Implementation and Evaluation of a Community Gardening and Nutrition Program among at-risk Youth

Felicia Lorene Reese

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science
In
Human Nutrition, Foods, and Exercise

Jamie M. Zoellner
Jennie L. Hill
Isabel S. Bradburn

March 18, 2013
Blacksburg, Virginia

Keywords: childhood obesity, community garden, nutrition education, fruit and vegetables

Implementation and Evaluation of a Community Gardening and Nutrition Program among at-risk Youth

Felicia Lorene Reese

ABSTRACT

Background: Community-based participatory research (CBPR) has been recommended as an effective approach to engage communities in implementing research projects relevant to their needs and interests. Following this approach, the Dan River Partnership for a Healthy Community was formed to address regional obesity concerns in the Dan River Region, a health disparate area located in south central Virginia and north central North Carolina. Community gardens were identified as a priority, and the development and implementation of this study continues previous collaborative efforts in evaluating the effectiveness of community gardens within this region.

Objectives: The primary aim of this study was to determine if applying the Social Cognitive Theory (SCT) to an adapted curriculum throughout a 10-week gardening and nutrition education intervention would increase youths' willingness to try fruits and vegetables (FV), self-efficacy for eating and asking for FV and gardening, knowledge of nutrition and gardening, and outcome expectations for FV. Secondary aims were to determine if age groups or attendance rates would positively influence outcome measures and to qualitatively evaluate youths' perceptions about their experiences and opinions about the program.

Methods: Utilizing a pre-post design, researchers delivered this program once weekly with 60 minutes of interactive nutrition or gardening education and 30 minutes of experiential gardening. Questionnaires included validated and novel measures. Repeated measure ANOVA analyses were used to determine changes in outcome measures. Post-program interviews were conducted with youth and qualitative data was coded and analyzed.

Results: Of the 43 enrolled youth, 42 were African American. Although willing to try FV did not change significantly, there were significant improvements in self-efficacy for asking for FV from 1.70 (0.34) to 1.83 (0.29) ($F=7.07$; $p=.013$) and overall gardening knowledge from 14.53 (3.45) to 15.74 (3.90) ($F=7.67$; $p=.01$). There were also significant improvements in some of the knowledge subcategories for gardening and nutrition, including plant parts and my plate ($p<0.05$). Qualitative findings indicated the majority of the participants expressed positive perceptions of the program with the most liked components including food sampling, games and gardening experiences.

Discussion and Implications: Our findings demonstrate the feasibility of developing and implementing an adapted theory-driven community gardening and nutrition education program for low socioeconomic youth in public housing. It implicates the need for future research on youth community gardens using the CBPR approach. Findings were shared with community partners and future efforts will expand this program.

Acknowledgements

I am truly blessed to have such a strong support system and would like to thank everyone who has helped me throughout my graduate studies. Without God, this wouldn't have been possible, so I thank him for this opportunity and the strength he gave me to successfully complete my Master's degree. I would like to thank all of my family and friends for their continuous prayers, encouragement, and support; especially my mother, grandmother, father, and step father. I want to express my appreciation to my boyfriend, Demetrius Brown, for his companionship and always staying by my side throughout my academic career.

I also would like to thank my committee chair/advisor, Dr. Jamie Zoellner for believing in me and accepting me into this program. I appreciate the guidance and mentorship that she provided throughout my graduate research experience. I would also like to thank my committee members Drs. Jennie Hill and Isabel Bradburn for their assistance in this process.

I am grateful for the George Washington Carver Scholarship program. I have been a recipient of this program for my entire graduate career and I am thankful for the funding and opportunities this program has provided. I especially would like to thank Dr. Randy Grayson for recruiting me into this wonderful program and his continuous support and encouragement.

I would like to express thanks to the entire Behavioral and Community Translational Obesity Research Team for providing a comfortable learning environment and their contributions throughout my research experiences. I appreciate the assistance and arrangements that our project manager, Terri Corsi provided during our research initiatives. I specifically want to thank Karissa Grier who worked very closely with me on these research efforts. She was always willing to lend a hand, creative and played a major role in contributing to this project. I

would also like to thank Lorien MacAuley for her dedication, enthusiasm and large contribution to this research as well. Ramine Alexander, Grace Wilburn, Clarice Waters, Angie Bailey and Jessica Li are other members of the team who assisted with data collection that I would like to acknowledge as well.

Lastly, I would like to thank the Dan River Partnership for a Healthy Community, as they have played a major role in this research study. I especially want to thank the youth who participated and the site leaders, Constance Covington and Fanchenette Bennett for partnering with us to complete this study. It has truly been a life changing and knowledge sharing experience. I will always cherish the life long memories of my graduate experience and everyone I met along the way.

Table of Contents

CHAPTER 1: LITERATURE REVIEW

Introduction

Over the past few decades in the U.S., obesity levels have significantly increased; tripling among youth between the ages of 2-11 and doubling for youth between the ages of 12-19 (Lutfiyya, Garcia, Dankwa, Young, & Lipsky, 2008; Ogden, Carroll, Kit, & Flegal, 2012; Zapata, Bryant, McDermott, & Hefelfinger, 2007). One in three children (ages 2-19) are overweight or obese (American Heart Association, 2012). Obesity and associated unhealthy behaviors have been shown to continue into adulthood if not addressed early in life (Powers, Struempler, Guarino, & Parmer, 2005). Obesity is associated with higher risk of various diseases including, but not limited to hypertension, diabetes, heart disease, cancer, reproductive health complications and respiratory problems (National Institute of Health, 1998). Although, eating a diet high in fruit and vegetables increases protection against these previously mentioned diseases (Van Duyn & Pivonka, 2000), the latest report from the National Health and Nutrition Examination Survey 2003-2004 shows that adolescents are not consuming the recommended amounts of fruit and vegetables on a daily basis (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). Furthermore, results from the 2010 National Youth Physical Activity and Nutrition Study (NYPANS) indicate that high school students' median for eating fruit and vegetables was only 1.2 servings. This falls below the recommendation of five fruit and vegetables daily (Center for Disease Control, 2012). Unfortunately, research shows that youth from lower socioeconomic status (SES) consume inadequate amounts of fruit and vegetables (FV) compared to their counterparts, and also consume higher amounts of refined sugar and fat

(Hanson & Chen, 2007). Inadequate fruit and vegetable consumption is largely due to the lack of accessibility and affordability often seen in health disparate and low income areas, especially among blacks (Hanson & Chen, 2007). These areas tend to have a higher prevalence of chronic disease because of poor diets as well (Thompson, 2004; Wenrich, Brown, Wilson, & Lengerich, 2012). Due to the low intake of FV in youth from low SES backgrounds, there is a need to promote increased FV intake among this population.

One potential intervention approach to address the insufficient intake of FV among youth from disadvantaged regions, and the focus of this research, is the use of community gardens (CG). Community gardens are defined as any piece of land gardened by a group of people and can provide nutritious food, stimulate social interactions, promote education and exercise and create opportunities to influence behavioral change (American Community Garden Association, 2012) . This literature review will focus on the effectiveness of community garden and nutrition education intervention approaches among youth. While a variety of community outcomes will be considered, the emphasis will be on health behaviors, knowledge and health outcomes. When evaluating various approaches in gardening and nutrition education interventions, it is important that we consider the benefits of incorporating theoretical approaches. This review synthesizes the health outcomes and conclusions examined in studies centered around CG and nutrition education interventions, community-based participatory research and theory driven interventions targeting at risk, health disparate populations.

Community Gardens and Nutrition Education Approaches among Youth

There were ten identified studies that delivered community-based interventions with both community garden and nutrition education components (Beckman & Smith, 2008; Heim, Bauer, Stang, & Ireland, 2011; Heim, Stang, & Ireland, 2009; Hermann et al., 2006; Koch, Waliczek, & Zajicek, 2006; Lautenschlager & Smith, 2007; McAleese & Rankin, 2007; Morgan et al., 2010; Morris, Neustadter, & Zidenberg-Cherr, 2001; Somerville, Kessler, Wallace, & Burns-Whitmore, 2012). Of these studies, eight were pre-post interventions (Beckman & Smith, 2008; Heim et al., 2011; Heim et al., 2009; Hermann et al., 2006; Koch et al., 2006; Morgan et al., 2010; Morris et al., 2001; Somerville et al., 2012) with two including a control (Morgan et al., 2010; Morris et al., 2001). There was one quasi-experimental with a control (Lautenschlager & Smith, 2007) and the other study was a non-equivalent randomized control trial (McAleese & Rankin, 2007). Shared outcomes exhibited across all studies included FV intake, willingness to try FV, nutrition knowledge and values placed on nutrition.

Heim and colleagues (2011) conducted a pre-post 12 week pilot study that incorporated social cognitive theory to examine how a garden based intervention influences the home food environment and child asking behavior. This study included 93 children between the ages of 8-11 years old, of which 78% were White, 8% Hispanic, 3% African American, 6% Asian American and 5% mixed or other. This intervention focused on constructs from social cognitive theory teaching children about various aspects of gardening by planting, maintaining and harvesting their own gardens. Increasing FV availability was also encouraged by implementing 20-30 minute sessions twice weekly. In addition, parents were given weekly newsletters in regards to FV availability and accessibility in the household. Data collection was self-administered to all caregivers assessing child asking behaviors, parental behavior in supporting

child FV intake, child FV consumption, FV availability, and parental values of FV. Between baseline and follow-up assessments, there were improvements across all variables. The means for each category are as follows; child asking behavior on a range of 0-1; (0.5 to 0.6) ($p<.01$), parental encouragement of FV ranged from 1-4; (2.6 to 2.7) ($p=.06$), parental value of FV ranged 1-4 (3.5 to 3.7) ($p< .01$), availability/accessibility of FV ranged from 1-4 (3.1 to 3.2) ($p= .05$), vegetables available in previous two weeks ranged 0-11 (5.3 to 6.3) ($p < .001$), and fruit available in previous two weeks ranged from 0-5 (2.9 to 3.3) ($p <.05$). This study suggests that community based garden interventions that involve both children and their parents are beneficial in changing child asking behaviors for FV as well as the home food environment.

Hermann and colleagues (2006) studied the impact of an after-school educational and gardening program on vegetable intake and physical activity of youth using a pre-post design. Forty-three 3rd through 8th grade youth were involved in this study, including 72% Native American, 25% White and 3% Hispanic. In implementing this intervention, cooperative extension professionals educated the youth by involving them in hands on nutrition education, food preparation and physical activity sessions using various curriculums once weekly for 90 minutes each on different age groups. Questionnaires were administered to the children to gather information about vegetable consumption and physical activity behaviors. Findings indicated significant increases between pre and post assessments with vegetable intake from 21% to 44% ($p< 0.02$) reporting that they eat vegetables every day. Significant increases in physical activity also occurred from 49% to 79% ($p <0.05$) reporting to be physically active every day. No analysis of differences between ethnic groups was reported. This study suggests that combining nutrition and gardening education in a program can create a positive change in youths' vegetable intake and physical activity when participating in a school based intervention.

Using the Theory of Planned Behavior, Lautenschlager and colleagues (2007) studied the effects of a community garden on dietary behaviors, values, beliefs, cooking and gardening behaviors of youth over a 10 week period. This quasi-experimental with a control consisted of two sets of inner-city youth with both having three groups each and no randomization. The first set (G1) (n=26) consisted of three groups that received the gardening program while the other set (G2) (n=14) of three did not. The participants of G1 were selected by program staff while those of G2 were selected by community members. Forty youth between the ages of 9-15 participated in this study from different ethnic backgrounds with 15% White, 30% African American, 17.5% Hispanic, 27.5% Asian, 7.5% Somali, 12.5% multiracial and 2.5% considered other. To gather information about youth's dietary intentions, knowledge, attitudes, perceived behavioral control and subjective norms, focus groups took place among G1 and G2. During analysis of the focus groups, Lautenschlager and colleagues (2007) found that G1 participants were more receptive to try nutritious, ethnic and unfamiliar foods and more capable of identifying healthy diets when compared to the control group. They also found that G1 was independently involved in cooking and gardening more so than the control group. These findings propose that implementing theory-based community garden interventions positively influence dietary and gardening behaviors, knowledge, skill and practices in youth.

