Published in final edited form as:

Am J Health Promot. 2018 July ; 32(6): 1386–1401. doi:10.1177/0890117117715052.

Kids SIP^{smart}ER: A Feasibility Study to Reduce Sugar-Sweetened Beverage Consumption Among Middle School Youth in Central Appalachia

Hannah Lane, PhD, MPH¹, Kathleen J. Porter, PhD, RD², Erin Hecht, BS², Priscilla Harris, JD³, Vivica Kraak, PhD, RD⁴, and Jamie Zoellner, PhD, RD²

¹Growth and Nutrition Division, Department of Pediatrics, University of Maryland School of Medicine, Baltimore, MD, USA

²Department of Public Health Sciences, University of Virginia, Charlottesville, VA, USA

³Appalachian School of Law, Grundy, VA, USA

⁴Department of Human Nutrition, Foods and Exercise, Virginia Polytechnic and State University, Blacksburg, VA, USA

Abstract

Purpose—To test the feasibility of Kids SIP^{smart}ER, a school-based intervention to reduce consumption of sugar-sweetened beverages (SSBs).

Design—Matched-contact randomized crossover study with mixed-methods analysis.

Setting—One middle school in rural, Appalachian Virginia.

Participants—Seventy-four sixth and seventh graders (5 classrooms) received Kids SIP^{smart}ER in random order over 2 intervention periods. Feasibility outcomes were assessed among 2 teachers.

Intervention—Kids SIP^{smart}ER consisted of 6 lessons grounded in the Theory of Planned Behavior, media literacy, and public health literacy and aimed to improve individual SSB behaviors and understanding of media literacy and prevalent regional disparities. The matched-contact intervention promoted physical activity.

Measures—Beverage Intake Questionnaire-15 (SSB consumption), validated theory questionnaires, feasibility questionnaires (student and teacher), student focus groups, teacher interviews, and process data (eg, attendance).

Reprints and permission: sagepub.com/journalsPermissions.nav

Corresponding Author: Hannah Lane, Growth and Nutrition Division, Department of Pediatrics, 737 W Lombard Street, Room 169C, Baltimore, MD 21201, USA. hlane@peds.umaryland.edu.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Standards

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human individuals/patients were approved by the Virginia Tech institutional review board. Written informed consent was obtained from all participants' parent/guardians.

Analysis—Repeated measures analysis of variances across 3 time points, descriptive statistics, and deductive analysis of qualitative data.

Results—During the first intervention period, students receiving Kids SIP_{smart}ER (n = 43) significantly reduced SSBs by 11 ounces/day ($P = .01$) and improved media ($P < .001$) and public health literacy ($P < .01$) understanding; however, only media literacy showed between-group differences ($P < .01$). Students and teachers found Kids SIP_{smart}ER acceptable, in-demand, practical, and implementable within existing resources.

Conclusion—Kids SIP_{smart}ER is feasible in an underresourced, rural school setting. Results will inform further development and large-scale testing of Kids SIP_{smart}ER to reduce SSBs among rural adolescents.

Keywords

sugar-sweetened beverages; child or adolescent; Appalachia; feasibility

Purpose

Excessive consumption of sugar-sweetened beverages (SSBs; including soda, juice, energy drinks, and sports drinks) is linked to obesity, type 2 diabetes, cardiovascular diseases, and dental caries.^{1–9} Most American children and adolescents consume excessive SSBs, and those living in rural, low-income households consume disproportionate amounts.^{1,10–12}

Sugar-Sweetened Beverages in Central Appalachia

In Central Appalachia (including parts of Kentucky, West Virginia, Virginia, and Tennessee),¹³ excessive SSB consumption is particularly prevalent. Regional data indicate that consumption rates among children are about 3 times the national average of 155 calories, or about 12 ounces/day, and far above the intake recommendations of less than 8 ounces/day.^{1,14–19}

Central Appalachia experiences high rates of poverty and chronic diseases, including the highest childhood obesity prevalence of any geographic, racial/ethnic, or income group.^{20–23} These disparities result, in part, from geographic isolation, lack of access to medical care, and a dearth of health promotion programs.^{13,20}

Reducing SSB consumption among children and adolescents in this region could substantially reduce obesity rates and obesity-related comorbidities. Although promising studies have demonstrated effective interventions to reduce SSB consumption among children and adolescents,^{2,6,8,24} few interventions have been effectively adapted to highly rural contexts such as Appalachia, where resources for implementation are limited and unique cultural norms are pervasive.^{25–27} A feasibility study can fill this gap by providing insight into an intervention's potential for success under various contexts, preparing researchers and community members for larger translational studies.^{27,28}

Feasibility Studies

Feasibility studies evaluate the degree to which an intervention is desired, acceptable, and has potential to work within specific contexts. Feasibility constructs include limited efficacy/effectiveness, acceptability, demand, practicality, implementation, and potential for integration. Limited effectiveness refers to the extent to which an intervention results in predicted trends in behavior changes. It is used when statistical power is limited or follow-up periods are short. Acceptability, demand, and practicality focus on how delivery agents (eg, teachers) and recipients (eg, students) respond to the intervention, whether they are likely to use it, and whether they can deliver it within the existing context. Implementation measures the extent to which a program can be successfully delivered with high fidelity in a defined, but not fully controlled, setting. Integration assesses the extent to which a program can be embedded within the existing infrastructure/ system of the intervention setting.^{28,29}

Purpose of the Current Study

This study was a randomized crossover study in 1 middle school to test the feasibility of Kids SIP_{smart}ER, a 6-week intervention to reduce SSBs among middle schools students in Central Appalachia. Kids SIP_{smart}ER was adapted from SIP_{smart}ER, an effective theory-based intervention that reduced SSBs among Appalachian adults.^{30,31} Like SIP_{smart}ER, Kids SIP_{smart}ER theoretical framework combines theory of planned behavior (TPB) with health and media literacy and adds the novel concept of public health literacy. This article reports results from the first intervention period of this trial and aims to (1) evaluate limited effectiveness of the intervention to reduce SSB consumption and improve targeted theoretical constructs (TPB, media literacy, public health literacy) among students receiving the intervention both immediately following and 3 months after the intervention and (2) describe students' and teachers' perceptions of acceptability, demand, practicality, implementation, and future integration.

Methods

Design

The county selected for this study is a designated medically underserved area and ranks 132 of 133 in Virginia's 2015 County Health Rankings.^{32,33} The county reports similar disparities in graduation rates, unemployment rates, rates of children living in poverty, and quality-of-life outcomes as other Appalachian Virginia counties.³³ In this county, the research team collaborated with a local advisory board, whose goal was to improve oral health and obesity outcomes among local children by reducing access to and consumption of SSBs. The advisory board included representatives from the school nutrition services and school board. Prior to the present study, this board helped recruit 9 local middle schoolers for a formative study, during which program materials and assessment instruments were systematically assessed and adapted to ensure theoretical grounding and enhance age and cultural acceptability.³⁴ This included incorporating specific examples and scenarios (ie, marketing targeted to rural youth) and using local terminology (ie, "pop" compared to "soda"). Additionally, advisory board members recommended a local elementary/middle school for this feasibility study and helped the researchers build a relationship with the school principal. The principal, teachers, and research team worked collaboratively to

execute recruitment, implementation, and evaluation. Additionally, the crossover design adhered to the principal's request that all students have the opportunity to benefit from the intervention.

During intervention period 1 (Fall 2015), 5 sixth- and seventh-grade classrooms were randomized to receive either Kids SIP_{smart}ER or a matched-contact physical activity program. The classrooms received the other program during the second intervention period (Spring 2016; Figure 1). Data were collected prior to, immediately following, and 3 months after the first intervention period.

