 1.32 (equivalent to almost one serving per day) after 30 days. More recently, these strategies have also been adapted to be used in middle school students, however; overall there are very few studies that have looked at younger youth and have examined racial/ethnic disparities in SSBs (Lane et al., 2018; Smith et al., 2019).

Current Study

The current study examines SSB consumption trends in a sample of middle school students and outcomes of a school-based campaign to reduce SSB consumption and increase water consumption.

Aim 1

Examine whether racial/ethnic differences exist in SSB consumption of middle school youth.

1. It is hypothesized that SSB consumption in Non-Hispanic White youth will be significantly lower than SSB consumption in Hispanic youth, Non-Hispanic Black youth, and Non-Hispanic Asian youth.
2. It is hypothesized that disparities between Non-Hispanic White youth and their racial and/or ethnic minority peers in SSB consumption will be partially explained by water consumption and perception of peer SSB consumption.

Aim 2

Explore whether a community- and student-led campaign led to improvements in beverage consumption (both SSB and water).

1. It is hypothesized that students' mean SSB consumption will decrease after the campaign.
2. It is hypothesized that students' mean water consumption will increase after the campaign.
3. It is hypothesized that exposure to the student-led campaign will predict changes in consumption from baseline to post-campaign. In addition, differential impact of campaign exposure on student subgroups will be explored by examining

interaction effects of campaign exposure with racial/ethnic groups as well as gender.

Chapter III: Methodology

Analyses were conducted using an existing dataset that was developed to evaluate health initiatives conducted at one middle school. This chapter describes participants and measures in the present study which is a secondary analysis of the larger program evaluation. Additionally, to better understand the design of the larger evaluation and the origins of the data, this section includes an overview of the development of a community-based partnership that designed health promotion initiatives at the school and participated in the evaluation of those initiatives.

Participants

One Title 1 middle school in Broward County provided a potential pool of 1,176 racially/ethnically diverse students, of whom 419 (36%) were included in the study. Title 1 school status is determined by the proportion of students (at least 40%) enrolled in the county's free and reduced lunch program. At the time of recruitment, 87% of students at the selected school qualified for the free and reduced lunch program. Results from recent school-based health screenings also indicate that approximately one-third of students at the school are considered overweight (approximately 10%) or obese (approximately 22%).

For the purpose of the present study, students with missing data on outcome and/or control variables (i.e., related to SSB consumption and demographic characteristics, described subsequently), were excluded from analyses. The final sample was composed of 419 participants across grade-levels sixth, seventh, and eighth.

Procedure

Core Community Advisory Board

The larger school-based evaluation was developed with input from a core community advisory board (CCAB). The CCAB was developed in 2016 in response to school-based BMI screening results at the local middle school. It was made up of a diverse group including parents, school administrators, school health providers, stakeholders from non-profit community organizations, and researchers. Patient Centered Outcomes Research Institute (PCORI) Pipeline to Proposal funds were used to support the CCAB as it recruited members, developed a mission and governance policies, and considered potential next steps. According to the CCAB's governance document, the partnership is "committed to developing evidence-based, sustainable, community-based solutions and to create a culture of health in our community, thereby reducing the prevalence of childhood obesity in (the community)" (unpublished, 2019, p. 1).

With PCORI funding, the CCAB initially developed its priorities and mission using a CBPR approach. CCAB members gathered key information through coalition meetings, community forums, and discussion groups with students at the school. Input from the community was used to identify health concerns as well as barriers impacting the community. The health status and related behaviors of students emerged as common themes such as limited physical activity, limited water consumption, and poor diet. Additionally, the community identified a scarcity of resources and services including limited access to nutritious and affordable foods, which was perceived to be associated with a greater consumption of soda and other sweet drinks. Examples of evidence-based and community-led initiatives targeting these priority areas (e.g., Smith and Holloman, 2014), were presented by academic partners and discussed with the board. At the end of PCORI funding in 2018, CCAB members applied to several funding mechanisms aimed at supporting their development of initiatives targeting physical activity and nutrition among youth enrolled at their community middle school. They received several small parent-led grants and a large community organization-led grant that have supported several initiatives. Initiatives underway at the school include the development of a part-time school wellness champion position and a youth advisory board focused on cultivating a “culture of health” among students.

Development of Youth Advisory Board

With assistance and support from the CCAB, in March of 2019, students from each grade-level were recruited through announcements during lunch periods and in designated classes to form a youth advisory board. Students with particular interests in health and wellness were also informed by their teachers about the opportunity to participate in the new board. The purpose of the Youth Advisory Board was to identify and support student-led health promotion initiatives. Specifically, one of the early goals of the Youth Advisory Board was to be involved in the CCAB’s initiative to reduce SSB consumption in the school and to develop their own student-led initiatives and campaigns for the future.

Campaign Components

The school-based initiative was developed as a campaign with many components similar to published initiatives conducted with children and adolescents aimed at reducing SSB consumption and increasing water intake (Lane et al., 2018; Smith & Holloman, 2014; van de Gaar et al., 2014; Wang et al., 2016). The “30-day water challenge” encouraged students to drink more water and less SSBs using a number of campaign strategies. Students were informed about the “30-day water challenge” through announcements made during first period and lunch. Youth Advisory Board members wore wristbands with messaging to drink more water. Additionally, poster materials with information about the health consequences associated with SSBs and benefits of drinking water were hung in various parts of the school. Campaign strategies also included fruit-infused water demonstrations, free bottled water, and campaign wristbands provided to all students during their lunch period on several occasions.

Data Collection

In order to assess the impact of the "30- day water challenge," the CCAB conducted an evaluation of students in 6th, 7th, and 8th grade through a Student Survey and lunchtime observation. Both of these types of data were collected at two time points: (1) baseline (pre-campaign), and (2) post-campaign (one-month post-baseline). The data was collected by employees of a non-profit community partner (who frequently collect program evaluation data for funders) and by members of the CCAB (trained to participate in data collection for the evaluation) and are hereafter referred to as "facilitators."

Survey Completion. Students were given the option to complete the survey or not during "specials" courses. Students could choose from surveys translated in English and Spanish. The facilitators reviewed the instructions, different beverage types, and serving sizes all described on the survey. Students were able to ask clarifying questions and were given approximately 20 minutes to complete. The post-campaign surveys were completed in the same class periods one month later. Students were again given the option to opt out of the post-campaign surveys.

Lunch Period Observation. Direct observations of student lunch trays were conducted as part of the larger program evaluation. The different types of beverages consumed by students in 6th, 7th, and 8th grade were observed during lunch periods at baseline and one-month later. Before students from each grade-level arrived at their respective lunch period, each pair of four observers identified two distinct tables (total of four tables per lunch period) to record the types of beverages consumed by the students seated at the pre-determined table. Tables were chosen in advance of the lunch period to observe 20% of the tables. Students were observed through their entire lunch period (lasting 30 minutes in duration).

Measures

Student Survey

The Student Survey was developed by the CCAB (see Appendix). Researchers provided input regarding previously published evaluations and existing surveys, while parents and school CCAB members provided input on feasibility and relevance regarding survey items. The final survey used in the larger program evaluation took approximately 15 minutes to complete. For the present study, only the variables described below were extracted from the larger evaluation data.

Demographics. Demographic characteristics of the participants, including age, grade-level, gender, and race/ethnicity were collected via student self-report.

Beverage Consumption (SSB and water). For the current study, two variables were used to assess SSB consumption, and two variables to assess water consumption: (1) days of SSB or water consumption per week (e.g., 0 days, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days); and (2) the weekly servings of SSB or water consumption. Mean servings per week was calculated by multiplying the frequency variable (days per week) by student's self-reported mean daily intake measured in serving sizes.

Items from previously validated surveys were adapted for the Student Survey to assess SSB and water consumption (Smith & Holloman, 2014; Wang et al., 2008). Students were asked on how many of the past seven days did they drink any SSBs, and on how many of the past seven days did they drink water. They responded on an 8-point Likert scale ranging from 0 (*no days*) to 7 (*every day*). Sugar-sweetened beverages (SSBs) were defined for the students at the top of the survey as beverages sweetened with added sugar. Examples were given of SSBs including flavored milk, fruit juices (with added sugar), sweetened tea/coffee, lemonade, regular soda, and energy/sport drinks (Grummon et al., 2018). Examples of water were also provided including tap, fountain, and bottled water. To calculate mean daily intake (by serving size), respondents were also asked to estimate the number of servings consumed per day, on average. Students were asked to consider one glass (approximately 8 oz) or can (approximately 12 oz) as a single drink (or single serving) whereas a 20-oz bottle was considered two drinks (or two servings; Wiecha et al., 2006).