In another study, McAleese (2008) and colleagues conducted a 3-group non-equivalent randomized control trial. This 12-week intervention took place in a school setting. Two schools acted as experimental groups; with experimental group one (E1) only providing nutrition education, experimental group two (E2) providing both nutrition education and gardening components and the other group (C1) acting as a control with no treatment. The E1 group used the *Nutrition in the Garden* curriculum (Lineberger & Zajicek, 1998) to provide lessons and

activities on nutrition to the students and the E2 group included the curriculum with additional workbooks and gardening activities. Students involved in the study in all three groups completed three 24-hour recall workbooks in the beginning and at the end of the intervention. This study included 122 youth between the ages of 10-13 and only provided generic demographic information stating that participants had similar ethnic and socioeconomic backgrounds. Of these students, 99 students were included in the analysis for this study (i.e., completed at least 2 of the 3 food recalls). Students from the experiential E2 group significantly increased their fruit (0.8 to 1.9 servings) and vegetable consumption (1.2 to 2.6 servings) ($p<0.001$) and all other nutrients measured (Vitamin A (430.4 to 612.4µg) $p=0.004$, Vitamin C (58.2 to 143.4mg) $p=0.016$, Fiber (12.7 to 16.9g) $p=0.001$) compared to E1 and C1 groups. There were no significant changes across other outcomes in the C1 or E1 groups. Findings suggests that both gardening and nutrition education programs positively impact youth's FV consumption as well as nutrient levels and therefore should be promoted and implemented in school settings.

Morris (2001) and colleagues implemented a pre-post with a control design for an entire school year to examine the effects of a nutrition education and gardening program on first graders willingness to try FV. Additional outcomes that were examined in this study included child preferences, food identification, attitudes and knowledge. This study included six schools from urban areas of California, of which three were intervention schools and received nutrition and gardening education and experience, while the three control schools did not receive anything. The teachers at the intervention site were previously trained and incorporated nutrition and gardening education that was guided by social cognitive theory within their curriculum throughout the school year. Pre and post assessments took place in a one-on-one interview format to evaluate the children's food group identification, willingness to taste, preferences, and

knowledge of various vegetables (Birch, 1980). Ninety-seven first grade students participated, including 48 in the experimental and 49 in control. Results showed that between pre and post assessments children in the intervention group significantly increased their willingness to try vegetables (4.07 to 4.83) ($p< 0.005$) while the control group exhibited no changes (3.90 to 3.90) on a five point scale. Other outcome measures of nutritional knowledge and food identification significantly increased in the intervention group (1.9 to 2.5) ($p < 0.02$) and the control group did not demonstrate significant changes (2.4 to 2.5) on a five point scale. This study indicates the feasibility and effectiveness of theory driven garden based nutrition education programs implemented within school settings for youth to improve their dietary behaviors.

A study by Morgan (2010) and colleagues examined the impacts of a school garden and nutrition education intervention on children's FV consumption, preferences, FV knowledge and quality of school life. This pre-post10 week intervention took place in two schools. The students were split into three groups; group one (G1) received nutrition education and gardening (n=35), group two (G2) received nutrition education only (n=35) and group 3 (G3) received no intervention at the other school which acted as control site (n=57). Teachers were trained and given previously used curricula to modify for Australian context and integrate into their classroom lessons. Assessments were taken at baseline and four months following the intervention using credible instruments that were previously developed. To measure FV intake, 24-hour food recalls were administered by an interviewer. Vegetable preferences were measured using a "taste and rate" method (Birch & Sullivan, 1991) and FV knowledge was assessed with a questionnaire previously used in the "Gimme 5" intervention (Baranowski et al., 2000). Quality of school life was assessed using a previously validated survey as well (Ainley & Bourke, 1992). In total, 127 students between the ages of 11-12 participated. Post-test findings demonstrated

that the children in both intervention groups (G1 & G2) were significantly more willing to taste overall with G1 and G2 having means of 4.5 compared to the control group with 3.9 (scale of six). These groups also scored higher on overall taste ratings (G1 18.2) and (G2 18.5) compared to the control with 15.5 (scale of 30). Morgan (2010) and colleagues also found a significant difference in those who had lower FV knowledge at baseline and follow up between the control group and G1 ($p=0.02$). G1 also improved significantly in their ability to identify vegetables ($p<0.001$) when compared to G2 and the control group. These findings suggest that a nutrition and garden education program is beneficial and effective in increasing FV consumption, FV willingness to try, FV preferences, FV knowledge and quality of school life among youth.

Heim (2009) and colleagues conducted a twelve week SCT driven nutrition and gardening pilot intervention to promote FV consumption at a YMCA summer camp. This pre-post pilot expanded upon a previous study to examine participants' satisfaction and the short-term effectiveness of this program on FV exposure, preferences, self-efficacy, asking behavior, home availability and basic demographics of the study sample. There were 93 fourth through sixth grade participants of which 78% were White, 8% Hispanic, 6% Asian American, 5% mixed/other and 3% African American. This program met twice weekly for about 20-30 minutes focusing on experiential gardening and nutrition activities which included taste testing, goal setting, role playing, plant parts, nutrient needs of humans and plants, MyPyramid for kids and environmental stewardship. Overall, results were positive for this study with 97.8% reporting that they enjoyed taste testing, 93.4% enjoyed preparing FV, 95.6% working in their garden and 91.3% learning about FV. Between baseline and follow-up, there was a significant increase in the number of V ever eaten 7.80 (2.24) to 9.17 (2.09) $p<0.001$, F ever eaten 4.72 (.61) to 4.86 (.41) $p= 0.0187$, in V preferences 3.17 (.75) to 3.40 (.71) $p < 0.001$ and in child asking

behaviors 2.16 (.47) to 2.32 (.51) p=0.002. All other outcomes were not significant. Findings from this study demonstrate the importance of youth engagement in garden based nutrition programs to influence FV intake and implicate the need for more research on the predictors (i.e access, availability, participation) of FV intake.

Somerville (2012) and colleagues implemented a garden-based nutrition education program guided by social cognitive theory for forty children between the ages of six and twelve. This pre-post intervention took place in an after-school setting among mostly Hispanic youth (83%) to examine its effect on youths' FV intake and snack preferences. This thirteen week intervention took place once weekly with one-hour sessions that consisted of activities that emphasized FV snack preparation and consumption. Activities included taste testing, snack preparation and FV BINGO while concurrently applying constructs of social cognitive theory. Results from this study were captured through self-reports and observational methods. They found that F intake significantly ($p<0.05$) increased between pre and post measures from 2.23 (4.18) to 4.13 (2.16) and V intake ($p<0.05$) from 2.17 (1.82) to 3.07 (1.87). Overall, FV intake increased from .68 servings to 1.28 and the average chip intake decreased from .94 servings to .30 servings. This study suggests that theory based interventions that use experiential learning to engage youth are appropriate for influencing FV eating behaviors and preferences in minority children and the need for more research.

In a study by Koch (2006) and colleagues, 56 second through fifth graders participated in a nutrition and gardening education program to evaluate its effect on their nutritional knowledge, attitudes and behaviors toward eating FV. The period in which the intervention was offered varied between counties depending upon their availability (i.e. offered once weekly for 12 weeks or offered everyday for a week) between May and August. This pre-post intervention focused on

concepts from *Health and Nutrition from the Garden (Genzer et al., 2001)* which taught children about healthy eating on a budget. There were 12 activities for the youth to take part in and different measures were used to evaluate nutritional knowledge, attitudes and behaviors regarding FV intake. Results found significant improvements in youths' knowledge about the benefits of eating FV ($p \leq 0.05$); however there were no significant improvements in their attitudes or snack preferences. Findings from this study indicate the importance and affect that gardening and nutrition education programs have on youth and implicate the need for these interventions among youth for behavior change.

In another study from Lautenschlager Beckman (2008) and colleagues, a ten week garden and nutrition education program driven by the theory of planned behavior was implemented to youth between the ages of eight and fifteen. The Youth Farm and Market Project (YFMP) used a pre-post design focusing on environmental responsibility, cultural diversity and the food system. This study evaluates the dietary behaviors and nutritional and gardening knowledge from pre and post surveys of this program. With a sample of 96 youth, one third were African American, one third white and all others were Hispanic and Hmong. Results from this study found that boys increased their FV intake significantly between pre and post tests when compared to the girls who increased meat and cholesterol. For boys, V intake increased from 2.05 (1.3) to 3.43 (2.5) $p= 0.007$ and F intake increased from 2.01 (1.7) to 3.05 (2.1). Girls significantly increased their meat intake with 1.01 (1.0) to 1.49 (1.4) $p= 0.04$ and both genders increased their nutrition and gardening knowledge between pre and post tests. Boys increased from 4.00 (3.20) to 5.24 (3.33) $p=0.000$ and the girls increased from 5.10 (2.39) to 5.46 (3.03) $p=0.403$. The findings from this study suggest that gender and age differences are present in learning styles and needs to be examined in further research.

These studies demonstrate the potential of such interventions in being able to create behavioral change. Overall, the studies depict the lack of nutrition interventions targeting African Americans as well as pertinent outcome measures of willingness to try FV. This review shows the implications for further theory driven, garden based nutrition education interventions that measure outcomes of willingness to try, self efficacy, outcome expectations and knowledge as a whole entity targeting low socioeconomic youth.

From this body of literature, it is necessary to focus future research initiatives on more theory-based rigorous nutrition and gardening interventions for youth that aim to create behavioral change and address the obesity issues of the United States. It is apparent in this review that multifaceted interventions have the potential of being successful, yet mixed findings warrant further investigation. This knowledge should be shared across the academic spectrum and disseminated back to communities so that researchers and community members can join together in making greater impacts and educating youth about the importance of consuming adequate amounts of FV.

Social Cognitive Theory

Social Cognitive Theory (SCT) focuses on how certain behaviors can be acquired and maintained through the interaction of reciprocal determinism (Bandura, 1986). Reciprocal determinism is defined as the interaction between people, behavior and the environment to trigger change. This theory is one of the most commonly used theories for understanding and changing health behaviors (Baranowski et al., 2000). It incorporates various constructs interactively to promote behavioral change, including knowledge, self-efficacy, outcome expectations, goal setting and reinforcement. Within these constructs are ways in which knowledge and behavior is transferred and measured to be effective (Bandura, 2004). Skills training and observational learning contribute to knowledge and a person's confidence in their ability to perform certain behaviors is a form of self-efficacy. Outcome expectations are addressed when role modeling of positive behavior takes place to influence a person's anticipation of outcome behaviors. Setting goals and reinforcements are integral parts of this theory as well.

This theoretical framework seems to be effective when working with youth to influence health behaviors (Lytle & Achterberg, 1995) and may significantly change dietary habits (Resnicow et al., 1997). As previously mentioned, SCT was the most commonly used theory in the reviewed youth-based nutrition and community garden research (Heim et al., 2011; Heim et al., 2009; Morris et al., 2001; Somerville et al., 2012). Using a theory based approach is valuable as it guides the development of educational lessons and evaluation instruments for interventions that will aid in progress towards a common goal (Morris et al., 2001). Specifically, SCT is beneficial when working with youth as they are most influenced by their environment and visual learning styles (Morris et al., 2001). This theory is important

throughout the planning and development stages of research so that those implementing the intervention will have the proper guidance and be able to follow through all constructs needed to address the issues of the community. Doing so will allow researchers to evaluate how successful the intervention was based on how well the constructs of the SCT were carried out and how well they were received by participants. In evaluating an intervention, this theory also can be used as a tool to ensure various points were covered and assist in enhancing future efforts.

Community-Based Participatory Research Approaches among Youth and the Dan River Partnership for a Healthy Community

Community based participatory research (CBPR) is defined as an equal collaboration and partnership between researchers and community members throughout research initiatives to address the needs of that community (Israel, Eng, Schulz, & Parker, 2005; Strickland, 2006; Tapp & Dulin, 2010). CBPR has been identified to increase the value of ongoing research, as well as improve community health by creating social change and lowering health disparities within disadvantaged communities (Horowitz, Colson, Hebert, & Lancaster, 2004; Minkler, Blackwell, Thompson, & Tamir, 2003; O'Toole, Aaron, Chin, Horowitz, & Tyson, 2003). This approach is beneficial in the community in which it takes place as it provides applicable knowledge that could potentially be disseminated to other settings (Macaulay et al., 1999; Macaulay & Nutting, 2006). Furthermore, it promotes capacity building and co-learning. It identifies local public health issues and addresses their causes, while permitting community engagement and development that foster long term commitment (Strickland, 2006). Because of the trusting relationships and resources built through CBPR, it can potentially improve the health of others beyond those involved within one particular community; which is why it is continuing to emerge as a successful model of implementation (Tapp & Dulin, 2010).