All sixth and seventh graders at the selected school completed the surveys and participated in the lessons as part of their regularly scheduled science class; however, only students whose parent/guardian provided consent were included in the analysis. By signing the consent form, parent/guardians also agreed to receive weekly phone calls during both intervention periods. Students were excluded from data analysis if they did not attend regular science class or had participated in the formative study (Figure 1). Of the 97 students, 91 (94%) were eligible and 77 (85%) returned consent forms. Of these, 74 (97%) attended regular science class and were present at baseline survey administration, and 63 (82.9%) were present for baseline height/weight collection. No students were non-English speaking, and 1 student with special needs attended a separate class and did not receive the intervention. Three classrooms were randomized to receive Kids SIP_{smart}ER (n = 43) first and 2 classrooms (n = 31) received the physical activity program first (Figure 1). Parents/guardians received a gift card for receiving the phone calls. All students, regardless of consent status, received a t-shirt. Students with parent consent who were randomly selected to participate in focus groups received a gift card. The Virginia Tech Institutional Review Board approved this study.

Intervention

Table 1 illustrates the Kids SIP_{smart}ER curriculum that was adapted from SIP_{smart}ER, an effective intervention for Appalachian adults and targeted TPB, health literacy, media literacy, and public health literacy constructs.^{30,31} The TPB posits that a person's intention to change his or her behavior is influenced by attitudes, control, and perception of norms.^{35,36} The TPB constructs related to dietary behaviors have been shown to be particularly dynamic among adolescents who are starting to make independent decisions yet are strongly influenced by peer and family norms.³⁷ Media literacy encourages obtaining, interpreting, and controlling the influence of media messages and has been strongly linked to health behaviors in adolescents.^{38–41} In fact, general media literacy is an important concept in Virginia's standards of learning for middle schools.⁴² Public health literacy encourages youth to obtain, interpret, and act on information needed to make public health decisions that benefit a community.⁴³ Constructs, including conceptual foundations, critical skills, and orientation to civic responsibility, emphasize social determinants of health in communities and encourages youth to take part in eliminating them.⁴³ In combination, Kids SIP_{smart}ER contextualizes individual behavior change within a whole school and community, thus simultaneously targeting individual-level behavior change and increasing awareness of social/environmental changes needed to reduce public health burden of SSBs.

Trained researchers delivered 6 weekly 45-minute lessons during science classes, with assistance from the teachers. Lessons included a teach-back worksheet⁴⁴ to reinforce objectives from the previous lesson, a short didactic portion, an interactive application activity (ie, game or skit), and an at-home assignment. The materials were designed using clear communication techniques, and the delivery involved few resources.⁴⁴ Teach-back worksheets consisted of 4 to 6 questions developed using lessons' theory-based learning objectives and were completed in small groups (lessons 2–5) or as individuals (lesson 6). At-home assignments for students included tracking SSB intake with a drink diary, observing the widespread availability of SSBs in the media and community, and practicing role modeling scenarios with family and friends. To encourage reinforcement of the lesson content at home, brief (~1 minute) phone calls were delivered to parents using the school's automatic call system.

The matched-contact physical activity intervention also consisted of 6 lessons that incorporated teach-back worksheets, activity diaries, at-home assignments, and parent phone calls. Students learned physical activity traits, benefits, and recommendations. They also discussed physical activity gimmicks and tried different physical activities in each class (ie, yoga or dancing).

Measures

Demographics—Self-reported age and gender information were collected at baseline (Table 2).

Body mass index percentile—Height and weight were collected by members of the research team in a private room, using a research-grade stadiometer and Tanita scale. Students were provided with their height and weight on request. Data were collected in duplicate, with shoes and outerwear off. Baseline body mass index (BMI) percentiles were calculated according to sex and age-specific Centers for Disease Control and Prevention growth charts.⁴⁵

Limited effectiveness—Paper-and-pencil surveys were administered during 1 class period at 4 time points (Figure 1). With the exception of public health literacy, all instruments were adapted from previously validated instruments in adolescents.^{46–50} The questionnaires were written at an appropriate age and reading level and tested for age and cultural acceptability during the formative study.³⁴

SSB ounces—The SSB intake was assessed using the Beverage Intake Questionnaire-15, a 15-item frequency questionnaire which asks participants to recall, on average, how often they consumed various beverages in the last month and how much they consumed each time.^{48,49} Five items determined SSB intake: soda, energy/sports drinks, coffee with cream/sugar, sweet tea, and sweetened fruit juice. Data were converted into ounces and kilocalories (kcal) for analysis.

Psychosocial and literacy constructs—The SSB-specific TPB constructs (ie, “I plan to limit my sugary drinks to less than 1 cup a day”),^{46,48} media literacy (ie, “Certain sugary drink brands are designed to appeal to people like me”),⁵⁰ and public health literacy (ie,

“Sugary drinks are a problem for my community”) were assessed using a 5-point Likert-type response scale (strongly disagree to strongly agree), which were averaged across subscales. No validated measure exists to assess public health literacy, so an instrument was developed based on one previous study⁵¹ and a validated community connectedness subscale.⁵² Table 3 illustrates the number of items and Cronbach α s (range = 0.53–0.89).

Physical activity—One question asked participants to report the days per week they had been physically active (ie, “any kind of physical activity that increased your heart rate and made you breathe harder”) for 60 minutes.⁵³

Demand, acceptability, implementation, practicality, and integration—Demand, acceptability, practicality, implementation, and integration were assessed quantitatively and qualitatively among both teachers and students. For teachers ($n = 2$), surveys containing 10 statements with Likert-type responses and 5 open-ended questions specifically designed to assess feasibility were collected immediately after each of the 6 lessons (Table 4). Teachers also participated in an exit interview. Student perceptions were assessed through 4 questions with Likert-type responses on a survey at the first follow-up period (time 2). Students were randomly selected for 2 follow-up focus groups (1 per grade). To assess implementation, field notes, attendance records, “drink diaries” return rates, correct teach back worksheet responses, and cost data were analyzed.

Analysis

Limited effectiveness—Data entry and analysis for quantitative data were conducted using SPSS software version 22 (IBM, Armonk, New York, USA). Data were checked for normality, and outliers on the primary variable (SSB ounces), defined as values > 3 standard deviations (SD) from the mean, were excluded.⁵⁴ Item imputation, using last-observation carried forward, was used for values missing due to absenteeism or incomplete surveys. Approximately 1% of variables were imputed.

Repeated measures analyses of variance tested the hypotheses that students in Kids SIP_{smart}ER would significantly reduce their SSB consumption over time and relative to students in comparison classrooms, from time 1 to time 2. Additionally, they tested the hypothesis that this difference would be maintained at time 3 (3-month follow-up). An effect size was calculated on the SSB outcome between time 1 and time 3 to inform power calculations for future studies. Changes in SSB consumption among students in Kids SIP_{smart}ER during intervention period 2 (time 3 to time 4) were also assessed, but no statistical comparisons between groups were made since, as hypothesized, groups were not similar at time 3.

Additional feasibility measures—To determine teachers’ perceived demand, acceptability, and practicality, survey averages were calculated across lessons. Open-ended responses were recorded and deductively coded to further describe feasibility measures.⁵⁵ Students’ mean level of satisfaction and perceived demand from the post survey were also computed. To assess implementation, attendance, drink diary return rates, and percentage of

correct responses on teach-back worksheets were tabulated, and cost data for materials and time spent on delivery were compiled.

Feasibility constructs were also assessed via teacher interview and student focus group recordings, which were transcribed verbatim. Transcripts were independently analyzed by 2 researchers who met to compare coding and generate a list of themes based on the feasibility constructs.^{28,55} Field notes were reviewed and evaluated for similar themes. All feasibility outcomes reflect the first intervention period.

Results

Demographics

Table 2 describes baseline characteristics and health behaviors of students. At baseline, average daily SSB intake was 36.2 ounces (SD = 26.9), or 470 kcal (SD = 355.1). Enrolled students had a mean BMI percentile of 80.4 (SD = 25.2), including 25.4% overweight and 39.7% obese students. Groups were not statistically different at baseline.

Limited Effectiveness

Intervention period 1—Table 3 details limited effectiveness outcomes. Five students (3 outliers and 2 with missing baseline data) were excluded from the analysis. Within the group receiving Kids SIP_{smart}ER (n = 42), significant decreases in SSB fluid ounces were found (−11.0 oz [SD = 26.5]; $P = .010$). These differences were maintained at time 3 (−12.2 oz [SD = 25.5]; $P = .003$; Cohen's d effect size = 0.48). Relative to the comparison group, there were no significant between group differences for SSB fluid ounces at time 2 or time 3 (times 1–3 Cohen's d between-group effect size = 0.29).

