Exploring health disparities in rural regions of Virginia: The impact of health literacy and social capital

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Abstract

In the United States, low-income, ethnic/racial minorities and rural populations are at increased risk for poorer health outcomes compared to higher income, non-minorities, and urban populations. Two key determinants that influence rural health disparities are health literacy and social capital. Health literacy can be described as an individual-level factor and defined as, "the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions." Social capital is a concept that accounts for the role of collective social functioning and has been defined as, "the features of social structures—such as levels of interpersonal trust and norms of reciprocity and mutual aid—which act as resources for individuals to facilitate collective action." The overarching goal of this research is to explore factors influencing health disparities, including health literacy, social capital in two rural regions of Virginia.

The first study is embedded in Talking Health, a larger 2-arm RCT targeting adults in rural Southwest Virginia and examined participants' perceptions of and satisfaction with components of a behavioral intervention designed using health literacy concepts to decrease sugary beverage intake in rural, low-health literacy participants. The second study is also embedded in the Talking Health trial, yet focused on the maintenance of behavior 12-months after the intervention concluded. Guided by RE-AIM, this study examined the reach, effectiveness and implementation of a 12-month randomized extended care intervention aimed at enhancing long-term maintenance of behavior change and study retention when compared to a control condition. The last study is part of a larger telephone surveillance survey conducted in the Dan River Region located in south central Virginia. This study described current levels of social capital in the Dan River Region and examined the influence of social capital on FV consumption, physical activity, sugary beverage intake and BMI on a sample of rural and urban adults.

Dedication

In memory of my Maw Maw,
who served as a constant source of motivation to me on this journey.

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Attributions

Manuscript 1: **The impact of health literacy on rural adults' satisfaction with a multi-component intervention to improve sugar-sweetened beverage behaviors**

Kathleen Porter is a post-doctoral associate in the Department of Human Nutrition, Foods and Exercise at Virginia Tech. She assisted with coding qualitative data, conceptualization of data management and editing the manuscript.

Jennie Hill is an assistant professor in the Department of Human Nutrition, Foods and Exercise at Virginia Tech. She assisted with editing the manuscript.

Yvonnes Chen is an associate professor in the William Allen White School of Journalism and Mass Communications at the University of Kansas. She assisted with editing the manuscript.

Paul Estabrooks is a professor in the Department of Human Nutrition, Foods and Exercise at Virginia Tech. He assisted with editing the manuscript.

Jamie M. Zoellner is an associate professor in the Department of Human Nutrition, Foods and Exercise at Virginia Tech. She was the principle investigator that received funding for this project and assisted in the conceptualization of this manuscript, developed the protocol for data collection, guided the data analysis and assisted in editing the manuscript.

Manuscript 2: The reach, implementation and effects of a telephone-based maintenance intervention for reducing sugary beverage intake among rural, low-health literate adults

Wen You is an associate professor in the Department of Agriculture and Applied Economics at Virginia Tech. She assisted in the quantitative data analysis.

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Manuscript 3: Exploring the relationship between social capital and obesity-related health behaviors in a health disparate region

Yvonnes Chen is an associate professor in the William Allen White School of Journalism and Mass Communications at the University of Kansas. She assisted with editing the manuscript.

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Chapter 1

Introduction

One of the overarching goals of Healthy People 2020 is to achieve health equity, eliminate disparities, and improve the health of all groups. In the United States, low-income, ethnic/racial minorities and rural populations are at increased risk for poorer health outcomes compared to higher income, non-minorities, and urban populations. For example, compared to urban adults, rural adults were more likely to be obese, less likely to meet fruit and vegetable recommendations, were less likely to meet CDC recommendations for moderate or vigorous physical activity and reported higher rates of sugar sweetened beverage (SSB) consumption. Further, those who live in rural regions were more likely to report having diabetes and experience greater mortality due to cardiovascular disease, coronary heart disease, hypertension, and stroke as compared to their urban counterparts. Rural areas are often understudied because these populations are dispersed and hard-to-reach. Some of the determinants of rural health disparities are geographic isolation, lower socioeconomic and educational status, lower-rates of health insurance, limited job opportunities and lack of access to healthy foods. In the state of Virginia, the southwest and south central regions represent two rural health disparate areas.

Two additional factors potentially connected to rural health disparities are health literacy and social capital. Health literacy is an individual level factor that is currently defined as, "the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions." Social capital is a concept that accounts for the role of collective social functioning and has been defined as, "the features of social structures—such as levels of interpersonal trust and norms of reciprocity and mutual aid—which act as resources for individuals to facilitate collective action.

These distinct, but kindred areas of research interest intersect in this dissertation and are combined in the following three studies with individuals from rural, health disparate populations. The intention of the literature review is to provide an overview of: the definition of health equity and obesity related health disparities based on race/ethnicity, socioeconomic status, geographical location; two health disparate regions in Virginia; the ecological model; trends in obesity and

obesity related health behaviors; and two potential factors contributing to health disparities, health literacy and social capital.

Chapter 2 and 3 of this dissertation is embedded in a larger health literacy trial, Talking Health, which is a pragmatic randomized controlled trial to determine the effects of a health behavior intervention on reducing SSB consumption (SIP*smart*ER) as compared to a matched contact control group targeting physical activity behaviors (MoveMore). Chapter 4 is a secondary data analysis of a larger telephone surveillance survey conducted in the Dan River Region located of south central Virginia to collect data on behavioral (e.g. physical activity, nutrition) and social factors (e.g. social capital) related to obesity. The overall objective of this research is to explore health literacy and social capital in two rural health disparate regions in Virginia.

The aim of the first study was to determine if health literacy status influenced participants' satisfaction and perceptions of the components of SIP*smart*ER (small group classes, interactive-voice response (IVR) calls, personal action plans and self-monitoring logs). The quantitative findings showed participant satisfaction with each intervention component was high and similar across both health literacy groups. The majority of qualitative responses were positive and code counts were comparable between literacy groups with a few exceptions. The study was completed in 2015 and is under review in *Health Education Research.*

The purpose of the second study was to report the maintenance of primary outcomes (i.e., 6 to 18-month assessments and 0 to 18 month assessments) across conditions and to compare the outcomes of the maintenance intervention groups to the control group. A secondary aim was to explore factors related to the reach and implementation of the maintenance phase. It was found that SIPsmartER participants consumed significantly less SSB at 18 months than reported at the start of the intervention. There were no significant differences in outcomes between the SIPsmartER maintenance groups.

Last, the aim of the third study was to describe levels of social capital in the Dan River Region and to explore the relationship between social capital and participant demographics, obesity related risk behaviors (e.g. SSB intake, fruit and vegetable intake, physical activity behaviors) and BMI. This study found support for the hypothesis that social capital is higher in rural areas, but did not confirm past studies linking higher social capital to healthy behaviors and reduced BMI. Furthermore, this study found a 1-point increase in social capital predicted a 44

kcal decrease in sugary beverage consumption.

Chapter 2

Literature Review

Health Equity and Health Disparities

In the United States, low-income, ethnic/racial minorities and rural populations are at increased risk for poorer health outcomes compared to higher income, non-minorities, and urban populations. To address the health divide between groups in the U.S., one of the overarching goals of Healthy People 2020 is to achieve health equity, eliminate disparities, and improve the health of all groups [1]. Health equity is rooted in universal human rights and values. Article 1 of the United Nation's Universal Declaration of Human Rights states, "All human beings are born free and equal in dignity and rights" [2]. Since 1948, *The World Health Organization's* (WHO) Constitution proclaims, "the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being"[3]. In line with the WHO's constitution, *Healthy People 2020* defines *health equity* as the "attainment of the highest level of health for all people" [4]. Every country in the world is now a part of a least one human rights treaties that addresses health-related rights [3]. Achieving health equity would mean low-income, ethnic/racial minorities and rural populations would share similar health outcomes as higher income, non-minorities and urban dwellers.

However, in order to achieve health equity, health disparities must first be eliminated. Over the past two decades there has been confusion and debate around the definition of disparities. Taken at face value, health disparities and inequalities simply mean differences in health between two groups with no regard to social justice. For example, while elderly suffer worst health than young adults, this health difference is not considered a health disparity [5]. In 1990, Margaret Whitehead defined health inequalities as "differences in health that are not only unnecessary and avoidable, but in addition are considered unjust and unfair" [6]. Since 1990, the World Health Organization, the International Society for Equity in Health and several notable researchers such as Braveman, Gruskin, Graham and Murray have offered up varying definitions of health disparities, inequalities and equity to explicitly include social justice in health [7]. Currently, *Healthy People 2020* define a *health disparity* as

> "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion" [8].

The current definition defines a disparity as a difference that is a result of unfair disadvantages and obstacles, however, what constitutes an obstacle or disadvantage is not explicitly defined leaving room for interpretation. Health disparities are often conceptualized by race, but broader conceptualizations include gender, poverty level, sexual orientation, disability status and geographic location. Unfortunately, significant disparities remain in the burden of illness and death experienced by ethnic/racial minorities, low-socioeconomic populations and underserved groups such as disadvantaged rural Whites. Nationally, health disparities are well documented by race, socioeconomic status and geography.

Racial/Ethnic Disparities

Compared to non-Hispanic whites, ethnic/racial minorities are at increased risk for obesity and related chronic conditions such as heart disease, stroke, type 2 diabetes and certain types of cancers. For example, non-Hispanic blacks have the highest age-adjusted rates of obesity (47.8%), followed by Hispanics (42.5%), non-Hispanic whites (32.6%), and non-Hispanic Asians (10.8%) [9]. African American women have the highest rates of obesity (57.6%) compared to other groups in the U.S [10]. In 2010, compared to non-Hispanic Whites, African Americans were 30 percent more likely to die from heart disease, twice as likely to have a stroke, 2.2 times more likely to die from diabetes, and have the highest mortality rate of any racial group for all cancers combined [11, 12].

Socioeconomic Disparities

An impressive body of literature supports a strong association between health and socioeconomic status (SES) [13-15]. Due to factors such as limited education and low income, people with low SES have higher rates of morbidity and mortality than those with higher SES [14, 16]. SES involves access to resources such as money, knowledge, power, social support and

social networks that can be used to avoid risk of diseases [14]. Racial/Ethnic and geographic disparities are often reflected in SES because minorities and rural residents typically have lower SES than Whites and urban residents [17].

The relationship between obesity and low SES is similar at all income levels. The exception is among non-Hispanic black and Mexican American men with higher income who are more likely to be obese than their low-income male counterparts. For example, 44.5% of non-Hispanic and Mexican American men with income at or above 350% poverty are obese compared to 28.5% with an income below 130% of the poverty level. However for women, those with higher income are less likely to be obese than low-income women. Among women with household incomes at or above 350% poverty, 29.9% are obese as compared to 42.0% of those with income below 130% of the poverty level. Gradient trends are similar for non-Hispanic white, non-Hispanic black, and Mexican-American women; however the trend was only statistically significant for White women [18].

Geographical Disparities

Rural populations experience disparities in both risk factors and health outcomes. For example, compared to urban adults, rural adults were more likely to be obese (27.4% versus 23.9%), and were less likely to meet CDC recommendations for moderate or vigorous physical activity (44.0% versus 45.4%) [19]. Besides less PA, behavioral risk factors such as higher rates of tobacco use and poorer diet quality are associated with the increase in obesity in rural areas [20]. Further, those who live in rural regions were more likely to report having diabetes (9.6% versus 8.4%) and experience greater mortality due to cardiovascular disease, coronary heart disease, hypertension, and stroke as compared to their urban counterparts [21-23]. Some of the determinants of rural health disparities are geographic isolation, lower socioeconomic and educational status, lower rates of health insurance and limited job opportunities. Additionally, rural residents are older, are more likely to report fair or poor health status and have fewer physicians available for care [19, 24].

Health Disparate Regions of Virginia

Healthy disparities can also be documented on a smaller scale, using state-level data. Within the state of Virginia, Southwest Virginians and South Central Virginians experience significant health disparities.

Southwestern Virginia

The rural, Appalachian region of southwest Virginia is a federally designated medically underserved area. According to US Census Bureau data, this region includes 95% Caucasian, 58% with ≤ high school education and 18% living below the federal poverty level [25]. When compared to state and national averages (27.4% and 27.6%), the region has high rates of obesity (34.6%) [26]. In one cross-sectional study of southwest Virginia residents, 67% were categorized as overweight or obese [27]. Compared to the rest of the state, obesity-related chronic diseases like heart disease, hypertension and diabetes are higher in the southwest region of Virginia [28]. To help understand and address these disparities, in 2011 researchers from Virginia Tech initiated Talking Health, a type 1 effectiveness-implementation hybrid randomized-controlled trial targeting sugar sweetened beverage (SSB) and physical activity behaviors for adults in southwest Virginia.

South Central Virginia

Another health disparate region in Virginia is The Dan River Region. It is located in south-central Virginia and north-central North Carolina and includes the city of Danville; Pittsylvania county in Virginia; and Caswell County in North Carolina. The city of Danville, Pittsylvania county and Caswell county, respectively, are characterized by high unemployment: 9.5%, 6.6% and 9.6%; low educational attainment, residents with 4-years of higher education: 16.3%, 16.3% and 9.7%; high poverty rates: 26.5%, 14.7% and 20.5%; and high rates of obesity: 30.0%, 29.0% and 30.4 [29]. Combined, these risk factors contribute to the vulnerability of this health disparate region. In 2009, the Dan River Partnership for Health Communities (DRPHC) formed between key stakeholders in the area and academic researchers from Virginia Tech to address the obesity problem in the area from an ecological perspective [30].

Ecological Model

The determinants of health disparities in the US are still poorly understood. Complex relationships between an individual and their environment influence health behaviors and outcomes. One way to better understand health disparities is by taking an ecological perspective. Ecological models recognize both individual and social factors including the environment and public policy as important to shaping behavior and health outcomes. Such models are based on two concepts: first ecological models acknowledge individual behaviors have multiple levels of influence, and second individual behavior is both influenced by and influences the social environment [31-33].

The multiple levels of influence include: intrapersonal (biological, psychological), interpersonal (social, cultural), organizational, community, and policy [32, 33]. Intrapersonal factors include the characteristics of the individual such as knowledge, attitudes, skills, or intentions to comply with behavioral norms. Many of the behavior change models used in health promotion target changing the individual [32]. Interpersonal factors including relationships with family members, friends, neighbors, and contacts at work are important sources of influence in the health of individuals. Social support gained from interpersonal relationships is an important mediator of life stress and an important part of overall well-being [34]. Organizational factors include day care settings, schools and universities, and work settings, whereas community factors include informal social networks, churches, voluntary associations and neighborhoods. Lastly, policy factors refer to regulatory policies, procedures and law that protect the health of the community [33].

The second concept of the ecological models is reciprocal causation. Reciprocal causation recognizes that each level of influence can shape the behavior of people and be shaped by the behavior of people. Ecological models have been used in guiding the development of specific health behavior change interventions such as tobacco control, and broad areas such as the public health agenda of Healthy People 2020 [35]. Interventions and health promotion programs based on an ecological perspective are more likely to be and have been effective [32].

The current obesity epidemic reflects a complex interaction between social forces and biological adaptations. Individual behaviors such as increased SSB consumption, decreased fruit and vegetable intake and physical inactivity do not occur in isolation; powerful social and environmental factors influence and are influenced by individual behavior [36]. Efforts are

currently focused on understanding and combating the obesity epidemic through multi-level ecological models. Positive change must come from all parts of society including policy approaches to improve the food and physical activity environment, worksite and school-based programs to promote healthy eating and physical activity, and individual and family-based strategies to increase knowledge and self-efficacy regarding healthy behaviors. Multi-level efforts to make healthy food and activity choices accessible to all are needed [37, 38].

Trends in Health Behaviors and Outcomes

Obesity

It is estimated that 33% of adults in the United States are overweight, 35.7% are obese and 6.3% are extremely obese based on the results of the 2009-2010 National Health and Nutrition Examination Survey (NHANES). Obesity in the United States increased from 13% in 1960-1962 to 36% in 2009-2010, while rates of overweight remained stable [39]. Body Mass Index (BMI) is a number calculated by dividing weight in kilograms by height in meters squared and is used to classify overweight (BMI 25.0-29.9), obesity (BMI greater than or equal to 30.0) and extreme obesity (BMI greater than or equal to 40.0) [40]. Research shows that as weight categorized as overweight and obese increase the risk for many conditions including coronary heart disease, type 2 diabetes, certain types of cancers, hypertension, dyslipidemia, stroke, liver and gallbladder disease, sleep apnea and respiratory issues, osteoarthritis, and gynecological problems [41]. In addition to the significant health impact of obesity, the medical care costs of obesity are astounding. The estimated per capita medical spending for the obese is approximately 42% higher than for normal weight. In 2008, it was estimated that the yearly cost for obesity could total $147 billion [42].

Overweight and obesity result from an energy imbalance that involves an excess of caloric intake and a decrease in physical activity. The *2010 Dietary Guidelines for Americans* states “to curb the obesity epidemic and improve their health, Americans must decrease the calories they consume and increase the calories they expend through physical activity”[43]. However multiple influences as seen through the ecological model such as genetics, metabolism, behavior, environment, culture and socioeconomic status play a role in obesity making it a complex health issue to address. Behavior and environment are the greatest areas to target for

prevention and treatment of obesity [44]. Reducing the proportion of adults who are obese is both a Healthy People 2020 objective (2020 target 30.5%) and a leading health indicator of a national high priority health issue [45]. Among the key target areas to prevent obesity and other chronic diseases, the CDC's Division of Nutrition, Physical Activity, and Obesity recommends increasing physical activity, increasing fruit and vegetable intake; and decreasing consumption of sugary drinks.

Physical Activity

According to the *2008 Physical Activity Guidelines for Americans*, the term "physical activity," refers to bodily movement that enhances health [46]. It is recommended that adults do at least 150 minutes a week of moderate-intensity or 75 minutes a week of vigorous-intensity aerobic physical activity to receive substantial health benefit. Muscle strengthening activities that involve all major muscle groups should be done on 2 or more days a week to receive additional health benefits. There is strong evidence to suggest that participating in regular physical activity can lower the risk of: coronary heart disease, stroke, high blood pressure, adverse blood lipid profile, type 2 diabetes, metabolic syndrome, colon and breast cancer [46].

However, according to 2009 Behavioral Risk Factor Surveillance System (BRFSS) data, only 51.0% of adults engaged in recommended physical activity [47]. Lower-income, rural residents and minority groups such as non-Hispanic back adults and Hispanic adults are less likely to meet the 2008 Physical Activity Guidelines [48, 49]. More non-Hispanic white adults (22.8%) meet the 2008 Physical Activity Guidelines for aerobic and muscle-strengthening activity than non-Hispanic black adults (17.3%) and Hispanic adults (14.4%) . Within rural populations, factors associated with an inactive lifestyle included female gender, less than a high school education, poor health and currently smoking [49].

Fruit and Vegetable Intake

The *2010 Dietary Guidelines for Americans* recommends individuals increase their fruit and vegetable (F&V) intake. This recommendation is based on three reasons. First, F&Vs contain important nutrients such as folate, magnesium, potassium, dietary fiber, and vitamins A, C and K. Secondly, moderate evidence suggests that an intake of 2.5 cups of F&V per day lowers the risk of cardiovascular disease and protects against certain types of cancers. Lastly,

moderate evidence suggests that increased intake of F&V may protect against weight gain in adults [43]. Increasing fruit and vegetable intake are both Healthy People 2020 objectives, and increasing vegetable consumption is a leading health indicator of a national high priority health issue. The 2020 target for vegetables is 1.1 cups per 1,000 calories and 0.9 cup per 1,000 calories for fruits for the population aged 2 years and older [45]. The current recommendations are based on age, sex, and level of physical activity. The average recommendation for adults aged 18 and older is 1.5-2 cups of fruit and 2.5-3 cups of vegetables per day. Healthy People 2020 objectives base F/V recommendations on caloric requirement; however, data from the Behavioral Risk Factor Surveillance System (BRFSS) report fruit and vegetable intake by citing the number of times per day the foods were eaten. Thus the difference in measurement represents a limitation to measuring progress made toward our Healthy People 2020 objective to increase fruit and vegetable intake.