Throughout the literature search, there were no youth gardening and nutrition interventions that utilized the CBPR approach. While CBPR initiatives have been used across youth programs, only one study focused on youth gardening and nutrition. The body of literature that was found on CBPR mostly focused on the processes and evaluation of CBPR in general and in interventions. This literature illustrated that CBPR can be effective and beneficial to the community (Zoellner, Zanko, Price, Bonner, & Hill, 2012) despite some of the challenges that may stem from it. Though this literature was descriptive and did not implement a youth gardening and nutrition intervention, Robinson-O'Brien (2009) encourages and recommends the use of this approach in developing, implementing and evaluating CG (Robinson-O'Brien, Story, & Heim, 2009). CBPR is also recognized as a means of addressing health concerns within the community through the use of CG (Zoellner, Zanko, et al., 2012). These efforts often take place in predominantly low income African American communities (Israel et al., 2005; Minkler et al., 2003) to promote community development and empowerment through flexibility in mutual learning environments (Bacon, Mendez, & Brown, 2005; Israel et al., 2005). Overall, these studies demonstrate the strength and necessity of CBPR in different areas of interest and attest its use in health disciplines to contribute to scientific knowledge (Bacon et al., 2005). The lack of literature on CBPR gardening and nutrition interventions targeting youth implicates the need for more research in this area.

The Dan River Region, where this pilot took place, is a rural, health disparate area located in south central Virginia and north central North Carolina. This is a medically underserved region (Human Health Services, 1997; Virginia Department of Health, 2008) suffering from high obesity and unemployment rates above state and national levels (Department of Labor, 2011). This population has a low educational attainment (Census Bureau, 2009) and

16.5% are living below the Federal poverty line (VDH, 2008; Woolf et al., 2010). Though this community lacks the necessary resources for community development and community capacity, there are many community stakeholders from various backgrounds excited about building this community up (Zoellner, Motley, et al., 2012). Because of the disadvantages and concerns of community capacity to develop and implement effective programs addressing health issues within this region, efforts evolved to form a CBPR partnership (Zoellner, Motley, et al., 2012). Over a four year span, three needs assessments took place throughout this region (Beachler, 2009; Byington, R., Naney, C., Hamilton, R., & Behringer, B., 2007) giving the community an understanding of the health issues that need to be addressed; placing priority on obesity. A partnership between community members and Virginia Tech researchers was formed within the Danville community. The formation of this partnership began in 2009 after the Danville Regional Foundation invited community representatives from different backgrounds (i.e. faith-based, government, education) to a round table discussion on obesity. A steering committee was formed and from there more community discussion led to subcommittees within the partnership (i.e nutrition, education, physical activity and environmental subcommittees). These committees met on several occasions and created a causal model to address specific issues related to their focus by figuring out the root causes of the community's health issues. Thus, the Dan River Partnership for a Healthy Community was formed to address regional obesity concerns and community gardens were identified as a potential solution by community leaders.

Zoellner (2012) and colleagues used the CBPR approach to identify future efforts in addressing health concerns within this health disparate region guided by the social-ecological model and behavioral theory. This study used a mixed methods design to gather data on the opinions and interests of the community in developing and implementing a community garden.

The sample size included 87 underprivileged youth between the ages of 5 to 13, 67 parents (age 25-61) and 10 community stakeholders from different areas (education, churches, community and recreation). In April of 2010, the partnership between community stakeholders and Virginia Tech researchers began to find solutions to obesity related issues within their communities. The majority of the youth (68%) reported that they would work in a garden and 82% would consume produce grown in the garden. All categories for parents (gardening attitudes, beliefs, self efficacy, FV availability and variety) were above the mid-point with the exception of gardening intentions which was neutral. In the qualitative analysis, community stakeholders eluded to themes of community cohesion, physical activity and improving nutritional outcomes as possible benefits of implementing a community garden. Overall this study provides findings that support the need for further CBPR approaches in community garden initiatives that address health behaviors.

In 2011 a case study using a mixed methods approach was conducted to explore the potential public health impact of six community gardens in the Dan River Region (Zanko, 2012). Combined, the six gardens yielded 811 pounds of produce, most of which were distributed to the families of the youth who participated in the garden. Interviews and focus groups revealed that garden leaders and participants were enthusiastic about the results of the efforts of the community gardens and expressed interest in continuing to maintain gardening space. Working very closely with the Nutrition subcommittee, Virginia Tech researchers developed and implemented this pilot. The development and implementation of this study continues the efforts of previous collaborations in expanding the partnership to other community organizations interested in our community efforts.

Conclusion

In summary, addressing dietary behaviors among low income populations has been recognized as a priority since they are more likely to consume unhealthy foods and develop chronic diseases (Billson, Pryer, & Nichols, 1999; Leather, 1995; Lobstein, 1999). Low income African Americans have the highest rates of obesity and have an increased risk for developing health issues (Hanson & Chen, 2007). Furthermore, research should use youth based CG and nutrition education as a focal point in interventions aiming to influence children's behaviors toward FV intake.

In the previous section, there were ten studies involving gardening and nutrition education approaches to address child health behaviors. Eight of the studies used a pre-post design (Beckman & Smith, 2008; Heim et al., 2011; Heim et al., 2009; Hermann et al., 2006; Koch et al., 2006; Morgan et al., 2010; Morris et al., 2001; Somerville et al., 2012) and two of those had a control group (Morgan et al., 2010; Morris et al., 2001). One study used a non-equivalent randomized control trial (McAleese & Rankin, 2007) and another used quasi-experimental with a control (Lautenschlager & Smith, 2007) . Of those, only two examined outcomes of willingness to try fruit and/or vegetables (Morgan et al., 2010; Morris et al., 2001) and none focused on African American youth, outcome expectations or used the community based participatory research approach. Nutritional knowledge was a common outcome measured throughout the literature that exhibited mixed findings (Beckman & Smith, 2008; Koch et al., 2006; Lautenschlager & Smith, 2007; Morgan et al., 2010; Morris et al., 2001). There were six studies that used theoretical approaches, most often the SCT (Heim et al., 2011; Heim et al., 2009; Morris et al., 2001; Somerville et al., 2012). The Theory of Planned Behavior was implemented in two of those studies providing evidence that theory driven interventions can be

valuable and successful (Beckman & Smith, 2008; Lautenschlager & Smith, 2007). The findings across all studies support the use of theory based nutrition education and gardening interventions that target youth to influence health behavior.

This review reveals gaps in the literature, illustrating the necessity of theory based CG and nutrition education interventions, specifically addressing low socioeconomic youth in health disparate areas. It also highlights the added value of using the CBPR approach to address the needs of the community through program development, implementation and evaluation. Our pilot study attempts to bridge these gaps in the literature, specifically related to theory based, CBPR interventions focusing on nutrition and gardening for youth. Our short-term goal is to understand the feasibility and effects of implementing an experiential gardening and nutrition program among predominantly African American youth residing in public housing. Our long-term goal is to understand the potential of this approach to engage community partners, reach youth, and help combat youth obesity in health disparate areas.

CHAPTER 2: THEORY BASED GARDENING AND NUTRITION CURRICULUM FOR YOUTH

Specific Aims

Primary Aim

1. To determine if an experiential 10 week gardening and nutrition education program guided by Social Cognitive Theory would increase willingness to try FV among low socioeconomic youth.

Secondary Aims

1. To determine if an experiential 10 week gardening and nutrition education program guided by Social Cognitive Theory and targeting low socioeconomic youth would increase their self-efficacy for FV and gardening, self-efficacy of asking for FV, gardening and nutrition knowledge, and outcome expectations of eating FV.
2. To determine if age or attendance rates would positively influence willingness to try FV, self-efficacy for eating FV and asking for FV, gardening and nutrition knowledge, and outcome expectations of eating FV.
3. To qualitatively evaluate youth's perceptions about their experiences and opinions about the program.

Methods

Virginia Tech's institutional review board (IRB) approved all human subjects study procedures. Low socioeconomic children between the ages of five to sixteen who resided in two different public housing sites were the target audience for this intervention. The children participated on a voluntary basis with completed assent and parental consent forms obtained prior to child enrollment.

Study Design and Overview

This mixed methods pilot study used a pre- post-experimental design. The community garden and nutrition program was implemented over a 10 week period, beginning in May and ending early August of 2012. Researchers delivered the nutrition and gardening education program once weekly at each site for 90 minutes each; providing approximately 60 minutes of nutrition or gardening education with experiential learning and engaging activities, and 30 minutes with hands on gardening. Educational material was adapted from the Junior Master Gardeners curriculum (JMG, 2001). The curriculum was adapted to align more closely with SCT and include more culturally appropriate lessons.

Table 1 outlines each lesson, the target outcomes, and corresponding constructs from SCT. The program content was delivered exclusively by graduate research assistants. It focused on different aspects of gardening throughout the first four weeks with lessons on the following topics; Basic gardening I & II, gardening techniques and gardening maintenance. Within these lessons, children learned about plant parts, plant parts that can be eaten, plant needs, when and where you can plant, the plant life cycle and when to harvest. Children were exposed to all aspects of the lessons when actively participating in gardening activities as well as interactive activities that were embedded into the lesson plans. During weeks five through nine, the

program focused on nutrition including lessons titled basic nutrition I & II, safe practices, healthful eating and food demonstrations and tasting. Children learned about MyPlate, macro and micro-nutrients, food safety, recipes and alternative ingredients for trying new ways to eat common foods. Through active engagement, food preparation and tastings, children were given the opportunity to experience first-hand new and unfamiliar foods in a supportive environment; which also reflected the environmental construct of SCT. Many of the foods that were taste tested throughout this program were not grown in the youth gardens and were purchased from super markets for various reasons. There was limited availability of produce in the gardens because the time for harvesting had not yet arrived. The different sites had unequal amounts of produce due to the differences in their garden sizes; so to provide both sites with the same experiences, produce was purchased. During week ten of the program, children where provided with a recap of the pertinent topics covered throughout the course of the program. Following the recap, a brief ceremony of appreciation was given to the children for their participation and completion of the program.

Through planning and curriculum development, SCT was incorporated in our ten week program to address the outcome measures of our research. Within the lessons, we created activities and teachings based on the constructs of this theory. Each week, we encouraged youth to set goals revolved around increasing FV intake and trying new FV. For example, students were given incentives for reaching weekly goals using a "Stars of the Garden" chart to showcase their achievements. This chart displayed color coded stars to recognize those who accomplished their goals. This activity reflects the goal setting, reinforcement, behavioral capability and self-efficacy constructs. We also incorporated food demonstrations and sampling in some of the lessons to reflect the reinforcement, behavioral capability and self-efficacy constructs from the

theory. In order to measure the feasibility of delivering this theory based gardening and nutrition curriculum, we strategically developed and planned the program and collaboration with community members. To address the needs of the site leaders, the youth and the graduate research assistants, we worked closely in the planning stages to determine the best format of implementing the intervention.

Through numerous conversations and meetings with the site leaders of each housing authority, they expressed that once weekly would be the best fit for successful implementation of the program with this population. Site leaders felt that this plan would be most appropriate to incorporate with their established schedule. It was thought to be more realistic for them to be completely involved and engaged in the program if they only had to commit to one day per week. They agreed that lessons should have a duration of one hour and a half to keep children engaged while still having enough time to learn the material. It would also allow them to provide other summer activities and events for the youth of this community in addition to this program. The site leaders were responsible for all youth activities and events; therefore, they deemed that this level of participation in the program would not be burdensome or overwhelming for the youth. The site leaders were most involved with the logistics as mentioned, however, they did not collaborate with the researchers in developing or implementing the nutrition and gardening curriculum for this program.

