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Adolescent sugar-sweetened beverage intake is associated with parent intake, not knowledge of health risks

Elizabeth A. Lundeen, PhD,
Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway NE, Atlanta, GA 30341. Tel: 770-488-6517, Fax: 770-488-6039, yxj4@cdc.gov.

Sohyun Park, PhD,
Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway NE, Atlanta, GA 30341. Tel: 770-488-5163, Fax: 770-488-6039, spark3@cdc.gov.

Stephen Onufrak, PhD,
Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway NE, Atlanta, GA 30341. Tel: 770-488-5551, Fax: 770-488-6039, seo5@cdc.gov.

Solveig Cunningham, PhD, and
Hubert Department of Global Health, Rollins School of Public Health, Emory University, 1518 Clifton Road NW, Atlanta, GA 30322. Tel: 404-727-6486 sargese@emory.edu.

Heidi M. Blanck, PhD
Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway NE, Atlanta, GA 30341. Tel: 770-488-5638, Fax: 770-488-6039, hcb3@cdc.gov.

Abstract

Purpose: To examine associations of adolescent sugar-sweetened beverage (SSB) intake with parent SSB intake and parent- and adolescent-knowledge of SSB-related health risks.

Design: Quantitative, cross-sectional.

Setting: 2014 *SummerStyles* survey.

Subjects: 990 parent and adolescent (12–17 y) pairs.

Measures: The outcome was self-reported adolescent intake (0, >0 to <1, or ≥1 time/d) of SSBs (soda, fruit drinks, sports/energy drinks, other SSBs). The exposures were self-reported parent

Correspondence to: Elizabeth A. Lundeen, PhD, Epidemiologist, Division of Nutrition, Physical Activity and Obesity (DNPAO), National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), Centers for Disease Control and Prevention (CDC), 4770 Buford Highway NE, Atlanta, GA. Tel: 770-488-6517, Fax: 770-488-6039, yxj4@cdc.gov.

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SSB intake (0, >0 to <1, ≥1 to <2, or ≥2 times/d) and parent and adolescent knowledge of SSB-related health risks (weight gain, diabetes, and dental caries).

Analysis: Separate multinomial logistic regression models were used to estimate adjusted odds ratios (aOR) for adolescent SSB intake ≥1 time/d (ref: 0 times/d), according to 1) parent SSB intake, and 2) parent- and 3) adolescent-knowledge.

Results: About 31% of adolescents consumed SSBs ≥1 time/d, and 43.2% of parents consumed SSBs ≥2 times/d. Adolescent and parent knowledge that SSB intake is related to health conditions ranged from 60.7% to 80.4%: weight gain (75.0% and 80.4%, respectively), diabetes (60.7% and 71.4%, respectively), and dental caries (77.5% and 72.9%, respectively). In adjusted models, adolescent SSB intake ≥1 time/d was associated with parent intake ≥2 times/d (aOR=3.30; 95% CI=1.62–6.74), but not with parent or adolescent knowledge of health risks.

Conclusion: Parental SSB intake may be an important factor in understanding adolescent behavior; knowledge of SSB-related health conditions alone may not influence adolescent SSB behavior.

Keywords

Sugar-sweetened beverages; knowledge; adolescents; parents; family behavioral concordance

PURPOSE

Sugar-sweetened beverages (SSBs), such as non-diet soda, fruit drinks that are not 100% fruit juice, sports drinks, energy drinks, and sweetened tea, are the largest source of added sugars in the diet of U.S. children. (1) During 2011–2014, 62.9% of U.S. youth aged 2–19 years consumed at least one SSB on a given day, with adolescents aged 12–19 years having the highest SSB intake among youth. (2) Males aged 12–19 years, in particular, are high consumers of SSBs, obtaining on average 232 kilocalories from SSBs on a given day, compared to 162 kilocalories consumed by females in this age group. (2)

Research has shown that frequent (e.g. ≥1 time/day) SSB consumption in youth is positively associated with the risk of obesity (3–7), insulin resistance (8), metabolic syndrome (9, 10), asthma (11), and dental caries. (12) Due to these health risks associated with frequent SSB consumption, efforts have focused on reducing regular SSB consumption among youth. The success of these efforts may depend upon understanding the multiple factors associated with youth SSB consumption.

One study found that more than half of SSB consumption among youth occurs at home. (13) Therefore, the family food environment and parents' behaviors may influence children's consumption of SSBs. The Family Ecological Model provides a conceptual framework outlining parenting domains pertaining to diet and physical activity that can influence a child's obesity-related behaviors. (14) They identify four domains: "1) knowledge and beliefs about behaviors that reduce/promote obesity risk behaviors; 2) modeling of healthy and unhealthy eating and activity behaviors; 3) shaping children's eating and physical activity behaviors by the use of reward and punishment systems; and 4) accessibility of healthy and unhealthy eating and physical activity options." (14) Some research has

explored the pathways in this framework as they relate to the influence of parents' knowledge and practices on youth SSB intake.

Studies have found that parental consumption of SSBs is positively associated with children's consumption. (15–19) Research has also shown that availability of SSBs in the home is positively associated with SSB consumption among youth. (15–17, 20) Additionally, several family behaviors and practices have been found to be associated with a child's SSB consumption: parent restriction of a child's SSB intake (20), screen time (21–24), frequency of eating meals as a family (20), and frequency of eating at restaurants, particularly fast food restaurants (21, 25–28).