In the U.S. the intake of vegetables and fruits is low. The *State Indicator Report on Fruits and Vegetables, 2013* found 37.7% of US adults consume fruits less than one time daily and 22.6 % consume vegetables less than one time daily. The median average intake of fruit was 1.1 times per day and vegetables were 1.6 times per day [50]. Beyond reporting on individual-level behavior, *The State Indicator Report on Fruits and Vegetables, 2013*, presents data on policy and environmental indicators as well. Currently 69.5% of US census tracts have at least one healthier food retailer within ½ mile of tract boundary, but that leaves over 30% of US census tracts with low access. Several studies have shown associations between access to supermarkets and healthier food intake [51, 52].

Based on 2009, BRFSS data, 33.7% non-Hispanic Black, 37.2% Hispanic, and 31.1% non-Hispanic White adults aged 18 and older consumed fruit two or more times per day. With regard to fruit intake, more women consumed fruit (36.1%) compared to men (28.7%) and the largest majority of adults who consumed fruit two or more times/day were aged 65 and older. Vegetable intake varied more between groups with 21.9% non-Hispanic Black, 19.7% Hispanic, and 27.7% non-Hispanic White adults aged 18 and older consuming vegetables three or more times per day. In addition to racial/ethnic disparities with regard to vegetable consumption, there are also notable disparities based on income and education. Only 22.0% of adults with an annual income of less than $25,000 reported consuming vegetables three or more times per day, compared to 29.4% with an income greater than $50,000. The same difference holds true for

education, with 19.5% with less than high school diploma reporting eating vegetables three or more times per day compared to 32.2% of college graduates [53].

Sugar-Sweetened Beverages

In 2009-2010, sugar sweetened beverages (SSB) contributed 7% of daily energy intake among adults [54]. SSB's include soda, fruit drinks, sports and energy drinks, sweetened coffee and tea and other sweetened beverages. Between 1977 and 2001, caloric intake from SSBs increased by 135% [55]. Currently SSBs are the main source (40%) of added sugar in the US diet [56]. Added sugar increases caloric intake and promotes obesity without providing the nutrients that reduce the risk of cancer. Furthermore, beverage calories in particular do not suppress the intake of other calories and can result in a higher risk of obesity [57]. Of particular importance, there is strong scientific data associating SSBs with chronic health issues such as metabolic syndrome, type 2 diabetes, cardio-metabolic disease and non-alcoholic fatty liver disease in adults [56-60]. Due to relationships with obesity and increased risk of chronic disease, the 2010 Dietary Guidelines for Americans, the American Cancer Society and the American Heart Association all promote a reduction in SSBs and added sugar intake from the US diet [61-63]. Reducing consumption of calories from added sugars is a Healthy People 2020 objective with the 2020 target set at 10.8% mean percent of total daily calorie intake from added sugars for those aged 2 years and older [45]. According to 2005-2010 NHANES data, approximately 13% of adult's total caloric intakes came from added sugars. Non-Hispanic Black females (15.2%), and females with a household income below 130% poverty (15.7%) consumed the highest percentages of calories from added sugars [64].

The highest rates of SSB consumption were found in rural, low income and less educated populations and the odds of heavy consumption (≥ 500 kcals/day) are the highest in low SES populations [65, 66]. At the same time, low SES populations report higher rates of overweight and obesity, and obesity related conditions making them especially susceptible to the health risks of SSBs [67]. In one cross-sectional study of southwest Virginia residents, SSB intake averaged 457 kcals/day of SSB compared to a national average of 151 kcals/day. Of that sample, 67% were categorized as overweight or obese. [27, 54]. Lastly, a study by Zoellner et al. (2011) found a relationship between health literacy and SSB consumption. Within a cross-sectional sample of Lower Mississippi Delta residents, health literacy status predicted SSB consumption. Every one-

point increase in health literacy scores was associated with 34/kcal/day lower SSB intake. This is the first study to establish a relationship between health literacy and SSB consumption.

Potential Factors Contributing to Health Disparities

The current Healthy People 2020 definition of a disparity is a difference that is a result of unfair disadvantages and obstacles based on social economic and/or environmental disadvantages. However what constitutes an obstacle or disadvantage is not explicitly defined leaving room for interpretation. In addition to disadvantages related to racial or ethnic group inclusion; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; and geographic location-- health literacy and social capital are two other factors could potentially contribute to health disparities.

Health Literacy

Health literacy (HL) is recognized as a national priority area by both the American Dietetic Association and Health People 2020 [68, 69]. Ratzan and Parker defined health literacy as the degree to which individuals have the capacity to obtain, process, and understand health information and services needed to make appropriate health decisions [70-72]; this definition was later adopted by Healthy People 2010 and the Institute of Medicine [70, 72]. At the individual level, health literacy represents a number of individual skills needed to navigate the health care system and to make appropriate health care decisions. These skills include oral literacy (speak and listen effectively), print literacy (read and write prose) and numeracy (use of quantitative information) [70, 73].

The most inclusive examination of adult literacy was conducted by the US Department of Education through a survey called, "National Assessment of Adult Literacy," (NAAL). The survey included items measuring health literacy directly. Out of four categories for health literacy, 36% of respondents scored in the lowest two: "basic" and "below basic." The NAAL demonstrated higher prevalence of poor health literacy among the elderly with 59% of adults age 65 and older scoring in the lowest two categories. Educational attainment also presented a strong association with health literacy. Out of the respondents who had not completed high school, 76% scored in the lowest two categories. Lastly, race and ethnicity were also associated with higher rates of low health literacy. In the lowest category, "below basic," only 9% of respondents were

white compared to 24% black, 41% Hispanic, 13% Asian, and 25% American Indian and Native Alaskan. Because of the disparities in literacy rates among different groups, health literacy could contribute to disparities in health outcomes.

Approximately 80 million adults are thought to have limited health literacy (LHL); and limited health literacy is associated with numerous poor health outcomes. A seminal 2004 systematic review of the literature identified 44 studies that addressed the relationship between literacy and health outcomes [74]. The study sought to answer the follow four key questions: 1. Are literacy skills related to the use of health care services? 2. Are literacy skills related to health outcomes? 3. Are literacy skills related to the cost of health care? 4. Are literacy skills related to disparities in health outcomes according to race, ethnicity, culture or age? Dewalt and colleagues found evidence to support a relationship between HL and diabetes, and HIV infection control. The authors found good quality evidence supporting a positive and significant relationship between reading ability and participant's knowledge of health outcomes or health services. For example, studies showed participants with LHL had less knowledge of mammography, cervical cancer screening, HIV medication, smoking, asthmas, hypertension, diabetes, and heart health. Included in the systematic review was a study by Scott and colleagues that found evidence to support a relationship between HL and screening and prevention. LHL increased the odds of ever having an influenza vaccine, pneumococcal vaccine, mammography, and a pap smear [75]. Two studies by Baker et al. found LHL patients were at higher risk for hospitalization compared to patients with adequate literacy [76]. Furthermore, the systematic review found three good quality studies to support the relationship between health literacy and a global health status measure; LHL increased the odds of reporting a fair or poor health status. On the other hand, Dewalt et al. found insufficient evidence to support a relationship between HL and the use of services such as physician visits. Lastly the systematic review did not find a relationship between HL and costs of health care and nor significant evidence supporting the role of literacy in mediating disparities in health outcomes by race, ethnicity, culture or age. This could be partly due to the fact the outcomes assessed and analytic methods differed across studies, and at times covariates such as age, education, socioeconomic status, health care access, or experience with the health care setting weakened the statistical relationship.

In 2011, RIT International- University of North Carolina Evidence-based Practice Center (RTI-UNC EPC) updated their 2004 systematic review of health literacy outcomes and included

interventions as well [77]. The study sought to answer the follow two key questions: 1. Are health literacy skills related to a. use of health services, b. health outcomes, c. costs of health care, and d. disparities in health outcomes or health care service use according to race, ethnicity, culture or age and 2. For individuals with low health literacy skills, what are effective interventions to a. improve use of health care services, b. improve health outcomes, c. affect the costs of health care, and d. improve health outcomes and/or health care service use among different racial, ethnic, cultural, or age groups. Question number 1 embodies the same questions that guided the 2004 systematic review. New to the 2011 review was the inclusion of studies that evaluated interventions, numeracy skills and that directly measured HL instead of relying on proxy measures were reviewed.

With regard to key question number 1a: Are health literacy skills related to the use of health services, Berkman et al. (2011) found moderate evidence supporting an association between LHL and increased hospitalization, greater emergency care use, less use of mammography, less screening of cervical cancer, lower probability of receipt of influenza vaccine and less access to insurance. The effects of health literacy on health outcomes varied. Key question 1b found strong evidence to support a higher risk of mortality for seniors with LHL. Moderate evidence supported a relationship between LHL and poorer ability to take medications properly, poorer ability to read labels and health messages, and poorer overall health status among seniors. There was insufficient evidence to support key question 1c examining differences in health literacy level and costs of health care. Lastly, the systematic review found health literacy skills mediated or partially explained disparities between black and white participants in the following outcomes: a health condition that keeps respondents from working or having a long-term illness, self-reported health status, receipt of influenza vaccine, physical and mental health related quality of life, self-reported health among seniors, prostate-specific antigen levels among newly diagnosed prostate cancer patients, non-adherence to HIV medications, children's lack of health insurance, and misinterpretation of medication labels.

Berkman et al. (2011) also reported on *interventions* to mitigate the effects of low health literacy on a. use of health services, b. health outcomes, c. costs of health care, and d. disparities in health outcomes or health care service use according to race, ethnicity, culture or age. The interventions designed to mitigate the impact of LHL on the use of services mainly focused on the presentation of information. The strength of evidence relating to a specific intervention

design is low mainly due to the broad differences across interventions. Specific design features that resulted in improvements in comprehension for LHL populations were: presenting essential information by itself, presenting essential information first, presenting information so that the higher indicates better quality, using the same denominators to present baseline risk and treatment benefit information, adding icon arrays to numerical presentations of treatment benefits, and adding video to verbal narratives. However, the review found moderate evidence for the effect of mixed interventions that focused on adherence and self-management to reduce emergency room visits and hospitalizations in LHL populations.

The effect of *interventions* on health outcomes in LHL populations varied. There was insufficient evidence to support the effects of interventions on knowledge, self-efficacy, adherence, health-related skills, quality of life, and cost. On the other hand, intensive disease management interventions were effective at reducing disease prevalence. The review found insufficient evidence for the effects of mixed interventions on health care cost and no studies were found that addressed the effects of interventions on disparities.

Overall, Berkman et al. (2011) identified common attributes of successful interventions designed to mitigate the effects of low health literacy. Common features across interventions that improved distal outcomes were their high intensity, theory basis, pilot-testing before full implementation, emphasis on skill building, and delivery by a health professional. The studies that reported improved distal outcomes also reported changes in intermediate outcomes such as knowledge, self-efficacy and behavior-- suggesting the intermediate outcomes are also important targets in interventions designed to lessen the effects of low health literacy.

Carbone and Zoellner (2012) conducted a systematic review targeted to dietetics practitioners to summarize the literature on health literacy and nutrition-related health literacy measurement development studies, readability of nutrition-related education materials, and individual health literacy skill assessments [78]. To begin, the authors found numerous studies that used an unspecified literacy measurement and urged practitioners to utilize existing health literacy measures. The authors identified several existing nutrition related HL measures that were available to practitioners including the Newest Vital Sign, the Nutritional Literacy Scale, the Nutrition Label Survey and CARDES. Brief screening HL measures such as the Rapid Estimate of Adult Literacy in Medicine and the Short Test of Functional Health Literacy in Adults were

available to reduce participant burden. Lastly, disease specific measures such as the Literacy Assessment for Diabetes, the Diabetes Numeracy Test are all useful in the context of dietetics.

Another significant finding from Carbone and Zoellner's (2012) review related to the readability of nutrition materials. The review found that 12 out of the 16 readability studies included materials written at a ninth-grade level or higher. The authors concluded that since 20% of the US population reads at or below a fifth-grade level [79] that nutrition information is too difficult for people to understand, and more work is needed to educate practitioners on the available readability assessments to increase the understandability of the materials. Current recommendations call for materials to be written at a fourth to eighth-grade reading level [80].

Lastly, Carbone and Zoellner (2012) found in their review of 13 nutrition-related health literacy studies that health literacy skills were correlated to the nutrition-specific skills of estimation of portion sizes, understanding nutrition labels, and seeking out and trust in nutrition information sources. Carbone and Zoellner confirmed Berkman et al. (2011) finding that intervention studies resulted in improvement in knowledge, however there was insufficient data to report on how interventions impacted health outcomes. The authors highlighted the need for more high-quality health literacy studies.

Allen and colleagues (2011) conducted a systematic review of the disease self-management and health promotion interventions designed to address health literacy using the RE-AIM framework to survey the information available to inform the translation of health literacy research to practice [81]. The RE-AIM framework (reach, effectiveness, adoption, implementation and maintenance) allows for the evaluation of both internal and external validity indicators. External validity is the generalizability of results across target populations, settings and times [82] and is important information for decision makers who are considering adopting a health promotion intervention. The systematic review aimed to fill the gap in the literature and report on issues related to external validity. The key finding of the Allen et al. (2011) review was that the current research on health promotion interventions for low health literacy populations provides insufficient data to confirm if health literacy interventions can attract the target population, achieve a sustainable effect, or are generalizable outside of a clinical setting. The authors call for future studies to address the RE-AIM dimensions that are vital to understand the potential public health impact of health literacy intervention efforts [83].

Improving the health literacy of the population is a Healthy People 2020 objective, however responsibility for meeting the objective has shifted to health care providers. The objectives point to providers assuming responsibility for providing clear communication through the use of easy-to understand instructions, asking patients to describe how they will follow instructions, by offering help with completing forms, and by listening and respecting what patients have to say [84].

Social Capital

The ecological perspective recognizes health behavior has both individual and environmental determinants [33]. Beyond individual factors such as knowledge and attitudes, interpersonal processes can impact health behaviors through formal and informal social support systems such as family members, friends, neighbors, contacts at work and acquaintances. Furthermore, broader social factors found at the community level including social capital have been found to influence health behaviors through direct and indirect mechanisms such as promoting rapid diffusion of health information, exerting social control over different health behaviors [85], and improving access to health services [86].

Social capital, a subset of social cohesion, is a concept that accounts for the role of collective social functioning. Social cohesion represents two broader attributes of society including the absence of latent social conflict and the presence of strong social bonds known as social capital [85]. Social capital has been defined as the "features of social structures- such as levels of interpersonal trust and norms of reciprocity and mutual aid- which act as resources for individuals and facilitate collective action" [87, 88]. Bourdieu defined social capital as "the sum of resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" [89]. The central generalizations that emerge from the various definitions consistently point to social capital as: an *ecologic* characteristic of the collective (neighborhood, community, society) not the individual, and as a *public good* that facilitates cooperation between individuals who are within the structure to pursue shared objectives for mutual benefit. Moreover, trust and reciprocity emerge as important constructs and serve as the basis of the measurement of social capital [85, 90].

The principal findings on social capital and health is that high social capital is associated with positive health outcomes and health behaviors [91] and low social capital is associated with risk behaviors and corresponding disease outcomes [92]. Individual-level indicators of social capital have been positively associated with various health behaviors such as physical activity [93, 94] higher levels of fruit and vegetable intake [95, 96], and smoking [97]. Social capital has also been linked to health outcomes such as self-rated health, [98] cardiovascular and cancer mortality rates, [92, 99] and obesity and diabetes [95, 100-102]. Again, social capital has been found to influence health behaviors through direct and indirect processes such as promoting rapid diffusion of health information, exerting social control over different health behaviors [85], and improving access to health services [86].

To further understand the mechanisms linking neighborhood/community social capital to health outcomes, there are two types of effects being presented as possible explanations: compositional and contextual. A *compositional* reason for area differences in health outcomes would be that different types of individuals live in different places. The argument would follow that since low-socioeconomic (SES) people die sooner than high-socioeconomic people, regardless of where low-SES people live, they will die sooner. Thus the differences between individuals would account for the differences in health outcomes between places. A *contextual* reason for area differences in health outcomes would be that there are attributes of the social (e.g. social capital) or physical environment (e.g. hazardous pollution) that contribute to people's health. The argument would follow that low-SES people might live longer in a clean, unpolluted physical environment with access to health services. Thus the differences between the environments would account for the differences in health outcomes between places [103].

Past research looking at compositional and contextual effects or an interaction between the two, focused on mortality risk. A longitudinal British study of 300,000 people investigated the association between level of social deprivation in electoral wards and premature mortality among residents. The study concluded the excess mortality associated with residence was entirely explained by the adverse personal and household socioeconomic factors of the people living in the area—a compositional effect [104]. On the contrary, a longitudinal U.S. study of 239,187 people investigated the association between mortality risk and median census tract income. The study concluded family income had a stronger association with mortality than census tract income, but that area socioeconomic status made a unique and substantial

contribution to mortality- both a compositional and contextual effect [105]. Both Sloggett and Joshi, and Anderson et al. found support for compositional effects based on SES, however Berkman and Kawachi contend that SES are partly a product of your place of upbringing due to opportunities for education and employment, rather than solely an individual characteristic [85]. More recently, studies are examining factors beyond area and individual level SES such as neighborhood access to healthy food to explain the compositional and contextual differences related to health outcomes. Research suggests that neighborhood residents who have better assess to supermarkets and limited access to convenience stores tend to have healthier diets and lower levels of obesity [106]. Investigating the relationship between social capital and neighborhood assess to healthy food or other risk factors related to obesity may further advance our understanding of the mechanisms linking social capital to health comes.

Contributions of this Study

In summary, this dissertation will explore health disparities and the impact of health literacy and social capital in rural regions of Virginia**.** A key goal of Healthy People 2020 is to achieve health equity, which requires eliminating persistent disparities in health outcomes. Health disparities are often conceptualized as differences by demographic factors such as race or gender; however, geographic location is an important driver of health inequity and disparities. Rural populations throughout the U.S., including the rural regions of Virginia, have higher prevalence of unhealthy behaviors and chronic disease. These geographically dispersed and hard-to-reach areas are often understudied. Thus, public health research and interventions are needed in rural, low-literate, health disparate areas.

The proposed studies contribute to addressing and advancing research in health disparities in several ways. First, to fully understand and mitigate health disparities in these regions, mixed method approaches that include qualitative research are critical. For example, using qualitative approaches to understand the perceptions of an intervention in a rural population can provide critical information, aiding in the explanation of effects, program refinement, and it can inform the translation of research into practice for these underserved areas and populations.

Second, there is a large research base for interventions targeting physical activity and dietary change; however, few interventions evaluate the maintenance of behavior change.

Understanding how rural populations can sustain health-promoting behaviors in the long term is essential to decrease the risk of chronic disease. Additionally, consideration must be given to the barriers rural populations face in accessing care such as travel distance and competing demands. Interactive voice response (IVR) phone calls targeting health behavior change and maintenance have the capacity for broad population reach in rural health disparate populations and could represent a cost-effective way to improve accessibility and dissemination of maintenance programs. This study will contribute to the literature on the acceptability of interventions delivered via IVR in rural areas and with participants with limited health literacy.

Finally, from an ecological perspective, it is equally important to address broader social factors (barriers) found at the community level including social capital. Beyond individual factors, contextual influences such as assess to healthy food and social capital are related to health outcomes. The social capital study will add to the emerging literature on the relationship of social capital to health behaviors and BMI and will establish a local metric for social capital in the Dan River Region.

Overall, in the spirit of health equity, these studies will advance the emerging health disparities literature related to the influence of health literacy and social capital, and inform the research to practice translation of a behavioral intervention.

Specific Aims

The overall objective of this study is to explore health disparities and the impact of health literacy and social capital in rural regions of Virginia. The specific aims are:

1. To identify emergent themes related to participant's likes, dislikes and barriers and describe participant satisfaction with each of the multiple components of SipSmartER by health literacy status.
2. To examine the reach, effectiveness and implementation of a 12-month randomized extended care intervention (theory-guided interactive voice recognition calls and human-delivered support calls) aimed at enhancing long-term maintenance of behavior change and study retention when compared to a control condition.
3. To described current levels of social capital in the predominantly rural Dan River Region and examine the influence of social capital on FV consumption, physical activity, sugary beverage intake and BMI on a sample of rural and urban adults.

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Chapter 3

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

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Abstract

SIP*smart*ER is a six-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 to 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]. Additionally, 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]; this ability is known as HL. It is estimated that 88% of U.S. adults may lack the HL skills needed to manage their health and prevent disease [17]. Adults living in rural areas tend to have low educational attainment and low socio-economic status, which are factors strongly associated with low HL. Specifically among adults over the age of 25, 20.1% living in the Appalachian region of Virginia have less than a high school diploma compared to 11.7% of non-Appalachian Virginians. Likewise, the per capita income of residents of Appalachian region of Virginia is $21,763 compared to $34,721 for non-Appalachian Virginians [18].