Perception of Peer SSB Consumption. One item was adapted from Perkins, Perkins, and Craig (2018) to assess perceptions of peer SSB consumption by asking respondents to consider how often most kids in their grade drink SSBs (i.e., “On a typical day, how many sweetened beverages do you think most kids in your grade drink?”) and rated using a 6-point Likert scale from 0 (*they do not drink any sweetened beverages*) to 5 or more drinks a day.

Exposure to Campaign. Items were included as part of the post campaign questionnaires to determine the extent to which students were exposed to the campaign including whether they registered for the campaign (*yes*/*no*). Exposure to campaign was also calculated by the number of different sources of information about the campaign that students recalled, ranging from 0 ("*I did not see/hear about the "30-day water challenge*") to 6 (possible sources of exposure within the school).

Finally, exposure to campaign was assessed by student report of the number of their closest friends that participated in the "30-day challenge." Students responded using a 5-point Likert scale from 0 (*none*) to 4 (*4 or more friends*).

Direct Lunchtime Observations

An observational checklist was adapted from Grummon and colleagues (2017) and used to record SSBs and water present on student lunch trays and brought from home during the school lunchtime observation (see Appendix). The observation had limitations that included the inability to accurately identify all beverages (e.g., water bottles that were prefilled from home).

In-school Beverage Consumption (Observed). The inter-rater agreement was calculated for each pair of independent observers. We reported the average between each independent observer pair for each beverage type to describe the different beverage types consumed by student's during lunchtime.

Analyses

All analyses were performed using IBM SPSS Version 27.0 (IBM Corp., 2020). The institutional IRB found this project did not meet criteria for human subjects' research and was exempt from their review. Descriptive analyses were conducted to describe the sample on demographic and beverage consumption characteristics at baseline, including means and standard deviations for continuous variables (e.g., age) as well as frequencies and percentages for categorical variables (e.g., gender, race/ethnicity groups). In addition, lunchtime observation data was categorized and presented to describe the different kinds of SSBs consumed by students during school lunch. Raw percent agreement was calculated to examine the agreement between coders on the type of beverages consumed by students. Analysis of variance tests were used to examine the mean and proportional differences by racial/ethnic groupings for each beverage consumption variable in the analysis. Pearson correlations and multiple linear regression analyses were conducted to determine the contribution of selected predictor variables in explaining the variation in beverage consumption scores. In the regression models, race/ethnicity was included as a set of dummy variables with Non-Hispanic White students for comparisons to Non-Hispanic African-American/Black (Black), Latino/Hispanic (Hispanic), and Non-Hispanic Asian (Asian) students.

Due to the hierarchical nature of these data, where repeated observations (level-1) within students (level-2) were further nested within classrooms (level-3), between-group variance for each outcome variable was tested to assess for the presence of a clustering effect at the higher-order level (i.e., classroom). If significant nesting effects were found (Intraclass Correlation Coefficient>0.02), a random regression model was conducted (Gelman & Hill, 2007). Otherwise, Ordinary Least Squares (OLS) regression was employed. Statistical significance was set at $p \leq 0.05$ and effect sizes (ES) were calculated to measure the magnitude of any effects. Beta value (β) refers to the regression coefficient and the R square (R^2) is presented to indicate the proportion of variance in the outcome that can be explained by the predictor variables.

To test hypotheses 1.1 and 1.2, two separate regression models were conducted in blocks with covariate variables (age and gender) entered at stage one of the regression and all four racial/ethnic groupings entered in stage two. Other predictors of interest, including baseline measures of weekly water servings and perceptions of peer SSB consumption, were entered in the full model at stage 3 in order to examine their effect on racial/ethnic group and SSB consumption.

To test hypotheses 2.1 and 2.2, paired samples *t* tests were conducted for each of the four beverage consumption variables, including days of SSB consumption per week, weekly SSB servings, days of water consumption per week, and weekly water servings.

To test hypothesis 2.3, a raw change model was used to examine possible predictors of post-campaign changes for each of the four beverage consumption variables. In models examining SSB consumption as the outcome variable, average weekly water servings at baseline was entered as the primary covariate. In models examining water consumption as the outcome variable, average weekly SSB servings at baseline was entered as the primary covariate. For all models, predictors of interest included three variables to assess the relationship between exposure to the school-based student-led campaign and changes in beverage consumption. The differential impact of students' recall of different campaign sources, participation in the school-based "30-day water challenge," and number of closest friends that participated in the school-based "30-day water challenge" on student subgroups was explored as the next step. To this end, the association for gender and race/ethnicity groups were estimated by adding interaction terms for gender or race/ethnicity to the adjusted models with the outcome of interest.

CHAPTER IV: Results

Description of Sample

Descriptive statistics for the relevant demographic variables of participants at baseline are presented in Table 1. The sample consisted of 419 youth, ranging in age from 10 to 15-years-old at baseline. Approximately half the sample identified as female (48.4%) and most were in 6th grade (*n* = 207) or 7th grade (*n* =153). Fewer participants were in 8th grade (*n* = 52) due to an off-site field trip during the school day at the time of the study. Consistent with the demographics of the surrounding community (National Center for Education Statistics, 2020), most students identified themselves as African American/Black (52.2%), followed by Hispanic (31.3%), White (11.2%), and Asian (3.3%). Students reported consuming SSBs on average 4.03 (*SD* = 2.4) days of the week and 10.0 (*SD* = 9.4) servings of SSBs per week at baseline. Students reported consuming water on average 6.0 (*SD* = 2.0) days of the week and 21.0 (*SD* = 11.0) servings of water per week at baseline. Table 2 also shows the distribution of beverage consumption variables by age, gender, and racial/ethnic groupings. The mean for each observer pair during lunchtime observations of beverages consumed by students at baseline and post-campaign are reported in Tables 3-4.

Table 1

Demographic Characteristics at Baseline

Characteristic	*n*	*M* (*SD*) or %
Age (in years)	12.4 (1.0)	12.4 (1.0)
10	2	.5
11	80	19.5
12	153	37.3
13	119	29
14	48	11.7
15	8	2.0
Gender		
Female	201	48.4
Male	214	51.6
Race/ethnicity		
Black non-Hispanic	205	52.2
White non-Hispanic	44	11.2
Asian non-Hispanic	13	3.3
Hispanic	123	31.3
Other non-Hispanic	8	2.0

Note. Frequency and percentages are provided for categorical variables and means, standard deviations are provided for continuous variables.

Table 2

Beverage Consumption Trends at Baseline

Characteristic	Beverage Consumption Variables			
	SSB Frequency	SSB Weekly Servings	Water Frequency	Water Weekly Servings
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Total	4.03 (2.4)	10.0 (9.4)	6.0 (2.0)	21.0 (11.0)
Age (in years)				
10	7.0 (0.00)	10.5 (4.95)	4.5 (3.54)	12.50 (12.02)
11	3.90 (2.4)	8.3 (8.12)	5.71 (1.9)	20.45 (11.34)
12	3.95 (2.44)	9.64 (9.61)	6.11 (1.61)	21.69 (10.22)
13	4.14 (2.33)	10.52 (9.4)	5.56 (2.02)	18.93 (10.9)
14	4.19 (2.34)	10.78 (10.01)	5.7 (1.98)	21.32 (11.09)
15	3.88 (2.64)	12.0 (10.58)	4.63 (2.4)	17.13 (10.82)
Gender				
Female	4.25 (2.35)	10.1 (9.55)	5.89 (1.89)	19.91 (10.75)
Male	3.83 (2.37)	9.67 (9.18)	5.7 (1.85)	21.04 (10.89)
Race/ethnicity				
Black non-Hispanic	4.50 (2.3)	11.5 (9.42)	5.42 (2.05)	19.12 (10.95)
White non-Hispanic	2.45 (2.12)	5.14 (7.42)	6.14 (1.61)	22.7 (10.06)
Asian non-Hispanic	2.54 (2.63)	5.38 (9.58)	6.62 (0.961)	26.5 (9.73)
Hispanic	3.92 (2.34)	8.47(8.5)	6.631 (1.42)	22.45 (10.3)
Other non-Hispanic	5.13 (2.42)	13.3 (8.33)	5.63 (2.33)	18.5 (12.62)

Note. Sugar-sweetened beverage = SSB.