The decision to make the lessons once weekly for an hour and a half was also compatible with graduate research assistants' schedules. The graduate research assistants had to be flexible in the early stages of implementation to find an appropriate time that did not conflict with their class schedules or that of the youths'. Graduate research assistants were dedicated to seeing the success of the program and committed to driving two hours each way to deliver the lessons.

They felt that delivering the program once weekly was economical considering the cost of travel and potential overnight stays. In the weeks leading to the implementation of the program, the graduate research assistants developed and prepared the materials which included curriculum content, handouts, worksheets, activities, visual aids, and samples.

Indicators of feasibility that were taken into account when conducting this study were fidelity, adherence, assessing the quality of program delivery, and participant responsiveness and involvement. Feasibility is defined as the extent to which a new program or policy can be successfully used or carried out within a given agency, in a particular setting, or in a certain population (Brownson, Colditz, & Proctor, 2012). In order to address the adherence and quality of delivery, we completed process evaluations at the end of each session that included questions as outlined in Appendix 8. Some of the questions were rated using a score between one through five, with one being "not at all" and five being "completely" agree. These evaluations allowed us to reflect on the delivery of each lesson, the responsiveness of the youth and their level of participation and ultimately the success of the program.

Recruitment

Recruitment for the nutrition and gardening education program took place a month prior to enrollment. Flyers and parent questionnaire packets were developed by research assistants and distributed throughout each housing authority by the site leaders. Recruitment flyers were passed out to all residents through door-to-door delivery within the community and visibly posted in the youth center. Graduate research assistants collaborated with site leaders to provide the proper resources (i.e. all printed materials) to recruit community members. Site leaders played a major role in advocating for the program to the youth consistently throughout the recruitment month to raise awareness of the program. Parents were encouraged to complete the

entire questionnaire in order to be eligible for the incentives and for their children to enroll in the program. The packets that were distributed to the parents were self-administered and included the parental questionnaire and the consent form. Upon completion, parents were instructed to return their completed packet to the site leader and given additional flyers to inform them about the enrollment processes. During enrollment children were interview administered a questionnaire and anthropometric measures (height and weight) were taken. As a team, Virginia Tech graduate research assistants and site leaders set up dates and times that were best appropriate for their communities to host events leading up to the initial sessions of the program. These events (i.e. planting days) involved various activities that introduced what the program would consist of for the community. Shopping and planting dates were established and both sites were given a budget of two hundred dollars to get the proper materials for their site. Each site needed materials and equipment for the development of their gardens which consisted of seeds, transplants, soil, pots, garden tools and starter kits.

Data Collection Procedures

Enrollment took place over a four day period at each site. Post assessments took place one to two weeks following the intervention, over a two day period at each site. Trained researchers interview administered a questionnaire to all children. Previously validated and novel questionnaires were used (Geller, Dzewaltowski, Rosenkranz, & Karteroliotis, 2009; Thomson et al., 2010). The child surveys measured willingness to try using 26 questions (Thomson et al., 2010). Of those items, five questions refer to location's where the child would be willing to try a new food, sixteen questions refer to child willingness to try of different types of foods and four questions refer to their perceptions of how healthy they are and if they eat most, favorite or all foods offered to them. All of the willingness to try questions were on a scale

of 0-2 with 0 being the lowest and 2 being the highest with choices of no, yes or maybe (0=no,1=maybe, 2=yes). Child perceptions of whether they and their parents eat any food offered, eat most foods or only eat favorite foods were also measured on a scale of 0-2. Outcome expectations for eating FV used seven items and these questions refer to what they think will result whether positive or negative from consuming FV. This measure was newly developed for this pilot by Virginia Tech Graduate research assistants, considering there were no scales for this particular measure found within our literature search. We did not report on this measure due to low Cronbach scores and we are considering adapting this measure for future programs. Self-Efficacy for eating FV used 13 questions that refer to if they think they are capable of choosing a FV during certain meals instead of chips, candy or desert (Geller & Dzewaltowski, 2010; Geller et al., 2009). Self-Efficacy of asking for FV used eight questions which refer to if they think they are capable of asking for F or V in different settings and from family members (Geller & Dzewaltowski, 2010; Geller et al., 2009). Self-Efficacy for gardening used six questions that refer to if they think they are capable of gardening (Zanko, 2012). All of these sections were measured on a 0-2 point scale with possible answers of no, maybe, and yes. The Gardening knowledge section used 28 questions; six questions refer to parts of the plant that can be eaten, five refer to what plants need in order to grow, four refer to what type of soil plants need to grow best in, nine refer to the plant life cycle, one refers to whether or not you need chemicals to get rid of weeds and pests, and three refer to what helps improve soil. Possible answers for the gardening knowledge sections were yes, no or I don't know with the exception of one question which used a multiple choice format. All others were measured on a scale of 0-2 with (0=lowest, 2=highest) level of knowledge and depended on coding for correct answers. The Gardening knowledge section of the questionnaire was novel for this pilot study in efforts to

capture specific components from the curriculum used. Nutritional knowledge used 19 questions; one question asks about the number of food groups represented on the MyPlate image, and uses free response. Eight questions ask about what food groups are shown on the MyPlate image and had possible choices of no, yes or I don't know (0-2 point scale). One question refers to the number of servings of FV one should consume daily (free response), nine questions refer to macro nutrients and four refer to food safety with choices no, yes or I don't know on a 2-point scale. All of the nutrition knowledge measures were novel to this pilot to relate directly to the theory based curriculum that was used. The demographic variables assessed included race, gender, age and number of siblings. Measures of height in centimeters and weight in kilograms were also measured in a confidential area, following the questionnaire. The data collection took approximately 30 minutes per child to complete both (questionnaire and anthropometrics).

During post assessment, an exit questionnaire was interview administered to the children to collect qualitative data about their experiences and what they learned throughout the duration of the program. The exit interview questionnaire consisted of eight questions that allowed open-ended responses for each child, for example: 1) What did you like most about the program? 2) What did you like least about the program? 3) What ideas do you have to make the program more exciting for the future? 4) How do you think we can get more kids from your neighborhood to come to the program? 5) How has the program helped you with gardening? 6) How has the program helped you with nutrition and eating fruit and vegetables? 7) What are some new fruit and vegetables that you have tried since starting the program? and 8) Do you think you will continue to set goals to eat the recommended amount of fruit and vegetables after the program ends?

Data Analysis

For quantitative data, basic descriptives were used to summarize all study variables and Cronbach alphas were conducted on the baseline questionnaires to assess the reliability of each scale. Repeated measure ANOVA tests were used as the primary method of analysis to examine potential differences between pre- and post-measures. They were also used to explore potential differences among 1) attendance rates, categorized as low (0-4 lessons) or high (5-10 lessons) and 2) age groups, categorized as younger (5-9 yrs) and older (10-16yrs). An intent-to-treat analysis using the last observation carried forward method [e.g. for non-completers, baseline value is substituted for post-intervention value (assumes a zero change)] was compared to analysis using complete cases only. Findings did not vary by approach; therefore, intent-to-treat results are presented. Analyses were performed using the SPSS 20.0 software package. A critical value of .05 was used for significance testing.

In assessing the reliability of our measures, we calculated Cronbach alphas on each (excluding knowledge based questions). We examined all scales with the following scores; Willingness to try overall (.860), Willingness to try fruit (.679), Willingness to try vegetables (.775), Self-efficacy for eating FV (.754), Self-efficacy for asking for FV (.720), and Self-efficacy for gardening (.474). We did not calculate Cronbach alpha scores for our knowledge based questions considering they are based on participants understanding of content and responses may vary.

In the qualitative analysis, field notes from the exit interviews were entered into an excel document. Three research assistants independently coded the field notes. Then they met to resolve discrepancies and come to a consensus on the codes and emergent themes(Rallis & Rossman, 2011).

RESULTS

Participants

Demographic information is summarized in Table 2. There were 43 participants enrolled in this pilot study between the ages of five and sixteen with a mean age of 8.7 (2.8) years. The sample consisted of 42 (97.7%) African American youth. Of this sample, gender was split almost equally with 23 (53.3%) female and 20 (46.5%) male participants. In the total sample, 34.9% of the participants were classified as overweight, 18.6% were obese, 27.9% were normal and 4.7% were considered thin when separating by weight status. The average attendance was 41.2% over the ten week program period.

Quantitative

The quantitative results are shown in Table 3. To examine the differences between pre and post measures, repeated measure ANOVA's were performed for all variables. There were significant changes in self-efficacy for asking for fruit and vegetables, and gardening knowledge overall. This pilot also found significant increases in some of the subcategories for gardening and nutrition; these included plant parts and MyPlate. The food safety subcategory significantly decreased between pre and post measures.

There were no significant effects on willingness to try FV, self-efficacy for eating FV, self-efficacy for gardening and nutrition knowledge overall. The subcategories for gardening knowledge that showed no significant changes were the plant life cycle and gardening maintenance. Lastly, the macronutrients subcategory of the nutrition knowledge demonstrated no significant effects.

Following these analyses, repeated measure ANOVA's were performed to explore the differences between pre and post measures by attendance rates and by age groups. Attendance was split into categories of low (0-4 classes) and high attendance (5-10 classes). Age groups were split between younger (5-9 years) and older age groups (10-16 years). After examining outcome measures by attendance, those with higher attendance demonstrated significant differences between pre and post measures for the MyPlate subcategory 5.19 (1.54) to 6.61 (1.54) p=.000 and self-efficacy for eating FV 1.52 (0.42) to 1.71 (0.39) p=.011 when compared to low attendance, which did not show significant differences. The Plant life cycle subcategory showed significant decreases between pre and post measures 5.88 (1.69) to 5.00 (1.80) p=.004 in those with low attendance, when compared to those with high attendance who demonstrated no significant change. In the food safety subcategory for nutrition knowledge, the older children illustrated a significant decrease between pre and post test 3.58 (.61) to 2.95 (.23) p=.000, when compared to the younger youth who exhibited no significant changes.

Qualitative

Table 4 summarizes results from the exit interviews. Child exit interviews were administered after follow-up assessments were completed on a voluntary basis. Each interview took approximately five to eight minutes to complete. Of the 43 participants, 25 had parental consent and assented to participate in the exit interview. The interviewer asked questions pertaining to likes and dislikes of the program as well as suggestions to improve recruitment efforts and program enjoyment.

When asked about what was liked most about the program, children indicated that they enjoyed trying food (n=10), and indicated that they enjoyed the gardening experience (n=8). Some quotes associated with these themes are "Learning how to plant and about fruit and

vegetables", "Working in the garden and trying different foods", "Games and trying different foods". Another enjoyable component included playing games and activities (n=2) and a few children expressed that they enjoyed the program as a whole (n=2).

When asked about what was liked least in the program, most children indicated that they did not have any complaints about the program (n=10). A few dislikes included outdoor activities (n=2) in which one participant described their displeasure as "When we had to work in the sun". Another dislike was trying foods (n=2).

When asked about ideas for improvement and more excitement in future programs, the majority of the children suggested increasing games (n=8) and other suggestions included increasing food sampling (n=3) and increasing the variety of plants in their garden (n=3). Some of the responses within this theme from the children were "more games", "have more samples", and "More fruits and vegetables in program", respectively.

When asked about ways to get more kids from the neighborhood involved in the program, there were suggestions to have large recruitment events (n=4), door-to-door solicitation (n=4), and distribution of printed materials (n=7). Some of their responses included "Come outside with a microphone and talk", "Knock on their door and ask their mom if they can come. If they are not in it, let them know they can be in the program if they live nearby", and "Bring out signs, posters, have people tell others, post flyers at school".

When asked how this program has helped the children with gardening, many of the responses were increased knowledge of healthy eating (n=3) and gardening (n=9), increased interest in gardening (n=3) and inspiration to garden (n=2). Some of the responses from the children were "now I know I want to garden because it seems exciting and it's tasty", "It's helped

me learn I can stop eating so much junk food and start eating fruit", "We looked at the plants, watered, picked the plant, we do fun things. Learned how to plant seeds, water, they grow, then we pick them. It takes a long time to grow".

When asked about how the program has helped the children with nutrition and eating fruit and vegetables, many of the children said that it helped them try new foods (n=4), learn about nutrition (n=5), and increased their FV intake (n=4). Some of the responses included "Its helped me eat fruits and vegetables", "it did, gave me more knowledge", "It has made me know about different FV that I didn't think about before, so now I may try them."