At both follow-up time points (time 2 and time 3), significant within-group ($P < .01$) and between-group ($P < .01$) effects were observed for media literacy. Within- and between-group effects for public health literacy were significant at time 3 ($P < .01$; $P = .014$, respectively). At time 2, between-group effects were significant for implementation intentions ($P = .03$) and approached significance for perceived behavioral control, subjective norms, and behavioral intentions ($P = .10$ –.14). There were no significant differences in attitudes or days meeting physical activity recommendations at either follow-up.

Intervention period 2—During the second intervention period (Figure 1; data not shown), students receiving Kids SIP_{smart}ER (n = 25) reduced their consumption by −9.6 ounces, which approached statistical significance ($P = .07$). Significant increases ($P < .05$) in media literacy, public health literacy, attitudes, subjective norms, and behavioral intentions were observed.

Demand, Acceptability, and Practicality

Tables 4 and 5 detail feasibility results from teachers and students. Of the 12 surveys, 8 (67%; 1 per teacher per lesson) were collected, and 1 follow-up interview was conducted with both teachers. According to survey results (Table 4), across lessons, teachers moderately or strongly agreed with all questions (4.3–5.0 on a 5-point scale), indicating that

they found the content both appropriate and important and that their students liked and learned from the lessons. In their interview (Table 5), the teachers similarly indicated their satisfaction, as well as their students', with Kids SIP_{smart}ER. Both teachers rated the importance of reducing sugary drinks in their school/community as a 5 (of 5) and cited high obesity rates at younger ages as the primary reason. They indicated no other program was addressing these concerns and suggested it be incorporated into the science curriculum. The primary barriers to acceptability identified by the teachers included lack of parental reinforcement at home and strong familial influence and habit formation limiting behavior change among young teens. The teachers suggested tailoring the program for younger grades (fourth or fifth) or conducting a multiyear program to increase parent engagement and reach kids before "habits are engrained." Despite recognizing the need to involve parents, the teachers felt that less than half of their students' parents would attend an in-person program. Teachers felt that the program was practical within existing resources and that, with adequate training, they could teach it without assistance.

Survey results for students receiving Kids SIP_{smart}ER in the first period and present at time 2 (n = 42) revealed that the majority liked the program and thought the content was important for them and for other students (Table 4). Twelve students participated in 2 focus groups (Table 5), which revealed aspects of the program that they found fun (ie, "made our own commercial"), helpful ("drink diaries"), surprising ("how much sugar is actually in them"), and inspiring ("I helped my brother stop drinking pop"). Student focus group participants agreed with the teachers that SSBs were a problem in their community and that this program was unique and necessary, particularly for schools across their county. Students did not report any dislikes but preferred the games and hands-on activities to writing activities. Regarding feasibility, similar challenges to those described by teachers emerged from the student focus groups. Many felt that the program should be expanded to younger students to prevent habit formation; however, others felt that younger students might not understand, pay attention, or share what they learned with their families. The students similarly perceived that many parents would not be interested in or show up for a program about SSBs.

Implementation

Teachers felt that the lessons required the same resources they typically use in their classroom. Interview results reiterated these findings (Table 5). In the first intervention period, 17 of 18 possible lessons (6 lessons per classroom) were delivered. One lesson was disrupted by a school-wide assembly. Factors influencing consistent implementation included varying classroom layouts, class sizes, class duration (the last class of the day was 5–7 minutes shorter), and broken equipment. In all of the fully delivered lessons (n = 17), the teach-back activity and didactic portions were fully completed; however, the application activity was not always fully completed due to time constraints. Student attendance in the 3 classes across the 6 lessons was 93%. All students attended at least half of the lessons. Students' return rates for the drink diaries steadily declined from week 2 to week 6—in week 2, the average return rate was 78%, and by week 6 the return rate was 12%. Students, in groups, answered between 63% and 83% of teach-back questions correctly during lessons 2 to 5. For lesson 6, individual students answered correctly 72% of the time.

Of the 6, 5 (83.3%) possible parent calls were delivered. The first call was missed due to a delay in setting up the call system. Materials costs for color printing, prizes, and t-shirts for Kids SIP_{smart}ER was about \$8 per student. Staff time required for lesson preparation and delivery was about 5 h/wk.

Integration

Teachers felt that the primary potential barrier to future integration was a lack of buy-in from other teachers and competing priorities for class time (ie, standardized testing). They suggested providing face-to-face training, keeping the program in classroom subjects where its components align with state standards of learning (ie, life science) and maintaining a once weekly schedule for 6 to 8 weeks to avoid disrupting test preparations.

Discussion

This study established the feasibility of implementing Kids SIP_{smart}ER in middle schools in a rural, medically under-served region. Demand, acceptability, implementation, practicality, and limited effectiveness were established, and barriers for integration and suggestions for adaptation were detailed. Importantly, this study provides effect size information and feasibility data needed to inform a larger scale study in a region known to consume excessive SSBs.

Limited Effectiveness

Despite statistics indicating that rural Americans, particularly Appalachians, consume excessive SSBs and suffer disproportionately from associated diseases, this study is one of only a few SSB studies that have focused on rural adolescents and only the second to focus on Appalachia.^{56–58} Smith and colleagues' pilot study demonstrated that a brief, peer-delivered intervention developed using community-based research methods led to a significant decrease in ~150 kcal of SSB/d among students at 2 Appalachian high schools.⁵⁸ This reduction is nearly identical to the 144-kcal decrease shown in our study, suggesting that the use of community-based research approaches is promising in this region. Our study expands on the Smith study and reports feasibility indicators needed to inform practical translation across Appalachia.^{25,28}

Kids SIP_{smart}ER showed limited effectiveness to reduce SSB consumption among intervention period 1 participants immediately following the intervention and at 3-month follow-up, with a moderate effect size (Cohen $d = 0.48$). The lack of significant between-group effects was due, in part, to a linear, nonsignificant, decrease in the comparison group of about 5 SSB ounces/d. There were no baseline differences, and we are not aware of any environmental changes that would have changed SSB consumption. Comparison students may have been influenced to change their behavior simply by filling out the beverage questionnaire; however, group interaction bias is more likely. While the classes traveled as a cohort throughout their academic classes, cohorts may have interacted and exchanged information during lunchtime, recess, other shared periods, or outside school time. Future full-scale studies should select study designs that minimize interaction bias, such as

randomization at the school level. A delayed contact design, which allows all students opportunity to benefit, may be ideal.

Despite these biases, the significant and sustained decrease in ~12 oz of SSBs/d among Kids SIP_{smart}ER students is promising. The importance is highlighted by a recent meta-analysis, which found a 0.07 BMI increase for every additional 12 ounces of SSB consumed.⁶

This study also contributes to the literature showing the importance of media literacy education to improve health behaviors among adolescents.^{41,59–61} To our knowledge, this is the first adolescent SSB study to incorporate and report on changes in media literacy.²⁵ Young adolescents are highly engaged with media, both as frequent users and as targets of pervasive industry marketing efforts.⁶² Thus, bolstering media literacy is crucial to reducing the influence of marketing on purchasing and consumption.

This is also the first known study to target and assess public health literacy in middle school students. Our study expands on the only other known study to incorporate public health literacy. This study, by Rogers et al, developed a social marketing and advocacy campaign for urban Hispanic and Latino high school students.⁵¹ The campaign resulted in a greater understanding of and actions against the social factors that influence diabetes disparities among Hispanic and Latino teens.⁵¹ Our study incorporated similar public health literacy concepts into a theory-based behavioral intervention and targeted a younger disparate population. The improvements in public health literacy based on survey and focus group findings indicate that middle school students can grasp social contributors to SSB consumption, acknowledge the importance of reducing SSBs on a community level, and feel empowered to play a role in this reduction. Students were inspired to talk to their families about the harms of SSBs and work toward eliminating them at home. One teacher described a student's efforts at home:

There's a kid who comes from a very rough background . . . and she stepped up and was like ' . . . I've stopped drinking pop in my house, I'm trying to get my brothers and sisters to step back from it, too.' If you know the family background, that's a huge deal . . . for her to say that in front of the class, it's a big deal.