Note. Frequency and percentages are provided for categorical variables and means, standard deviations are provided for continuous variables.

Table 3

Mean Beverages Observed Between Each Pair of Independent Observers at Baseline

	Sixth Grade		Seventh Grade		Eighth Grade	
	Pair A	Pair B	Pair A	Pair B	Pair A	Pair B
Water (bottle)	2.50	1	1	0	10	3
Flavored Milk	26	25	6	21.50	10	16
Plain Milk	3.50	3	5.50	0	3	0
Regular Soda	1	0	0	1	0	0
Energy/Sport Drink	0	0	1	0	0.50	0
Sweetened Tea/ Coffee	0	0	0	0	0	0
<100% Fruit Juice	0.50	0	0	0	0	2
100% Fruit Juice	29	34	15	0	22	16
Unknown Type	0	0.50	0	0	2	0.50
Other	0	0	0	0	0	0

*Note***.** Level of agreement for observer pair A was 80%. Level of agreement for observer pair B was 92%.

Table 4

Mean Beverages Consumed Between Each Pair of Independent Observers at Post-campaign

	Sixth Grade		Seventh Grade		Eighth Grade	
	Pair A	Pair B	Pair A	Pair B	Pair A	Pair B
Water (bottle)	N/A	1	5	1	2.5	2
Flavored Milk	N/A	22	13.5	16	12	28.5
Plain Milk	N/A	2	2.5	6	1	4
Regular Soda	N/A	0	0	0	0	0
Energy/Sport Drink	N/A	2	0	0	0	0
Sweetened Tea/ Coffee	N/A	0	0	0	0	0
<100% Fruit Juice	N/A	0	0	1	1	0
100% Fruit Juice	N/A	1	0	0	0	0
Unknown Type	N/A	2	0	2	0	2
Other	N/A	0	0	0	0	0

*Note***.** Level of agreement for observer pair A was 90%. Level of agreement for observer pair B was 85%.

Note. Inter-rated agreement for observer pair A could not be assessed for sixth grade students and were therefore excluded.

Primary Analyses

Given the nesting of students within classes, analyses examined potential violations of the independent observations assumption. Models were tested for each outcome variable to assess for the presence of a clustering effect at the higher-order level (i.e., classroom), which would indicate a violation of the assumption. The intraclass correlation (ICC) was calculated to determine the degree of similarity within clusters. The ICC index can range from 0 to 1, with higher values indicating higher homogeneity within groups (Gelman & Hill, 2007). Only minimal variation was accounted for by classrooms (ICC<0.02) for all outcome variables except weekly SSB servings at baseline (ICC=0.05). As such, the regression model in the analysis of weekly SSB servings at baseline was augmented to account for clustering using a random effects model.

Predictors of SSB Consumption at Baseline (1.1, 1.2)

The primary objective of aim 1 was to determine whether racial/ethnic differences exist in SSB consumption. In a standard OLS framework, hierarchical regressions are used to determine whether newly added variables show a significant improvement in the proportion of explained variance in the dependent variable by the model.

As noted above, the regression model was augmented to examine associations with weekly SSB servings at baseline and account for clustering at the classroom level (Breslow & Claytown, 1993) by treating classroom as a random effect. In these set of analyses, we used a parallel approach by relying on chi-square change tests ($\Delta\chi^2$) for the base model (age and gender), the base model plus the second set of predictors (i.e., race/ethnicity groups), and then adding the third predictor block to the model (weekly water servings and perception of peer SSB consumption at baseline). Individuals who identified in the "other" category for racial/ethnic subgroups were excluded because the numbers were too small for meaningful analysis.

Trends for Days of SSB Consumption per Week at Baseline. As shown in Table 5, the first model in which days of SSB consumption per week at baseline was predicted from age and gender was not statistically significant. When considered together, age and gender accounted for .7% of the variance in days of SSB consumption per week at baseline. The second model which included age, gender, and racial/ethnic groupings was statistically significant. Adding the second block of variables (i.e., racial/ethnic groupings) revealed that the entire model accounted for 6.7% of the variance in days of SSB consumption per week at baseline, indicating that the addition of racial/ethnic groupings improved prediction over and above age and gender alone. Finally, student water consumption and perceptions of peer SSB consumption at baseline also accounted for significant incremental variance (i.e., predicted an additional 1.6% of the variance in days of SSB consumption per week at baseline). The overall regression model was statistically significant.

The predictor that coded the contrast between non-Hispanic Black and White groups was significant, suggesting that on average Black students reported higher levels of weekly SSB servings at baseline compared to White students (b=1.44, p<.001). The predictor that coded the contrast between Hispanic and White non-Hispanic groups was also significant, indicating that on average Hispanic students reported higher levels of weekly SSB servings at baseline compared to White students (b=1.11, p=.003). The contrast predictor featuring Asian students and White, non-Hispanic students was not significant (p=.47).

Water consumption at baseline was another significant predictor of days of SSB consumption per week at baseline, and the association was negative suggesting that a lower weekly water servings is associated with more days of SSB consumption per week at baseline (b=-.03, p=.01). Age, gender and, perceptions of peer SSB consumption at baseline were not statistically significant unique predictors. When considered jointly, the seven predictors accounted for significant variance in days of SSB consumption per week at baseline, $F(2,365) = 3.11$, $p = .05$, $R^2 = .089$.

Table 5

OLS Hierarchical Regression Predicting Days of SSB Consumption per Week at Baseline from Demographics, Racial/ Ethnic Groupings, and Other Baseline Characteristics

	b	*se*	sr^2	*p*
Set 1: Demographics:				
$\Delta F(2, 370) = 1.30$, $p = .30$, $R^2 = .007$				
Age	.05	.12	<.00	.70
Gender (0=female, 1=male)	-.33	.24	.00	.20
Set 2: Racial/ Ethnic Groupings:				
$\Delta F(3,367) = 9.00$, $p < 0.001$, $R^2 = .074$				
Black, non-Hispanic	1.44	.34	.04	<.001***
Hispanic	1.11	.40	.02	.003**
Asian, non-Hispanic	-.53	.73	<.00	.47
Set 3: Other Baseline Characteristics:				
$\Delta F(2,365) = 3.11$, $p = 0.05$, $R^2 = .089$				
Weekly water servings	-.03	.01	.02	.01**
Perception of peer SSB consumption	.08	.10	<.00	.41

Note. Sugar-sweetened beverage = SSB.

Note. All coefficients are from final model.

Note. *$p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Trends for Weekly SSB Servings at Baseline. As shown in Table 6, the first two-predictor model in which weekly SSB servings at baseline was predicted by age and gender was significant. The second model which included age, gender, and racial/ethnic groupings was statistically significant, indicating that racial/ethnic groupings improved the predictive value over and above age and gender alone (i.e., chi-square decreased from 5824.83 to 5290.90). Finally, adding the student water consumption and perceptions of peer SSB consumption at baseline improved the model chi-square (259.68). The final overall regression model was statistically significant.

Age was a significant unique predictor of weekly SSB servings at baseline, suggesting that older youth reported higher significant beverage consumption, b=.10 *se*=.35, *p*=.04. The predictor that coded the contrast between Black and White, non-Hispanic groups was significant, suggesting that on average Black students reported higher levels of weekly SSB servings at baseline compared to White students (b=4.90, *p*<.001). The predictor that coded the contrast between Hispanic and White, non-Hispanic groups was also significant, indicating that on average Hispanic students reported higher levels of weekly SSB servings at baseline compared to White students (b=2.55, *p*=.02). The contrast predictor featuring Asian students and White, non-Hispanic students was not significant (*p*=.63).

Table 6

Random Regression Model Predicting Weekly SSB Servings at Baseline from Demographics, Racial/ Ethnic Groupings, and Other Baseline Characteristics

	b	*se*	*p*
Set 1: Demographics:			
Age	.70	.35	.04*
Gender (0=female, 1=male)	-.40	.70	.60
Set 2: Racial/ Ethnic Groupings:			
$\Delta\chi^2(3) = 533.93$, $p < .0001$			
Black, non-Hispanic	4.90	1.10	<.001***
Hispanic	2.60	1.12	.02*
Asian, non-Hispanic	-1.00	2.00	.63
Set 3: Other Baseline Characteristics:			
$\Delta\chi^2(2) = 259.68$, $p < .0001$			
Weekly water servings	-.04	.03	.16
Perception of peer SSB consumption	1.23	.25	<.001***

Note. Sugar-sweetened beverage = SSB.

