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The impact of health literacy on rural adults' satisfaction with a multi-component intervention to reduce sugar-sweetened beverage intake

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Abstract

SIP*smart*ER is a 6-month behavioral intervention designed using a health literacy universal precautions approach that has been found effective at reducing sugary beverage intake in rural, low socioeconomic adults. The purpose of this mixed-methods study is to determine if health literacy status influenced participants' satisfaction and perceptions of each intervention component: small group classes, interactive-voice response (IVR) calls, personal action plans and self-monitoring logs. Of the 155 participants enrolled in SIPsmartER, 105 (68%) completed an interview-administered summative evaluation including 68 high and 37 low health literate participants. The quantitative findings show participant satisfaction with each intervention component was high (i.e. classes = 9.6, IVR calls = 8.1, action plans = 8.9–9.1, logs = 8.7 on a 10-point scale) and similar across both health literacy groups. The majority of qualitative responses were positive (81.8%) and code counts were comparable between literacy groups with a few exceptions. As compared with high health literacy respondents, low health literacy respondents more frequently mentioned liking the content and length of IVR calls, liking the motivational aspects of the personal action plans, and identified numeracy issues with the self-monitoring logs. Overall, applying a health literacy universal precautions approach is an effective and acceptable strategy for both high and low health literacy groups.

Introduction

Sugar-sweetened beverages (SSBs) are the largest source of added sugars in the American diet, contributing 6.9% of daily energy intake among adults [1, 2]. SSB consumption is correlated with multiple public health concerns such as obesity, diabetes, cardiovascular disease and dental caries [3–7]. Disproportionally high rates of SSB consumption are found in rural, low-income, and low health literate (HL) populations [8–12]. In addition, rural and low-income populations report higher rates of overweight and obesity, and obesity-related conditions [13, 14] and low HL populations are more likely to have chronic conditions and to report their health as poor [15]; consequently making rural, low-income and low HL populations especially susceptible to the health risks of SSBs.

To manage their health, people need to be able "to obtain, process and understand basic health information and services needed to make appropriate health decisions" [16, p. ix]; this ability is known as HL. It is estimated that 88% of U.S. adults may lack the HL

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skills needed to manage their health and prevent disease [17]. Adults living in rural areas tend to have low-educational attainment and low socioeconomic status, which are factors strongly associated with low HL [18, 19]. For example, in Virginia, the rate of adults over the age of 25 having less than a high school diploma is 20.1% in Appalachian counties compared with 11.7% in non-Appalachian counties. Similarly, the per capita income of residents of Appalachian region of Virginia is $21 763 compared with $34 721 for non-Appalachian Virginians [20].

Despite the need, there are no known behavioral interventions that have taken a health literacy approach to target SSB reduction among rural adults. To address this gap in the literature, SIP*smart*ER was developed in 2011 and targets adults living in the rural Appalachia region of southwest Virginia. SIP*smart*ER is a 6-month multi-component behavioral intervention targeting SSB reduction and was designed using an HL universal precautions approach [21]. HL universal precautions are steps taken when practitioners and researchers assume that all participants have difficulty comprehending health information [22, 23]. This approach is founded on the concept that all participants, regardless of HL status, benefit from improving patient understanding of health information and reducing the complexity of health care. In brief, SIP*smart*ER included utilization of clear communication techniques to ensure the information was delivered in ways everyone, regardless of HL status, could understand and incorporated strategies to promote self-management and empowerment, such as goal setting and self-monitoring.

The effectiveness of *SIPsmartER* was tested through the *Talking Health* trial, which was guided by the RE-AIM planning and evaluation framework [24]. Effectiveness results of the randomized trial found that at 6 months SIP*smart*ER changes averaged −227 SSB kcal/day when compared with the control group at −53 SSB kcal/day ($P < 0.001$). SIP*smart*ER also improved quality of life and resulted in a small, yet statistically significant reduction in BMI. Furthermore, there were no statistically significant differences between low and high HL participants in these 6-month improvements [25].

These findings provide support that an intervention designed to mitigate the burden of low HL can similarly benefit those with low and high HL skills [26, 27]. However, questions remain about the potential differences in acceptability of intervention components among different literacy groups. Kessler *e al.* [28] propose that in order to comprehensively use evaluation models such as the RE-AIM framework, researchers need to use qualitative methods to understand outcomes. Qualitative methodology is useful to understand implementation, identify populations that benefitted the most from the intervention and target modifications that can maximize the effectiveness of the intervention [29]. Utilizing qualitative responses with quantitative program satisfaction data can further help explain outcome effects and aid in program refinement [30, 31]. However, to our knowledge, there are no known HL trials reporting the use of qualitative methods to understand the outcomes of the intervention or explore potential differences in acceptability by HL status. To address this gap in the literature and inform future adaptations and dissemination of SIP*smart*ER, we used a mixed-methods' evaluation to determine if an HL universal precautions approach resulted in similar satisfaction among low and high HL participants. Therefore, the purpose of this mixed-methods paper is to (i) determine participants' satisfaction and perception ratings across the multicomponent intervention by HL status and (ii) qualitatively identify emergent codes related to participant's likes, dislikes and barriers of each component by HL status.