Studies are needed to develop and validate robust instruments to assess public health literacy as well as expand application of the framework to include school- and community-level action.

Related to TPB variables, only implementation intention showed a significant between-group difference, which resulted from a decrease in the comparison group. Given Kids SIP_{smart}ER's strong theoretical basis and formative testing, the lack of improvement in TPB variables was unexpected. One hypothesis is that the intervention was too brief (5 hours over 6 weeks);⁶³ however, 3 TPB-based dietary interventions in adolescents were of similar duration and resulted in significant changes in behavioral or implementation intentions with associated behavior change.^{64–67} In our study, all students participated as part of their regular science class and were not self-selected; thus, not all chose to set goals, monitor their SSB intake, or participate in other TPB-based strategies. A post hoc exploratory analysis for the first intervention cohort showed moderate and statistically significant correlations

between 4 TPB variables and SSB change scores (ie, implementation intentions: $r = -0.30$, behavioral intentions: $r = -0.35$, perceived behavioral control: $r = -0.31$, and subjective norms: $r = -0.40$), indicating that students with greater improvements in these variables had more reduction in SSB consumption. This finding supports Ajzen's TPB foundational research and aligns with previous literature.^{35,36,64–67} Although there were significant SSB decreases, results may have been augmented by more change in TPB variables, particularly attitudes and behavioral intentions, which have a strong relationship with SSB behaviors in adults and children.⁴⁸ While our study was designed to ensure inclusion of all students, future classroom-based studies should track students' degree of participation, and be adequately powered to explore this link.

Additional Feasibility Measures

Feasibility outcomes demonstrate that Kids SIP*smart*ER is acceptable, in-demand, and practical to deliver in a rural Appalachian school. Teachers felt that the program could easily fit within the science curriculum and that teachers with a foundational science background could teach it with a brief training. Future studies should evaluate the extent to which the curriculum could fit into other participants, such as health education, and whether non-science teachers could deliver the program. Home culture and lack of parental involvement were the primary perceived barriers to future studies and/or integration. School culture and environment were not perceived to be barriers, except potential time constraints caused by standardized testing requirements.

Although the high participation rates demonstrate acceptable recruitment strategies, teachers mentioned that future programs may not be as successful if they do not offer a parent incentive. The primary acceptability barrier was a lack of substantial parent component. This is consistent with other school-based obesity interventions, including SSB-specific interventions, which recommend targeting parents and the home environment.^{68–70} Teachers and students were further concerned that parents in their region, particularly parents of middle schoolers, would not participate in such an intervention. This is justified by other obesity prevention studies in Appalachia, which have struggled with parent buy-in.^{71,72} Teachers suggested implementing the program in lower grades or conducting a multiyear program to increase parent involvement; however, this would require substantial curricular changes and additional formative testing, and may not be generalizable to schools that are not combined elementary/middle schools. Alternatively, expanding the parent call component and/or the curriculum's emphasis on role modeling could be methods to better reach parents.

Limitations

Similar to most feasibility studies, this study was limited by a small sample size and lack of a true control group; however, the matched-contact crossover design allowed all students in this rural, underserved school to participate. The SSB intake was self-reported, which may introduce bias; however, the SSB measure has been previously validated in youth and is practical for a school-based setting.^{48,49} Additionally, differences at time 3 prohibited statistical comparisons between the 2 intervention periods; however, similar decreases were shown among students receiving Kids SIP*smart*ER in the second period 2. Also, the extent

to which parents received, listened to, and spoke with their children about the content of the calls was not assessed. Finally, results may lack generalizability, although the school selected for this intervention is representative of the region.

The strengths of this study include the mixed-methods evaluation design that allowed for better description of feasibility indicators and the matched-contact randomized design, which is novel for feasibility studies. Also, this study reported 3-month follow-up data to assess maintenance of behavior changes. Program strengths include the use of few resources, low time intensity, and opportunities to embed the program within standards of learning requirements.

Future studies should prioritize school and community buy-in prior to implementation. Furthermore, they should avoid interaction biases, be adequately powered to assess intervention effects on SSB consumption and psychosocial constructs, better address “home culture,” and incorporate methods to test teachers’ capacity to implement the intervention. A dissemination and implementation study with a dual focus of training and monitoring the ability of teachers to deliver and sustain the curriculum as well as evaluation of program effectiveness among students, is recommended.^{73–74} Finally, future efforts should target environmental- and policy-level strategies, as multilevel interventions hold the best promise for improving SSB consumption and related childhood obesity outcomes.

Acknowledgments

The authors express appreciation to all members of our regional advisory board, especially the principal and science teachers at Hurley Elementary Middle School, for their continuous support and enthusiasm for this project. They thank the graduate and undergraduate students and staff from Virginia Tech with their assistance in curriculum develop, data collection, and intervention delivery: Katelynn Perzynski, Donna Brock, Aurielle Lowery, Dimple Mohzi, and Natalie Woodford.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Support for this research was provided, in part, by National Institutes of Health/ National Cancer Institute (grant no 1R01CA154364-01) and the Virginia Tech Fralin Translational Obesity Research Center. The views expressed are solely those of the authors and do not reflect the official policy or position of the US government.

References

1. Kit BK, Fakhouri TH, Park S, Nielsen SJ, Ogden CL. Trends in sugar-sweetened beverage consumption among youth and adults in the United States: 1999–2010. *Am J Clin Nutr*. 2013; 98(1):180–188. [PubMed: 23676424]
2. Avery A, Bostock L, McCullough F. A systematic review investigating interventions that can help reduce consumption of sugar-sweetened beverages in children leading to changes in body fatness. *J Hum Nutr Diet*. 2015; 28(suppl 1):52–64. [PubMed: 25233843]
3. Evans EW, Haves C, Palmer CA, Bermudez OI, Cohen SA, Must A. Dietary intake and severe early childhood caries in low-income, young children. *J Acad Nutr Diet*. 2013; 113(8):1057–1061. [PubMed: 23706351]
4. Imamura F, O’Connor L, Ye Z, et al. Consumption of sugar sweetened beverages, artificially sweetened beverages, and fruit juice and incidence of type 2 diabetes: systematic review, meta-analysis, and estimation of population attributable fraction. *BMJ*. 2015; 351:h3576. [PubMed: 26199070]