Research has found that mothers' general knowledge about nutrition is associated with healthier diets in children, and this association is stronger among younger children. (29) Few studies have examined the relationship between parents' and youths' knowledge about SSBs and youths' SSB intake. Two studies explored the relationship between parents' knowledge about the sugar and calories in SSBs and youths' SSB intake, but neither found a significant association. (30, 31) To our knowledge, the association between adolescent SSB intake and both parent and adolescent knowledge of specific health risks related to daily SSB intake has not been examined in the same study. Therefore, the present study aimed to examine associations of adolescent SSB intake with (1) parent SSB intake, (2) parent- and (3) adolescent-knowledge of SSB-related health risks.

METHODS

Study Sample and Survey Administration

We used data from the summer wave of Porter Novelli's 2014 *Styles* survey, which is an annual online survey of U.S. panelists in GfK's Knowledge Panel®. The Knowledge Panel® is established using address-based sampling methods and contains approximately 55,000 panelists. If needed, a laptop computer and access to the Internet were provided for home use. The *Styles* surveys are panel surveys designed to inquire about a variety of topics, including consumers' knowledge, attitudes, and behaviors pertaining to health issues.

The present study is based on participants from two waves of the *Styles* surveys—*SpringStyles* and *SummerStyles*. The spring survey was sent from March 31 to April 21, 2014 to 4,168 parents (defined hereafter as having adolescent children between the ages of 12–17 years), including 1,023 parents within a random sample of 7,873 adults (≥18 years) from the panel, plus a supplemental oversample of 3,145 parents (Figure 1). The spring survey had a response rate of 55.2%, with 2,302 parents completing the survey. During the summer wave of *Styles* from June 13 to July 7, 2014, a parent-adolescent pairs survey was distributed to 2,153 parents who completed the spring wave, including 539 parents in a random sample of 4,545 adults, and a supplemental oversample of 1,614 parents. Parents were asked to encourage their adolescent 12–17 years of age to complete the adolescent section of the survey. If the parent had more than one adolescent 12–17 years in the home, the automated survey randomly selected one adolescent to participate in the survey. Adolescent-adult dyad households who completed the survey received nominal compensation (reward points worth approximately $10) and were eligible to win an in-kind

prize through a monthly sweepstakes. The *SummerStyles* survey was completed by 1,005 parent-adolescent pairs, for a response rate of 46.7%. For the present study, the final analytic sample included 990 parent-adolescent pairs who had data on SSB intake (n=15, 1.5%, were excluded due to missing SSB data).

The data were weighted, according to characteristics of the adolescent respondents, to match the U.S. Current Population Survey proportions for age, sex, race/ethnicity, education level, household income, census region, metro status, whether or not a respondent had internet access prior to joining the panel, and number of adolescents 12–17 years in the house (a proxy for household size). The U.S. Centers for Disease Control and Prevention licensed the results of the 2014 *SummerStyles* survey from Porter Novelli. Analyses of these data were exempt from institutional review board approval because personal identifiers were not included in the data file.

Outcome Variable

The outcome of interest was frequency of adolescent SSB intake, which was measured using one food frequency questionnaire (FFQ)-style screener question: (1) “During the past 7 days, how many times did you drink sodas, fruit drinks, sports or energy drinks, and other sugar-sweetened drinks? Do not include 100% fruit juice, diet drinks, or artificially sweetened drinks.” Adolescents provided the frequency of their consumption using the following response options: none, 1 to 6 times/week, 1 time/day, 2 times/day, 3 times/day, or ≥4 times/day. To enable an assessment of daily consumption, adolescent intake was categorized as 0, >0 to <1, and ≥1 time/day.

Exposure Variables

There were seven main exposure variables: parent SSB intake and parent and adolescent knowledge of three SSB-associated health conditions. Frequency of parent SSB intake was determined using 4 FFQ-style screener questions: (1) “During the past month, how often did you drink REGULAR SODA or pop that contains sugar? Do NOT include diet soda”; (2) “During the past month, how often did you drink COFFEE, including lattes, and TEA, including bottled tea, that was sweetened with sugar or honey? Do not include drinks with things like Splenda or Equal”; (3) “During the past month, how often did you drink SPORTS and ENERGY drinks such as Gatorade, Red Bull, and Vitamin water?”; and (4) “During the past month, how often did you drink sweetened fruit drinks, such as Kool-aid, cranberry cocktail, and lemonade? Include fruit drinks you made at home and added sugar to.” These questions are identical to the SSB screener used in the 2015 National Health Interview Survey, which contained a Cancer Control Supplement that measured adult dietary intake data. Parents rated the frequency of their consumption using the following response options: none, 1 to 6 times/week, 1 time/day, 2 times/day, 3 times/day, or ≥4 times/day. Response values were converted to the number of times per day that SSBs were consumed, with 1–6 times/week converted to 0.5 times/day (3.5 divided by 7) and ≥4 times/day converted to 4 times/day, and responses to the four SSB questions were summed to create a total consumption variable. Parent SSB intake was categorized as 0, >0 to <1, ≥1 to <2, and ≥2 times/day. These categories were determined based on the distribution of the data showing

adults have more frequent daily SSB consumption than adolescents, and to match categories used in previous research (32).

Parent and adolescent knowledge of SSB-associated health conditions was measured using the following question: “Which of the following conditions do you think are related to drinking sugary drinks, such as regular sodas, fruit drinks (e.g., Kool-Aid, lemonade), sports or energy drinks (e.g., Gatorade, Red Bull), and sweetened teas?” Respondents were shown the following health conditions and given the option to select all that apply: weight gain, diabetes, cavities, or none of these.