Despite the need to address limited HL skills with a behavioral intervention to reduce SSB consumption, especially among rural adults, such research is limited. 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 six-month multi-component behavioral intervention targeting SSB reduction and was designed using a HL universal precautions approach[19]. HL universal precautions are steps taken when practitioners and researchers assume that all participants have difficulty comprehending health information [20, 21]. 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 evaluative framework [22]. Effectiveness results of the randomized trial found that at six months SIP*smart*ER changes averaged -227 SSB kcals/day when compared to the control group at -53 SSB kcals/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 [23].

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 [24, 25]. However, questions remain about the potential differences in acceptability of intervention components among different literacy groups. Kessler and colleagues propose that in order to comprehensively use evaluation models such as the RE-AIM framework, researchers need to use qualitative methods to understand outcomes [26]. 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 [27]. Utilizing qualitative responses with quantitative program satisfaction data can further help explain outcome effects and aid in program refinement [28, 29]. 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 a HL universal precautions approach resulted in similar satisfaction among low and high HL participants. Therefore, the purpose of this mixed-methods paper is to: 1) determine participants' satisfaction and perception ratings across the multicomponent intervention by HL status and 2) qualitatively identify emergent themes related to participant's likes, dislikes and barriers of each component by HL status.

Methods

Study design

SIP*smart*ER is the intervention arm of *Talking Health*, a six-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. The current 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 six-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 kcals/day, report no contraindications to physical activity, and have regular access to a telephone. A total of 1056 individuals were screened in various community settings. 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.

SIPsmartER 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 [30-34]. The intervention included three small-group classes, one live teach-back call, 11 IVR-automated telephone calls, personal action planning and SSB self-monitoring (Table I). A detailed description of SIP*smart*ER and the *Talking Health* trial is provided elsewhere [19].

Small group classes

Participants were invited to attend three 90 to 120-minute 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. Lessons used aspects of TPB, HL, media literacy, and numeracy to provide content that increased motivation, skills, and support to drink fewer SSBs.

Teach-back call

Teach-back, which allows participants to explain key concepts using their own words, and teach-to-goal strategies, which provide participants with multiple opportunities to demonstrate mastery of those concepts were used [35, 36]. 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. During the fifteen minute call, participants were provided with up to three teach-back opportunities [37].

Interactive voice response 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 participants were guided through action planning to set a new goal for the upcoming week.

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[38]. 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.

Self-monitoring

To encourage self-management, simple behavioral self-monitoring logs were provided to participants to track their SSB intake daily and to compute their daily average on a weekly basis to report to the IVR calling system. 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.

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 (NVS) [39]. 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 [40].

Summative Evaluation

As an exit interview during the six-month assessment [18], a summative evaluation (see Appendix A) 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 asked participants about their overall experiences with each component as well as perceptions about specific traits of each component including content of classes (3 items), IVR calls (5 items), personal action plan (2 items), and behavioral logs (3 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 alpha's were computed to test the internal consistency of satisfaction scales and ranged from 0.67-0.86 (Table III). 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 [41, 42]. 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. 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 5) 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 II). Baseline characteristics, including HL, did not significantly differ between participants who completed the summative evaluation and non-completers, except for age. Completers were older. 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 less than $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 to high HL participants, low HL participants had significantly lower levels of education, income, and full-time employment.

Participation

When compared to summative evaluation completers, non-completers participated in significantly less classes, teach-back and IVR calls (Table II). 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 III). 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). Additionally, 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 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 (n=417) were mentioned more frequently than dislikes (n=93).

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 to high HL participants, a greater number of low HL participants identified content (p=.05) and length of calls (p=.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 (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 themes 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 group were more likely to mention motivation as a like of the personal action plans (p=.03), while high HL participants reported more likes for the consciousness raising aspect of the personal action (p=.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 themes 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 themes 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 to high HL participants ($p=.025$).

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 [28, 43-45]; 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 [26], 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 [23].

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 towards 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 [19, 20, 46]. 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 [20].

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 to high HL participants (7.8 vs. 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 to 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 to higher literacy participants [47]. 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 [48]. 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 [20]. 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 want to 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 [38, 49, 50]. Participant extracts from both groups confirm that the personal action plans is 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 is consistent with the HL universal precautions recommendation to support patients' efforts to improve their health through action planning [20].

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 [51]. 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%); with participants reporting it took too long to log their behaviors or 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 [51]. Furthermore, these findings illuminate an area of the intervention that could be improved upon. Future studies may want to 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.

Conclusions

Although several conceptual resources illustrate the importance of using a 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

multi-component 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.

Table 3-1. 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

Table 3-2. 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

[1] P-value for either Independent T-Test or X^2 test to determine if differences exist between groups

Table 3-3. 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-value
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

[1] 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

Table 3-4. Codes, definitions, sample meaning units, code counts and differences by health literacy status.

Component & Codes	Code Definition	Sample Meaning Unit	All[a] (N=105)		Low HL (N=38)		High HL (N=67)		P-Value[b]
Small group classes			*(n=102)*		*(n=37)*		*(n=65)*		
LIKED			*n*	*%*	*n*	*%*	*n*	*%*	
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*

Component & Codes	Code Definition	Sample Meaning Unit	All[a] (N=105)		Low HL (N=38)		High HL (N=67)		P-Value[b]
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
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)*		
LIKED			*n*	*%*	*n*	*%*	*n*	*%*	*P-value*
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

Component & Codes	Code Definition	Sample Meaning Unit	All[a] (N=105)		Low HL (N=38)		High HL (N=67)		P-Value[b]
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
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	"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

Component & Codes	Code Definition	Sample Meaning Unit	All[a] (N=105)		Low HL (N=38)		High HL (N=67)		P-Value[b]
	with a computerized system, or states a preference to interact with a human.								
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 our 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)*		
LIKED			*n*	*%*	*n*	*%*	*n*	*%*	*P-value*
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	"It helped me feel better about myself and my determination;	14	13.7	9	24.3	5	7.7	0.03

Component & Codes	Code Definition	Sample Meaning Unit	All[a] (N=105)		Low HL (N=38)		High HL (N=67)		P-Value[b]
	support or motivation for the participant.	helped me be determined." –*Low HL, male*							
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)*		
LIKED			*n*	*%*	*n*	*%*	*n*	*%*	*P-value*
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	.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

Component & Codes	Code Definition	Sample Meaning Unit	All[a] (N=105)		Low HL (N=38)		High HL (N=67)		P-Value[b]
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	.77
DISLIKED			*n*	*%*	*n*	*%*	*n*	*%*	*P-value*
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

[1] 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

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Chapter 4

The reach, implementation and effects of a telephone-based maintenance intervention for reducing sugary beverage intake among rural, low-health literate adults

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Abstract

Extended care provides prolonged participant contact to prevent relapse following initial behavior change and has proven to be a viable strategy in addressing long-term maintenance of weight loss. Guided by RE-AIM, this study examined the reach, effectiveness and implementation of a 12-month randomized extended care intervention aimed at enhancing long-term maintenance of behavior change and study retention. As part of a 2-arm RCT targeting adults in rural Southwest Virginia, participants were randomly assigned to a behavioral intervention to reduce sugary beverages (SipSmartER) or increase physical activity (MoveMore). At the completion of the behavioral intervention (6-months) participants were further randomized to one of three maintenance conditions including behavior-specific interactive voice recognition (IVR) calls, behavior-specific human-delivered support calls, or an IVR call control condition. A total of 170 participants enrolled in the maintenance intervention, representing 78% of participants who enrolled in the first 6-month intervention phase. Enrollees were significantly older and less likely to be Hispanic ($p<0.05$), as compared to non-enrolled participants. There were no significant differences in participant characteristics between the 137 who completed the 18-month data collection visit and the 32 that did not. Of 12 possible calls (one per month), within SIPsmartER, average call completion rate was: IVR=6.0 ± 4.7, Live = 3.7± 3.3 and Control = 5.1± 4.2. Within MoveMore, IVR =3.7 ± 4.4, Live =4.9 ± 3.9 and Control =2.8 ± 4.1. Within both conditions and across intervention groups, call completion rates did not differ significantly. At the end of follow-up (18-months), SSB kcal/d remained significantly lower than baseline levels for SIPsmartER participants by 208 kcal/d (95% CI=-184.78, -79.21; $p<.001$). Within SIPsmartER, there were no significant differences between call groups for all outcomes. Within MoveMore, minutes of moderate to vigorous physical activity or strength training were not significantly different than amounts of activity reported at baseline both within and between groups. Strength training minutes differed significantly between the IVR and control groups between 6 and 18 months (-25 vs. -3 minutes; $p=0.029$) and between baseline and 18 months (10.8 vs. 0; $p=0.030$). In conclusion, this study suggests that SIPsmartER, an intervention integrating behavioral theory and health literacy concepts results in a sustained reduction in SSB intake in rural adults. This study supports previous findings that dietary behaviors may be more agreeable to change than physical activity behaviors. Future research should focus on the refinement of interactive technology-based interventions.

Introduction

Maintenance, at the individual level, refers to the long-term effects of a program on outcomes 6 or more months after the most recent intervention contact [1]. Behavioral maintenance represents a key challenge for the prevention and treatment of chronic disease [2] and likewise maintenance of change following interventions is not often reported, especially in community-based interventions [3, 4]. Extended care provides prolonged participant contact to prevent relapse following initial behavior change and is a viable strategy to address long-term maintenance of health behaviors following an intervention[5]. Telephone-delivered extended care programs represent a potentially effective and low-cost way for promoting long-term health behavior change in rural communities [5, 6].

SSB consumption is correlated with multiple public health concerns such as obesity, diabetes, cardiovascular disease and dental caries [7-11]. Rural, low-income, and low-health literate populations report disproportionally high rates of SSB consumption [12-16], as well as higher rates of overweight and obesity, and obesity related conditions [17, 18]. In the context of an obesity epidemic, the American Heart Association recommends reductions in added sugar intake to no more than 100-150 kcal/d for most Americans [8] and one of the Healthy People 2020 nutrition and weight status objectives is to reduce consumption of calories from added sugars in the population aged 2 years and older [19]. Attaining and maintaining current recommendations for sugar sweetened beverage (SSB) intake over long periods of time could represent a simple strategy to improve health, yet no known SSB trials have examined maintenance of behaviors.

In the weight loss literature, the use of extend care is recommended to address the issue of maintenance [5]; although a systematic review of the effectiveness of technology-based (internet, telephone and interactive television) weight-loss maintenance interventions found mixed results [20]. Overall the review found technology based extended care was more effective than usual care, but not as effective as personal contact. Nonetheless, when considering extended care programs in rural communities, it is necessary to explore different delivery methods because of increased travel to care centers and costs [18, 21]. Automated telephone calls utilizing interactive voice response (IVR) systems may represent a cost-effective and acceptable strategy to facilitate ongoing engagement in healthy behaviors with individuals in rural areas [22, 23]. Several studies support the use of IVR calls for chronic disease self-management [24], physical

activity promotion [25, 26] and smoking cessation [26]. However, there is limited research related to the use of IVR delivered telephone calls as a maintenance strategy, especially when compared to human-delivered telephone calls [20, 27].

In addition to the importance of exploring effective strategies for maintaining behavioral changes, there is a need to examine factors related to the generalizability of the findings [28]. The public health impact of a behavioral intervention is assessed not only by its effectiveness, but also by important criteria related to both internal and external validity factors. The RE-AIM research evaluation framework directs attention to five key areas: **r**each, **e**ffectiveness, **a**doption, **i**mplementation and maintenance. Reach is an individual level measure of participation defined as the absolute number, proportion, and representativeness of individuals who participate in a given intervention[29, 30]. Reach data gives insight into the percentage and risk characteristics of persons who participant in a program compared to those who do not participate. Effectiveness is defined as the impact of the intervention on important outcomes including biologic, behavioral and quality of life. Adoption looks at the proportion and representativeness of settings that adopt a policy or program. Implementation is used to describe the extent to which the intervention was delivered as intended. At the individual level implementation can be measured by participant adherence to a health program. Lastly, maintenance at the individual level refers to the long-term effects of the intervention on behavior change [31]. Together, all five dimensions of RE-AIM can help evaluate the public health impact of an intervention.

Talking Health, is a 2-phased pragmatic randomized-controlled health literacy trial that was guided by the RE-AIM evaluation framework. The trial targeted the Appalachia region of rural southwest Virginia where notable education, health, and economic disparities exist compared to state and national averages [32, 33]. Phase 1 of Talking Health evaluated the 6-month effectiveness of SIPsmartER, an intervention designed to decrease SSB consumption in adults, when compared to a matched contact physical activity promotion control group (MoveMore). Phase 2 of the Talking Health trial, and the focus of this current investigation, was designed to determine the effectiveness of a 12-month randomized maintenance intervention (theory-guided IVR and human-delivered (Live) support calls) aimed at enhancing long-term maintenance of behavior change and study retention when compared to an IVR delivered control condition. Theory of Planned Behavior constructs, self-monitoring and goal setting strategies were applied to intervention calls. The primary aim of this paper is to report the maintenance of

primary outcomes (i.e., 6 to 18-month assessments and 0 to 18 month assessments) across conditions and to compare the outcomes of the maintenance intervention groups to the control group. A secondary aim is to explore factors related to the reach and implementation of the maintenance phase.

Methods

Participants

Participants were enrolled in 2-phases of the trial. Phase 1 of the trial occurred in a total of eight southwestern Virginian counties (i.e. Lee, Giles, Pulaski, Washington, Grayson, Wise, Wythe, and Montgomery) and took place between April 2012 and November 2014. Eligibility criteria for enrollment in phase 1 included English-speaking adults who were 18 years of age or older, consumed at least 200 SSB kcals/day, reported no contraindications for physical activity, had regular access to a telephone and who were not concurrently enrolled in another nutrition or physical activity program. Participants were randomly assigned to SIPsmartER (n=155) or MoveMore (n=146). Individuals enrolled in SIPsmartER participated in a 6-month behavioral modification program aimed to decrease SSB intake, with the primary goal of achieving the SSB recommendation of less than 8oz per day. Individuals enrolled in MoveMore participated in a 6-month behavioral modification program aimed to increase physical activity, with the primary goal of achieving 150 minutes of moderate intensity PA and muscle strengthening activities on two-or more days per week. Both behavioral modification programs included three small group sessions, one teach-back call, 11 IVR telephone calls, completion of personalized action plans and self-monitoring log sheets. Both SIPsmartER and MoveMore conditions were guided by Theory of Planned Behavior (TPB) and health literacy concepts and strategies, and were designed for broad dissemination. A detailed account of the structure, theoretical constructs, and content of the classes and IVR calls is described elsewhere [34].

Study Design

Eligibility criteria for phase 2 included active enrollment in phase 1 and completion of at least one IVR call during the initial intervention. Phase 2 participants were stratified into four groups according to their 6-month health screening attendance and IVR completion rate during phase 1 (completed 6-month assessment and completed <6 IVR calls vs. completed 6 month

assessment and completed >6 IVR calls vs. did not complete 6 month assessment and completed <6 IVR calls vs. did not complete 6 month assessment and completed >6 IVR calls) and were randomly assigned to an IVR intervention group, Live intervention group or a control group across both conditions. SIPsmartER IVR (n=33), SIPsmartER Live (n=32) and SIPsmartER Control (n=19). Move More IVR (n=36), MoveMore Live (n=32) and MoveMore Control (n=18). The current study includes participants from six of the eight counties (i.e. Lee, Giles, Pulaski, Washington, Grayson and Wise) wherein phase 2 ended in March 2015. Virginia Tech Institutional Review board approved all study procedures. Participants were informed of the random allocation process and provided their written consent to participate. Gift cards in the amount of $25, $50, and $75 were provided at the baseline, 6-month and 18-month assessments, respectively.

Maintenance Intervention

IVR Group

Participants in the IVR intervention group received Theory of Planned Behavior (TPB) informed telephone support calls from an automated IVR system. The 11 monthly calls ranged in length from 10-15 minutes and were structurally similar to the 11 IVR calls received in the initial 6-month intervention [34]. During each maintenance call, participants reported their behavior (SIPsmartER=ounces of SSB; MoveMore =minutes of PA), received tailored feedback based on goal maintenance and could elect to set a new maintenance goal. Participants were given the option to identify new barriers and strategies pertaining to their behavior or keep the same ones identified previously. To the end of the call, a short TPB-based message reinforced key information presented during phase 1 (see Appendix B); media literacy was the target of two messages.

Live Group

Participants in the live intervention group received TPB based telephone support calls that included 11 monthly calls from an appointed member of the Talking Health research team. The 10-15 minute calls followed the same format as the IVR Group calls described above.

Control Group

Participants in the control group received 11 monthly IVR delivered calls that included monthly updates on the study such as, "it's been three months since we've seen you," and delivered entertaining science facts such as, "sunshine can help your sleep patterns." Participants did not report their current behavior, set goals or hear a TPB support message. Additionally, information specific to SSB or PA was not addressed in the control call.

Measures

All outcomes were measured during health screenings that occurred at baseline, 6-months and 18-months. SSB intake was measured by BEVQ-15, a validated food-frequency instrument that assesses beverage consumption over the past month [35]. MVPA and strength training was measured by the Godin Leisure Time Exercise Questionnaire to estimate time spent in physical activity over the past 7 days [36]. Secondary outcomes included weight and BMI. Weight was measured without shoes and light clothing using a calibrated digital Tanita scale (Model: 310GS). Height was measured with a research-grade stadiometer at baseline. Eligibility and demographic information was collected during the screening process prior to enrollment in Phase 1. The screening instrument included questions about gender, age, race/ethnicity, education level, income, employment status, health care coverage, marital status, number of children in the home, county of residence, SSB intake and contraindications for physical activity.

Reach was determined by examining the proportion and representativeness of individuals who participated in phase 2. We assessed representativeness by comparing the demographic characteristics of Talking Health participants enrolled in phase 2 to those not enrolled and by comparing demographic characteristics between those who attended the 18-month assessment to those who did not attend. Further we investigated the reach of the maintenance groups by comparing 18-month participation rates of the IVR and live groups to the control group. Implementation was defined as the number of telephone calls completed over the 12-month intervention (out of a possible 11). Completion rates and proportions (% completing between 0-3, 4-7 and 8-11 calls) were calculated for each maintenance group across both conditions. Maintenance of primary outcomes was examined by comparing assessment outcomes from 0 to 6 months, 6 to 18 months and 0 to 18 months across both conditions and by randomized maintenance group. We determined if maintenance was demonstrated by following the criteria

set forth by Fjeldsoe and colleagues that specifies a statistically significant between-groups difference in favor of the intervention group is reported at the end of the intervention and at follow-up for at least one behavioral outcome [4].

Statistical analysis

All data were entered into SPSS statistical analysis software (version 22.0, 2012, International Business Machines Corporation, Pittsburgh, PA) and validated scoring procedures were applied to compute outcome variable scores. Descriptive statistics were used to summarize demographic characteristics and engagement rates. Chi square tests of association or Fisher's exact tests (categorical variables) and independent t-tests (continuous variables) were used to compare demographics and engagement rates between maintenance participants and non-participants. Independent t-tests were used to compare maintenance participation rates and primary outcomes of each condition by maintenance assignment. Comparisons by maintenance assignment were limited to those participants who attended both the 6 and 18-month follow-up assessment.

Multilevel mixed-effects linear regressions analysis was performed using Stata software to account for clustering of individuals within cohorts (version 13, 2013, StataCorp LP, College Station, TX). Data are presented based on intention-to-treat (baseline value carried forward) and present at follow-up analysis[37, 38].

The mixed-effect models controlled for individual characteristics, time, condition, and a time by condition interaction to determine differences between SIPsmartER and MoveMore participants. All models calculated cluster robust standard errors. The baseline covariates controlled in the models were chosen a priori and included age, gender, race/ethnicity, income, education level, HL level, employment status, number of children, smoking status, and baseline BMI.

