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Self-regulation interventions to reduce consumption of sugar-sweetened beverages in adolescents

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ABSTRACT

This study evaluated the efficacy of self-regulation interventions through the use of drink-specific implementation intentions and drink-specific Go/No-Go training tasks as compensatory strategies to modify inhibitory control to reduce intake of sugar-sweetened beverages (SSB). In a between-subjects randomized manipulation of implementation intentions and Go/No-Go training to learn to inhibit sugary drink consumption, 168 adolescents reporting inhibitory control problems over sugary drinks and foods were recruited from high schools in southern California to participate. Analysis of covariance overall test of effects revealed no significant differences between the groups regarding calories consumed, calories from SSBs, grams of sugar consumed from drinks, or the number of unhealthy drinks chosen. However, subsequent contrasts revealed SSB implementation intentions significantly reduced SSB consumption following intervention while controlling for inhibitory control failure and general SSB consumption during observation in a lab setting that provided SSBs and healthy drinks, as well as healthy and unhealthy snacks. Specifically, during post-intervention observation, participants in the sugar-sweetened beverage implementation intentions (SSB-II) conditions consumed significantly fewer calories overall, fewer calories from drinks, and fewer grams of sugar. No effects were found for the drink-specific Go/No-Go training on SSB or calorie consumption. However, participants in SSB-II with an added SSB Go/No-Go training made fewer unhealthy drink choices than those in the other conditions. Implementation intentions may aid individuals with inhibitory (executive control) difficulties by intervening on pre-potent behavioral tendencies, like SSB consumption.

1. Introduction

Adolescents commonly consume sugar-sweetened beverages (Harrington, 2008; Jahns, Siega-Riz, & Popkin, 2001; Keast, Nicklas, & O'Neil, 2010). Two large scale national probability samples of over 20,000 youth (ages 12 to 19) covering the years 1999–2004, found that 84% of adolescents reported consuming at least one sugar-sweetened beverage (SSB) in the last 24 h (Wang, Bleich, & Gortmaker, 2008). Further, sugar-sweetened beverage (SSB) consumption has been linked to obesity in youth and adolescents in much research (de Ruyter, Olthof, Seidell, & Katan, 2012; Fiorito, Marini, Francis, Smiciklas-Wright, & Birch, 2009; Ludwig, Peterson, & Gortmaker, 2001; Malik, Schulze, & Hu, 2006), although not every study supports the linkage (Gibson, 2008). Recent reviews report a positive association of SSB consumption with excess calories, energy imbalance, increasing body mass index, and overweight status (Harrington, 2008; Malik et al., 2006; Vartanian, Schwartz, & Brownell, 2007).

Some adolescents have greater difficulty resisting reinforcing foods like sugary drinks, in part as a result of an imbalance in neurocognitive processes that can lead to behavioral control problems (e.g., Ames et al., 2014). When an individual with inhibitory deficits is faced with reinforcing environmental cues, such as sugary drinks, they may have limited capacity to effectively alter or inhibit pre-potent tendencies. In the flow of daily activities, there may be a lack of potential for some youth to engage executive resources before sugar drink or snack consumption is initiated as other factors compete for control processes. Self-regulation strategies may be particularly important for individuals with inhibitory

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control deficits, in order to help prevent future risk for overweight or obesity.

Since frontal control functions are not yet fully developed in adolescents, use of interventions that do not require much frontal lobe involvement or depth of processing (e.g. implementation intentions) are helpful for youth who do not have full maturation of decision brain regions. In a prospective study that evaluated developmental differences in brain regions of 13 youth every two years, from age 4 to 21, Gogtay et al. (2004) found that regions implicated in executive control functions, mediated by the prefrontal cortex, matured last and during later adolescence. Others have found similar dynamic maturational changes in frontal cortical regions during late adolescence (for review, Giedd, 2008; Sowell, Thompson, & Toga, 2004; Toga, Thompson, & Sowell, 2006). Some impulsive-type behaviors have been attributed to these continued developmental changes (see Crews & Boettiger, 2009; Crews, He, & Hodge, 2007; Spear, 2000).

One potential compensatory strategy to aid individuals with inhibitory control problems is implementation intentions (Gollwitzer, 1993). The general idea of the use of implementation intentions (II) is to intervene on an individual's pre-potent response such that a behavioral tendency or impulse, like drinking sugar-sweetened beverages (SSBs), is inhibited without the need to engage executive processes (Orbell, Hodgkins, & Sheeran, 1997). The absence of compensatory strategies for adolescents with inhibitory control problems may place them at elevated risk for poorer dietary behaviors. Coupled with general inhibitory difficulties mediated by prefrontal systems, the acquisition of relatively automatic responses to specific reinforcing foods - that develop through repeated experiences (e.g., Bargh & Chartrand, 1999; Stacy, 1997) and rewarding effects - may have an even stronger effect on one's ability to inhibit a response (i.e., cue-response link; see Everitt & Robbins, 2005). Yet, all individuals with inhibitory control deficits do not drink or eat impulsively or uncontrollably when exposed to reinforcing foods.

1.1. Implementation intentions, new (alternative) behaviors, and inhibition

Implementation intentions specifically link an intention to perform a behavior with a situation, in the form of "If situation X occurs, then I will perform behavior Y" (Gollwitzer, 1999). Implementation intentions are specific action plans that specify *when*, *where*, *and how* to act in a given situation. Implementation intentions are believed to lead to spontaneous action of a specified behavior when the specified situational cue is encountered. This type of intention focuses on automatic processes and the link between specific behavioral goals and triggering cues. This approach is compatible with basic research revealing the importance of the spontaneous, triggering effects of cues (Stacy & Wiers, 2006). Probably because of its reliance on more spontaneous processes activated by situational cues, implementation intentions have been shown to have strong effects on goal attainment for individuals across a range of health behaviors (for review, Gollwitzer & Sheeran, 2006), including eating behaviors (for review, Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011). With respect to diet, findings from a meta-analysis conducted by Adriaanse et al. (2011) revealed a small effect for reducing unhealthy food consumption and a medium effect for enhancing healthy food consumption. The studies reviewed did not specifically test II with respect to inhibiting SSB consumption and only one study addressed youth (age range 11–16; Gratton, Povey, & Clark-Carter, 2007) with a large effect for enhancing fruit/vegetable intake. With respect to inhibitory control, implementation intentions have also shown strong effects on inhibitory task performance for individuals with inhibitory deficits, including schizophrenic individuals (Brandstatter, Lengfelder, & Gollwitzer, 2001) patients with frontal lobe damage (Lengfelder & Gollwitzer, 2001), and youth with ADHD (Gawrilow & Gollwitzer, 2008).