Covariates

Adolescent SSB intake and knowledge were assessed according to several sociodemographic factors, including adolescent age (12–14 years, 15–17 years), sex, and weight status (underweight/normal weight, overweight, obesity), parent age (18–34 years, 35–44 years, ≥45 years), parent sex, parent race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic other), parent marital status (married/domestic partnership, not married), parent education (≤high school, some college, ≥bachelors), parent weight status (underweight/normal weight, overweight, obesity), annual household income (≤$34,999, $35,000–$74,999, $75,000–$99,999, ≥$100,000), and region (Northeast, Midwest, South, West). For both parents and adolescents, self-reported weight and height data were used to calculate body mass index (BMI) (weight [kg] / height [m]^2). Parental weight status was categorized as underweight/normal weight (BMI <25 kg/m^2), overweight (BMI 25 to <30 kg/m^2), or obesity (BMI ≥30 kg/m^2). (33) The CDC child growth reference charts (34, 35) were used to calculate adolescent BMI percentiles, and adolescent weight status was categorized as: underweight/normal weight (BMI<85th percentile), overweight (85th percentile ≤BMI< 95th percentile), and obesity (BMI≥95th percentile).

Statistical Analysis

For unadjusted analyses, chi-square tests were used to examine differences in adolescent SSB intake and knowledge across categories of parent and adolescent sociodemographic factors as well as to assess the associations of adolescent SSB intake with parent SSB intake and adolescent and parent knowledge of SSB-associated health conditions. We used multinomial logistic regression models to calculate odds ratios, based on a reference of 0 times/day, for adolescent SSB intake ≥1 time/day and >0 to <1 time/day. For the purpose of our study, we only presented odds ratios for the daily SSB intake group (i.e., ≥1 time/day). Separate models were fit for each exposure variable: parent SSB intake and parent and adolescent knowledge (yes/no) of health conditions related to SSB intake (i.e., weight gain, diabetes, and dental caries). Models were fit separately for each exposure due to collinearity. Models controlled for adolescent age, sex, and weight status, as well as parent age, sex, race/ethnicity, marital status, education, weight status, household annual income, and census region. Models were run using complete case analysis, and sample sizes for the models were n = 943 for parent SSB intake, n = 945 for parent knowledge, and n = 944 for adolescent knowledge. Analyses were conducted using Statistical Analysis Software (SAS) (version 9.3, SAS Institute Inc., Cary, NC) and were weighted to account for the survey design.

RESULTS

Among adolescent participants, 51.4% were male, about half were between the ages of 12–14 years (49.2%) and half between the ages of 15–17 years (50.8%), and the majority were underweight or normal weight (69.4%) (Table 1). Among parent participants, 59.9% were female, and the majority were non-Hispanic white (63.5%), married or in a domestic partnership (85.4%), and aged 35 years or older (85.6%). Thirty-one percent of adolescents consumed SSBs ≥1 time/day. Adolescent SSB intake differed by sex, region, and parent marital status, parent education, and parent weight status (all $p<0.05$; χ^2 tests). Within sociodemographic factors where there was a significant difference in adolescent SSB intake across groups, the proportion of adolescents with SSB intake ≥1 time/day was highest among males (33.6%), those who lived in the Midwest (36.4%), and those whose parent was not married (41.0%), had ≤ high school education (41.0%), and was overweight (34.1%) or obese (33.1%).

The majority of adolescents identified that SSB intake is related to weight gain (75.0%), diabetes (60.7%), and dental caries (77.5%) (Table 2). The proportion of adolescents who recognized weight gain as a SSB-associated health condition was highest among those 15–17 years of age (80.4%), those with a household income ≥$100,000/year (81.2%), and those whose parent was male (79.5%) and ≥45 years of age (82.9%) (all $p<0.05$; χ^2 tests). Adolescent knowledge of diabetes as a SSB-associated health condition was highest among those 15–17 years of age (65.2%) and those with obesity (70.5%) (both $p<0.05$; χ^2 tests). Adolescent recognition of dental caries as a SSB-associated health condition was highest among those whose parent was non-Hispanic white (81.1%), ≥45 years of age (84.1%), had a bachelor's degree or higher (82.5%) and had a household income ≥$100,000/year (82.7%) (all $p<0.05$; χ^2 tests).

Among parents, 43.2% consumed SSBs ≥2 times/day (Table 3). Most parents recognized that SSB intake is related to weight gain (80.4%), diabetes (71.4%), and dental caries (72.9%). Parental knowledge of these health conditions was significantly associated with adolescent knowledge (Table 2). Among parents who were aware of the SSB-associated health condition, the majority of adolescents were also aware that drinking SSBs is associated with a higher risk of weight gain (79.5%), diabetes (68.7%), and dental caries (85.4%). In unadjusted analyses (Table 3), higher adolescent SSB intake was associated with higher parent SSB intake ($p<0.001$; χ^2 test), and with a lack of adolescent knowledge that weight gain is related to SSBs ($p=0.03$; χ^2 test). In adjusted models, adolescent SSB intake ≥1 time/day was associated with parent intake ≥2 times/day (aOR=3.30; 95% CI=1.62–6.74), but not with parent or adolescent knowledge of health risks related to SSB intake.

