

Individual, home and neighborhood factors related to a childhood obesity intervention.

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ABSTRACT

Obesity is one of the most pressing global population health issues, and importantly one that affects racial/ethnic minorities and those of low socioeconomic status disproportionately. Obesity tracks from childhood into adulthood and is related to serious medical and economic consequences throughout the life course. Childhood obesity is well recognized as a complex and multifaceted problem influenced by broader social, geographic and environmental factors. A social ecological framework that is transdisciplinary is needed to address individual-level influences and choices that lead to energy imbalance, but also to address the complex interactions among home and neighborhood environmental features that provide the context for health-related behavior change. The overall goal of this dissertation is to investigate multilevel factors that could influence outcomes of an intervention program aimed at addressing childhood obesity. Including studies that investigated the use of clear communication strategies to facilitate parents' comprehension, home media environment related to change in children weight status and the neighborhood environmental context of families. This dissertation draws upon a social ecological model that acknowledges multiple levels of human interaction with the environment and represents a comprehensive approach to designing, implementing and evaluating interventions that which target multiple influences on health behaviors. The *iChoose* is a 3-month family-based childhood obesity treatment program developed under a community-based participatory research approach led by the Partnering for Obesity Planning and Sustainability (POPS) Community Advisory Board (CAB). The studies within this dissertation use clear communication evaluation and qualitative feedback from focus groups, intervention outcome data and home environmental surveys, as well as environmental audits of neighborhoods. To investigate multilevel factors could influence intervention outcomes, we used both multiple statistical analytical techniques and a Geographic Information System (GIS) spatial analysis to evaluate the *iChoose* program

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INTRODUCTION

Obesity is one of the most pressing global population health issues, and importantly one that affects racial/ethnic minorities and those of low socioeconomic status disproportionately. There is little doubt that environmental and social influences are important contributors to the rapid rise in childhood obesity over the past few decades [1, 2]. Specifically, childhood obesity is well recognized as a complex and multifaceted problem [3, 4] influenced by broader social, geographic and environment factors. The challenge ahead is to identify obesogenic factors and modify them so that healthier choices are clear communicated [5] “more available, easier to access, and widely promoted to a large proportion of the community” [3]. A social ecological framework that is transdisciplinary is needed to address individual-level influences, such as the quality of writing materials that could interfere with participants ability to understand an intervention’s main messages [5] to improve choices that lead to energy imbalance [6], as well as the complex interactions among home and neighborhood environmental features that provide the context for health-related behavior change [4].

Health literacy is important for public health [7] since it represents “the ability to obtain, understand, communicate, and use information” [8]. However, 36% of adults in the USA have limited HL [9] which disproportionately affects rural and low-income populations [10, 11]. There are a number of efficacious childhood obesity interventions, however few have been taken to scale and there is concern that the written materials used in efficacy studies with select populations may be too difficult for the intended audiences [9]. Thus, especially for these high-risk communities, it is critical for obesity interventions to be culturally relevant and tailored to the needs of the target population in order to improve health outcomes and reduce disparities [12]. Tailoring health education materials may be an important tool for education in minority

groups and could be used as a strategy to bring individualization and personalization of health messages to members of specific groups [13]. While a number of extensive resources and toolkits exist to improve individual and institutional health literacy, there is an absence in the current literature related to incorporating clear communication strategies when adapting evidence-based interventions for new populations. Clear Communication strategies proposes to use a comprehensive set of multiple methods of communication theories and models to guide development, implementation and assessment of messages and written materials to make them easier for people to read, understand, and use [14].

Effectively engaging community and research organizations in community-based participatory research (CBPR) that reviews, adapts, implements, and evaluates interventions can aid the translation of evidence-based interventions into community practice [6]. In this context, the Dan River Partnership for a Healthy Community (DRPHC), a community-academic partnership operating using CBPR principles in the health disparate DRR [15, 16], organized the Partnering for Obesity Planning and Sustainability Community Advisory Board (POPS-CAB). The POPS-CAB, over a 3-year period, identified an evidence and family-based childhood obesity treatment program, Bright Bodies [17] and adapted the content and structure guided by clear communication strategies [5, 18, 19] in an iterative systematic formative evaluation process for local delivery in the form of a program called *iChoose*. The program included a number of strategies including preparation of a healthy plate, family-based physical activity, goal setting and feedback, and acknowledging the social ecology of behavior change - including strategies to change the home environment by increasing opportunities for physical activity and healthful eating. *iChoose* was then pilot tested with 3 waves of families (n=101) and demonstrated, on average, a significant reduction in the weight status of participating children [20]. Even once an

evidence-based intervention is adapted for local implementation with a goal of sustained delivery [6], there still appears to be wide variability among child outcomes with some losing weight, some maintaining weight, and some gaining weight. This suggests that contextual factors related to home and community environments may exert different influences on families that are engaged in a childhood obesity program. The Social Ecological Model (SEM) describes behavior as the outcome of the interaction between an individual and his/her environment [21] and represents a comprehensive approach to designing, implementing and evaluating interventions that target multiple influences on behaviors [22]. From a social ecological perspective, the variability in child weight in response to family-based childhood obesity programs may be due to home and neighborhood environment differences [2].

In fact, numerous studies have consistently demonstrated that environmental factors are associated with physical activity, healthful eating, and childhood obesity [2]. For instance, children from neighborhoods with better nutrition and physical activity environments were less likely to be obese than children from neighborhoods low on both measures. Additionally, home environmental factors such as availability and accessibility to healthful food items and physical activity opportunities as well as parenting strategies have been related to reduced childhood obesity [23]. However, there is little evidence that interventions targeting family lifestyle changes can either enhance or disrupt the relationships between environments factors, physical activity, eating, and weight management. In addition, it is unclear the degree to which home and neighborhood factors may inhibit or support positive outcomes from childhood obesity interventions, and predict changes in physical activity, nutrition, and weight [24]. Therefore, there is a need to better understand the environmental context within which childhood obesity treatment interventions are implemented [24, 25]. The purpose of this study is to determine if a

childhood obesity intervention that targets home environmental changes can disrupt the relationship between the neighborhood environment and child physical activity, eating, and weight.

Accordingly, the overall goal of this dissertation is to investigate multilevel factors that could influence outcomes of an intervention program. Including studies of the use of clear communication strategies to facilitate parents' comprehension, home media environment related to change in children weight status and the neighborhood environmental context of families. This dissertation draws upon a social ecological model that acknowledges multiple levels of human interaction with the environment and represents a comprehensive approach to designing, implementing and evaluating interventions that target multiple influences on health behaviors. The studies used clear communication evaluation and qualitative feedback from focus groups, intervention outcome data and home environmental surveys, as well as environmental audits collected from previous studies. To investigate multilevel factors that could influence intervention outcomes, we used both multiple statistical analytical techniques and a spatial analysis using a Geographic Information System (GIS).

The first study describes the development of a culturally relevant childhood obesity workbook for parents of overweight children. The analysis used clear communication strategies to address key learning objectives in order to fill the gap in the literature on processes to evaluate and improve written intervention materials for an adapted evidence-based childhood obesity intervention. The mixed methods process evaluation was used to develop and conduct a formative evaluation of the *iChoose* workbook using a community-based participatory research approach. Results describe the iterative and systematic approach to conduct a formative evaluation of materials clear communication. Results of the remaining studies help explain the

variance in children's changes in outcomes by testing interactions among multiple levels of home and neighborhood environments with a contextual analysis. Specifically, the second study explored short-term (post intervention) change in home media environment (HME) factors and their association with change in BMI z-scores in children participating in a family-based childhood obesity treatment intervention. We hypothesized that home media environment would change after intervention and that those changes would correlate with a change in BMI z-scores. In the third study, existing neighborhood environment audit data were used to examine neighborhood environmental factors related to intervention reach including representativeness of enrolled and not enrolled families and delivery location influences; and nutrition and physical activity neighborhood environment (NE) factors as they relate to changes in eating, physical activity, and weight status of children that participated in the *iChoose* program.

The three studies undertake different aspects of a multilevel social ecological perspective that strives to be transdisciplinary, involving knowledge from different fields with an intention to achieve intellectual integration that extends the concepts, theories, and methods [26]. Our main goal was to advance framing obesity as a complex public health issue and provide data to further reduce childhood obesity [3]. The knowledge gained with these studies can help fill the gap on effective strategies to prevent and curb the growing childhood obesity epidemic in health disparate areas [27].

MANUSCRIPT 1: A participatory process to develop intervention materials using clear communication strategies: The *iChoose* experience.

INTRODUCTION

Health literacy among the general public has become progressively more important for public health since many aspects of healthcare depend on understanding written information and verbal instruction [7]. Health literacy includes addressing individual skill development as well as providing the delivery of actionable information that is easily understood in a manner appropriate to the audience [28]. A literature review demonstrated that health literacy is a stronger predictor of health outcomes than social-economic status, education, gender, and age [29]. Therefore, providing Americans with clear information about health promotion and disease prevention is a national priority [28]. However, over 90 million people have low literacy skills [30] in that they have difficulties understanding and applying health information.

A number of activities have been developed to address patients with lower health literacy across a variety of health sectors [18, 19]. In particular, initiatives such as the National Action Plan to Improve Health Literacy [28], the federal Plain Writing Act [19], and the National Institutes of Health's (NIH) "Clear Communication" initiative [31] have all focused on incorporating plain language approaches to provide information that is accessible based on the audience's cultural competence. The goal is to develop clear and effective written materials—those that attract and hold the readers' attention, make them feel respected and understood, and motivate action [18]. Supported by those initiatives, a number of tools were created to guide the development and evaluation of written materials for programs and interventions. Tools such as the Toolkit for Making Written Material Clear and Effective [18] and Clear Communication

Index Score [32] are both examples that, despite being highly recommended [33, 34], are rarely used in the research context to inform health promotion intervention materials.

The foundation of clear communication strategies to help produce “low barrier” material health information includes the Centers for Disease Control and Prevention’s (CDC) “3 A’s principles” (Accurate, Accessible, and Actionable), plain language, and a reader-centered approach [18]. Plain language, as the name suggest, simplifies information without sacrificing the content or compromising the meaning. This approach gives special attention to graphic design and issues of cultural appropriateness thereby making materials appealing to readers at all literacy levels. A reader-centered approach strives to understand the intended audiences by taking the reader’s perspective in identifying possible barriers within written material.

Most clear communication guidelines derived from the social marketing framework and seek to improve communication of health messages [14]. This framework proposes tailoring messages fulfilling the interests of a defined group of both those who would benefit from a behavior change and those who want to promote the desired behavior [35]. In this sense, messages are implemented as a systematic, continuous process driven by decision-based research in which feedback is used to adjust the message to ensure that all efforts are integrated and consistent to support the intervention’s goals and objectives [36]. From a social marketing research perspective, it is necessary to improve current and future communication evaluations to base conclusions about success or failure of strategies used to inform and influence individual and community decisions that enhance health [14].

Cultural assessment, relevance, and clear communication may be especially important in the area of promoting healthful eating, physical activity, and weight control [12]. Lower HL is associated with difficulty assessing how weight can affect health [37], and difficulty

understanding food labels [38], portion sizes [39], and growth charts [40]. Not surprisingly, both low HL [10, 11] and childhood obesity [10, 11] disproportionately affect rural and low-income populations, and obesity risk is increased in children whose parents have low HL [41-44]. Family-based treatment interventions have been developed to address childhood obesity [17, 45-48] and, while all include written materials [49], there is limited evidence that those materials have been adapted and or developed using clear communication strategies. Further, written materials used in efficacy studies with select populations may be less clear for the intended audiences [9]. Clear communication strategies that address lower health literacy can enhance the uptake of information and skills, and be integrated into childhood obesity treatment programs; however, the lack of clearly reporting these strategies highlights the potential low generalizability of written materials used in efficacy trials. It is critical to determine the degree to which written materials clearly and effectively communicate information when adapting evidence-based childhood obesity interventions for families in health disparate communities.

Involving groups to develop and evaluate materials is a strategy to improve clear communication. Those groups need to include members that reflect a broad range of expertise, skills, and interests, and are familiar with cultural and linguistic patterns of the intended readers [18]. In this context, effectively engaging community and research organizations in community-based participatory research (CBPR) may be helpful. CBPR approaches that include the targeted community in the review, adaptation, implementation and evaluation of interventions could improve health communication and use of culturally appropriate materials [6, 50]. One benefit of a CBPR approach is that it allows team members that interact with patients/participants on a regular basis, and would ultimately deliver intervention content, to provide feedback on communication styles that may be more or less effective within the target population. Finally,

obtaining feedback from members of the target population is an essential component in the process to ensure participant-level relevance of the written materials [18].

This study used a community-academic partnership to adapt written materials for a childhood obesity treatment program using clear communication strategies. This paper (1) describes the development of a culturally relevant childhood obesity workbook for parents of overweight children that used clear communication strategies to address key learning objectives and (2) fills the gap in the literature on processes to evaluate and improve written intervention materials for evidence-based childhood obesity interventions. Both the development and assessment followed a mixed methods iterative and systematic formative evaluation to assess clear communication using a CBPR approach. Results describe readability tests and community-academic materials' evaluation using the CDC's clear communication index (CCI) [32] and suitability assessment of materials (SAM) [51]. As well, results from the intended audience testing and perceptions collected via parents' surveys and focus groups, and delivery staff feedback from classroom workbook's use. We hypothesized that an iterative process that included the engagement of program participants and community staff in the development, evaluation, and revision of a program workbook would result in materials that were consistent with local culture and clear communication strategies.

METHODS

The Setting and Intervention Description

The Dan River Region (DRR), where this project took place, is a predominantly rural, health disparate and federally designated medically under-served area [52, 53] located in south-central Virginia and north-central North Carolina. The region currently has some of the lowest health literacy and highest rates of childhood obesity in the country [54]. In 2009, the Dan River

Partnership for a Healthy Community (DRPHC) was formed as a community-academic partnership to address these concerns. The DRPHC operates using CBPR principles with a primary mission to address obesity in the region [55]. Under the larger DRPHC umbrella, clinical and community partners serving children in the region formed the Partnering for Obesity Planning and Sustainability (POPS)-CAB to develop programming specifically to treat childhood obesity [56]. The POPS-CAB, collaboratively identified an evidence and family-based childhood obesity treatment program, Bright Bodies [17], and adapted the content and structure for local delivery in the form of a program – the *iChoose* program.

iChoose is a 3-month family-based program that includes the following components: (1) 120 minute family sessions that would occur every other Saturday over the 12-week program, broken into a nutrition lesson, exercise time, and behavioral skills training (2) 20-25 minute telephone support calls to set goals, resolve barriers, and reinforce content using the 5 A's, teach-back and teach-to-goal strategies on weeks between family sessions, (3) two 60 minute exercise sessions per week, (4) workbooks for the parent and the child based on clear communication strategies, and (5) child newsletters that reinforced content and provided fun activities.

Participatory Approach

We used a CBPR approach to engage community and research organizations to review, adapt, implement, and evaluate [6] written materials used in the intervention. This participatory approach has been shown to reduce health disparities and enhance study relevance, validity, effectiveness, cultural sensitivity, and translation into practice [57-60]. Additionally, the CBPR process allows for the combination of unique knowledge and resources from community and research partners to be applied synergistically towards shared goals to improve health outcomes and reduce inequalities. The POPS community advisory board (CAB) was composed by an

academic research team and community partners from the Dan River Region. The academic interdisciplinary research team is from the Fralin Translational Obesity Research Center (TOR) at Virginia Tech. The community and clinic community partners are from the Pittsylvania/Danville Health District (PDHD), Children’s Healthcare Center (CHC), Danville Parks Recreation & Tourism, and Boys & Girls Club. The CBPR approach also aligned to an important strategy to improve clear communication – the team approach [18]. The team approach included members from the community, engaged delivery staff, parents from the intended audience, and researchers.

Development and Evaluation Process of *iChoose* Workbooks.

One objective of the POPS-CAB was to create materials that would be relevant to local families. Thus, we designed a mixed methods approach that would engage the POPS-CAB and end-users of the workbook in a process to review and adapt materials. Accordingly, we conducted a formative evaluation of the *iChoose* workbook using CBPR in a reader-centered approach. Our systematic process included a multi-step process for each module to ensure that materials were appropriate for a low health literate audience (Figure 1).

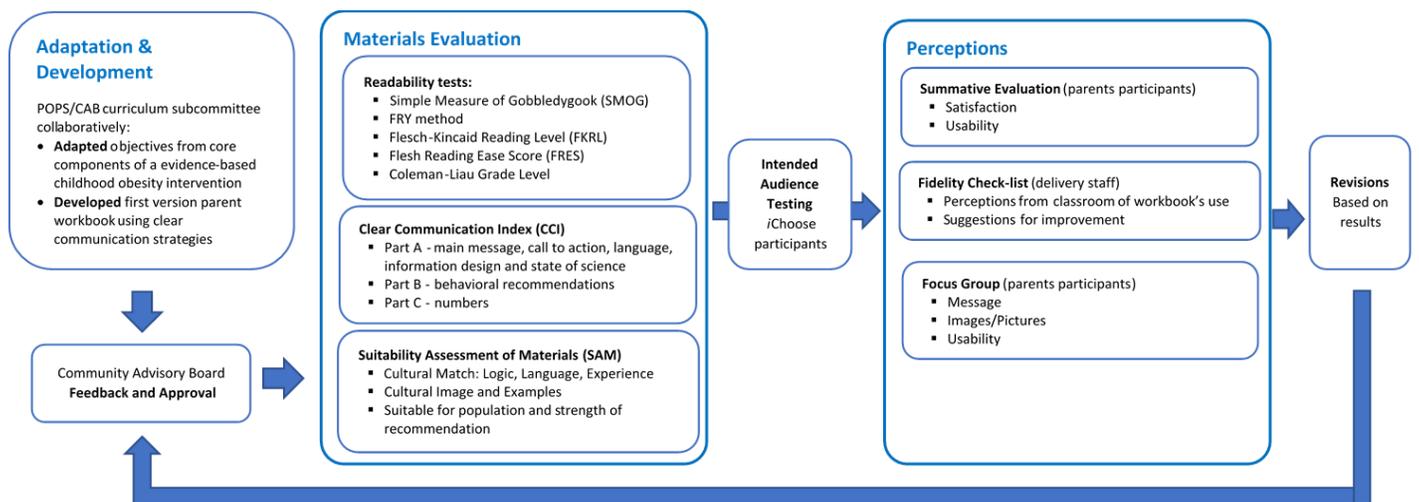


Figure 1. Development of workbook content using clear communication strategies.

The overall research design for the development and evaluation of the *iChoose* workbook was a participatory and iterative mixed method design. The mixed method data collection was used to strengthen the validity of the conclusions reached by the study [61]. We included triangulation of quantitative (CCI, SAM, readability tests and surveys) and qualitative (interviews, classroom feedback and focus groups) methods from different sources (i.e. community and academic partners, delivery staff, and parents) to increase the validity of the findings. This triangulation is considered a useful means of capturing more detail, minimizing the effects of bias, and ensuring a balanced interpretation of available data [62]. Thus, both participatory research and formative evaluation approaches [50] were designed to involve the POPS-CAB members and program participants, in multiple components [63] of the process, including oversight of data collection, analyses, and dissemination of results. The intent was not only to develop an evidence-based workbook but also incorporate health literacy best practice to achieve a clear and effective communication for the target population. This case study occurred over a period of 3 years and is part of a larger iterative project (NIMHD-R24MD008005). The Institutional Review Board (IRB) at Virginia Tech approved this study, and all participants gave written informed consent prior to participation.

Adaptation and Development

After the intervention selection process by the POPS-CAB members, community partners identified that the written materials from the selected intervention (Bright Bodies) needed adaptations to better fit their community profile, including more culturally relevant content and images as well as the need to address different levels of health literacy. As the Bright Bodies materials were under a copyright and could not be modified, the POPS-CAB identified the core

intervention objectives from the literature and used them to develop a parent workbook to accompany the program. The POPS-CAB established a curriculum subcommittee (CS), composed of both researchers and community partners, to develop the workbook, based on those objectives, from evidence-based content review. Six chapters were created (Table 1), one for each intervention module. Themes for the intervention modules were reviewed and incorporated as individual chapters in the workbook. Following the family class format, the chapters were divided into components of Nutrition, Physical Activity (PA), and Behavioral Strategies. Each of the six chapters included the module objectives, educational content, a class activity, and homework. The subcommittee presented a first version of the workbook to the POPS/CAB to approve and/or make suggestions and followed this with two rounds of evaluation (Figure 1).