Note. All coefficients are from final model.

Note. *$p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Examining Change in Beverage Consumption from Baseline to Post-Campaign (2.1, 2.2)

Results of four paired samples *t*-tests described here can be found in Table 7. There were no notable effect sizes observed in any of the paired *t* tests reported. Participants' report of average days of SSB consumption per week were not statistically different from baseline (*M*=4.0, *SD*=2.37) to post-campaign (*M*=3.91, *SD*=2.34). Likewise, participant report of weekly SSB servings were not statistically different from baseline (*M*=9.7, *SD*=9.2) to post-campaign (*M*=10.0, *SD*=9.6). With respect to water consumption trends, participants' report of average days of water consumption per week were not statistically different from baseline (*M*=5.84, *SD*=1.87) to post-campaign

(*M*=5.68, *SD*=1.98). Likewise, participant report of weekly water servings was not statistically different from baseline (*M*=20.68, *SD*=10.73) to post-campaign (*M*=19.59, *SD*=11.18). All Cohen's *d* estimates were small in magnitude, suggesting convergence between the lack of statistical significance and small effect sizes (see Table 7).

Table 7

Pre and Post-Campaign Beverage Consumption Comparisons

Variable(s)	Mean (SD)	Standard Error Mean	95% CI [Lower Bound, Upper Bound]	*t*	*p*	*d*
How many days per week SSBs were consumed, *n*=333			[-0.19, 0.37]	.65	.52	.04
Time 1	4.00 (2.37)	.13				
Time 2	3.91 (2.34)	.13				
Average servings of SSBs consumed per week, *n*=327			[-1.407, .78]	-.57	.57	-.03
Time 1	9.70 (9.20)	.51				
Time 2	10.00 (9.60)	.53				
How many days per week water was consumed, *n*=333			[-.055, .37]	1.46	.14	.08
Time 1	5.84 (1.87)	.10				
Time 2	5.68 (1.98)	.11				
Average servings of water consumed per week, *n*=320			[-.12, 2.30]	1.76	.079	.09
Time 1	20.68 (10.73)	.60				
Time 2	19.59 (11.18)	.62				

Note. Time 1 = Baseline; Time 2 = Post-campaign; Sugar-sweetened beverages = SSBs

Note. *$p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Predictors of Changes in Beverage Consumption (2.3)

A series of regression analyses were conducted to assess the relationship between exposure to the student-led campaign and changes in beverage consumption (Tables 8-11). Two SSB consumption and two water consumption outcome variables were examined using a raw change score (time 2 – time 1). Predictors of interest included racial/ethnic groupings and the three exposures to campaign variables, including student's recall of different campaign sources, participation in the school-based "30-day water challenge," and the number of closest friends that participated in the school-based "30-day water challenge." Age, gender, and baseline beverage consumption were included in each model as covariates. Next, the models tested interactions between each of the three exposures to campaign variables and race/ethnicity groups, as well as gender. Only significant interaction terms were included in the final models. Individuals who identified in the "other" category for racial/ethnic subgroups were excluded because the numbers were too small for meaningful analysis.

SSB Consumption. Omnibus tests for the multiple linear regression models predicting days of SSB consumption per week and changes in weekly SSB servings from baseline to post-campaign were not statistically significant. Small R square values were estimated for models predicting changes in days of SSB consumption per week and changes in weekly SSB servings from baseline to post-campaign (.05 and .03), suggesting that these models explained little of the variance in changes in SSB consumption scores from baseline to post-campaign. The standardized coefficients for the individual covariates and predictors are provided in Tables 8 and 9.

Table 8

Regression Analysis for Predictors of Days of SSB Consumption per Week Change Scores

Variable	*b*	SE B	β	*t*	*sr*²	*p*
Weekly water servings at baseline	-.01	.02	-.03	-.41	<.001	.70
Perception of peer SSB consumption post-campaign	-.20	.12	-.10	-1.40	.01	.20
Age	-.13	.16	-.05	-.82	<.001	.41
Gender (0=female, 1=male)	-.31	.33	-.06	-.96	<.001	.34
Exposure to campaign						
Recall of different campaign sources	.03	.20	.01	.17	<.001	.86
Number of closest friends in water challenge	-.20	.12	-.11	-1.60	.01	.11
Student participation in water challenge	.62	.38	.11	1.64	.01	.10
Race/Ethnicity						
Black, non-Hispanic	.55	.50	.10	1.20	.01	.24
Hispanic	.90	.50	.20	1.81	.01	.10
Asian, non-Hispanic	1.05	.90	.10	1.20	.01	.24

Note. Sugar-sweetened beverage = SSB.

Note. Full model was not statistically significant, $F(10,266) = 1.30$, $p = .25$, $R^2 = .05$.

Note. $^*p \leq 0.05$, $^{**} p \leq 0.01$, $^{***} p \leq 0.001$.

Table 9

Regression Analysis for Predictors of Weekly SSB Servings Change Scores

Variable	*b*	SE B	β	*t*	sr^2	*p*
Weekly water servings at baseline	.04	.06	.05	.72	<.001	.50
Perception of peer SSB consumption post-campaign	-.42	.50	-.06	-1.00	<.001	.40
Age	-.15	.62	-.02	-.24	<.00	.81
Gender (0=female, 1=male)	-2.10	1.23	-.11	-1.70	.01	.10
Exposure to campaign						
Recall of different campaign sources	-.33	.73	-.03	-.50	<.001	.70
Number of closest friends in water challenge	-.60	.50	-.10	-1.30	.01	.20
Student participation in water challenge	2.53	1.44	.12	1.8	.01	.10
Race/Ethnicity						
Black, non-Hispanic	.04	1.80	.00	.03	<.001	1.00
Hispanic	-.30	2.0	-.01	-.20	<.001	.90
Asian, non-Hispanic	.53	3.31	.01	.20	<.001	.90

Note. Sugar-sweetened beverage = SSB.

Note. Full model was not statistically significant, $F(10,263) = .90$, $p = .53$, $R^2 = .03$.

Note. *$p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Water Consumption. Omnibus test for the multiple linear regression model predicting days of water consumption per week from baseline to post campaign was not statistically significant and a small R square value (.05) suggests that the model explained little of the variance in change in days of water consumption per week from baseline to post-campaign. The standardized coefficients for the individual covariates and predictors are provided in Table 10.

The full model predicting change in weekly water servings from baseline to post-campaign was statistically significant (see Table 11). Age was a significant unique predictor, suggesting that older youth reported higher significant changes in weekly water servings from baseline to post-campaign (b=1.73, *p*=.01). In addition, perception of peer SSB consumption post-campaign was positively associated with changes in weekly water servings from baseline to post-campaign, indicating that students reporting higher SSB consumption among their peers had increased their weekly water servings from baseline to post-campaign (b=1.12, *p*=.02) than students reporting lower SSB consumption among their peers.

With respect to the exposure to campaign variables, the number of closest friends that participated in the "30-day water challenge" was another significant predictor of change in weekly water consumption from baseline to post-campaign, and the association was negative suggesting that students reporting fewer friends participating in the campaign had increased weekly water servings from baseline to post-campaign (b=-1.21, *p*=.01). Neither student's recall of different campaign sources nor participation in the "30-day water challenge" were statistically significant predictors of change in weekly water servings from baseline to post-campaign (p<.20 and .13, respectively). Additionally, gender and SSB consumption at baseline were not significant (*p*=.53 and .73, respectively). Moreover, no statistically significant interaction terms were found (*p*=ns).

Table 10

Regression Analysis for Predictors of Days of Water Consumption per Week Change Scores

Variable	*b*	SE B	β	*t*	sr^2	*p*
Weekly SSB servings at baseline	.00	.01	.02	.30	<.00	.80
Perception of peer SSB consumption post-campaign	.10	.10	.06	1.00	<.00	.33
Age	.30	.12	.13	2.22	.02	.03*
Gender (0=female, 1=male)	-.10	.24	-.02	-.31	<.00	.80
Exposure to campaign						
Recall of different campaign sources	.20	.14	.10	1.21	.01	.23
Number of closest friends in water challenge	-.06	.10	-.05	-.70	<.00	.52
Student participation in water challenge	.40	.30	.10	1.30	.01	.20
Race/Ethnicity						
Black, non-Hispanic	-.40	.34	-.10	-1.20	.01	.30
Hispanic	-.74	.40	-.20	-2.10	.02	.04*
Asian, non-Hispanic	.20	.70	.02	.30	<.00	.80

Note. Sugar-sweetened beverage = SSB.

