

A Review of Existing Health Intervention Programs Aimed to Reduce Consumption of Sugar  
Sweetened Beverages by Children in Low Socioeconomic Populations

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## Abstract

Instances of childhood obesity have nearly tripled since 1970 and 20% of American children are now considered to be clinically obese (BMI above 95th percentile). Childhood obesity is correlated with increased risk of hypertension, type II diabetes mellitus, dyslipidemia and other diseases that potentially decrease quality of life. Consumption trends demonstrating increased caloric intake from added sugars in sugar sweetened beverages (SSB) is similar to known increases in childhood obesity rates. United States Department of Agriculture recommendations for added sugar per day is less than 10% of total calories consumed yet the average American between ages 3-17 consumes approximately 16% of its total caloric intake from SSB. Sugar Sweetened Beverages are an easily modifiable component of diet that, if reduced, will positively impact risk and instances of childhood obesity. These modified beverages are defined by the American Heart Association as any liquid beverage that contains any added sugar including from natural sources (e.g., fructose in juice). Health programs that aim to reduce SSB are broadly categorized by effort into mass media education, legislative action (taxes on added sugar), and efforts that utilize mobile phone or computer application and have been implemented in a wide variety of populations. Despite these efforts, low socioeconomic populations are particularly affected by childhood obesity, and related diseases, due to a steady increase in consumption of SSB. A need for cost effective intervention programs that target the populations most at risk has been highlighted by the White House task force on childhood obesity and the American Academy of Pediatrics. However little information has been compiled on what type of program is most effective in low socioeconomic populations. Here I propose a comprehensive literature review of existing programs that have been effective with reducing SSB consumption by children from low socioeconomic backgrounds. This will contribute to the ongoing effort to isolate effective strategies specifically targeting low socioeconomic populations. Broader impacts of this review will contribute to implementation of effective health programs that will reduce consumption of SSB by low socioeconomic populations and therefore a reduction in the instances of childhood obesity in low socioeconomic populations.

## **Introduction**

Approximately one fifth of American children and adolescents are obese, and will potentially suffer long-term health complications resulting in relatively poor quality of life and shorter life expectancy (Freedman et al. 2001). Instances of childhood obesity has tripled in almost 40 years, from 5% in 1971 to 17% in 2009 (May et al. 2013). Increased caloric intake from the consumption of Sugar Sweetened Beverages (SSB) reflects the trend of increasing childhood obesity (Lasater et al. 2011). Soda and carbonated beverage consumption has decreased in the past decade yet many children and adolescents still obtain approximately 16% of their total caloric intake from added sugars in SSB (Kann & Shanklin 2014). A percentage of this magnitude is alarming because the recommended daily consumption of added sugars is no more than 10% of total caloric intake (Johnson et al. 2009).

High SSB consumption is associated with excess energy consumption that leads to obesity (BMI over the 95th percentile) as well as a higher risk for type II diabetes mellitus, hypertension and dyslipidemia (Dietz 1998). A reduction in consumption of SSB is one of the most impactful dietary variables to prevent diseases associated with childhood obesity (Singh et al. 2015). Low socioeconomic status is associated with higher consumption of SSB, and children in this category are disproportionately affected by diseases associated with childhood obesity (Spear et al. 2007; Han & Powell 2013).

Both the White House task Force on Childhood Obesity and the American Academy of Pediatrics have encouraged basic cost effective approaches that reduce and prevent childhood obesity (Spear et al. 2007). This includes public awareness methods that are effective at promoting decreased SSB consumption (Spear et al. 2007). Many studies have been conducted to reduce children's intake of SSB (Dietz 1998; Freedman et al. 2001 Ebbeling et al. 2002;

Barquera et al. 2013; Bleich et al. 2014; Boles et al. 2014; Batis et al. 2016; Bogart et al. 2017). Experimental trials include a range of approaches from taxation of SSB to education-based programs. Some approaches utilize 24-hour beverage recall surveys to evaluate the effects of 6 month positive reinforcements encouraging decreased SSB consumption (Ebbeling et al. 2002). However, very few approaches of reducing SSB consumption by children in low socioeconomic populations have been as effective as they were in other populations (Bleich et al. 2014).