Children were asked if they tried any new fruits or vegetables since starting the program and (n=6) said they've tried both F&V, while others reported trying only new fruit (n=8) or only new vegetables (n=8). The children reported specific new foods that they tried with some of these responses, "squash, olives, lemons, strawberries, basil", "spinach, tomatoes, and squash", "string beans, corn, peas, oranges, apples, grapes".

Lastly, they were asked if they thought they could continue to set goals to eat the recommended amount of fruit and vegetables upon completion of the program. Twenty-one of the children responded with "Yes" and three were not sure if they could commit to setting goals following the program.

Findings from the process evaluations following each weekly lesson demonstrated the feasibility of this research. These evaluations allowed the educators to capture their progress and r perceptions of the participant's excitement about the program. The scale for process evaluations ranged from one to five with one being "not at all" and five being "completely" agree. The process evaluations found that throughout the duration of the program, 80% of the

lessons received a high score of 5 for delivered as intended , 5% received a score of 4, 10% received a 3 and 5% received a 2. When evaluating how well the youth understood the lessons throughout the ten weeks, 75% of the lessons received a score of 5, 15% received a 4, and 5% received scores of 2 and 3. The youth received high scores for satisfaction of the program with 65% of the lessons receiving a 5 and 35% receiving a 4.

CHAPTER 3: CONCLUSION AND DISCUSSION

Discussion

The development and implementation of this pilot is in response to expressed needs for a community-level initiative around CG. (Zoellner, Motley, et al., 2012). It also addresses the need with CG initiatives to utilize the CBPR approach in community garden efforts (Robinson-O'Brien, 2009; Draper, 2010). To our knowledge this pilot was the first to deliver a gardening and nutrition program in low income housing authorities. Other programs have been delivered primarily through schools (Hermann et al., 2006; McAleese & Rankin, 2007; Morgan et al., 2010; Morris et al., 2001).

Findings from this study build on previous research and demonstrate the feasibility of developing and implementing an adapted curriculum in two low income housing authorities. This pilot study examined the effects of implementing a theory driven experiential gardening and nutrition program for predominantly African American youth in public housing. It addressed the potential of collaborative efforts using the community-based participatory approach to ultimately increase fruit and vegetable intake and help combat youth obesity in health disparate areas.

Though we did not find significant differences in our primary outcome, willingness to try FV, we were able to find significant effects in other outcomes that influence willingness to try. Our findings were not consistent with other research studies that did find significant change for willingness to try FV (Morris et al., 2001). We suspect this discrepancy is due to the lack of sampling opportunities throughout the gardening component of the program which adversely affected our findings. It has been documented that increased exposure to FV with experiential

gardening activities is effective in increasing children's willingness to try various FV (Morgan, 2009; Birch et al. 38 in Morgan). In comparison to other studies during our literature search, only one examined self-efficacy (Heim, 2009) with no significant increases, five measured nutrition and/or gardening knowledge yielding mixed results (Beckman & Smith, 2008; Koch et al., 2006; Lautenschlager & Smith, 2007; Morgan et al., 2010; Morris et al., 2001), while none examined outcome expectations. The studies that found significant increases in nutritional knowledge may be attributed to the extended duration of their programs (Beckman & Smith, 2008; Koch et al., 2006; Morris et al., 2001) while our insignificant findings may be related to the use of a curriculum inappropriate for the younger participants in our study. Though we hypothesized that older children and children who attended more sessions would have greater improvements in the outcome measures there were few significant differences by age or attendance. This may be due to having a small sample size and being underpowered. The food safety subcategory in nutrition knowledge unexpectedly decreased which may be due to a ceiling effect where high baseline scores left little room for improvement. The significant improvements of self-efficacy for asking for FV in our study demonstrate the potential for behavioral change to increase FV willingness to try.

The process evaluations were beneficial in providing us with an understanding of how to achieve program success and insight for future development and implementation. Though results for this pilot are reported as one, there were two different sites of implementation. After examining both sites separately and combined, there were no significant differences; therefore they are reported as one. There were no known studies in our literature review that evaluated the processes of their intervention for comparison. The challenges with program delivery within this study were mostly due to the wide age range of youth, various distractions (i.e youth chatter,

parent disruptions), and the lack of authority. During the first three weeks of the intervention, there was difficulty establishing the authoritative role as an instructor at one site, while the other site understood the difference. In subsequent weeks, the scores improved and the program ran more smoothly with our established roles. Our findings indicate that the youth understood the content of the program well with 85% of the lessons receiving a score equal to or above 4 on a scale of 5. They also seemed to enjoy the program as their satisfaction scores were above or equal to 4 on a scale of 5. We also noticed a difference in the attendance rates of the youth. We reported the attendance overall for the duration of the program which was 41.2%, however this only included those who were enrolled in the program, while we often had more youth present who were not enrolled in the program.

The qualitative findings from this pilot gave us a better understanding of the satisfaction and growth shown among our participants, despite some of the insignificant results. The majority of the participants expressed positive perceptions of the program with the most liked components including food sampling, games and gardening experiences, comparable to another study which found similar results (Heim et al., 2009). Children were encouraged to try new foods at home and share their experiences with family members to promote change in the home, which was also seen in previous studies (Heim et al., 2009). Newsletters were distributed to parents monthly to advocate for increased FV availability and accessibility in the home, as research suggests that parental V consumption is a strong determinant of youths V consumption (Morgan et al., 2010). Parents would visit some of the lessons on different occasions and they vocalized the differences they witnessed in their children in regards to the foods they wanted to eat. They alluded to buying spinach and more vegetables which were things they never brought previously to their child's participation in our program. Parental presence was important during

our nutrition education lessons as it gave us the opportunity to also educate the parents which could possibly have a greater influence on the family as a whole. It was also beneficial in providing parents the opportunity to try new foods and learn easy recipes that would involve their children in food preparation. While parents were helpful at times, they also created distractions for youth during activities. Often times, the parents would over power the youth in participation which was not the programs intention.

During the nutrition education component, youth were engaged and enthusiastic about participating in food demonstrations and tastings. When offered new or unfamiliar foods in the beginning youth were reluctant, so we continued to encourage them and reminded them of the benefits the foods provided. The majority of the youth tried the new FV that were offered and were pleased with the taste which suggests that they would be more receptive to trying new foods in the future.

This study was not without limitations. The first limitation of this study was the absence of a control group in which one site receives nutrition and gardening education without access to a physical garden. However, other studies with a control group have demonstrated that the groups with education and experience have better outcomes such as greater increases in willingness to try FV (Morris, 2001; Morgan, 2010). Another reason that we chose not to include a control group is because we were more concerned about meeting the needs of the community. The collaboration was beneficial for both the community and the researchers as it provided the opportunity to build stronger relationships and resources within this community by expanding to different housing authorities. Some of the benefits from this partnership included the engagement of community leaders and insight on the most appropriate and effective ways to approach community members through recruitment and implementation of this pilot. While

there were many strengths of collaborating with community members throughout our pilot, there were also some challenges. Some of the challenges that surfaced were the inability to conduct a rigorous research design and participation from a large sample size within this community. There were other studies that employed a pre-test/post-test design without a control (Heim, 2009; Koch, 2006; Lineberger 2000; Wright 2010) that yielded positive results. Amongst these similarly designed studies there were significant improvements in vegetable consumption (Wright, 2010), vegetable preference (Heim, 2009; Lineberger, 2000), snack preference (Lineberger, 2000), and asking behavior (Heim, 2009). Another potential limiting factor that may have hindered congruent results was the wide age range included in analysis. Youth in our program ranged from ages 5 to 16. One study included children from kindergarden through 8th grade; however children were clustered by two or three grades (Herman, 2006). Other studies also focused on a range of one to three grades (Heim et al., 2009; Morris et al., 2001). This approach may be adopted for future programming. Analysis showed no differences by age however this could be a consequence of a small sample size and low power. Low attendance was closely associated with our small sample size. In future efforts we will consider adjusting the components of the curriculum to address the needs of each age group and make concerted efforts to involve more community members in the delivery of this program.

To replicate this pilot in future efforts there are a few changes that would be made. More sampling opportunities would be provided for the youth during the gardening education component of the program to improve their willingness to try new FV. Due to the challenge in educating a wide age range, the age groups would be split up by younger (5-9) and older (10-16) or the age eligibility will be increased to eight years of age so that the content in the lessons will be appropriate for each group and well received. There would be minor revisions to the

curriculum placing more emphasis on FV consumption and possibly removing the food safety component of the nutrition knowledge section. This measure can be removed, as it may not be a necessity for the youth to increase their willingness to try FV. In the next phase of this study an additional measure of outcome expectations for gardening would be included to see if any differences will manifest. Lastly, to increase recruitment and retention rates more reinforcements and incentives for participation would be encouraged.

Conclusion and Implications

This study demonstrates the potential in using theory-driven CG and nutrition education programs with youth to effectively improve their perceptions for eating FV. The use of a multi-faceted approach in youth was feasible and effective in this study in improving health behaviors that influence FV intake. This study provided opportunities for community members and researchers to collaborate and build a foundation for further growth in this health disparate community. Considering the lack of literature examining the effectiveness of CG on youth health behaviors, this pilot study provides the framework for utilizing a CBPR approach to implement community gardens in low income areas. Future studies should adopt this approach to promote positive behavior change toward increasing willingness to try FV, self-efficacy for eating and asking for FV, and nutrition and gardening knowledge as these outcomes are the stepping stones that promote increased FV intake. It is encouraged to involve community members in these efforts to build capacity in this region and in turn create social change that impacts health behavior outcomes. The need for more research on this topic is apparent and is the next step in addressing the obesity epidemic in the United States.

Table 1: Curriculum Outline

Nutrition and Gardening 10 Week Curriculum Outline

Lesson topics	Intervention schedule	Content (120 min)	Learning Objectives	SCT constructs	Target Outcomes
Basic Gardening	Week 1 May 10	Introduction Rules and tools Plant parts Plant parts we eat Plant needs Mud Pies	-To accurately identify plant parts and parts of the plant that we eat as well as understand the purpose of plants and what they need to live and grow. -To communicate efficiently. -To learn & commit to garden rules & duties.	Self Efficacy Environment & situation Reciprocal determinism Reinforcement Goal Setting	Self-efficacy of gardening Knowledge of gardening
Basic gardening part 2	Week 2 May 17	The Zones Small and large	-To be knowledgeable in plant spacing & planting in appropriate	Reciprocal determinism	Self-efficacy of gardening

		(plant spacing) Make Your Pick (when to plant) Home Sweet Home (location)	temperature zones. -To gain confidence in ability to evaluate & select locations to grow gardens. -To gain confidence in ability to plant crops during appropriate seasons.	Reinforcement Goal Setting Self Efficacy Environment & situation	Knowledge of gardening
Gardening techniques	Week 3 June 13	Water cycle Plant life cycle Harvesting	-To understand processes of water cycle and how it relates to plant needs. -To be knowledgeable about the plant life cycle. -To have skills in gardening and gain confidence in ability to garden & harvest FV.	Self-efficacy Outcome expectations Reinforcement Goal Setting Behavioral Capability Reciprocal determinism	Self-efficacy of gardening Outcome expectations for gardening Knowledge of gardening

Garden maintenance	Week 4 June 20	Let's try organic Weeding Pests Soil improvement Problem Solving/Sustainability	-To be knowledgeable and skilled in organic gardening practices and its importance. -To gain confidence in ability to problem solve in the garden and practice organic gardening and sustainability.	Self-efficacy Emotional Coping responses Outcome expectations Reciprocal determinism Goal Setting Reinforcement	Self-efficacy for gardening Knowledge of gardening Outcome expectations for gardening
Basic food	Week 5	MyPlate	-To be knowledgeable & confident	Behavioral	Nutrition

nutrition	June 27	Fruit and Veggie Lab Nutrients (function & source)	about basic nutrition, MyPlate, functions & sources of macro & micro nutrients. -To understand health benefits of eating FV. -To gain confidence in ability to try & eat more FV.	Capability Reciprocal determinism Goal setting Self-efficacy Reinforcement Outcome expectations	knowledge Self-efficacy for eating FV Outcome expectations for FV
	FREE WEEK	HOLIDAY NO SESSION			
Basic food nutrition part 2	Week 6 July 11	Portion distortion Plan 10 in 2 Healthy snacks	-To be knowledgeable about portion sizes and their importance. -To attain positive expectations about eating healthy snacks.	Outcome expectations Goal Setting Self-efficacy	Nutrition knowledge Self-efficacy for