Tools for Workbook Evaluation

A readability evaluation of the workbook content was performed to assure that the reading level was adequate to the proposed target population. The workbook writing aimed a 5th grade reading level. To evaluate the reading level, we used five different measures of readability: the Simple Measure of Gobbledygook (SMOG), the FRY method, Flesch-Kincaid Reading Level (FKRL), Flesh Reading Ease Score (FRES), and the Coleman-Liau Grade Level. All the measures were applied in a plain document, which means no pictures or tables were included in the calculations. We decided to use different measures for readability since each one focused on a different aspect of the text (e.g. word and/or syllable count, sentence length). The SMOG is considered the gold standard for measuring readability [64] with a formula that accounts for polysyllable count to estimate the years of education a person needs in order to understand a piece of writing [65]. It is widely used, particularly for checking health messages [66]. In the FRY method [67], instead of using calculation formulas, the intersection of the average number

of sentences and the average number of syllables are plotted onto a graph where the results determine the reading level of the content. The Fry graph is often used to provide a common standard by which the readability of documents can be measured [68]. Both FKRL Index formula and FRES take into account the sentence length, despite having different formulas, where the “best text” should contain shorter sentences and words. In the FKRL, the result is a number that corresponds with a grade level. In the FKES to draw a conclusion from the results, the following scores are used: 90-100 very easy; 80-89 easy; 70-79 fairly easy; 60-69 standard; 50-59 fairly difficult, 30-49 difficult, 0-29 very confusing. FKLES Scores between 60 and 70 are largely considered acceptable. The U.S Army uses the FKRL and the US Department of Defense uses the FKES for assessing the difficulty of technical manuals. Finally, while the other readability tests use the number of syllables, the Coleman-Liau Grade Index (CLI) uses the number of characters in words.

Since readability scores do not provide information on reading ease, prominence of main messages, behavioral strategies to initiate action, or cultural relevance, they can be misleading when determining the likelihood that the materials clearly and effectively deliver information. Therefore, in addition to the readability tests the POPS-CAB performed a more comprehensive assessment of written materials that explicitly address the degree to which information is clearly communicated to intervention participants. After a literature review, we decided to use both the Clear Communication Index (CCI) and the Suitability Assessment of Materials (SAM). Both the CCI and SAM evaluation was conducted by the POPS/CAB members (n=14).

The Clear Communication Index (CCI) was developed using a comprehensive set of multiple methods of communication theories and models to guide development, implementation and assessment of messages and written materials to make them easier for people to read,

understand, and use. The CCI is a research-based tool to plan and assess public communication materials [32]. The CCI is formed by items that represent the most important characteristics to enhance clarity and aid people's understanding of information drawn from the scientific literature in communication and related disciplines. The Index supports the efforts of the CDC to comply with the Plain Writing Act of 2010 and achieve goals set forth in the National Action Plan to Improve Health Literacy and the CDC Action Plan to Improve Health Literacy [69]. Based on 20 items the CCI provides a numerical score on a scale of 100 to objectively assess materials. The CCI assesses materials in seven key areas divided into four parts. Part A includes the main message and call to action, language, information design and state of the science. Part B evaluates the clarity of behavioral recommendations. Part C focuses on the use of numbers and clarity of expressing numbers while Part D focuses on providing a clear description of associated risks of taking or not taking a certain action. Not all parts of the CCI are applicable to all written materials and depend on the presence or absence of information on behavioral goals, the use of numbers, or if risk factors are presented in the materials. The scores from each part were tallied to obtain an overall score (out of 100%), with a recommended standard of 90 or above to make materials easy to understand and use [69].

The CCI does not include an assessment of cultural appropriateness so the Suitability Assessment of Materials (SAM) tool was also used [51]. The SAM enables reviewers to consider 6 categories: content, literacy demand, graphics, layout and typography, learning stimulation, and cultural appropriateness. The SAM's score falls into one of three categories: superior, adequate or not suitable. SAM has been widely used by many researchers [70-72] that attest to its validity and reliability. The SAM identifies specific shortcomings that reduce the overall suitability of materials for a particular audience, and were used in some studies to select patient

nutrition education materials [73] and evaluate childhood obesity intervention materials [49]. As the SAM is redundant, in some areas, to other assessment tools used in this study, we used only the SAM items related to cultural appropriateness, cultural images and examples, and strength of recommendation, which were not covered by the CCI.

Training and Procedures for Workbook Evaluation and Refinement

POPS-CAB members (n=16) completed training on the CCI and SAM evaluations. A daylong training was offered by a CDC expert and developer of the CCI instrument via videoconferencing, and a SAM presentation hosted by academic partners targeted local capacity development and shared learning between the partners. Trained POPS/CAB members (n=14) were subsequently randomly assigned to conduct the evaluation individually on specific chapters of the workbook (2 to 3 members per chapter). Six small groups composed of members of the research team (n=7) and community partners (n=7) that had individually assessed the respective chapters reconciled and consolidated their individual CCI ratings into a shared rating. During these small group sessions, POPS-CAB members used the materials to resolve differences in ratings. Across all groups, consensus on rating was achieved and used as the CCI value for the given chapters. Individual and reconciled ratings were summarized and “within subjects” t-tests were used to determine differences in individual overall CCI and SAM ratings and across the CCI evaluation areas (Parts). Parts A and B were applied to all chapters. Part C was pertinent to chapters 1 to 3 and Part D wasn’t pertinent to the material evaluated in this study. Though the sample size of stakeholders was small, we also compared community and academic partner ratings to determine if differences emerged in ratings.

Intended Audience Testing

The workbook versions were pilot tested in the first and second wave of *iChoose* program implementation. On the first wave, we tested the workbook before revisions. On the second wave, we tested the workbook after revisions based on material evaluation and perceptions. The parents/caregivers that participated in the interventions' waves 1 and 2 had an average age of 40 years (SD = 8.5 years), were predominantly female (95%), and nearly half had income less than \$25K (46%) and most had at least a high school education (91%). Additionally, the participants completed the Newest Vital Sign (NVS) to assess health literacy and numeracy. The NVS consists of a nutrition label with 6 accompanying questions meant to assess literacy and numeracy skills ranging from parents of young children to older adults, among racial/ethnic minorities [74]. It is reliable, has been validated [74] and demonstrated high sensitivity and moderate specificity for detecting limited literacy [75]. NVS results in our sample indicated that approximately 36% of the parent/caregivers had limited HL.

Summative evaluation interviews (n=38) and focus groups (FG; n=11) were used to gather parent feedback on the workbook. Trained research personnel conducted both activities. The summative evaluation was completed with all parents that completed a post program assessment and included questions about satisfaction (e.g. "How satisfied were you with the parent workbook?"), and usability (e.g. "How often did you use the workbook outside of the family class?"). For the FG, the curriculum subcommittee developed a script with CCI-based questions to guide the discussions for each workbook chapter following their objectives (e.g. "How well do you think these messages were explained in the workbook?", "What things in the workbook helped you to better understand these messages?"). Five to 10 participants were considered necessary to complete the FG activities [76-78] and 11 of 14 invited parents agreed to participate. To accommodate participant schedules, we conducted two small focus groups and

offered childcare. FGs were audio-taped and transcribed verbatim to provide information on areas that contributed to potential workbook adaptations.

During the intervention period, fidelity check-lists were also completed for each family class and included opportunities for staff to provide comments about how the workbook was used and if there were adaptations suggested. We selected all comments (open ended) related to the workbook from the fidelity check-lists across 2 waves of intervention delivery.

Revisions

Following the CCI evaluation, the curriculum subcommittee went through the FG transcripts and field notes, delivery staff qualitative feedback, and CCI open ended questions, selecting quotes that indicate proposed changes. The findings were then summarized as a “proposed revision list” for each workbook chapter and chapter section. The curriculum subcommittee then made adaptations to the workbook based on the revision list. The final documents were presented and reviewed by the POPS-CAB using an iterative process. Feedback from the POPS-CAB was used to confirm, correct or clarify the changes made to the workbook.

Analysis

The quantitative data from instruments and surveys was analyzed in SPSS version 21, and analyses included frequencies, means, standard deviations, paired t-tests, with results presented in tabular format. The transcripts from the focus groups and qualitative portion of the forms were reduced to meaning units by the curriculum subcommittee and inductively categorized across the areas used to evaluate and improve the workbook chapters - we provide representative quotes within the results section indicated by quotation marks and italics (Table 3). All results are presented based on the initial version of the workbook used in Wave 1 (before) and the revised workbook (after) used in Wave 2.

RESULTS

Material Evaluation

Readability Tests

Readability tests revealed an overall workbook mean reading level to be at 5th grade. Variability between the measures showed results ranging from below 4th grade for SMOG (3.8) when considering complexity of words (polysyllabic) and 7th grade for Coleman-Liau (6.8) when considering length of words (character count). Also variability was found in the Flesh Reading Score with the ease of reading ranging from standard (62) to easy (80-86). However the overall result by chapters was found to be easy (80) to fairly easy (78). Table 1 shows results for all five tests performed in which no statistically significant changes were observed between tests conducted on the first version of the workbook (before revisions) and on the second version (after revisions).

Table 1. Readability tests results before and after revisions.

	SMOG Grade Level Score		Flesh-Kincaid Grade Level Score		Fry Grade Level Score		Coleman-Liau Grade Level Score		Flesh Reading Ease Score (0 very confusing; 100 very easy)	
	Before	After	Before	After	Before	After	Before	After	Before	After
Overall	3.8	3.8	5.1	5.1	5.8	5.8	6.7	6.8	80	78
Chapter 1	4.1	4.3	6.1	5.8	7.0	7.0	7.3	6.9	74	77
Chapter 2	4.2	3.8	6.1	6.0	7.0	7.0	7.1	7.5	75	62
Chapter 3	3.8	3.8	4.4	4.5	5.0	5.0	6.2	6.2	85	84
Chapter 4	3.8	3.8	4.3	4.6	5.0	5.0	5.8	6.3	86	83
Chapter 5	4.1	4.0	5.0	5.1	6.0	6.0	6.9	7.0	82	81
Chapter 6	3.0	3.0	4.4	4.3	5.0	5.0	6.9	6.9	80	81

No significant differences between revisions.

Clear Communication Index

The initial POPS-CAB CCI evaluation resulted in an overall score of 76 (Table 2). Qualitative comments (e.g., need to address multiple main messages and include more ethnically diverse pictures) demonstrated the need for a second revision. For the final product, the CAB CCI evaluation resulted in a significant improvement in overall rating (88, $p<0.01$). Mean ratings were nearly identical between community and academic partners, as well as individual and group reconciled ratings. When considering results by the Index parts per workbook section, all overall ratings showed improvement across chapters (Table 2). Results from Main message (Part A) range went from 59-67 before revisions to 86-88 after revisions and Numbers (Part C) went from 58-67 to 60-92. Changes to the clarity of Main message showed larger improvement. Both before and after revisions the workbook had strong Behavioral recommendations (Part B = 94-100 across chapters).

Table 2. CCI results before and after workbook revisions.

CCI SCORE						
	Before			After		
Overall	76**			90**		
Community	77*			89*		
Researchers	75 *			90*		
Chapter 1	49			94		
Chapter 2	73			88		
Chapter 3	57			87		
Chapter 4	69			87		
Chapter 5	83			85		
Chapter 6	93			88		
Scores by CCI Sections						
	A - Core/Main Message		B - Behavioral Recommendation		C - Numbers	
	Before	After	Before	After	Before	After
Overall	63**	87**	96**	98**	67**	80**
Nutrition	62*	88*	100	100	58	60
Physical Activity	67*	86*	94*	100*	75*	92*
Behavioral	59**	88**	94	94	67**	89**

* $p<0.1$ ** $p<0.05$

Suitability Assessment of Materials

SAM results are presented in Table 3, which shows that the cultural appropriateness of material remained superior ($\mu=2$) before and after for overall results and when considered by research members. However, community partner ratings for the Cultural Image and Examples went from adequate ($\mu=1$) to superior ($\mu=2$). Before the evaluation the majority of the comments in the SAM’s comments section was related to improving pictures to “*represent more ethnicities*”. This improvement can be exemplified by comments left by community members after revision “*Great improvement regarding different ethnicities/cultures*”. Strength of recommendation was strong overall for both revisions (before=8/10; after=9/10).

Table 3. SAM results before and after revisions.

SAM						
	1. Cultural Match in Logic, Language and Experience		2. Cultural Image and Examples		3. Suitable for your population?	
	Before	After	Before	After	Before	After
Overall	Superior	Superior	Superior**	Superior**	8*	9*
Community	Superior	Superior	Adequate*	Superior*	7***	9***
Researchers	Superior	Superior	Superior	Superior	9	9

*p<0.1 **p<0.05 *** p<0.01

Perceptions

Summative Evaluation

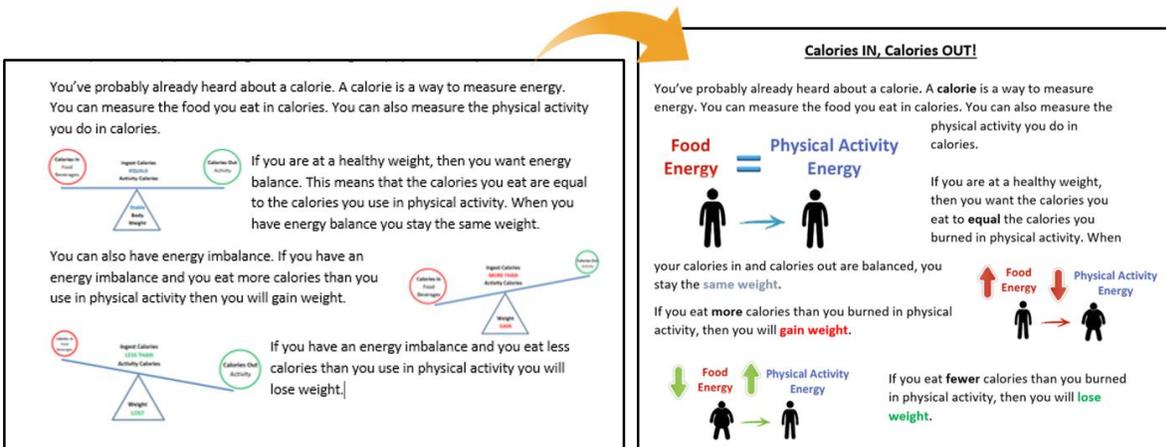
Data gathered from the parent/caregiver summative evaluation presented no significant difference between waves. Results indicated that parents felt satisfied with the workbook ($\mu=9.2/10$, $SD=1.08$) and found it to be helpful ($\mu=9.3/10$, $SD=1.5$), and agreed that was easy to find information that they need in the workbook ($\mu=9/10$, $SD=1.4$). Lower rates were found about the usability, parents not often used the workbook outside the classes ($\mu=3.5/10$, $SD=1.4$), not often used the goal setting and tracking sheets ($\mu=3.4/10$, $SD=1.5$), or think they will often

use it after the program ended ($\mu=2.8/10$, $SD=1.6$). Qualitatively, parents indicated they liked that it was easy to read and follow, used plain simple examples and thought the illustrations were nice. Parents reported lack of time, often due to work or other commitments, as the primary barrier to using the workbooks.

Fidelity Check-list

Delivery staff feedback revealed areas for improvement related to comprehension (e.g., difficulty in understanding energy balance) and format (e.g. Use “rounded” number to facilitate calculations). Table 4 shows sample of selected quotes by chapter from the transcripts and from the delivery staff feedback that influence changes in the workbook’s first version and Figure 2 provides a sample of changes.

Figure 2. Sample of change in Chapter 1 - Energy Balance section based on qualitative feedback.



Focus groups revealed that the workbook accomplished its objectives and was easy to understand. They also reported that the workbook helped them rethink their behaviors and influenced them to promote health changes. Furthermore, parents reported that the written materials supported the other intervention components and was used as a reference resource. Finally, focus groups also revealed areas that needed improvement in format (e.g. more visual

cues and separation of sections) and content (e.g. screen time focused in all types of media not only on TV) were also highlighted (Table 4).

DISCUSSION

We have described an iterative and systematic formative evaluation using a CBPR approach to develop, evaluate and improve an evidence-based culturally relevant childhood obesity workbook for parents of overweight children that used clear communication strategies to address key learning objectives. Because written materials are often used as an important intervention component [49], the main objective of this study was to offer a process guide for the development and evaluation written materials using a collaborative approach. The study also adds to the current literature by providing a process to combine available health literacy tools [49], such as the clear communication index evaluation system, SAM, and readability statistics with a CBPR.

We documented that the intervention materials developed for this study were written at a 5th grade reading level which was below the average grade level required for our participants (>9th grade [79]). This is consistent with research on written materials targeting parents to prevent childhood obesity [49] where the findings from the SAM measure identified specific areas related to cultural appropriateness that reduced the overall suitability of materials in their original form. The SAM has been used in some studies to select patient nutrition education materials [73] and to evaluate childhood obesity intervention materials [49]. The SAM ratings improved following revision in our study, primarily due to changes in community partner assessments. White and colleagues also documented superior ratings after making specific revisions in response to SAM scores. Common revisions in response to these scores included re-wording

passive sentences, enhancing the color schemes, reframing of health information to better coincide with typical reading patterns, and adding in culturally appropriate visuals [49].

This is the first study, to our knowledge, that incorporated the CCI in the evaluation of childhood obesity treatment materials for parents. The CCI added evaluative factors for written materials beyond readability statistics and cultural appropriateness and provided actionable information to improve the original workbook materials. Consistent with Bauer and colleagues, revisions based on the CCI resulted in written materials that were rated higher than original materials. These changes are hypothesized to increase the likelihood of parents, regardless of their educational level, to identify and understand the main message and behavioral strategy, and interpret numbers in each workbook section. Unfortunately, this hypothesis cannot be directly tested with the current study due to the multi-component intervention (e.g., changes in comprehension could be due to adaptations made to in-person class or telephone support sessions rather than due to workbook changes)—though this would be an excellent area for future research.

The findings of our study also highlight the importance of moving beyond readability statistics as a sole indicator of the appropriateness of written materials for a given audience. It is of note that the results of the readability assessments did not change when comparing to the original and revised materials—both were ~5th grade reading level. In contrast, both the CCI and SAM assessments provided actionable information for revisions and demonstrated significant improvements in ratings between the original and revised materials. Despite the finding that approximately 36% of the parents in our sample had limited HL and that 18% of the adults in the region lack basic literacy skills [80], readability assessments would have suggested that the original materials were appropriate. However, readability scores do not provide information on

reading ease, prominence of main messages, behavioral strategies to initiate action, or cultural relevance—as the CCI and SAM provide—and can be misleading when determining the likelihood that the materials clearly and effectively communicate intervention information. Therefore, the use of clear communication strategies has the potential to enhance program efficacy, perceived cultural relevance from community members and satisfaction among participants.

The CBPR approach that actively engaged community partners in the workbook planning and adaptation process increased community capacity related to health literacy. Community members of the POPS/CAB played a critical role in the design and implementation of the written materials. Incorporating CAB feedback was important to develop clear and suitable materials for the regional childhood obesity treatment program. Their involvement in the interpretation and application of the evaluation findings also enhanced the quality of the materials. The engagement of community partners in training on the CCI and SAM included the added value of increasing capacity in community members and may also lead and contribute to improved organizational health literacy [81]. Still, the participatory evaluation process also presented a significant time commitment for community partners and we balanced this by determining the minimum data necessary for the workbook development. This challenge is not unique to our study and has been described in several papers reporting on CBPR research approaches (Israel et al).

Our study included a number of limitations. First, we did not conduct a final round of focus groups to assess the final version of the parent workbook. Although the use of the focus group interviews in phase 1 contributed to understanding of the problem from a reader-centered point of view, it was extremely labor and time intensive, including time needed to conduct the analysis collaboratively with community partners. Therefore, we decided not to conduct a second

round of focus groups after the final revisions since the materials showed a significant improvement and reached acceptable clear communication and suitability levels. Second, the sample size of CAB members that evaluated the documents before and after revisions was small. This is due to the nature of the study and our goal to report on the process of assessment and adaptation. Third, we developed the workbook and tested it within a multi-component intervention, which does not allow for independent comparison of changes in the workbook with comprehension and study outcomes. Still, the findings provide a process for developing clear written materials for adults from an ethnically diverse, low income, and low literate community.