Results

Reach

From the first six counties, a total of 218 individuals participated in phase 1 of the Talking Health trial, of whom 170 (78.0%) met phase 2 eligibility criteria (**Figure 1**) and were enrolled. One woman reported being pregnant at the 18-month follow-up and was excluded from

the analysis. The 169 adult participants (mean age 42.3 ± 13.1 years) included in the analysis were 94.7% White, 81.8% female, 28.4% ≤ high-school educated with a mean income of $24,911. 2. The mean NVS score was 4.1 ± 1.9 **(Table 1).** When compared to Talking Health participants not enrolled in maintenance, enrollees were somewhat older in age (enrolled =42.3, not enrolled= 37.3, p=.045) and did not identify as Hispanic (enrolled=0.0%, not enrolled=4.2%, p=.008). There were no significant differences between gender, race, educational attainment, income nor NVS scores.

Eighty one percent of those enrolled in maintenance attended the 18-month data collection. There were no significant differences in participant characteristics between the 137 who completed the 18-month data collection visit and the 32 that did not. Furthermore, there were no statistically significant differences in 18-month attendance rates between the maintenance treatment groups: IVR vs. control and live vs. control within SIPsmartER or MoveMore(data not shown).

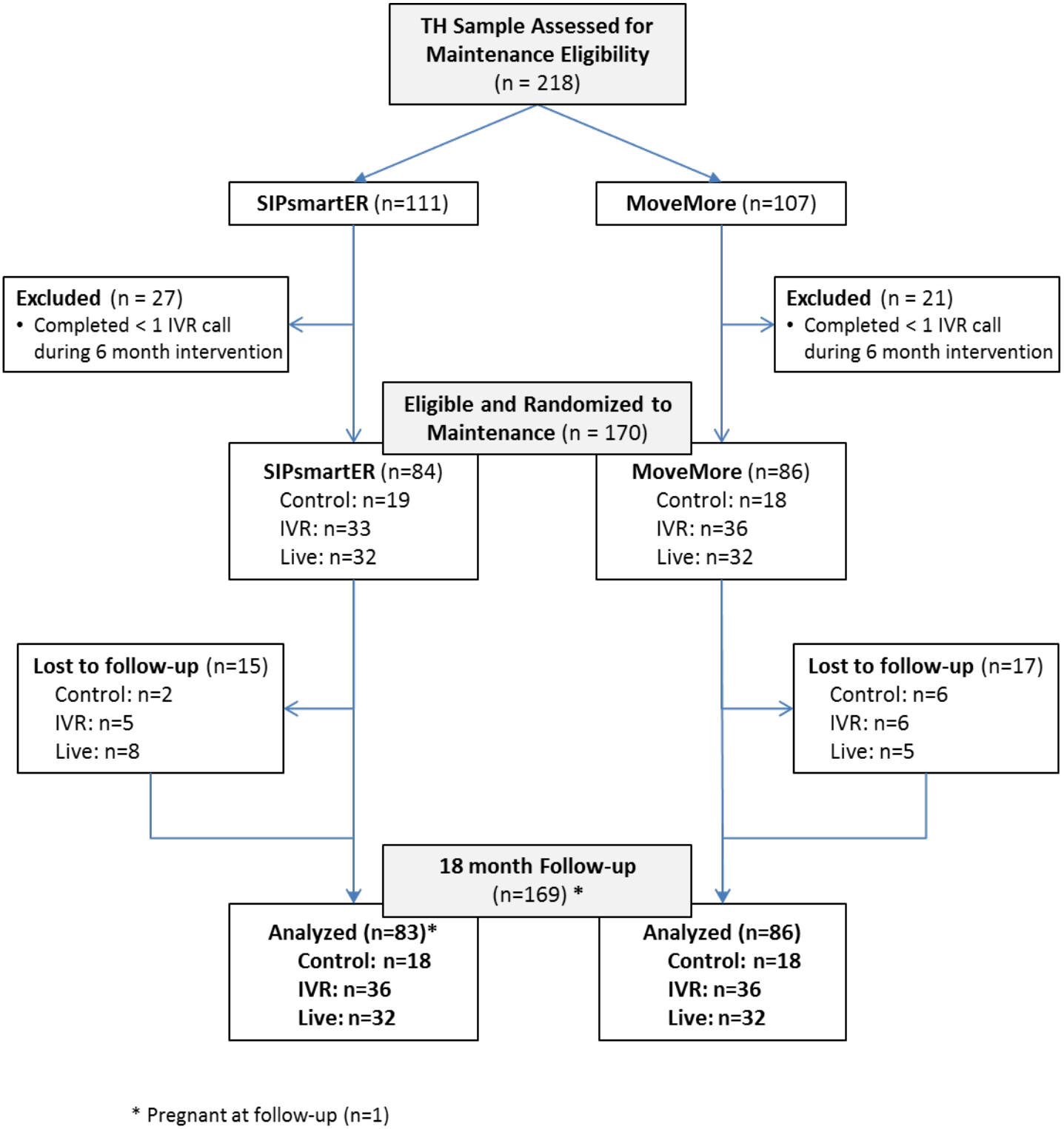

Figure 4-1: Maintenance phase participant flow diagram.

Implementation

Within SIPsmartER, the IVR group completed an average of 6.0 ± 4.7 calls, the Live group completed an average of 3.7± 3.3 calls and the Control group completed an average of 5.1± 4.2 calls **(Table 2**). Within MoveMore, the IVR group completed an average of 3.7 ± 4.4 calls, the Live group completed an average of 4.9 ± 3.9 calls and the Control group completed an average of 2.8 ± 4.1 calls. Within both conditions, there were no significant differences between call completion rates when comparing maintenance treatment groups (IVR and Live) to the control group. Lastly, there were no significant differences between the mean call completion rates between MoveMore and SIPsmartER (MM=3.9 ± 4.2 calls vs. SS=4.9 ± 4.2 calls; p=.148).

Within SIPsmartER, the largest percentage of participants to complete 0-3 calls were SIPsmartER Live (56%), whereas the largest percentage of participants to complete 8-11 calls were SIPsmartER IVR (50%). Within MoveMore, the largest percentage of participants to complete between 0-3 calls were MoveMore control (72%) and all three groups completed 8-11 calls at similar rates: IVR (27.8%), Live (31.3%) and Control (31.6%). There were no significant differences between the proportion of calls completed when comparing maintenance treatment groups (IVR and Live) to the control group.

Effectiveness

Maintenance of Primary Outcomes by Condition

As illustrated in **Table 3**, during phase 1 (baseline to 6 months) the self-reported SSB kcal/d intake significantly decreased by approximately 251 kcals (95% CI=-379.17, -122.00, p<0.001) for the SIPsmartER group compared to 74 kcals (95% CI=129.38, -18.99, p<0.01) for the control condition, MoveMore (p<0.01). During phase 2 (6 to 18 months) SIPsmartER participants continued to slightly decrease by 3 kcals/day and MoveMove participants decreased by 8 kcals/d in, although not significantly within or between conditions. At the end of follow-up (18months), SSB kcal/d remained significantly lower than baseline levels for SIPsmartER participants by 208 kcal/d (95% CI=-184.78, -79.21) compared to MoveMore participants who decreased by 59 kcal/d. There were no significant differences between groups at the 18-month follow-up for intake of SSB kcal/d.

During phase 1, the minutes/day of moderate to vigorous PA decreased by 10 minutes for SIPsmartER participants and by 9 minutes for MoveMore participants and continued to decrease

for MoveMore participants in phase 2 by 4-minutes compared to a 5-minute increase in MVPA for SIPsmartER participants ($p<0.05$). At the end of follow-up, MVPA minutes were not significantly different than amounts of activity reported at baseline both within and between groups. During phase 1, the number of minutes of strength training activity decreased for SIPsmartER participants by approximately 2 minutes compared to an approximate 25 minute (95% CI=9.85,40.33, $p<0.05$) increase for MoveMore participants ($p<0.05$). During phase 2, strength training minutes increased by approximately 1 minute for SIPsmartER participants but decreased significantly by 13 minutes (95% CI=-22.60, -3.75, $p<0.01$) for MoveMore participants ($p<0.001$). At the end of follow-up, strength training minutes were not significantly different than amounts of activity reported at baseline both within and between groups.

For BMI and weight, there were no significant changes within or between groups during phase 1, 2 or at the end of follow-up.

Maintenance of Primary Outcomes by Maintenance Assignment for each Condition

During phase 2, there were no significant changes in SSB kcal/d by treatment groups: IVR vs. control and live vs. control (**Table 4**) in the SIPsmartER (SS) or MoveMore (MM) condition. At the end of follow-up (18months), SSB kcal/d remained lower than baseline levels for all SIPsmartER and MoveMore groups. : -294 kcal/d in the IVR group, -271 kcal/d in the live group and -180 kcal/d in the control group. Changes in SSB kcals/d did not differ significantly between SIPsmartER treatment groups, however c.hanges in SSB kcal/d differed significantly between the MoveMore IVR and control groups (-3.9 vs. -231.6; $p=0.018$).

MoveMove IVR and control participants continued to decrease by approximately 2 and 51 kcals/d respectively, while the live group reported a 34 kcal/d of SSB increase during phase 2. Changes in MoveMore SSB kcal/d did not differ significantly between treatment groups: IVR vs. control and live vs. control. At the end of follow-up, SSB kcal/d remained lower than baseline levels for all MoveMore groups: -7.8 kcal/d in the IVR group, -85.3 kcal/d in the live group and -231.6 kcal/d in the control group. Changes in SSB kcal/d differed significantly between the IVR and control groups ($p=0.018$).

There were no significant differences between by treatment groups for minutes of MVPA for SS or MM during phase 2 or at the end of follow-up. The minutes/day of moderate to vigorous PA decreased for both SIPsmartER and MoveMore participants during phase 1. During

phase 2, within the SIPsmartER condition, the live group continued to decrease by approximately 56 minutes while the IVR and control group increased by approximately 27 and 62 minutes respectively. There were no significant differences between SIPsmartER treatment groups for MVPA during phase 2. At the end of follow-up, all SIPsmartER groups reported higher amounts of MVPA minutes than at baseline: approximately 54 minutes for the IVR group, 6 minutes for the live group and 29 minutes for the control group with no significant differences between treatment groups.

There were no significant changes in strength training activity between SIPsmartER treatment groups during phase 2 or at the end of follow up. All three groups within MoveMore continued to decrease minutes of strength training activity during phase 2. There was a significant difference between the MoveMore IVR and control groups (-25 vs. -3 minutes; p=0.029) during phase 2. Changes in minutes of strength training activity from baseline to 18-months differed significantly between the IVR and control groups (11 vs. 0 minutes; p=.030). Within the MoveMore condition, the IVR and control groups continued to decrease MVPA by approximately 30 and 43 minutes respectively, while the live group increased by approximately 10 minutes during phase 2. There were no significant differences between MoveMore treatment groups for MVPA minutes during phase 2. At the end of follow-up, the MoveMore IVR and live groups reported higher amounts of MVPA minutes than at baseline: approximately 16 minutes for the IVR group and 19 minutes for the live group, while the control group reported a decrease of approximately 53 minutes from baseline. There were no significant differences between treatment groups.

During phase 1, the number of minutes of strength training activity decreased for SIPsmartER participants and increased for MoveMore participants. Within SIPsmartER, the IVR and live group increased minutes of strength training activity by approximately 5 and 2 minutes, respectively during phase 2. The control group decreased by approximately 3 minutes during phase 2. At the end of follow-up, both the IVR (-6.7) and control (-1.8) groups reported a decrease in strength training minutes compared to baseline values, whereas the live group reported an increase of 1.8 minutes. There were no significant differences between SIPsmartER treatment groups during phase 2 or at the end of follow-up.

All three groups within MoveMore continued to decrease minutes of strength training activity during phase 2: by 25 minutes in the IVR group, by approximately 17 minutes in the live

group and by approximately 3 minutes in the control group. There was a significant difference between the MoveMore IVR (-25 minutes) and control groups (-3 minutes) (p=0.029) during phase 2. At the end of follow-up, both the IVR and live group reported an increase of strength training activity by approximately 11 and 2 minutes respectively. The control group reported no change from baseline. Changes in minutes of strength training activity from baseline to 18-months differed significantly between the IVR and control groups (p=.030).

There were no significant changes between groups for both the SIPsmartER and Move More conditions during phase 2 or at the end of follow-up for both BMI and weight.

Discussion

This study examined the maintenance of primary outcomes for both conditions of the Talking Health trial and the reach, implementation and effects associated with a 12-month maintenance intervention across SIPsmartER and MoveMore. Overall, at the end of 18-months, SIPsmartER participants consumed significantly less SSB than reported at the start of the intervention. However, MoveMore participants did not report a significant improvement in number of moderate to vigorous PA or strength training minutes compared to their baseline values or to SIPsmartER participants.

While the difference between SIPsmartER and MoveMore SSB consumption at the end of 18-months was not statistically significant and therefore did not meet the maintenance criteria set forth by Fjeldsoe and colleagues, the sustained changes experienced by the intervention participants one year after the conclusion of the trial are of practical significance. SIPsmartER participants demonstrated a mean SSB reduction of approximately 208 kcal/d between baseline and 18-months. This is especially important for low-income, rural populations who experience disproportionally high rates of SSB consumption [12-16] as well as higher rates of overweight and obesity, and obesity related conditions [17, 18]. SIPsmartER participants also decreased BMI and weight values at both 6 and 18-months, although not statistically significant. Our weight findings are somewhat contradictory to the PREMIER trial, which found that a reduction in SSB was associated with weight loss, specifically a reduction of 100 kcal/d of SSBs was associated with a weight loss of .0.25 kg at 6 months [39].Regardless of non-significant weight findings in our trial, reducing added sugar intake over time may have clinical usefulness in this vulnerable population to improve risk factors other diet-related chronic health conditions.

Findings from previous interventions targeting physical activity and diet suggest that dietary behaviors may be more agreeable to change than physical activity behaviors which may explain why the MoveMore participants did not report sustaining or maintaining their PA behaviors at the 18-month follow-up [4].

This study also examined the reach, implementation and effects associated with a 12-month maintenance intervention across both SIPsmartER and MoveMore. The maintenance intervention was designed as a low-cost/low intensity tool for participants to continue using familiar strategies such as self-monitoring, goal assessment, and action planning learned in phase 1. Results showed no significant differences in SSB intake, MVPA minutes, BMI and weight between participants receiving theory-based IVR or live calls compared to the contact-only control group across both conditions. Within MoveMore, contrary to our hypothesis, the control group reported a significantly smaller decrease in strength training minutes compared to the IVR group during the 12-month intervention. However from baseline to the end of follow-up, participants in the IVR group reported a statistically significant increase of 10.8 minutes in strength training when compared to no change in the control group. The results of the current study have implications for designing future behavior-change maintenance interventions for rural populations.

Several reasons could explain our finding that the theory guided maintenance intervention was not more effective than the control. One reason and perhaps a limitation of the study is we did not control for participant's 6-month values or make maintenance assignments based on progress made during phase 1 of the intervention. Participants were randomly assigned to a maintenance group based on IVR call completion rates and 6-month health screening attendance due to differing levels of engagement during in phase 1. A second explanation may be lack of motivation. After using the telephone during the initial intervention, participants may have been unmotivated to continue to use the telephone as a medium for health behavior change for 12 additional months. Although the telephone is convenient for participants, overall completion rates of the calls were low. Other studies of technology-based maintenance interventions report low utilization of technology [40, 41].

Despite low utilization of the maintenance calls, SIPsmartER participants in all three groups reduced SSB intake from baseline to 18-months. Fjeldsoe et al. [4] noted one of the key findings in their systematic review of maintenance of behavior after dietary and physical activity

interventions was the importance of follow-up prompts to achieve maintenance, basically the use of brief contact after the intervention. Unlike the weight loss maintenance literature, the Fjeldsoe review did not find support for self-monitoring as a strategy to promote maintenance. Because SIPsmartER participants significantly sustained their SSB decreases during the maintenance intervention, perhaps the receipt of the call (hearing the phone ring, seeing a missed call or hearing voicemail), but not completion of the call, was enough contact to motivate participants to continue to drink less SSB. Fjeldsoe et al. noted there is limited experimental evidence to draw upon for the effectiveness of follow-up prompts making this a target area for future investigation. Lastly, within the broader weight-loss maintenance literature, the effectiveness of technology-based maintenance interventions is mixed [20]. Both Cussler et al. and Thorndike et al. [40, 41] evaluated the effects of a behavioral internet-based maintenance intervention compared to usual care. In both studies, all groups maintained significant weight loss, but internet use did not improve sustained weight loss more effectively than usual care. To our knowledge, this is the first RCT to test the effectiveness of an IVR/live call-based maintenance intervention targeting dietary and physical activity behaviors.

The reach analysis showed participants enrolled in maintenance were mostly similar to participants not enrolled except that non-enrollees were younger. This finding is expected since enrollment into the maintenance condition was contingent upon participants completing at least 1 IVR call during phase 1 and participants aged 19-33 completed significantly fewer calls during phase 1 as compared to older participants [42]. The overall low engagement in the maintenance intervention is both a concern and an interest. With only 30% of all maintenance participants completing eight or more calls, it would be prudent to consider strategies to increase engagement. Svetkey et al. suggest adding an occasional personal contact component to complement the technology-based maintenance intervention [43]. However as discussed previously, if brief follow-up prompts are as effective as a behavior-based intervention on maintenance, this would represent a practical, low-cost and time efficient strategy to sustain behavior change, especially dietary behaviors.

There were several limitations of this research. This study analyzed six of the eight cohorts in the Talking Health trial thereby the current sample size is lower than the original sample size calculation and may impact power. Future incorporation of the additional cohorts may impact the results of the analysis. The non-statistically significant findings should be

interpreted with caution. Secondly, this study may have limited generalizability beyond the targeted region of rural southwest Virginia. However, with the exception of men being underrepresented, the participants in the Talking Health trial were representative of the targeted region; besides age, the enrolled maintenance participants are representative of those not enrolled in the maintenance intervention.

In conclusion, our study suggests that an intervention integrating behavioral theory and health literacy concepts can be accessible to all educational levels and can result in a sustained reduction in SSB intake in this high-risk population. However, we did not find evidence that the control intervention targeting physical activity can result in sustained PA in this population. Brief monthly behavior-based calls delivered via IVR or a member of the research staff did not impact maintenance of behavior any differently than control calls. The current results of this study should not discourage further study of technology-based maintenance interventions in rural communities. Instead future research should focus on using more advanced statistical methods to determine the effect of delivery mode (IVR vs. Live) on call completion rates and outcomes, refinement of interactive technology-based interventions and on understanding the impact of follow-up prompts on maintenance.

Table 4-1. Representativeness of participants in the 12-month maintenance phase and those who completed 18-month assessment: The Talking Health trial cohorts 1-6.

		Maintenance Phase			**18-month Assessment**		
	Talking Health Enrollees n=218	Maintenance Enrollees n=169	Maintenance Non-enrollees n=48	Chi-square or independent t-test	Attendees n=137	Non-Attendees n=32	Chi-square or independent t-test
Female	80.2%	81.8%	77.1%	0.541	83.2%	71.9%	0.141
Mean Age (SD)	41.2 (13.7)	42.3 (13.1)	37.3 (15.2)	0.045	43.2 (12.8)	38.3 (13.3)	0.063
White	93.5%	94.7%	89.6%	0.205	96.4%	87.5%	0.067
Hispanic	.9%	0.0%	4.2%	0.008	0.0%	0.0%	n/a
Beyond High school	70.5%	71.6%	66.7%	0.509	71.5%	71.9%	.969
Mean Income (SD)	$24, 285.7 (17221.9)	$24,911.2 (17234.2)	$22,083.3 (17176.6)	0.320	$23,359.4 (16963.1)	$25,273.7 (17060.4)	.580
Newest Vital Sign (SD)	4.0(1.9)	4.1(1.9)	3.9 (2.0)	0.654	4.1 (1.9)	4.0 (2.2)	.949

Table 4-2. Implementation: mean and proportion of calls completed by condition and maintenance assignment.

	SIPsmartER			**MoveMore**			**T-Test (p-value)**			
	IVR n=32 (1)	Live n=32 (2)	Control n=19 (3)	IVR n=36 (4)	Live n=32 (5)	Control n=18 (6)	(1) vs. (3)	(2) vs. (3)	(4) vs. (6)	(5) vs. (6)
Call Completion Rate, M (SD)	6.0 (4.7)	3.7 (3.3)	5.1 (4.2)	3.7 (4.4)	4.9 (3.9)	2.8 (4.1)	.437	.234	.466	.063
Proportion of calls completed n (%)							**Chi-Square (p-value)**			
0-3 calls	12 (37.5%)	18 (56.3%)	8 (42.1%)	21 (58.3%)	15 (57.0%)	13 (72.2%)	.351	.443	.638	.200
4-7 calls	4 (12.5%)	9 (28.1%)	5 (26.3%)	5 (13.9%)	7 (21.9%)	1 (5.6%)				
8-11 calls	16 (50.0%)	5 (15.6%)	6 (31.6%)	10 (27.8%)	10 (31.3%)	4 (31.6%)				

Table 4-3. Adjusted Change in primary outcomes at 6 and 18-months by treatment condition (n=169).