Note. Full model was not statistically significant, $F(10,273) = 1.60$, $p = .12$, $R^2 = .05$.

Note. *$p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table 11

Regression Analysis for Predictors of Weekly Water Servings Change Scores

Variable	*b*	SE B	β	*t*	sr^2	*p*
Weekly SSB servings at baseline	.00	.07	.02	.34	<.00	.73
Perception of peer SSB consumption post-campaign	1.12	.50	.14	2.22	.02	.02*
Age	1.73	.70	.16	2.70	.03	.01**
Gender (0=female, 1=male)	-.81	1.30	-.04	-.63	.01	.53
Exposure to campaign						
Recall of different campaign sources	1.02	.80	.10	1.30	.01	.20
Number of closest friends in water challenge	-1.21	.50	-.18	-2.60	.02	.01**
Student participation in water challenge	2.24	1.50	.10	1.50	.01	.13
Race/Ethnicity						
Black, non-Hispanic	-2.60	1.90	-.12	-1.40	.01	.17
Hispanic	-2.80	2.00	-.12	-1.42	.01	.16
Asian, non-Hispanic	-1.53	3.50	-.03	-.44	<.00	.66

Note. Sugar-sweetened beverage = SSB.

Note. Full model was statistically significant, $F(10,263) = 2.60$, $p = 0.005$, $R^2=0.09$.

Note. $*p \leq 0.05$, $** \; p \leq 0.01$, $*** \; p \leq 0.001$.

CHAPTER V: Discussion

The aims of the present study were twofold: (1) to examine the relationship between racial/ethnic groups and SSB consumption in adolescents at one middle school, and (2) to explore whether a community driven, school-based health initiative to reduce SSB consumption and increase water consumption led to improvements in beverage consumption trends. Given the adverse health risks associated with SSB consumption, researchers and public health organizations have urged policy makers, schools, and the food industry to support broad environmental changes to reduce SSB consumption in children and adolescents. Despite considerable declines in SSB consumption in recent decades, youth continue to consume excess SSBs and intake is disproportionately higher among certain racial/ethnic minority groups (Lee, et al., 2018; Mendez et al., 2019).

Trends and Predictors of SSB Consumption

Overall students in the present study report consuming SSBs an average of four days per week and consuming an average of 10 servings of SSBs per week at baseline. This exceeds AHA guidelines to limit SSB intake to no more than 8 servings per week (Vos et al., 2017). The background variables of gender and age were included in the hierarchical models as covariates. Although females appeared to consume more SSBs than males, gender was not a significant predictor. With respect to age, older students report more weekly SSB servings than younger students. Age did not affect days of SSB consumption per week at baseline.

As hypothesized, there were marked differences in SSB consumption at baseline between non-Hispanic White and racial/ethnic minority students. Specifically, in comparison to White students, Black and Hispanic students consumed an additional 4.9

and 2.6 servings on average each week, respectively. Additionally, Black and Hispanic students were shown to consume SSBs on more days on average per week relative to their White peers (an additional 1.44 and 1.22 days, respectively). These numbers may be conservative estimates given that students were asked to consider a 12-oz can as a single serving. Our findings were comparable to other studies reporting elevated consumption of SSB among Hispanic and Black youth relative to White youth in the U.S. (Beck et al., 2020; Tasevska et al., 2017).

Weekly water servings at baseline contributed significantly to the explained variance in the days of SSB consumption per week at baseline, though did not affect weekly SSB servings at baseline. While it has been suggested that unhealthy dietary behaviors may cluster together (Leung et al., 2018; Russo, et al., 2020), some studies have shown no association between SSB and water consumption among youth (Vieux, Maillot, Rehm, Barrios, & Drewnowski, 2020).

With respect to youths' perceptions of peer SSB consumption, students reporting higher SSB consumption among peers consumed more weekly SSB servings on average at baseline. However, perception of peer SSB consumption did not affect days of SSB consumption per week. Given that weekly SSB servings was assessed by creating a new variable (frequency or number of days multiplied by number of servings on a typical day), it is possible that students estimated the number of SSBs consumed by their peers on a typical day in relation to their own intake. This would be consistent with the role of peer influences in adolescent dietary behaviors (Salvy, De La Haye, Bowker, & Hermans, 2012). In fact, findings from Perkins, Perkins, and Craig's study (2010) showed that youth typically overestimate how frequently their peers consume SSBs and individual

SSB consumption was mores strongly association with youths' perceptions of peers' SSB intake than with true estimates of peer SSB consumption.

Predictors of Change in Beverage Consumption

The present study is one of only a few SSB studies that have focused on a brief, student-led school-based intervention developed using community-based research methods for middle school-aged students. These strategies were developed similar to others in the literature (Lane et al., 2016; Smith & Holloman, 2014). Prior research studies have demonstrated favorable outcomes for reducing SSB consumption among youth, though the generalizability of the findings is limited due to study samples focused on older adolescents in high school (e.g., Smith, Sexton, Pettigrew & Eastburn, 2021) or exclusion of SSB consumption variables as an outcome (only water, see Patel et al., 2011). Furthermore, in the latter study, only seventh graders were included in data collection.

Contrary to our hypotheses, comparisons between baseline and post-campaign SSB and water consumption revealed no statistically significant differences. It was also hypothesized that student's recall of different campaign sources, participation, and number of closest friends that participated in the school-based health initiative would be associated with changes in SSB and water consumption. There were no statistically significant changes in SSB consumption due to student's exposure to the school-based health initiative, as measured by the aforementioned factors. Likewise, student's recall of different campaign sources, participation in the school-based health initiative and the number of the closest friends that participated did not predict changes in water consumption from baseline to post-campaign. However, the number of close friends participating in the school-based health initiative significantly predicted changes in weekly water consumption from baseline to post-campaign. Specifically, student’s reporting higher participation among close friends reported decreased weekly water servings from baseline to post-campaign (i.e., drank fewer weekly servings after thirty days). In addition, perception of peer SSB consumption post-campaign predicted changes in weekly water servings. Specifically, student’s reporting higher SSB consumption among their peers had higher weekly water servings baseline to post-campaign. Both of these findings were in the reverse direction expected. It has been suggested that youth may be more motivated to adopt to behavior changes in line with health promotion messages to consume more water without a perceived peer pressure to drink water (see Smit et al., 2012). It is also unclear to what extent these peers represent an important social network for students. However, more research is needed to understand and establish the validity of these findings.

With respect to the third hypothesis of aim 2, there were no differences in the relationship between exposure and beverage consumption for different racial/ethnic groups. It may be that the school-based health initiative did not penetrate widely into areas outside of the school environment that have been linked to youth dietary behaviors, including access and availability of beverages in their home, home of their peers, neighbors, and food establishments. Additionally, these findings may be due to limitations of the present study described subsequently.

Strengths, Limitations, and Future Directions for Research

To our knowledge, this study is the first to test a community-driven approach to reduce SSB consumption and increase water consumption in a sample of middle-schoolers. Moreover, this study adds to a sparse body of evidence on participatory research methods for racial/ethnic minority youth (see review by Lane et al, 2019) and offers insight into challenges to address among researchers interested in engaging youth from undeserved and underrepresented communities. The present study has several strengths including the diverse composition of the sample, the large sample size, and the prospective nature of the data, allowing for hypotheses with temporal predictions. Additional strengths include the use of hierarchical models to account for nested data thus allowing for accurate parameter estimates.

The study also has several limitations that should be considered. Survey items were adapted from prior studies and were considered reasonably valid (Smith & Holloman, 2014; Wang, Bleich, & Gortmaker, 2008), though as with any self-report data are subject to potential sources of bias, including recall error and social desirability. In addition to the presentation of pictures of graduated portion sizes to improve the accuracy of reporting dietary intake, observations and other objective measures can assist with the interpretation of findings (Grummon, Sokol, Hecht, & Patel, 2019). In the present study, observational data was not used to assess outcomes. In addition, survey data was only collected from students present in school during specific class periods and could not account for students absent at that time which resulted in an under-sampling of students in eighth grade.