CONCLUSION

This article describes a CBPR approach to applying clear communication strategies in the development of childhood obesity intervention materials. The approach is driven by and tailored to community needs, and involved contributions from individuals who would ultimately deliver the intervention and participants who have engaged with the intervention materials. We found that a process that included the engagement of community members and program participants in the development, evaluation, and revision of a program workbook to be both feasible to our CAB and staff, as well acceptable to potential participants who represented the target population. Our iterative process resulted in improved written materials that are written in an adequate grade reading level, clearly communicated the objectives of the program, and were culturally relevant while achieving a high satisfaction among users. The findings from this study suggest this is a potentially generalizable process for improving the clear communication of written materials from evidence-based interventions.

Table 4. Sample of Perceptions that led workbook changes and adaptation

Chapter	Learning Objectives	POPS/CAB Feedback From CCI open questions	Delivering Staff Feedback From Summative Evaluation	Example of Participant's feedback From Focus Group	Workbook's Change - Adaptations
Overall		<ol style="list-style-type: none"> 1. More than one message 2. Main message is not at the beginning of section. 3. Pictures could represent more ethnicities (people and food) 4. Some sentences are in passive voice 	<p>Include most of the intervention hand-outs in the workbook</p> <ul style="list-style-type: none"> • Change activities – simplify to facilitate time management at classroom • Change activities – Use “rounded” number to facilitate calculation 	<ol style="list-style-type: none"> 1. “I think that the workbook was put together really well. It was organized and in sections, and explained each section thoroughly. It was easy to read...and we will continue to refer to it as needed.” 2. “Something that I think would be helpful is it has them in this book, but then it stays in this book ... if it was on my refrigerator every time I opened it, I would be like, oh, okay.” 	<ul style="list-style-type: none"> *Reorganized content to focus in one main message with is stated in the first paragraph * Changed pictures for include more diverse ethnicity. * Included most of the handouts as part of the workbook. * Made the tracking sheets and goal settings as “tear out” without compromising the content (blank back) * Added the Tips for You section * Changed remained passive voice sentences to active voice
Chapter 1	<ol style="list-style-type: none"> 1. Describe energy balance and how it influences weight. 2. Identify the food groups included in MyPlate. 3. Identify that children should participate in 60 minutes of moderate to vigorous activity daily. 4. Set a specific, time-based, and achievable goal for eating and physical activity. 	<ol style="list-style-type: none"> 1. [Need to] focused on energy balance 	<ol style="list-style-type: none"> 1. Better discussion about calories and energy balance (make clear that they need imbalance) 2. Setting SMART goals were too intense for young kids next time have kids set 1 goal / SMART goal setting was “too much to digest” for kids 	<ol style="list-style-type: none"> 1. “Plain and simple.” 2. “This explained it in real details and everything.” 3. “[Had] anything that could be done to this section to make better” 4. Energy balance was hard [to understand], I mean... We need imbalance right?” 	<ul style="list-style-type: none"> *Changed energy balance content language (energy “in-burned” to “in-out”), and pictures (changed scale to body outlines) *Reduced the SMART goals to kids

Chapter	Learning Objectives	POPS/CAB Feedback From CCI open questions	Delivering Staff Feedback From Summative Evaluation	Example of Participant's feedback From Focus Group	Workbook's Change - Adaptations
Chapter 2	<p>1. Choose foods to eat more often, and to cut back on foods to eat less often.</p> <p>2. Identify how to be physically active in a way that fits their preferences and lifestyle.</p> <p>3. Help their children to identify barriers and address them at daily bases without focusing overly on weight.</p>	<p>1. Pictures of sometime/ anytime foods might be more helpful than words alone (there are sometimes graphics - arrows + smiley face - but no food pictures on graphics in this section.</p> <p>2. First statement could state the health foods are anytime food.</p> <p>3. May need more diverse pictures - more non-white people.</p> <p>4. [Heath snacks] Dried fruit and nuts can be expensive and people don't know what hummus is.</p>	<p>Families were not using the tracking system.</p>	<p>1. "I think it could have been a little bit more with healthy foods and choices."</p> <p>2. "Maybe put the name of the food because that was kind of hard to tell [by the picture]"</p> <p>3. "I actually like this [exercise] pyramid. I think it would be clearer and maybe if it was a tear-out and we could put in on the refrigerator it would be great"</p> <p>4. "I would like to see on my fridge; that we could reference every day without having to go into a notebook (...) It would really make my kids more accountable and think about that."</p> <p>5. "I think the activity pyramid is helpful. But it's just don't make it so pixelated so we can actually read it.</p> <p>6. "I like color and what I see is a whole bunch of black and white (...) this seems like schoolwork a lot of times (...) I look this part and think: Boring!"</p> <p>7. "The information is great. I think it just should have been more visual pictures, and then maybe added a couple of extra pages and...it's like all this information in one place."</p> <p>8. "They need to highlight some of the main points or something."</p> <p>9. "I think its [multiple choice] a good way to get started because I've never really set goals like this (...) And I think this was a good way to kind of get the ball rolling."</p>	<p>* Made the tracking sheets and goal settings as "tear out" without compromising the content (blank back)</p> <p>* Changed layout to include more pictures, less text dense and more colorful.</p> <p>* Made a new adapted version of the excise pyramid which was more clear and included race variety images.</p> <p>* Added legend to food pictures</p> <p>* Added an annex section with health snacks options that are quick, easy and affordable.</p>
Chapter 3	<p>1. Define the appropriate portion sizes for parents and kids.</p> <p>2. Recognize when they are hungry and when are enough.</p> <p>3. Identify ways to cut back screen time to less than 2 hours per day.</p> <p>4. Develop strategies to change home environment cues so that they support healthy eating and physical activity.</p>	<p>1. More active voice: screen time "it is recommended" is passive consider "we recommend" and take out "can" and make it clear.</p> <p>2. Calories in food not rounded.</p> <p>3. Consider breaking up the "cut back on screen time" paragraphs in bullets.</p>	<p>1. Discussion on home environment and goal sheets were good.</p> <p>2. Change "hand portion activity" to match the instructions.</p>	<p>1. "Screen time focused in all no just TV".</p> <p>2. "My kids grasped it and they were able to really use it [hand measurement], you know, as far as even going out to eat, you know. They would say is this the right size for chicken? And we would say well look at your hand."</p> <p>3. "It [home environment] gets lost in the workbook. Because this is actually really good because, you know, then I'm looking at it again. It's really, really a good thing to have. But like the other worksheet that they hand out, I use that and I put that on the refrigerator to schedule things, you know."</p>	<p>* Changed "hand portion activity" to match the instructions and include race diverse pictures.</p> <p>* Changed the Screen time section including all screen types no just TV and added a screen time calendar for families.</p> <p>* Made the home environment quiz a "tear out".</p>

Chapter	Learning Objectives	POPS/CAB Feedback From CCI open questions	Delivering Staff Feedback From Summative Evaluation	Example of Participant's feedback From Focus Group	Workbook's Change - Adaptations
Chapter 4	<ol style="list-style-type: none"> 1. Understand and making sense of a food label. 2. Understand importance of games and how they can help them to improve health. 3. Identify appropriate rewards for healthy behaviors and weight loss. 4. Identify how they can be a role model for their family and friends. 	Need to better outline ways to help to be successful.		<ol style="list-style-type: none"> 1. "More information on the label part". 2. "I think the food label message was really good. My son, he bought into that, you know, looking at calories and sugar and stuff like that, and my daughter as well (...) The one thing that I think we went over that I think we should have talked more about is the ingredients." 3. "It broke it down really good for her [my daughter], and she even now does it on her own." 4. "That's something y'all should include is how much we need as far as our nutrients and sodium and how much a person should be taking in, because that really wasn't in there." 5. "I don't know what I can do about sugar... I can't just cut off all from my kids... I need an acceptable daily number..." 6. "I didn't necessarily use the chart, but we learned from it; that making activity a reward is much better than ice cream, you know. And I learned, too, that my kids like it better." 7. "More pictures" 	<ul style="list-style-type: none"> * Added more information on label section including sugar and sodium (the "5/10 rule"), and ingredients information. * Added more pictures illustrating recommended actions.

Chapter	Learning Objectives	POPS/CAB Feedback From CCI open questions	Delivering Staff Feedback From Summative Evaluation	Example of Participant's feedback From Focus Group	Workbook's Change - Adaptations
Chapter 5	<p>1. Reflect on eating choices in the last week and identify triggers to that lead to unhealthy eating.</p> <p>2. Identify movements and intensity routines of activities using music & dance that can help them to improve their family's health.</p> <p>3. Identify strategies and resources to help their children to deal with bullying and teasing situations using the 5 step strategy AWARE.</p>	None		<p>1. "I think they were explained really well, especially this first page. It looks like a summary of everything, you know, with my plate and using their hand. The energy balance, you know, it was just a really nice summary before we moved on to the next section... I think that's really important."</p> <p>2. "I would like to see more maybe pictures of some of the exercises. Some of the exercises that we did or maybe some that the program suggested that we do at home. That would be helpful."</p> <p>3. "I think the bullying part maybe, you know, just like the other part where you're talking about elaborating on it a little more (...) Maybe a different picture or other pictures, because this triangle is good, but I think maybe we can do better, you know, to really drive home the whole bullying thing."</p> <p>4. "I like these iChoose [tracker] where you had the vegetables...well the fruit, vegetables, grain, protein, dairy, and sometimes food... I think that's great because that kind of its one thing to just think you're doing all right. Versus you see it in print and you're thinking, oh, I thought I had more vegetables than that. You know, it just brings it home. So I think this was a really good tool."</p>	<p>* Included an appendix which exercises that families did in the exercise class (circuit), and also which exercise that could be done at home.</p> <p>* Improved bullying section by reducing content and focusing in strategies.</p> <p>*Included in all sections a "recap" paragraph at the beginning of each chapter.</p>

Chapter	Learning Objectives	POPS/CAB Feedback From CCI open questions	Delivering Staff Feedback From Summative Evaluation	Example of Participant's feedback From Focus Group	Workbook's Change - Adaptations
Chapter 6	<p>1. Describe relapse and recovery in a healthy eating and physical activity.</p> <p>2. Identify and practice exercises that can help to decrease stress.</p> <p>3. Identify strategies and resources to prevent relapse and to recovery after a relapse.</p>	<p>1. "I feel this should be more goal based + strategies to avoid relapse"</p> <p>2. [X] suggested making title mention lapse/relapse more clear [Y] felt it was fine the way it was since the cycle graphic is just underneath.</p> <p>3. Not sure why the image about "desserts is stress backwards". Seems counter to our main goals because the image with a cake did not support recommended behaviors and its purpose was unclear.</p> <p>4. One list exceeded 7 bullets, but barely and the items in the list are short and easy to read.</p>	<p>Replace Desserts image with a culturally more appropriate image of health stress management methods such as those in the text next to the image.</p>	<p>1. "I think you used very familiar words that you're used to hearing about if you listen to anything about weight loss and stuff; they do talk about lapses and those kinds of things and healthy habits. You know, recovery is probably not a word I've heard used before with like lapses and relapses. That's not a word I would necessarily think of."</p> <p>2. "When we first got the book and I saw recovery, I'm like recovery? Is this talking about alcoholics?"</p> <p>3. "My take on it is that I like strong language like that because it makes me...it motivates me to get back on the wagon or whatever. Get me back on the trail to doing what I personally need to do, you know, to reach my goals--It means something positive to me because of my background. So I guess you guys, you have to find a balance between me and [participant Y] is it?"</p> <p>5. "I think it was proactive [plan]. It's always important to be proactive because, once something happens, you react and you don't always have the best thought process. But if you have a plan in place, then you're like, okay, I did this. Let me go to this and let me figure out where I should do from here to fix it.</p> <p>6. "I like that [stress management] ... And I like how you guys have this all set up, but I think maybe you could elaborate just a little bit more. Give us a little bit more tools of relaxation because, you know, us superwomen need all the help we can get, you know, to tackle the day."</p> <p>7. "I think this is helpful, you know, because it helps you to sustain, you know, all the lessons that you learned through the program. I have not actually cracked the book open and wrote down my strategies. I mean, I have it up in here and I have it in my heart. And I feel that I'm using the tools that you guys gave me. And this book is more of a reference for me, but I haven't opened it up and started writing anything down."</p>	<ul style="list-style-type: none"> * Replaced images with a culturally more appropriate image of health stress management methods. * Review bullet list to contain less up to 7 items. * Reviewed content to be more goal based and focused in the family plan after the program. * Kept lapse and relapse (strong language) to motivate the family planning for maintenance phase. * Added more stress management tools for families. * Included a family contract to stimulate parents keeping changes after program ends.

MANUSCRIPT 2: Home media environment factors and change in child BMI in a family-based childhood obesity

INTRODUCTION

Obesity tracks from childhood into adulthood [82] and is related to serious medical [83, 84] and economic consequences throughout the life course[85]. Childhood obesity continues to be a leading public health concern, with 18% of 6-11 year olds qualifying as overweight, and an additional 17% qualifying as obese [86]. Contributors to childhood obesity include high energy intake and low energy expenditure, both of which have been linked to changes in the environment [87]. Choices play a role in what children eat and do, but there are also environmental influences - the likelihood that an individual will engage in a healthy behavior is largest when the environment offers healthy opportunities [88].

In this context, family-based interventions have been implemented on the premise that making changes in the home environment are important determinants of treatment outcomes[89, 90]. A recent systematic review of the literature [91] showed that interventions that used family-based programs to promote change in the home environment to support physical activity behavior, modify dietary intake, and reduce sedentary behaviors were more successful in helping lower children's weight. While these interventions have shown the ability to reduce and maintain weight status, their translation into regular community or clinical practice is not apparent [4, 92]. Even once an evidence-based intervention is adapted for local implementation, holding great promise for developing sustainable interventions[6], there still appears to be wide variability among child outcomes with some losing weight, some maintaining weight, and some gaining weight. Unfortunately, it is unclear the degree to which home environmental changes predict changes in weight status [93] in a family-base intervention context.

The home environment has been documented as a factor that can either facilitate or inhibit healthful behavior among children [3, 23, 94, 95]. Since it represents a substantial part of the full environmental context in which a child grows, develops, eats, and behaves [94], changing the home environment may improve a child's healthy behaviors and weight status in the long term [89]. Both parenting practices and the physical environment are important factors in helping children to eat more healthfully and be physically active [23, 89, 95]. However, there is little evidence that multilevel interventions targeting multiple strategies including both social (e.g. parent polices) and physical (e.g. availability) home factors related child's healthy behaviors can either enhance or disrupt the relationships between the home environment and weight management.

Knowing the influences of different home environment components on children's weight status correlates may be important to improve the design of future initiatives to reduce childhood obesity. Considering the home environment, evidence indicates that when more media opportunities are available, children are more likely to engage in sedentary activities [96-99]. In fact, studies often utilize media availability (e.g. numbers of televisions/computers in the home and televisions in children's bedrooms) and media use (e.g. TV viewing, video gaming and computer use) as a measure of children's sedentary behavior [100-106]. An increase in media-related sedentary behavior may result in a significant energy imbalance, because of increased caloric intake and a decrease in energy expenditure, causing excess weight gain [102, 103]. Not surprising, media-related sedentary lifestyle patterns have been associated with childhood obesity [102]. The time spent with media is thought to be one of the most modifiable environmental influences of obesity, and interventions that emphasize decreasing media use in children improved weight indices [104]. Nevertheless, despite the mobile and online media

revolutions [107], which increase the accessibility of different types of media and use by children (video games, hand held devices, smartphones), much attention has focused solely on the role of television as a contributor to childhood obesity [108].

Kaiser Family Foundation's study of children's media use [107] revealed a radical increase over the past five years both in the amount of time spent with media and the total amount of media content consumed during that time. Children engage with media every day and by some records, nearly 8 hours each day. Indeed, children also use multiple devices at the same time—using the computer for school work, or time spent texting or talking on a cell phone. However, in homes that limit children media opportunities (e.g. avoiding a TV in the bedroom, turning the TV off during meals) or by imposing some type of media-related rules, children spend substantially less time with media than children with more media-lenient parents [107]. The Kaiser's study also highlights the effect of the mobile and online media revolutions on child media consumption—making new ways for children to engage with television programming.

A better understanding of the modifiable risk factors for overweight and obesity among children is of critical importance to reduce its prevalence [109]. The home media environment may be an important determinant of treatment outcomes [89]. Yet, surprisingly we know very little about specific home media environmental influences on children's healthy behaviors [110]. And even less is known about those influences when related to outcomes of childhood obesity treatment interventions [3]. As a result, it is unclear what home media environment (HME) factors are most likely to result in a reduction by a multi strategy intervention, and whether this will result in a decrease in obesity. The evaluation of interventions with home environmental modification components can provide an opportunity to examine changes in weight outcomes occurring in conjunction with changes in the HME [111].

Therefore, in this exploratory study, we aimed to examine short-term (post-intervention) change in HME factors and test HME relationships with change in BMI z-scores in children participating in family-based childhood obesity treatment intervention. We hypothesized that HME would improve after intervention and those changes will correlate with a change in BMI z-score. A secondary aim was to determine the relationship between the HME and screen time. Finally, we examined the relationship between screen time changes and changes in BMI z-scores. Determining HME changes and influence on children's outcomes resulting from an intervention may provide useful information to developing strategies to address childhood obesity and sedentary lifestyles.

METHODS

This study is part of a larger planning grant with the goal to increase local capacity to develop, test, and sustain an evidence and family-based childhood obesity treatment program in an area that provided services to low income and racially diverse audiences. The Partnering of Obesity Planning and Sustainability-Community Advisory Board (POPS-CAB) produced the *iChoose* program that included a number of strategies to change the home environment by increasing opportunities for healthful eating and physical activity, and reduce sedentary behaviors. Families were identified by local health providers and screened for eligibility (N=586). Inclusion criteria for families included having an 8-12 year old child with BMI percentile ranking greater than or equal to 85%, no major cognitive impairments or contraindications for physical activity, living in the study region, English-speaking, and not currently participating in a weight loss program (N=557). The intervention was pilot tested with

3 waves of families (n=101). Participants completed both baseline assessments and completed the post-intervention (3-months) assessments (n=71) were included in the analyses.

iChoose combined healthful eating, physical activity, and behavioral strategies. Program components included: (1) 90 minute family sessions that would occur every other Saturday over the 12-week program, broken into a nutrition lesson, exercise time, and behavioral skills training (2) 20-25 minutes telephone support calls to set goals, resolve barriers, and reinforce content using the 5 A's, teach-back and teach-to-goal strategies during weeks between family sessions, (3) two 60 minute exercise sessions per week, (4) workbooks for both parent and child based on clear communication strategies, and (5) child newsletters that reinforced content and provided fun activities.

The *iChoose* curriculum contained a home environment behavior change element targeting the family development of strategies to change home media environment cues so that they support healthy eating and physical activity. Overall aims for media health behaviors were reducing screen time and improving physical activity opportunities at home. Specifically, the family's home media environment component objectives focused on: (a) identifying media environmental characteristics (barriers and facilitators) to promote healthy habits; (b) establishing and/or reinforcing parental policies to monitor media use (e.g. family schedule for media use); (c) reducing child media availability (e.g. removing TVs from children bedroom); (d) avoiding eating in front of TV; (e) improving exercise opportunities while watching TV (e.g. getting up to move and play during the TV commercials); and (e) media-related goal setting focused on limiting media use to 2 hours or less per day for both parent and children (e.g. family contract).

Measures

During in-person baseline and post-intervention assessments, parents completed a sociodemographic and home environment survey, and children anthropometric measurements (i.e. height and weight) and self-reported screen time were collected. Children's weight was measured to the nearest 0.1 kg using a medical weight scale (Tanita TBF 300), and height was measured with a stadiometer, calibrated in 0.1-cm intervals. Parents completed the social-demographic survey including, but not limited to, education level, income, age, race/ethnicity, and gender.

To measure HME factors parents completed the Comprehensive Home Environment Survey (CHES) [106], which has been tested for reliability and validity in a low-income population of parents of children 5-17 years old [106]. Items and subscales assessed in this study following the CHES scoring system are listed in Table 1. Variables and scales from the CHES were selected based on their alignment with the *iChoose* media environment curriculum objectives. Specifically, we assessed the HME as; (a) Parental Policies to Monitor Media scale with 6 items and total score ranging from 0-6 points; (b) Media Availability scale with 7 items and total score ranging from 0-7 points; (c) Eating In Front of the TV scale with one item and score ranging from 0-1 point; and (d) Exercise Opportunities in the Media Area scale with 2 items and total score ranging from 0-2 points. Using the originally proposed scales from the CHES, Parental Policies to Monitor Media, Eating in front of the TV and Media Availability, a total score was calculated using the sum of the scores of the 3 scales, which included 14 items and could range from 0-14 points. Higher total score on the scales indicates a home environment more supportive to health media behaviors and a lower total score indicated a less supportive HME.