Gawrilow and Gollwitzer (2008) found that children with ADHD performed significantly better (i.e., they effectively inhibited responses) when they formed implementation intentions on a Go/No-Go task and their performance was almost on par with youth without inhibitory control deficits. Given that critical decision points and responses are constrained by the motivational properties of cues that elicit behavior, then, an intervention should link specific cues to behaviors, such that when encountering those cues, an alternative behavior is automatically enacted. An implementation intention essentially "hands over" behavioral control to specific situational cues (e.g., encountering a refrigerator full of soda), which, in turn, spontaneously elicits a particular behavior or goal (e.g., I will resist drinking the soda) and does not rely on much information processing on the part of the individual.

The present study evaluated the influence of implementation intentions on inhibitory control and contrasted effects with drink-specific Go/No-Go training. No-Go training has been shown to be effective in reducing chocolate consumption and increasing dietary control in college students (Houben & Jansen, 2011, 2015) as well as reducing alcohol consumption in college students (Houben, Havermans, Nederkoorn, & Jansen, 2012; Houben, Nederkoorn, Wiers, & Jansen, 2011).

The present study manipulated between-subjects implementation intentions toward inhibitory control with two types of cue-specific versions, one for homework and one for sugar-sweetened beverage consumption to affect inhibitory control. The implementation intentions intervention should assist individuals in suppressing relatively habitual responses, require fewer cognitive resources, and help the individual to enact an alternative behavior (Gollwitzer, 1993). The study also tested the use of two types of Go/No-Go tasks - a Go/No-Go with homework cues, and a sugar-sweetened beverage (cue-specific) Go/No-Go to evaluate the added value of training inhibitory control on these tasks. The drink-specific version of the task is more likely to simulate real-life exposure to SSB cues and should provide information about cue effects that may be fundamental in understanding intervention effects.

2. Methods

2.1. Participants

Participants were 168 adolescents recruited from 12 regular public high schools within 20 miles of Claremont, California. Although 28 schools were identified, schools were enrolled on a first-come, first-serve basis until 12 sites agreed to participate. Schools with at least 25% of their student population enrolled in a free or reduced-cost meal program were classified as eligible for the study to promote participation of students from lower socioeconomic status families at elevated risk of being overweight or obese. Students were eligible if they were: (1) 14–17 years old, (2) able to speak and write English, (3) free of major illness such as heart disease, cancer, and diabetes, (4) not receiving clinical treatment for obesity or an eating disorder, (5) not allergic to wheat, peanuts, milk, or eggs, and (7) able to travel to the assessment site with a parent or guardian who spoke English or Spanish.

Trained research personnel distributed interest forms to high schools that contained two items that measured inhibitory control deficits in response to unhealthy foods. The items included, *'I have a hard time resisting junk food,'* and, *'I can't stop myself from eating junk food even though I know it is unhealthy'*. Examples of junk food were provided, including soda, energy drinks, chips, and candy. Students responded to each item using a 6-point Likert scale, ranging from 1 = *'strongly disagree'* to 6 = *'strongly agree'*. Since the intervention was designed for individuals with inhibitory control problems, only students rating both items as 3 or more were invited to participate. From the available sample of 24,712 students, 1696 adolescents returned a completed interest form, and 43% returning an interest form were *excluded* for not reporting inhibitory control problems.

Bilingual research personnel contacted families of eligible students through email, phone or text. Of those contacted, 292 families scheduled an appointment and 172 (59%) attended. Of those who showed up for the appointments, 168 (98%) completed the study. Power analyses for the current study were based on detecting medium effect sizes for main and interaction condition effects, adjusted for covariates (age, gender, ethnicity, SSB consumption and false alarms). A sample size of 52–64 per condition (3 conditions), should be sufficient to detect a medium effect size $f = 0.25$ to 0.30, with power of 0.80 and significance level $(\alpha) = 0.05$, for the primary outcomes (Cohen, 1992). The sample here was slightly less than projected. However, previous studies obtained significant condition effects for manipulations and outcomes comparable to those investigated here with sample sizes ranging from 33 to 68. In these studies, effect size d varied from 0.63 to 0.93 (Gollwitzer & Sheeran, 2006). More recently, however, for some diet-related outcomes, effect size $d = 0.29$ for reducing unhealthy eating and $d = 0.51$ for promoting healthy eating (Adriaanse et al., 2011).

The study was conducted at Claremont Graduate University offices in Claremont, California and all participants completed all aspects of the study. The majority of participants were Hispanic (70.4%, $N = 119$). Fifty-three (31.4%) were males and 116 (68.6%) were females, with a mean age of 16.12 ($SD = 1.0$). Forty-seven participants (27.8%) had at least one parent who had obtained at least a college degree.

2.2. Procedure

To maximize hunger and thirst among participants, the adolescents were instructed not to eat or drink two hours before their appointment. Adherence was verified upon arrival. Adolescents who deviated from this protocol were asked to schedule a new appointment at a later date and time. Bilingual research personnel obtained written assent from the adolescent and written consent from their parent or guardian. Forms were provided in Spanish when necessary. Forms stated that all activities during the two-and-a-half hour appointment would be recorded on video. A between-subjects randomized design was implemented. Participants were randomly assigned to one of three experimental conditions: (1) a homework-specific implementation intention group with a drink-specific Go/No-Go, (2) a drink-specific implementation intention group with a homework-specific Go/No-Go, or (3) a drink-specific implementation intention group with a drink-specific Go/No-Go group. The homework–specific II and Go/No-Go served as control conditions in order to evaluate the effectiveness of the intervention for SSBs. To evaluate the efficacy of the intervention, it was deemed important to develop a control intervention that built resistance to a common, unwanted student behavior without influencing SSB consumption. Based on feedback from school personnel, a control intervention was crafted that helped students avoid using electronic media devices (cell phones, MP3 players, etc.) when they needed to complete their homework.

After being assigned to a condition, participants completed a one-hour computerized assessment comprised of neurocognitive performance tasks and measures of demographics, acculturation, and dietary behavior, along with the computerized interventions in which participants were asked to form drink-specific or homework-specific implementation intentions and engage in drink-specific or homework-specific Go/No-Go training. At the end of the assessment, participants were given a ten-minute break before completing a few more computerized assessments. The second assessment included additional neurocognitive tasks including working memory as well as other measures of dietary behavior. The assessments and the computerized intervention were programmed in Inquisit Experimental Software and administered on mini-laptops as in our previous studies (Ames et al., 2007; Grenard et al., 2008). At the conclusion of these activities, participants were given a $50 gift card to compensate them for their time. All activities were approved by the Claremont Graduate University Institutional Review Board.