DISCUSSION

Our findings showed the majority of parents and adolescents recognized that SSB intake is associated with weight gain, diabetes and dental caries. In adjusted models, high parent SSB intake (≥2 times/day) was associated with higher adolescent odds of drinking SSBs at least once per day. Previous literature has also demonstrated this positive association between

parent SSB intake and youth SSB intake, (15–19) suggesting that reducing parents' intake of SSBs may be an important strategy to reduce SSB intake among their children.

Educating parents and youth on the health risks associated with frequent SSB intake may be an important strategy, however, education alone may not be sufficient to reduce SSB intake. We found that parent and adolescent knowledge of SSB-related conditions was not associated with adolescent odds of being a daily SSB consumer, which is somewhat consistent with previous literature. One study examined parent and adolescent knowledge of concepts related to energy balance, including several SSB knowledge questions, and found that parent knowledge significantly predicted adolescent knowledge, but neither parent nor adolescent knowledge was associated with adolescent SSB intake. (30) Other research has found that parents' knowledge of the sugar and calorie content of SSBs is not associated with their children's intake, but parents' perception of certain SSBs such as sports drinks as being "healthy" is associated with higher intake of these beverages among their children. (31) Another study found that adolescents who perceived energy drinks to be a safe beverage option were more likely to consume energy drinks at least once per week. (36) An online survey and simulation found that placing a warning label on SSBs indicating that they contribute to obesity, diabetes and tooth decay, is associated with greater knowledge among parents of the health harms associated with consumption of SSBs and reduced intent to purchase SSBs for their children (37); this same study was conducted among adolescents 12–18 years, and it was found that those who viewed the warning label on SSBs were less likely to choose SSBs in the internet simulation, and more likely to understand the health harms associated with consumption of SSBs. (38) However, these studies based on online simulations measured the hypothetical effectiveness of point-of-purchase health warning labels, rather than un-aided knowledge of SSB-associated health risks, and also measured hypothetical preference for SSBs rather than actual usual intake of SSBs.

Studies on the association between adult SSB-related knowledge and adult SSB intake also show equivocal findings on the relationship between SSB knowledge and behavior. (32, 39) One study found that adults' knowledge about the caloric content of regular soda was not associated with SSB intake, but that knowledge of the contribution of SSBs to weight gain was associated with SSB intake. (39) Another study found that of six SSB-related health conditions (weight gain, diabetes, dental caries, high cholesterol, heart disease, and hypertension), only knowledge of heart disease was significantly associated with being a frequent daily consumer (≥2 times/day) of SSBs among U.S. adults. (32)

In addition to parental knowledge and parental modeling of behaviors, the other parenting domains captured in the Family Ecological Model have been explored in relation to youth SSB intake, specifically accessibility of unhealthy eating options and shaping children's eating behaviors by the use of reward systems. Research has shown that greater SSB intake among youth is associated with greater availability of SSBs in the home (15–17, 20) and using food as a reward for good behavior (20). Additionally, there are several other parenting practices and aspects of the home and family food environment that may be associated with a child's SSB consumption. For example, greater SSB intake among youth is associated with: greater time spent in front of television and other screens (21–24); less frequently eating meals as a family and more frequently eating evening meals in front of the television

(20); greater exposure to advertising for SSBs (40); frequently eating at fast food restaurants (21, 25–28); and less restrictive parenting practices. (41) However, much of this literature has focused on younger children, whose dietary habits may be more influenced by parents. Future research should focus on identifying home and parent factors that could be targeted in interventions to reduce SSB intake among adolescents, as our findings show that knowledge of SSB-related health conditions alone may not be sufficient for adolescent behavior change.

The present study is subject to limitations. First, the *SummerStyles* survey is cross-sectional, so causality cannot be determined. Second, the *SummerStyles* survey has a relatively low response rate and is based on a sample that may not be nationally representative, and therefore, the findings of this study might not be generalizable to the entire U.S. population. However, the data were weighted, according to characteristics of the adolescent respondents, to match key sociodemographic distributions from the U.S. census. Third, the *SummerStyles* survey uses food frequency questionnaire-style screener questions to measure SSB intake, rather than multiple 24-hour dietary recalls or food records. However, studies have shown that estimates of beverage intake derived from food frequency questionnaires were similar to estimates derived from multiple 24-hour dietary recalls or food records. (42–44) Fourth, SSB intake was measured as frequency rather than volume, and therefore, the amount of SSBs consumed cannot be determined from these data. Lastly, research has found that using one screener question to assess SSB intake in adults results in significantly lower estimates of daily SSB intake compared to using four screener questions (45); therefore, it is possible that SSB consumption was over- or underestimated for adolescents or parents in the current study.

In conclusion, while the majority of adolescents and parents reported knowing that SSB intake is related to weight gain, diabetes, and dental caries, parent and adolescent knowledge of these conditions was not associated with adolescent odds of consuming SSBs daily. Furthermore, our findings that high parent SSB intake was associated with adolescent daily SSB intake suggest that reducing parents' intake of SSBs may be an important pathway to model health behaviors and reduce adolescent SSB consumption, whereas parent and adolescent knowledge of health risks alone may not be sufficient to change adolescent consumption. Understanding ways in which the home environment and parenting practices influence SSB intake among adolescents could aid in designing interventions to reduce adolescent SSB intake.

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SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Parental modeling of dietary behaviors may influence a child's diet. Studies have found that parental sugar-sweetened beverage (SSB) intake is positively associated with children's SSB intake.

What does this article add?

High parent SSB intake (≥2 times/day) was associated with higher odds of adolescent (12–17 years) daily SSB intake (≥1 time/day) (aOR=3.30; 95% CI=1.62–6.74). While the majority of parents and adolescents reported knowing that SSB intake is related to weight gain, diabetes, and dental caries, parent and adolescent knowledge of these conditions was not associated with adolescent odds of being a daily consumer of SSBs.