In addition, two assessments of child screen time additional scales were completed—by parental report (i.e. How many hours of television does your child watch? and How many hours does your child spend on the computer or video games?; scored 0 =>7 hours; 1<7 hours) with a possible score ranging from 0-2 points and by child self-report (On an average school day, how many hours do you watch TV? and On an average school day, how many hours do you play video or computer games or use a computer or laptop for something that is not school work? [112]; scored 0 = > 4 hours or more; 1= <4 hours) with a possible score ranging from 0-2 points.

Table 1. Home Media Environment Measures, Baseline and Post Intervention Results.

SCALE	VARIABLE	SCORE CODE ^a	BASELINE M (SD)	POST- INTERVENTION M (SD)
Characteristic s of Family's Media Environment	What best describes your television service for the primary television in the home?	0= > Premium channels, Satellite/dish, 1= No cable, Basic cable	0.35 (0.05)	0.38 (0.05)
	Approximately how many video games and computer games are in your home?	0= ≥ 11, 1= ≤10	0.87 (0.04)	0.87 (0.04)
	How often is your television left on, whether or not it is being watched?	0=2-3 hours, 1= Never, Rarely	0.27 (0.05)	0.23 (0.05)
	How much time are they allowed to watch Television or Videos per day?	0= > 2 hours, 1= ≤ 2 hours	0.48 (0.06)	0.54 (0.06)
	How often are these limits [Television or Videos] enforced?	0= Never, Rarely, Sometimes; 1= Frequently, Always	0.52 (0.06)	0.56 (0.06)
	Does your family eat dinner while watching television?	0=yes 1=no	0.32 (0.05)**	0.53 (0.06)**
	How much time is allowed to play or talk with friends on the computer per day?	0= > 2 hours, 1= ≤ 2 hours	0.45 (0.07)	0.49 (0.07)
	How often are these limits [play or talk with friends] enforced?	0= Never, Rarely, Sometimes; 1= Frequently, Always	0.52 (0.06)	0.43 (0.06)
Parental Policies to Monitor Media	Do you have any firm limits or agreements with your child about how much he/she can watch TV or videos?	0= No, 1= Yes	0.61 (0.06)	0.64 (0.06)
	Do you have any firm limits or agreements with your child about how much time he/she is allowed to play on the computer or use it to communicate with friends?	0= No, 1= Yes	0.57 (0.06)	0.52 (0.06)
	Do you have any firm limits, or agreements, about how much time your child can play video games?	0= No, 1= Yes	0.54 (0.06)	0.58 (0.06)
	Do you have the following rule: No TV/DVD before homework	0= No, 1= Yes	0.83 (0.05)	0.90 (0.03)
	Do you have the following rule: No computer before homework	0= No, 1= Yes	0.80 (0.04)	0.77 (0.05)
	Do you have the following rule: No internet without permission	0= No, 1= Yes	0.78 (0.05)	0.80 (0.05)
	How many TVs do you have in your home?	0= ≥ 1, 1= <1		

Media Availability	Do you have a digital TV recorder (e.g., TiVo, Replay TV, Sonic Blue)	0= Yes, 1= No	0.47 (0.06)	0.47 (0.06)
	Does your child have a TV in his/her bedroom?	0= Yes, 1= No	0.12 (0.04)	0.15 (0.04)
	Does your child have a video game station or computer?	0= Yes, 1= No	0.09 (0.03)	0.10 (0.04)
	Do you have a desktop or laptop computer in your home?	0= Yes, 1= No	0.15 (0.04)	0.19 (0.05)
	Does your child have a PSP, Nintendo DS, iTouch or any other handheld video game?	0= Yes, 1= No	0.11 (0.04)	0.11 (0.04)
	Do you have video games on your phone?	0= Yes, 1= No	0.35 (0.06)	0.34 (0.06)
Eating in front of the TV	How often does your child eat in front of the TV?	0= 2-3 times per week, and 4-5 times per week, and every day 1= Never and 1 time or less per week	0.34 (0.06)	0.43 (0.06)
Exercise Opportunities in Media Area	Do you have exercise equipment (such as stationary bikes, treadmills) in your main TV viewing area?	0= No, 1= Yes	0.07 (0.03)*	0.16 (0.04)*
	Does your main TV viewing area have adequate space for your child to play or exercise while watching TV/Videos?	0= No, 1= Yes	0.88 (0.04)	0.94 (0.03)

^a Higher total score indicates a home environment more supportive to health media behaviors

* p<.05 **p<.001

Data Analysis

Multiple descriptive statistical tests were performed using Characteristics of Family's Media Environment variable values at baseline and post intervention to summarize the data, including means and standard deviations. We excluded those who did not attend the post-intervention (3 month) assessment. Data were entered and scored using SPSS®20 and analyzed using statistical significance set at a value of $p < 0.05$.

Using the CHES [106] scoring metrics each HME variable score was calculated as 0 or 1 as indicated in Table 1. For each scale, a total score was calculated for both baseline and post-intervention using the sum of their containing variables scores (Table 1). Paired-samples t-tests were conducted to evaluate the impact of the intervention on participants' scores on each scale. Paired-samples t-tests were conducted to evaluate the impact of the intervention on participants' scores on both HME 3-Scale and 5-Scale totals. BMI z-scores were computed for the children based on age and gender.

Change scores from baseline to post intervention were calculated for each of the scales. Linear regression models tested if there was a relationship between change in children's BMI z-scores and the change in the HME scores. Model included as the independent variables the change scores from the Parental Policies to Monitor Media, Eating in front of the TV and Media Availability scales originally proposed by CHES.

RESULTS

The data are presented for the study participant population (70 parents and children) that completed both baseline and the 3 month post-intervention assessment. The parent participants in this study sample were on average 39.7 (± 8.84) years of age, 93.6% female, and the majority of

individuals were black, non-Hispanics (54.4%). More than 58% of participants had at college degree and nearly half were married (48%). Parent participants in the present study were mostly employed (69.1%) and near half had a household income of less than \$25K (48.8%). The average age of children in the sample was 10 years of age ($SD = 1.3$ years), and there were nearly equal numbers of males and females (51.5% and 48.5%, respectively). A larger proportion of the children were black, non-Hispanics (61.4%). Child participant BMI z-scores were on average $1.9 \pm .43$ which is equivalent to, on average, approximately the 98th percentile.

Characteristics of Family's Media Environment

Baseline home media environment characteristics reported by parents presented on average $3.7 (\pm 1.48)$ TVs at home and the service for the primary television in the home was satellite/dish (41.8%) or cable with premium channels (26.5%). Nearly half (54.5%) of homes have a digital TV recorder (e.g., TiVo, Replay TV, Sonic Blue). The majority of homes have a computer (85%). Eighty-eight percent of the children have a TV in their bedroom, 85%, own a video game station or computer, and have handheld video game device (86%) such as PSP, Nintendo DS or iTouch. Ninety-seven percent of the homes have at least one video game and 41% have 11-20 games. In just over half (52%) of the homes, the TV is often left on whether or not it is being watched, and 65% of the families reported eating dinner while watching TV. Each day, children were allowed, on average, to watch TV or videos for 66 ± 69 minutes, play video games for 50 ± 55 minutes, and play or talk with friends on the computer for 44 ± 48 minutes. Nearly half of parents reported having firm limits or agreement about how much time their children are allowed to watch TV or videos (58%), play video games (53%), play or talk with friends on the computer (57%) and 66%, 65%, and 55%, respectively, reported they enforced those limits "always". The majority of TV viewing areas had adequate space for child play or

exercise while watching TV/Videos (87%) but did not have exercise equipment in the area (91%).

Home environment Change

When examining individual items scores change from baseline to post-intervention (Table 1), there was a statistically significant difference in item scores for family television viewing while eating dinner ($t(67)=3.18, p=0.002$), exercise equipment availability in the main TV viewing area ($t(67)=2.18, p=0.033$), and from baseline to post-intervention. The eta square statistic 0.04 and 0.03 respectively, indicated a small effect size. No other significant changes were noted.

Computed sum scores for scales of parental policies to monitor media, eating in front of the TV, media availability subscales, exercise opportunities in TV area and screen time are presented in Table 2. There was a significant difference in scale for Exercise Opportunities in TV Area from baseline ($M=0.48, SD=0.22$) to post-intervention ($M=0.55, SD=0.23$); $t(67)=-2.3, p=0.024$. The eta square statistic (.06) indicated a small effect size. However, there were no statistically significant ($p < .05$) changes from baseline to post-intervention for the scales Parental Polices to Monitor Media, Eating in front of the TV, Media Availability and both parent and children reported Screen Time from baseline to post-intervention, as seen in Table 2.

Table 2. Baseline to Post-Intervention Home Media Environment subscales scores.

Scale Scores ^a	Range	Baseline, <i>M</i> (<i>SD</i>)	Post-Intervention, <i>M</i> (<i>SD</i>)
Parental Policies to Monitor Media	0-6	4.10 (0.23)	4.22 (0.21)
Media Availability	0-6	1.73 (0.15)	1.79 (0.14)
Eating in front of the TV	0-1	0.34 (0.06)	0.43 (0.06)

Exercise Opportunities in TV Area	0-2	0.96 (0.05)*	1.10 (0.06)*
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^a Higher total score indicates a home environment more supportive to health behaviors

* p<.05

Parental polices to monitor media, eating in front of the TV and media availability scales scores were used to calculate a 3-Scale overall score for HME. A paired-samples t-test was conducted to evaluate the impact of the intervention on participants' scores on HME scale. There was a no statistically significant difference in total score of 3-Scale HME from baseline (M=6.11, SD=0.28) to post-intervention (M=6.46, SD=0.24); $t(67)=1.45$, $p=0.15$.

Home environment and BMI

Children reduced their BMI z-scores by a mean of 0.04 (± 0.18) and 64% of the children (n =45) reduced their BMI z-scores during the 3-month intervention. Multiple regression analyses were conducted to examine the relationship between change in children's BMI z-scores and the change in the Parental Policies to Monitor Media, Eating in front of the TV, and Media Availability, Screen Time and Exercise Opportunities in Media Area scales scores. Table 3 summarizes the descriptive statistics and analysis for Model. The multiple regression with three predictors explained a significant proportion of the variance in BMI z-score changes ($R^2 = 0.139$, $F(3, 63) = 3.38$, $p < 0.024$). As can be seen in Table 3, the Eating in front of the TV scale (higher score reflected less eating in front of the TV) had significant negative regression weights, indicating children with higher scores on these scales had larger reductions in BMI z-score, after controlling for the other variables in the Model. There were no statistically significant ($p < .05$) relationships between BMI z-sores change from baseline to post-intervention and change scores of Parental Policies to Monitor Media and Media Availability subscales.

Table 3. Summary statistics, correlations and results from the regression analysis

VARIABLE	MODEL ^a	
(Change in Score)	<i>M (SD)</i>	β (95% CI)
Parental Policies to Monitor Media	0.12 (1.60)	0.20 (-0.08, 0.01)
Media Availability	0.59 (0.90)	0.12 (-0.02, 0.73)
Eating in Front of the TV	0.09 (0.45)*	-0.27 (-0.20, -0.01)*

a. $R^2 = 0.139$, $F(3, 63) = 3.38$, $p < .024$

* $p < .05$

Screen Time

Parents reported that 62% of the children watched more than 7 hours of TV per day and 32% play more than 7 hours of video game per day. On the other hand, the majority of children reported 3 or less hours of watching TV and playing video games (73.3%). Multiple regression analyses were conducted to examine the relationship between change in HME 3-scale scores model and changes in screen time reported by both parents and children, and to examine the relationship between change in children's BMI z-scores and changes in screen time.

There was a statistically significant difference in variable scores for parental report in how many hours of TV their child watched ($t(67)=2.24$, $p=0.028$) from baseline ($M=0.76$ $SD=0.05$) to post-intervention ($M=0.90$ $SD=0.04$). The eta square statistic 0.03 indicated a small effect size. However, the scale combining combined TV and video game hours reported by parents were not statistically significant ($t(67)=1.47$, $p=0.14$) from baseline ($M=1.71$, $SD=0.07$) to post intervention ($M=01.82$, $SD=0.05$). Moreover, there were no statistically significant ($p < 0.05$) relationships between BMI z-sores change, the HME 3-scale model and change scores of parental report of child's screen time.

Furthermore, there was no statistically significant difference in scores of children's self-reported screen time scale ($t(53)=0.57$, $p=0.5$) from baseline ($M=0.78$, $SD=0.42$) to post

intervention ($M=0.81$, $SD=0.39$). Moreover, there were no statistically significant ($p < .05$) relationships between HME 3-scale model and change scores of child's self-reported screen time. However, the combined TV and video game hours reported by children were a predictor of the BMI z-score change ($R^2 = .094$, $F(1, 52) = 5.39$, $p=0.024$, $-0.047 \pm (0.127)$) indicating that those children that reported reducing their screen time tended to have a higher reduction in BMI z-scores.

DISCUSSION

This study explored the home media environment of families participating in a family-based childhood obesity treatment intervention that targeted improvements in media behaviors from baseline to the post program (3 month) follow-up. Specifically, the methods of this study were designed to explore changes in home media environment factors and their association with change in BMI z-scores in participating children. The results provide support that the intervention was able to improve aspects of the families HME (i.e. families avoiding eating dinner in front of TV, reducing child hours of TV watching, and increasing the availability of exercise equipment in TV viewing area) and that reducing child reported screen time and avoiding eating in front of the TV was related to a higher reduction in their BMI z-scores. The changes observed in families HME followed the intervention objectives for media behaviors to reduce screen time and improve physical activity opportunities at home. These changes provided the basis for the experimental evaluation of how home media environment can influence outcomes in a multilevel childhood obesity intervention targeting multiple strategies.

The study findings were similar to the results from the Kaiser Family Foundation's study of children's media use [30]. Families had a similar number of TVs, digital TV recorders, the percent of homes with at least one video game, and percent of homes with a computer. Parents in

our sample reported having firm limits or agreement about how much time children were allowed to watch TV or play video games (62%) when compared to 28% from the Kaiser study that had time-related rules for media. Fewer families, however, had a satellite/dish or cable with premium channels but almost twice as many study children had a TV in their bedroom (88%) when compared to those in the Kaiser family study (54%).

Parents reported that majority of the children watched more than 7 hours of TV per day (that included other electronic devices) with is compatible with an average of 7½ hours of media use reported previously. On the other hand, the majority of children reported 3 or less hours of watching TV and playing video games. This discrepancy may be due to the different measure used. Parent report measures were from the CHES [106] with three possible options (<7, 7-14, and >14 hours), while children self-report measures were from YRBSS [112] with six possible options ranging from no TV to 5 or more hours. Still, parent reports of child TV time significantly changed between baseline and follow-up while the child report measure did not. It could be that children were more accurate in their assessment and the intervention activities that drew parental attention to TV viewing resulted in parents become more aware of their children's TV time [27].

Overall, the results suggest that the intervention may have reduced the number of families that eat dinner in front of the TV and increased the availability of exercise opportunities in the TV viewing area. At baseline, a high proportion of families reported regularly eating in front of the TV and none reported having exercise equipment in the TV area—both representing areas for improvement. Our regression analyses found that changes in eating in front of the TV was a significant predictor of change in BMI z-score. Research has shown children who routinely eat while viewing television may be predisposed to childhood obesity due substantial increases in

energy intake [113] due to the frequency of meals and snacks [114] and the consumption higher fat food items and fewer fruits and vegetables [115].

The generalizability of this study may be limited to the population tested in this intervention because the subjects come from a demographically low income and health disparate region. As well, considerations are due to the program and selection criteria were we can only draw conclusions about HME in a sample of overweight/obese children. Further, all of the HME measures were self-reported by parents and children. Future studies may choose to include in-home observation assessments of media environment in addition to CHES self-reported items. Additionally, future testing should investigate changing HME and media behaviors in the long term to assess whether or not those changes were sustained by the families.

CONCLUSIONS

A family-based childhood obesity treatment program appears to be successful in improving the home media environment. Specifically, participants reported reducing hours watching TV and eating in front of the TV, as well as in improving physical activity opportunities in TV viewing area at home. Initial findings indicate that child eating while in front of a TV and reducing their reported screen time may be particularly important for child weight change. The current study contributed to the literature on family-based childhood obesity interventions by providing a better understanding of which home media environments factors may be modifiable by a multilevel program that promotes changes in the home environment. Our results not only demonstrated what home media environment (HME) factors may be improved by a multi-strategy intervention but also related some of those changes to a reduction in child weight status. This HME changes and influence on children's outcomes confirms information for

previous and future childhood obesity interventions—focusing on HME may contribute to reduced child weight status.

However, we recognize that media is increasingly used in education for children and a persistent part of daily life. Although the *iChoose* curriculum targeted the reduction of recreational media use (e.g. sedentary screen time), a potential risk is that the media reduction message may be confusing, given the use of technology, particularly computers and tablets/iPads in educational settings. Thus intervention strategies that focus on recreational sedentary media should be highlighted throughout the program, and examples given in the curriculum to ensure that both parents and children understand the difference in using a media to complete an assignment for school or work and using it to watch a television show or surfing the internet.

MANUSCRIPT 3: The neighborhood environment in the context of a childhood obesity treatment intervention.

INTRODUCTION

Obesity is one of the most pressing global population health issues, and importantly one that affects racial and ethnic minorities and those of low socioeconomic status disproportionately [116]. Obesity tracks from childhood into adulthood [82] and is related to serious medical [83, 84] and economic consequences throughout the life course [85]. There is little doubt that environmental influences are important contributors to the rise in childhood obesity [1, 2]. Other contributors to childhood obesity include high energy intake and physical activity (PA) environments [87]. The likelihood that an individual will engage in a healthy behavior is largest when the environment offers healthy opportunities [88]. Accurate assessments of environmental characteristics that support healthy eating and PA have become a topic of recent interest [117]. Unfortunately, it is unclear the degree to which neighborhood environments could inhibit or support program participation and impact the reach of a program into a targeted area. Further, studies testing the ability of contextual factors such as characteristics of neighborhood food and physical activity environments to predict changes in physical activity, nutrition, and weight status are equivocal [96, 118-120]. Thus, further investigation of what aspects of the environment are more influential is needed to inform future interventions [24].

Numerous studies have demonstrated that environmental factors are associated with physical activity, healthful eating, and childhood obesity [2, 119, 121]. For instance, children from neighborhoods with better nutrition and physical activity environmental characteristics were less likely to be obese than children from neighborhoods inferior on both measures [2]. Children's weight status was found to be associated with availability and accessibility to fruits

and vegetables [122], neighborhood hazards [24], access to physical activity facilities and availability of bicycle and walking trails [123], walkability[124] and community features (e.g. parks and recreational facilities) [111]. Also the number of accessible destinations [125], safety [126] and outdoor play spaces that feature shade, swings, water and cleanliness [127] contribute to children's physical activity. Importantly, strong empirical evidence is not yet available for *modifiable* and *specific* neighborhood environmental features due to the difficulty to implement broad environmental changes [111]. Among both adults and children, most studies have not simultaneously considered environmental factors on both physical activity and nutrition [96] and there are no studies that also assess the home environment. Though there are research studies that have examined the relationship between environmental factors, physical activity, and nutrition in children [96], we are unaware of any that did so in the context of a childhood obesity treatment intervention. There is a need to better understand the relationship between home and neighborhood environment and children on eating, physical activity, and weight status outcomes from family-based childhood obesity interventions.

Important aspects of programs and interventions that aim to address health behavior promotion, such as reach and effectiveness, could influence their public health impact [128]. As King and colleagues report the promotion of any health behaviors involves a geographic component once the “where” influence program’s populations that are reached and their outcomes [129]. Thus, family-based childhood obesity interventions could be aided by the use of an evaluation framework that identifies both reach and effectiveness at it relates to neighborhood environments. For instance, by identifying the reach aspects of the target population (e.g. representativeness) related to settings (e.g. intervention's geographic location), as well effectiveness of interventions related to geographic access to resources that could influence

health outcomes [129]. The present study proposes to opportunistically investigate enrollment data with geodemographic aspects of the study area and then combine systematic environmental audit data with individual-level child data before and after a family-based childhood obesity intervention [55]. It is hypothesized that different neighborhood environmental factors may be related to intervention enrollment and child changes in physical activity, eating, and weight. Of particular importance will be the better understanding of how all of these factors impact intervention reach and effectiveness.