2.3. Computerized intervention

The computerized intervention displayed images of nine electronic devices (see Fig. 1) that distracted adolescents from completing their homework and nine sugar-sweetened beverages (see Fig. 2) that adolescents had difficulty resisting when they were thirsty. The SSBs were elicited from focus groups conducted with youth similar to those studied. All participants chose two electronic devices and two sugar-sweetened beverages.

2.3.1. Implementation intentions

Drink-specific and homework-specific implementation intentions (II) were used to modify inhibitory control. The participants practiced an implementation intention structured using the format *"If I see X, then I will resist it"* where X represented the image chosen by the participant. For example, if a participant selected Sprite, they would practice the statement, *"If I see Sprite, then I will resist it"*. The mental encoding process was then enhanced using a two-step process. The first step involved presenting the participant with the first half of the statement, e.g. *"If I see a Sprite …"*, and asking them to type the second half, e.g. *"… then I will resist it."* The second step instructed the participant to type the entire statement from memory without a prompt. The difficulty of this two-step mental encoding process was assessed using a 7-point Likert scale ranging from 1 = *'very difficult'* to 7 = *'very easy'*. This process was repeated for a second drink-specific implementation intention. There were no significant differences between the three groups with respect to ease of mental encoding. All participants found the process relatively easy (all group means > 5.25; $p > 0.25$). Participants assigned to the homework-specific group utilized a similar procedure except that electronic devices were substituted for sugar-sweetened beverages. For example, participants assigned to the homework-specific group might practice the following statement: *"If I see a Nintendo DS, then I will resist it"*.

2.3.2. Go/No-Go training

Training on a homework-specific or drink-specific Go/No-Go task was used to enhance inhibitory control in response to visual cues. The tasks were based on a procedure developed by Houben and Jansen (2011). Participants completed 180 trials. In each trial, an image was displayed for 600 milliseconds (ms). In the drink-specific version of the task, a bottle of water was presented 50% of the time (see Fig. 3) and one of the two sugar-sweetened beverages selected previously was presented the remaining 50% of the time. All images appeared in the center of the screen, were exactly the same size, were displayed against a white background, and were followed by a blank screen presented for 400 ms. Participants received feedback following each trial such that when a participant pressed a key in response to an image of a sugar-sweetened beverage or failed to press a key in response to an image of a bottle of water after 600 ms, the word 'Incorrect' was displayed on the

Fig. 1. Selectable images of electronic devices.

screen in red. Conversely, if the participant pressed a key in response to an image of a bottle of water or resisted pressing a key for 600 ms in response to an image of a sugar-sweetened beverage, 'Correct' was displayed on the screen in black. The homework-specific version of the Go/No-Go task was identical except that images of electronic devices and homework materials were used as stimuli (see Fig. 4).

2.4. Observation

Following participation in the computerized experimental procedures, participants were escorted to another room to wait to talk with a study coordinator about the study. During that waiting period (10 min), participants had free-access to an array of nine sugar-sweetened beverages placed in a small refrigerator and nine healthy beverages placed in another refrigerator, including the five water bottles presented in the drink-specific Go/No-Go task (see Figs. 2 and 3). Drinks were arranged to mimic retail environments frequented by adolescents (Shearer et al., 2015). Both refrigerators had a door window so beverages were clearly visible. Two bottles of each beverage were placed in each refrigerator. In addition, eight high sugar and high fat snack foods and eight low sugar and low fat snack foods were arranged in the space between the refrigerators (see Birch, McPhee, & Sullivan, 1989; Birch, McPhee, Bryant, & Johnson, 1993; Faith et al., 2004). Snacks were included to assess whether any generalization from the SSB interventions occurred with respect to calories consumed. A planogram was used to ensure the number and placement of snacks and drinks was standardized across participants.

Four concealed cameras disguised as motion sensors and smoke detectors captured the choices of each participant. During the second computerized assessment, participants were asked if they detected the cameras and subsequently changed their behavior. Four participants reported that they noticed the cameras. However, analyses removing these participants had no effect on the results; therefore, we retained all participants in the final analyses. No participants reported feeling uncomfortable about the study procedures.

2.5. Computerized measures

Although multiple computerized measures were administered, only demographics, sugar-sweetened beverage consumption, general response inhibition, and working memory capacity were

Fig. 2. Selectable images of sugar-sweetened beverages.

Fig. 3. Go stimuli for drink-specific Go/No-Go Task.

Fig. 4. Go stimuli for homework-specific Go/No-Go Task.

analyzed in the current study.

2.5.1. *Demographics*

Age, gender, ethnicity, language acculturation (language spoken at home, alpha = 0.93; Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987; Norris, Ford, & Bova, 1996) and socioeconomic status were assessed. Socioeconomic status of the family was assessed with the Family Affluence Scale (Boyce, Torsheim, Currie, & Zambon, 2006). Acculturation orientation to the United States from country of origin was assessed with an 8-item Acculturation, Habits, and Interests Multicultural Scale for Adolescents (AHIMSA; Unger et al., 2002) that has demonstrated good internal consistency reliability ($\alpha = 0.79$).

2.5.2. *Sugar-sweetened beverage (SSB) consumption*

The consumption of SSBs was measured using a modified version of the Youth/Adolescent Questionnaire (YAQ). The YAQ is designed for youth ranging in age from 9 to 18 years (Rockett, Wolf, & Colditz, 1995). Prior research indicates that the YAQ is a valid ($r = 0.54$ when compared with three 24-h recalls; Rockett et al., 1997) and reproducible measure (Rockett et al., 1995). The questionnaire asks participants how often, on average, they consume various food items. Response categories for consumption vary on the basis of the food, with foods grouped as a serving unit. Consumption of SSBs was computed by summing the average intake of six sugar-added or sugar-containing drink items, such as non-diet soda, lemonade or other non-carbonated fruit drinks.