What are the implications for health promotion practice or research?

Reducing parents' SSB intake may be an important pathway to model health behaviors and reduce adolescent SSB intake, however, parent and adolescent knowledge of health risks alone may not be sufficient to change adolescent intake. Future research could focus on identifying factors in the home environment and parenting practices that serve as barriers and facilitators to reducing SSB intake among adolescents.

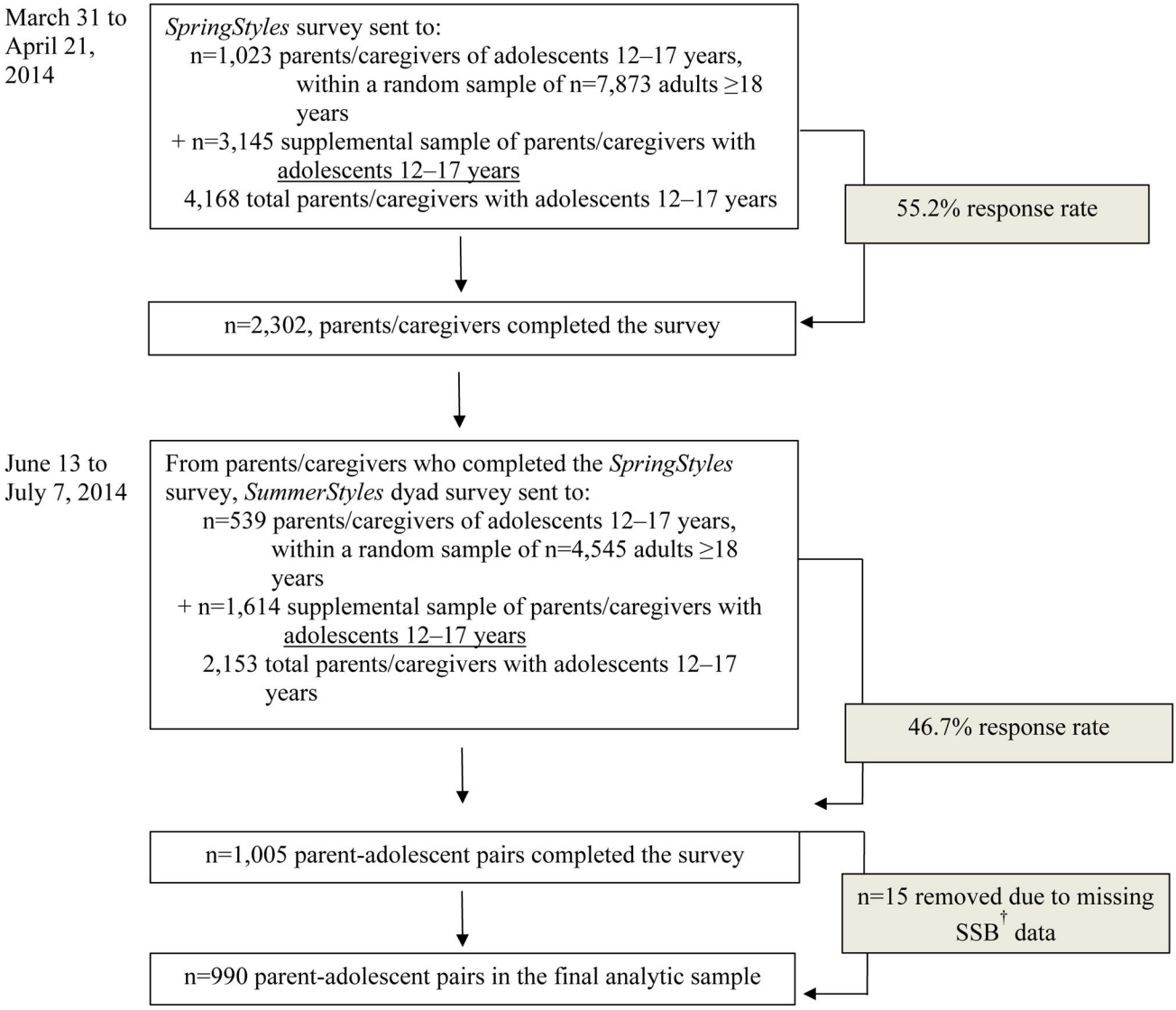

Figure 1.
Survey administration and sample selection for 2014 *SpringStyles* and *SummerStyles* surveys. †Sugar-sweetened beverage.

Table 1.

Characteristics of study participants and their association with adolescent sugar-sweetened beverage (SSB) intake during the past 7 days (*SummerStyles*, 2014)