Methods

Study design

SIP*smart*ER was the intervention arm of *Talking Health*, a 6-month randomized controlled trial testing the effectiveness of SIP*smart*ER against the matched-contact, physical activity promotion comparison group, MoveMore. The trial was implemented in eight southwest Virginia counties

between April 2012 and October 2014. This study focuses exclusively on the mixed-methods summative evaluation of SIP*smart*ER, which was administered upon conclusion of the intervention. Participants received a $25 and $50 gift card, respectively, at completion of the baseline and 6-month assessments. This study was approved by the Virginia Tech Institutional Review Board and participants provided written informed consent.

Participants

To be eligible, participants had to be 18 years of age and older, speak English, consume at least 200 SSB kcal/day, report no contraindications to physical activity, and have regular access to a telephone. Participants were recruited via passive strategies, such as newspaper ads, flyers and post cards, or through active strategies involving Virginia Tech research assistants and Virginia Cooperative Extension agents who recruited from community organizations such as Head Start, local health departments and free clinics, retail shops and community events. Locations serving lower socioeconomic individuals, the target population for this study, were the focused setting of the active recruitment activities [32]. A total of 1056 individuals were screened. Of the total screened, 620 (58.7%) were eligible and 301(28.5%) enrolled in *Talking Health*, of which 155 were randomized into SIP*smart*ER.

SIP*smart*ER intervention

Guided by the Theory of Planned Behavior (TPB) and HL concepts, the primary objective of SIP*smart*ER was to decrease SSB consumption by improving participants' attitudes, subjective norms and perceived behavioral control relative to SSB intake as well as their HL, numeracy (e.g. being able to read a nutrition label), media literacy and self-monitoring skills [33–37]. The intervention included three small-group classes, one live teach-back call, 11 interactive-voice response (IVR)-automated telephone calls, personal action planning and SSB self-monitoring (Table I). TPB constructs of attitudes, subjective norms, perceived behavioral control and intention were used to create class and IVR content. A detailed description of the theoretical development, implementation and evaluation of the *Talking Health* trial is provided elsewhere [21, 25, 38, 39].

Small group classes

Participants were invited to attend three 90–120-min small group classes (6–10 participants). A professional health educator delivered the interactive lessons that incorporated hands-on demonstrations, videos, PowerPoint presentations and in-class handouts/worksheets. All aspects of each lesson—oral and written—used plain language, a communication technique designed to make language easy to read, understand and use [40]. Lessons used aspects of TPB, HL, media literacy and numeracy to provide content that increased motivation, skills and support to drink fewer SSBs.

Personal action plans

To foster empowerment, participants completed personal action plans—based on the 5 A's of behavior change—that included **a**ssessing current levels of SSB intake, **a**dvising on realistic reduction goals, collaborative **a**greement on a reduction goal, **a**ssistance in identifying strategies to overcome barriers and **a**rranging for follow-up contact at class or by phone [41]. The instructor provided participants with guidance and support as they completed their plans in class, and the IVR system guided the continued development and evaluation of goals, barriers and strategies.

Teach-back call

The objectives of the live teach-back call were to document comprehension of key concepts from the first small group class and mastery of behavioral self-monitoring [42]. Teach-back allows participants to explain key concepts using their own words [43]. Participants were asked five question-related key concepts covered during the first class. If a participant provided incorrect information, a teach-to-goal approach was used whereby they were given the correct information and two more opportunities to correctly recall the information.

Table I. *Description of intervention components and universal health literacy precautions used*

Component	Number	Frequency	Purpose	Types of HL activities
Group classes	3	Weeks 1, 6, 17	To build behavior-specific content knowledge and skills in a supportive group setting	1. Interactive information presentation using: hands-on demonstrations, videos, PowerPoint visual aids, and simplified handouts 2. Facilitated group discussion and encouragement of questions 3. Instructor-guided goal setting through the use of action plans
Teach-Back call	1	Week 2	To provide participants an opportunity to demonstrate mastery of key concepts and behavioral self-monitoring	1. Teach back 2. Teach-to-goal
IVR calls	11	Bi-weekly	To motivate and reinforce behavior-specific knowledge and skills between classes To track behavior change progress and set new goals	1. Goal setting and self-monitoring 2. Repetition of key concepts
Personal action plans	3	Weeks 1, 6, 17 (during classes)	To foster empowerment by setting new behavior change goals while recognizing barriers and potential solutions to barriers during classes	1. Instructor-guided goal setting and barrier identification
Behavioral logs	26	Weekly	To promote self-management by monitoring behavior throughout intervention.	1. Self-monitoring

Teach-to-goal is based on Mastery Learning theory that says people learn at different rates, but everyone can master material if given multiple opportunities [44].