To advance community-created models and assessments on environmental influences for obesity [130], this study expands upon previous studies by identifying all physical activity resources [131, 132], food outlets [132], and obesity disparities existing within the Dan River Region (DRR) [27] in the context of the *iChoose* family-based program. The study was framed in a social determinant of health and social ecological perspective that strives to be transdisciplinary, involving researchers from different fields with an intention to achieve intellectual integration that extends the concepts, theories, and methods [26]. This approach involves the application of the social ecological theory [133] to help explain the variance in children's changes in physical activity and eating behavior, and weight status by testing interactions among multiple levels of neighborhood environment combined with a contextual analysis.

METHODS

This study is grounded in the social ecological framework [21, 134, 135] and uses a mixed methods approach to examine (1) aspects of intervention reach including representativeness of enrolled and not enrolled families and delivery location influences; and (2) neighborhood environmental factors as they relate to changes in eating, physical activity (PA),

and weight status of overweight and obese children between 8 and 12 years old. Specifically, this study opportunistically examines the degree to which both social and built environmental neighborhood factors moderate the relationship between the home environment and the effect of a childhood obesity treatment program - *iChoose*. It is hypothesized that different environmental factors may differentially influence child changes in PA, eating, and weight as a result of the family-based *iChoose* childhood obesity intervention.

Study Setting & Intervention

The DRR is a predominantly rural, health disparate and federally designated medically under-served area [52, 53]. Located in south-central Virginia and north-central North Carolina, the DRR includes the city of Pittsylvania, and Henry and Caswell Counties, and is anchored by the small regional city of Danville. Danville residents experience high unemployment, low educational attainment and have some of the highest rates of childhood obesity in the country [54]. Regional data on childhood obesity are limited; data collected by school nurses in one local school district showed 17% of 1st graders were overweight (i.e., BMI percentile 85th-94th) and 19% were obese. By 5th grade, in this same cohort, the prevalence increased to 19% overweight and 36% obese. This rate of obesity is 3 times higher than state averages which estimate 12% of Virginia high school students are obese [136]. Thus, the geographic profile, socio-demographic characteristics, and current economic strain in the DRR create a vulnerable situation for residents. In fact, the region currently ranks 126th out of 133 for health outcomes by county or city in the Commonwealth of Virginia[79].

The *iChoose* intervention is a 3-month program. Program components included: (1) 90 minute family sessions that would occur every other Saturday over the 12-week program, broken into a nutrition lesson, exercise time, and behavioral skills training (2) 20-25 minute telephone

support calls to set goals, resolve barriers, and reinforce content using 5 A's (Ask, Advise, Assess, Assist, and Arrange), teach-back and teach-to-goal strategies on weeks between family sessions, (3) two 60 minute exercise sessions per week, (4) workbooks for both parent and child based on clear communication strategies, and (5) child newsletters that reinforced content and provided fun activities.

Data Collection Procedures

Data have been collected as part of the *iChoose* program that includes 3 waves of families (n=101) who participated in the program between February 2014 and June 2015. *iChoose* inclusion criteria included children aged 8-12, a BMI of >85%, and English speaking. The *iChoose* program was delivered at local facilities including a central parks and recreation location for Wave 1 and a different parks and recreation facility for Wave 2 and 3. Different locations were used for delivery of intervention. Wave 1 was delivered in the Parks and Recreation of Danville main building; and Waves 2 and 3 were delivered in the Glenwood Community Center. As a component of the program's evaluation, reach data were collected during the enrollment phase for the 3 waves including family location and demographic characteristics. Reach was operationalized as the representativeness defined as similarity or differences of the demographic characteristics, specifically race and income, and spatial distribution between those who participate and those who are eligible but do not. Participants completed 3 assessments (baseline, program completion at 3 months, and post program follow-up at 6 months) as part of the study. The social-demographic survey included, but was not limited to race/ethnicity, and household income.

Geographical data was acquired from US Census Bureau. Datasets used in this study included TIGER/Line shapefiles, selected demographic and economic data, and cartographic

boundary shapefiles. Geoprocessing of data files from both states of VA and NC allowed for the creation of a geodatabase for the DRR. Roads line shapefiles were then used to create an Address Locator to georeference the delivery sites and families' home locations. Family neighborhoods were defined as an area within a buffer around each family's home location. We created both a 400-meter (.25 mile) buffer around each family's home, which was considered a "walkable" distance [137, 138] and 1,600 meters (1 mile) buffer which was considered a short "drivable" distance in their neighborhood (i.e. accessible to households with a vehicle) [138, 139] around each family's home location. Previous built environment studies have created geodatabases of food establishments and physical activity resources [27, 140-144] to document neighborhood environments was used in this study.

Retail food outlets and restaurants were identified, enumerated, and classified (stores or restaurants) based on the Nutrition Environment Measures Survey (NEMS), which has been shown to be a reliable and valid measure of the food environment [145, 146]. Further classification and coding of data yielded a score regarding the availability (not available, limited selection of one or two items, good variety/selection) and quality (not available, poor quality, fresh and good quality) of fruits and vegetables [145] and restaurants were classified into three categories (fast casual, fast food and sit down) [146]. Scores for Availability (0 to 30), price (-9 to 18) and quality (0 to 6) scores are accounted in a total summary score up to 54 points (availability + price + quality) [145].

Enumeration of physical activity outlets are detailed in Hill et al. [141], but briefly it includes identification of physical activity outlets by community partners, internet keyword searches and drive by observation of outlets. For the physical activity environment, DRR public and private indoor and outdoor recreation outlets were geocoded and mapped. The Physical

Activity Resource Assessment (PARA) tool [147] was used by trained auditors to systematically audit physical activity outlets for features, amenities, and incivilities [131]. Researchers recorded the availability of designated space and facilities for sports and other physical activity (e.g., basketball court); water features (e.g., ponds, fountains); trees and shade or partial shade in rest areas; walking and bike paths, and the quality of these paths; available parking; amenities, such as access to public transportation, BBQ grills, garbage cans, drinking fountains; and blight, such as graffiti, vandalism, litter, and/or abandoned building(s). Operational Definitions of the average of each characteristic were score as 0 = Not Present, 1 = Poor, 2 = Mediocre, 3 = Good [147].

Exploratory analyses included the child PA, eating, and weight status (i.e., child outcomes) data at baseline and program completion (3 months) data from the *iChoose*. The in-person assessments included both child and parent interview-administered surveys on eating and physical activity and anthropometric measurements (i.e. height, weight,). The measures are as follows: *Weight Status*: (1) Weight was measured to the nearest 0.1 kg using a medical weight scale (Tanita TBF 300). (2) Height was measured with a stadiometer, calibrated in 0.1-cm intervals. BMI-z scores was calculated using the established formula and percentile rankings were computed for the children based on age and gender. *Eating behaviors*: Fruit and Vegetable Intake was assessed using the Youth Risk Behavior Surveillance System (YRBSS) questionnaire [112]. *Physical activity behaviors*: the valid and reliable Godin leisure time exercise questionnaire [148] was used to measure minutes of moderate to vigorous physical activity (MVPA). This questionnaire shown to be reliable among children [148].

Data Analysis:

All data were entered and scored using SPSS®20, and spatial analyses were performed in ArcGIS™ 10.3.1 for Desktop. Data were analyzed using statistical significance set at a value of $p < 0.5$. Multiple descriptive statistical tests were run in order to summarize the data, including means and standard deviations. Since the intervention changes between waves was minimal (e.g. extending the family sessions to 2 hours, revised workbooks and delivery transition from research to community partners/train-the-trainer model), we will combine the data from all 3 cohorts that participated in the *iChoose* program. Participant home location, food outlets most commonly used by families (Parent survey: “Where do you typically shop for your groceries?”), and PA resources were geocoded to assign longitude/latitude coordinate points for each address and distance from the home was calculated using an ArcGIS extension (i.e. spider diagram tool).

To investigate aspects of reach, we analyzed data from families enrolled and not enrolled in the *iChoose* program [149]. Results of reach data of enrolled or not families are compared with race and income census data by block group in the same area. Census 5-year estimates of household income and proportion of black residents was used to measure race distribution as an indicator of neighborhood racial composition. Spatial distribution was analyzed both related to the family home location and its distance from the intervention delivery location. Proximity analyses was performed using multiple ring buffer analyses; we created a 2-mile, 5-mile, 10-mile, 15 mile, and 20-mile buffer around the delivery location and then calculated the number and proportion of families that were enrolled and not enrolled that were located within each buffer. A cluster analyses was performed to identify potential clustering related to enrolled and not enrolled families. This analysis determines if the spatial patterns are clustered, dispersed or random. To determine the statistical significance of each calculation, we calculated a pseudo p-value based on different permutations of a dataset [150]. Overall, the *iChoose* program contacted

695 prospective participants, 581 having addresses. Eleven addresses were post-office box, not an actual home location and were unable to be geocoded. After joining addresses with available participant data, it was possible to match location for a total of 500 contacted families (86%), 99 enrolled (98%) and 401 not enrolled (86%).

We conducted a spatial analysis using the geocoded addresses of homes, and PA and food outlets to determine the spatial relationships among neighborhood environment factors. For calculating proximity to nutritional and physical activity resources, each facility was given an individual resource identification (ID) number and mapped in ArcGIS™. Geocoded food outlets most commonly used by families allowed us to analyze proximity, distance, availability and quality, and outlet type accordingly; this analysis was used to determine if there is a significant difference in the number of food establishments and PA outlets by children outcomes. Continuous distance using the spider diagram tool to connect homes to the reported commonly used grocery facility was mapped and calculated for each family participant.

Neighborhood characteristics were derived for the area within a buffer around each family's home location. Proximity analyses were performed by creating both a 400-meter and 1,600 meters buffer around each family's home, and then calculating the number of food/PA outlets, availability, and quality by outlet type that were located within each buffer around the home. To compare the level of a variable in one outcome to that of the second variable in neighborhood, we conducted cluster analyses. Density was used to calculate the density of food/PA outlets in the buffer around those families' homes.

Analyses were performed to investigate the relationship between environmental factors and child changes in physical activity, eating, and weight status. Additionally, multiple linear regression were performed with change variables calculated from baseline to post intervention

data for child outcomes (i.e. eating, PA, and weight status) and with neighborhood environmental factors (NE) variables measured at one point in time. All variables were used as continuous variables (e.g. surveys, audits, BMI z-score). We examined the differences in responsiveness to the intervention using the described outcomes and environmental parameters as independent variables in multi-leveled regressions. Normality of the data was assessed and multiple linear regressions were used for linear distribution. Specifically, analyses were conducted first, to test relationships between NE nutrition and PA audits results (count, availability and quality) and children change scores outcomes to conduct an overtime effect analyses. To measure spatial correlations using feature locations and attribute values (enrolled/not enrolled), we calculated Moran's I to determine if data were clustered using weight as a count of features (homes) in the DRR.

RESULTS

Spatial analysis of reach data

Sociodemographic characteristics

Overall analysis revealed that sociodemographic characteristic of enrolled families was related to the general population by income but not by race. A higher proportion of black families were enrolled both in the DRR and Danville City. Race characteristics' results are presented in maps (Figure 1-3) and tables (Tables 1 and 2). The majority of contacted families were located in Danville city and the enrolled families had a 74% proportion of black (Table 2) a higher proportion compared to 48% in the population for the same area (Table 1).

Figure 1: Enrolled and Not Enrolled families by DRR race

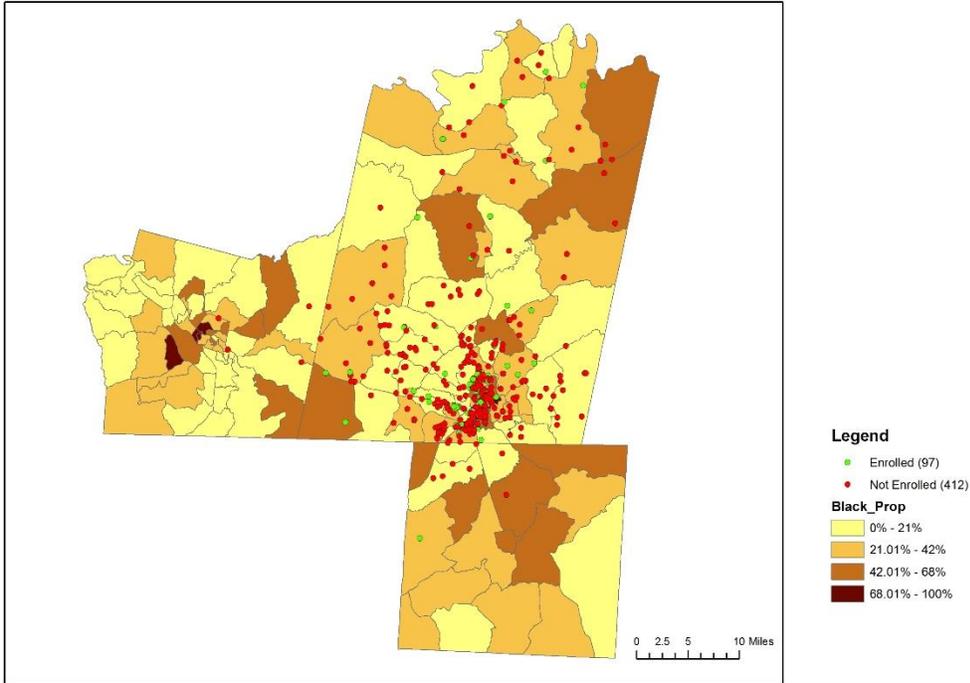


Table 1. DRR race: proportion of black

Area	% Black	Range	SD
Danville City	48%	0-100	25%
Pittsylvania County	21%	0-59	15%
Henry County	24%	0-79	19%
Martinsville City	44%	0-99	29%
Caswell County	35%	5-55	18%
DRR (total)	32%	0-100	23%

Figure 3: Enrolled families of DRR by race.

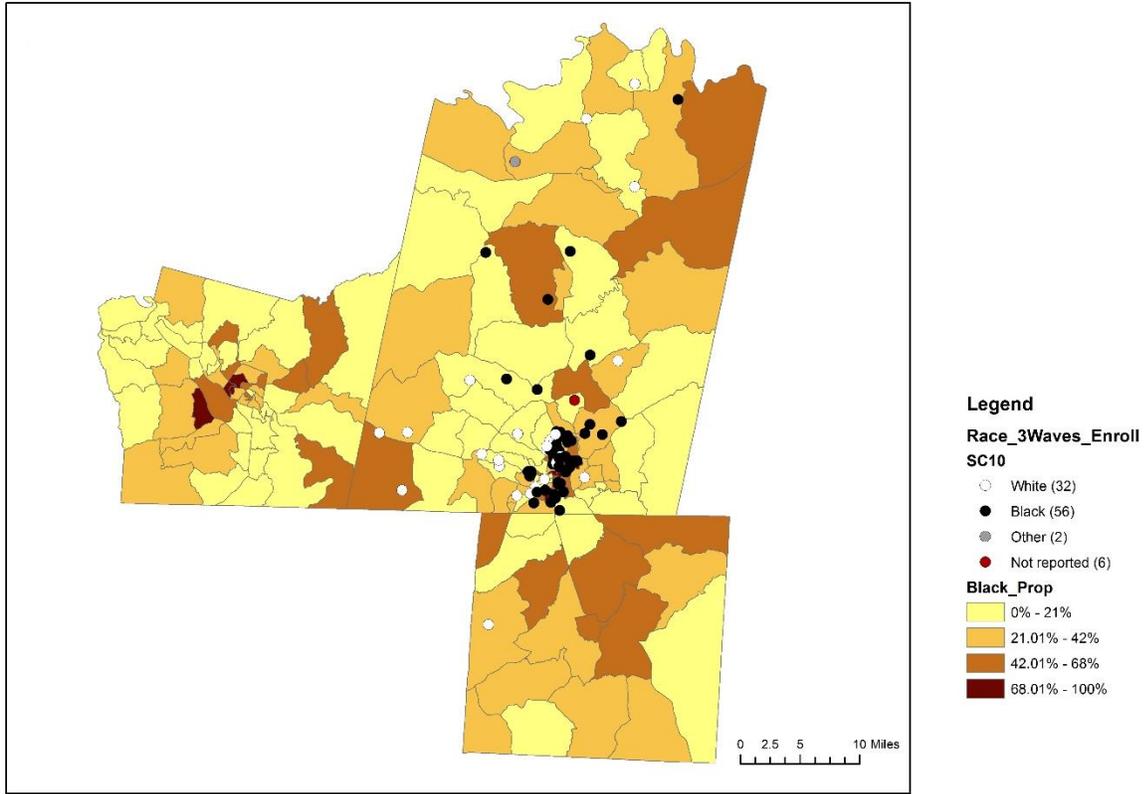


Table 2. Enrolled race by DRR area

Area	Enrolled				
	Total	Black	White	Not Responded	% Black
Danville City	53	39	14	0	74%
Pittsylvania County	33	12	13	5	36%
Henry County	0	0	0	0	0%
Martinsville City	0	0	0	0	0%
Caswell County	1	0	1	0	0%
Total	87	51	28	5	59%

Figure 4: Not enrolled families of DRR Area by race

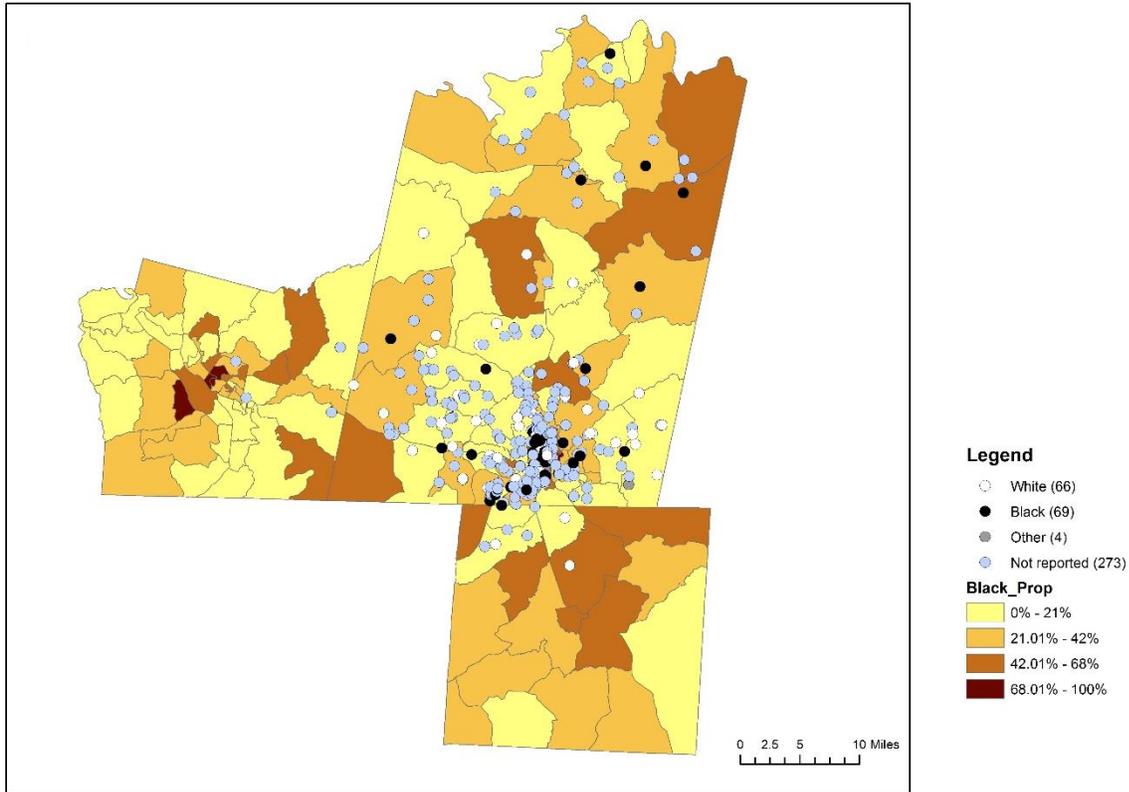


Table 2. Not enrolled race by DRR area

Area	Not Enrolled				
	Total	Black	White	Not Responded	% Black
Danville City	172	43	16	110	25%
Pittsylvania County	178	16	34	127	9%
Henry County	2	0	0	2	0%
Martinsville City	2	0	0	2	0%
Caswell County	8	1	3	4	13%
Total	362	60	53	245	17%

Income characteristics' results are presented in Figure 5 and Table 3. Overall the DRR presented a 36.2% (SD 15.6%) of the population with an income less than \$25000 per year. Of enrolled families 38% had an income less than \$25,000 per year.