5. Xi B, Huang Y, Reilly KH, et al. Sugar-sweetened beverages and risk of hypertension and CVD: a dose-response meta-analysis. *Br J Nutr.* 2015; 113(5):709–717. [PubMed: 25735740]
6. Malik VS, Pan A, Willett WC, Hu FB. Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis. *Am J Clin Nutr.* 2013; 98(4):1084–1102. [PubMed: 23966427]
7. Tahmassebi JF, Duggal MS, Malik-Kotru G, Curzon MEJ. Soft drinks and dental health: a review of the current literature. *J Dent.* 2006; 34(1):2–11. [PubMed: 16157439]
8. Te Morenga L, Mallard S, Mann J. Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ.* 2012; 346(3):e7492–e7492. [PubMed: 23321486]
9. Wang J, Light K, Henderson M, et al. Consumption of added sugars from liquid but not solid sources predicts impaired glucose homeostasis and insulin resistance among youth at risk of obesity. *J Nutr.* 2013; 144(1):81–86. [PubMed: 24198307]
10. Leung CW, Blumenthal SJ, Hoffnagle EE, et al. Associations of food stamp participation with dietary quality and obesity in children. *Pediatrics.* 2013; 131(3):463–472. [PubMed: 23439902]
11. Taveras EM, Gillman MW, Kleinman K, Rich-Edwards JW, Rifas-Shiman SL. Racial/ethnic differences in early-life risk factors for childhood obesity. *Pediatrics.* 2010; 125(4):686–695. [PubMed: 20194284]
12. Wang YC, Bleich SN, Gortmaker SL. Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988–2004. *Pediatrics.* 2008; 121(6):e1604–e1614. [PubMed: 18519465]
13. Appalachian Community Fund. [Accessed October 15, 2015] Central Appalachia. 2014. <http://www.appalachiancommunityfund.org/central-appalachia/>
14. Johnson RK, Appel LJ, Brands M, et al. Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. *Circulation.* 2009; 120(11):1011–1020. [PubMed: 19704096]
15. Lloyd-Jones DM, Hong Y, Labarthe D, et al. American Heart Association Strategic Planning Task Force and Statistics Committee. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic Impact Goal through 2020 and beyond. *Circulation.* 2010; 121(4):586–613. [PubMed: 20089546]
16. Harris, P. Impact of sugar-sweetened beverages and citric acid drinks on oral health in Central Appalachia: a problem that needs more attention. Paper presented at: American Public Health Association; November 6, 2013; Boston, PA.
17. Harris P. Undoing the damage of the Dew. *Appalachian J Law.* 2009; 9(1):53.
18. World Health Organization. Guideline: Sugars Intake for Adults and Children. Geneva, Switzerland: World Health Organization; 2015.
19. U.S. Department of Health and Human Services and U.S. Department of Agriculture. [Accessed November 15, 2016] 2015–2020 Dietary Guidelines for Americans. 82015. <http://health.gov/dietaryguidelines/2015/guidelines/>
20. Bellamy GR, Bolin JN, Gamm LD. Rural healthy people 2010, 2020, and beyond. *Fam Community Health.* 2011; 34(2):182–188. [PubMed: 21378515]
21. Gregg, EW., Kirtland, KA., Cadwell, BL., et al. Morb Mort Wkly Rep. Vol. 58. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services; 2009. Estimated County-Level Prevalence of Diabetes and Obesity – United States, 2007; p. 1259-1263.
22. Montgomery-Reagan K, Bianco JA, Heh V, Rettos J, Huston RS. Prevalence and correlates of high body mass index in rural Appalachian children aged 6–11 years. *Rural Remote Health.* 2009; 9(4): 1234. [PubMed: 19848443]
23. Levi, J., Vinter, S., Richardson, L., StLaurent, R., Segal, LM. F as in Fat: How Obesity Policies are Failing in America. Washington, DC: Trust for America's Health; 2009. <http://stateofobesity.org/files/fasinfat2009.pdf>. Updated July 1, 2009 [Accessed October 15, 2009]
24. Levy DT, Friend KB, Wang YC. A review of the literature on policies directed the the youth consumption of sugar-sweetened beverages. *Adv Nutr.* 2011; 2(2):182S–200S. [PubMed: 22332051]

25. Lane H, Porter K, Estabrooks P, Zoellner J. A systematic review to assess sugar-sweetened beverage interventions for child and adolescents across the socio-ecological model. *J Acad Nutr Diet*. 2016; 116(8):1295–1307. [PubMed: 27262383]
26. Smith LH, Valenzuela J, Ludke RL. Engaging rural and urban Appalachians in research using a community-based participatory research approach. *PRISM*. 2012; 1(1):3–17.
27. Glasgow RE, Klesges LM, Dziewaltowski DA, Bull SS, Estabrooks P. The future of health behavior change research: what is needed to improve translation of research into health promotion practice? *Ann Behav Med*. 2004; 27(1):3–12. [PubMed: 14979858]
28. Bowen DJ, Kreuter M, Spring B, et al. How we design feasibility studies. *Am J Prev Med*. 2009; 36(5):452–457. [PubMed: 19362699]
29. Grier K, Hill J, Reese F, et al. Feasibility of an experiential community garden and nutrition programme for youth living in public housing. *Public Health Nutr*. 2015; 18(15):2759–2769. [PubMed: 25704529]
30. Zoellner J, Chen Y, Davy B, et al. Talking Health, A pragmatic randomized-controlled health literacy trial targeting sugar-sweetened beverage consumption among adults: rationale, design & methods. *Contemp Clin Trials*. 2014; 37(1):43–57. [PubMed: 24246819]
31. Zoellner JM, Hedrick V, You W, et al. Effects of a behavioral and health literacy intervention to reduce sugar-sweetened beverages: a randomized-controlled trial. *Int J Behav Nutr Phys Act*. 2016; 13:38. [PubMed: 27000402]
32. Health Resources and Services Administration. [Accessed October 20, 2016] Virginia MUA/P By State and County. 2016. <https://datawarehouse.hrsa.gov/tools/analyzers/MuaSearchResults.aspx>. Updated June 8, 2017
33. Robert Wood Foundation. County Health Rankings and Road-maps: Virginia 2015. Buchanan County: 2015. <http://www.countyhealthrankings.org/app/virginia/2015/rankings/buchanan/county/outcomes/overall/snapshot>. Updated as of 2017 [Accessed October 15, 2015]
34. Lane H, Porter K, Zoellner J, Harris P. Using a participatory process to increase acceptability of a program to reduce SSBs and promote civic action in Appalachian youth. *Ann Behav Med SBM Proc*. 2016; 50(suppl 1):S295.
35. Ajzen, I. From intentions to actions: a theory of planned behavior. In: Kuhl, J., Beckmann, J., editors. *Action Control* Springer Science + Business Media. Heidelberg, Germany: 1985. p. 11-39.
36. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991; 50(2):179–211.
37. Hackman C, Knowlden A. Theory of reasoned action and theory of planned behavior-based dietary interventions in adolescents and young adults: a systematic review. *Adolesc Health Med Ther*. 2014; 5:101. [PubMed: 24966710]
38. Chen YC. The effectiveness of different approaches to media literacy in modifying adolescents' responses to alcohol. *J Health Commun*. 2013; 18(6):723–739. [PubMed: 23496333]
39. Pinkleton BE, Austin EW, Chen YCY, Cohen M. assessing effects of a media literacy-based intervention on US adolescents' responses to and interpretations of sexual media messages. *J Child Media*. 2013; 7(4):463–479.
40. Thoman E, Jolls T. Media literacy – a national priority for a changing world. *Am Behav Sci*. 2004; 48(1):18–29.
41. Primack BA, Douglas EL, Land SR, Miller E, Fine MJ. Comparison of media literacy and usual education to prevent tobacco use: a cluster-randomized trial. *J Sch Health*. 2014; 84(2):106–115. [PubMed: 25099425]
42. Virginia Department of Education. [Accessed October 15, 2016] Virginia Standards of Learning and Common Core State Standards. 2016. http://www.doe.virginia.gov/testing/common_core/index.shtml. Updated as of 2017
43. Freedman DA, Bess KD, Tucker HA, Boyd DL, Tuchman AM, Wallston KA. Public health literacy defined. *Am J Prev Med*. 2009; 36(5):446–451. [PubMed: 19362698]
44. Brega, A., Barnard, J., Mabachi, NM., et al. AHRQ Health Literacy Universal Precautions Toolkit. 2. Aurora, CO: Colorado Health Outcomes Program, University of Colorado Anschutz Medical Campus. Prepared for: Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services; 2015. http://www.ahrq.gov/sites/default/files/publications/files/healthlittoolkit2_4.pdf. Updated May 2017 [Accessed October 2015]