IVR calls

The overall objectives for the IVR calls were to reinforce key intervention messages, provide motivation and facilitate behavior goal setting and tracking. Participant IVR accounts were set-up at the baseline health assessment, including selection of preferred days/times for calls. Participants were given a toll-free number to access the IVR system if they missed a call. During the calls, participants used voice recognition or the keypad to answer questions. First, they provided the average amount of SSBs consumed based on their weekly self-monitoring log. The system determined the participant's level of goal attainment: meeting or exceeding goals, not meeting goals but some progress or no progress. Tailored behavioral reinforcement messages, rooted in TPB principles and designed using plain language, were provided and the IVR system guided participants through the action planning process to set a new goal for the upcoming week. The IVR system recorded the new goals in the main database and verbally confirmed these goals to the participant during the phone call.

Self-monitoring

To encourage self-management, simple behavioral self-monitoring logs were provided to participants to record ounces of SSB intake daily. The instructor reviewed how to correctly complete the behavioral self-monitoring logs and compute weekly averages during the first class and proper log completion was reinforced during the teach-back call. Participants used the logs to calculate daily and weekly SSB totals, and weekly averages. Weekly averages were inputted into the IVR system to facilitate behavioral tracking.

Table II. Participant satisfaction ratings of the intervention components overall and by health literacy status

	Number of items in scale[a]	Scale Cronbach's α	Overall ($N = 105$) mean (SD)	Low HL ($N = 36$) mean (SD)	High HL ($N = 64$) mean (SD)	*P* values
Small group classes[b]	3	0.85	9.5 (.8)	9.5 (.9)	9.6 (.7)	0.88
IVR calls[c]	5	0.86	8.1 (2.0)	8.6 (2.0)	7.8 (2.0)	0.06
Design of personal action plan[d]	1	n/a	9.1 (1.3)	9.2 (1.4)	9.1 (1.2)	0.68
Helpfulness of personal action plan[e]	1	n/a	8.9 (1.9)	9.5 (.9)	8.5 (2.2)	0.00
Behavioral logs[f]	3	0.67	8.7 (1.5)	9.0 (1.4)	8.5 (1.5)	0.13

[a]The two single item questions addressing participant satisfaction with the personal action plan were not combined due to an unacceptable Cronbach's α.
[b]$n = 100$; differential responses due to missing data.
[c]$n = 99$; differential responses due to missing data.
[d]$n = 98$; differential responses due to missing data.
[e]$n = 99$; differential responses due to missing data.
[f]$n = 101$; differential responses due to missing data.

Measures

Demographics

Information on gender, age, race/ethnicity, educational level, income, employment status, health care coverage, marital status, number of children in the home and county of residence was collected during the screening process. The HL level of participants was assessed at the baseline assessment using the 6-item validated Newest Vital Sign [45]. According to validated scoring procedures, participants who correctly answered four or more questions were determined to have a high likelihood of adequate literacy skills (high HL) whereas those answering three or fewer questions correctly indicated a likelihood of limited literacy skills (low HL). SSB intake was measured at the baseline and follow-up assessments, with the BEVQ-15, a validated assessment of beverage behaviors over the past 30 days [46].

Summative evaluation

As an exit interview during the 6-month assessment [18], a summative evaluation was interview-administered by a trained member of the research team. To mitigate social desirability responses bias, members of the research team with the least amount of personal contact with participants administered the summative evaluation. The evaluation was designed to gain an understanding of participants' satisfaction with and perceptions of the different intervention components.

Quantitative questions were asked to participants about their overall experiences with each component as well as perceptions about specific traits of each component including content of classes (three items), IVR calls (five items), personal action plan (two items) and behavioral logs (three items). Items were measured using a 10-point scale ranging from 1 = strongly disagree or strongly dissatisfied to 10 = strongly agree or strongly satisfied.

After responding to the scaled questions for each component, participants were asked to describe specific aspects of the components they liked and disliked and to identify barriers they experienced. Finally, participants were asked to identify which aspect of the program they found to be the most motivating. Interviewers recorded participants' responses to open-ended questions on a paper or electronic version of the summative evaluation for each participant.

Analysis

Quantitative analysis

Quantitative statistical analyses were performed using SPSS statistical analysis software, version 22.0. Descriptive statistics were used to summarize

all quantitative measures. Responses to scaled questions for each component were summed and averages were computed. Cronbach alphas were computed to test the internal consistency of satisfaction scales and ranged from 0.67 to 0.86 (Table II). Because the two satisfaction items regarding the personal action plan had unacceptable internal consistency, each item was analyzed independently. Independent sample *t*-tests and Chi-square tests were used to analyze differences between HL groups. Statistical significance was set at $P < 0.05$.