Previous studies have documented disparities in children's SSB intake, with higher consumption among low SES communities (Kit et al., 2013;). Moreover, SES disparities in SSB consumption have been shown to vary by race/ethnicity, with particularly marked racial/ethnic differences observed in lower SES groups (Mendez et al., 2019). In the present study, student report of zip-code was planned to be used to identify mean household income for each student's region. The larger evaluation did not assess other SES indicators such as household income or parent education given the limitations of student report. Unfortunately, students were not able to reliably report their zip-code as evident by frequently missing responses or reporting of hometown/place of residence. Therefore, the present study was limited in its ability to examine the potential confound between SES and racial/ethnic minority status.

Additionally, the present study did not account for other variables of interest. For example, several studies with youth populations have linked nutrition knowledge to dietary habits. Pirouznia's study (2001) demonstrated a positive association between nutrition knowledge and eating behaviors among children in the U.S., particularly as they increased in age, while another study conducted in Sicily found a negative association between children's nutrition knowledge and unhealthy dietary habits, including SSB consumption (Grosso et al., 2013). Additionally, Irwin, Speechley, & Gilliland (2001) cross-sectional study of Canadian children found that higher nutrition and water knowledge is associated with reduced SSB consumption and increased water consumption.

Finally, the study surveys did not ask students to identify different types of SSBs consumed. Research has shown that racial/ethnic disparities in SSB consumption exist for certain types of SSBs and may not be true for others. More specifically, Black youth consume more sweetened fruit drinks than any other type of SSB, while soft drinks are the greatest source of SSBs for Mexican American and White youth. (Han & Powell; 2013; Mendez et al., 2019; Russo, et al., 2020). Moreover, the broad inclusion of all SSB types in the present study prevented us from examining the potential differential effects of the intervention on different types of SSBs. Despite these limitations, these findings fit together with existing literature and offer more evidence for the need to intervene to curb SSB consumption in younger racial/ethnic minority youth.

The present study leads us to several recommendations for future research. As noted previously, the school-based “30-day water challenge” occurred in the context of other health promotion efforts within the school. While this initiative focused on beverage consumption, it is unclear to what extent other health initiatives may have played a role in the findings of this study (Siega-Riz et al., 2011). For example, shortly before the school’s promotion efforts focused on “30-day water challenge,” increasing physical activity and reducing sedentary behavior was a targeted health initiative within the school. As noted previously, it is suggested that health behaviors tend to cluster together. Changes in student’s health behaviors focused on physical activity may have indirectly effected student’s beverage consumption pattern. Future researchers interested in examining the efficacy of student led school-based interventions targeting SSB consumption in middle-schoolers should compare outcomes across multiple schools. Advisory board members can support researchers in these efforts by identifying other local middle school(s) and fostering relationships with school administration (Lane et al., 2019). Moreover, repeated measures, with multiple baseline and post-campaign data collection points would provide more information about the changes in beverage consumption overtime. It has also been suggested that future research should include measures to assess the perception of peer facilitators as it relates to their ability to influence change among their peers (Lane et al., 2018).

Additionally, researchers should continue to engage youth in identifying and address health promotion issues that are relevant to their lives. Fewer research endeavors have engaged younger adolescents which may be due to several challenges (e.g., maturity level, cognitive ability). In the spirit of CBPR, it is important that researchers utilize developmentally appropriate strategies to engage younger adolescents. For example, creative and artistic research methods, such as Visual Voices and Photo Voice, may generate more interest in younger participants (Treadwell & Taylor, 2017; Bashmore et al., 2017; Lofton & Bergren, 2018). A youth-led photovoice project is being developed at the middle-school that participated in the current project. Photovoice is a qualitative research method used to engage individuals from underserved and underrepresented populations (O'Malley & Munsell, 2020). These methods may be especially important for racial/ethnic minority youth to establish trust with researchers. Youth participation in CBPR can foster more culturally competent and effect public health interventions for underserved and disadvantaged youth (Checkoway & Richards-Schuster, 2003).

Implications for Policy and Clinical Practice

The frequent consumption of SSBs among students in the present study highlights an important public health concern, given the number of adverse health outcomes associated with high SSB consumption. Findings from this study reflect concerning racial/ethnic disparities with respect to SSB consumption trends and offer important implications for policy makers, health practitioners, school personnel, parents, and researchers. First, despite having limited access to SSBs in school, students continue to consume SSBs. Our qualitative findings from the lunchtime observations show that a majority of SSBs consumed were flavored milk drinks, and a lower proportion were soft drinks. This finding is representative of the proportion of students at the school who qualify for the free and reduced lunch program (more than 85% of students) and is consistent with wellness policies and nutrition standards that limit the sale of SSBs within schools. Presently, flavored milks remain the only SSBs available in schools as part of federal school meal programs. While some, including the AAP (2004), differentiate flavored milks from other types of SSBs, some argue that the benefits (i.e., source of calcium and protein) of these beverages do not outweigh the risks. Flavored milk often contains a high quantity of added sugars, like other types of SSBs, and has been shown to contribute to added energy intake among regular consumers (Striegel-Moore et al., 2006). Removal of flavored milk from school meals may decrease added sugar and SSB consumption, without compromising the intake of key milk-related nutrients (Thompson et al., 2020). Given a lack of consensus in the existing literature, more research is needed to clarify the health benefits versus consequences of flavored milks and other choices within federal school meal programs (e.g., inclusion of 100% fruit juice beverages). These policy choices disproportionately impact lower SES youth, and, as a result, can influence existing racial/ethnic health disparities for youth in the US.

Another study implication related to current school meal policies, is related to student's water consumption. Lunchtime observations at baseline and post-campaign indicate that water is consumed less than other beverages at school. Students were sometimes provided with free bottled water as part of the present study's school-based health initiative; however, this was not consistent throughout the one-month long initiative. Furthermore, while plain/flavored milk and 100% fruit juice are provided to students in the free and reduced lunch program, water is not provided. Existing studies indicate that water provision within schools (e.g., filtered water dispensers) can encourage youth to increase water consumption and may help replace SSBs (Mogham, Krieger, & Louden, 2019). Despite the 2010's HHKA requirement that water be provided with school meals, one study found low rates of water fountain use among students and that over 50% of U.S. schools in 2012 did not provide free water in school cafeterias (see Kenney et al., 2016). These trends likely reflect concerns about tap water safety and quality (Patel et al., 2014). Policies that emphasize provision of filtered water sources may increase water consumption among middle schoolers (Patel et al., 2011), however, more research is needed.

The present study sought to improve outcomes using a peer-led initiative. There is considerable evidence that peer mentoring is useful for promoting health behavior changes (Petosa & Smith, 2014). Given what is known about the influence of peers in child and adolescent behavior, peer-led education has been adapted in schools to address topics including sexual health (Tolli, 2012), Human Immunodeficiency Virus (HIV) prevention (Van der Maas & Otte, 2009), and smoking prevention (Bosi et al., 2013). Furthermore, research suggests that peers may also influence physical activity and dietary behaviors (Finnerty et al., 2010). The rationale for peer-led health interventions is that behaviors are socially influenced, and child and adolescent behavior habits are shaped through social interactions (Campbell & MacPhail, 2002). Similarly, these assumptions about the influence of peers underpins strategies that emphasize peer-led health programs targeting SSB consumption. Future studies utilizing peer influence in school-based interventions should consider recruiting older students, namely high schoolers, in health promotion programs targeting younger students in middle school (Frerichs et al., 2016).

It has been suggested that self-efficacy or confidence of their ability to influence their peers and serve as “role models” may also strengthen peer-led health programs, though this was not assessed in the present study.

Middle school aged students are at a critical time for increased autonomy in their dietary choices. In the present study, weekly SSB servings at baseline increased with age. Younger students may require more home interventions due to their greater dependence on their caregivers with respect to foods that are purchased for them or available in the home. There is considerable evidence showing that parent and family involvement in school-based intervention targeting dietary habits of children as effective, particularly among younger children (see systematic review by Rahman et al., 2017). Parents can play an important role in guiding the health habits of children through the food/beverage items provided in the home and modeling of healthy behaviors. The dissemination of educational materials (e.g., factsheets) that promote healthy dietary behaviors, including the importance of reducing SSB consumption and replacing SSBs with healthier beverages options (e.g., water) can help remind parents to reinforce the messaging that youth receive at school. One strategy to engage caregivers may include the use of integrated SMS technology (e.g., Zoellner et al., 2019) given that text messaging is used by many worldwide and may be an efficient and personalized form of caregiver engagement.