Intention to treat analysis [ab]								
		Baseline[c] Mean	Δ, baseline to 6 months	p-value[d]	Δ, 6 to 18 months	p-value[d]	Δ, baseline to 18 months[e]	p-value[d]
SSB, kcals[f]	SS	480.47 (404.43)	**-250.58 ***** [-379.17,-122.00]	**p<0.01**	-2.94 [-32.65,26.77]	NS	**-208.11***** [-184.78,-79.21]	NS
	MM	394.53 (304.72)	**-73.86 **** [129.38,-18.33]		-8.10 [-53.74,37.54]		-59.42 [-121.74,2.91]	
MVPA, minutes[g]	SS	58.01 (116.64)	-10.42 [-39.83,18.99]	NS	4.52 [-0.55,9.59]	**p<0.05**	-4.88 [-37.09,27.33]	NS
	MM	70.33 (123.65)	-8.52 [-37.62,20.58]		-4.13 [-12.01,3.75]		-14.88 [-44.16,14.39]	
Strength Training PA, minutes[h]	SS	9.34 (45.52)	-2.23 [-10.91,6.45]	**p<0.05**	1.55 [-2.34,5.45]	**p<0.001**	-2.00 [-7.12,3.12]	NS
	MM	4.36 (23.79)	**25.09**** [9.85,40.33]		**-13.17**** [-22.60,-3.75]		4.48 [-0.21,9.16]	
BMI	SS	32.41 (8.31)	-0.19 [-0.40,0.02]	NS	0.06 [-0.40,0.51]	NS	-0.18 [-0.78,0.43]	NS
	MM	33.62 (8.83)	0.15 [-0.14,0.45]		-0.23 [-0.93,0.48]		-0.05 [-1.13,1.03]	
Weight	SS	88.17 (23.50)	-0.34 [-1.00,0.33]	NS	-0.16 [-1.12,0.81]	NS	-0.61 [-1.93,0.72]	NS
	MM	93.73 (24.17)	0.09 [-0.41,0.59]		-0.47 [-2.29,1.34]		-0.40 [-2.53,1.72]	

Within group statistical significance indicated by bold face asterisks: *p<0.05, **p<0.01, ***p<0.001

SS= SIPsmartER condition; MM=MoveMore condition; SSB=Sugar-sweetened beverages; PA= Physical Activity; MVPA=Moderate-Vigorous Physical Activity.

[a] Intention-to-treat uses last observation carried forward imputation procedure

[b] Models are controlled for baseline covariates including age, gender, race/ethnicity, income, education level, health literacy level, employment status, number of children, smoking status, and BMI. Change scores and 95% confidence intervals are adjusted for covariates.

[c] Means (Standard Deviations) are not adjusted for covariates.

[d] p-value for between group differences

[e] Baseline to 18 Month ITT uses baseline observation carried forward to 18 months.

[f] SIPsmartER primary outcome.

[g] MoveMore primary outcome

Table 4-4. Changes in primary outcomes by maintenance assignment in SIPsmartER and MoveMore (present at follow-up).

	SIPsmartER Mean (SD)			MoveMore Mean (SD)			T-Test (p-value)			
	IVR n=32 (1)	Live n=32 (2)	Control n=19 (3)	IVR n=36 (4)	Live n=32 (5)	Control n=18 (6)	(1) vs. (3)	(2) vs. (3)	(4) vs. (6)	(5) vs. (6)
Change 6 to 18 months [a]										
SSB, kcals [b]	-32.8 (186.2)	-9.1 (278.5)	42.0 (87.7)	-2.3 (240.3)	34.2 (208.1)	-50.9 (314.1)	.112	.425	.617	.361
MVPA, minutes [c]	26.7 (171.9)	-55.9 (289.2)	62.0 (80.9)	-30.0 (130.2)	10.4 (134.1)	-42.5 (63.7)	.357	.168	.702	.099
PA, strength training total minutes [d]	5.4 (29.7)	1.7 (11.8)	-3.3 (26.1)	-25.0 (46.6)	-17.2 (42.2)	-2.5 (8.7)	.350	.448	.029	.099
BMI [e]	.20 (1.7)	.26 (2.1)	-.33 (1.6)	.48 (1.6)	-.70 (2.4)	-.83 (5.6)	.328	.323	.503	.944
Weight, Kg [f]	.49 (4.4)	.10 (4.4)	-.93 (4.5)	1.5 (4.5)	-1.9 (6.6)	-1.8 (13.3)	.296	.482	.476	.980
Change 0 to 18 months [g]										
SSB, kcals [h]	-294.4 (321.7)	-270.9 (338.1)	-180.3 (501.7)	-3.9 (258.3)	-85.3 (202.3)	-231.6 (251.4)	.431	.502	.018	.070
MVPA, minutes [i]	53.5 (189.3)	6.0 (116.7)	28.5 (207.6)	16.0 (155.8)	19.1 (150.7)	-53.3 (146.4)	.697	.697	.132	.162
PA, strength training total minutes [j]	-6.7 (42.7)	1.8 (15.9)	-1.8 (29.4)	10.8 (22.0)	2.2 (41.7)	0.0 (0.0)	.680	.652	.030	.856
BMI [k]	-.15 (2.2)	-.31 (2.3)	-.19 (1.6)	.35 (1.8)	-.56 (2.6)	-.13 (6.0)	.951	.849	.794	.797
Weight, Kg [l]	-.42 (6.2)	-1.3 (4.6)	-.54 (4.4)	1.1 (5.3)	-2.5 (6.4)	.13 (14.4)	.925	.591	.839	.568

SS= SIPsmartER condition; MM=MoveMore condition; SSB=Sugar-sweetened beverages; PA= Physical Activity; MVPA=Moderate-Vigorous Physical Activity.

[a] Analysis performed on participants with both 6 and 18 month data

[b] SS, IVR n=27, Live n=23, Control n=17; MM IVR n=29, Live n=26, Control n=12; differential response due to missing data

[c] SS, IVR n=24, Live n=23, Control n=15; MM IVR n=28, Live n=26, Control n=12; differential response due to missing data

[d] SS, IVR n=26, Live n=23, Control n=15; MM IVR n=28, Live n=26, Control n=12; differential response due to missing data

[e] SS, IVR n=24, Live n=23, Control n=15; MM IVR n=26, Live n=26, Control n=12; differential response due to missing data

[f] SS, IVR n=24, Live n=23, Control n=15; MM IVR n=26, Live n=26, Control n=12; differential response due to missing data

[g] Analysis performed on participants with baseline and 18-month data

[h] SS, IVR n=25, Live n=23, Control n=17; MM IVR n=29, Live n=26, Control n=12; differential response due to missing data

[i] SS, IVR n=27, Live n=24, Control n=17; MM IVR n=30, Live n=27, Control n=12; differential response due to missing data

[j] SS, IVR n=27, Live n=24, Control n=17; MM IVR n=30, Live n=27, Control n=12; differential response due to missing data

[k] SS, IVR n=25, Live n=24, Control n=17; MM IVR n=28, Live n=26, Control n=12; differential response due to missing data

[l] SS, IVR n=25, Live n=24, Control n=17; MM IVR n=28, Live n=27, Control n=12; differential response due to missing data

Table 4-5. Adjusted Change in primary outcomes at 6 and 18-months by treatment condition, present at follow-up (n=130). (Supplemental table, results not reported in manuscript)

Present at follow-up analysis [ab]								
		Baseline[c] Mean	Δ, baseline to 6 months [b]	p-value[d]	Δ, 6 to 18 months [b]	p-value[d]	Δ, baseline to 18 months [b]	p-value[d]
SSB, kcals[e]	SS	440 (331)	**-267.04**** [-434.85,-99.23]	**p<0.05**	-6.85 [-40.44,26.73]	NS	**-273.89***** [-412.40,135.39]	**p<0.05**
	MM	390 (307)	**-68.96*** [-129.68,-8.24]		2.83 [-50.70,56.36]		-66.13 [-139.18,6.92]	
MVPA, minutes[f]	SS	60 (124)	-12.19 [-48.71,24.33]	NS	4.92 [-1.96,11.80]	**p<0.05**	-7.27 [-47.69,33.16]	NS
	MM	72 (132)	-14.02 [-44.77,16.73]		-6.74 [-16.25,2.77]		-20.76 [-55.77,14.25]	
Strength Training PA, minutes[f]	SS	11 (51)	-4.61 [-14.78,5.56]	**p<0.001**	2.02 [-3.19,7.22]	**p<0.001**	-2.59 [-9.42,4.23]	NS
	MM	3 (23)	**23.00**** [8.44,37.56]		**-17.85***** [-28.29,-7.41]		5.15 [-0.41,10.71]	
BMI	SS	32 (8)	**-0.31*** [-0.57,-0.05]	NS	0.09 [-0.50,0.69]	NS	-0.22 [-1.02,0.58]	NS
	MM	34 (10)	0.20 [-0.21,0.61]		-0.25 [-1.19,0.69]		-0.05 [-1.13,1.03]	
Weight	SS	86.60 (21.45)	-0.60 [-1.40,0.19]	NS	0.00 [-1.33,1.33]	NS	-0.60 [-2.37,1.16]	NS
	MM	93.38 (25.44)	0.10 [-0.68,0.87]		-0.48 [-2.89,1.93]		-0.38 [-3.20,2.43]	

Within group statistical significance indicated by bold face asterisks: *p<0.05, **p<0.01, ***p<0.001

SS= SIPsmartER; MM=MoveMore ; SSB=Sugar-sweetened beverages; PA= Physical Activity; MVPA=Moderate-Vigorous Physical Activity.

[a] Present at follow-up analysis includes all participants with available data at baseline, 6 and 18-months

[b] Models are controlled for baseline covariates including age, gender, race/ethnicity, income, education level, health literacy level, employment status, number of children, smoking status, and BMI. Change scores and 95% confidence intervals are adjusted for covariates.

[c] Means (Standard Deviations) are not adjusted for covariates.

[d] p-value for between group differences

[e] SIPsmartER primary outcome.

[f] MoveMore primary outcome.

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Chapter 5

Exploring the relationship between social capital and obesity-related health behaviors in a health disparate region

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Abstract

A growing number of studies on social capital and health have found high social capital to be associated with increased physical activity and fruit and vegetable (FV) intake, and lower levels of obesity. Historically, rural areas are thought to possess more social capital than urban places, however rural residents are at increased risk of obesity, eating an unhealthy diet and not meeting physical activity recommendation. The primary aim of this study was to describe current levels of social capital and examine the influence of social capital on BMI, FV consumption, physical activity, and sugary beverage intake on a sample of rural and urban adults in the Dan River Region. As part of a larger telephone surveillance survey conducted in south central Virginia to collect data on behavioral (e.g. physical activity, nutrition) and social factors (e.g. social capital) related to obesity, a total of 784 participants completed a telephone survey, including 73% from rural areas. Mean social capital in the study area was 4.0 ± .92 on a 5-point scale. Urban residents reported significantly lower levels of social capital compared to their rural counterparts (3.8 ± 1.0 vs 4.1 ± .87; p=0.002). Overall, social capital scores significantly differed by education, income and employment status. Those with less education reported significantly lower social capital than those with more education (3.8 ± .98 vs 4.1 ± .86; p=.001), those making less than $20,000 reported lower social capital than participants with higher income, (3.7 ± 1.1 vs. 4.2 ± .70; $p < .001$), and those unable to work reported lower social capital than those employed or retired (3.7 ± 1.1 vs. 4.0 ± .85; p=.003). When controlling for covariates and residency, social capital did not predict BMI, fruit and vegetable intake or physical activity. Social capital did predict sugary beverage intake $R^2= .097$, $F(10, 743)=8.02$, $p<.001$. A one-point increase in social capital was related to a 44 kcal decrease in sugary beverages. This study supports the hypothesis that social capital is higher in rural areas, but did not confirm past studies linking higher social capital to reduced BMI and healthy behaviors, with the exception of sugary beverages. This is the first study to describe the current levels of social capital in the Dan River Region and to find an association between social capital and sugary beverage consumption. The high levels of social capital in this community could be leveraged by the DRPHC to coordinate and facilitate effective community-based health programming in the region.

Background

Nationally, more than two-thirds of adults are overweight or obese [1]. Research shows that weight categorized as overweight and obese increase the risk for many conditions including coronary heart disease, type 2 diabetes, certain types of cancers, hypertension, dyslipidemia, stroke, liver and gallbladder disease, sleep apnea and respiratory issues [2]. Moreover increased sugar sweetened beverage (SSB) consumption, inadequate fruit and vegetable (FV) intake and physical inactivity are all positively associated with increased body weight and risk of obesity [3-7]. Prior studies have identified individual demographic and socioeconomic factors as determinants associated with obesity, excess SSB consumption, inadequate FV intake, and decreased physical activity. These individual associations include age, gender, race, educational attainment, employment status and income [6, 8-15].

The ecological perspective recognizes health behavior has both individual and environmental determinants [16]. Two factors known to influence obesity, diet and physical activity patterns at the community level are place of residence (urban vs. rural) and social capital. Research has shown that rural residents are at increased risk of obesity, eating an unhealthy diet and not meeting physical activity recommendation [6, 17, 18]. This is partly explained by lack of access to healthy food options and opportunities for physical activity [19, 20]. Rural residents are typically poorer, less educated, older and have lower access to health care services than those living in urban areas [21, 22].

Social capital has been defined as the "features of social structures- such as levels of interpersonal trust and norms of reciprocity and mutual aid- which act as resources for individuals and facilitate collective action" [23, 24]. There is a growing amount of evidence associating social capital with various indicators of health. Kawachi et al reported ecologic associations between social capital and mortality in 39 US states; lower levels of social trust were associated with associated with higher rates of most major causes of death [25]. Holtgrave and Crosby conducted a state-level correlational analysis and found greater levels of social capital are protective against obesity and diabetes [26]. Kim et al. also found state level social capital to be modestly protective against obesity and physical inactivity [27]. At the individual level, studies examining social capital and specific health behaviors are starting to emerge. Addy et al. found indicators of social capital to be positively associated with increased levels of physical activity [28, 29]. Poortinga found a relationship between social support, social capital

and daily fruit and vegetable consumption [30]. Participants who lacked social support were less likely to consume 2-5 servings of FV daily and individuals with higher levels of social capital on the community level were more likely to consume 2-5 servings of fruit and vegetables daily.

Social capital has been found to influence health behaviors through direct and indirect mechanisms such as promoting rapid diffusion of health information, exerting social control over different health behaviors [24], and improving access to health services [31]. Trust, reciprocity and cooperation have emerged as important components of social capital and serve as a dominant metric for individual-level social capital [24, 32]. Despite being associated with poorer health, rural areas are generally thought of as being endowed with higher levels of social capital than urban places [33, 34]. Several contemporary studies have examined rural-urban differences in social capital [33, 35-39]; however the results are mixed. Understanding trust, reciprocity and cooperation, important components of social capital and factors influencing collective action, can help public health researchers increase the effectiveness of community-based health promotion [40]. However, there is little practical research on social capital in small, rural areas[39, 41].

The Dan River Partnership for a Healthy Community (DRPHC) is a community academic partnership operating under community-based participatory research principles in the health disparate Dan River Region (DRR) [42, 43]. The vision of the coalition is "to promote an environment that supports opportunities for all Dan River Region residents to make healthy food choices and to be physically active in order to achieve or maintain a healthy weight" [44]. To support and strengthen community-created causal models for obesity [42] and initiatives by the DRPHC, the need for locally generated surveillance data on health outcomes and behavioral factors related to obesity was identified as a priority. Therefore, the primary aim of the current study is to describe current levels of social capital in the Dan River Region by socio-demographic variables and area of residence (urban vs. rural). A secondary aim is to determine if social capital is associated with obesity and obesity-related health behaviors while accounting for sociodemographic characteristics and geographic location.

Methods

All study activities were approved by Virginia Tech IRB and survey participants provided verbal informed consent prior to completing study activities.

Study Area

The Dan River Region is a medically under-served area/population (MUA/MUP) located in south central Virginia and north central North Carolina [45]. The region is comprised of three counties, all designated rural by the USDA Rural Urban Community Area Codes (RUCAs) [46]. Within the three rural counties exists a mid-size regional city and another nearby town. More than half of the residents of the three counties (84,000 out of 137,000) live outside of the city and town, further away from regional resources including healthcare, retail outlets, institutions of higher education and larger employees. For the purpose of this study, we define urban residents as those who live within the city limits of the regional city and residents who live outside the city/town limits are classified as rural. The Dan River Region is also educationally and economically disadvantaged compared to other areas in the Commonwealth [47, 48].

Sampling

A professional survey unit was contracted to conduct a telephone survey of the residents in the Dan River Region utilizing listed and unlisted landline and cellular phone numbers. A random proportional sampling frame was created based on the three counties and the two urban areas. Completion of the survey took approximately 25 minutes and all participants received a $20 gift card. A detailed description of the sampling procedure is provided elsewhere [49].

Survey development

Modeled after the 2011 Behavioral Risk Factor Surveillance System (BRFSS), the telephone survey comprised of ten modules [50]. The survey modules reported in this study include fruit and vegetables, exercise (physical activity), sugary beverage intake, social capital and socio-demographics. The survey unit conducted a pre-test within the region (n=22). Feedback from the pilot test resulted in minor adaptions to the wording and detailed instructions and clarifications for the survey unit. Results from the pilot test were not significantly different than the full sample therefore the pilot respondents are included for analyses.

Measurements

BMI was calculated from self-reported height and weight converted to kg/m2. Normal weight is categorized as BMI=18.5-24.9, overweight is BMI=25.0-29.9, and obese is BMI=>30 [51].

For behavioral outcomes, a variety of previously validated survey tools were identified. All were appropriate for population-based surveillance and telephone surveys. The valid and reliable National Cancer Institute Fruit and Vegetable screener measured FV intake [52]. For fruit intake, two items asked how often the participant drank 100% fruit juice or ate any kind of fruit. For vegetable intake, four items assessed how often the respondent ate beans, dark green vegetables, orange-colored vegetables or other vegetables. The items assessing fried potatoes, white potatoes and tomato sauce were not used. Participants reported how many times per day, week or month they consumed each FV. Summary scores were calculated by converting all response categories to times per day and then averaging across items. Both fruit and vegetable intake is reported as mean servings/day.

Self-reported physical activity was measured using the valid and reliable Godin-Shepard leisure time exercise questionnaire [53]. Participants were asked about time spent being physically active in the last 7 days. The number of times participating and the number of minutes per time participating were recorded for 4 different types of activities: strenuous or vigorous, moderate, and mild activity and strength training. The measure was scored using published protocols. Physical activity is scored as minutes/week.

The valid and reliable BEVQ is a 15-item beverage questionnaire designed to estimate an individual's consumption of water, sugar-sweetened beverages (SSB) and total beverage intake, including alcoholic beverages (fl oz and energy in kilocalories) [54]. Participants responded with frequency of consumption and portion size for each type of beverage. Survey administrators used the following prompts for beverage portion descriptors: less than 6 fl oz (3/4 cup), for example the size of a small juice box or juice glass; 8 fl oz (1 cup), for example the size of a school milk cartoon; 12 fl oz (1.5cups), for example the size of a regular can of soda; 16 fl oz (2 cups); more than 20 fl oz (2.5 cups). The questionnaire was scored using published protocols and beverages are reported as fluid ounces/day.

Social capital was measured using the 5-item "social cohesion and trust" subscale from the Project on Human Development in Chicago Neighborhoods (PHDCN) [31]. Using a 5-point Likert Scale (e.g, "1" as strong disagree", "2" as somewhat disagree, "3" as neutral, "4" as somewhat agree, "5" as strongly agree"), participants were asked how strongly they agreed that: "people around here are willing to help their neighbors," "I live in a close-knit neighborhood," "People in my neighborhood can be trusted," "People in my neighborhood generally don't get

along with each other," and "People in this neighborhood do not share the same values". Single items were scored (the last two statements were reverse coded) and summed across the 5 items. Mean scores were created for participants with data for 3 or more items. A higher score indicates higher or more positive perceptions of neighborhood social capital.