	Weighted % ± standard error				
		Adolescent SSB intake[a]			
Characteristic	**All**	**0 times/d**	**>0 to < 1 time/d**	**≥ 1 time/d**	**P value[b]**
Total (unweighted, N = 990)		27.6 ± 1.7	41.9 ± 1.9	30.6 ± 1.8	
Adolescent age (n = 990)					
12–14 years	49.2 ± 1.9	28.9 ± 2.5	40.0 ± 2.6	31.1 ± 2.5	0.59
15–17 years	50.8 ± 1.9	26.2 ± 2.4	43.7 ± 2.8	30.1 ± 2.6	
Adolescent sex (n = 990)					
Male	51.4 ± 1.9	23.4 ± 2.4	42.9 ± 2.7	33.6 ± 2.5	0.04
Female	48.6 ± 1.9	31.9 ± 2.6	40.7± 2.6	27.3 ± 2.5	
Adolescent weight status[C] (n = 964)					
Underweight/normal weight	69.4 ± 1.9	27.9 ± 2.0	42.7 ± 2.2	29.5 ± 2.1	0.80
Overweight	16.0 ± 1.5	29.3 ± 5.0	38.4 ± 4.9	32.3 ± 5.0	
Obesity	14.6 ± 1.5	25.8 ± 5.4	38.4 ± 5.3	35.8 ± 5.0	
Parent age (n = 990)					
18–34 years	14.5 ± 1.7	34.9 ± 6.3	31.7 ± 5.6	33.4 ± 5.9	0.34
35–44 years	41.5 ± 1.8	25.3 ± 2.7	44.1 ± 3.1	30.6 ± 2.9	
≥45 years	44.1 ± 1.8	27.4 ± 2.3	42.8 ± 2.5	29.7 ± 2.4	
Parent sex (n = 990)					
Male	40.1 ± 1.8	26.7 ± 2.7	42.5 ± 2.9	30.8 ± 2.8	0.92
Female	59.9 ± 1.8	28.1 ± 2.3	41.4 ± 2.5	30.4 ± 2.3	
Parent race/ethnicity (n = 990)					
Non-Hispanic white	63.5 ± 1.9	28.3 ± 2.0	42.1 ± 2.1	29.5 ± 2.0	0.92
Non-Hispanic black	8.5 ± 1.0	25.8 ± 6.0	37.1 ± 6.2	37.1 ± 6.4	
Hispanic	17.7 ± 1.6	26.8± 4.7	42.1 ± 5.1	31.1 ± 4.6	
Non-Hispanic other	10.3 ± 1.4	26.3 ± 5.9	46.6 ± 7.5	27.1 ± 6.6	
Parent marital status (n = 990)					

Characteristic	Weighted % ± standard error				
		Adolescent SSB intake[a]			
	All	0 times/d	>0 to < 1 time/d	≥ 1 time/d	P value[b]
Married/domestic partnership	85.4 ± 1.2	28.5 ± 1.9	43.0 ± 2.1	28.5 ± 1.9	0.03
Not married	14.6 ± 1.2	23.0 ± 3.9	36.1 ± 4.5	41.0 ± 4.8	
Parent education (n = 990)					
≤High school/GED	24.2 ± 1.6	25.1 ± 3.8	33.9 ± 3.9	41.0 ± 4.2	0.002
Some college	36.7 ± 1.8	28.2 ± 3.0	40.4 ± 3.1	31.4 ± 2.8	
≥Bachelors	39.1 ± 1.8	28.6 ± 2.5	49.1 ± 2.9	22.3 ± 2.4	
Annual household income (n = 990)					
≤$34,999	22.5 ± 1.6	26.8 ± 3.9	36.6 ± 4.1	36.7 ± 4.1	0.20
$35,000–$74,999	30.8 ± 1.6	22.9 ± 2.8	46.1 ± 3.2	31.0 ± 3.0	
$75,000–$99,999	20.2 ± 1.5	30.9 ± 4.1	42.2 ± 4.2	26.9 ± 3.9	
≥$100,000	26.6 ± 1.7	31.7 ± 3.4	41.6 ± 3.7	26.7 ± 3.3	
Parent weight status (n = 964)					
Underweight/normal weight (BMI <25.0 kg/m^2)	32.3 ± 1.8	30.9 ± 3.2	45.8 ± 3.4	23.3 ± 3.0	0.04
Overweight (BMI 25.0–<30.0 kg/m^2)	34.7 ± 1.8	30.1 ± 3.0	35.8 ± 3.1	34.1 ± 3.1	
Obesity (BMI ≥30.0 kg/m^2)	33.1 ± 1.7	23.7 ± 3.1	43.2 ± 3.4	33.1 ± 3.2	
Census region (n = 990)					
Northeast	17.3 ± 1.5	40.8 ± 4.6	34.3 ± 4.2	24.9 ± 4.2	0.01
Midwest	24.1 ± 1.4	23.3 ± 3.1	40.3 ± 3.5	36.4 ± 3.4	
South	35.2 ± 1.8	23.5 ± 2.9	46.3 ± 3.4	30.1 ± 3.1	
West	23.4 ± 1.6	27.9 ± 3.6	42.0 ± 4.0	30.2 ± 3.7	

Abbreviations: SSB, sugar-sweetened beverage; GED, General Educational Development; BMI, body mass index.

[a] Adolescent SSB intake was measured using one screener question which asked about the combined consumption of beverage types: soda, fruit drinks, sports/energy drinks, and other SSBs.

[b] Chi-square tests were used for each variable to examine differences across categories.

[c] Adolescent weight status was based on body mass index: <85th percentile is normal or underweight, ≥85th percentile to <95th percentile is overweight, and ≥95th percentile has obesity. Percentiles were calculated using the CDC child growth reference charts. (33, 34)

Table 2.