Qualitative coding and analysis

Conventional content analysis was used to describe the range of participant likes, dislikes and barriers to the program components. Content analysis is a research method that allows extraction of the essence of many words into fewer content related categories [47, 48]. With oversight from the primary investigator and using an inductive approach, two graduate research assistants reviewed the first 20% of the responses to the open-ended questions several times and independently categorized statements that reflected key concepts. Next, based on the initial reviews, two study authors along with two graduate students developed a study codebook with definitions for each code. These coders independently identified meaning units within each participant's responses that corresponded to the codes and then met to discuss discrepancies and gain consensus. If a participant mentioned the same code more than once, it was only counted as a single response. During the coding process, codes were reviewed periodically for overlap and codes were collapsed when appropriate. The meaning units for codes were tracked using SPSS and code counts were tabulated. Chi-square tests and Fisher's exact tests (e.g. when cell counts were less than five) were used to analyze the distribution of code count by HL status.

Results

Sample

Of the 155 participants enrolled in SIP*smart*ER, 105 (68%) completed the 6-month summative evaluation and are included in this study (Table III). Baseline characteristics, including HL, did not significantly differ between participants who completed the summative evaluation and non-completers. The mean age of included participants was 43.3 years. Approximately 83% were female and 94% identified as Caucasian. Thirty-four percent of the participants had a high school education or less, 66% reported an annual income of <$25 000, 33% worked full or part-time and 69% reported having insurance coverage.

HL status indicated 35% with low HL and 65% with high HL. When compared with high HL participants, low HL participants had significantly lower levels of education, income and full-time employment ($P < 0.05$) (Table III).

Participation

When compared with summative evaluation completers, non-completers participated in significantly less classes, teach-back and IVR calls (Table III). There was a non-significant trend ($P = 0.06$) suggesting low HL participants attended a higher proportion of classes; however, high and low HL completers did not differ on teach-back call or IVR participation.

Quantitative ratings

Quantitative findings show participant satisfaction ratings for each intervention component ranged from 8.1 to 9.6 on the 10-point scale (Table II). Small group classes were the intervention component most favored by both groups (low HL: 9.5, high HL: 9.6).

There were no significant differences by HL status with regard to the satisfaction subscales for classes, IVR and diaries. However, on average, low HL participants rated the helpfulness of the personal action plan significantly higher than high HL participants (low HL: 9.5, high HL 8.5, $P = 0.00$). In addition, there was also a trend toward the IVR calls being rated higher among low HL participants than their high HL peers (low HL: 8.6, high HL 7.8, $P = 0.06$).

Overall, the majority of the sample (53%) identified small group classes as the most motivating

Table III. Characteristics of participants who did and did not complete the 6-month assessment, comparisons between low and high health literacy (HL) participants, and intervention participant rates

	Total ($N = 155$)	Completed the 6-month assessment ($N = 105$)	Did not complete the 6-month assessment ($N = 50$)	*P* value[a]	Low HL ($N = 37$)	High HL ($N = 68$)	*P* value[a]
Age (years) mean (SD)	41 (13.5)	43.3 (12.8)	37.5 (14.1)	0.01	45.3 (14.2)	42.2 (11.9)	0.24
Female *n* (%)	126 (81.3)	87 (69)	39 (78)	0.51	28 (72.7)	59 (86.8)	0.18
Caucasian *n* (%)	143 (92.3)	94 (89.5)	49 (98.0)	0.11	33 (89.2)	66 (97.1)	0.18
Education level, ≤high school *n* (%)	45 (29)	27 (25.7)	18 (36.0)	0.26	24 (66.7)	12 (17.6)	0.00
Annual income *n (%)*				0.13			0.02
<$10 000	45 (29.0)	32 (30.5)	13 (26.0)		17 (45.9)	15 (22.1)	
$10 000–$24 999	63 (40.6)	37 (35.2)	26 (52.0)		13 (35.1)	24 (35.3)	
>$25 000	47 (30.3)	36 (34.3)	11 (22.0)		7 (18.9)	29 (42.6)	
Employment status *n* (%)				0.39			0.01
Full or part time	47 (30.3)	35 (33.3)	12 (24.0)		10 (27.0)	25 (36.8)	
Unemployed	32 (20.6)	19 (18.1)	13 (26.0)		15 (40.5)	9 (13.2)	
Other	76 (49.0)	51 (48.6)	25 (50.0)		12 (32.4)	34 (50.0)	
Has health insurance *n* (%)	95 (61.3)	67 (63)	28 (56)	0.38	26 (70.3)	46 (67.6)	0.83
Participation mean (SD)							
Classes attended (of 3 total)	2.05 (1.16)	2.58 (.78)	.92 (1.01)	0.00	2.76 (.60)	2.49 (.86)	0.06
Teach back call (of 1 total)	0.67 (.47)	0.83 (.38)	.34 (.48)	0.00	.86 (.35)	.81 (.40)	0.47
IVR calls completed (of 11 total)	5.88 (4.44)	7.92 (3.55)	1.60 (2.78)	0.00	8.22 (3.20)	7.76 (3.74)	0.54

[a]*P* values for either Independent *t* test or χ^2 test to determine if differences exist between groups.

component of the intervention. Following small group classes, 12% identified behavioral logs, 7.5% IVR and 3% identified personal action plans as the most motivating component of the intervention. No significant differences were found between the low HL and high HL groups.