2.5.3. *General response inhibition*

To assess general response inhibition, a generic Go/No-Go task modeled on a study by Lock, Garrett, Beenhakker, and Reiss (2014) was administered prior to the computerized intervention. In the generic task, participants completed 5 practice trials and 120 main trials. In each trial, a letter was displayed for 600 milliseconds (ms). 75% of the time a Go signal was presented as various letters (e.g., *J*, *K*, *L*, *M*), and 25% of the time a No-Go signal was presented as the letter *'X'*. All letters appeared in the center of the screen, were exactly the same size, and were followed by a blank screen presented for 400 ms. When a participant pressed a key in response to the No-Go signal *'X'* or failed to press a key within 600 ms in response to a Go signal, the word 'Incorrect' was displayed on the screen. The proportion of false alarms, or failure to withhold a response to the No-Go signal *'X'*, across trials was used in the analyses as a measure of general response inhibition.

2.5.4. *Self-ordered point task (SOPT)*

A computer-based version of the SOPT (Peterson, Pihl, Higgins, & Lee, 2002) was used to assess working memory capacity. Performance on this task is associated with neural activity in the dorsolateral prefrontal cortex, the brain region implicated in mediating functions of working memory (Petrides, Alivisatos, Meyer, & Evans, 1993). On this task, participants selected an image from a 3×4 matrix of 12 images. On each subsequent trial, the array of images in the matrix changed location and participants had to choose a different image on each of 12 screens presented, with six repetitions of abstract and concrete items (e.g., a calculator). Clicking on the same image on two different screens was considered an error. Test–retest reliability is good for young adults across a 43-day interval ($r = 0.82$; Ross, Hanouskova, Giarla, Calhoun, & Tucker, 2007). Internal consistency among adolescent participants was acceptable (alpha = 0.72; Grenard et al., 2008). The SOPT score was the number of total selections (6 trials x 12 screens, 72 selections) minus the number of errors, with higher scores indicative of better working memory capacity.

2.6. *Observation measures*

Three trained research personnel coded video recordings of participants' behavior during the ten-minute break. The first two coders performed the assessment independently. The third coder resolved discrepancies and generated the final dataset used in subsequent analyses.

2.6.1. *Consumption behavior*

Drink and snack consumption was defined as taking at least one sip of a drink or one bite of a snack. For each instance in which a specific snack or drink was consumed coders entered the amount to one decimal point. For example, if a participant took a couple sips of a bottle of Sprite then '0.1' (or 10%) would be entered into the database. The recorded value was then multiplied by the nutrients associated with each snack or drink. Nutrient information was determined using the Nutrition Data System for Research, a validated (Karvetti & Knuts, 1985) computer software application. Within this application, nutrient values and composition are provided by the USDA Nutrient Data Laboratory (Schakel, Sievert, & Buzzard, 1988; Sievert, Schakel, & Buzzard, 1989). For each snack/drink consumed, the precise amount of calories and total sugar was calculated. For example, if a participant drank 10% of a can of coke, then it was recorded that they consumed 10% of the added sugar normally present in that can of coke. Inter-rater reliability for consumption behavior was very good, *Kappa* = *.82*.

2.6.2. Drink choice

Drink choice was determined by coders with the use of a '*Check all that apply'* format to indicate the types of drinks selected by the participant during the ten-minute break in the observation room independent of whether or not the drink was consumed during the break. Response options included *'Healthy Drink(s)', or 'Unhealthy Drink(s).* Healthy drinks consisted of bottles of water that contained no calories and no grams of sugar. Unhealthy drinks were comprised of sugar-sweetened beverages with at least 110 calories and 27 g of sugar per bottle. Inter-rater reliability was excellent, *Kappa* = *.95*.

2.7. Analytic procedure

First, several participant characteristics were evaluated to make sure the randomization procedure was effective and that there were no significant differences between conditions. Table 1 describes characteristics of the participants in each condition. None of the demographic variables or covariates differed across study conditions. Next, planned evaluation of both the overall test and contrasts were assessed with a series of analysis of covariance (ANCOVA) models,[1] using self-report of typical sugar-sweetened beverage consumption and impulsivity (measured by proportion of false alarms in the Go/No-Go task) as covariates. Program effects were assessed for calories consumed, calories consumed from drinks, grams of sugar consumed, and grams of sugar consumed from drinks during the study break. All overall analyses results comparing the three groups against each other are two-tailed. All specific contrast results reported are one-tailed. Logistic regression analysis (with the same covariates) was also used to assess program effects on the number of participants who chose at least one healthy or unhealthy drink during the study break. Table 2 includes means and standard deviations of continuous outcome variables and frequencies of binary variables. Table 3 includes medians and the 25th and 75th percentiles for consumption outcome variables. Table 4 includes program effect *p*-values and effect sizes. Effect sizes (η^2) for ANCOVA models were calculated by dividing the amount of outcome variation explained by the intervention conditions by the total amount of outcome variation such that $\eta^2 = SS_{effect}/SS_{total}$.

[1] Although running the omnibus ANCOVA was not necessary because planned comparisons as outlined were hypothesized, the investigators desired to obtain as much information as practicable from the present data. Since the planned comparisons were hypothesized *a priori* in the grant proposal funding the study, post hoc comparisons were not considered appropriate. 'These planned comparisons can be made whether the omnibus F is significant or not.' (Keppel, 1973, p. 90; also see Keppel & Wickens, 2004).

3. Results

Overall, there was no difference among intervention groups for the number of calories consumed ($p = 0.219$, $\eta^2 = 0.019$) or for the number of calories from drinks consumed ($p = 0.133$, $\eta^2 = 0.025$). In addition, there was no overall difference among intervention groups for the grams of sugar consumed ($p = 0.158$, $\eta^2 = 0.023$) or for the grams of sugar from drinks consumed ($p = 0.218$, $\eta^2 = 0.019$). In addition, no overall difference among intervention groups for the number of participants who chose at least one unhealthy drink ($p = 0.077$) or the number of participants who chose at least one healthy drink ($p = 0.568$) was observed. Another logistic regression analysis with covariates was used to assess the effect of the implementation intentions component and the Go/No-Go component on the number of participants who chose at least one unhealthy or healthy drink. None of these analyses showed significant differences among the groups. However, specific planned contrasts revealed significant differences between groups, described below.