Figure 5: Enrolled families of Danville Area by Income

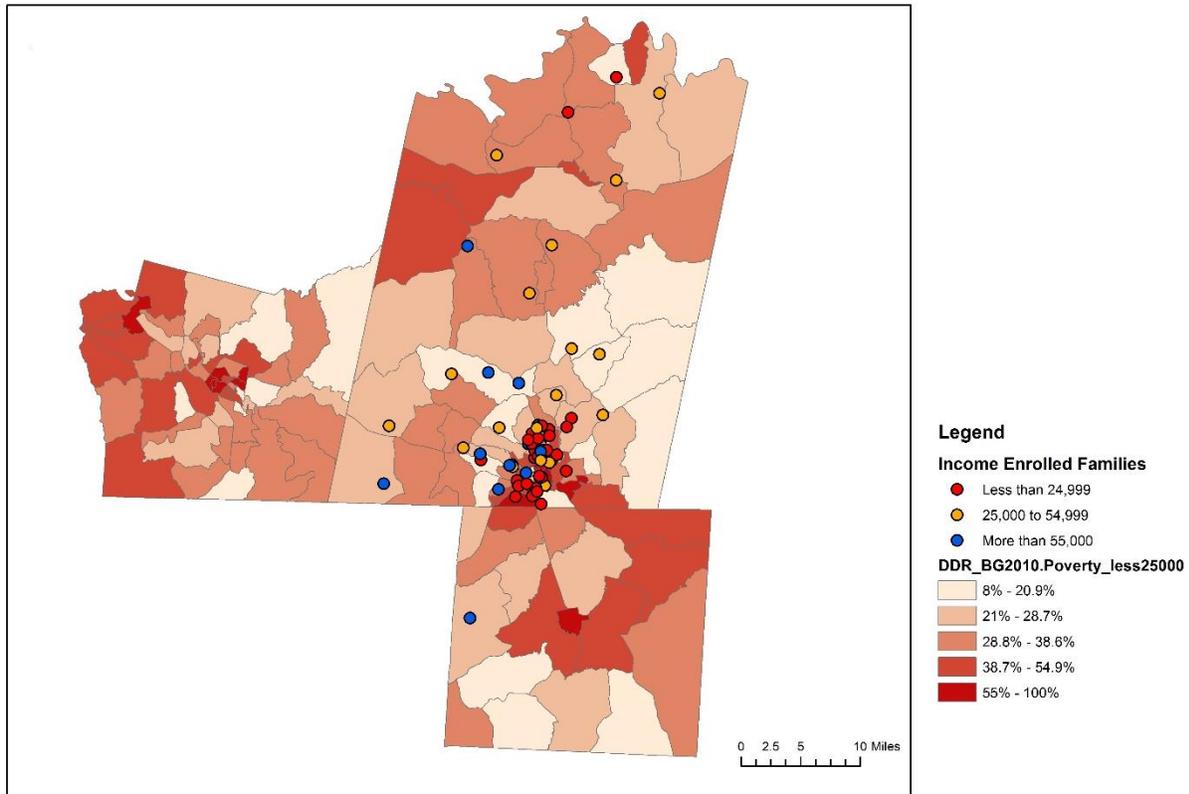


Table 3. Enrolled families of Danville Area by Income

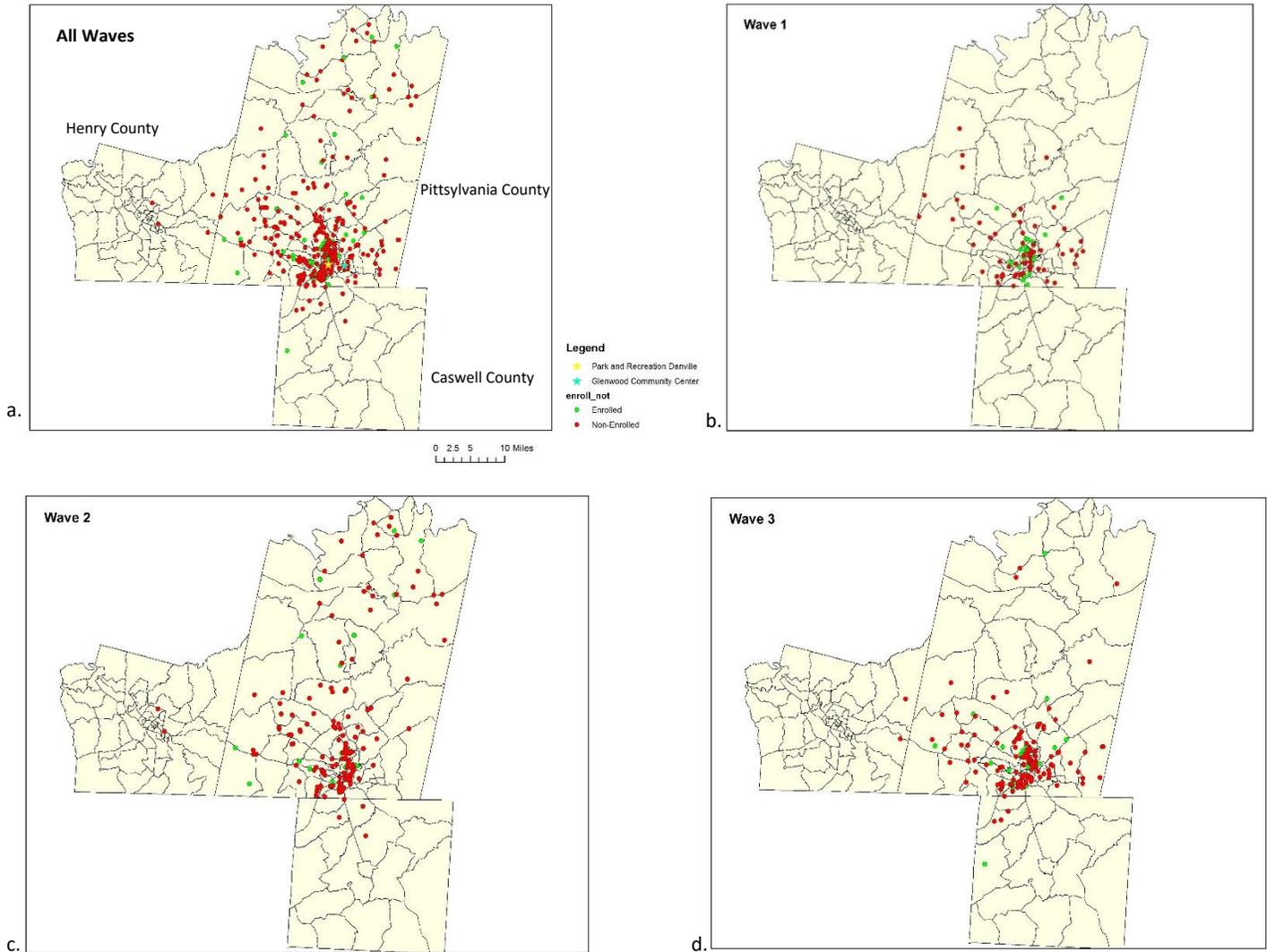
Income	Proportion
Less than 10K	10%
10-14K	28%
25-29K	26%
More than 55K	16%
Not Reported	20%

Spatial Distribution

Families contacted to participate in *iChoose* were concentrated in the Danville city area and the non-enrolled families tended to be from outlying counties. The Figure 6 map sequence shows the distribution of families' locations. In the map showing all waves (Figure 6a) Henry

County (VA) has 4 not enrolled families and Caswell County (NC) has 9 not enrolled and only one enrolled family. A similar pattern was repeated across waves.

Figure 6: *i*Choose DRR location of enrolled and not enrolled families:

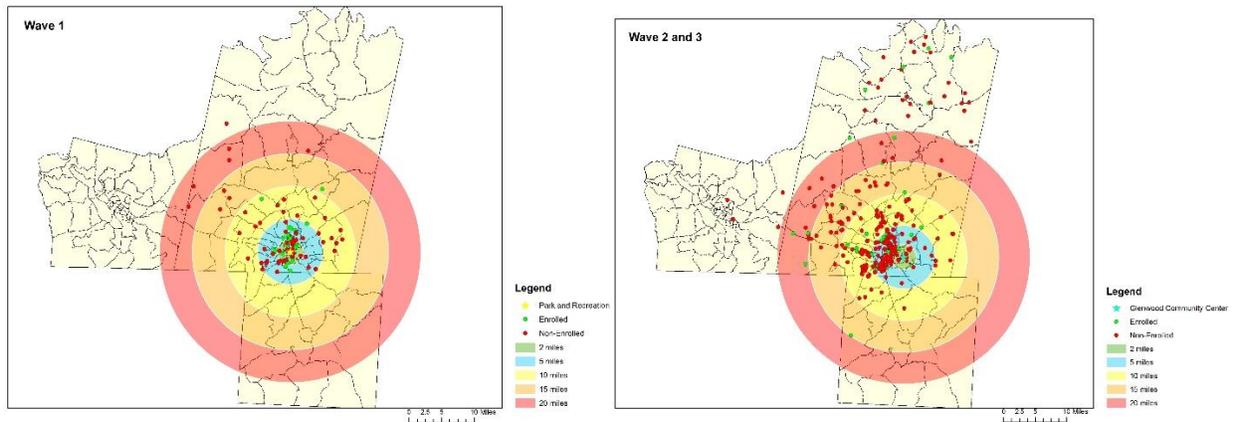


To investigate patterns in the location of contacted families by nearest program delivery location, we performed a multiple ring buffer analysis. Multiple ring buffers showed a similar pattern for all waves in which 52% of the contacted families are from a 5-mile radius and 78% are in a 10-mile radius from the delivery location. The majority (66%) of enrolled families for all waves were located 5 miles from the delivery location and 51% of not enrolled families were from more than 10-miles away. Results are summarized in Table 4.

Table 4. Contacted families distribution in multiple rings buffer from the delivery location

Buffer Distance	Wave 1		Wave 2		Wave 3		Total	
	Enrolled	Not Enrolled						
2 Miles	8	21	2	8	0	12	10	41
5 Miles	15	16	11	50	16	65	42	131
10 miles	3	21	3	37	6	44	12	102
15 Miles	1	3	0	24	3	12	4	39
20 Miles	0	2	5	8	1	4	6	14
>20 Miles	0	0	4	23	1	5	5	28

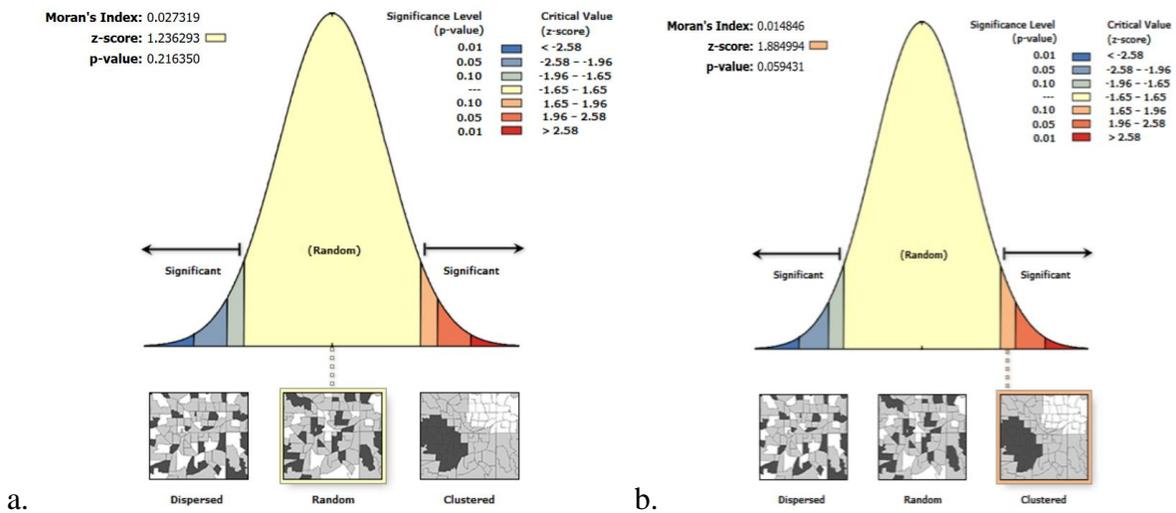
Figure 7. Multiple rings buffer from the delivery location



Results showed that for enrolled families (a) in a Distance Threshold of 2800 Meters, the Moran's Index was 0.027 (Expected Index=-0.013, Variance=0.001) (Figure 8a?). Given the z-score of 1.236, the pattern does not appear to be significantly different than random (p-

value=0.216). However, in the same distance threshold not enrolled families (Figure 8b) presented a Moran's Index of 0.0148 (Expected Index= -0.003, Variance= 0.000090). Given the z-score of 1.885, there is a less than 10% likelihood that this clustered pattern could be the result of random chance (p-value= 0.059). Further investigations will be necessary to explore other clustering possibilities such as by sociodemographic characteristics.

Figure 8. Clustered analyses of enrolled not-enrolled families



Neighborhood Environment

Nutritional Environment

Figure 9 documents that enrolled families had more access to food resources if they were in close proximity to Danville city. Families in the Pittsylvania and Caswell counties had fewer food resources. Enrolled families traveled an average 3.7 miles (± 3.7 , Range 0-15.7) for their grocery shopping. Figure 10 is a spider diagram that pictorially represents family residential distance to grocery store location.

Figure 9. Spatial distribution of enrolled families, where families shop, and available food outlets

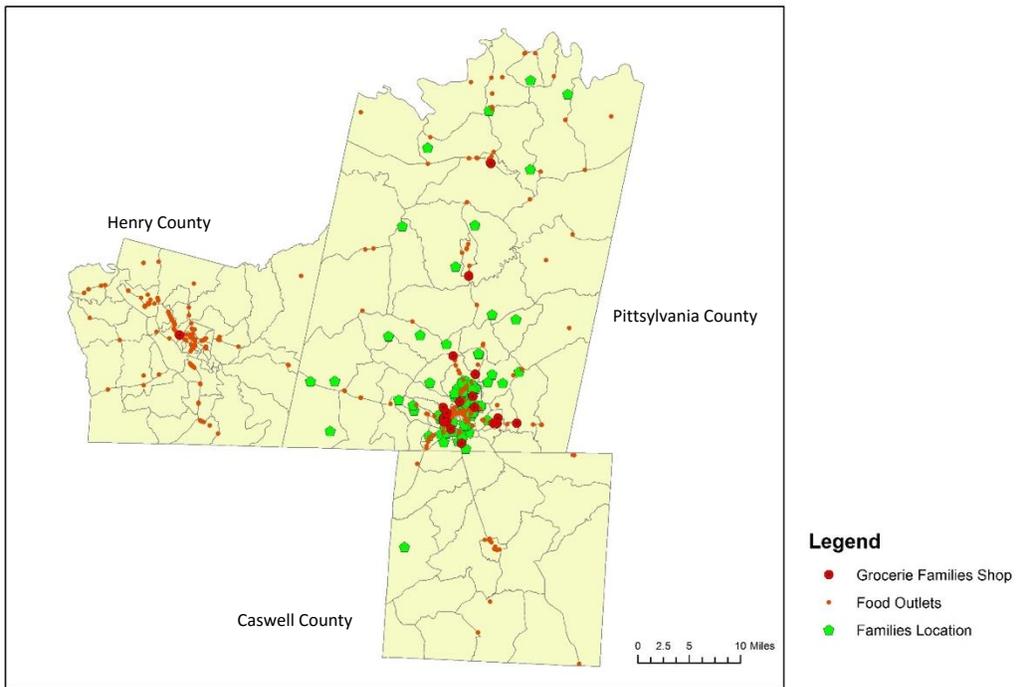
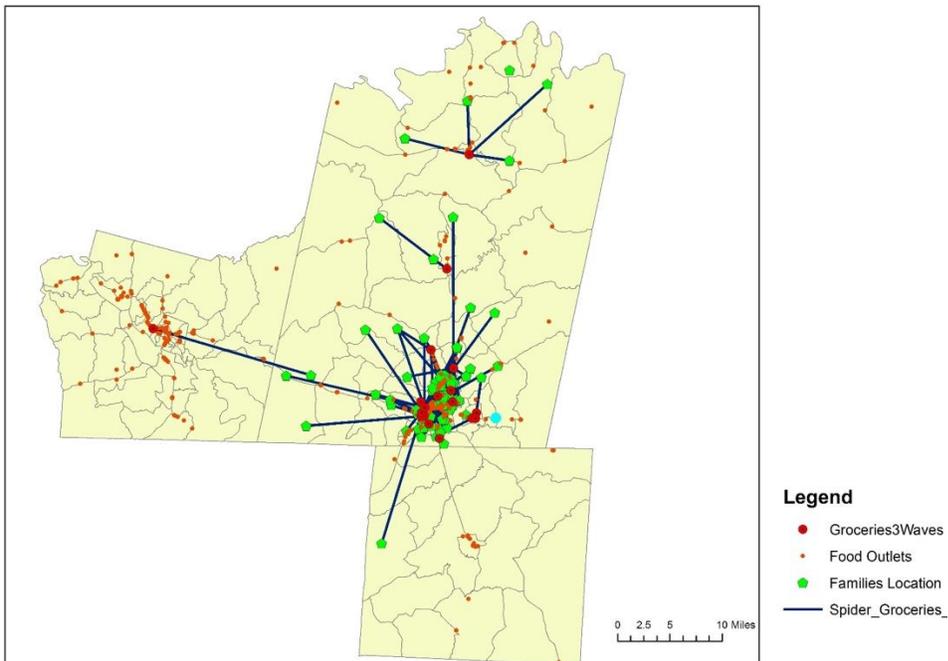


Figure 10. Spider diagram of family home location and groceries they shop



A total of 187 food stores were identified in the DRR and 38 (20%) were classified as grocery stores (Table 5). The families enrolled in *iChoose* reported shopping in 8 grocery stores that had a combined 17 locations (Table 6).

Table 5. DRR Food outlets by area and type.

Area	Grocery Store		Convenience Store		other		Total
	Frequency	%	Frequency	%	Frequency	%	
Caswell County	3	23	7	54	3	23	13
Henry County	14	26	26	48	14	26	54
Pittsylvania County	8	17	30	64	9	19	47
Danville City	11	18	38	63	11	18	60
Martinsville City	2	15	5	39	6	46	13
Total	38	20	106	57	43	23	187

Table 6. Grocery Stores that families reported shopping.

	Type	Store Locations	Number of Families*	%	NEMS <i>M (SD)</i>
1	multinational hypermarket chain	4	34	30.4	36.9 (.54)
2	South-Eastern supermarket chain	8	59	52.6	35.54 (1.49)
3	American discount supermarket chain	1	4	3.5	29.0 (0)
4	locally owned and operated supermarket chain	1	6	5.4	20.0 (0)
5	Southeast grocery store chain	1	1	0.9	24.0 (0)
6	global discount supermarket chain	1	2	1.8	25.0 (0)
7	locally owned and operated supermarket - wholesale and single items	1	1	0.9	28.0 (0)
8	Membership-only warehouse chain -bulk grocery items	1	5	4.5	**

*Families could choose more than one location

** No data were available based on the NEMS recommendation that establishments that require membership should be exclude from the stores audit data collection.

In the 400-meter buffer, 74% of families didn't have any type of food outlet within walking distance ($M=.66\pm1.61$), and only 2 families had a grocery store ($M=.023\pm.15$). Sixteen percent of families had a corner store ($M=.22\pm.54$), however corner stores ($n=13$) had a significant ($p<.05$) lower availability of health options ($M=.06\pm3.8$), price ($M=2.2\pm0.8$), quality ($M=3\pm0$) and overall NEMS score ($M=5.8\pm5.2$). In a 1600-meter buffer (Table 7), 30% of families didn't have any type of food outlet ($M=.66\pm1.61$), 53% didn't have any grocery store ($M=.023\pm.15$), and 47% had fast food outlets ($M=.06\pm.32$). Characteristics of grocery stores from the 1600-meter buffer were significant lower in availability, price and overall NEMS score than those where families reported actually shopping (NEMS).

Table 7. Grocery Stores from the Neighborhoods compared to families reported shopping.

Variable	Neighborhood (1600m buffer)		Grocery store where the family shops	
	Mean	Std. Deviation	Mean	Std. Deviation
Availability	20.74**	5.53	27.13**	3.50
Price	0.73*	1.81	1.56*	1.71
Quality	5.97	0.16	6.00	0.0
NEMS score	27.05**	6.46	34.69**	4.43

Note: Higher scores indicate greater availability and better quality, and lower prices for healthful options compared to "regular" choices.* $p<.05$ ** $p<.001$

The multiple regression models including neighborhood nutritional environment predictors did not explain significant variance in changes in outcomes. There were no statistically significant ($p < .05$) relationships between fruit and vegetable consumption or BMI z-score change from baseline to post-intervention.

