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Evaluating the Feasibility of a Gardening and Nutrition Intervention with a Matched Contact-Control Physical Activity Intervention Targeting Youth

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Abstract

The study reported here involved Cooperative Extension as a key research partner and was guided by a community-based participatory research approach and a feasibility study framework. The research objective was to assess four indicators of feasibility (i.e., acceptability, demand, implementation, and limited-effectiveness) of a gardening and nutrition program delivered at three youth community sites as compared to a matched contact-control physical activity intervention delivered at three different youth community sites. Conducted in a medically underserved region, the mixed-methods, quasi-experimental study revealed numerous opportunities for and barriers to increasing youths' willingness to try fruits and vegetables and increasing physical activity among youths.

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Introduction

Optimal fruit and vegetable consumption in youth plays a protective role in the prevention of obesity,

cardiovascular disease, and other chronic conditions (Van Duyn & Pivonka, 2000). However, the percentage of youths who consume fruits and vegetables decreases with age (Nielsen, Rossen, Harris, & Ogden, 2014). Several studies have shown that experiential, garden-based nutrition education programs have the potential to expand preferences and improve dietary intake of fruits and vegetables among youths (Robinson-O'Brien, Story, & Heim, 2009; Story, Lytle, Birnbaum, & Perry, 2002). Along with fruit and vegetable intake, physical activity (PA) also has important health benefits (Van der Horst, Paw, Twisk, & Van Mechelen, 2007). However, only about 24.8% of youths engage in moderate-to-vigorous PA for 60 min at a time (Fakhouri, Hughes, Burt, Song, Fulton, & Ogden, 2014). Although various evidence-based nutrition and PA programs are available (Research-Tested Intervention Programs, 2014), an understudied factor is the translation of these programs into real-world settings, including those involving health-disparate populations.

Community-based participatory research (CBPR) is an approach used to identify and address social and public health issues in communities (Israel, Eng, Schulz, & Parker, 2005; Minkler & Wallerstein, 2010). This approach to research can build community welfare (Newhall, 2013) and engage community members in addressing their own health concerns (Wallerstein & Duran, 2010).

Guided by the CBPR approach, the Dan River Partnership for a Healthy Community was formed in 2009 when interested stakeholders and academic researchers saw a need to combat obesity in the Dan River Region. Located in south-central Virginia and north-central North Carolina, this region suffers from health and economic disparities and has been deemed a medically underserved region (Virginia Department of Health, 2008). The region is home to some of the highest rates of obesity, diabetes, and cardiovascular disease in the United States.

A 2-day comprehensive participatory planning and evaluation workshop identified community priorities and concerns (Zoellner, Zanko, Price, Bonner, & Hill, 2012). Two prioritized interventions were (a) establishing community garden (CG) initiatives to increase accessibility of fresh foods and (b) providing PA programming. Since the workshop, the partnership has executed several related projects and health initiatives in the region (Dan River Partnership for a Healthy Community, 2014). The partnership includes approximately 25 local organizations, including Cooperative Extension. By spearheading subcommittees and engaging in and leading community programming, Extension has played a vital role in the networking and collaborations of the partnership.

In 2010 and 2011, a community needs assessment and mixed-methods case study was conducted to further explore opportunities for and barriers to sustainable CG initiatives in the Dan River Region (Zanko, 2012; Zoellner et al., 2012). In 2012, the partnership launched a study evaluating the feasibility of developing and implementing a gardening and nutrition program (also referred to herein as a CG program or CG intervention) in two low-income housing authorities (Grier et al., 2015). In that initial small-scale study, program evaluations showed significant improvements in self-efficacy for asking for fruits and vegetables, overall gardening knowledge, and knowledge of recommendations from MyPlate, the U.S. Department of Agriculture (USDA) nutrition guide. However, the study was performed at two community sites that had limited numbers of participating youths and included no control site, and community partners were not involved in intervention delivery. Extending from that initial feasibility study, the study reported here was intended to further strengthen the CBPR components of the research and to improve the overall study design methodology for evaluating the feasibility of the program.

Purpose and Objectives

Aligned with the feasibility framework suggested by Bowen et al. (2009), the objectives of the study were to assess acceptability, demand, implementation, and limited-effectiveness of the gardening and nutrition program.

- Acceptability of an intervention reflects how both the targeted individuals and those involved in program implementation react to the intervention.
- Demand is the extent to which intervention aspects are used by target participants.
- Implementation is defined as the extent to which, likelihood of, and manner in which an intervention can be fully implemented as planned and proposed.
- Limited-effectiveness refers to the potential of the intervention to successfully improve targeted outcomes with the intended population.