Little information exists about the most effective strategies for reducing SSB consumption by children of lower socioeconomic status. Missing is a comprehensive review of inexpensive cost effective strategies that can be implemented in areas of lower socioeconomic status. Here I propose a review paper that will highlight strategies that function in populations that are most affected by consumption of SSB. This review will help contribute new information toward developing an effective health program to reduce childhood obesity through encouraging reduced SSB consumption. This would be useful to public health agencies when designing a protocols for long-term reduction in SSB consumption by children in populations that are most susceptible to childhood obesity and associated diseases.

### **Literature Review**

The global pandemic of childhood obesity and associated diseases supports increasing concerns about the health effects resulting from high consumption of dietary sugars (Han & Powell 2013). Sugar Sweetened Beverages (SSB) have been identified as a target for dietary sugar reduction programs aimed to reduce children's consumption of SSB. A reduction in SSB will decrease instances of diseases correlated with high added sugar consumption such as childhood obesity (Ebbeling et al. 2002). Existing efforts to reduce children SSB consumption include intervention-based trials in most developed countries (Singh et al. 2015). Despite these

attempts, children of low socioeconomic background maintain relatively high consumption rates of SSB, and high instances of disease related to excess sugar consumption (Bleich et al. 2014).

### *Obesity in children and adolescents*

Between 1970 and 2005 the commercial availability of added dietary sugars increased by 19% (Ogden et al. 2012). Today the main source of added sugars in American diets are SSB (Johnson et al. 2009; Barquera et al. 2013). These beverages can be defined as any water-based, consumable liquid with added sugar, including soft drinks and modified fruit juice. The amount of added sugar that children should consume daily is under 10% of total caloric intake (Johnson et al. 2009). Caloric intake from SSB increased 135% between 1970 and 2001 in children under the age of 15 making the total daily caloric consumption from added sugar greater than 17% (Johnson et al. 2009; Han & Powell 2013). Though soda consumption has decreased, consumption of other SSB by adolescents has increased due to the growing trend in energy drink advertising and availability in the marketplace. This has resulted in numerous types of SSB being widely available, meaning that the overall trend in consumption in SSB has continued to rise (Barquera et al. 2013; Kahn & Shanklin 2014). High SSB consumption is linked to an increased risk of obesity (Lasater et al. 2011; Barragan et al. 2014; Batis et al. 2016). Childhood obesity increases risks of developing two diabetes mellitus, hypertension, and atherosclerosis (Dietz 1998; Ebbeling et al. 2002; Bogart et al. 2017). Evidence supports childhood obesity as a precursor of adult cardiovascular disease and adult obesity (Freedman et al. 2001; Falbe et al. 2016). These factors collectively suggest that childhood obesity could lead to decreased quality of life and increased risk of mortality (Dietz 1998; Han & Powell 2013).

### *SSB consumption by socioeconomic categorization*

High consumption of SSB in low socioeconomic children with parents educated at a level below high school is more prevalent than children whose parents are educated above this level (Han & Powell 2013; Falbe et al. 2015). Evidence supports that low socioeconomic status is a positive determinant for high SSB consumption (Freedman et al. 2001; Johnson et al. 2009; Ogden et al. 2012). This suggests that individuals of low socioeconomic class may have more access to SSB than other types of healthier beverage options including water and unsweetened, decaffeinated tea. (Bleich et al. 2014; Singh et al. 2015). Low socioeconomic populations also demonstrate higher prevalence of diseases related to consumption of excess dietary sugars (Ebbeling et al. 2002; Wang et al. 2012; Singh et al. 2015). Together this implies that low socioeconomic populations should be targeted for major reductions in consumption of SSB.

### *SSB reduction programs*

A range of existing SSB consumption habits has resulted in different types of intervention methods (Ebbeling et al. 2002). Most methods are effective in high socioeconomic populations but are significantly less effective in low socioeconomic populations (Han & Powell 2013; Nezami et al. 2016; Falbe et al. 2016). Because these populations are the most vulnerable to high SSB consumption there is a need for more effective methods for reducing SSB consumption by children in low socioeconomic populations (Boles et al. 2014; Falbe et al. 2016). Experimental methods for reducing SSB consumption include a range of approaches and can be categorized into three broad categories: mass media- based education campaigns, government interventions, and inquiry-based (e.g., phone and computer applications) interventions.