PA Environment

A total of 117 physical activity outlets were identified in the DRR. Figure 11 shows that Danville city has a higher number of PA resources than Pittsylvania and Caswell counties. The majority of resources were schools or parks (Table 8). Physical activity outlets in the study area

presented, on average, poor features ($M=0.5\pm.33$), limited amenities ($M=1.15\pm.52$), and high incivilities ($M=0.21\pm 6.4$).

Figure 12. PA resources and home location of families enrolled.

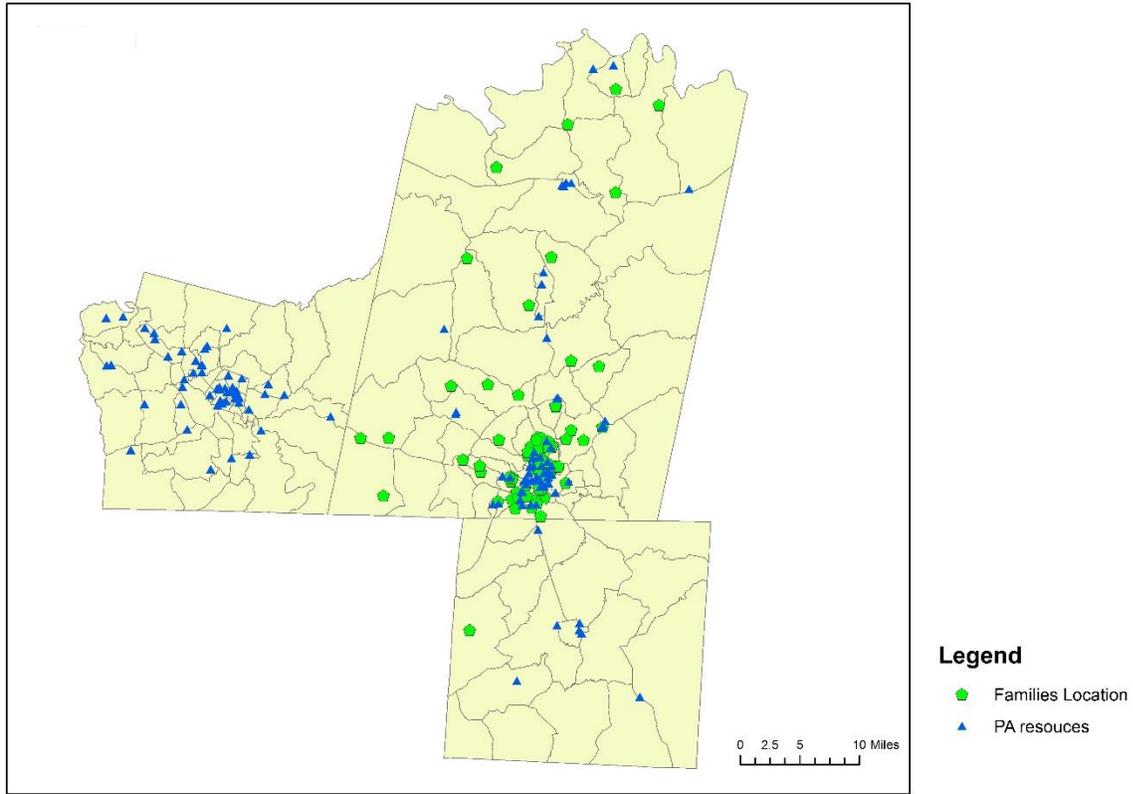


Table 8. DRR Physical Activity outlets by type and area.

Area	Fitness club		Park		Sport facility		Trail		Community Center		School		Combination		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Caswell County	-	-	1	12	-	-	-	-	-	-	7	88	-	-	8
Henry County	1	3	11	32	1	3	1	3	3	9	18	51	-	-	35
Pittsylvania County	-	-	3	17	1	5	-	-	-	14	78	-	-	-	18
Danville City	2	5	17	44	2	5	-	-	7	18	10	26	1	2	39
Martinsville City	3	18	13	76	-	-	-	-	1	6	-	-	-	-	17
Total	6	5	45	39	4	3	1	1	11	9	49	42	1	1	117

The majority (70%) of families didn't had any PA resources located within 400 meters of their home ($M=.31\pm.49$). Those that did included resources rated as having poor features ($M=.38\pm.22$), limited amenities ($M=1.01\pm.35$), and high incivilities ($M=1.5\pm6.4$). Additionally, 36% of families did not have a PA resource within 1600 meters of their home ($M=2.8\pm3.0$). Similarly, the PA resources that were available were rated as having poor features ($M=.43\pm.14$) and limited amenities ($M=1.11\pm.27$). Characteristics of PA resources from both the 400-meter and the 1600-meter buffer were not significantly different from each other or from the overall DDR area. The multiple regression models did not explain variance in weekly minutes of moderate and vigorous physical activity or BMI z-scores change from baseline to post-intervention.

DISCUSSION

The purpose of this study was to examine the potential role of neighborhood environments on changes in child physical activity, eating, and weight status as the result of a childhood obesity treatment intervention. The findings add to the literature related to the geographic clustering of families that enroll in a childhood obesity intervention, the choice of grocery shopping based on price and food quality rather than proximity, and the overall lack of PA resources for program participants. However, we did not find that neighborhood environmental variables were significantly related to changes in child weight status.

Assessment of sociodemographic characteristics and comparisons between enrolled and non-enrolled eligible families suggested that the sample was representative of the low income levels of the region, but was over represented with African American families. This latter lack of representativeness was interpreted as a positive outcome based on the disproportionate impact obesity has on African American populations [132]. Additionally, few studies report the

representativeness of the study sample [149] and typically racial minorities are under-represented in research [151].

Geographic accessibility is a complex relationship between the spatial separation of people from health-supporting resources—and this separation may be related to poorer health outcomes [152] across different types of health interventions [153]. Still, there remains limited quantitative information regarding its impact [154]. Our findings suggest that spatial separation may not be a primary driver in a small geographic region where families choose to shop at grocery locations that provide higher quality or less expensive foods when compared to locations closer to the participants' home. Conversely, spatial analysis of nearness indicates that both contacted and enrolled families seem to be concentrated in the main city area from where intervention was delivered in which more than 80% of enrolled families for all *iChoose* waves were located at a 10 miles from the delivery while not enrolled were from more than that distance from the delivery location. Location is essential to delivery of interventions; not surprisingly, the World Health Organization (WHO) has been involved in a number of initiatives using GIS to perform analysis to provide guidelines and tools to improve physical access to specific health interventions worldwide [152]. When added to previous literature, our findings suggest that spatial distance is important for where intervention services are provided, but may not be as important for grocery store locations when families will travel past lower quality resources to access higher quality food.

A systematic review [155, 156] of neighborhood differences in food and physical activity outlets revealed that poor access was most often related to less healthful behaviors for residents of low-income, minority, and rural neighborhoods. However, a previous study by block group in the DRR showed that there were no differences in the number of food or PA outlets by income or

race [141]. Nutritional neighborhood environment analyses revealed that families participating in the *iChoose* have more access to food resources at close proximity in the main city area compared to counties. In walkable distance (400m) we found none or lower food resources, including groceries and fast-food, however, fast-food outlets count were higher in a short drivable distance (1600m). However, food resources were significantly lower in availability, price and overall NEMS score than the ones families reported shopping at, which could explain why families traveled an average 3.7 miles, sometimes even going to a different county. Also, the majority of families participating in the intervention prefer to shop in a larger type of grocery store, such as a supermarket. Consistent with studies of nutritional environment in which the assumption is that a supermarket is the most reliable means to variety and quality at a reasonable price [157]. An important point was that although the NEMS characteristics of grocery stores were considerably lower for availability, quality and price, our sample still presented higher scores than the ones found in the literature for both high and low income areas [145]. Physical activity neighborhood environment revealed similar patterns as analysis of nutritional results for distribution and access. However, characteristics of physical activity outlets from both the 400m and the 1600m neighborhoods around homes were considered poor quality in all aspects and had no difference from each other or from the overall DDR area.

Environmental influences are important contributors to childhood obesity [1, 2] and weight gain in children has been linked to food and physical activity environment [87]. Even though, our study did not find any nutritional or physical activity neighborhood factors predicting change in child BMI z-scores, fruit and vegetable consumption, or minutes of moderate to vigorous physical activity, similar results have been found by Burdette and colleagues [158] where neighborhood proximity to playgrounds and fast food restaurants was not

associated with child overweight in an urban low-income population. It may be due to the fact that childhood obesity is a complex and multifaceted issue [3, 4], which is influenced by individual-level choices as well as a number of broader social and environmental factors [6] and intricate interactions [4].

CONCLUSION

Spatial analysis techniques used to provide more information about obesity at the neighborhood level showed to be feasible, and the use of mapping as a visualization tool aided in efforts to communicate and better understand the results of the analysis that otherwise could not be seen by tabular analysis. Results contribute to previous efforts in the region to understand and explore the potential influence of the food and physical activity resource environment. Of particular importance this study aided to better understanding of how neighborhood factors impacted intervention reach but not effectiveness. Spatial analysis of both representativeness and enrollment showed that geographic location is important when delivering an intervention in a disparate rural community. However, any neighborhood environmental factors assessed were not related to child changes in physical activity, eating, and weight as we hypothesized. Our study did not find any nutritional or physical activity neighborhood factor that predicts change in child outcomes of a family-based obesity intervention. Future research should investigate further other obesogenic factors that influence families' nutrition and physical activity choices, rather than the food and PA neighborhood environment, especially those that could be more easily modifiable and widely promoted to a large proportion of the community. Nutritional environment has been identified to be realistic to presence of food outlets for rural area, however presented a higher availability of quality food at reasonable prices. Both high quality level for groceries where families shop and low for PA resources could explain why it did were predictors of intervention

change in child outcomes. Therefore could be a potential point different interventions/strategies may be more appropriate/effective in different areas aiming change in built environment intervention.

The attempt to measure the obesogeneity of neighborhood environments involved several complex tasks beyond the scope of this study. Thus, future investigations could test several different variables in a simulation sensitivity analysis to provide different practical scenarios to rank environments with regard to children's intervention outcomes. Finally, concerns may be rise about preserving the confidentiality of participants' individual records containing sensitive information (i.e. home location), while also preserving, to the maximum degree possible, the geographic properties of the data. In this study we used broad scale maps to mask individual-level data to assure data validity as well protect participants' identities while permitting many important geographically-based analyses.

GENERAL CONCLUSIONS

The social ecological perspective allow us to consider different factors and levels of influence of complex issues [21, 135] such as childhood obesity. Accordingly, the studies of this dissertation draw upon a social ecological model that acknowledges those multiple levels of human interaction and represents a comprehensive approach to evaluating different aspects of a childhood obesity intervention which target multiple influences on health behaviors. This includes the development of materials that clearly communicate multiple program objectives and strategies, and the home and neighborhood environmental influences in children's health behaviors and weight status in a family-based childhood obesity treatment intervention.

The first aspect of the social ecological model (SEM) investigated in this dissertation was related to an individuals' ability to clearly understand the messages and strategies proposed, and successfully apply key components of the intervention. Thus, materials developed and used in the intervention need to clearly communicate its messages while being culturally appropriate for the target population [12, 14]. Study 1 focused on the development of evidence-based materials that were clear, concise and culturally relevant to participants, so can they could better comprehend and retain information and strategies leading them to action to improve health behaviors. Results of our iterative and systematic approach to conduct a formative evaluation that involved academic-community partners and parents showed promising results regarding the improvement of study materials for clear communication. This process led to materials with appropriate reading level and proper clarity of messages, which are culturally suitable and rated as highly satisfactory by the parents of participants in the intervention. Future studies need to

further investigate whether these materials lead to greater adherence to the proposed intervention strategies.

The second aspect of SEM that this dissertation investigated in study 2 was to understand the influence of the home media environment on children's weight status. In particular, this intervention used culturally relevant and suitable materials that clearly communicated messages in order to better present strategies in how to improve the home media environment to promote healthful behaviors regarding eating and physical activity. These strategies included a home environment behavior change element related to media that targeted parental policy changes to media usage in the home including reduction on screen time and improving availability of exercise opportunities at home. Results suggest that the intervention was effective in improving certain aspects of the home media environment. More specifically, families were less likely to eat dinner in front of the TV, and parents reported reducing child's TV watching time and increasing the availability of exercise equipment in the TV viewing area by the end of the intervention. Further, results showed that reducing child reported screen time across all media and avoiding that they eat in front of the TV were associated with a higher reduction in their BMI z-scores among those that made the greatest improvement in those areas. These results demonstrate the promise of culturally relevant and suitable materials that clearly communicate messages in providing information that are effective in changing the home media environment, and these changes may potentially lead to greater weight loss. Future studies still need to investigate others aspects of the home environment to better understand how these complex components may influence overall weigh change among children.

While these changes to the home media environment hold promise to addressing children's weight status within their own home, children's and parents' health behaviors are still

influenced by larger environmental factors [2]. The third study of this dissertation sought to better understand the influence of this broader aspect of the SEM on (a) children's family enrollment in a childhood obesity treatment program and (b) on children's weight status. The reach of an intervention is of utmost importance to its overall impact [128]. In other words, if childhood treatment programs do not reach those who are most vulnerable and most at risk, its overall public health impact will be limited. Our results, suggest that the location where a childhood obesity treatment program is offered is of vital importance to its ability to reach those most in need. In particular, we found that enrolled families were similar to the general population by income (low) but not race were families enrolled presented higher proportion of black families than the study area. Spatial analysis of enrollment showed that geographic location was important when delivering an intervention in a health disparate rural community. More specifically, both contacted and enrolled families seem to be concentrated within the main city area where the intervention was delivered. More than 80% of enrolled families for all waves lived within 10 miles of the delivery location, while families that did not enroll were more likely to live much further away.

Additionally, once families enroll in a childhood obesity treatment program, their ability to understand, follow, and engage in the strategies presented are key to their success in the program [5]. Studies 1 and 2 of this dissertation demonstrated that an iterative, systematic, participatory approach to the development of culturally relevant and literacy appropriate intervention materials is feasible, leads to more parental satisfaction and has the potential to improve the home media environment of these families. However, families can only engage in healthier nutrition and physical activity behaviors if those opportunities are available to them [3]. The third study of this dissertation sought to investigate how the availability and quality of these

resources may influence children's weight status. The food outlets closest to participant's homes were considered to have the worst quality in all aspects and this may have contributed to their decision as to where to shop for food. Results indicated that families tended to bypass those outlets closest to them and traveled on average 4 miles from their home to shop at higher quality outlets. Additionally, families had very little access to high quality physical activity resources close to their homes. Although these results were not associated with children's overall change in weight status, these are important factors to be considered by future interventions.

Finally, the results of these 3 studies demonstrate the importance that different aspects of the social ecological model have on individual health behavior, in particular as it relates to complex behaviors associated with childhood obesity. First, an individual's ability to comprehend, follow and engage in evidence-based strategies presented by an intervention is heavily influenced by the cultural relevance, literacy appropriateness and clarity of the materials and strategies presented [14]. An iterative, systematic participatory process holds promise to developing such materials (study 1). Second, these culturally relevant and literacy appropriate clear materials demonstrated effectiveness in improving certain aspects of the home media environment (study 2), while also leading to an improvement in children's weight status (study 2). Third, families can only participate and benefit from childhood treatment interventions if they have access to them (study 3). Our results indicated that those at greater risk (i.e. Black families) and most vulnerable (i.e. low income) in the study catchment areas enrolled in the program, demonstrating the influence of location and access on families' ability to join childhood obesity treatment programs. Furthermore, to engage and follow the strategies promoted by these interventions families need to have access to those resources (study 3). Most of the families participating in the program had to travel farther to have access to quality food outlets (study 3),

and practically none had access to quality physical activity outlets in their walkable or drivable neighborhood (study 3). In conclusion, changes in the home media environment seem to lead to improvement in children's weight status; however these changes can be influenced by the parent's ability to comprehend and engage with culturally relevant and literacy appropriate materials, while having access to the location where these programs are offered and the nutritional and physical activity resources needed to successfully engage in said behaviors. Successful childhood obesity treatment programs must consider all of these factors in order to have the greatest impact on children's weight status.

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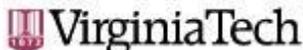
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APPENDIX A: Institutional Review Board (IRB) Letter of Approval



Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0969
email irb@ut.edu
website <http://www.irb.ut.edu>

MEMORANDUM

DATE: September 30, 2013
TO: Jamie M. Zoellner Dr, Paul Andrew Estabrooks, Jennie L Hill, Madlyn Irene Frisard, Wen You, Ramine Carrice Alexander, Karissa Niphore Grier, Fabiana Brito Silva, Maggie Berrey
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE: POPS-Phase 2 iChoose Intervention
IRB NUMBER: 13-803

Effective September 30, 2013, the Virginia Tech Institutional Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 2,6,7**
Protocol Approval Date: **September 30, 2013**
Protocol Expiration Date: **September 29, 2014**
Continuing Review Due Date*: **September 15, 2014**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

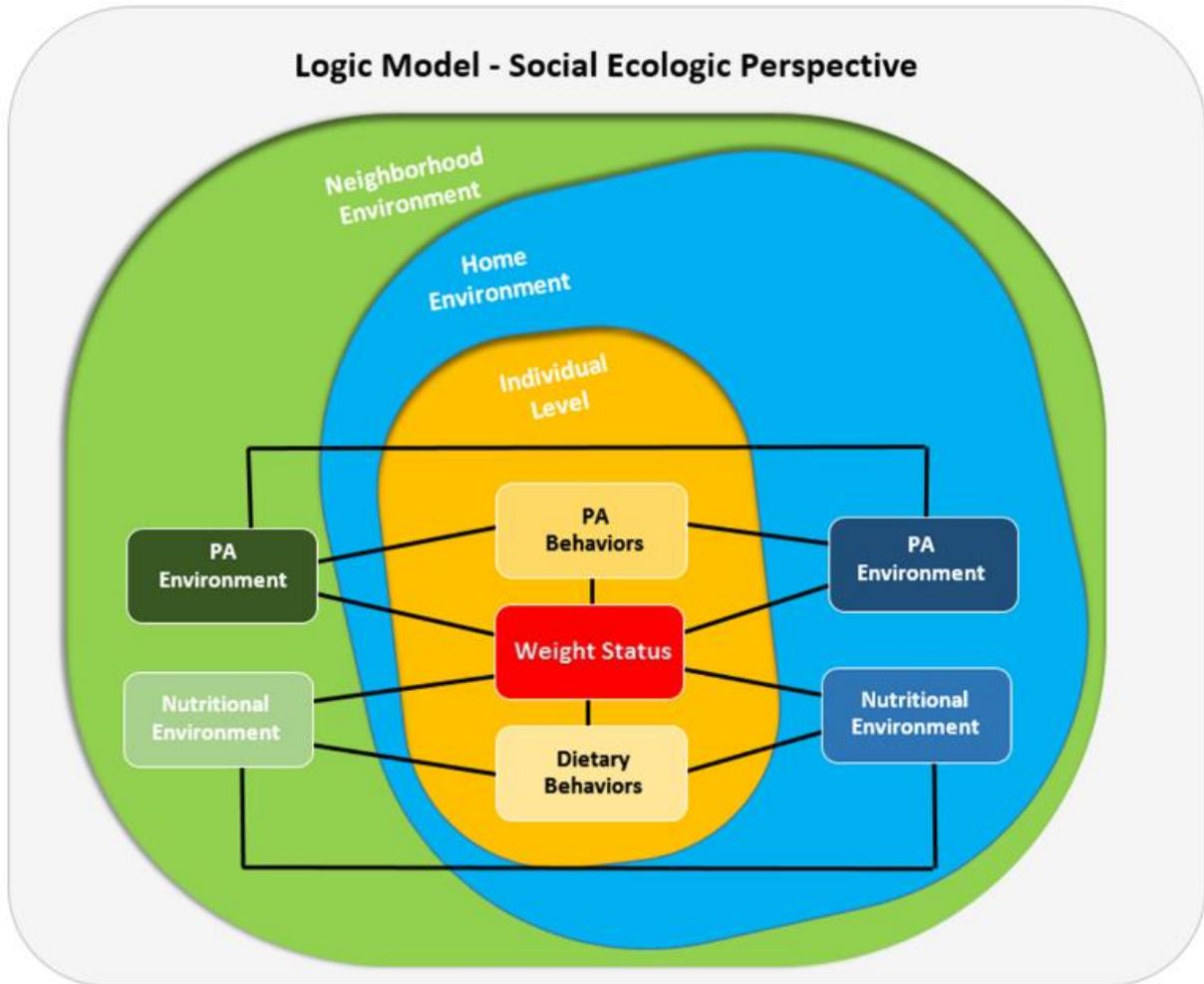
Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

APPENDIX B: Study's Logic Model - Social Ecological Perspective



APPENDIX C: Focus Group Protocol and Semi-structure Script

FOCUS GROUP PROTOCOL

This protocol was developed to provide consistent guidelines for data collection within the POPS Program who plan to conduct focus groups.