In comparison to the initial feasibility study, an important distinction of the phase of the initiative described herein was the involvement of Extension agents as key partners in the research implementation, most notably program delivery.

Methods

The mixed-methods, quasi-experimental, pretest-posttest study design involved six youth-based community sites in the Dan River Region. The sites were matched by type (i.e., two structured summer camps, two Boys & Girls Clubs sites, and two housing authority sites), and one of each type was assigned to receive either the CG program or a matched contact-control PA intervention. Each 8-week program was offered at the assigned sites and comprised one 90-min session weekly. In addition to strengthening the ability of the research to test the feasibility of the CG program, the research design allowed all enrolled youths to participate in health-related programming. The research was approved by the Virginia Tech Institutional Review Board, and signed parental consent and youth assent were obtained prior to program initiation. A $5 gift card was given to each youth who participated in the focus groups.

Representatives from Extension, other researcher partners, and the regional USDA Summer Feeding Program identified sites and planned the study. Each selected site participated in the feeding program. Researchers and community site program leaders met to discuss the purpose and potential benefits of the relevant program (CG or PA) and to engage community staff in recruitment and program facilitation.

To be eligible, youths had to attend the summer camp, participate in Boys & Girls Clubs, or live in the housing authority; be 8 to 14 years old; and complete a baseline assessment. Although all youths at a particular site were allowed to engage in the program at the site, data were not collected for a youth if eligibility criteria were not met.

CG Program

Each session of the CG program included 60 min of classroom education on nutrition and gardening content, which was delivered through didactic presentations and group discussions, and 30 min of experiential gardening, during which youths experienced hands-on application of the classroom content in the garden.

Results and lessons learned from the initial feasibility study informed curriculum modifications that were put in place for the study reported here (Grier et al., 2015). Curriculum content and topics focused on gardening techniques (e.g., planting, maintenance, harvesting) and healthful food and beverage choices based on MyPlate recommendations. Food preparation and sampling occurred each week, and a collection of recipes used during the program was provided to participants. The curriculum was a combination of the junior master gardener curriculum (Junior Master Gardener Teacher/Leader Guide, Level One, 1999; Welsch, Whittlesey, Seagraves, Hall, & Harlow, 1999) and Virginia Tech Cooperative Extension agriculture and nutrition curricula. Biweekly newsletters on gardening and home fruit and vegetable consumption were given to youths and their parents. Two Virginia Cooperative Extension professionals, who were active members of the partnership's nutrition subcommittee, collaborated with three Virginia Tech researchers to deliver the program content. One Cooperative Extension professional was a family nutrition program assistant, and the other was a 4-H youth development Extension agent who was proficient in agriculture. Both lived and worked in the area and had extensive experience in youth engagement.

PA Program

Each session of the PA program included 30 min of content and instruction and 60 min of PA relating to the curriculum content for the week. Curriculum content was delivered by three researchers and was adapted from the Sports, Play, and Active Recreation for Kids (SPARK) afterschool curriculum. SPARK is a research-based program designed to be enjoyable while promoting high levels of PA (Sallis et al., 1997). Biweekly newsletters were given to youths and their parents to encourage daily PA.

Measures

Measures used for the various indicators of feasibility are described in this section; additional details are presented in Table 1 at the end of the section.

Acceptability and Demand

Measures of acceptability and demand for both programs involved youths and program site leaders. For youths, attendance and program retention was assessed. Also, postprogram focus group sessions involving a 10-item semistructured script were conducted to capture the youths' opinions about program components. Focus group sessions were audio-recorded and transcribed verbatim. Nutrition and gardening measures had been pretested during the initial feasibility study with youths 8 to 14 years of age in the targeted region (Grier et al., 2015). For site leaders, individual postprogram interviews were conducted by trained research staff, and researcher field notes were recorded. Nine open-ended questions evaluated the leaders' perceptions of program components, the recruitment experience, youth engagement, and the potential for program continuation.

Implementation

For each session, a 4-point implementation measure was completed collectively by program delivery staff to reflect the degree to which learning objectives were met (1 = *not met*, 4 = *met completely*). Also, field notes related to facilitators and barriers to implementation were recorded. After each session, staff discussed and reached consensus on the degree to which each objective was met. Time spent on activities was

recorded as well.