Descriptions of likes, dislikes and barriers to each component

Table IV summarizes the codes generated for each component, code definitions, a representative meaning unit for each code, and counts and percentage of participants reporting a code by HL status. Across all components, the majority of responses about the components were positive (81.8%) as likes (417 meaning units) were mentioned more frequently than dislikes (93 meaning units).

Five major codes emerged regarding likes of small group classes: information (56.9%), group dynamics (24.5%), hands on activities (24.5%), staff and instructor (16.7%) and presentation (15.7%). Although, the majority of the participants, 70.5%, indicated there was nothing they disliked about the classes, the two dislikes that emerged were logistics (6.9%) and information (4.9%). Regarding barriers for attending group classes, schedule conflicts (22.7%) and health/personal issues (15.5%) emerged. There were no significant differences between low HL and high HL participant responses among all small group classes' codes.

Related to likes of the IVR calls, five major codes also emerged: motivating (29.3%), convenient (17.2%), content (15.2%), call back feature (13.1%) and length of call (10.1%). When compared with high HL participants, a greater number of low HL participants identified content ($P = 0.05$) and length of calls ($P = 0.03$) as an IVR like. About half (51%) of the respondents reported there was nothing they disliked related to IVR calls. The codes that emerged as dislikes were: content

Table IV. *Codes, definitions, sample meaning units, code counts and differences by health literacy status*

Component and codes			All[a] (*N* = 105) (*n* = 102)		Low HL (*N* = 38) (*n* = 37)		High HL (*N* = 67) (*n* = 65)		
Small group classes									
Liked	**Code definition**	**Sample meaning unit**	***n***	**%**	***n***	**%**	***n***	**%**	***P* value[b]**
Information	Positive statements about the quality of information and/or ideas presented to participants during the class; content	"Good information about the beverage industry/media, and how drink companies influence our decisions."–*High HL, male*	58	56.9	23	62.2	35	53.8	0.53
Group dynamics/cohesion	Positive statements about the group process, such as interacting with others, group discussion, bonding with the group, and meeting new people	"We shared information and perspectives. The group helped each other."– *Low HL, female*	25	24.5	7	18.9	18	27.7	0.35
Hands on activities	Positive comments about specific in-class hands-on activities and visual aids	"I liked the activities like counting sugar packets and pouring out our normal serving of SSB."–*High HL, female*	25	24.5	7	18.9	18	27.7	0.35
Staff and instructor	Positive statements about the staff or the instructor	"The instructor interacted with us and encouraged us."–*Low HL, female*	17	16.7	7	18.9	10	15.4	0.78
Presentation	Positive comments related to lesson presentation, such as the organization of the presentation, and how the material was explained, group discussions	"I enjoyed the visual/interactive presentation - helped me learn better, learned new things and perspectives."–*High HL, female*	16	15.7	5	13.5	11	16.9	0.78
Disliked			***N***	**%**	***n***	**%**	***n***	**%**	***P* value**
Logistics	Negative statements related to specific class logistics (e.g., timing of the classes, the days it was offered) that prevented/hindered class attendance	"Facility was not the best, on campus would be better."–*High HL, male*	7	6.9	1	2.7	6	9.2	0.26
Information	Negative comments about the type of information or ideas presented during class, or expressing a wish for more information	"Would like to talk about sugar in food, not just drinks."–*High HL, female*	5	4.9	0	0.0	5	7.7	0.16
Barriers to class attendance									
Schedule conflict	Participants state they could not attend class because of a conflict with their work or personal schedule	"I was working, they kept switching me from day to night shift."–*Low HL, male*	25		22.7 9		23.7 16		22.2 1.00

(continued)