3.1. Calories consumed

Specific contrast ANCOVAs were used to assess the effect of the implementation intentions component (Condition 1 vs. Condition 2 and 3) and the Go/No-Go component (Condition 2 vs. Condition 1 and 3). Compared to the participants in Condition 1, who participated in homework distractor implementation intentions, the participants in Condition 2 and 3, who participated in sugar-sweetened beverage implementation intentions, consumed significantly fewer calories overall ($p = 0.050$, $\eta^2 = 0.017$) and significantly fewer calories from drinks ($p = 0.030$, $\eta^2 = 0.022$) during the post-intervention observation. No significant differences in calories consumed or calories from drinks consumed were found for conditions that targeted sugar-sweetened beverages in the Go/No-Go task (Conditions 1 and 3) versus the homework distractor Go/No-Go condition (Condition 2). ANCOVA models were also estimated to assess specific differences between Condition 3 (consisting of sugar-sweetened beverage implementation intentions and Go/No-Go training) and the other conditions that included control targets. The only significant finding was that participants in Condition 3 consumed significantly fewer calories from drinks than those in Condition 1 ($p = 0.028$, $\eta^2 = 0.034$).

3.2. Sugar consumed

Specific contrast ANCOVAs were used to assess the effect of the implementation intentions component (Condition 1 vs. Condition 2 and 3) and the Go/No-Go component (Condition 2 vs. Condition 1 and 3). Compared to participants in Condition 1, participants in Condition 2 or 3 consumed significantly fewer grams of sugar ($p = 0.029$, $\eta^2 = 0.022$), but there was no statistically significant difference in the amount of sugar from drinks consumed ($p = 0.065$, $\eta^2 = 0.014$). No statistically significant differences in grams of sugar consumed or grams of sugar from drinks consumed were found for Conditions 1 and 3 versus Condition 2. ANCOVA models were also estimated to assess specific differences between Condition 3 and the other conditions that included control targets. The only statistically significant finding was that participants in Condition 3 consumed significantly fewer grams of sugar from drinks than those in Condition 1 ($p = 0.039$, $\eta^2 = 0.029$).

3.3. Drink choice

Logistic regression models were estimated to assess specific differences between Condition 3 and the other conditions that

Table 1
Summary of population demographics and covariates.

	Condition 1	Condition 2	Condition 3	*p*
Gender				0.171
Female	41	41	33	
Male	15	15	23	
Acculturation Orientation				0.146
Assimilation	24	23	30	
Separation	0	0	3	
Integration	22	22	14	
Marginalization	0	0	0	
No Orientation	10	11	9	
Mean SSBs Daily (SD)	0.66 (0.62)	0.62 (0.60)	0.75 (0.72)	0.541
Mean Proportion False Alarms (SD)	41.42 (18.3)	45.56 (18.49)	45.65 (20.79)	0.415
Mean SOPT (SD)	60.57 (5.00)	58.91 (8.65)	58.36 (10.33)	0.352
Mean BMI (SD)	23.05 (4.83)	23.36 (4.91)	24.64 (6.00)	0.242
Mean Age in years (SD)	16.25 (1.02)	16.00 (1.01)	16.12 (0.97)	0.402

Note. The *p*-value denotes the significance of a test of whether the variables differ across experimental condition groups.

Table 2
Means and frequencies for outcome variables.

Variable	Overall Test *p*-value	Target of implementation intentions		
		Homework distractors	Sugar sweetened beverages	Sugar sweetened beverages
		Target of Go/No-Go		
		Sugar sweetened beverages	Homework distractors	Sugar sweetened beverages
		Condition 1 (n = 56)	Condition 2 (n = 56)	Condition 3 (n = 56)
		Mean (SD)	Mean (SD)	Mean (SD)
Calories	0.219	219.94 (202.74)	170.69 (127.71)	190.89 (175.64)
Calories from Drinks	0.133	29.23 (66.61)	17.14 (43.95)	12.41 (37.51)
Grams of Sugar	0.158	20.80 (14.84)	15.10 (12.89)	16.49 (18.98)
Grams of Sugar from Drinks	0.218	5.72 (13.53)	3.94 (10.23)	2.62 (7.92)
		Frequency (%)	Frequency (%)	Frequency (%)
Unhealthy Drink Choice	0.077	16 (29%)	13 (23%)	7 (13%)
HealthyDrink Choice	0.568	34 (61%)	39 (70%)	33 (59%)

Note: The overall test *p*-value is reported as two-tailed.

Table 3
Medians and percentiles for consumption outcome variables.

Variable	Target of implementation intentions					
	Homework distractors		Sugar sweetened beverages		Sugar sweetened beverages	
	Target of Go/No-Go					
	Sugar sweetened beverages		Homework distractors		Sugar sweetened beverages	
	Condition 1 (n = 56)		Condition 2 (n = 56)		Condition 3 (n = 56)	
	Zero count	Median (25th %ile, 75th %ile)	Zero count	Median (25th %ile, 75th %ile)	Zero count	Median (25th %ile, 75th %ile)
Calories	N = 11	228 (140, 350)	N = 8	165.75 (131.75, 280)	N = 9	190 (105, 270)
Calories from Drinks	N = 45	180 (90, 180)	N = 48	105 (95, 145)	N = 50	110 (90, 115)
Grams of Sugar	N = 14	26.56 (10, 33)	N = 9	14.7 (10, 29.43)	N = 11	14.43 (10, 27)
Grams of Sugar from Drinks	N = 45	31 (15.5, 31)	N = 48	27.25 (21.25, 34.75)	N = 50	27 (15.5, 30.5)

Note. Medians and percentiles for each outcome are computed for participants with non-zero scores on that outcome.

included control targets. This showed that there were fewer participants in Condition 3 that chose at least one unhealthy drink compared to those in Condition 1 ($p = 0.018$) and compared to those in Condition 2 ($p = 0.043$).

3.4. Moderation effects

Because the efficacy of the intervention could depend on working memory (assessed by performance on the SOPT), we re-estimated all previous analyses using working memory as a moderator. No interaction terms or main effects of working memory or study condition were significant in any of the models.

4. Discussion

This study evaluated self-regulation strategies to modify inhibitory control in adolescents with self-reported control problems in response to unhealthy foods. To help intervene on pre-potent responding or increase behavioral control over consumption of sugar-sweetened beverages (SSBs), adolescents participated in a controlled experimental study in which implementation intentions (IIs) and Go/No-Go training were manipulated. Implementation

Table 4
Program effects.