45. Ogden CL, Kuczmarski RJ, Flegal JM, et al. Centers for Disease Control and Prevention 2000 growth charts for the United States: Improvements to the 1977 National Center for Health Statistics version. *Pediatrics*. 2002; 109(1):45–60. [PubMed: 11773541]
46. Zoellner J, Estabrooks PA, Davy BM, Chen YC, You W. Exploring the theory of planned behavior to explain sugar-sweetened beverage consumption. *J Nutr Educ Behav*. 2012; 44(2):172–177. [PubMed: 22154130]
47. Primack BA, Gold MA, Switzer GE, Hobbs R, Land SR, Fine MJ. Development and validation of a smoking media literacy scale for adolescents. *Arch Pediatr Adolesc Med*. 2006; 160(4):369. [PubMed: 16585481]
48. Riebl SK, MacDougall C, Hill, et al. Beverage choices of adolescents and their parents using the theory of planned behavior: a mixed methods analysis. *J Acad Nutr Diet*. 2016; 116(2):226–239. [PubMed: 26686818]
49. Hedrick VE, Savla J, Comber DL, et al. Development of a Brief Questionnaire to Assess Habitual Beverage Intake (BEVQ-15): sugar-sweetened beverages and total beverage energy intake. *J Acad Nutr Diet*. 2012; 112(6):840–849. [PubMed: 22709811]
50. Chen Y, Porter KJ, Estabrooks PA, Zoellner J. Development and evaluation of the Sugar-Sweetened Beverages Media Literacy (SSB-ML) scale and its relationship with SSB consumption. *Health Commun*. 2016:1–8.
51. Rogers EA, Fine S, Handley MA, Davis H, Kass J, Schillinger D. Development and early implementation of The Bigger Picture, a youth-targeted public health literacy campaign to prevent type 2 diabetes. *J Health Commun*. 2014; 19(suppl 2):144–160. [PubMed: 25315590]
52. The Colorado Trust. The Afterschool Initiative's Toolkit for Evaluating Positive Youth Development. Denver, CO: The Colorado Trust and National Research Center, Inc; 2004. <http://www.uwex.edu/ces/4h/evaluation/documents/EvaluationToolkitJun04.pdf>. Updated June 2004 [Accessed October 15, 2014]
53. Centers for Disease Control and Prevention. [Accessed October 15, 2015] Behavioral Risk Factor Surveillance System Survey Questionnaire. 2015. <http://www.cdc.gov/brfss/>. Updated May 8, 2017
54. Tabachnick, BG., Fidell, LS. *Using Multivariate Statistics*. 6. New York, NY: Prentice Hall PTR; 2013.
55. Creswell, JW., Plano Clark, VL. *Designing and Conducting Mixed Methods Research*. 2. Thousand Oaks, CA: Sage; 2010.
56. Delpier T, Giordana S, Wedin BM. Decreasing sugar-sweetened beverage consumption in the rural adolescent population. *J Pediatr Health Care*. 2013; 27(6):470–478.
57. Goto K, Waite A, Wolff C, Chan K, Giovanni M. Do environmental interventions impact elementary school students' lunch-time milk selection? *Appl Econ Perspect Policy*. 2013; 35(2): 360–376.
58. Smith LH, Holloman C. Piloting “Sodabriety”: a school-based intervention to impact sugar-sweetened beverage consumption in rural Appalachian high schools. *J Sch Health*. 2014; 84(3): 177–184. [PubMed: 24443779]
59. Bergsma LJ, Carney ME. Effectiveness of health-promoting media literacy education: a systematic review. *Health Educ Res*. 2008; 23(3):522–642. [PubMed: 18203680]
60. Kaestle CE, Chen Y, Estabrooks PA, Zoellner J, Bigby B. Pilot evaluation of a media literacy program for tobacco prevention targeting early adolescents shows mixed results. *J Health Promot*. 2013; 27(6):366–369.
61. Banerjee SC, Greene K. Analysis versus production: adolescent cognitive and attitudinal responses to antismoking interventions. *J Health Commun*. 2006; 57:773–794.
62. Harris, JL., Schwartz, M., Brownell, KD., et al. *Sugary Drink FACTS: Evaluating Sugary Drink Nutrition and Marketing to Youth*. New Haven, CT: Rudd Center for Food Policy and Obesity; 2011. http://www.albany.edu/anthro/files/SugaryDrinkFACTS_ReportSummary.pdf [Accessed October 2015]
63. Connell DB, Turner RR. The impact of instructional experience and the effects of cumulative instruction. *J Sch Health*. 1985; 55(8):324–331. [PubMed: 3851109]

64. Ezendam NP, Evans AE, Stigler MH, Brug J, Oenema A. Cognitive and home environmental predictors of change in sugar-sweetened beverage consumption among adolescents. *Br J Nutr*. 2010; 103(5):768–774. [PubMed: 20003610]
65. Gratton L, Poverly R, Clark-Carter D. Promoting children's fruit and vegetable consumption: interventions using the theory of planned behaviour as a framework. *Br J Health Psychol*. 2007; 12(pt 4):639–650. [PubMed: 17535489]
66. Karimi-Shahanjari A, Rashidian A, Omidvar N, Majdzadeh R. Assessing and comparing the short-term effects of TPB only and TPB plus implementation intentions interventions on snacking behavior in Iranian adolescent girls: a cluster randomized trial. *Am J Health Promot*. 2013; 27(3): 152–161. [PubMed: 23286591]
67. Tsobatzoudis H. Evaluation of a planned behavior theory-based intervention programme to promote healthy eating. *Percept Mot Skills*. 2005; 101(2):587–604. [PubMed: 16383096]
68. Bogart LM, Elliott MN, Uyeda K, Hawes-Dawson J, Klein DJ, Schuster MA. Preliminary healthy eating outcomes of SNaX, a pilot community-based intervention for adolescents. *J Adolesc Health*. 2011; 48(2):196–202. [PubMed: 21257120]
69. Bjelland M, Bergh IH, Grydeland M, et al. Changes in adolescents' intake of sugar-sweetened beverages and sedentary behavior: results at 8 month mid-way assessment of the HEIA study – a comprehensive, multi-component school-based randomized trial. *Int J Behav Nutr Phys Act*. 2011; 8:63. [PubMed: 21679476]
70. Waters, E., de Silva-Sanigorski, A., Burford, BJ., et al. *Cochrane Database Syst Rev*. 2011. Interventions for preventing obesity in children; p. CD001871
71. Schetzina KE, Dalton WT III, Lowe EF, et al. Developing a coordinated school health approach to childhood obesity prevention in rural Appalachia: results of focus groups with teachers, parents and students. *Rural Remote Health*. 2009; 9(4):1157. [PubMed: 19877760]
72. Ickes MJ, Slagle KM. Targeting obesity in rural and Appalachian children and families: a systematic review of prevention and treatment interventions. *Universal J Public Health*. 2013; 1(3): 51–64.
73. Zoellner J, VanHorn L, Gleason P, Boushey CJ. What is translational research? Concepts and application in nutrition and dietetics. *J Acad Nutr Diet*. 2015; 115(7):1057–1071. [PubMed: 26115559]
74. Curran GM, Bauer M, Mittman B, Pyne JM, Stetler C. Effectiveness–implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact. *Med Care*. 2012; 50(3):217–226. [PubMed: 22310560]

SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Children and adolescents in the United States, particularly in rural areas such as Appalachia, consume excessive amounts of SSBs, which is linked childhood obesity and other adverse health outcomes. While school-based interventions are frequently used strategies to promote SSB reduction, few interventions are tailored for or tested in rural, medically underserved regions where consumption is particularly prevalent.

What does this article add?

This study establishes the feasibility of Kids SIP_{smart}ER, a theory-based, 6-week intervention to reduce SSBs in individuals and communities, in a rural Appalachian middle school.

What are the implications for health promotion practice and research?

This study justifies further development and testing of Kids SIP_{smart}ER and informs further testing and potential dissemination as an evidence-based intervention to reduce SSB consumption across the Appalachian region.

Figure 1. Randomized crossover study design, participation rate, and sample size for Kids SIP^{smart}ER feasibility study for middle school students in the Appalachian region of Virginia, 2015 to 2016.

Table 1

Kids SIP_{smart}ER Curriculum Overview and Parent Call Objectives, Corresponding With Theory of Planned Behavior (TPB), Media Literacy (ML), and Public Health Literacy (PHL) Constructs.