Table IV. *Continued*

Component and codes			All[a] ($N = 105$)		Low HL ($N = 38$)		High HL ($N = 67$)		
Small group classes			($n = 102$)		($n = 37$)		($n = 65$)		
Liked	**Code definition**	**Sample meaning unit**	***n***	**%**	***n***	**%**	***n***	**%**	***P* value[b]**
Health and personal issues	Participants state they could not attend class because of issues around their own or a family member's health and well being	"I had surgery 2 days before the class and didn't feel well."–*High HL, female*	17	15.5	4	10.5	13	18.1	0.41
IVR Calls			***(n = 99)***		***(n = 36)***		***(n = 63)***		***P* values**
Liked			***n***	**%**	***n***	**%**	***n***	**%**	
Motivating and supportive	Positive comments that refer to the IVR calls as a source of support or motivation for the participant	"It encouraged me to stick to my goals."–*High HL, female*	29	29.3	8	22.2	21	33.3	0.26
Convenient/simple to use	Positive comments that described the IVR system as simple/easy to use	"It (IVR calls) was easy because you knew what it was going to ask, and it was easy to use."–*Low HL, female*	17	17.2	5	13.9	12	19.0	0.59
Content	Positive comments concerning the information transmitted by the IVR system such as strategies to overcome barriers, reminding participants of important information such as what to drink and what not to drink, and other TPB-based messages	"They helped me to understand the class material more."–*Low HL, male*	15	15.2	9	25.0	6	9.5	0.05
	Positive comments concerning being able to call back into the system on their own time	"I could call back into the system if I couldn't answer."–*High HL, female*	13	13.1	3	8.3	10	15.9	0.36
Length of calls	Positive comments about the length of the calls.	"Liked that they were short."–*Low HL, female*	10	10.1	7	19.4	3	4.8	0.03
Disliked			***n***	**%**	***n***	**%**	***n***	**%**	***P* value**
Content	Negative comments concerning the information transmitted by the IVR system such as strategies to overcome barriers, reminding participants of important information such as what to drink and what not to drink, and other TPB-based messages	"Needed something new at the end b/c I knew what is was going to say and it was boring."–*High HL, female*	13	13.1	3	8.3	10	15.9	0.36

(continued)

Table IV. *Continued*

Component and codes			All[a] (*N* = 105) (*n* = 102)		Low HL (*N* = 38) (*n* = 37)		High HL (*N* = 67) (*n* = 65)		
Small group classes									
Liked	**Code definition**	**Sample meaning unit**	***n***	**%**	***n***	**%**	***n***	**%**	***P* value[b]**
Length of calls	Negative comments about the length of the call	"I wanted to hurry through it, it felt like a hindrance b/c it was long."–*High HL, female*	12	12.1	2	5.6	10	15.9	0.20
Automation	Participant references a dislike of automation, computers, and the inability to authentically interact with a computerized system, or states a preference to interact with a human	"Don't like talking to a computer, would have liked a live person."–*Low HL, male*	9	9.1	3	8.3	6	9.5	1.00
Barriers to IVR call completion									
Timing of calls	Participant states the timing of the calls prevented them from taking the call	"Didn't come at good times, like if I was out eating."–*Low HL, female*	24	21.8	11	28.9	13	18.1	0.23
Schedule conflict	Participant references their personal or work schedule as a barrier	"I was at work and couldn't answer the phone."–*Low HL, male*	14	12.7	5	13.2	9	12.5	1.00
Phone issues	Participants state their cell phone was disconnected or some other issue concerning their phone as a barrier	"Ran out of minutes on my phone."–*High HL, female*	10	9.1	3	7.9	7	9.7	1.00
Personal action plan			**(*n* = 102)**		**(*n* = 37)**		**(*n* = 65)**		***P* value**
Liked			***N***	**%**	***n***	**%**	***n***	**%**	
Goal setting	Positive comments about following a course of action, setting goals, adhering to goals, keeping track of goals, or adhering to a schedule	"Filling out goals helped it stick in my mind, it helped me choose coke zero when I had a choice to make."–*High HL, female*	38	37.3	11	29.9	27	41.5	0.29
Consciousness raising/awareness	Positive comments about how the material helped the participant recognize or perceive a fact by saying things like, "showed me, gave me things to think about, made me aware, made me conscious, or realize my feelings, etc	"A drink with sugar doesn't seem bad at the time, but when you add it all up and look at the numbers you're like WOW."–*High HL, female*	25	24.5	4	10.8	21	32.3	0.02
Motivation	Positive comments stating how the PAP was a source of support or motivation for the participant	"It helped me feel better about myself and my determination; helped me be determined."–*Low HL, male*	14	13.7	9	24.3	5	7.7	0.03

(continued)