Variable	Condition 1 vs. 2 vs. 3		Condition 1 vs. 2 and 3		Condition 2 vs. 1 and 3		Condition 1 vs. 3		Condition 2 vs. 3	
	Overall Test *p*- value	η^2	*p*-value	η^2	*p*-value	η^2	*p*-value	η^2	*p*-value	η^2
Calories	0.219	0.019	0.050[a]	0.017	0.094	0.011	0.155	0.010	0.244	0.004
Calories from Drinks	0.133	0.025	0.030[a]	0.022	0.377	0.001	0.028[a]	0.031	0.217	0.006
Grams of Sugar	0.158	0.023	0.029[a]	0.022	0.115	0.009	0.090	0.018	0.332	0.002
Grams of Sugar from Drinks	0.218	0.019	0.065	0.014	0.500	0.000	0.039[a]	0.026	0.175	0.008
Unhealthy Drink Choice	0.077		0.075		0.239		0.018[a]		0.043[a]	
Healthy Drink Choice	0.568		0.403		0.155		0.343		0.158	

Note. The overall test *p*-value is reported as two-tailed; specific contrasts are reported as one-tailed.
[a] Significant one-tailed test ($\alpha = 0.05$).

Intentions are believed to lead to spontaneous action of a specified behavior when a *specified* environmental cue is encountered. The youth randomized to the drink-specific II intervention groups were expected to inhibit SSB consumption during subsequent exposure to a variety of SSBs as well as healthy drinks following the lab-based intervention. The effect of drink-specific inhibitory implementation intentions was expected to result in an effect on inhibitory control processes. Overall tests of effects found no significant differences between groups regarding the number of calories consumed, number of calories from drinks, or grams of sugar consumed from drinks or the number of participants who chose unhealthy drinks. However, subsequent contrast analyses revealed some small significant effects. Tests of planned contrasts are valid and can be statistically significant even when the overall test of interactions is non-significant. In addition, these tests reflect the specific hypothesis intended to be evaluated (Keppel & Wickens, 2004). Contrast analyses revealed that individuals randomly assigned to the drink-specific II groups resulted in a stronger effect on inhibitory performance relative to the alternative homework II group. That is, youth in the drink-specific II groups consumed significantly fewer calories overall, fewer calories from drinks and fewer grams of sugar in general in the post-intervention observation room relative to the youth in the homework II.

These findings suggest that implementation intentions may provide a self-regulation strategy and aid some individuals who have difficulty engaging executive resources when encountering sugary drinks or perhaps snacks in the flow of daily activities. Implementation intentions allow for the enactment of alternative behaviors (e.g., resisting sugary drinks) in the presence of cues to habitual dietary behavior. Although individuals in the present study were selected with some indication of problems in inhibitory control, future study of interaction effects in a more diverse sample may reveal that, individual differences in neurocognitive control ability moderate the impact of an intervention on behavioral control such that those individuals with more habitual responding or deficits in inhibition may benefit more from compensatory strategies that help regulate eating in the face of reinforcing cues. Given that critical decision points and responses are constrained by the motivational properties of cues that elicit behavior (cf., Cardinal & Everitt, 2004; Everitt & Robbins, 2005) an intervention should link specific cues to behaviors such that the cue automatically activates enactment of the alternative behavior. Further, since adolescence is a developmental period characterized by continued maturation of control brain functions, use of interventions that do not require much frontal lobe involvement or depth of processing (e.g. implementation intentions) are promising regulatory strategies. Evaluation of implementation intentions in larger samples of youth is needed to more clearly understand the efficacy of this intervention strategy in aiding behavioral control over a range of appetitive behaviors.

This study also explored a drink-specific Go/No-Go training to determine its added value in reinforcing inhibitory effects. The influence of neurocognitive processes on behavior suggests that adolescents with better inhibitory function are better able to limit consumption of sugary drinks and that interventions designed to improve behavioral control might aid in overcoming habitual responding. Overall, the added value of a drink-specific Go/No-Go training was not observed and there was no main effect of training on consumption behavior. However, the value of the training was observed in a specific contrast as follows: there were more participants that chose at least one healthy drink in the drink-specific II and drink-specific Go/No-Go training group than the other two conditions. We had expected that the use of Go/No-Go training with discriminative cues would affect inhibitory processes, but our findings did not support this hypothesis.

However, in a series of experiments aimed at understanding the mechanisms underlying Go/No-Go training, Verbruggen and Logan (2008) found automatic-inhibition was supported by consistent cue pairing with no-go signals. They further noted that when consistent pairing of cues on the Go/No-Go did not occur, or when higher-level goals required resisting habitual responses, then there might be a need for engagement of executive processes. A key difference between Verbuggan and Logan's work and our study that may have affected our findings (in addition to issues related to age-related brain maturation and function), was the use of SSBs as no-go signals and the need to create new competitive associations during No-Go training among a young population reporting problems regulating behavior in response to unhealthy foods. Although consistent pairing of go signals (i.e., water) occurred in our training, the go signals need to be able to compete with the reinforcing effects of SSB consumption in order to counter learned associations. However, in alcohol and chocolate-inhibition No-Go training studies, Houben and colleagues have been successful in decreasing consumption of reinforced behaviors in college students. Houben and colleagues suggest that the underlying mechanism affecting behavior change in their No-Go training is not inhibitory control but instead a devaluation of the stimuli paired with the stopping response and the building of new associations (Houben & Jansen, 2015; Houben et al., 2012). Our study population was a younger population that may not be as amenable to the training of new associations while devaluing reinforcing effects of sugary drinks. Studies addressing age-related differences may help to increase our understanding of the mechanisms underlying behavior change on cue driven No-Go training tasks.

It should be emphasized that interventions that inhibit habitual responding to cues focus on how cues become integrally tied with habits, how they trigger behavior in systematic ways not always known by the participant, and how the habit process can be interrupted and re-directed toward less problematic paths. Interventions on cues also provide some opportunities to link ecologically identified cues with skills or strategies taught in interventions. Programs may be much more effective if they use naturally existing "triggers" to link, activate, and propel whatever strategy is implemented (e.g., alternative behavior or inhibition strategies).

4.1. Limitations

The generalizability of the findings reported here are limited by the adolescent sample; however, it also may be argued that adolescents are the primary target audience for the types of compensatory strategies tested here since they are at higher risk for poor decision-making due to continued cortical sculpting and associated function (for reviews, see Crews & Boettiger, 2009; Sowell et al., 2004; Spear, 2000). Further, the effects observed were relatively small (range effect size $d = 0.26$ to 0.36) and not equivalent to medium effect sizes on which the power for the study was determined. It is possible that non-significant results are a product of low-power and replication of the study with a larger sample size may yield different findings. However, the study focused on observed, rather than self-reported behavior, making it likely that the obtained experimental effects may be robust and not the result of demand characteristics. Another limitation is that because the effects were limited to immediate consumption in a highly controlled setting, we don't know if these effects will hold outside a lab analog study or the duration of any effects observed. This was the first study of this nature in this population and it is likely the paradigms could be improved further to yield stronger effects. Future longitudinal research is needed to establish the impact of the interventions examined here in the long term, among varying populations and age groups, and over longer retention intervals.