To control for location and personal variables, socio-demographic information related to age, gender, race, education, income, employment and marital status were collected. Categorical variables were collapsed to eliminate empty cells for analyses.

Statistical analysis

SPSS 22.0 was used to generate descriptive statistics including frequencies, means, and standard deviations for the covariates, independent and dependent variables; $p < .05$ was considered statistically significant. One-way ANOVA and chi-square were used to test for differences by socio-demographics and residency. Linear regression models were used to test the predictive value of social capital for continuous outcomes of FV, PA, SSB and BMI. The researchers used purposeful selection methods for linear regression to enter and test potential covariates for the regression models. In this approach, potential covariates are retained in the model if univariate tests are significant at $p<.25$ [55]. These variables were then tested in multivariate models including a check for confounding among covariates. Covariates that were common across three or more outcome variables and that remained in the multiple linear models included gender, race, educational and employment status. Age, marital status and residency were not significant covariates in at least three of the outcome models and were not included in the models. A second model controlled for covariates and residency. All models presented in Table 2 included coefficients adjusted for covariates and significance level stet at $p<.05$.

Results

A total of 784 participants completed the telephone survey (77% response rate). **Table 1** lists descriptive characteristics of the study sample. Mean age was 60 (±15.4 years), 73% of respondents were female, 76% white, and 34% reported income below $20,000. Most of the sample did not graduate college. Thirty-six percent were employed, over half the sample was married or living with a partner and 73% lived in a rural residence. There were significant differences between socio-demographic characteristics by rural or urban residency for race, income, employment and marital status, and social capital. Compared to the urban sample, the

rural sample had a significantly higher proportion of white (p=.002), employed (p=.01), and married participants (p=.001) and a lower proportion of participants with an income below $20,000 (p=.004).

Social Capital

Mean social capital was 4.0 ± .92 on a 5-point scale (**Table 1**). Urban residents reported significantly lower levels of social capital compared to their rural counterparts (3.8 ± 1.0 vs 4.1 ± .87; p=0.002).

For the combined sample, social capital scores significantly differed by education, income and employment status. Those with less than high school or a high school education reported significantly lower social capital than those with more education (3.8 ± .98 vs 4.1 ± .86; p=.001). Compared to participants with higher income, those making less than $20,000 reported lower social capital (4.2 ± .70 vs 3.7 ± 1.1; p < .000). Lastly, compared to employed and retired participants, those unable to work reported lower social capital (4.0 ± .85 vs 3.7 ± 1.1; p=.003).

In the urban sample, social capital differed significantly by gender and income. Females reported higher social capital than males (3.9 ± 1.0 vs. 3.6 ± .86; p=.02) and those making less than $20,000 reported lower levels of social capital than higher incomes (3.5 ± 1.1 vs 3.9 ± 1.1; p=.008). Like the combined sample, social capital of the rural sample differed significantly by education, income and employment. Those with a high school education or less reported less social capital than those with more education (3.8 ± .99 vs 4.1 ± .76; p < .000). Participants with higher income reported more social capital than those making less than $20,000 (4.1± .85 vs 3.9 ± 1.1; p = .004). Lastly, compared to retired participants, those unable to work reported lower social capital (4.1 ± .79 vs 3.7 ± 1.1; p=.007).

Health Outcomes

The average BMI was 29.1 ± 5.8. Participants ages 18-35, white and retired reported lower BMI. The mean intake of FV was 2.9 ± 2.6 cups/day. Females and college educated consumed more FV. The average minutes of moderate-to-vigorous physical activity (MVPA) per week was 127 ± 182. Males, college educated, higher income, employed and married or living with a partner reported more MVPA. Mean intake of SSB was 18.6 ± 22.0 fluid ounces and 234.0 ± 282.2 kcals. Participants over the age of 55, female, retired and widowed consumed less SSB. There were no significant differences in health outcomes between urban and rural

participants.

Prediction of health behavior and outcomes by social capital

Results from regression models are reported in **Table 2** for the combined urban and rural groups for the health outcomes of interest. The BMI model, R^2=.066, F(10, 715) = 5.08, p <.000, indicate that after controlling for demographic covariates (model 1), social capital did not predict BMI. Likewise in the FV model, R^2=.031, F(10, 743) = 2.34, p=.01, social capital did not predict FV intake. In the MVPA model, R^2=.057, F(10, 740) = 4.50, p <.000, social capital did not predict MVPA. Lastly, in both SSB models (fluid oz and kcal), R^2=.098, F(10, 743) = 8.07, p <.000 and R^2= .097, F(10, 743)=8.02, p<.000 social capital did predict SSB fluid ounces and kcal. A significant inverse relationship was detected between social capital and SSB (p <.000). A one-point increase in social capital was related to a 3.6 fluid ounce and 44 kcal decrease in SSB.

A similar pattern of relationships between health outcomes and social capital was observed when controlling for residency (model 2) in addition to covariates. The BMI model, R^2=.067, F(11, 714) = 4.63, p <.000 suggested that after controlling for demographic covariates and residency, social capital did not predict BMI. Likewise, in the FV model, R^2=.031, F(11, 742) = 2.15, p =.02, social capital did not predict FV intake. Next, in the MVPA model, R^2=.057, F(11, 739) = 4.08, p <.000, social capital did not predict MVPA. Lastly, in the SSB models (fluid oz and kcal), R^2=.099, F(11, 742) = 7.37, p <.000, R^2= .098, F(11, 742)=7.33, p<.000 social capital did predict SSB fluid ounces and kcal. A significant inverse relationship was detected between social capital and SSB (p <.000). A one-point increase in social capital was related to a 3.7 fluid ounce and 45 kcal decrease in SSB.

Discussion

Rural residents and Americans in general are at increased risk of being overweight or obese [6, 21]. Health behaviors such as inadequate FV intake, physical inactivity and increased SSB consumption are all positively associated with increased body weight and risk of obesity [5, 7, 56]. There has been numerous approaches to understanding the determinants of obesity and obesity-related health behaviors, although there is little research investigating the association between individual level social capital and obesity and obesity-related health behaviors in small, rural, health disparate areas. The present paper describes current levels of social capital in the Dan River Region and examines the influence of social capital on BMI, FV consumption, MVPA

and SSB intake on a sample of rural and urban adults to contribute new findings to the literature on social capital and obesity and obesity related health behaviors. Our study contributes to the small number of studies that have analyzed social capital between rural and urban areas, examined associations between social capital and BMI, FV intake, and physical activity, and we are the first to examine the association between social capital and SSB intake.

This analysis found that social capital differed by residency. Rural residents reported higher mean levels of social capital as compared to urban residents. Only a few contemporary studies have examined rural-urban differences in social capital. Robert Putnam, in his book, *Bowling Alone—The Collapse and Revival of American Community [33]* concluded that "smaller is better from a social capital point of view" (p. 205). He used associational activity as a proxy for social capital and found larger metropolitan areas had fewer people participating in groups, clubs and local organizations. Using various measure of trust as a proxy for social capital, Onyx and Bullen [36] and Ziersch [35] found higher levels of social capital in rural areas as compared to urban areas in Australia. Conversely, Sorensen [37] and Dean and Sharkey [39] did not find evidence supporting higher social capital in rural areas. Sorensen used four social capital measures: association membership, social trust, institutional trust and voluntary associational work and found the first three measures of social capital were equally high in rural and urban areas, but voluntary associational work was higher in rural areas of Denmark [37]. Dean and Sharkey measured the extra-familial support dimension of social capital and found mean levels of social capital were slightly higher in urban area rather than rural areas of Central Texas. Our measure of social capital focused on social cohesion and trust and confirms the findings of Putnam, Onyx and Bullen, and Ziersch.

Our finding that higher social capital is associated with more education is well supported in the current literature[33, 37, 38, 57]. Furthermore, Sorensen found social capital to be significantly correlated with education, job status and income when using social trust as an indicator of social capital [37], a finding that is confirmed in our study.

Over the past ten years, support for the association between higher social capital and more positive health behaviors such as FV intake and physical activity has emerged, however our study did not confirm these associations [28, 30, 41]. A prior analysis of the demographic and socioeconomic predictors of FV intake and physical activity of participants in this study found those with higher education were more likely to consume more FV and engage in PA [49].

Women were found to consume more FV, but were less likely to participate in PA. Additionally, our failure to find an association between social capital and BMI seems to be in contrast to the findings of Holtgrave and Crosby [26] and Kim et al. [27] who both found an association between state level social capital and obesity in the United States. However Kim et al. did not find the same significant association at the county level and Holtgrave and Crosby were unable to capture social capital at the county level. Although support for our finding is found in the study by Moore et al. who found an association between *network* social capital and obesity, but not between obesity and social capital measured as individual trust. Lastly, our study did find that social capital predicted SSB intake-- for every one-point increase in social capital, a 3.6 fluid once and 44 kcal decrease in SSB was found. To our knowledge, this is the first study to find social capital to be a predictor of sugary beverage intake.

These results should be considered in light of several limitations. First, the study is cross-sectional; therefore no causal inferences can be drawn between social capital and the health outcomes presented in this paper. Recruitment efforts sought a representative sample for the Dan River Region population; which may affect generalizability of findings to other rural regions. This study relies on self-reported data, which could contribute to measurement error. Lastly, lack of conceptual and theoretical frameworks for social capital are often cited criticism and our study did not attempt to address those underlying issues in the measurement of social capital. We did use one of the most common measure of social capital in the literature, which allows us to compare to similar studies but not to others. Nevertheless, this study contributes unique findings related to associations of social capital and health behaviors in a rural, health disparate population.

Conclusions

In conclusion, as far as we are aware, this is the first study to describe the current levels of social capital in the Dan River Region and to find an association between social capital and sugary beverage consumption. Despite the high prevalence of obesity coupled with the low prevalence of healthy behaviors in the region, overall levels of social capital are high, especially when compared to other studies on social capital. Putnam defined social capital as those "feature of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" [23]. This definition of social capital recognizes trust as a prerequisite for coordination/cooperation. The high levels of trust in this community could

be leveraged by the DRPHC to coordinate and facilitate effective community-based health programming in the region. Specifically, special efforts to offer programs in venues that are deemed safe and by personnel who share the same values with the target audience should be made when reaching out to vulnerable segments of the region's population such as those with disabilities and low levels of education and income. These data will be disseminated to key stakeholders in the Dan River Region through established partnerships of the DRPHC with the intent of enhancing the effectiveness of the community programs delivered in the area.

Table 5-1. Socio-demographic characteristics, social capital and health outcomes for combined, urban and rural samples.

Variable	**Total sample** **N=784**	**Urban** **N=210**	**Rural** **N=574**	**P-value***
Personal characteristics				
Age, M±SD	59.6 ± 15.4	60.9± 14.7	59.1 ± 15.6	0.14
Gender	n(%)	n(%)	n(%)	
Male	210 (27)	54 (26)	157 (27)	.36
Female	574 (73)	156 (74)	417 (73)	
Race				
White	578 (76)	137 (67)	441 (78)	.002
Blacks/other	188 (24)	66 (33)	137 (22)	
Education				
< high school	119 (15)	30 (14)	89 (16)	.65
High school graduate or GED	274 (35)	72 (34)	202 (35)	
Some college	245 (31)	63 (30)	182 (32)	
College Graduate or higher	145 (19)	45 (22)	100 (17)	
Household Income				
<$20,000	221 (34)	75 (44)	146 (30)	.004
$20,000-$50,000	257 (39)	54 (32)	203 (42)	
>$50,000	178 (27)	42 (24)	136 (28)	
Employment Status				
Employed	277 (36)	69 (33)	208 (36)	.01
Unemployed	63(8)	13 (6)	50 (9)	
Homemaker/Student	58 (8)	13 (6)	45 (8)	
Retired	301(39)	78 (38)	223 (39)	
Unable to work	79 (10)	34 (16)	45 (8)	
Marital Status				
Married or living w partner	443 (56)	99 (48)	344 (60)	.001
Divorced or separated	135 (18)	35 (17)	100 (18)	
Widowed	121 (15)	41 (20)	80 (14)	
Never married	78 (10)	32 (15)	46 (8)	
Social Environment				
Social Capital, M±SD	4.0 ± .92	3.8 ± 1.0	4.1 ± .87	.002
Health Outcomes				
FV M±SD cups/day	2.9 ± 2.6	2.8 ± 1.9	2.9 ± 2.8	.66
PA, M±SD Minutes of moderate-vigorous activity/week	129.8 ± 182.4	122.4 ± 181.7	132.5 ±182.7	.49
SSB, M±SD fluid oz	18.6 ± 22.0	17.9 ± 21.3	18.8 ± 22.3	.61
SSB, M±SD kcal	234.0 ± 282.2	224.6 ± 268.7	237.4 ± 287.1	.57
BMI	28.5 ± 5.8	29.0 ± 6.8	28.3 ± 5.3	.11

*ANOVA test or χ 2 used to determine if differences exist based on rural or urban residency

Table 5-2. Demographic, residency and social capital associations with BMI, FV intake (cups/day), minutes of MVPA, and fluid uunces and Kcal of SSB intake (n=784).

	Model 1: Demographics and Social Capital					**Model 2: Demographics, Residency and Social Capital**				
	BMI β (SE)	**F/V β (SE)**	**MVPA β (SE)**	**SSB fl oz β (SE)**	**SSB kcal β (SE)**	**BMI β (SE)**	**F/V β (SE)**	**MVPA β (SE)**	**SSB fl oz β (SE)**	**SSB kcal β (SE)**
Female	-.70 (.46)	0.53 (.22)*	-54.38 (15.10)***	-6.21 (1.76)***	-80.51 (22.58)***	-.70 (.46)	0.53 (.22)*	-54.37 (15.10)***	-6.20 (1.76)***	-80.43 (22.57)***
White	-2.59 (.48)***	-.13 (.22)	18.79 (15.71)	4.00 (1.83)*	46.93 (23.47)*	-2.57 (.49)***	-.15 (.34)	18.54 (15.82)	3.86 (1.85)*	45.00 (23.63)
Education (reference: college)										
<High School	1.04 (.74)	.905 (.34)**	-57.58 (23.62)*	.14 (2.76)	7.99 (35.39)	1.07 (.74)	-.92 (.34)**	-57.80 (23.69)*	.009 (2.77)	6.20 (35.49)
High School/GED	.51 (.60)	-.582 (.28)*	-13.19 (19.37)	-1.11 (2.27)	-11.45 (29.15)	.53 (.60)	.60 (.28)*	-13.38 (19.42)	-1.22 (2.27)	-12.96 (29.10)
Some college	.91 (.60)	-.231 (.28)	-10.44 (19.51)	-.93 (2.3)	-14.93 (29.15)	.93 (.60)	-.24 (.28)	-10.56 (19.54)	-1.00 (2.30)	-15.94 (29.20)
Employment (reference: employed)										
Unemployed	-.45 (80)	-.331 (.37)	-40.94 (25.93)	3.59 (3.03)	37.76 (38.83)	-.44 (80)	-.34 (.37)	-41.06 (25.96)	3.53 (3.03)	36.85 (38.87)
Student/homemaker	-1.21 (.84)	.399 (.38)	1.11 (26.78)	-.32 (3.13)	-5.01 (40.10)	-1.21 (.84)	.40 (.38)	1.08 (26.80)	-.33 (3.13)	-5.22 (40.11)
Retired	-.47 (.48)	.074 (.22)	-50.30 (15.67) **	-8.58 (1.82)***	-114.18 (23.40)***	-.48 (.48)	.078 (.22)	-50.21 (15.68) **	-8.53 (1.82)***	-113.50 (23.42)***
Disabled	.96 (.76)	-.393 (.35)	-57.82 (24.43) **	3.07 (2.86)	38.41 (36.58)	.92 (.76)	-.38 (.35)	-57.47 (24.57) *	3.27 (2.87)	41.14 (36.78)
Residence (urban)						.22 (.47)	-.10 (.22)	-2.11 (15.22)	-1.20 (1.78)	-16.62 (22.77)
Social Capital	-.43 (.23)	0.06 (.10)	8.98 (7.23)	-3.60 (.85)***	-44.21 (10.92)***	-.42 (.23)	0.06 (.11)	8.87 (7.35)	-3.67 (.86)***	-45.09 (11.0)***

* p<.05; ** p<.01; *** p<.001

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Chapter 6

Summary and Conclusions

Both the southwest and south central areas of Virginia, two predominantly rural regions, are burdened with educational, economic, and health disparities. Rural populations in Virginia and throughout the U.S. are more likely than their urban counterparts to be overweight, physically inactive and to consume sugar sweetened beverages, behaviors that contribute to health disparities such as chronic disease incidence [1-3]. Finding effective ways to understand and intervene on factors related to health disparities remains a significant problem in public health [4]. Factors beyond the individual, directly or indirectly, play a role in determining individual health through both the physical and social environment. These factors are known as the social determinants of health (SDOH) and Healthy People 2020 recognizes five key areas of SDOH: economic stability, education, health and health care, neighborhood and built environment, and the social and community context[5].

Social determinants play a key role in health disparities and in a seminal article by Link and Phelan they argue we need to examine what puts people at "risk of risks" to develop effective interventions [6]. Modest changes in health behavior can be achieved with theory-based interventions, but it is less clear if the behavior will be sustained or result in population-level health improvements [7]. Critics argue interventions studies do not account for the social context that shapes behaviors[8]. The social ecological model (SEM) integrates the multiple levels of influence, including intra- and interpersonal factors, community and organizational factors and public policies to provide a comprehensive framework to understand the determinants of health and health-related behaviors [9]. The overarching goal of this research was to use the SEM to explore two factors influencing health disparities, health literacy and social capital, in the southwest and south central areas of Virginia. This research sought to understand the impact of health literacy, an intrapersonal factor, on participant satisfaction with a behavioral intervention designed to reduce sugary beverage consumption as well as social capital, a community level factor, on obesity and obesity-related behaviors.

The first study included a sample of 155 rural participants including 34% with a high school education or less and 66% with an annual income of less than $25,000. We found both low health literacy and high health literacy participants were satisfied with all components of SIPsmartER (i.e. small group classes, IVR calls, personalized action plans and self monitoring logs). SIPsmartER was designed using a health literacy universal precautions approach, which assumes all participants have difficulty comprehending health information. Participation rates in the small group classes, teach back call, and IVR calls were similar across low and high health literacy groups. Both groups reported high satisfaction ratings across all components and the qualitative analysis corroborated the quantitative findings. The findings from this study also align with the SSB reduction findings from the trial—both low and high literacy groups achieved equitable reductions in SSB consumption [10]. Overall this study provides evidence that efforts to improve participant understanding of health information can provide benefits to low and high health literacy participants. Using a health literacy universal precautions approach to design behavioral interventions in rural, low-income areas is a promising strategy to improve a health behavior that contributes to obesity and obesity-related health disparities. Results of the summative evaluation can guide future program improvements. Future studies are needed to explore how satisfaction influences health behavior outcomes. This would provide more direction for intervention development to promote decreased intake of sugary beverages.

Expanding on the first study, the second study focused on the long-term effects of SIPsmartER and MoveMore, also known as behavior maintenance. An important finding from this study was that at 18-months, SIPsmartER participants sustained a reduction in SSB intake as compared to their baseline measures. Sustaining health-promoting behaviors in the long term is essential to decrease the risk of chronic disease in rural populations. This study also found that the maintenance intervention reached a similar participant profile as the Talking Health trial with the exception that maintenance enrollees were older and less likely to be Hispanic. This study confirmed that those with less income and education were being reached by the maintenance intervention. Contrary to the research hypotheses, call completion rates and 18-month attendance did not differ between theory-based and control calls for both SIPsmartER and MoveMore. Health outcomes did not differ between the intervention groups and control group for SIPsmartER and only one difference was found for MoveMore. The IVR group significantly increased strength-training minutes as compared to the control group from baseline to 18-

months. MoveMore participants did not sustain increased physical activity levels at 18-months as compared to their baseline measures. This study suggests that SIPsmartER, an intervention integrating behavioral theory and health literacy concepts results in a sustained reduction in SSB intake in rural adults. Future studies with enough statistical power to utilize advanced statistical methods to determine the impact of delivery mode on effects, retention and engagement would be helpful. IVR phone calls targeting health behavior change and maintenance have the capacity for low-cost broad population reach in rural populations, however it is unclear from the current analysis if the effectiveness of the phone calls are impacted by delivery mode (IVR vs. Live). A summative evaluation, similar to the one used in study 1, administered at the end of the maintenance intervention would provide additional information to understand participant perceptions of the maintenance phase and barriers to call completion. This information would provide more direction for maintenance intervention development to promote sustained decreases in sugary beverage consumption.