Table IV. *Continued*

Component and codes			All[a] ($N = 105$)		Low HL ($N = 38$)		High HL ($N = 67$)		
Small group classes			($n = 102$)		($n = 37$)		($n = 65$)		
Liked	**Code definition**	**Sample meaning unit**	***n***	**%**	***n***	**%**	***n***	**%**	***P* value**[b]
Information	Participants identifying new information or ideas presented to them by the personal action plan	"It helped me think of alternatives I wouldn't have thought about before."–*High HL, male*	7	6.9	4	10.8	3	4.6	0.25
Disliked			***n***	**%**	***n***	**%**	***n***	**%**	***P* value**
Format of document	Negative comments about the features of the PAP such as the amount of space to write in, the amount of information presented or the fact is was paper instead of electronic	"They were in my binder and didn't always have my binder to look at."–*High HL, female*	6	5.9	0	0.0	6	9.2	0.08
Behavioral logs			($n = 102$)		($n = 37$)		($n = 65$)		***P* value**
Liked			***n***	**%**	***n***	**%**	***n***	**%**	
Consciousness raising/awareness	Positive comments regarding how the material helped the participant recognize or perceive a fact by saying phrases such as, "showed me, gave me things to think about, made me aware, made me conscious, realize feelings, etc."	"Made me realize how much I was really drinking."–*Low HL, female*	49	48.0	14	37.8	35	53.8	0.15
Tracking progress	Positive comments about following a course of action, setting goals, adhering to goals, keeping track of goals, or adhering to a schedule	"It was nice to look back and see what I drank and what I didn't drink."–*High HL, male*	30	29.4	11	29.	19	29.2	1.00
Accountability	Positive comments about been held accountable, being honest or responsible regarding their actions	"Liked that I was accountable for what I was drinking."–*Low HL, female*	15	14.7	5	13.5	10	15.4	1.00
Motivating	Positive comments stating how the logs were a source of support or motivation for the participant	"I put it on the fridge, and I liked that it was the first thing I saw in the morning, and it reminded me that I couldn't go over that amount."–*High HL, female*	14	13.7	6	16.2	8	12.3	0.77
Disliked			***n***	**%**	***n***	**%**	***n***	**%**	***P* value**

(continued)

Table IV. *Continued*

Component and codes Small group classes Liked	Code definition	Sample meaning unit	All[a] ($N = 105$) ($n = 102$)		Low HL ($N = 38$) ($n = 37$)		High HL ($N = 67$) ($n = 65$)		*P* value[b]
			n	%	*n*	%	*n*	%	
Inconvenient	Negative comments about the time it took to log behaviors or the need to fill them out daily	"It was a pain to keep track of, didn't want to carry them around and taking the time to write beverages down."–*High HL, male*	24	23.5	5	13.5	19	29.2	0.09
Format of document	Negative comments about the features of the PAP such as the amount of space to write in, the amount of information presented or the fact is was paper instead of electronic	"Maybe add images to help with portion size."–*High HL, female*	9	8.8	3	8.1	6	9.2	1.00
Numeracy issues	Negative comments relating to completing the calculations necessary to update their logs/diaries	"At first it was hard because I couldn't remember how to figure out the averages; I figured it out later."–*Low HL, female*	8	7.8	6	16.2	2	3.1	0.03

[a]Differential responses due to missing data.
[b]*P* value for either $\chi 2$ or Fisher's exact test to determine if differences exist based on HL status.

(13.1%), length of calls (12.1%) and automation (9.1%). Codes that emerged as barriers for completing the IVR calls were: timing of calls (21.8%), schedule conflicts (12.7%) and phone issues (9.1%). For both low HL and high HL groups, the timing of the calls was most frequently mentioned, 28.9 and 18.1% respectively. No significant differences were found between the groups for IVR dislikes and barriers.

Four major codes emerged regarding likes of the personal action plans: goal setting (37.3%), consciousness raising/awareness (24.4%), motivation (13.7%) and information (6.9%). The low HL groups were more likely to mention motivation as a like of the personal action plans ($P = 0.03$), while high HL participants reported more likes for the consciousness raising aspect of the personal action ($P = 0.02$). Of those responding to likes about the personal action plans, most (69%) said there was nothing they disliked about the PAPs. The only theme that emerged as a dislike of the PAP was the format of the document (5.9%) and only high HL participants mentioned it.

Lastly, four major codes emerged regarding likes of the self-monitoring logs: consciousness raising/awareness (48.0%), tracking progress (29.4%), accountability (14.7%) and motivating (13.7%). No significant group differences were found for liked codes. The majority of the respondents (57%) reported there was nothing they disliked about the drink logs. Three major codes emerged as a dislike in this area: inconvenient (23.5%), format of document (8.8%) and numeracy issues (7.8%). Low HL participants had more responses identifying numeracy issues as a dislike of the self-monitoring logs when compared with high HL participants ($P = 0.025$).

Discussion

This study supports the hypothesis that interventions designed using universal HL precautions are acceptable and beneficial to those with low and high HL. The quantitative assessment revealed both low HL and high HL participants were satisfied with all the components of the SIP*smart*ER intervention. These findings are consistent with past studies reporting high participant satisfaction ratings for health interventions [30, 49–51]; however, to our knowledge, this is the first study to examine participant perceptions of a program based on universal HL precautions by HL status. Qualitative assessment of participant excerpts corroborated the quantitative findings and provided further support that participants considered the program to be an overall positive experience. Following recommendations to use qualitative methods to understand outcomes [28], this summative evaluation aligns with the SSB reduction findings from the trial—in addition to having equitable reductions in SSB consumption, both low and high HL participants were satisfied with the program [25].