Conclusion

This study adds to the limited body of evidence on participatory research methods for health promotion in middle-schoolers and includes important considerations for future research engaging racial/ethnic minority youth in underserved communities. Findings from the current study are consistent with national trends showing racial/ethnic disparities in SSB consumption. The effectiveness of student-led school-based health initiatives targeting SSB consumption in racial/ethnic minority middle school adolescents remains unclear. Future research should explore additional factors that may influence adolescent's beverage consumption habits particularly among Black and Hispanic youth, including SES and adolescents' knowledge about healthy diet/nutrition. Additionally, further research is needed to assess beverage consumption patterns over longer periods and across multiple schools.

Perhaps most critically, systemic and policy approaches are likely needed to improve healthy lifestyle behaviors in children and adolescents from lower SES communities. These approaches can help people develop healthier behaviors by reducing barriers to healthy behaviors (e.g., filtered water provision) and eliminating easy access to unhealthy resources (e.g., limiting access to SSBs). Previous research indicates that school nutrition policies can have a positive impact on student's dietary intakes, particularly among youth at risk for food insecurity (Kubik et al., 2003). These system-level approaches are more permanent than programs that focus on individual-level behavioral change (Zakocks & Edwards, 2006). Multilevel factors can influence health outcomes and contribute to disparities in health. Meaningful policy changes can address systemic barriers that sustain these disparities. Findings from the present study suggest that school nutrition programs can positively shape health behaviors among youth by limiting access to SSBs within the school, however, racial and ethnic disparities persist. There is a need for all community stakeholders: schools, parents, and healthcare professionals to support and empower young adolescents in healthy habit development and change.

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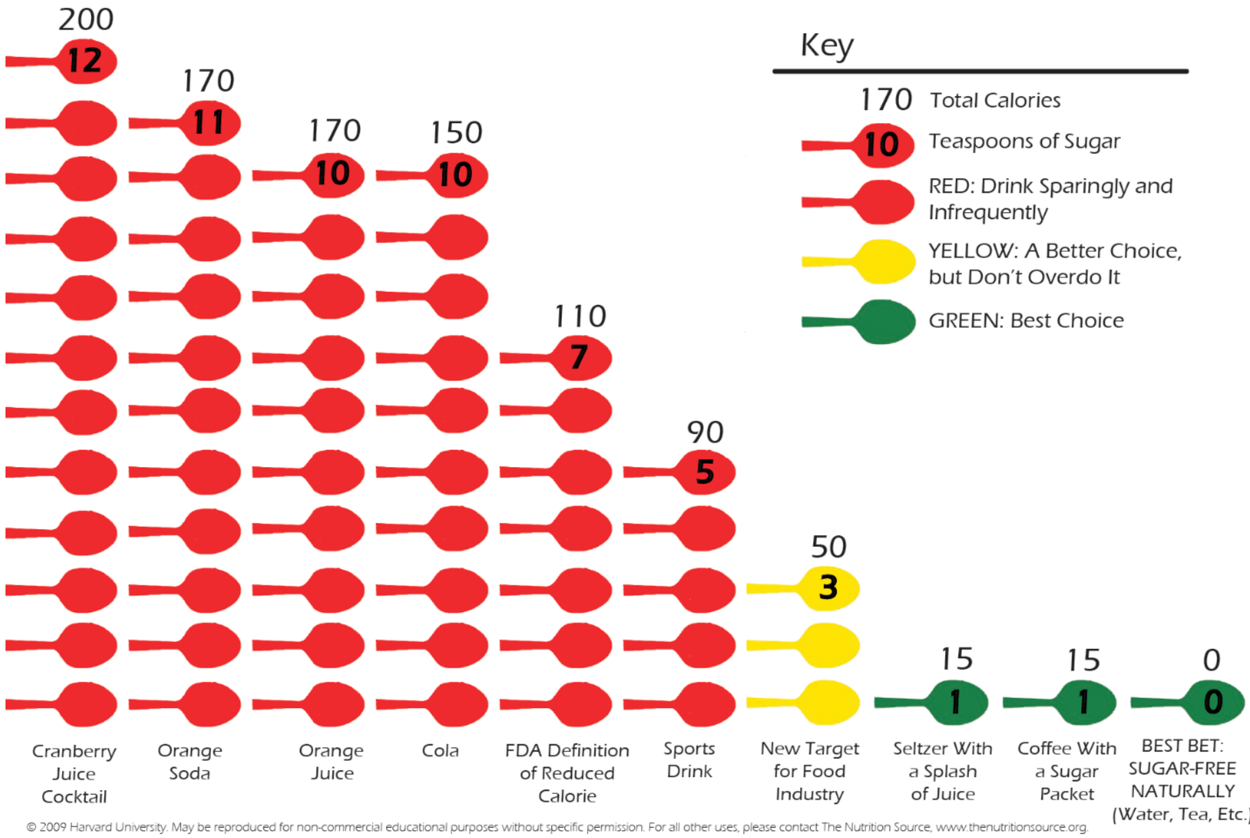
Appendix A

Calorie and teaspoon of sugar in 12-oz beverages



Calorie and teaspoon of sugar in 12-oz beverages. Drinks that fall in the red category contain more than 12 grams of sugar per serving and in the yellow category have up to 12 grams of sugar. Alternative beverages considered the "best-choice" beverages fall in the green category and contain little or no added sugars. Reproduced from The Nutrition Source by Harvard School of Public Health. Copyright 2009 by Harvard University.

Appendix B

Student Survey at Baseline

1) What is your Name: ______________________ ______________________
(First Name) (Last Name)

2) What is your Age? (*Circle*): 10 or 11 or 12 or 13 or 14 or 15 and older

3) What is your Grade Level? (*Circle One*): 6th or 7th or 8th

4) What is your Ethnicity? (*Circle One*): Hispanic/Latino or Not Hispanic/Latino

5) What is your Race (*Circle One or More*): Black / White / Asian / Other (*Write Answer*): ____________

6) What is your Gender? (*Circle One*): Boy or Girl

SURVEY DIRECTIONS: The questions below will ask you about the drinks you had in the last 7 days. Please take a moment to think about this last week and use the table below to help you complete the survey.

SURVEY KEY	
Beverage Types	• Sweetened Beverages (added sugar) = flavored milk, fruit juice, lemonade, regular soda, sweetened tea/coffee, energy/sport drinks • Water = tap, water fountain, bottled
Beverage Serving Size	• One glass (approximately 8 ounces) = one drink • One can (approximately 12 ounces) = one drink • One bottle (approximately 20 ounces) = two drinks
Fruit/Vegetable Serving Size	• One serving of fruit = about the size of your fist • One serving of vegetable = about 12 baby carrots

7) In the last 7 days, how many days did you drink **sweetened beverages**? (*Select One*):
- ☐ 0 (No days)
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7 (Every day)

8) On days when you drink them, how many glasses, cans, or bottles of **sweetened beverages** did you drink? (*Use Survey Key and Select One Below*):
- ☐ 0 (I don't drink sweetened beverages)
- ☐ 1 drink
- ☐ 2 drinks
- ☐ 3 drinks
- ☐ 4 drinks
- ☐ 5 or more drinks on those days

9) In the last 7 days, how many days did you drink **water**? (*Use Survey Key and Select One Below*):
- ☐ 0 (No days)
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7 (Every day)

10) On days when you drink **water**, how many glasses, cans, or bottles did you drink? (*Use Survey Key and Select One Below*):
- ☐ 1 drink
- ☐ 2 drinks
- ☐ 3 drinks
- ☐ 4 drinks
- ☐ 5 or more drinks on those days

11) From where did you usually get your **sweetened beverages**? (*Select all that apply*):
- ☐ School cafeteria
- ☐ School vending machine
- ☐ PTSA bookstore
- ☐ At a store on my way to school
- ☐ Brought from my home
- ☐ I do not drink sweetened beverages

12) From where did you usually get **water**? (*Select all that apply*):
- ☐ School cafeteria
- ☐ School vending machine
- ☐ PTSA bookstore
- ☐ At a store on my way to school
- ☐ Brought from home
- ☐ Water Fountain (count tap/sink)

13) Which do you think is the healthiest drink to quench your thirst? (*Select One*):
- ☐ Water
- ☐ Fruit juice
- ☐ Sugary drink
- ☐ Energy drink
- ☐ Not sure

Page 1 of 2

TURN OVER

Student Survey at Baseline.