			-To gain confidence in ability to choose healthy options for snacks. -To increase willingness to try healthy options for snack.	Behavioral capability Observational Learning Reciprocal determinism Reinforcement	eating FV Self-efficacy of asking for FV Outcome expectations of nutrition
Safe practices	Week 7 July 18	Safe Practices (food prep)	-To be knowledgeable about safe practices of preparing food & its importance in preventing illness or injury. -To gain confidence in ability to perform safe practices when preparing food.	Self-efficacy Behavioral Capability Outcome expectations Environment & Situation	Nutrition knowledge Self-efficacy for eating FV Outcome

				Goal Setting Reinforcement	expectations for nutrition
Healthful eating	Week 8 July 25	Recipes and substitutions Demos & Sampling	-To increase willingness to try FV when introduced to new foods. -To gain positive expectations of consuming FV. -To gain confidence in ability to prepare healthy foods & eat them regularly. -To have capability of preparing healthy kid-friendly recipes at home.	Self-efficacy Goal Setting Reciprocal Determinism Observational Learning Behavioral Capability Outcome Expectations	Willingness to try FV Self-efficacy for eating FV Self-efficacy of asking for FV Nutrition knowledge Outcome

					expectations for nutrition
In class tasting	Week 9 Aug 1	Class tasting (fear factor)	-To increase willingness to try FV when introduced to new & unfamiliar foods. -To gain confidence in ability to try new FV -To gain positive expectations about trying new FV	Reciprocal Determinism Self-efficacy Outcome expectations Behavioral Capability Goal Setting Reinforcement	Willingness to try FV Nutrition knowledge Self-efficacy for eating FV Self-efficacy of asking for FV

					Outcome expectations for nutrition
Recap and close	Week 10 Aug 8	Recap of Program Closing ceremony	-To be knowledgeable about basic nutrition and gardening. -To gain confidence in ability to garden and try FV.	Self-efficacy Reciprocal determinism Outcome expectations Reinforcements	Willingness to try FV Self-efficacy of eating & asking for FV Nutrition & gardening Knowledge Outcome

	expectations for nutrition & gardening

Table 2: Demographics of Participants

Table 2. Basic demographics of youth participants	
Measures	**Mean (SD)**
Age	8.7 (2.8)
	N (%)
Gender	
Female	23 (53.5)
Male	20 (46.5)
Race	
Black	42 (97.7)
Other	1 (2.3)
Weight Status	
Thinness*	2 (4.7)
Normal**	12 (27.9)
Overweight***	15 (34.9)
Obese****	8 (18.6)
***(-2.99<X<-2)**	
****(-1.99<X<0)**	
*****(.1<X<1.99)**	
******(>2)**	

Table 3: Quantitative Results

Table 3. Outcome Measures Before and After Participation in the Gardening and Nutrition Program Using Last Observation Carried Forward (n=43)						
Variable	**Chronbach α**	**# of Items**	**Mean Scores Pre (SD)**	**Mean Scores Post (SD)**	**F**	**P**
Willingness to try FV*	.860	26	1.43 (.42)	1.47 (.42)		
Self-efficacy for eating FV**	.754	13	1.61 (.35)	1.68 (.31)		
Self-efficacy for asking for FV**	.720	8	1.70 (.37)	1.83 (.29)	7.07	<.05
Self-efficacy for gardening**	.474	6	1.75 (.31)	1.81 (.28)		
Gardening knowledge §×	-	25	14.59 (3.59)	16.22 (4.05)	7.67	<.01
Plant parts ŧ×	-	6	2.16 (1.36)	2.56 (1.30)	6.74	<.05
Plant needs #×	-	6	4.37 (.98)	4.37 (1.45)		
Plant life cycle^×	-	9	5.53 (1.75)	5.35 (1.77)		
Garden maintenance ◊×	-	4	2.05 (1.07)	2.14 (1.04)		
Nutrition knowledge¶×	-	23	12.65 (2.29)	12.86 (1.97)		
MyPlate ~×	-	10	5.65 (1.54)	6.26 (1.47)	7.78	<.05
Macronutrients ǂ×	-	9	3.70 (1.24)	3.65 (1.54)		
Food safety Ŧ×	-	4	3.30 (.64)	2.95 (.21)	8.87	.001

FV indicates fruits and vegetables; SD, standard deviation

*Responses were on a 3 point scale; 0, not willing; 1, maybe willing; 2, willing

**Responses were on a 3 point scale; 0, not sure; 1 somewhat sure; 2, sure

×1, correct; 0, incorrect

Table 4: Qualitative Results

Table 4. Emergent Codes and Quotes Reflecting Participants' Experiences and Impression of the Gardening and Nutrition Program			
Interview Question	**Code**	**Number of Mentions**	**Sample Quote**
What did you like most about the program	Trying food	10	"Trying vegetables"
	Gardening experience	8	"Learning how to plant and about fruits and vegetables"
	Curriculum content	4	"It fun and we get to learn about new stuff and eat new stuff"
	Program in general	3	"I liked the program questions"
	Playing games & activities	2	"Games and trying different foods"
What did you like least about the program?	Did not dislike anything	7	"Liked everything"
	Trying food	2	"Trying spinach"
What ideas do you have for us to make the program more fun or exciting in the future?	Increase games	8	"More games"
	Increase food sampling	3	"Have more samples"
	Increase variety of plants	3	"New seeds"
How has the program helped you with gardening?	Increased knowledge of gardening	9	"Taught [me] how to keep bugs/pests away"
	Increased knowledge of healthy eating	3	"It's helped me learn. I can stop eating so much junk food and start eating fruit."
	Increased interest in gardening	3	"Now I know I want to garden because it seems exciting and its tasty."
	Inspired to garden	2	"Helped [me] garden with grandma."
How has the program helped you with nutrition and eating fruits and	Learned about nutrition in general	6	"It did; gave me more knowledge"
	Increased fruit and vegetable	4	"It's helped me eat fruits and vegetables"

vegetables?	intake		
	Tried new foods	4	"Tried new vegetables"
	Increased knowledge of healthy eating	3	"It has made me know about different F+V that I didn't think about before, so now I may try them"
If any, what are some new fruits and vegetables you've tried since starting the program?	New fruit	8	"Strawberries, grapes"
	New vegetables	8	"Spinach, tomatoes, and squash"
	New fruit and vegetables	6	"String beans, corn, peas, oranges, apples, grapes"
Do you think you will continue to set goals to eat the recommended amount of fruits and vegetables after the program ends?	Yes	21	"Yes"
	Not sure	3	"Maybe"
How do you think we can get more kids from your neighborhood to come to the program?	Distribute printed material	7	"Give more flyers"
	Have large recruitment event	4	"Come outside with a microphone and talk"
	Door-to-door solicitation	4	"Knock on their door and ask their mom if they can come if they are not in it. Let them know they can be in the program if they live nearby"
	Encourage word of mouth through children	2	"We can ask friends"

Several responses were unable to code and thus were not included

REFERENCES

Ainley, J., & Bourke, S. (1992). Student views of primary schooling. *Research Papers in Education, 7*(2), 107-128.

Association, American Community Garden. (2012). What is a community garden? , from http://www.communitygarden.org/learn/

Association, American Heart. (2012, April 9, 2012). Overweight in Children. from http://www.heart.org/HEARTORG/GettingHealthy/Overweight-in-Children_UCM_304054_Article.jsp

Bacon, C., Mendez, E., & Brown, M. (2005). Participatory action research and support for community development and conservation: examples from shade coffee landscapes in Nicaragua and El Salvador.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*: Prentice-Hall, Inc.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior, 31*(2), 143-164.

Baranowski, T., Davis, M., Resnicow, K., Baranowski, J., Doyle, C., Lin, L.S., . . . Wang, D.T. (2000). Gimme 5 fruit, juice, and vegetables for fun and health: outcome evaluation. *Health Education & Behavior, 27*(1), 96-111.

Beckman, Lauren Lautenschlager, & Smith, Chery. (2008). An evaluation of inner-city youth garden program participants' dietary behavior and garden and nutrition knowledge. *J Agr Edu, 49*, 11-25.

Billson, H., Pryer, JA, & Nichols, R. (1999). Variation in fruit and vegetable consumption among adults in Britain. An analysis from the dietary and nutritional survey of British adults. *European Journal of Clinical Nutrition, 53*(12), 946.

Birch, L.L. (1980). Effects of peer models' food choices and eating behaviors on preschoolers' food preferences. *Child development*, 489-496.

Birch, L.L., & Sullivan, S.A. (1991). Measuring children's food preferences. *Journal of School Health, 61*(5), 212-214.

Brownson, Ross C, Colditz, Graham A, & Proctor, Enola K. (2012). *Dissemination and implementation research in health: translating science to practice*: Oxford University Press.

Geller, K.S., & Dzewaltowski, D.A. (2010). Examining Elementary School—Aged Children's Self-Efficacy and Proxy Efficacy for Fruit and Vegetable Consumption. *Health Education & Behavior, 37*(4), 465-478.

Geller, K.S., Dzewaltowski, D.A., Rosenkranz, R.R., & Karteroliotis, K. (2009). Measuring Children's Self‐Efficacy and Proxy Efficacy Related to Fruit and Vegetable Consumption. *Journal of School Health, 79*(2), 51-57.

Hanson, M.D., & Chen, E. (2007). Socioeconomic status and health behaviors in adolescence: a review of the literature. *Journal of behavioral medicine, 30*(3), 263-285.

Health, National Institutes of. (1998). Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: the Evidence Report. Bethesda, MD: National Institutes of Health, U.S. Department of Health and Human Services.

Heim, S., Bauer, K.W., Stang, J., & Ireland, M. (2011). Can a community-based intervention improve the home food environment? Parental perspectives of the influence of the delicious and nutritious garden. *Journal of Nutrition Education and Behavior, 43*(2), 130-134.

Heim, S., Stang, Jamie, & Ireland, Marjorie. (2009). A garden pilot project enhances fruit and vegetable consumption among children. *Journal of the American Dietetic Association, 109*(7), 1220-1226.

Hermann, Janice R., Parker, Stephany P., Brown, Barbara J., Siewe, Youmasu J., Denney, Barbara A., & Walker, Sarah J. (2006). After-School Gardening Improves Children's Reported Vegetable Intake and Physical Activity. *Journal of Nutrition Education and Behavior, 38*(3), 201-202. doi: 10.1016/j.jneb.2006.02.002

Horowitz, C.R., Colson, K.A., Hebert, P.L., & Lancaster, K. (2004). Barriers to buying healthy foods for people with diabetes: evidence of environmental disparities. *Journal Information, 94*(9).

Israel, B.A., Eng, E., Schulz, A.J., & Parker, E.A. (2005). *Methods in community-based participatory research for health*: Jossey-Bass.

Kimmons, J., Gillespie, C., Seymour, J., Serdula, M., & Blanck, H.M. (2009). Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. *The Medscape Journal of Medicine, 11*(1), 26.

Koch, S, Waliczek, TM, & Zajicek, JM. (2006). The effect of a summer garden program on the nutritional knowledge, attitudes, and behaviors of children. *HortTechnology, 16*(4), 620-625.

Lautenschlager, L., & Smith, C. (2007). Understanding gardening and dietary habits among youth garden program participants using the Theory of Planned Behavior. *Appetite, 49*(1), 122-130.

Leather, S. (1995). Fruit and vegetables: consumption patterns and health consequences. *British Food Journal, 97*(7), 10-17.

Lobstein, T. (1999). Health, income and diet. *Tackling Inequalities in Health and Diet Related Disease. London: KKS Printing, Sustain Publications*, 3-10.

Lutfiyya, M.N., Garcia, R., Dankwa, C.M., Young, T., & Lipsky, M.S. (2008). Overweight and obese prevalence rates in African American and Hispanic children: an analysis of data from the 2003–2004 National Survey of Children's Health. *The Journal of the American Board of Family Medicine, 21*(3), 191-199.