#### *Method 1: Educational Media Campaigns*

Current educational media efforts rely on visual representation of the sugar content of popular SSB and a description of health effects of consuming excess sugar. This includes a recent education-based method called Rethink Your Drinks campaigns (Barragan et al. 2014) that aimed to improve beverage nutrition literacy. For example, one Food and Drug Agency campaign magazine displayed that a can of Coke ® (The Coca-Cola Company, Atlanta, GA, USA) has 40 g of added sugar in it to displace these 40 g of table sugar would be placed in a bag next to the can of soda (Boles et al. 2014). See Figure 1 for an example from [www.Sugarstacks.com](http://www.Sugarstacks.com), an internet resource aimed at nutrition literacy of sugar.

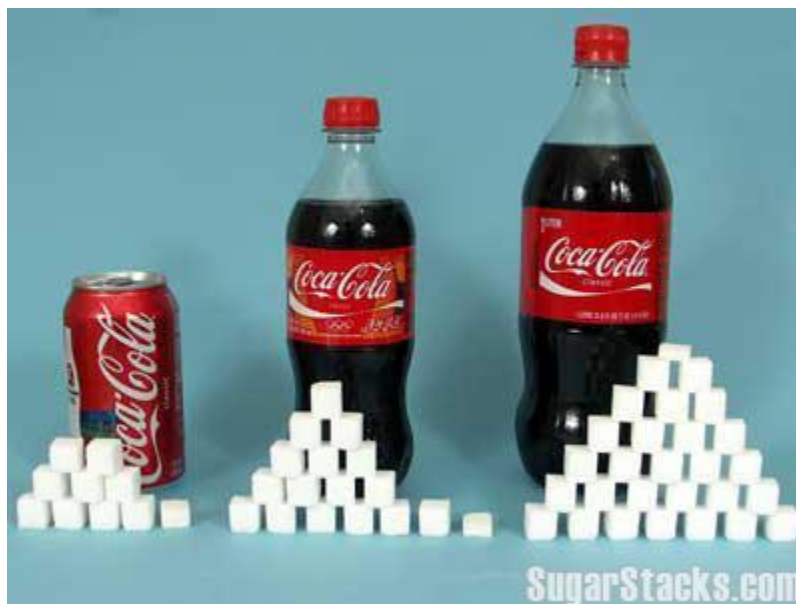


Figure 1. Sugar cubes displayed in front of Coca Cola bottles to represent the sugar content of each Soda

([www.SugarStacks.com](http://www.SugarStacks.com)).

Another educational media effort used a video that was created by southern Nevada Health District where a child is shown eating the equivalent grams of sugar in a Mountain Dew® (PepsiCo, Erlanger, KY, USA) in packets of sugar (Ebbeling et al. 2002). A similar video entitled, Man Eats Sugar was created and showcased the amount of sugar in popular sodas with sugar packets (Barragan et al. 2014). Most mass media education campaigns rely of showcasing the sugar content of beverages and are effective in the short term because they rely on dramatized representations of sugar and often fail to create lasting results (Barragan et al. 2014; Nezami et al. 2016).

### *Method 2: Governmental Interventions*

The governmental interventions that have been most effective at reduction of consumption of SSB have been taxation of SSB (Ebbeling et al. 2002; Barragan et al. 2014; Batis et al. 2016). Sugar taxes have been implemented in a few major cities in the United States, however, the most extensive and successful implementation of a SSB tax was in Mexico (Barquera et al. 2013; Bleich et al. 2014). In 2005, a pay-per-ounce tax on SSB was implemented and there was a trend towards decreased purchasing of SSB within its first year of implementation (Batis et al. 2016). It has been estimated that a nationwide (United States) SSB pay-per-ounce tax that increases the price of SSB by 10% would results in a 15% reduction in consumption of SSB (Wang et al. 2012; Bogart et al. 2017). However, taxation efforts have a differing effect on low socioeconomic populations in Mexico, low socioeconomic populations were shown to be the least deterred from purchase by a SSB tax (Barquera et al. 2013; Batis et al. 2016). The taxation efforts in the United States have variable results. A taxation effort within the United States occurred in Berkeley, California, a pay- per- ounce sugar tax was implemented in 2014. When it was evaluated it was shown to cause a 21% decrease in consumption of SSB in



low income neighborhoods (Falbe et al. 2015; Falbe et al. 2016). This shows that taxation efforts in the United States could be effective at reducing the consumption of SSB by children's however to my knowledge there has not been an attempt to evaluate the effect a sugar tax has on solely children's consumptions habits.