Week and Topic	Key Learning Objectives	Key Theoretical Constructs [Theory]	Parent Phone Calls
1. What's In Your Drink?	<ul style="list-style-type: none"> Identify a drink as sugary and distinguish between sugary and nonsugary drinks Calculate how much sugar is in various sugary drinks Recognize if they drink too many sugary drinks Identify adverse health effects of consuming too many sugary drinks Understand that most kids drink too many, but Appalachian kids drink disproportionate amounts 	Attitudes [TPB]; Conceptual Foundations [PHL]	Define SSBs, discuss harms and recommendations for adults and children
2. Drop the Pop!	<ul style="list-style-type: none"> Calculate ounces of sugary drinks they typically drink State reasons to set personal and group goals for drinking less sugary drinks Set SMART personal and group goals for drinking less sugary drinks State personal barriers that might make it hard for someone to drink less sugary drinks and identify ways to overcome those barriers 	Perceived Behavioral Control [TPB]; Intention [TPB]; Subjective Norms [TPB]	Illustrate barriers that are specific to the home and provide strategies to help child meet goals
3. The Game of Life: Pop Edition	<ul style="list-style-type: none"> Recognize personal financial benefits of drinking less sugary drinks Recognize personal health, social, and productivity costs of drinking too many sugary drinks Recognize public's health, social, productivity, and environmental costs of drinking sugary drinks Recognize that their community is disproportionately affected by sugary drinks 	Attitudes [TPB]; Subjective Norms [TPB]; Intention [TPB]; Conceptual Foundations [PHL]	Describe the health, economic and environmental costs of SSBs and relate that to child's health
4. Talking Back	<ul style="list-style-type: none"> Recognize that advertisements of sugary drinks are often untruthful Recognize that the beverage industry directly targets teens and those living in rural areas Understand specific tactics that advertisements use to sell beverage products State alternative messages beverage companies could use to tell the truth 	Attitudes [TPB]; Intention [TPB]; Media Literacy	Discuss how advertisements target rural adults and youth and give examples of ways to recognize tactics
5. Spreading the Word	<ul style="list-style-type: none"> Recognize that untruthful advertisements are widespread throughout their school, homes and community stores State what it means to be a "healthy role model" State messages they would use to teach a friend or family member that drinking too many sugary drinks is harmful and that the consequences are not inevitable 	Media Literacy; Perceived Behavioral Control [TPB]; Intention [TPB]; Critical Skills [PHL]	Suggest ways parents can be role models by reducing their own SSB intake and supporting their child
6. In Our Own Voice	<ul style="list-style-type: none"> Set individual long-term goals around sugary drinks 	Perceived Behavioral Control [TPB];	Encourage parents to discuss child's PSA and how they

Week and Topic	Key Learning Objectives	Key Theoretical Constructs [Theory]	Parent Phone Calls
	<ul style="list-style-type: none"> Recognize that they can be role models among their family and friends to drink less sugary drinks State the purpose of a public service announcement Demonstrate the use of various persuasive techniques based on target audiences State strategies to overcome barriers after program ends 	Behavioral Intentions [TPB]; Critical Skills [PHL]; Civic Orientation [PHL]; Media Literacy	overcome barriers now that program is over

Abbreviations: PSA, Public Service Announcement; SSBs, sugar-sweetened beverages.

Table 2

Baseline Description of Randomized Students in Crossover Study (n = 74).

	Intervention Group (Kids SIPsmartER), Period 1 ^a (n = 43)		Comparison Group (Physical Activity) Period 1 ^a (n = 31)	
	n or Mean	% or SD	n or Mean	% or SD
Female (n and %)	26	60.5	18	58.1
Mean age (mean and SD)	11.7	0.6	11.8	0.7
Mean SSB, oz ^b (mean and SD)	35.6	25.7	36.6	28.4
Mean SSB, kcal ^b (mean and SD)	457.9	341.1	469.4	376.3
Mean water, oz ^b (mean and SD)	26.7	19.4	22.7	18.0
Consuming more than recommended SSB (8 oz/d) ^b (n and %)	37	86.0	29	93.5
Getting less than recommended physical activity (60 minutes, 7 d/wk) (n and %)	31	72.1	23	74.1
Mean BMI %ile ^c (mean and SD)	78.2	27.9	83.7	20.5
Underweight ^c (<5 BMI %ile) (n and %)	1	2.6	0	0.0
Normal weight ^c (5.0–84.9 BMI %ile) (n and %)	12	31.6	9	23.7
Overweight ^c (85.0–94.9 BMI %ile) (n and %)	10	26.3	6	15.8
Obese ^c (>95% BMI %ile) (n and %)	15	39.5	10	26.3

Abbreviations: SD, standard deviation; SSBs, sugar-sweetened beverages; BMI, body mass index.

^aNo significant differences between 2 groups.^bDoes not include 4 students with missing data from BEV-Q (intervention n = 1; comparison n = 3).^cSome students who were present for survey collection were not present for height and weight data collection, so for height and weight, intervention n = 38; comparison n = 25).

Table 3

Limited Effectiveness Measures Between Intervention Group Receiving Kids SIP^{smart}ER and Comparison Group Receiving Physical Activity Program Before, Immediately Following, and 3 Months Following the Intervention, With Missing Values Imputed (n = 71).^a

	Items; Cronbach α	Intervention Group Period 1 (n = 43)						Comparison Group Period 1 (n = 28)						Between- Group Effects (<i>P</i>)									
		Baseline (T1)			Change Score (T1-T2)			Change Score (T1-T3)			Baseline (T1)					Change score (T1-T2)			Change Score (T1-T3)				
		Time 2 (T2)			Time 3 (T3)			Mean (SD)			Mean (SD)					Mean (SD)			Mean (SD)			Mean (SD)	
		Mean (SD)	Time 2 (T2)	Mean (SD)	Time 3 (T3)	Mean (SD)	Time 2 (T2)	Mean (SD)	Time 3 (T3)	Mean (SD)	Time 2 (T2)	Mean (SD)	Time 3 (T3)	Mean (SD)	Time 2 (T2)	Mean (SD)	Time 3 (T3)	Mean (SD)	Time 2 (T2)	Mean (SD)	Time 3 (T3)	Mean (SD)	Time 2 (T2)
Overall SSB ^{b,c} (fl oz)	n/a	35.6 (25.7)	24.6 (22.0)	23.4 (25.1)	−11.0 ^g (26.5)	−12.2 ^g (25.5)	32.2 (22.9)	28.8 (29.6)	26.8 (30.6)	−3.4 (20.8)	−5.4 (18.8)	0.22	0.25										
Overall SSB ^{b,c} (kcal)	n/a	467.6 (339.1)	323.9 (295.5)	301.2 (327.6)	−143.7 ^f (370.0)	−166.4 ^g (335.8)	411.9 (302.7)	362.1 (365.1)	338.0 (386.2)	−49.8 (276.2)	−74.0 (256.4)	0.28	0.24										
Media literacy ^{b,d}	19; 0.84	3.7 (0.6)	4.1 (0.6)	4.2 (0.7)	0.4 ^g (0.79)	0.5 ^h (0.6)	3.9 (0.5)	3.8 (0.6)	3.8 (0.6)	−0.1 (0.4)	−0.1 (0.4)	0.005	<0.001										
Public health literacy ^d	5; 0.68	3.0 (0.9)	3.3 (1.0)	3.4 (1.0)	0.3 (1.1)	0.4 ^g (0.9)	3.2 (0.7)	3.1 (0.7)	3.1 (0.8)	−0.1 (0.6)	−0.1 (0.8)	0.095	0.014										
Community connectedness ^{b,e}	3; 0.73	3.5 (0.8)	3.1 (1.3)	3.3 (1.2)	−0.4 (1.1)	−0.2 (1.1)	3.2 (0.9)	3.3 (0.9)	3.2 (1.1)	0.0 (1.1)	−0.0 (1.0)	0.12	0.68										
Attitudes ^d	6; 0.83	3.6 (0.8)	3.6 (0.9)	3.7 (0.9)	−0.0 (1.1)	0.0 (0.9)	3.4 (0.8)	3.2 (0.7)	3.1 (0.6)	−0.2 (0.8)	−0.3 (0.7)	0.46	0.13										
Perceived behavioral control ^d	3; 0.58	4.0 (0.9)	3.9 (0.8)	4.0 (0.9)	−0.1 (1.0)	−0.1 (0.9)	3.9 (0.8)	3.5 (0.7)	3.7 (0.9)	−0.5 (0.7)	−0.3 (0.8)	0.12	0.35										
Subjective norms ^{b,d}	3; 0.53	3.4 (0.0)	3.4 (0.9)	3.4 (0.9)	0.0 (1.0)	−0.0 (1.1)	3.8 (0.8)	3.4 (0.8)	3.4 (0.7)	−0.3 (1.1)	−0.4 (1.0)	0.14	0.17										
Behavioral intentions ^d	4; 0.85	3.4 (1.2)	3.5 (0.8)	3.3 (1.1)	0.0 (1.2)	−0.1 (1.1)	3.3 (1.1)	3.0 (0.9)	3.0 (0.9)	−0.3 (0.8)	−0.3 (0.7)	0.1	0.39										
Implementation intentions ^{b,d}	2; n/a	3.5 (1.2)	3.6 (1.0)	3.6 (1.1)	0.1 (1.3)	0.1 (1.2)	3.4 (1.2)	2.8 (1.3)	3.0 (1.4)	−0.6 (1.1)	−0.5 (1.1)	0.026	0.069										
Number of days/week physical activity recommendations met	n/a	4.9 (1.7)	4.5 (1.9)	4.4 (1.7)	−0.4 (2.3)	−0.5 (1.9)	4.9 (1.8)	4.5 (1.7)	4.3 (2.0)	−0.4 (1.7)	−0.5 (1.9)	0.98	0.96										

Abbreviations: SSB, sugar-sweetened beverages (soda pop, energy/sports drinks, coffee with cream and/or sugar, sweet tea, and sweetened fruit juice, does not include 100% juice); n/a, not applicable.