There are three phases to conducting our focus group and these phases are explained below:

PHASE 1: OVERALL ORGANIZATION

1. Project plan

2. Focus groups:

- a. Two focus groups - to enable to compare and identify themes which emerge from each discussion.
- b. Focus groups should run between 90 and 120 minutes.
- c. 8 participants in each group. Each focus group should have between six and ten participants (depend of enrolment). Fewer than six participants may limit the conversation and yield poor data while more than ten can be unwieldy.

3. Participants:

- a. Parents of families that participated in the POPS intervention.
- b. The key attributes of the participants is their unique point of view as a subject of the intervention. The experience in utilize the workbooks during the program is essential based on the purpose of evaluate Clear Communication.
- c. Secure names and contact information from the participants.
- d. Send invitations by mail and/or telephone call. Also one additional call to schedule convenient date and time for participant.
- e. Collect informed consent – by an IRB trained Graduate Assistant Research.
- f. Compensation: \$ 25.00 gift card from a local grocery shop. One per parent participant (one per family).
- g. Supervised play time in a different room will be offer to their children during the focus group.
- h. Will be providing refreshments and snacks.

4. Questions:

- a. Based on the purpose and goals of the focus group (attached).
- b. Questions were adapted from the CDC Clear Communication Index (CCI) and Suitability Assessment of Materials (SAM).
- c. Questions are order from general to specific.

5. Script

- a. *Part one:* welcome participants, explain purpose and context, explain what a focus group is, and make introductions. Explain that information is confidential and no names will be used. We will have a note-taker and record the proceedings.
- b. *Part two:* ask questions; use probes and follow up questions to explore the key concepts more deeply.
- c. *Part three:* close the focus group – thank participants, give them contact information for further follow up if requested, explain how you will analyze (by group) and share the data (participants can ask for a copy of report).

6. Facilitator and Co-facilitator

- a. One facilitator and one co-facilitator per focus group:
- b. Both *will be not* someone who directly oversees the issue or topical area we are exploring. This may make participants less open to sharing their thoughts or concerns.
- c. Both *will be* knowledgeable about the topic at hand, and can be a grad student or staff member from the study.
- d. Both will have the ability to keep the discussion going, deal tactfully with difficult or outspoken group members, and make sure all participants are heard
- e. Facilitator will ask the questions and co-facilitator the probes, but they not participate in the dialogue or correct participants.

7. Location

- a. Same location of the intervention delivering.
- b. Location was choose because is familiar to participants, comfortable, easily accessible, and where participants can see one another.

PHASE 2: CONDUCTING THE FOCUS GROUP

1. Materials:

- a. Notebook to note taking and tape recorder to record proceedings
- b. Consent forms
- c. Copies of Parents workbooks
- d. Focus group list of participants
- e. Focus group script
- f. Gift cards
- g. Pencils
- h. Markers for the withe board
- i. Name tags
- j. Clock
- k. Snacks

2. Facilitator and co-facilitator

- a. Arrive before the participants to set up room, refreshments, etc.
- b. Introduce themselves and the note-taker (co-facilitator) and carry on the focus group according to the script.
- c. Set a positive tone.

- d. Make sure everyone is heard; draw out quieter group members.
- e. Probe for more complete answers.
- f. Monitor questions and the time closely – make sure you are on track.
- g. Don't argue a point with a participant, even if they are wrong. Address it later if you must.
- h. Thank participants and tell them what your next steps are with the information.
- i. Distribute the gift cards

PHASE 3: INTERPRETING AND REPORTING THE RESULTS

1. Summary (each meeting)

- a. Immediately after the meeting, the facilitator together with the co-facilitator will write up a quick summary of his/her impressions.
- b. Transcribe the notes or audio recording of the focus group. This will be done as soon as possible after the focus group has been conducted.
- c. Facilitator and co-facilitator will discuss impressions with the other before reviewing the transcript.

2. Analyze of summaries

- a. Researchers will read the notes and look for themes/trends. Writing down any themes which occur more than once.
- b. Context and tone are just as important as words. If comments are phrased negatively or triggered an emotional response, this should be noted in the analysis.
- c. Interpret the results
 - i. What are the major findings?
 - ii. What recommendations might you have?

3. Report

- a. A report will be writing and presented for validation to the POPS/CAB members and send to participants.
- b. The report will include purpose, outcomes, process, findings, and recommendations.

4. Adjustments/Action (based on what we have learned)

- a. Schedule a meeting to discuss the implications and presented for validation to the POPS/CAB members
- b. Highlight the main themes, suggestions, issues, or problems that arose in the focus groups. Discuss with the POPS/CAB how we will address these.
- c. Prioritize the results and make action plans for the most important priorities.
- d. A copy also will be send to focus group participants to give them opportunity to context results.

FOCUS GROUP SEMI-STRUCTURE SCRIPT

Introduction

Good evening/morning. Thank you for taking the time to join our discussion about the iChoose program.

Your opinion will help us to improve this program for the next families on the program.

My name is ___(Facilitator)___, and I'm ___(Co-facilitator)____. We're conducting research on how to improve the iChoose program. The opinions you share with us today can help us to have a better understanding of how to design better materials. We want to talk with you about your experiences as participants in this program.

Before we get started, we'd like to explain the informed consent form to you. [Go over consent form. Participants sign].

Before we begin, let me suggest some things to make our discussion more productive.

- Because we'll be recording for an accurate record, it is important that you speak up
- And that you only speak one at a time. We don't want to miss any of your comments.
- We'll only use first names here. No reports will link what you say to your name, department, or institution. In this way, we will maintain your confidentiality.
- In addition, we ask that you also respect the confidentiality of everyone here. Please don't repeat who said what when you leave this room.

During the two hours we'll be here, I will ask you questions, and I will listen to what you have to say. I will not participate in the discussion. So please, feel free to respond to each other and to speak directly to others in the group. We want to hear from all of you. We're interested in both majority and minority viewpoints, common and uncommon experiences. So I may sometimes act as a traffic cop by encouraging someone who has been quiet to talk, or by asking someone to hold off for a few minutes.

Do you have any questions before we begin?

If it is OK with you, we will turn on the recorder and start now.

This parents focus group number ___ being conducted for the iChoose program on [DATE] by ___ and _____. Start time _____.

Focus Group Questions:

We are going to start with reviewing the workbooks [Pass out workbooks].

- 1. Let's begin by going around the table and stating your first name and then telling us a bit about how well the work book worked for your family and how your family use the workbook.**

Now we are going to put you in small groups to review certain sections of the workbook [Assign groups based on attendance—go through as many blocks as time permits]. You will have about 10 minutes to review the workbook and reflect on the questions listed on this handout [Pass out handout that was adapted from the Clear Communication Index]. Then we will ask the questions out loud for the entire group to comment on each section of the workbook.

Focus Group Questions- HANDOUT BLOCK 1

1. **Messages:** These are the main messages for the first block of the workbook.

Parents will be able to:

1. Describe energy balance and how it influences weight.
2. Identify the food groups included in MyPlate.
3. Identify that children should participate in 60 minutes of moderate to vigorous activity daily.
4. Set a specific, time-based, and achievable goal for eating and physical activity.

How well do you think these messages were explained in the workbook? What things in the workbook helped you to better understand these messages?

Was there any information (words, ideas, or activities) in this part of the workbook that was hard to understand? What could be done to make this information easier to understand?

2. **Images/pictures:** What about the images and pictures in the first block of the workbook?

What do you like about the images/pictures? Why? Did they help clarify the messages of this block?

Are there any images/pictures that are hard to understand? Why? How can these images/pictures be improved? Do we need different/more/less pictures?

Focus Group Questions- HANDOUT BLOCK 2

1. **Messages:** These are the main messages for the second block of the workbook.

Parents will be able to:

1. Choose foods to eat more often, and to cut back on foods to eat less often.
2. Identify how to be physically active in a way that fits their preferences and lifestyle.
3. Help their children to identify barriers and address them at daily bases without focusing overly on weight.

How well do you think these messages were explained in the workbook? What things in the workbook helped you to better understand these messages?

Was there any information (words, ideas, or activities) in this part of the workbook that was hard to understand? What could be done to make this information easier to understand?

2. **Images/pictures:** What about the images and pictures in the second block of the workbook?

What do you like about the images/pictures? Why? Did they help clarify the messages of this block?

Are there any images/pictures that are hard to understand? Why? How can these images/pictures be improved? Do we need different/more/less pictures?

Focus Group Questions- HANDOUT BLOCK 3

1. **Messages:** These are the main messages for the third block of the workbook.

Parents will be able to:

1. Define the appropriate portion sizes for parents and kids.
2. Recognize when they are hungry and when are enough.
3. Identify ways to cut back screen time to less than 2 hours per day.
4. Develop strategies to change home environment cues so that they support healthy eating and physical activity.

How well do you think these messages were explained in the workbook? What things in the workbook helped you to better understand these messages?

Was there any information (words, ideas, or activities) in this part of the workbook that was hard to understand? What could be done to make this information easier to understand?

2. **Images/pictures:** What about the images and pictures in the third block of the workbook?

What do you like about the images/pictures? Why? Did they help clarify the messages of this block?

Are there any images/pictures that are hard to understand? Why? How can these images/pictures be improved? Do we need different/more/less pictures?

Focus Group Questions- HANDOUT BLOCK 4

- 1. Messages:** These are the main messages for the fourth block of the workbook.

Parents will be able to:

1. Understand and making sense of a food label.
2. Understand importance of games and how they can help them to improve health.
3. Identify appropriate rewards for healthy behaviors and weight loss.
4. Identify how they can be a role model for their family and friends.

How well do you think these messages were explained in the workbook? What things in the workbook helped you to better understand these messages?

Was there any information (words, ideas, or activities) in this part of the workbook that was hard to understand? What could be done to make this information easier to understand?

- 2. Images/pictures:** What about the images and pictures in the fourth block of the workbook?

What do you like about the images/pictures? Why? Did they help clarify the messages of this block?

Are there any images/pictures that are hard to understand? Why? How can these images/pictures be improved? Do we need different/more/less pictures?

Focus Group Questions- HANDOUT BLOCK 5

- 1. Messages:** These are the main messages for the fifth block of the workbook.

Parents will be able to:

1. Reflect on eating choices in the last week and identify triggers to that lead to unhealthy eating.
2. Identify movements and intensity routines of activities using music & dance that can help them to improve their family's health.
3. Identify strategies and resources to help their children to deal with bullying and teasing situations using the 5 step strategy AWARE.

How well do you think these messages were explained in the workbook? What things in the workbook helped you to better understand these messages?

Was there any information (words, ideas, or activities) in this part of the workbook that was hard to understand? What could be done to make this information easier to understand?

- 2. Images/pictures:** What about the images and pictures in the fifth block of the workbook?

What do you like about the images/pictures? Why? Did they help clarify the messages of this block?

Are there any images/pictures that are hard to understand? Why? How can these images/pictures be improved? Do we need different/more/less pictures?

APPENDIX D: iChoose program’s Parent Home Environment Survey

Module 6: Questions About Your Child and Home Environment

[DATA COLLECTOR Initials]: | _____ | | _ |

[READ TO PARENT]: The next set of questions are about the child that is here with you today and enrolled in the iChoose Program. Please answer the questions related to that child only.] I will also be asking you some questions about the home in which you live.

| ____ | **6.1** Is your child taking any **prescription medicines?**

[note this is child selected for the iChoose Program]

(0) No

(1) Yes

Yes - Please tell me the medicines or I brought my child’s medicines.

No. My child does not take any prescription medicines.

Name of medicine	Reason for taking medication	Amount / size of pill	How many pills or doses does your child take at
Example: <i>Dexadrine</i>		<i>10 mg</i>	<u> 1 </u> morning ___ noon ___ dinner <u> 1 </u> bed
			___ morning ___ noon ___ dinner ___ bed
			___ morning ___ noon ___ dinner ___ bed
			___ morning ___ noon ___ dinner ___ bed ___ morning ___ noon ___ dinner ___ bed

(Please use the back of this form if you have more prescription medicine.)

6.2. Think about who prepares the food in your home, which of the following best indicates your role?

[circle participant response]

Food preparation is primarily my responsibility	I prepare food sometimes but it is not primarily my responsibility	I share food preparation equally with another family member	I rarely prepare food in our house
---	--	---	------------------------------------

6.3. Think about who plans family activities in your home, which of the following best reflects your role?

[circle participant response]

Activity planning is primarily my responsibility	I plan family activities but it is not primarily my responsibility	I share family activity planning equally with another family member	I rarely plan family activities
--	--	---	---------------------------------

6.4. Think about the foods your child eats, which of the following best describes you?

[circle participant response]

I am the one who has the most knowledge about what my child eats	I have some knowledge about what my child eats but <i>I am not</i> the one who knows the most	I share equally in my knowledge of what my child eats with another family member	I do not usually know what my child eats
--	---	--	--

6.5. Think about the activities your child participates in, which of the following best describes you?

[circle participant response]

I am the one who has the most knowledge about my child's activities	I have some knowledge about my child's activities but <i>I am not</i> the one who knows the most	I share equally in my knowledge of my child's activities with another family member	I do not usually know about most of my child's activities
---	--	---	---

6.6. What best describes your home?

[circle participant response]

Apartment Condominium Multi-family house Single Family House Mobile Home Shelter



6.7. How often does your family eat fruits and vegetables that you have grown?
[circle participant response]

Not at all Rarely Some of the time Most of the time All of the time

6.8. What is the average time that you spend preparing the evening meal?
[circle participant response]

0-15 minutes 16-30 minutes 31-45 minutes 46-60 minutes >60 minutes

6.9. Where do you typically shop for your groceries?

[circle participant response]

Corner Store Farmers Market Grocery Store (e.g., Food Lion, Walmart) Other: _____

.....

.....

6.10. Write in name of store _____; general location _____
 _____ (i.e. 7th & piney forest in Danville)

PART B: Think about the things that are currently in your home and circle your response for each question.

6.11. Please indicate if you have the following areas in or around your home or apartment. If you have an area but it is not suitable for your child to play/exercise in please answer “No”

Inside playroom/area	Yes	No
Workout/exercise room	Yes	No
Outside Play area/yard	Yes	No

6.12. What is the approximate size of your yard?
[Circle Participant Response]

We do not have a Small Medium Large
 yard

6.13. Which of the following things does your child have?
[Circle Participant Response]

NOTE: If there is more than one child indicate in the margin if there is a difference in access for either child.

a. Jungle-gym/swing set	Yes	No		
	<i>If yes, is it in working condition?</i>			Yes
b. Size-appropriate bicycle	Yes	No		
	<i>If yes, is it in working condition?</i>			Yes
c. Rollerblades/skates	Yes	No		
	<i>If yes, are they in working condition?</i>			Yes
d. Skateboard/scooter	Yes	No		
	<i>If yes, is it in working condition?</i>			Yes
e. Jump rope	Yes	No		

	<i>If yes, is it in working condition?</i>		Yes	No
f. Basketball hoop	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
g. Baseball equipment (At least one of the following: ball, bat or mitt)	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
h. Tennis/racquetball racket	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
i. Hockey Equipment (at least a hockey stick)	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No

j. Ball of any kind (Volleyball, soccer, football, fitness ball, foam balls etc.)	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
k. Pedometer (step counter)	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
l. Winter Sports Equipment (at least one of the following: sled, skis, snowboard, ice skates)	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
m. Home aerobic equipment (e.g., treadmill, cycle)	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
n. Yoga/exercise mat	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
o. Hiking shoes	Yes	No		
	<i>If yes, are they in working condition?</i>		Yes	No
p. Running shoes (athletic or “tennis” shoes)	Yes	No		
	<i>If yes, are they in working condition?</i>		Yes	No
q. Sandbox	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No
r. Trampoline	Yes	No		
	<i>If yes, is it in working condition?</i>		Yes	No

6.21. Does your child have a video game station or computer? **[Circle Participant Response]**
NOTE: If there is more than one child indicate in the margin if there is a difference for either child.

Yes No Don't know

6.22. Do you have a desktop or laptop computer in your home? **[Circle Participant Response]**

Yes No Don't know

6.23. Does your child have a PSP, Nintendo DS, iTouch, iPad (iPad mini) or any other handheld video game?
[Circle Participant Response]
NOTE: If there is more than one child indicate in the margin if there is a difference for either child.

Yes No Don't know

6.24. Do you have video games on your phone? **[Circle Participant Response]**

Yes No Don't know

6.25. Approximately how many video games and computer games are in your home? (Include items that are owned, rented and borrowed) **[Circle Participant Response]**

0 1-10 11-20 21-30 31-40 41-50 >50

6.26. How often is your television left on, whether or not it is being watched? **[Circle Participant Response]**

Never Rarely Sometimes Frequently Always

PART F: Based on the last 30 days, thinking about your parenting regarding time spent watching television, playing video games, and on the computer, please circle your answers.

NOTE: If there is more than one child indicate in the margin if there is a difference for either child.

6.27. Do you have any firm limits or agreements with your child about how much he/she can watch TV or Videos?

No (If no, go to Question 6.28)

Yes (If yes, go to Question 1a)

1a. How much time are they allowed to watch Television or Videos per day? _____

1b. How often are these limits enforced?

Never

Rarely

Sometimes

Frequently

Always

6.28. Do you have any firm limits or agreements with your child about how much time he/she is allowed to play on the computer or use it to communicate with friends?

No (If no, go to Question 6.29)

Yes (If yes, go to Question 2a)

2a. How much time is allowed to play or talk with friends on the computer per day? _____

2b. How often are these limits enforced?

Never

Rarely

Sometimes

Frequently

Always

6.29. Do you have any firm limits, or agreements, about how much time your child can play video games?

No (If no, go to question 6.31)

Yes (If yes, go to Question 3a)

3a. How much time are they allowed to play video games per day? _____

3b. How often are these limits enforced?

Never Rarely Sometimes Frequently Always

6.30. How often does your child eat in front of the TV?

Never 1 time or less per week 2-3 times per week 4-5 times per week Everyday

6.31. Do you have the following rules.... (please circle your response)

a. No TV/DVD before homework	Yes	No
b. No computer before homework	Yes	No
c. No internet without permission	Yes	No

Part G. For each category, circle the description that best fits your child or your family. It is important to indicate the **most common or typical pattern** and not what you would like to happen.

NOTE: If there is more than one child indicate in the margin if there is a difference for either child.

In a typical week...				
6.32. Does your family eat dinner while watching television?	Yes		No	
6.33. Do you use food as a reward for good behavior?	Yes		No	
6.34. Do you restrict how much your child eats potato chips, cookies, and candy?	Yes		No	
6.35. Do you have a routine or schedule for bedtime for your child?	Yes		No	
6.36. How many hours of sleep does your child usually get each night?	<8	8-9	9-10	>10
6.37. How many hours of television does your child watch?	<7	7-14	>14	
6.38. How many hours does your child spend on the computer or video games?	<7	7-14	>14	
6.39. Do you monitor the amount of television your child watches?	Yes		No	
6.40. How often does your child eat breakfast?	Almost never	Sometimes	Often	Almost always
6.41. How often does your family eat at least one meal together each day?	Almost never	Sometimes	Often	Almost always

6.42.	How often does your family eat fast food during the week?	Almost never	Sometimes	Often	Almost always
6.43.	How often does your family eat fruits and/or vegetables with your main meal?	Almost never	Sometimes	Often	Almost always
6.44.	How often do you use prepackaged foods (like frozen pizza) for your main meal?	Almost never	Sometimes	Often	Almost always
6.45.	How often does your family freshly prepare food (like chicken, pasta) for your main meal?	Almost never	Sometimes	Often	Almost always
6.46.	How often does your family play games outside, ride bikes, or walk together?	Almost never	Sometimes	Often	Almost always
6.47.	How often does your child participate in physical activity during their free time?	Almost never	Sometimes	Often	Almost always

6.48. In the past year how many organized sports with a coach or leader (e.g. soccer) or in organized group activities involving physical activity (e.g. swim lessons) has your child participated in?

0-1

1-2

3-4

5+