14) In the last 7 days, how many days did you exercise or participate in sports activities that made you sweat and breathe hard, such as basketball, jogging, fast dancing, swimming laps, tennis, fast bicycling, or similar aerobic activities? (*Select One*):

☐ 0 (No days)
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7 (Every day)

15) **A.** Do you want to participate in the following activities after school (including evenings and weekends)? (*Select each activity that you would like to participate in)*:

☐ Aerobics
☐ Basketball
☐ Biking
☐ Dance/Zumba
☐ Karate
☐ Soccer
☐ Walking Club
☐ Water Aerobics
☐ Weight Training
☐ Yoga
☐ Other (*write here*): ______________________
☐ Other (*write here*): ______________________

B. What time of day would you to participate if any of the above activities were offered?
Please write here: ________________________

____

____

16) In the last 7 days, how many days did you eat **5 or more servings of fruits and/or vegetables** (*use Survey Key on Page 1 and Select One below*):

☐ 0 (No days)
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7 (Every day)

Now, take a moment and think about the other students in your grade

17) On a typical day, how many **sweetened beverages** do you think **most kids in your grade** drink? *(Use Survey Key on Page 1 and Select One below*):

☐ 0 (They do not drink any sweetened beverages)
☐ 1 drink
☐ 2 drinks
☐ 3 drinks
☐ 4 drinks
☐ 5 or more drinks a day

Page 2 of 2

PLEASE DO NOT COMPLETE SHADED AREA BELOW

TP 1 **DATE COMPLETED:** __ __/ __ __/ 2019 **RA Initials:** _______ **ID #** ___-___-___-___

Student Survey at Baseline.

Appendix C

Student Survey at Post-campaign

1) What is your Name: ______________________ ______________________
(First Name) (Last Name)

2) What is your home zip-code? _________

SURVEY DIRECTIONS: The questions below will ask you about the drinks you had in the last 7 days. Please take a moment to think about this last week and use the table below to help you complete the survey.

SURVEY KEY	
Beverage Types	• Sweetened Beverages (added sugar) = flavored milk, fruit juice, lemonade, regular soda, sweetened tea/coffee, energy/sport drinks • Water = tap, water fountain, bottled
Beverage Serving Size	• One glass (approximately 8 ounces) = one drink • One can (approximately 12 ounces) = one drink • One bottle (approximately 20 ounces) = two drinks
Fruit/Vegetable Serving Size	• One serving of fruit = about the size of your fist • One serving of vegetable = about 12 baby carrots

3) In the last 7 days, how many days did you drink **sweetened beverages**? (*Select One*):

☐ 0 (No days)
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7 (Every day)

4) On days when you drink them, how many glasses, cans, or bottles of **sweetened beverages** did you drink? (*Use Survey Key and Select One Below*):

☐ 0 (I don't drink sweetened beverages)
☐ 1 drink
☐ 2 drinks
☐ 3 drinks
☐ 4 drinks
☐ 5 or more drinks on those days

5) In the last 7 days, how many days did you drink **water**? (*Use Survey Key and Select One Below*):

☐ 0 (No days)
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7 (Every day)

6) On days when you drink **water**, how many glasses, cans, or bottles did you drink? (*Use Survey Key and Select One Below*):

☐ 1 drink
☐ 2 drinks
☐ 3 drinks
☐ 4 drinks
☐ 5 or more drinks on those days

7) From where did you usually get your **sweetened beverages**? (*Select all that apply*):

☐ School cafeteria
☐ School vending machine
☐ PTSA bookstore
☐ At a store on my way to school
☐ Brought from my home
☐ I do not drink sweetened beverages

8) From where did you usually get **water**? (*Select all that apply*):

☐ School cafeteria
☐ School vending machine
☐ PTSA bookstore
☐ At a store on my way to school
☐ Brought from home
☐ Water Fountain (count tap/sink)

9) Which do you think is the healthiest drink to quench your thirst? (*Select One*):

☐ Water
☐ Fruit juice
☐ Sugary drink
☐ Energy drink
☐ Not sure

10) On a typical day, how many **sweetened beverages** do you think **most kids in your grade** drink? (*Use Survey Key and Select One below*):

☐ 0 (They do not drink any sweetened beverages)
☐ 1 drink
☐ 2 drinks
☐ 3 drinks
☐ 4 drinks
☐ 5 or more drinks a day

Page 1 of 2

TURN OVER

Student Survey at Post-campaign.

11) In the past month, how often did you take part in an **extracurricular activity** (e.g., sport teams, clubs) at school? (*Select One*):

- ☐ Never
- ☐ Once or twice a month
- ☐ Once or twice a week
- ☐ Every day

12) In the last 7 days, how many days did you **exercise or participate in sports activities** that made you sweat and breathe hard, such as basketball, jogging, fast dancing, swimming laps, tennis, fast bicycling, or similar aerobic activities? (*Select One*):

- ☐ 0 (No days)
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7 (Every day)

13) Did you participate in the **"30-day water challenge"**? (*Select One*):

- ☐ Yes
- ☐ No (*please tell us why not*): ______________________

____

14) In the last 7 days, how many days did you eat **5 or more servings of fruits and/or vegetables** (*Use Survey Key and Select One Below*):

- ☐ 0 (No days)
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7 (Every day)

Now think about the "30-day water challenge"

15) Did you participate in your school's "**30-day water challenge**"?

- ☐ If YES, skip to #17
- ☐ If NO, continue to next question

16) Why did you not participate in the "**30-day water challenge**?" (*May Select One or More*):

- ☐ I did not know about the "30-day water challenge"
- ☐ I was not interested in the "30-day water challenge"
- ☐ Other (please *describe*): ______________________

____

17) Where in your school did you see or hear about the "**30-day water challenge**"? (*May Select One or More*):

- ☐ Posters
- ☐ Classmates
- ☐ Cafeteria
- ☐ Announcements
- ☐ Teachers
- ☐ I did not see/hear about the "30-day water challenge"
- ☐ Other (please *describe*): ______________________

____

18) How many of your closest friends participated in the "**30-day water challenge**"? (*Select One*):

- ☐ None
- ☐ 1 friend
- ☐ 2 friends
- ☐ 3 friends
- ☐ 4 or more friends

19) Did you increase your water consumption in the last month?

- ☐ Yes
- ☐ No

Page 2 of 2

PLEASE DO NOT COMPLETE SHADED AREA BELOW

TP 2 **DATE COMPLETED:** __ __ / __ __ / 2019 **RA Initials:** _______ **ID #** ___-___-___-___

Student Survey at Post-campaign.

Appendix D

Direct Lunchtime Observational Checklist

Today's Date: ____/____/_____ **Grade-level (*circle*)**: 6th , 7th , 8th		**Observer Initials**: ______ **Total Tables***: ______	Start time: _____ End time: _____	
**Counterclockwise from stage, count each table (with entire class) to determine Total # of tables and to label observed table.*			**Table #**: ____	**Table #**: ____
TOP PORTION: Count number of students at each table and number of students with 1 or more drinks				
		Total # of students (*at table*)		
		# (of students) with **purchased drinks** (*lunch tray*)		
		# (of students) with **drinks from home** (*lunch box*):		
		(of students) with **no purchased/brought** drinks:		
		# of students with only 1 drink with added sugar		
		# of students with at least 2 drinks with added sugar		
BOTTOM PORTION (BEVERAGE TYPES). Count each beverage type per table.				
		Plain Milk (e.g., whole, 2%, 1%, skim)		
WATERS		**Refillable water container** (*clearly water*)		
		Bottled water (e.g., sparkling/ flat)		
ADDED SUGARS		**Flavored Milk** (e.g., chocolate)		
		Regular Soda (e.g., Coke, Sprite)		
		Energy/ Sport Drinks (e.g., Gatorade)		
		Sweetened Coffee/ Tea		
	Fruit Juices	**100% Fruit** (*clear on label*)		
	Fruit Juices	**< 100% Fruit** (*clear on label*)		
	Fruit Juices	**Unknown Sugar %**		
	Fruit Juices	***Record fruit juice brands** (*e.g., Dole*)		
OTHER BEVERAGES (*Describe in blank cells*)		**Diet Soda** (e.g., Diet Coke, Coke Zero)		
		Refillable bottle (unknown content)		
NOTES				

Direct Lunchtime Observational Checklist.