Lytle, L., & Achterberg, C. (1995). Changing the diet of America's children: what works and why? *Journal of Nutrition Education, 27*(5), 250-260.

Macaulay, A.C., Commanda, L.E., Freeman, W.L., Gibson, N., McCabe, M.L., Robbins, C.M., & Twohig, P.L. (1999). Participatory research maximises community and lay involvement. *Bmj, 319*(7212), 774-778.

Macaulay, A.C., & Nutting, P.A. (2006). Moving the frontiers forward: incorporating community-based participatory research into practice-based research networks. *The Annals of Family Medicine, 4*(1), 4-7.

McAleese, J.D., & Rankin, L.L. (2007). Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *Journal of the American Dietetic Association, 107*(4), 662-665.

Minkler, M., Blackwell, A.G., Thompson, M., & Tamir, H. (2003). Community-based participatory research: implications for public health funding. *Journal Information, 93*(8).

Morgan, P.J., Warren, J.M., Lubans, D.R., Saunders, K.L., Quick, G.I., & Collins, C.E. (2010). The impact of nutrition education with and without a school garden on knowledge, vegetable intake and preferences and quality of school life among primary-school students. *Public health nutrition, 13*(11), 1931.

Morris, J., Neustadter, A., & Zidenberg-Cherr, S. (2001). First-grade gardeners more likely to taste vegetables. *California Agriculture, 55*(1), 43-46.

O'Toole, T.P., Aaron, K.F., Chin, M.H., Horowitz, C., & Tyson, F. (2003). Community‐based Participatory Research. *Journal of General Internal Medicine, 18*(7), 592-594.

Ogden, C.L., Carroll, M.D., Kit, B.K., & Flegal, K.M. (2012). Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *JAMA: the journal of the American Medical Association, 307*(5), 483-490.

Powers, A. R., Struempler, B. J., Guarino, A., & Parmer, S. M. (2005). Effects of a nutrition education program on the dietary behavior and nutrition knowledge of second-grade and third-grade students. *Journal of School Health, 75*(4), 129-133. doi: 10.1111/j.1746-1561.2005.tb06657.x

Rallis, Sharon F, & Rossman, Gretchen B. (2011). *Learning in the field: An introduction to qualitative research*: Sage Publications, Incorporated.

Resnicow, K., Davis-Hearn, M., Smith, M., Baranowski, T., Lin, L.S., Baranowski, J., . . . Wang, D.T. (1997). Social-cognitive predictors of fruit and vegetable intake in children. *Health Psychology, 16*(3), 272.

Robinson-O'Brien, R., Story, M., & Heim, S. (2009). Impact of garden-based youth nutrition intervention programs: a review. *Journal of the American Dietetic Association, 109*(2), 273.

Somerville, Megan, Kessler, Lisa A, Wallace, Sharonda P, & Burns-Whitmore, Bonny. (2012). The Effect of a Garden-Based Nutrition Education Program on the Consumption of Fruits and Vegetables by Hispanic Children.

Strickland, C.J. (2006). Challenges in community-based participatory research implementation: Experiences in cancer prevention with Pacific Northwest American Indian tribes. *Cancer Control, 13*(3), 230.

Tapp, H., & Dulin, M. (2010). The science of primary health-care improvement: potential and use of community-based participatory research by practice-based research networks for translation of research into practice. *Experimental Biology and Medicine, 235*(3), 290-299.

Thompson, Tommy G. (2004). *Preventing Chronic Disease through Healthy Lifestyle*. Retrieved from http://www.hhs.gov/asl/testify/t040715.html.

Thomson, Jessica L., McCabe-Sellers, Beverly J., Strickland, Earline, Lovera, Dalia, Nuss, Henry J., Yadrick, Kathleen, . . . Bogle, Margaret L. (2010). Development and evaluation of WillTry. An instrument for measuring children's willingness to try fruits and vegetables. *Appetite, 54*(3), 465-472. doi: 10.1016/j.appet.2010.01.012

Van Duyn, Mary Ann S., & Pivonka, Elizabeth. (2000). Overview of the Health Benefits of Fruit and Vegetable Consumption for the Dietetics Professional: Selected Literature. *Journal of the American Dietetic Association, 100*(12), 1511-1521. doi: 10.1016/S0002-8223(00)00420-X

Wenrich, Tionni R., Brown, J. Lynne, Wilson, Robin Taylor, & Lengerich, Eugene J. (2012). Impact of a Community-based Intervention on Serving and Intake of Vegetables among Low-income, Rural Appalachian Families. *Journal of Nutrition Education and Behavior, 44*(1), 36-45. doi: 10.1016/j.jneb.2011.04.012

Zanko, Ashley. (2012). *Evaluating the Potential Public Health Impact of Community Gardens in a Health Disparate Region: A Case Study Approach.* Virginia Polytechnic Institute and State University.

Zapata, L.B., Bryant, C.A., McDermott, R.J., & Hefelfinger, J.A. (2007). Dietary and Physical Activity Behaviors of Middle School Youth: The Youth Physical Activity and Nutrition Survey*. *Journal of School Health, 78*(1), 9-18.

Zoellner, J., Motley, M., Wilkinson, M.E., Jackman, B., Barlow, M.L., & Hill, J.L. (2012). Engaging the Dan River Region to reduce obesity: Application of the comprehensive participatory planning and evaluation process. *Family & community health, 35*(1), 44.

Zoellner, J., Zanko, A., Price, B., Bonner, J., & Hill, J.L. (2012). Exploring Community Gardens in a Health Disparate Population: Findings from a Mixed Methods Pilot Study. *Progress in community health partnerships: research, education, and action, 6*(2), 153-165.

Appendix A: IRB Approval

VirginiaTech

Office of Research Compliance
Institutational Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, VA 24060
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: March 11, 2013

TO: Jamie M Zoellner Dr, Jennie L Hill

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)

PROTOCOL TITLE: Housing Authority Junior Master Garden Project

IRB NUMBER: **12-225**

Effective March 11, 2013, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Continuing Review 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) 7**
Protocol Approval Date:	**March 26, 2013**
Protocol Expiration Date:	**March 25, 2014**
Continuing Review Due Date*:	**March 11, 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.

Appendix B: Informed Consent

Informed Consent

Title of Research Project: Danville Housing Authority's Junior Master Gardener Project

Investigators: Dr. Jamie Zoellner, Karissa Grier, Felicia Reese; Department of Human Nutrition, Foods and Exercise; Virginia Polytechnic Institute and State University

I. Purpose of this Research/Project

The purpose of this project is to determine the effects of a gardening and nutrition program among youth and their caregivers/parents who live at Cedar Terrace and Cardinal Village in Danville, Virginia.

II. Procedures

The gardening and nutrition program is free and will be available to youth. The program includes about 10 classes that each last about 60-90 minutes. The caregivers/parents will receive newsletters about gardening and nutrition. The program will be offered during the 2012 gardening season (April-August 2012). To participate in this research, both the caregiver/parent and child will complete an evaluation before the program begins and at the end of the program. The caregiver/parent evaluation is a survey that includes questions about fruits, vegetables and gardening and will take about 30 minutes to complete. The child evaluation is a survey that will be read aloud to the child and includes questions about willingness to try fruits and vegetables and attitudes about nutrition and gardening and will take about 30 minutes to complete. Height and weight measurements will also be taken on the child.

III. Risks

The risks associated with this study are low. The only known risk is the inconvenience of time that it takes to complete the surveys.

IV. Benefits

The main benefit of this study is that youth will learn more about gardening and nutrition through the hands-on programs and activities. Caregivers/parents will learn more about gardening and nutrition through the newsletters.

V. Extent of Anonymity and Confidentiality

Caregiver's/parent's and child's identities will be kept confidential at all times and will only be known by the research investigators. An identification number will be assigned to the caregivers/parents and children. Only the investigators and trained researchers at Virginia Tech will have access to caregiver's/parent's and child's data. At no time will the researchers release the results of the study to anyone other than individuals working on the project without the caregiver's/parent's written consent.

VI. Compensation

After both the caregiver/parent and child complete the evaluation before the program begins they will receive one $15 gift card. After both the caregiver/parent and child complete the evaluation at the end of the program they will receive one additional $15 gift card.

VII. Freedom to Withdraw

I am free to withdraw myself and my child from the study at any time without penalty. If I choose to withdraw myself or my child, I will be compensated for the portion of the time of the study. If I choose to withdraw myself or my child, I will not be penalized. I am free not to answer any questions on the evaluation form. My child is also free not to answer any questions on the evaluation form and free to choose not to participate in any of the study activities. There may be circumstances under which the investigator may determine that I should not continue as a participant. I must be compensated for the portion of the project completed.

VIII. Participant's Responsibilities

I voluntarily agree to participate in this study and give permission for my child to participate in this study. I understand that participation in this study includes my child participating in a gardening and nutrition program and that my child and I will complete an evaluation before the program begins and at the end of the program.

IX. Participant's Permission

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

Name of Child Participating in the Study: _____

Printed name of Parent: _____

Signature of Parent: _____ Date:_____

Signature of Researcher: _____ Date:_____

Should I have any pertinent questions about this research or its conduct, and research subjects' rights, and whom to contact in the event of a research-related injury to the subject, I may contact:

Karissa Grier	540-231-1267
Investigator	kgrier@vt.edu
Felicia Reese	540-231-1267
Investigator	freese@vt.edu
Jamie Zoellner	540-231-3670
Faculty Advisor	zoellner@vt.edu
Susan Hutson	540-231-8766
Department Head	susanh5@vt.edu
David M. Moore	540-231-4991
Chair, Virginia Tech Institutional Review	moored@vt.edu

Board for the Protection of Human Subjects

Office of Research Compliance

2000 Kraft Drive, Suite 2000 (0497)

Blacksburg, VA 24060

Appendix C: Child Assent at Pre-test

Assent Statement for Children

Parental Permission on File: □ Yes □ No

(If "No", do not proceed with assent or research procedures.)

Hi, my name is _____ and I'm a student at Virginia Tech. We are going to have the Junior Master Gardener program here for a few weeks. The good thing about this program is that it will help us teach children like you about gardening and eating fruits and vegetables.

If you would like, you can be in the program. If you decide you want to be in the program I will ask you a few questions and take your height and weight. There is no right or wrong answer to the questions. The only people who will see your answers are the other researchers at Virginia Tech.

Also, if you join the program you will come to the Housing Authority once a week to learn about gardening and nutrition.

Your <*Mom/Dad/Guardian*> knows about the program and has already said that its okay for you to be in it but you don't have to if you don't want to. You can stop being in the program at any time. No one will be mad if you don't want to be in the program.

Do you have any questions for me?

If you have any questions that you think of later you can call Karissa or Felicia or you can ask your parents to call one of them. Their number is 540-231-1267. Their number is also on the flyer that your <*Mom/Dad/Guardian*> has.

Would you like to be in the program?

Child's Voluntary Response to Participation: □ Yes □ No

Name of Child:

_____

Signature of Researcher:

_____

(Optional) Signature of Child:

_____

Date: _____

Appendix D: Pre-Post Questionnaire

Willlingness to Try Fruits and Vegetables (WillTry)

Instructions for Survey Administrator: You will need your flashcards for Part I. Please read aloud each of the following questions to the child while showing them the appropriate picture. Check or mark the answer that the child provides.

Interviewer says: There are 3 possible answers for each question: yes, no or maybe. Please answer for yourself. It is not a test, so I can repeat any question or answer that you need.

		Yes	**No**	**Maybe**
WillTry1	Would you be willing to taste a new food if offered?			

Interviewer says: The following questions refer to where you might be willing to taste a new food. Again, please answer yes, no or maybe.

	Would you be willing to taste a new food…	**Yes**	**No**	**Maybe**
WillTry2	At home			
WillTry3	At a relative's home			
WillTry4	At a friend's home			
WillTry5	At a restaurant?			

WillTry6	At church?			

Interviewer says: There are 3 possible answers for the following questions. Please answer the following questions for yourself.