5. Conclusion

In sum, the self-regulation interventions tested here are capable of reaching large numbers of adolescents and can readily be adopted for widespread use. Although the overall test of effects revealed no differences between intervention groups and calories consumed, calories from SSBs, grams of sugar consumed from drinks, or the number of unhealthy drinks chosen, subsequent tests of contrasts revealed small intervention effects. As an intervention strategy, implementation intentions assist individuals in enacting alternative or inhibitory behaviors during critical decision points without the need to engage executive resources (Gollwitzer, 1993). As a potential intervention component for adolescents, implementation intentions may help compensate for self-regulatory problems, help override habitual behaviors, and establish new alternative behaviors that are relatively automatically elicited.

Conflict of interest

The authors have no financial or other relationships that might lead to a conflict of interest regarding the material discussed in this article.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.appet.2016.06.036.

References

Adriaanse, M. A., Vinkers, C. D. W., De Ridder, D. T. D., Hox, J. J., & De Wit, J. B. F. (2011). Do implementation intentions help to eat a healthy diet? A systematic review and meta-analysis of the empirical evidence. *Appetite, 56*(1), 183–193.

Ames, S. L., Grenard, J. L., Thush, C., Sussman, S., Wiers, R. W., & Stacy, A. W. (2007). Comparison of indirect assessments of association as predictors of marijuana use among at-risk adolescents. *Experimental & Clinical Psychopharmacology, 15*(2), 204–218.

Ames, S. L., Kisbu-Sakarya, Y., Reynolds, K. D., Boyle, S., Cappelli, C., Cox, M. G., & Stacy, A. W. (2014). Inhibitory control effects in adolescent binge eating and consumption of sugar-sweetened beverages and snacks. *Appetite, 81*, 180–192.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist, 54*(7), 462–479.

Birch, L. L., McPhee, L. S., Bryant, J. L., & Johnson, S. L. (1993). Children's lunch intake: Effects of midmorning snacks varying in energy density and fat content. *Appetite, 20*(2), 83–94.

Birch, L. L., McPhee, L., & Sullivan, S. (1989). Children's food intake following drinks sweetened with sucrose or aspartame: Time course effects. *Physiology & Behavior, 45*(2), 387–395.

Boyce, W., Torsheim, T., Currie, C., & Zambon, A. (2006). The family affluence scale as a measure of national wealth: Validation of an adolescent self-report measure. *Social Indicators Research, 78*(3), 473–487.

Brandstatter, V., Lengfelder, A., & Gollwitzer, P. M. (2001). Implementation intentions and efficient action initiation. *Journal of Personality & Social Psychology, 81*(5), 946–960.

Cardinal, R. N., & Everitt, B. J. (2004). Neural and psychological mechanisms underlying appetitive learning: Links to drug addiction. *Current Opinion in Neurobiology, 14*(2), 156–162.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Crews, F. T., & Boettiger, C. A. (2009). Impulsivity, frontal lobes and risk for addiction. *Pharmacology, Biochemistry and Behavior, 93*(3), 237–247.

Crews, F. T., He, J., & Hodge, C. (2007). Adolescent cortical development: A critical period of vulnerability for addiction. *Pharmacology, Biochemistry and Behavior, 86*(2), 189–199.

Everitt, B. J., & Robbins, T. (2005). Neural systems of reinforcement for drug addiction: From actions to habits to compulsion. *Nature Neuroscience, 8*(11), 1481–1489.

Faith, M. S., Keller, K. L., Johnson, S. L., Pietrobelli, A., Matz, P. E., Must, S., & Allison, D. B. (2004). Familial aggregation of energy intake in children. *The American Journal of Clinical Nutrition, 79*(5), 844–850.

Fiorito, L. M., Marini, M., Francis, L. A., Smiciklas-Wright, H., & Birch, L. L. (2009). Beverage intake of girls at age 5 y predicts adiposity and weight status in childhood and adolescence. *The American Journal of Clinical Nutrition, 90*(4), 935–942.

Gawrilow, C., & Gollwitzer, P. M. (2008). Implementation intentions facilitate response inhibition in children with ADHD. *Cognitive Therapy and Research, 32*(2), 261–280.

Gibson, S. (2008). Sugar-sweetened soft drinks and obesity: A systematic review of the evidence from observational studies and interventions. *Nutrition Research Reviews, 21*(02), 134–147.

Giedd, J. N. (2008). The teen brain: Insights from neuroimaging. *Journal of Adolescent Health, 42*(4), 335–343.

Gogtay, N., Giedd, J. N., Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A. C., & Thompson, P. M. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences of the United States of America, 101*(21), 8174–8179.

Gollwitzer, P. M. (1993). *Goal achievement: The role of intentions*. New York: Wiley.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*(7), 493–503.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. In M. P. Zanna (Ed.), *Advances in experimental social psychology, 38* pp. 69–119). San Diego, CA US: Elsevier Academic Press.

Gratton, L., Povey, R., & Clark-Carter, D. (2007). Promoting children's fruit and vegetable consumption: Interventions using the theory of planned behaviour as a framework. *British Journal of Health Psychology, 12*(4), 639–650.

Grenard, J. L., Ames, S. L., Wiers, R. W., Thush, C., Sussman, S., & Stacy, A. W. (2008). Working memory capacity moderates the predictive effects of drug-related associations on substance use. *Psychology of Addictive Behaviors, 22*(3), 426–432.

Harrington, S. (2008). The role of sugar-sweetened beverage consumption in adolescent obesity: A review of the literature. *The Journal of School Nursing, 24*(1), 3–12.

Houben, K., Havermans, R. C., Nederkoorn, C., & Jansen, A. (2012). Beer à no-go:

Learning to stop responding to alcohol cues reduces alcohol intake via reduced affective associations rather than increased response inhibition. *Addiction, 107*(7), 1280–1287.

Houben, K., & Jansen, A. (2011). Training inhibitory control. A recipe for resisting sweet temptations. *Appetite, 56*(2), 345–349.

Houben, K., & Jansen, A. (2015). Chocolate equals stop. chocolate-specific inhibition training reduces chocolate intake and go associations with chocolate. *Appetite, 87*, 318–323.