The third study included a sample of 784 participants including 73% rural, 50% with a high school education or less and 34% with an annual income of less than $20,000. The study focused on social capital in the Dan River Region and its relationship to obesity and obesity-related health behaviors. This study described the amount of social capital in the region and examined the influence of social capital on BMI, FV consumption, physical activity, and sugary beverage intake on a sample of rural and urban adults in the Dan River Region. Rural residents reported higher levels of social capital as compared to urban. Social capital differed significantly by socioeconomic status where lower amounts of education, income and employment were associated with lower levels of social capital. This study found that a 1-point increase in social capital was related to a 44 kcal decrease in sugary beverage intake. This study did not confirm past studies linking higher social capital to reduced BMI and healthy behaviors, with the exception of sugary beverages [11-15]. Future studies may wish to examine the structural dimensions of social capital as characterized by network connections or civic engagement and its relationship with obesity and obesity-related behaviors.

In conclusion, with the goal of informing efforts to reduce the negative impact of physical inactivity, inadequate fruit and vegetable intake and SSB consumption on obesity, this research found that a health literacy based behavioral intervention designed to decrease SSB intake is acceptable to all educational levels and can result in a sustained reduction in SSB

consumption in rural adults and identified preliminary evidence suggesting social capital can predict SSB intake. Linear regression results indicate that a 1-point increase in social capital was related to a 44 kcal decrease in sugary beverage intake. These findings provide direction for designing health promotion initiatives that reduce SSB consumption. These findings point to the importance of targeted interventions that test and incorporate health literacy informed messaging and strategies not only for adults with low health literacy but also low social capital. Results pointing to the high satisfaction ratings and the sustained behavioral change in SSBs point to the importance of the use of health literacy universal precautions aimed at making the intervention content accessible to all literacy levels in community-based interventions targeting at-risk populations. While it is unknown which intervention component impacted behavior change the most, participants rated the small group classes the highest and found them to be the most motivating component of the intervention. The process data suggest if modifications are made to the intervention for dissemination, the small group classes should be retained. Furthermore, although we lack a good understanding of how to build social capital [16], the findings from this research point to the importance of targeting SSB reduction intervention efforts in settings likely to support people with low social capital.

Improving the health of vulnerable populations requires interventions that target multiple area levels of influence, in multiple settings and that utilize multiple intervention strategies [17]. As such the social ecological model can guide future research integrating health literacy, social capital and other factors impacting health disparities. To build on the results of this study, future work can expand the current findings on social capital by utilizing a mixed-methods design to examine: network social capital and its associations with obesity and obesity-related health behaviors, how residents in the rural Virginian areas define social capital, and ways best to improve it. Future implementation of SIPsmartER in an adult population could utilize measures for both health literacy and social capital to understand the relationship between theses two concepts in rural populations. SIPsmartER could be adapted and offered to school age children through organizations known to foster social capital such youth and church programs in the community. Efforts to understand the social norms surrounding SSB intake in community organizations such as churches and worksites could be made with the goal of promoting healthy beverage social norms in the community. Lastly, efforts to support policy to restrict the purchase

of SSBs with Supplemental Nutrition Assistance Program (SNAP) and to invest in the social infrastructure of neighborhoods with low social capital could be made.

Because the determinants of health disparities are complex, a full understanding of the associations between health literacy, social capital and other SDOH will require innovative intervention strategies and engagement of community members most affected by health disparities [18]. Community-based participatory research (CBPR) is one way to bring together public health researchers and community members to understand, design and implement efforts to address the SDOH. [19]. Community-based partnerships utilize ecological perspectives, build on strengths and existing resources of all parties involved and promote empowerment and mutual benefit of all participants [20] Overall, the future direction of this research needs to revolve around linking individual health behavior strategies to broader community factors such as social and physical environments within community-based partnerships[21].

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Appendix A. Talking Health Summative Evaluation

Talking Health Summative Evaluation

Well done, you have almost completed the 6-month health assessment. Now I would just like to ask you several more questions about your thoughts on the program. We are really interested in your honest opinions, including things you liked and things you didn't like about the program. Please don't think you are going to hurt our feelings, because all the information you provide will really help us evaluate the program and figure out how we can make it better for members in your community in the future.

There are five sections to this final part. I will ask you about your thoughts on the small group classes, the personal actions plans, the drink diaries/exercise logs, and the telephone calls and the resources provided.

[NOW SHOW & EXPLAIN LIKERT-SCALE HANDCARD]

Any questions before we get started?

Group classes

RECORD FROM PROCESS DATA, DO NOT ASK: Number of Classes Attended: _____

IF ATTENDED 0 CLASSES:

Sometimes it was hard for our program participant's to get to the group classes, and I noticed that you missed the classes.

1. What was the biggest barrier for you attending the group classes?

2. What could our Talking Health team have done differently increase your attendance at the group classes?

Now Skip to Question 13.

IF ATTENDED 1-3 CLASSES:

|___| 3. How satisfied were you with how the group classes were **organized**?
[USE SATISIFACTION HAND CARD]

|___| 4. How satisfied were you with the **type of information** presented in the group classes?
[USE SATISIFACTION HAND CARD]

|___| 5. How satisfied were you with the **type of activities** presented in the group classes?
[USE SATISIFACTION HAND CARD]

6. Can you please talk to me about what you liked and disliked about the small group classes.

Probe: Anything else you liked? Anything else you disliked?

6a. Like	6 b. Dislike

IF ATTENDED 1-2 CLASSES (OR MISSED 1-2 CLASSES):
Sometimes it was hard for our program participant's to get to the group classes, and I noticed that you missed 1 or 2 classes.

7. What was the biggest barrier for you attending the group classes?

8. What could our Talking Health team have done differently increase your attendance at the group classes?

Personalized action plans

Now let's switch gears a bit and talk about the personalized action plans.

|___| 9. How satisfied were you with how the personalized actions plans were **set-up**?
[USE SATISFACTION HAND CARD]

|___| 10. *How much do you agree or disagree with the statement*: You did a good job **completing** the
personalized actions plan.
[USE AGREEMENT HAND CARD]

|___| 11. *How much do you agree or disagree with the statement:* Completing the personalized action plans were **helpful**.
[USE AGREEMENT HAND CARD]

12. Talk to me about what you liked and disliked about making the personalized action plans. Probe: Anything else you liked? Anything else you disliked?

12a. Like	12b. Dislike

Diaries/Log

You're doing great, all this information you are providing is really valuable. Now let's talk about the drink diaries/exercise logs.

|____| 13. How satisfied were you with how the drink diaries/exercise logs were **set-up**?
[USE SATISIFACTION HAND CARD]

|____| 14. *How much do you agree or disagree with the statement*: You did a good job **completing** the
drink diaries/exercise logs.
[USE AGREEMENT HAND CARD]

|____| 15. *How much do you agree or disagree with the statement*: Completing the drink diaries/exercise logs were **helpful**.
[USE AGREEMENT HAND CARD]

|____| 16. How often did you use your drink diaries/exercise logs?
[1] Did not use it at all
[2] Used it some days, but not everyday
[3] Used it everyday

IF Number 16 is '2':

|____| 16a. Did you use the drink diaries/exercise logs:
[1] more in the first half the program
[2] more in the second half of the program
[3] about the same throughout the program

17. Talk to me about what you liked and disliked about drink diaries/exercise logs.
Probe: Anything else you liked? Anything else you disliked? Did anything make it hard or easy to complete the drink diaries/exercise logs?

17 a. Like	17 b. Dislike

18. Was it hard or easy to figure out your daily averages? Why?

Teach-back call

RECORD FROM PROCESS DATA, DO NOT ASK: Teach Back Call Completed (Y/N): _____
If no, Skip to Question 22 or 24.
Now I'm just going to ask you a few questions about the telephone calls. For these first few questions, please try to remember back to after the first class when our staff called you and personally reviewed the material covered in class. You were asked several questions about this material.

|___| 19. *How much do you agree or disagree with the statement*: Going through this material personally with the staff on the telephone **helped me learn** the material better.
[USE AGREEMENT HAND CARD]

|___| 20. *How much do you agree or disagree with the statement*: Answering the questions was difficult.
[USE AGREEMENT HAND CARD]

|___| 21. *How much do you agree or disagree with the statement*: For future programs, I would recommend this strategy where staff personally call and review the class materials.
[USE AGREEMENT HAND CARD]

Automated calls

RECORD FROM PROCESS DATA, DO NOT ASK: Number of IVR Calls Completed: _____

If completed 0 IVR calls:

For some of our program participants, it was really difficult for them to complete the automated calls, and I noticed that you were not able to complete any, so I'm curious:

22. What was the biggest barrier for completing the automated calls?

23. What could our Talking Health team have done differently increase your completion of the automated calls?

If completed 1-11 IVR calls :

Okay, great, now the remaining questions are about the automated telephone messages

|____| 24. *How much do you agree or disagree with the statement:* The automated calls provided me with **useful strategies** to help me reduce my sugary drinks/be more physically active.
[USE AGREEMENT HAND CARD]

|____| 25. *How much do you agree or disagree with the statement*: The automated telephone system was **easy to use**.
[USE AGREEMENT HAND CARD]

|____| 26. *How much do you agree or disagree with the statement:* The automated telephone system was **personal.**
[USE AGREEMENT HAND CARD]

|____| 27. *How much do you agree or disagree with the statement*: I was satisfied with **the length** of each call.
[USE AGREEMENT HAND CARD]

|____| 28. *How much do you agree or disagree with the statement:* I would use an automated telephone system again as a tool to provide me with strategies to promote healthy living.
[USE AGREEMENT HAND CARD]

29. Talk to me about what you liked and disliked about the automated calls.
Probe: Anything else you liked? Anything else you disliked?

29 a. Like	29 b. Dislike

|____| 30. Overall, **how satisfied** were you with the automated telephone calls?
[USE SATISIFACTION HAND CARD]

|____| 31. Try to think back to before you began this program when our staff was explaining the automated telephone calls. Did you think the automated telephone calls were going to be good or bad?

[1] Good, go to 31a

[2] Bad, go to 31b

|____| 31a. Now that we have completed that part of the program, were the automated calls

[1] Better than I thought it would be.
[2] Just as good as you thought it would be.
[3] Worse than you thought it would be.

|____| 31b. Now that we have completed that part of the program, were the automated calls

[1] Better than I thought it would be.
[2] Just as bad as you thought it would be.
[3] Worse than you thought it would be.

If completed <9 IVR calls.
For some of our program participants', it was difficult for them to complete the automated calls, and I noticed that you missed a few, so I'm curious:

32. What was the biggest barrier for completing the automated calls?

33. What could our Talking Health team have done differently increase your completion of the automated calls?

<u>Resources (MoveMore only)</u>
Now let's talk about the resources we provided. Talk to me about the Waling Indoors DVD provided.

|____| 34. How often did you use the DVD?

[1] Did not use it at all
[2] Used it 1-2 x total
[3] Used it 3-5 x total
[4] Used it about 1 x month
[5] Used it about 2-3 x month
[6] Used it about 1 x week
[7] Used it about 2-3 x week
[8] Used it 4 or more x per week

35. Talk to me about what you liked and disliked about the DVD.
Probe: Anything else you liked? Anything else you disliked?

Like	Dislike

|___| 36. How often did you use the exercise bands we provided?

[1] Did not use it at all
[2] Used it 1-2 x total
[3] Used it 3-5 x total
[4] Used it about 1 x month
[5] Used it about 2-3 x month
[6] Used it about 1 x week
[7] Used it about 2-3 x week
[8] Used it 4 or more x per week

37. Talk to me about what you liked and disliked about the exercise bands.
Probe: Anything else you liked? Anything else you disliked?

Like	Dislike

<u>Resources (SipSmartER only)</u>

Now let's talk about the resources we provided. Talk to me about the workbook provided.

|___| 38. How often did you use the workbook/additional handouts we provided?

[1] Did not use it at all
[2] Used it 1-2 x total
[3] Used it 3-5 x total
[4] Used it about 1 x month
[5] Used it about 2-3 x month
[6] Used it about 1 x week
[7] Used it about 2-3 x week
[8] Used it 4 or more x per week

39. Talk to me about what you liked and disliked about the workbook/additional handouts we provided.

Probe: Anything else you liked? Anything else you disliked?

Like	Dislike

Summary Questions

Okay great we're almost done, just a couple more questions.

40. Of all the parts of the program, which did you find to be the most motivating? [Do NOT read list, check all that they mention, and probe why?]

|____|[1] Group classes, why?

|____|[2] Personal action plans/goal setting, why?

|____|[3] Drink diaries/exercise logs, why?

|____|[4] Automated calls, why?

|____|[5] Live calls from research assistants, why?

|____|[6] Resources, why?

|____|[7] Other:_____, why?

|____| 41. How satisfied were you with the access and availability of the research staff? [USE SATISIFACTION HAND CARD]

42. If we were to recruit in your community for another health study, how would you suggest that we let people know about the study? What would motivate them to consider participating?

43. Okay, great, you've made it to the end! Is there anything else that you'd like me to know?

Now let's talk about what to expect for the next 12 months. It is really important for you to remember that you are still a part of the program for the next year. We won't be seeing you in class anymore, but we will be contacting you via telephone one time a month to check in with you and see how you're doing. We will either be contacting you in person or with the automated phone system. Those calls will last about the same amount of time as the current automated calls, which is about 5-10 minutes or less. We may also send you some health information in the mail. About one month before we are scheduled to come back here, we will call and make your 18-month screening appointment. When you complete that screening appointment, we will thank you with a $75 gift card. If at any time in the next year, you happen to have any questions about the program, or if you move or change your phone number, please call our office. We don't want to lose contact with you over the next year. We hope that you will continue the healthy habits you learned from our program for the rest of your life!
Can you tell me your address and telephone number so that I can confirm this?
Address:

Phone number:
Can you provide the phone number of at least one other friend & family member that we could contact if for some reason we cannot reach you for the 18-month follow-up?
Name:
Relationship:
Phone:

Do you have any additional questions or concerns?

Appendix B. Maintenance Supportive Messages

MoveMore

Supportive Message Call 12 (PA) Today I want to congratulate you for completing 6 months of the Move More program. The Talking Health staff is proud of you for taking this step towards improving your health and we appreciate your participation in the program.

Through the classes, workbook and phone calls, we hope you found new ways to set goals for yourself, think through your barriers and get moving doing various cardio and strength training exercises! Do you still have all of your materials? If so, hold on to them because you'll find them useful over the next year.

Now that you have the knowledge, skills, and tools you need to be successful and know what to do if you ever backslide on your physical activity routine, we feel confident you can maintain your physical activity goals for a lifetime --and even help a friend or family member along the way! We'll be cheering for you and giving you tips over the next year to stay focused. Above everything else, have confidence in yourself and strive to be healthy and active in the year to come. You've made a great effort so far! Keep it up!

Supportive Message Call 13 (PA) Almost everyone is influenced by the people around them. Your friends and family can have a big impact on your level of physical activity, so their support can be very helpful when you're trying to maintain an active lifestyle. Take a moment and explain to those who are important to you why you are choosing to lead a more active life. Invite someone to be physical active with you, you could walk together, go to a fitness class together, use a home exercise DVD, or use the exercise bands for strength training together.

There are many things that your friends and family can do to help you keep up with the changes you've made and they can really help motivate you to stay on track.

Recruiting a friend or family member to exercise with you is good for everyone. Having an exercise buddy is one the best strategies you can use to staff on track. You can set exercise goals together, motivate each other, and share your successes and frustrations with one another. Your buddy could have some great new ideas! Talk to each other often to share your successes and talk about why it is important to maintain your goals.

Maybe by now, you've also learned that you are a role model for your friends and family. Perhaps you've influenced them to make some of the same changes you've made! You should feel really great can about your ability to serve as a role model and influence the physical activity level of your friends and family.

Sometimes, we can feel pressed and influenced by others. You may have found that it's hard for you to be active when your friends and family aren't very active. But you have the ability to make your own decisions, and it can feel great to make your own choice and be more physically activity! And it can feel even better to set a good example for your children or other family members! Now that you've gone through this program, spread the good word and support someone you love in leading a more active life.

Supportive Message Call 14 (PA) I hope you have been well since we talked last! Today I would like to remind you about a topic that we learned about in one of the classes: exercise & weight loss gimmicks. Have you seen any exercise or weight loss gimmicks advertised over the

last month? They are everywhere, like on the TV and in magazines? There are tons of messages out there that contradict the recommendations. For example, we learned that infomercials advertising exercise equipment often exaggerate the results. To sell these fancy gadgets and gimmicks, advertisers often use "quick, instant" results to grab our attention. So don't be tricked! There is no quick fix to becoming healthier.

By now, I'm certain you know what the real recommendation for physical activity are- those that are based on scientific information. But here's a quick review. For cardio, most health benefits occur when you do at least 30 minutes a day, 5 days a week. What about strength training? Train all major muscles 2 days a week. Do at least 8-12 repetitions of the exercise and do at least 2 sets total. Don't forget that you should be active for at least 10 minutes at a time. Essentially the goal is for you to get at least 150 minutes of cardio and to strength train 2 times a week.

Remember that you can always use the resources we provided you in class, like the Walk Indoors DVD or the exercise bands—they take a little work, but they are also free and effective! Keep up the good work!

Supportive Message Call 15 (PA) Today I want to talk to you about staying motivated. Whether you've been doing well or having a slip up, it can be helpful to remind yourself of your motivations.

Refreshing these motivations will help you maintain your exercise goals or continue to reduce them. Sometimes it feels like motivation comes and goes… We all feel that way sometimes! When you're not feeling motivated to stick to your goals, think back at the important reasons you listed on your action plan.

Take some time to think about the things that really matter to you. You may want to revise your reasons for exercising. What are your reasons? Are they: setting a positive example for your children, having more time and energy for your loved ones, losing weight, reducing your risk for disease, improving your overall health, or some other very important reason that is unique to you?

Our participants share this tip with us to keep all of us motivated. You can write down your motivations in your workbook, on a post-it note or a piece of paper and keep it nearby. Whenever you need some encouragement, look at this piece of paper and remember the things that are most important to you. This tip t can really help you stay focused.

One last tip is to talk with someone else who is going through this change. If you are successful at meeting your goals, share with a buddy to help him or her live a healthy life. If you slip up, give your buddy a call and talk about your reasons for being more physically active. Your buddy will give you motivation and suggestions for getting you back on track.

Remember to build on small successes, stay positive and remind yourself that you're worth it!

Supportive Message Call 16 (PA) Today I want to remind you about what counts as cardio. I know it can be confusing to figure out if an activity counts toward the recommended number of minutes of cardio you need to do each week that will give you health benefits. Remember the recommendation for cardio is 150 minutes per week.

Do you remember what counts as cardio activity? I know it's been a while, but do you remember the 4 things that make an exercise, a cardio exercise?

Does BBLT jog your memory? It stands for 1. Heart Beating faster, 2. Breathing harder, 3. Using Large muscles, and 4. Ten minutes, remember you need to keep your heart beating faster, your lungs working harder and your large muscles moving for at least ten minutes at a time. If you've done all 4 things, then you can count that activity as a cardio activity.

Some examples of cardio include brisk walking, doing the Walk Indoors DVD, mowing the lawn—with a push mower of course, biking, swimming, jumping rope and playing tag with your children or grandchildren! Really, the possibilities for cardio activity are endless. You can always try to mix it up, so you never get bored with one particular activity. Also- try to build in cardio activity 10 minutes of cardio at a time during your normal daily activities, like parking for away and taking the stairs.

As for strength training, we hope you are working all your major muscle groups 2 times a week. Also, you can always get out your hand-outs from class and remind yourself of the different strength training options using the exercise bands.

If you haven't done so lately, I challenge you to try at least one new type of physical activity this week. OK remember BBLT, and good luck meeting your goal this week.

Supportive Message Call 17 (PA) It's hard to believe that you began your journey with the Talking Health Program about 1 year ago. Congratulations on working to meet your physical activity goals! We will be back in your town in about 6 months for your 18-month health assessment. Today I wanted to give you some tips on maintaining your plan and reaching your goals until we see you again.