	Would you be willing to taste…	**Yes**	**No**	**Maybe**
WillTry7	A new vegetable?			
WillTry8	A new fruit?			
WillTry9	A new dish? (eg casserole)			
WillTry10	An apricot?			
WillTry11	Baby carrots?			
WillTry12	Blueberries?			
WillTry13	Broccoli?			
WillTry14	Cauliflower			
WillTry15	Celery sticks with dip?			
WillTry16	A cucumber?			
WillTry17	A grape tomato?			
WillTry18	Green squash?			
WillTry19	Honeydew melon?			
WillTry20	Mandarin oranges?			
WillTry21	A plum?			

WillTry22	Yellow squash?			
WillTry23	In general, do you consider yourself a healthy eater?			
WillTry24	In general, do you consider your parent a healthy eater			

Interviewer says: There are 3 possible answers for the following questions. They are a little different than before. Please answer for yourself.

		Eat only favorite foods	**Eat most foods**	**Will eat any food offered**
WillTry25	Which of these best describes you?			
WillTry26	Which of these best describes your parent?			

Outcome Expectations for Eating FV (ExpectFV)

Interviewer says: There are 3 possible answers for each question: yes, no or maybe. Please answer for yourself.

		Yes	No	Maybe
ExpectFV1	You will have more energy for playing (sports, recess or after school) if you eat fruits and vegetables			
ExpectFV2	You will get sick more often if you don't eat fruits and vegetables			
ExpectFV3	Eating fruits and vegetables will help you grow			
ExpectFV4	You will have healthier skin if you eat fruits and vegetables			
ExpectFV5	If you eat fruits and vegetables, you will have stronger eyes			
ExpectFV6	If you eat fruits and vegetables at breakfast, you will be able to think better in class			
ExpectFV7	Eating fruits and vegetables may help keep you from getting cavities			

Self-Efficacy for Eating Fruits and Vegetables (SEFV)

Interviewer says: There are 3 possible answers for the following questions. Please answer the following questions for yourself.

		Yes	No	Maybe
SEFV1	**For breakfast, do you think you can…**			

A	Drink a glass of your favorite juice			
B	Add fruit to your cereal			
SEFV2	**For lunch at school, do you think you can …**	**Yes**	**No**	**Maybe**
A	Eat a vegetable that's served			
B	Eat a fruit that is served			
SEFV3	**For lunch at home do you think you can …**	**Yes**	**No**	**Maybe**
A	Eat carrot or celery sticks instead of chips			
B	Eat your favorite fruit instead of your usual dessert			
SEFV4	**For a snack do you think you can choose…**	**Yes**	**No**	**Maybe**
A	Your favorite fruit instead of your favorite cookie			
B	Your favorite fruit instead of your favorite candy bar			
C	Your favorite raw vegetable with dip instead of your favorite cookie			
D	Your favorite raw vegetable with dip instead of your favorite candy bar			
E	Your favorite raw vegetable with dip instead of chips			
SEFV5	**For dinner do you think you can …**	**Yes**	**No**	**Maybe**
A	Eat a big serving of vegetables			
B	Eat your favorite fruit instead of your usual dessert			

Self-Efficacy for Asking and Shopping for Fruits and Vegetables (SEFVAsk)

Interviewer says: There are 3 possible answers for the following questions. Please answer the following questions for yourself.

	Do you think you can:	**Yes**	**No**	**Maybe**
SEFVask1	Write your favorite fruit or vegetable on the family's shopping list			
SEFVask2	Ask someone in your family to buy your favorite fruit or vegetable			
SEFVask3	Go shopping with your family for your favorite fruit or vegetable			
SEFVask4	Pick out your favorite fruit or vegetable at the store and put it in the shopping basket			
SEFVask5	Ask someone in your family to make your favorite vegetable dish for dinner			
SEFVask6	Ask someone in your family to serve your favorite fruit at dinner			
SEFVask7	Ask someone in your family to have fruits and fruit juices out where you can reach them			
SEFVask8	Ask someone in your family to have vegetables cut up and out where you can reach them			

Gardening Knowledge (GarKnow)

Interviewer says: I want you to think about different fruits and vegetables and think about what part of the plant they come from. I'm going to ask you about what parts of plants you think you can eat. You can answer "yes", "no" or "I don't know".

	Can you eat…	**Yes**	**No**	**I don't know**
GarKnow1	Roots			
GarKnow2	Stems			
GarKnow3	Leaves			
GarKnow4	Flowers			
GarKnow5	Fruits			
GarKnow6	Seeds			

Interviewer says: I want you to think about all the things that a plant needs to grow. I'm going to ask you if plants need different things to grow and you can answer "yes", "no" or "I don't know".

	Do plants need…	**Yes**	**No**	**I don't know**
GarKnow7	Air to grow			
GarKnow8	Water to grow			
GarKnow9	Sunlight to grow			
GarKnow10	Nutrients to grow			
GarKnow11	Soil			

Interviewer says: I am going to ask you about what type of soil is best for plants to live and grow in. You can pick the answer you think is right or you can say "I don't know".

GarKnow12: Which of these do plants grow best in?

- □ Sand
- □ Silt
- □ Clay
- □ A mixture of sand, silt and clay
- □ I don't know

Interviewer says: I'm going to ask you questions about the plant life cycle. I will name different stages and you will tell me if it is part of the plant life cycle. You can answer "yes", "no" or "I don't know".

	Is ___ part of the plant life cycle?	**Yes**	**No**	**I don't know**
GarKnow13	Germination			
GarKnow14	The development of roots, stems and leaves			
GarKnow15	Hatching			
GarKnow16	Flowering			

GarKnow17	Pollination			
GarKnow18	Molting			
GarKnow19	Seed production			
GarKnow20	Sleeping			
GarKnow21	Death and decomposition			

Interviewer says: Is spraying chemicals the only way to get rid of weeds and pests in the garden?

	Yes	**No**	**I don't know**
GarKnow22			

Interviewer says: I'm going to ask you about ways to improve gardening soil. I'm going to name different things and you can tell me if it is a way to improve the soil. You can answer "yes", "no" or "I don't know".

	Can you improve the soil by…	**Yes**	**No**	**I don't know**
GarKnow23	Adding compost?			
GarKnow24	Adding sugar?			
GarKnow25	Adding fertilizer?			

Self-efficacy for Gardening (SEGar)

Interviewer says: I'm going to ask you how you feel about being able to garden. You can answer "yes", "no" or "maybe".

	Do you think you can…	**Yes**	**No**	**Maybe**
SEGar1	Find a space for a garden at your home?			
SEGar2	Prepare the soil and plant seeds or young plants for a garden?			
SEGar3	Choose plants or seeds that will grow in your garden?			
SEGar4	Weed and water the garden?			
SEGar5	Pick and eat the vegetables that you have grown in your garden?			
SEGar6	Find the time and energy to have a			

	garden?			

Nutrition Knowledge (NutKnow)

Interviewer says: MyPlate has replaced the food pyramid as a guide for the different foods you should eat. I'm going to ask you some questions about MyPlate.

NutKnow1. How many food groups are represented on the MyPlate image? (***Show handcard***)

- □ 1
- □ 2
- □ 3
- □ 4
- □ 5
- □ 6
- □ Don't know
- □ Refuse

I'm going to name some items and I want you to tell me if they are represented on the MyPlate image. You can answer "yes", "no" or "I don't know".

		Yes	**No**	**I don't know**
NutKnow2	Water			
NutKnow3	Dairy			
NutKnow4	Fruit			

NutKnow5	Sugar			
NutKnow6	Oil			
NutKnow7	Protein			
NutKnow8	Grains			
NutKnow9	Vegetables			

NutKnow10. How many servings of fruits and vegetables should you eat every day? (***Show handcard***)

- □ 1
- □ 2
- □ 3
- □ 4
- □ 5
- □ 6
- □ Don't know
- □ Refuse

Interviewer says: I'm going to ask you some questions about what foods have different nutrients. I'm going to list different foods and you can tell me if that food has the nutrient that I ask about. You can answer "yes", "no" or "I don't know".

NutKnow10	**Do(es) ___ have a**	**Yes**	**No**	**I don't know**

	lot of protein?			
NutKnow11	Olive oil			
NutKnow12	Potatoes			
NutKnow13	Beans			
NutKnow14	Do(es) ___ have a lot of carbohydrates?	Yes	No	I don't know
NutKnow15	Olive oil			
NutKnow16	Potatoes			
NutKnow17	Beans			
NutKnow18	Do(es) ___ have a lot of fat?	Yes	No	I don't know
NutKnow19	Olive oil			
NutKnow20	Potatoes			
NutKnow21	Beans			

Interviewer says: I'm going to ask you some questions about being safe with food. You can answer "yes", "no" or "I don't know".

	Should you…	**Yes**	**No**	**I don't know**
NutKnow22	Wash your hands before preparing food?			
NutKnow23	Wash fruits and			

	vegetables before you eat them?			
NutKnow24	Clean the surface before preparing food?			
NutKnow25	Cut raw meat and vegetables on the same cutting board?			

Demographics (Dem)

Interviewer instructions: Do not read 1 and 2 aloud; just select appropriate answer.

Dem01. Race (Please circle one): White Black Hispanic Other

Dem02. Gender (please circle one): Female Male

Interviewer: Read aloud and record responses

Dem03. How old are you?_____

Dem04. How many sisters & brothers do you have? #sisters_____ # brothers_____

Anthropometrics (Anthro)

Anthro1a: Height (cm): | ____ | ____ |____ |. | ____ |

Anthro2a: Weight (kg): | ____ | ____ |____ |.| ____ |

Appendix E: Parent Permission

Parent permission for exit interview

We appreciate you allowing your child to participate in our gardening and nutrition program. As stated in the permission form presented before the start of the program you and your child will answer survey questions now that the program is over. We have additional questions that we want to ask your child about their opinion and experience in the program. These additional questions will take about 10 minutes and are optional. If you or your child declines participating in the exit survey it will not affect your receipt of the gift card. Information obtained from these questions may help us improve the program in the future.

Do you give your permission to allow us to ask your child these additional questions?

- □ Yes, you may ask my child these additional questions
- □ No, do not ask my child additional questions

Name of child:

_____

Name of parent:

_____

Signature of parent: _____ Date: _____

Signature of researcher: _____ Date: _____

Appendix F: Child Assent for Exit Interview

Exit interview assent for child

Parent permission for exit interview on file?

- □ Yes, proceed
- □ No, do not read assent statement or ask exit interview questions

Read aloud to the child:

Thank you for answering the nutrition and gardening survey questions. I have a few more questions that I would like to ask that will only take about 10 minutes. You don't have to answer these questions if you don't want to. If you choose not to answer these questions it will not prevent you from receiving your gift card. These questions are about your opinion and experience in the program. Your answers could help us improve the program in the future. Do you have any questions for me? Do you want to answer a few more questions?

Child's response: □ Yes □No

Interviewer signature: _____

Child signature (optional): _____

Date: _____

Appendix G: Child Exit Questionnaire

Child exit interview questions

- What did you like most about the program?

- What did you like least about the program?

- What ideas do you have for us to make the program more fun or exciting in the future?

- How do you think we can get more kids from your neighborhood to come to the program?

- How has the program helped you with gardening?

- How has the program helped you with nutrition and eating fruits and vegetables?

- If any, what are some new fruits and vegetables you've tried since starting the program?

- Do you think you will continue to set goals to eat the recommended amount of fruits and vegetables after the program ends?

Appendix H: Process Evaluation

Evaluators

Karissa Grier

Felicia Reese

Lorien MacAuley

Program Components

Who:

What:

When:

Where:

How:

Evaluation Questions: General

Was the lesson delivered/completed as intended?

1	*2*	*3*	*4*	*5*
Not at all				*Completely*

What were the strengths of the implementation?

What were the barriers or challenges in implementation?

Did the children understand the lessons?

1	*2*	*3*	*4*	*5*
Not at all				*Completely*

What was the nature of the interaction between the instructors and the children?

Evaluation Questions: Specific

Who

How many children are enrolled?

How many children attended the session?

Characteristics/demographics of the children.

How satisfied were the children with the session?

1	*2*	*3*	*4*	*5*
Not at all				*Completely*

What were the methods of delivery?

When was the session conducted?

What was the length/duration of the session?

Where was the session held?

Why were these activities used?

Why were children not participating?