^aUsing last observation carried forward, 2-way, repeated measures ANOVA tested within- and between-group effects over 3 time periods: T1, baseline; T2, immediate follow-up; and T3, 3-month follow-up. Intervention group period 1 received Sip Smarter between T1 and T2; comparison group period 1 received Sip Smarter between T3 and T4.

^bMissing baseline data, n range = 67–70.

^cDaily fluid ounces and kilocalories calculated based on beverage frequency questionnaire.

^dResponses on a 5-point Likert scale (ie, strongly disagree to strongly agree).

^eResponses on a 5-point Likert scale (ie, never to all the time).

^fSignificant within-group changes, *P* < .05.

^gSignificant within-group changes, *P* < .01.

Significant within-group changes, $P < .001$.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 4

Quantitative Feasibility Results (Demand, Acceptability, Practicality, and Implementation) From Teacher Surveys After Each Lesson (n = 8) and Student Follow-Up Surveys (n = 42).

Focus Area	Question	Survey	Mean	SD
Demand/acceptability	The topic of this lesson is important for my students to learn about.	Teacher	5.0 ^a	0.0
Demand/acceptability	My students learned something new from this lesson.	Teacher	4.8 ^a	0.5
Demand/acceptability	My students liked doing this lesson.	Teacher	4.4 ^a	0.5
Demand/acceptability	This lesson helped my students learn to be role models for their friends and family.	Teacher	4.3 ^a	0.5
Demand/acceptability	I liked this program.	Student	4.6 ^b	0.8
Demand/acceptability	I learned something new from this program.	Student	4.5 ^b	0.8
Demand/acceptability	Other kids my age would like this program.	Student	4.0 ^b	1.1
Demand/acceptability	It is important for kids my age to get this program.	Student	4.6 ^b	0.7
Implementation	During this lesson, the instructors used words and phrases my students could understand.	Teacher	4.9 ^a	0.4
Implementation	The instructor did a good job of engaging my students in the activities during this lesson.	Teacher	4.9 ^a	0.4
Implementation	The handouts, worksheets, and activities were appropriate for my students.	Teacher	4.9 ^a	0.4
Practicality	This topic could fit into the science curriculum at my school.	Teacher	4.8 ^a	0.5
Practicality	I feel confident that I could teach this lesson as part of the science curriculum in the future.	Teacher	4.4 ^a	0.5
Practicality	I would enjoy teaching this lesson in the future.	Teacher	4.6 ^a	0.5

^a Average across 6 lessons; of 12 possible surveys, 8 were collected.

^b Average across students in Kids SIP^{smart}ER intervention period 1 who were present at immediate follow-up (n = 42).

Table 5

Qualitative Feasibility Results (Demand, Acceptability, Practicality, Implementation, and Integration) From Teachers and Students Following Kids SIP_{smarter}, an Intervention to Reduce SSB Intake in Appalachian Virginia.

Focus Area	Source	Sample Question (s)	Constructs/Themes	Themes/ Notable Quotes
Demand/acceptability <i>Extent to which new program is (1) judged as suitable, satisfying, attractive and (2) likely to be used</i>	Teacher interview	"How in general did you feel about the program as it was being implemented in your school and classrooms?"	Satisfaction	"The kids really enjoyed learning what we were telling them and it was valuable for them to hear that stuff and it was a great program for them to be involved with."
		If you were to rate the importance of reducing sugary drinks in your school and community on a scale of 1 to 5, what would you say?		"The kids really looked forward to it each week." "Well-needed, well-received . . . we appreciate you coming and opening our eyes to certain things."
				"I would definitely say a 5, especially in this area, we're starting to see some obesity and some health problems at younger ages now." "I also rate it as a 5. It seems like you're combatting more problems . . . kids not being as physically active, it's all video games and technology now . . . drinking all the sugar, it's adding weight, it's becoming a problem, it's gonna be a diabetes epidemic down the road."
			Novelty Challenges/ Recommendations	"This is the first we've seen anything like this." "It starts at a very early age, we're seeing children drink pop as early as 2 years old . . . getting parents more involved would lead to more results." "By the time they get to 7th grade their ideas are already formed and it's much harder to break a kid out of a habit. They've already developed that part of their personality." "Some [parents] may be like 'we don't care about this, it's none of your business what we feed our kids. You'll have others that are like, 'I didn't realize this, we need to cut back.'" "Move to 4th grade, where more parents are involved and may be more likely to 'buy-in'" "Have something different in 6th that's different than 7th and then expand on it, the repetition, might drive it home even more and lead to more successful change"
	Student focus groups	What is one thing about Sip Smarter that you found fun, helpful, surprising or inspiring?	Satisfaction	"They didn't make it boring, they made it fun by using cool stuff."
		Do you think it's important keep teaching Sip Smarter here at your school?		"It kind of changed my mind about pop." "Sip Smarter is really fun, it taught us tons of stuff about pop that we probably didn't know before and taught us not to drink a lot."
		What are some things that might make it hard to keep teaching Sip Smarter at your school?		"We're young right now. It's helping us a lot where we . . . like if we get older, we won't drink a lot of pop because we learned the consequences before we got old." "It's important because there's a lot of people here that drinks pop." "If you talk about it when they're young, they might change their life when they get older."

Focus Area	Source	Sample Question (s)	Constructs/Themes	Themes/ Notable Quotes
			Challenges	<p>"It should be spread out to more schools where the other schools can learn how bad it will be for them before they end up doing like some people already have."</p> <p>"I doubt [parents] would show up. They wouldn't listen; we'll listen better than grownups."</p> <p>"I'd say probably go down to 5th, but some littler kids may not understand . . . they really won't pay as much attention to it, they won't be tempted to go back and tell their family."</p> <p>"It's been a week since ya'll have been here and even today I heard kids say some stuff about sugary drinks so I mean the message has at least stuck with them to this point, and hopefully it will continue to stick with them."</p> <p>"It wasn't a problem to give up science time, in 7th you're only [standardized] testing in reading and math."</p> <p>"Tools and strategies were great . . . provided visual examples, used technology use as teachers do on a normal day."</p> <p>"The information [the researchers] shared with us gave us a nice base."</p> <p>"I already teach macronutrients, that's part of the standards every year and I do a little more because I've got a nutritional background. I have no problem teaching, and it's needed, it's much needed."</p> <p>"The [standardized testing] grades that are tested, you're so packed with stuff you have to present to your kids, it's really tough to working in anything else or give up any time."</p>
Practicality <i>Extent to which new program can be conducted within existing resources and circumstances without outside intervention</i>	Teacher interview	<p><i>How would you feel about teaching Healthy Hurley in your own classrooms?</i></p> <p><i>What other tools/strategies would you use if you taught this lesson?</i></p>	<p>Positive/negative effects on participants</p> <p>Ability to carry out program</p>	
Integration <i>To what extent can program be integrated within existing system?</i>	Teacher interview	<i>What barriers or challenges would there be to making this part of the curriculum?</i>	Institutional challenges standardized testing	