### *Method 3: Phone application/ Computer based intervention*

Phone and computer based strategies are useful in reducing SSB because they reach individuals participating in trials, maintain reinforcement of goals to reduce consumption of SSB and provide positive feedback (Boles et al. 2014; Nezami et al. 2016). They are also likely successful because they easily involve parents in reduction efforts of children's SSB consumption, a factor that greatly impacts long term success of reduction (Spear et al. 2007; Bogart et al. 2017). A successful reduction trial that utilized a phone application was the Smart Moms intervention trial. This intervention utilized daily beverage recall surveys filled out via phone application as well as constant positive feedback in the form of education on how to reduce SSB consumption by children (Nezami et al. 2016). This study demonstrates how low-burden interventions using mobile phone and computer devices can be effective at creating long-term reduction in SSB consumption among children.

Intervention trials aimed at reduction of SSB consumption by children have varying effects in low socioeconomic populations (Bleich et al. 2014; Batis, et al. 2016; Bogart et al. 2017). Missing from the peer-reviewed literature is a synthesis of the known effects of various types of intervention trials on children in low socioeconomic children.

## **Methods**

A comprehensive literature review will be conducted by Keyword search in databases such as www.pubmed.gov and Google Scholar search criteria such as “Childhood Obesity and Sugar Sweetened Beverages intervention programs”, “Obesity Related Diseases and Sugar Sweetened Beverages intervention trials”, and Childhood Obesity and Sugar Sweetened Beverage low socioeconomic population” will be used. Results would be filtered by year as well as relevance to topic. Articles will not be selected if they are: published before the first recorded case of childhood obesity,1970, that focused on populations over the age of 15, and focused on populations with high socioeconomic background. These criteria will ensure that only information relevant to developing more effective approaches for reducing consumption of SSB in children under the age 15 from low socioeconomic background.

Relevant literature will be summarized into a comprehensive paper and analyzed with attention to what programs have had success in low socioeconomic populations and which have not. A successful intervention trial/program will be defined as an intervention method that caused a statistically significant ( $p < 0.05$ ) reduction in any participant’s consumption of sugar sweetened beverages.

### **Budget**

This project will require no funding because it can be completed using the Antioch library and no-cost online databases.

Table 1: Budget

<b>Supplies</b>	<b>Cost (USD)</b>	<b>Comment</b>
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Internet access	0	Antioch’s Olive Kettering Library
<b>Equipment</b>		
Laptop	0	Already in possession

**Timeline**

This literature review will be conducted from April – June 2018. See Table 2 for a timeline by week for more details.

Table 2: Timeline by week

	W1	W2	W3	W4	W5	W6	W7	W8	W9
<b>Collecting Relevant Literature</b>	•	•	•						
<b>Reading Literature</b>		•	•	•	•				
<b>Analyzing Literature</b>						•	•	•	
<b>Writing Summary</b>							•	•	•

**Significance of Study**

Instances of childhood obesity have nearly tripled since the 1970’s (Dietz 1998; Ebbeling et al. 2002), causing new concerns because childhood obesity is a main health factor implicated in the causation of a wide range of serious diseases that ultimately decrease quality of life (Freedman et al. 2001; Han & Powell 2013). Sugar Sweetened Beverages (SSB) are a modifiable

dietary component whose consumption corresponds with increased risk and instances of childhood obesity (Johnson et al. 2009; Lasater et al. 2011; Nezami et al. 2016). In low socioeconomic populations, there are particularly higher instances of childhood obesity and related diseases as well as higher consumption of SSB (Barquera et al. 2013; Bleich et al. 2014; Singh et al. 2015). Thus, low socioeconomic populations need intervention programs to reduce SSB consumption (Ebbeling et al. 2002). There is an array of intervention program types aimed at reduction of consumption of SSB, however the approaches often have less successful reductions in consumption of SSB in low socioeconomic populations (Bleich et al. 2014; Batis et al. 2016; Falbe et al. 2016). A comprehensive literature review of intervention programs that have been implemented or adopted in low socioeconomic populations is a low-cost endeavor that will aid in the continuing effort to identify intervention program type that are successful in reduction of SSB consumption in low socioeconomic populations.

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