Houben, K., Nederkoorn, C., Wiers, R. W., & Jansen, A. (2011). Resisting temptation: Decreasing alcohol-related affect and drinking behavior by training response inhibition. *Drug and Alcohol Dependence, 116*(1), 132–136.

Jahns, L., Siega-Riz, A. M., & Popkin, B. M. (2001). The increasing prevalence of snacking among US children from 1977 to 1996. *The Journal of Pediatrics, 138*(4), 493–498.

Karvetti, R. L., & Knuts, L. R. (1985). Validity of the 24-hour dietary recall. *Journal of the American Dietetic Association, 85*(11), 1437–1442.

Keast, D. R., Nicklas, T. A., & O'Neil, C. E. (2010). Snacking is associated with reduced risk of overweight and reduced abdominal obesity in adolescents: National health and nutrition examination survey (NHANES) 1999–2004. *The American Journal of Clinical Nutrition, 92*(2), 428–435.

Keppel, G. (1973). *Design and analysis: A Researcher's handbook*. New Jersey: Prentice-Hall, Inc.

Keppel, G., & Wickens, T. D. (2004). *Design and analysis: A Researcher's handbook* (*4th* ed.). New Jersey: Prentice Hall, Inc.

Lengfelder, A., & Gollwitzer, P. M. (2001). Reflective and reflexive action control in patients with frontal brain lesions. *Neuropsychology, 15*, 80–100.

Lock, J., Garrett, A., Beenhakker, J., & Reiss, A. L. (2014). Aberrant brain activation during a response inhibition task in adolescent eating disorder subtypes. *The American Journal of Psychiatry, 168*(1), 55–64.

Ludwig, D. S., Peterson, K. E., & Gortmaker, S. L. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity: A prospective, observational analysis. *The Lancet, 357*(9255), 505–508.

Malik, V. S., Schulze, M. B., & Hu, F. B. (2006). Intake of sugar-sweetened beverages and weight gain: A systematic review. *The American Journal of Clinical Nutrition, 84*(2), 274–288.

Marin, G., Sabogal, F., Marin, B. V., Otero-Sabogal, R., & Perez-Stable, E. J. (1987). Development of a short acculturation scale for hispanics. *Hispanic Journal of Behavioral Sciences, 9*(2), 183–205.

Norris, A., Ford, K., & Bova, C. (1996). Psychometrics of a brief acculturation scale for hispanics in a probability sample of urban hispanic adolescents and young adults. *Hispanic Journal of Behavioral Sciences, 18*, 29–38.

Orbell, S., Hodgkins, S., & Sheeran, P. (1997). Implementation intentions and the theory of planned behavior. *Personality and Social Psychology Bulletin, 23*, 945–954.

Peterson, J. B., Pihl, R. O., Higgins, D., & Lee, A. (2002). *NeuroCognitive battery (version 2.0)*. Deerfield Beach, FL: ExamCorp.

Petrides, M., Alivisatos, B., Meyer, E., & Evans, A. C. (1993). Functional activation of the human frontal cortex during the performance of verbal working memory tasks. *Proceedings of the National Academy of Sciences, 90*(3), 878–882.

Rockett, H. R. H., Breitenbach, M., Frazier, A. L., Witschi, J., Wolf, A. M., Field, A. E., et al. (1997). Validation of a Youth/Adolescent food frequency questionnaire. *Preventive Medicine, 26*(6), 808.

Rockett, H., Wolf, A., & Colditz, G. (1995). Development and reproducibility of a food frequency questionnaire to assess diets of older children and adolescents. *Journal of the American Dietetic Association, 95*(3), 336–340.

Ross, T. P., Hanouskova, E., Giarla, K., Calhoun, E., & Tucker, M. (2007). The reliability and validity of the self-ordered pointing task. *Archives of Clinical Neuropsychology, 22*(4), 449–458.

de Ruyter, J. C., Olthof, M. R., Seidell, J. C., & Katan, M. B. (2012). A trial of sugar-free or sugar-sweetened beverages and body weight in children. *New England Journal of Medicine, 367*(15), 1397–1406.

Schakel, S. F., Sievert, Y. A., & Buzzard, I. M. (1988). Sources of data for developing and maintaining a nutrient database. *Journal of the American Dietetic Association, 88*(10), 1268–1271.

Shearer, C., Rainham, D., Blanchard, C., Dummer, T., Lyons, R., & Kirk, S. (2015). Measuring food availability and accessibility among adolescents: Moving beyond the neighbourhood boundary. *Social Science & Medicine, 133*, 322–330.

Sievert, Y. A., Schakel, S. F., & Buzzard, I. M. (1989). Maintenance of a nutrient database for clinical trials. *Controlled Clinical Trials, 10*(4), 416–425.

Sowell, E. R., Thompson, P. M., & Toga, A. W. (2004). Mapping changes in the human cortex throughout the span of life. *Neuroscientist, 10*(4), 372–392.

Spear, L. P. (2000). The adolescent brain and age-related behavioral manifestations. *Neuroscience and Biobehavioral Reviews, 24*(4), 417–463.

Stacy, A. W. (1997). Memory activation and expectancy as prospective predictors of alcohol and marijuana use. *Journal of Abnormal Psychology, 106*(1), 61–73.

Stacy, A. W., & Wiers, R. W. (2006). *Common themes and new directions in implicit cognition and addiction*. Thousand Oaks, CA, US: SAGE Publishers.

Toga, A. W., Thompson, P. M., & Sowell, E. R. (2006). Mapping brain maturation. *Trends in Neurosciences, 29*(3), 148–159.

Unger, J. B., Gallaher, P., Shakib, S., Ritt-Olson, A., Palmer, P., & Johnson, C. (2002). The AHIMSA acculturation scale: A new measure of acculturation for adolescents in a multicultural society. *Journal of Early Adolescence, 22*(3), 225–251.

Vartanian, L. R., Schwartz, M. B., & Brownell, K. D. (2007). Effects of soft drink consumption on nutrition and health: A systematic review and meta-analysis. *American Journal of Public Health, 97*(4), 667–675.

Verbruggen, F., & Logan, G. D. (2008). Automatic and controlled response inhibition: Associative learning in the go/no-go and stop-signal paradigms. *Journal of Experimental Psychology: General, 137*(4), 649–672.

Wang, Y. C., Bleich, S. N., & Gortmaker, S. L. (2008). Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988–2004. *Pediatrics, 121*(6), e1604–e1614.