Quantitative results revealed the small group classes were the highest rated and were identified as the most motivating component of the intervention by both the low HL and high HL groups—and low HL participants trended toward higher attendance. This finding may be explained by the dynamic nature of the small group classes to support participants of all HL levels and may be especially engaging for participants with low HL. Activities in line with HL verbal communication strategies such as hands-on demonstrations, group discussion and media analysis of SSB commercials from popular culture were used to engage participants [21, 22, 52]. This interactive pedagogy is likely to have led to an enjoyable and motivating learning experience as supported by qualitative extracts. Small-group classes also facilitated participant empowerment as it provided the opportunity for participants to make action plans; and discuss questions, accomplishments and setbacks in a supportive environment [22].

Quantitative satisfaction ratings indicated that the IVR calls were also ranked positively (8.1/10). However, the data suggest that low HL participants trend toward higher satisfaction ratings for the IVR calls when compared with high HL participants (7.8 versus 8.6). Participant extracts confirmed a significantly higher number of low HL participants liked the content transmitted by the IVR system and the length of the IVR calls when compared with the high

HL group. Past research has also found that low HL participants were more likely to prefer telephone-based self-management support when compared with higher literacy participants [53]. Furthermore, the content of the IVR calls reinforces information presented in the small group classes. Reviewing and repeating information is a recommended strategy for assisting patients with low literacy skills to comprehend the information and transfer it into long-term memory [54]. Reviewing class content via the IVR calls may be a benefit to low HL participants and is in line with HL universal precautions guidelines to use different modalities to communicate health information [22]. Despite the differences in IVR satisfaction ratings and perceptions, there were no differences in IVR completion rates between low HL and high HL participants. Future studies may explore the preferences of high HL participants for self-management support.

Qualitative findings revealed low HL participants commented more frequently about liking the motivational aspect of the personal action plans and the high HL group commented more about how completing the personal action plans made them more aware of their behavior. Based on goal setting research, the purpose of the SIP*smart*ER personal action plan was to assist participants in selecting goals, thinking though action plans and barriers, and providing participants with strategies to overcome the barriers [41, 55, 56]. Participant extracts from both groups confirm that the personal action plans are being received as intended and we do not foresee the differences in likes between the two groups to have an impact on the component's effectiveness or acceptability. Participants completing a personal action plan during class are consistent with the HL universal precautions recommendation to support patients' efforts to improve their health through action planning [22].

Quantitative findings showed the self-monitoring logs were well received by both groups with an overall score of 8.7. A large percentage (48%) of the total sample commented positively about how the logs helped them become aware of their sugary beverage intake. These findings support the research behind self-monitoring as a strategy to increase a person's awareness of a target behavior [57]. However, of all the dislike codes across all components, the inconvenience of the behavioral logs received the largest percentage of negative responses by both groups (23.5%). Participants reported it took too long to log their behaviors or that they disliked having to do it on a daily basis. A larger percentage of low HL participants reported a negative perception of the mathematical calculations necessary to track their daily SSB intake. Collectively these findings are consistent with past findings that suggest both the importance of self-monitoring and the burden of it [57]. Furthermore, these findings illuminate an area of the intervention that could be improved upon. Future studies may explore the feasibility of using a digital diary application for smart phones within a rural population to reduce the administrative and numeracy burden of behavioral logs.

Limitations

This study has a few limitations. First, the open-ended questions were hand-recorded not audio-recorded which may have led to a loss of some of the richness of qualitative responses and to the introduction of a middle layer of interpretation of the data by the recorder. However, we sought to minimize researcher interpretation and bias during the coding process by having well defined definitions within the codebook and using a team of researchers to independently code the data and compare responses. Second, the current sample consists of only participants who attended the 6-month summative evaluation (68% of total participants) who may have had a more positive outlook on the intervention components than those who did not attend. However, only age differed significantly between those that participated in the summative evaluation and those that did not, suggesting a representative sample of completers. Lastly, the results of Table IV should be interpreted with caution due to the relatively small sample size, the large number of comparisons made, and the potential for interpretation bias inherent in any coding scheme.

Conclusions

Although several conceptual resources illustrate the importance of using an HL universal precautions approach, this is the first known study to apply a mixed-methods' approach to empirically examine differences in perceptions among low and high HL participants enrolled in a multicomponent behavioral and HL intervention. When designing interventions for low socioeconomic and rural regions, efforts to improve patient understanding of health information and reduce the complexity of the health message can provide similar benefits to low and high HL participants. We found both low HL and high HL participants were satisfied with the SIP*smart*ER intervention and perceived its components positively. Qualitative data revealed low and high HL participants identified different aspects of the IVR system and personal action plans they liked, however both the qualitative and quantitative data support that both groups found each component acceptable. Furthermore, we discovered additional support for calculating mathematical averages for the self-monitoring logs might be needed for low HL participants. Overall, results of the summative evaluation can guide future program improvements of interventions aimed at improving health behaviors in rural populations.

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Conflict of interest statement

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