Characteristics of study participants and their association with adolescent knowledge of conditions related to sugar-sweetened beverage (SSB) intake (*SummerStyles*, 2014)

	Adolescent knowledge of health conditions related to SSB intake (answering *Yes*)[a, b] Weighted % ± standard error		
Characteristic	**Weight Gain**	**Diabetes**	**Dental Caries**
Total (unweighted, N = 982)	75.0 ± 1.7	60.7 ± 1.9	77.5 ± 1.7
Adolescent age (n = 982)			
12–14 years	69.3 ± 2.6*	56.0 ± 2.7*	76.3 ± 2.3
15–17 years	80.4 ± 2.2	65.2 ± 2.6	78.6 ± 2.4
Adolescent sex (n = 982)			
Male	71.7 ± 2.5	59.8 ± 2.7	75.8 ± 2.4
Female	78.4 ± 2.3	61.7 ± 2.7	79.2 ± 2.4
Adolescent weight status[c] (n = 958)			
Underweight/normal weight	75.1 ± 2.0	61.6 ± 2.2*	81.1 ± 1.8
Overweight	68.3 ± 5.2	48.1 ± 5.2	73.4 ± 5.1
Obesity	80.3 ± 4.7	70.5 ± 4.9	70.4 ± 5.3
Parent age (n = 982)			
18–34 years	57.2 ± 6.4*	60.6 ± 6.4	68.3 ± 6.1*
35–44 years	72.1 ± 2.8	56.3 ± 3.1	73.3 ± 2.8
≥45 years	82.9 ± 1.9	64.9 ± 2.4	84.1 ± 1.9
Parent sex (n = 982)			
Male	79.5 ± 2.4*	61.3 ± 2.9	79.7 ± 2.4
Female	71.9 ± 2.4	60.3 ± 2.5	76.0 ± 2.3
Parent race/ethnicity (n = 982)			
Non-Hispanic white	77.9 ± 1.8	60.9 ± 2.1	81.1 ± 1.8*
Non-Hispanic black	62.7 ± 6.5	50.9 ± 6.6	63.6 ± 6.5
Hispanic	73.5 ± 4.5	65.3 ± 5.0	73.9 ± 4.4
Non-Hispanic other	75.6 ± 6.6	63.1 ± 7.3	80.3 ± 6.5
Parent marital status (n = 982)			
Married/domestic partnership	76.2 ± 1.8	62.3 ± 2.1	78.9 ± 1.8
Not married	69.0 ± 4.7	52.8 ± 4.8	70.4 ± 4.6
Parent education (n = 982)			
≤High school/GED	72.9 ± 3.9	61.2 ± 4.1	70.7 ± 3.9*
Some college	73.5 ± 2.8	60.0 ± 3.1	77.2 ± 2.8
≥Bachelors	77.9 ± 2.5	61.0 ± 2.9	82.5 ± 2.4
Annual household income (n = 982)			
≤$34,999	68.2 ± 4.2*	57.2 ± 4.3	69.9 ± 4.1*
$35,000–$74,999	72.6 ± 3.0	59.8 ± 3.2	77.1 ± 2.8
$75,000–$99,999	79.6 ± 3.3	62.9 ± 4.2	81.1 ± 3.6

Characteristic	Adolescent knowledge of health conditions related to SSB intake (answering *Yes*)[a, b] Weighted % ± standard error		
	Weight Gain	**Diabetes**	**Dental Caries**
≥$100,000	81.2 ± 3.0	63.6 ± 3.7	82.7 ± 3.0
Parent weight status (n = 958)			
Underweight/normal weight (BMI <25.0 kg/m^2)	77.3 ± 2.9	63.6 ± 3.4	80.8 ± 3.0
Overweight (BMI 25.0–<30.0 kg/m^2)	76.3 ± 2.8	61.1 ± 3.2	74.7 ± 3.0
Obesity (BMI ≥30.0 kg/m^2)	71.8 ± 3.2	58.2 ± 3.4	77.9 ± 2.9
Parent SSB intake[d] (n = 982)			
0 times/day	80.8 ± 3.9	56.1 ± 5.3	82.8 ± 4.6
>0 to <1 time/day	78.2 ± 3.6	63.2 ± 4.5	77.5 ± 4.2
≥ 1 to <2 times/day	75.5 ± 3.0	64.0 ± 3.4	78.6 ± 2.9
≥ 2 times/day	71.8 ± 2.9	58.9 ± 3.0	75.1 ± 2.7
Parent knowledge of conditions related to SSB intake[a] (n = 978)			
Weight gain			
Yes	79.5 ± 1.7*	-	-
No	55.1 ± 4.7	-	-
Diabetes			
Yes	-	68.7 ± 2.1*	-
No	-	40.0 ± 3.7	-
Dental caries			
Yes	-	-	85.4 ± 1.6*
No	-	-	55.7 ± 4.1
Region (n = 982)			
Northeast	80.1 ± 3.9	59.6 ± 4.7	80.5 ± 3.3
Midwest	73.5 ± 3.3	55.8 ± 3.5	80.7 ± 2.9
South	74.9 ± 3.0	63.4 ± 3.2	72.9 ± 3.2
West	72.6 ± 3.6	61.8 ± 3.9	79.2 ± 3.5

Abbreviations: SSB, sugar-sweetened beverage; GED, General Educational Development; BMI, body mass index.

[a]Determined by the question, “Which of the following conditions do you think are related to drinking sugary drinks, such as regular sodas, fruit drinks (e.g., Kool-Aid, lemonade), sports or energy drinks (e.g., Gatorade, Red Bull), and sweetened teas?”

[b]Rao-Scott chi-square tests were used for each variable to examine bivariate differences across categories.

*P <0.05 based on χ^2 test. Denotes significant difference in adolescent knowledge across categories of the adolescent or parent characteristic.