If you have been successful on meeting your physical activity goals, give yourself a pat on the back! You should also take some time to treat yourself, like buying a new outfit, going on a picnic in the park, or preparing your favorite dinner! Just remember don't over indulge! It is always good to take time and reward yourself on meeting your personal goals! Since you've been trying really hard to meet your physical activity goals, I wanted to take some time to give you a few tips on maintaining your goals or getting back on track to meeting your new goals.

The first step is to take some time to think about and write down times, places, or things that typically get in your way when you are trying to be physically active. We call these high-risk situations. This could be things that don't happen that often, like getting sick, or things that happen all the time, like getting busy at work. Pick the two or three that are the most likely to slow down your physical activity.

The second step is to list other ways that you could deal with your high-risk situations so that you won't fall into temptation. Look in your Move More workbook from class and check out the strategies you have used before to overcome obstacles and see if any of those would fit.

The third step is to think about how successful you have been in increasing your physical activity since our first class. So remember you did it once, and you can definitely do it again or keep up your great progress!

Okay, the last step is to make a list of the pros and cons of sticking with your goals for physical activity. It might help to review your motives for making the changes in the first place. If you have some new motivators add these to your action plan or make a new list and check them out regularly.

These are just a few tips you can use to stay on track or get back on track if you start to backslide into old habits. Couch potato habits can be very hard to break, and it is very common for people to backslide. But don't ever get discouraged- the effort is worth it!

Supportive Message Call 18 (PA) Today I'd like to remind you of a topic that we learned in the MoveMore class-- how to seek resources in your community to be physically active. I hope you have been able to explore the handout we gave you in class about physical activities right outside your door.

These days, most of us have a choice of public parks, walking and biking paths, and outdoor courts and tracks close to where we live and work. In most cases they are free, and they offer an opportunity for you to enjoy time with family and friends while getting in some physical activity. You might also have other resources in your community like a fitness or wellness center that might have classes or programs you are interested in. Remember, the handout we gave you in class can help you find many different physical activity resources right outside your door that can help you stay active and healthy.

You can also look in your local newspaper for fun opportunities that can help you stay active. Many communities have annual walks, like a walk for breast cancer, heart disease, or even a fundraiser for a local school. These are great opportunities to increase your physical activity and be active with a friend, or family member or meet a new physical activity buddy.

You also have free physical activity resources at work, like taking the stairs instead of the elevator and parking farther away from the entrance. You can also take your exercise band with you to work, and do some of the strength training exercises we learned in class. The hallways are also a good resource and you can do a couple of laps every hour to get some brisk walking in. Finally what about using the restroom on another floor of your building—of course you would need to give yourself a little more time—but it could add in a few flights of stairs and some great physical activity every day. To help yourself remember to get up and move around at work, you can set your alarm to go off every hour or two. When your alarm goes off that means it's time for you to get up and move!

Staying on track with a healthy lifestyle can become boring and too routine. That is why it is helpful to explore new ways and strategies to support the new changes you are making.

Supportive Message Call 19 (PA) Today I'd like to talk to you a little more about investing in our health. You've been taking the initiative to step into a healthy lifestyle and we are very proud of you.

You know that exercise has immediate benefits. It gives you immediate energy, boosts your mood, and release stress. Do you know exercise also protects you against colds and flu? Now let's think about why exercise could also give you long-term benefits too. Our body is like a car engine. A car engine needs regular maintenance and check-ups to make sure it runs smoothly. Then you can get lots of mileages out of the car. Our body needs the same level of attention too. Within a year of regular exercise, do you know you can cut down cancer risk and adding years to your life?

Investing in your own body and health brings you long-term benefits. We gave you free exercise tools (walking in door DVD and exercise bands, community resources) in class so you didn't even have to spend anything to start investing in your health. Treat exercise like an investment. Make it a priority.

Supportive Message Call 20 (PA) Today I just wanted to let you know that you can always count on the Talking Health team to answer any questions you may have about physical activity. Our team spent a great deal of time developing the MoveMore program based on scientific

information, and you can be certain that the program has been based on the very latest health recommendations.

Also, it is a great idea to talk to your doctor about your physical activity levels. Doctors can be a great source of reliable and science based information.

Many people have never talked to their doctors about their physical activity levels and a lot of doctors may never bring it up. Several of the participants in the Talking Health Program shared the information they learned in class and the health screener numbers with their doctor and got some very valuable feedback.

Most doctors would tell you that it is important to be physical active, especially if you have a family history of certain diseases like diabetes. If you have more questions about the health benefits of physical activity, don't hesitate to ask for your doctor's advice. Doctors are full of great information that can keep you and your family healthy. Just like this program, doctors recommend at least 30 minutes of cardio a day, 5 days a week, and to do strength training for all major muscles 2 days a week.

Keep working hard to meet your goals- your health is SO worth it! I'll talk to you next month!

Supportive Message 21 (PA) I hope this message finds you well!

Today I'd like to talk to you a little bit more about the crazy gimmicks that companies try to sell you.I hope you've been noticing all the overhyped health claims on television. Remember that these companies are most interested in making a profit.

One activity we did in class was to analyze different exercise machines in infomercials. These infomercials dramatize the health benefits. They make us believe that the gadget will solve our problem and give us instant results. But we learn that they are not helpful. In fact, "ab circle pro," a gadget we talked about in class, was fined $25 million for lying to consumers. Also, some people in class told us that they bought gadget like "shake weight" but it didn't work at all. These infomercials use very fit models to advertise for their products. Remember, they are computer simulation and this is just another trick. Next time when you see another exercise machine infomercial, point out and share the tricks it uses to get us hooked.

We know you won't let the media and companies fool you! You can outsmart them and make the right decision.

Supportive Message 22 (PA) I'm so pleased to see that you've nearly made it to the end of the program. Our team is scheduled to be in your town next month for the 18-month health screening. You've done a great job at sticking with the program and the Talking Health team is proud of you for taking this step towards improving your health!

This is the last time that you'll be hearing from me, but the rest of the Virginia Tech team is excited to see you at the last health screening. If you haven't already scheduled your health screening appointment, give the team a call at 540-553-1768. If you have scheduled your appointment, then you should receive a postcard reminder in the mail as well as a phone call from one of our staff members.

The health screening will be the last time that you see the Talking Health team and after that it's up to you to stick with your physical activity goals. We know you can do it! Now that you have the tools you need to be successful and know what to do if you ever backslide on your physical activity goals, we feel confident you can maintain your physical activity goals for a lifetime and even help a friend or family member along the way! You should be very proud of

yourself for completing the program and all your efforts aimed at improving your physical activity levels! We'll see you at the last health screening, and until then take care and be well! Remember, if you haven't already scheduled your health screening appointment; give the team a call at 540-553-1768.
SIPsmartER

Supportive Message Call 12 (BEV) Hello, this is Brie and today I want to congratulate you for completing 6 months of the SipSmartER program. The folks on the Talking Health staff are proud of you for taking this step towards improving your health. Through the classes, workbook and phone calls, we hope you found new ways to set goals for yourself, think through your barriers and reduce your sugary drinks! Do you still have all of your materials? If so, hold on to them because you'll find them useful over the next year.

Now that you have the tools you need to be successful, we feel confident you can maintain your sugary drink goals with only a little help from us. So starting now, you will receive one call from me a month. During those calls, I will remind you of some of the important information you learned over the past six months to help you maintain your current sugary drink goals or to set new ones. These reminder calls will only last a few minutes and then it will be up to you to keep moving! We know you can do it. Best of luck. I'll talk to you again next month.

Supportive Message Call 13 (BEV) I hope you have been well since we talked last! Today I would like to remind you about a topic that we learned about in the second SipSmartER class: the media. Have you seen any sugary drink commercials or deals over the last month? Remember that media is truly all around us! Whether we realize it or not, we are all influenced by the media. Media includes messages and advertisements on TV, the radio, in magazines and newspapers, and on the internet. We also see media messages in books, on billboards and signs, and on food packaging. In the second class we told you that CocaCola spends $2.6 billion each year on advertising their sugary drink products. In fact, sugary drinks are the most advertised products on TV!

Sugary drink companies use all kinds of persuasion tools to grab our attention and get us hooked. They use things like bright colors, humor, celebrities, and catchy slogans so that we'll buy their products. Remember to think about the information that these ads are leaving out, such as the amount of sugar and calories in these sugary drinks.

Also be on the look out for product placement. Product placement is when you see a character on your favorite TV show drinking a specific sugary drink or when you see sugary drinks on sale by the check out line at grocery stores. Remember that you can always look back to the media diary in your workbook and the other worksheets we gave you in class.

Keep up the good work!

Supportive Message Call 14 (BEV) I hope this message finds you well! Today I'd like to talk to you more about the media. I hope you've been paying attention to the media messages in sugary drink ads and noticing product placement. Remember that sugary drink companies are only interested in one thing: making a profit. Their goal is to sell their products and they don't care what effect their drinks have on your health!

One activity we did in the second class was play product detective and analyze different sugary drink ads. We figured out which persuasion tools the media industry was using and who their target audience was. We also talked about the information that was left out of the ads. To talk back to the media industry, we created counter ads with our own messages and added health risks. Some people in class were really creative and made ads that said "Warning: drinking this soda will add unhealthy weight and take years off of your life." Don't let the media and sugary drink companies fool you! You are too smart for them and know how to interpret media messages.

Sometimes the messages on the front labels of sugary drinks can be misleading. For example, a bottle of apple juice might say "100% Juice" and "No Added Sugar." After reading the message on the front label, don't forget to turn your sugary drink around and check out the nutrition facts panel on the back. On the back of that container of apple juice, you will find that it actually has lots of sugar. In fact, one serving has as much as a can of coke! Remember to be critical of the messages you see and always read the nutrition facts panel.

Supportive Message Call 15 (BEV) I hope you have been well since I talked to you last! Today I'd like to talk to you about how reducing your sugary drinks can improve your overall health. Whenever you have health questions, you can always go to your doctor for information that is reliable and science based. Most doctors would tell you that it is healthy to limit your sugar intake, especially if you have a family history of certain diseases like diabetes. Limiting your sugar intake doesn't mean just cutting back on sweets. It also means reducing your sugary drinks! Most doctors recommend drinking 8 ounces or less of sugary drinks per day.

Doctors also recommend drinking 5-8 cups of water each day. Sometimes if we drink a lot of sugary drinks we don't drink very much water. This makes it tough to meet the recommendation for water. One way that you can increase your water intake and decrease your intake of sugary drinks is to jazz up your water. Try adding a slice of lemon, lime, or your favorite fruit to add flavor to your water without adding sugar. Another great strategy is to add sugar-free flavor packets like crystal light or drink sugar-free seltzer water. Drinking at least 5-8 cups of water per day will help you stay hydrated and feeling good.

If you have more questions about the health risks of sugary drinks, don't hesitate to ask for your doctor's advice. Doctors are full of great information that can keep you and your family healthy.

Supportive Message Call 16 (BEV) I hope you have been well and are sticking to your sugary drink goals! Remember that it is okay to slip up every now and then. We all do. If you slip up, something that can help you get back on track is thinking about the reasons you want to make a healthy change. Today I'd like to remind you of your motivations for cutting back on your sugary drinks.

In each SipSmartER class, we completed personal action plans to help us meet our sugary drink goals. We asked you to write down your reasons for making this change, some obstacles that could get in the way, strategies to overcome these obstacles, and people who could help you meet your goals. Some folks decided to reduce their sugary drinks in order to lose weight, set a good example for their kids, have more energy, and reduce their risk of disease.

Maybe your motivations have changed since the beginning of the program. I'd like you to take a few minutes to write down why you want to cut back on your sugary drinks on a piece

of paper or a sticky note. Carry this around with you in your wallet or purse. Whenever you are having a tough time, look at this piece of paper and remember what is really important to you.

It can also helpful to reduce your sugary drinks with a buddy. When you're having a tough time, give your buddy a call and talk to them about your reasons for making this change. They might be able to give your some motivation and suggestions for getting you back on track.

Supportive Message Call 17 (BEV) I hope you have been well since we talked last month! Almost everyone is influenced by the people in their life. It can be hard to maintain your sugary drink goals when your friends and family drink sugary drinks. Your friends and family have a big impact on what types of drinks you choose, so their support can be very helpful when trying to maintain this change. If you haven't already talked with your friends and family about why you decided to cut back on your sugary drinks and why it is important to you, take a few minutes this month to do that.

There are many things that your friends and family can do to help you keep up with the changes you've made. Last month we talked about how friends and family can help motivate you to stay on track. For example, it can be really helpful to find a buddy to help you stay on track with your goals and the changes you've made so far. Share how you are doing with each other and talk about what your barriers are and some strategies that you have found to overcome those barriers. Your buddy could have some great new ideas! Talk to each other often to share your successes and talk about why it is important to maintain your goals.

Sometimes, we can feel pressured to drink what everyone else is drinking, but remember that you don't have to. It can feel great to make your own choice and pick the healthier option! Maybe you've experienced a situation like that. If you're going to a social event, like a picnic or a party, bring a healthier option for yourself and others to enjoy! This is a great example to set for your children or other family members!

Just remember the support of your friends and family can help keep you on track and help you to maintain your healthy goals!

Supportive Message Call 18 (BEV) Today I'd like to remind you of a topic that we learned in the last SipSmarter class. During that class, we learned how to correctly use the nutrition facts to help identify sugary drinks. I hope that you've been able to practice using the nutrition labels when you make decisions about sugary drinks. Today we'll go over some simple ways to use the nutrition facts that we learned in class so that you can continue to make healthier drink choices and outsmart the sugary drink companies!

Remember that the goal of the sugary drink companies is to try to get you to buy and drink more of their products. They aren't concerned about your health. The sugary drink companies design the front of the drink cans or bottles so that they are eye-catching and appealing, but don't forget that the claims made on the front of the sugary drinks are very loosely regulated, which means that they don't have to be completely true. Luckily, the nutrition facts that are on the back of the sugary drinks are tightly regulated by the Food and Drug Administration, or the FDA. The FDA watches closely to make sure that the ingredients and nutrients in the drinks match the information printed on the nutrition facts, which means those numbers are very accurate.

In class we talked about three numbers that are found on the nutrition label: first, the serving size; second, how many servings are in the container; and third, how many grams of sugar that are in each serving. Just being aware of these three simple numbers will help you become more aware of the amount of sugar in your drinks and will empower you to continue to

make healthier drink choices. Sugary drink companies know that most people don't turn their drinks around to see the truth on the nutrition facts, but you're too smart for them! Keep practicing reading nutrition facts labels and keep up the great work reaching your sugary drink goals!

Supportive Message Call 19 (BEV) I hope this message finds you well! Today I'd like to talk to you a little more about the numbers related to sugary drinks, like the nutrition facts and the cost of sugary drinks. When we spoke last month, we talked about continuing to practice reading nutrition facts. With a little bit of practice, it is pretty easy to read and use the information from the nutrition facts. Today we'll go over how to figure out how much sugar is in a drink based on the servings per container and the grams of sugar.

Remember that the first thing you should pay attention to is the serving size information and the number of servings per container which are both found at the top of the label. Many sugary drinks seem to come in a single serving like a can or bottle, but as you now know, most sugary drinks are usually 2-3 servings. For example, now you know that a 20 oz bottle of Coke actually has two and a half servings per bottle!

The next thing you should look for is the grams of sugar in each serving. Then you just multiply the number of servings by the number of grams of sugar to know how much sugar is in the entire container you are drinking. Remember that the more sugar the drink has, the worse it is for your health. You can always look back at your worksheets from class to help you practice reading nutrition facts labels. Maybe now that you've gotten some practice reading the nutrition facts labels to find the number of grams of sugar in the whole container, you've also started to look at other things on the label such as calories and ingredients. When you use the nutrition facts label to make decisions about sugary drinks, you are taking control of your drink choices.

Another thing that we learned in class was that sugary drink companies try to get us to think that we are getting a good deal on sugary drinks, but in the long-run the poor health outcomes that come with sugary drinks are not worth the cost. We learned that the amount of money that most people spend on sugary drinks can really add up over time and it's quite common that an average family of four can spend about $400 per month on sugary drinks. We also learned that by cutting back on sugary drinks, we could also be saving a lot of money in healthcare costs! Paying attention to the numbers on the nutrition facts and to the costs associated with sugary drinks will make you a smarter and healthier consumer. Remember, you can always look back at your SipSmarter workbook to help you practice reading nutrition facts labels. It's full of all sorts of good information!

Supportive Message Call 20 (BEV) Keeping up with the changes you've worked so hard to make can be really difficult! Maybe you've experienced some times over the past few months since the program where you fell into some old habits and that's ok! Remember when we talked about some steps that you could take to avoid slipping back into drinking too many sugary drinks? Today we're going to talk about some of those strategies to help you maintain your goals!

One strategy you can try has four steps. The first step is to think about and write down the times, places, or things that would make you want to start drinking more sugary drinks again. These are called high-risk situations and could be things that don't happen very often, like a birthday party, or things that happen all the time, like getting busy at work and needing a little pick me up from soda or energy drinks. Just pick two or three high risk situations that are the

most likely to make you start drinking too many sugary drinks again, or if you've experienced any high-risk situations, write down some of the ones that you've dealt with.

The second step is to list other ways that you could deal with your high-risk situations so that you won't fall to the temptation. If you've already dealt with some high-risk situations, think about what you did to deal with it and some other ways that you could deal with those situations in the future. If you haven't already, look in your workbook and check out the strategies you've used before to overcome obstacles and see if any of those would fit.

The third step is to think about how you successfully cut back on sugary drinks in the first place. It's always good to remember that you can do this! You've already made such great changes for your health! The last step is to make a list of the pros and cons of sticking with your goals for how much sugary drinks you have each day. It might help to review why you wanted to make the change in the first place and since the program, you've probably come up with some new reasons. Write these down and look over them regularly to help you maintain your sugary drink goals!

Supportive Message 21 (BEV) I hope that you have been well since we last spoke! Last month we talked a strategy to help maintain your sugary drink goals. Today I want to remind you of some other tricks to try and stick with keeping your sugary drinks down to 8 ounces per day. The first trick is to realize that everyone can have a slip up here and there – it's ok! The second trick is to have a plan in place for when you slip up so that you can easily get back on track.

Try and find a piece of paper that you can keep in your wallet or purse and write this on it: Everyone struggles, everyone slips up, and I will probably slip up here and there too.

Just under that write: if I slip up and have too many sugary drinks, I won't feel guilty, but I will get back on track with my goal the very next day.

Finally, write your goal down followed by one of your reasons for cutting back. It could sound something like this: My goal is to drink 8 ounces or less of sugary drinks per day so that I can set a good example for my family.

Keep this list with you and look over it every once in a while to remind you of your goals and your reasons for sticking with them! Of course, if you do slip up, pull it out and follow the instructions!

We are really pleased that you stuck with the program and have taken a few minutes each month to talk to me. Look at how far you've come since the start of the program! But as you may have found out, sometimes it's not easy to stick with the things you've learned. You may have noticed that your environment can really help or get in the way of your sugary drink goals. Keep being a "product detective" to watch how the media and sugary drink companies try to get you to drink more sugary drinks, keep your friends and family involved in your goals, watch out for high-risk situations that may make you want to start drinking sugary drinks again, and, of course, keep up the great work!

Supportive Message 22 (BEV) I'm so pleased to see how far you've come in cutting back on your sugary drinks and reaching your goals. You've done a great job at sticking with the program and the Talking Health team is proud of you for taking this step towards improving your health!

This is the last time that you'll be hearing from me, but the rest of the Virginia Tech team is excited to see you at the last health screening. If you haven't already scheduled your health screening appointment, give the team a call at 540-553-1768. If you have scheduled your

appointment, then you should receive a postcard reminder in the mail as well as a phone call from one of our staff members.

The health screening will be the last time that you see the Talking Health team and after that it's up to you to stick with your sugary drink goals. We know you can do it! You have the tools to be successful; whenever you feel like you need a little motivation, check out your action plan and look at the reasons why you chose to cut back on sugary drinks in the first place. When you come across a new barrier to meeting your sugary drink goals, look at your workbook and find some strategies to overcome those barriers. When you find yourself in a high-risk situation, a place or event that might make you want to start drinking sugary drinks again, or slip up on your goals, just pull out the little piece of paper that has your plan for if you slip up on your goals.

You should be very proud of yourself cutting back on your sugary drink intake. We'll see you at the last health screening, and until then take care and be well!