[c]Adolescent weight status was based on body mass index: <85th percentile is normal or underweight, ≥85th percentile to <95th percentile is overweight, and ≥95th percentile has obesity. Percentiles were calculated using the CDC child growth reference charts. (33, 34)

[d]Parent SSB intake was measured using a screener with four questions, which ask about consumption of each SSB type separately: soda, sweetened coffee/tea, sports/energy drinks, fruit drinks.

Table 3:

Bivariate and multivariate associations between adolescent sugar-sweetened beverage (SSB) intake during the past 7 days and parent SSB intake and parent and adolescent knowledge of conditions related to SSB intake (*SummerStyles*, 2014)

		Bivariate analysis adolescent SSB intake[a] Weighted % ± standard error[c]				Multivariate logistic regression analysis Youth SSB intake ≥ 1 time/d[b]	
Consumption and knowledge factors	**All**	**0 times/d**	**>0 to < 1 time/d**	**≥ 1 time/d**	**P value[d]**	**Adjusted OR[e]**	**95% CI**
Parent SSB intake[f] (n = 990)							
0 times/day	12.5 ± 1.2	39.2 ± 5.2	43.1 ± 5.2	17.7 ± 3.8	<0.001	Reference	
>0 to <1 time/day	14.0 ± 1.1	33.4 ± 4.4	45.9 ± 4.6	20.7 ± 3.9		1.16	0.50 – 2.70
≥ 1 to <2 times/day	30.3 ± 1.7	26.6 ± 3.1	46.4 ± 3.5	27.0 ± 3.1		1.72	0.82 – 3.60
≥ 2 times/day	43.2 ± 1.9	22.9 ± 2.7	36.9 ± 2.9	40.1 ± 3.0		3.30	1.62 – 6.74†
Parent knowledge of conditions related to SSB intake[g] (n = 984)							
Weight gain							
Yes	80.4 ± 1.7	27.3 ± 1.9	43.0 ± 2.1	29.7 ± 2.0	0.49	0.95	0.54 – 1.66
No	19.6 ± 1.7	28.6 ± 4.5	37.2 ± 4.5	34.2 ± 4.4		Reference	
Diabetes							
Yes	71.4 ± 1.8	28.2 ± 2.1	41.5 ± 2.2	30.3 ± 2.1	0.83	0.89	0.54 – 1.46
No	28.6 ± 1.8	25.8 ± 3.4	42.8 ± 3.8	31.4 ± 3.5		Reference	
Dental caries							
Yes	72.9 ± 1.8	26.8 ± 2.0	43.9 ± 2.2	29.3 ± 2.0	0.26	0.97	0.58 – 1.64
No	27.1 ± 1.8	29.5 ± 3.7	36.5 ± 3.9	34.0 ± 3.9		Reference	
Adolescent knowledge of conditions related to SSB intake[g] (n = 982)							
Weight gain							
Yes	75.0 ± 1.7	26.7 ± 2.0	44.8 ± 2.2	28.5 ± 2.0	0.03	1.02	0.61 – 1.69
No	25.0 ± 1.7	29.3 ± 3.7	33.5 ± 3.7	37.1 ± 3.9		Reference	
Diabetes							
Yes	60.7 ± 1.9	27.4 ± 2.2	42.6 ± 2.4	30.0 ± 2.3	0.88	1.01	0.65 – 1.56
No	39.3 ± 1.9	27.2 ± 2.8	41.0 ± 3.1	31.8 ± 2.9		Reference	
Dental caries							
Yes	77.5 ± 1.7	25.7 ± 1.9	44.2 ± 2.1	30.1 ± 2.0	0.09	1.52	0.89 – 2.60

Consumption and knowledge factors	Bivariate analysis adolescent SSB intake[a] Weighted % ± standard error[c] All	0 times/d	>0 to < 1 time/d	≥ 1 time/d	P value[d]	Multivariate logistic regression analysis Youth SSB intake ≥ 1 time/d[b] Adjusted OR[e]	95% CI
No	22.5 ± 1.7	33.0 ± 4.1	34.4 ± 4.1	32.6 ± 4.1		Reference	

Abbreviations: SSB, sugar-sweetened beverage, aORs, adjusted odds ratios; CIs, confidence intervals.

[a] Adolescent SSB intake was measured using one screener question which asked about the combined consumption of beverage types: soda, fruit drinks, sports/energy drinks, and other SSBs.

[b] Multivariate logistic regression models predict adolescent SSB intake (reference: 0 times/d) based on parent SSB intake and parent and adolescent knowledge of conditions related to SSB intake. Models were run separately for each of the predictors.

[c] Weighted percent may not add up to 100% because of rounding.

[d] Chi-square tests were used for each variable to examine bivariate differences across categories.

[e] Models controlled for adolescent age, sex, and weight status, as well as parent marital status, annual household income, region, parent age, parent race/ethnicity, parent sex, parent weight status, and parent education. Sample sizes for the models were: n = 943 for parent SSB intake, n = 945 for parent knowledge of conditions related to SSB intake, and n = 944 for adolescent knowledge of conditions related to SSB intake.

[†] Considered statistically significant based on 95% confidence interval.

[f] Parent SSB intake was measured using a screener with four questions, which ask about consumption of each SSB type separately: soda, sweetened coffee/tea, sports/energy drinks, fruit drinks.

[g] Determined by the question, “Which of the following conditions do you think are related to drinking sugary drinks, such as regular sodas, fruit drinks (e.g., Kool-Aid, lemonade), sports or energy drinks (e.g., Gatorade, Red Bull), and sweetened teas?”