Limited-Effectiveness

Limited-effectiveness was measured using baseline and follow-up data for the youths. As noted previously, nutrition and gardening measures used in the study reported here had been pretested during the initial feasibility study. The primary pretested outcome measure was willingness to try fruits and vegetables (Thomson et al., 2010). Other outcome measures included self-efficacy for eating fruits and vegetables (Geller, Dzewaltowski, Rosenkranz, & Karteroliotis, 2009), self-efficacy for asking for fruits and vegetables (Domel et al., 1996), and measures developed for the purposes of the study (i.e., expectations for eating fruits and vegetables, fruit and vegetable consumption [Centers for Disease Control and Prevention, 1999], self-efficacy for gardening, gardening knowledge, and nutrition knowledge). For the PA group, the primary outcome measure was number of days active for 60 min over the preceding 7 days (Eaton et al., 2012). Other outcome measures included screen time (Eaton et al., 2012), PA self-efficacy (Eaton et al., 2012), and PA knowledge. Depending on youth and site needs, surveys were either interview-administered in small groups or self-completed. Demographic data were assessed. For each youth, height was measured using a portable stadiometer, and weight and body mass index (BMI) were measured using a Tanita body fat analyzer model TBF-310GS. BMI *z* scores were calculated using standard scoring procedures (The Children's Hospital of Philadelphia, 2015) to identify the proportion of youths enrolled who were overweight or obese. All data collectors were trained prior to conducting assessments.

Table 1.

Feasibility Measures and Sample Questions

Measure	Target	Sample question(s)
Acceptability and demand		
Postprogram focus group session	Youths	• What did you like most about the program? • What did you like least about the program? • What was your favorite game? • How would you feel about working with program site leaders as assistant staff if this program were to come back to your site?
Attendance	Youths	• How many children are present that enrolled in the program?

Postprogram interview	Program site leaders	• Talk to me about your experience in trying to recruit your youth to enroll in the program. • Did you notice any changes in willingness to try fruits and vegetables? • Did you notice any changes in willingness to engage in physical activity? • What was your perception of the data collection component of the program?
Implementation		
Evaluation and field notes	Intervention delivery staff	• What were the barriers or challenges to implementation?
Limited-efficacy		
"Pre-post" gardening survey—willingness to try FV, expectations for eating FV, self-efficacy for eating FV, self-efficacy for asking for FV, self-efficacy for gardening, FV consumption	Youths	• Would you be willing to taste a new fruit? • For dinner do you think you can eat your favorite fruit instead of your usual dessert? • For breakfast, do you think you can add fruit to your cereal? • Do you think you can ask someone in your family to buy your favorite fruit or vegetable? • Do you think you can prepare the soil and plant seeds or young plants for a garden?

		• During the past 7 days, how many times did you eat fruit? *(Do not count fruit juice.)*
"Pre-post" physical activity survey—screen time (TV and games), self-efficacy for PA, days active for 60 min	Youths	• On an average day, how many hours do you spend watching TV? • Do you think you can be physically active with other kids your age? • During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?
Knowledge—gardening knowledge, nutrition knowledge, PA knowledge	Youths	• Do plants need air to grow? • Is dairy part of the MyPlate picture? • How many minutes of physical activity should someone your age get every day?

Note. FV = fruits and vegetables. PA = physical activity.

Data Analysis

Data were analyzed using SPSS 21.0. Cronbach's alpha was used to determine the measure of reliability at baseline, excluding knowledge outcomes. Repeated measures analysis of variance was used to compare the between-group effects relative to preprogram-to-postprogram change. Knowledge scores were calculated as percentage correct versus incorrect. Only data from participants who completed both the preprogram and postprogram assessments and attended at least one CG or PA session were included in the analysis. The level of statistical significance was set as $p < .05$. Qualitative data were coded through a semiopen coding by three independent researchers and were subsequently discussed for consensus and analyzed for emergent themes (Creswell, 2012).

Results

Acceptability and Demand

Across the three CG program sites, approximately 93 youths were eligible, of which 32 (34%) enrolled in the program. Of those 32, 19 (59%) completed follow-up assessments. Enrolled participants attended an average of 4.1 CG program sessions, or about 51% of the eight available sessions. Across the three PA program sites, approximately 141 youths were eligible, of which 61 (43%) enrolled. Of those 61, 49 (80%) completed follow-up assessments. Enrolled participants attended an average of 4.9 PA program sessions, or about 61% of the eight available sessions. Site differences related to study enrollment, completion, and attendance are illustrated in Figures 1 and 2.

Figure 1.

Eligible Youths Who Completed Baseline and Follow-Up Assessments and Average Attendance of Youths in the CG Program

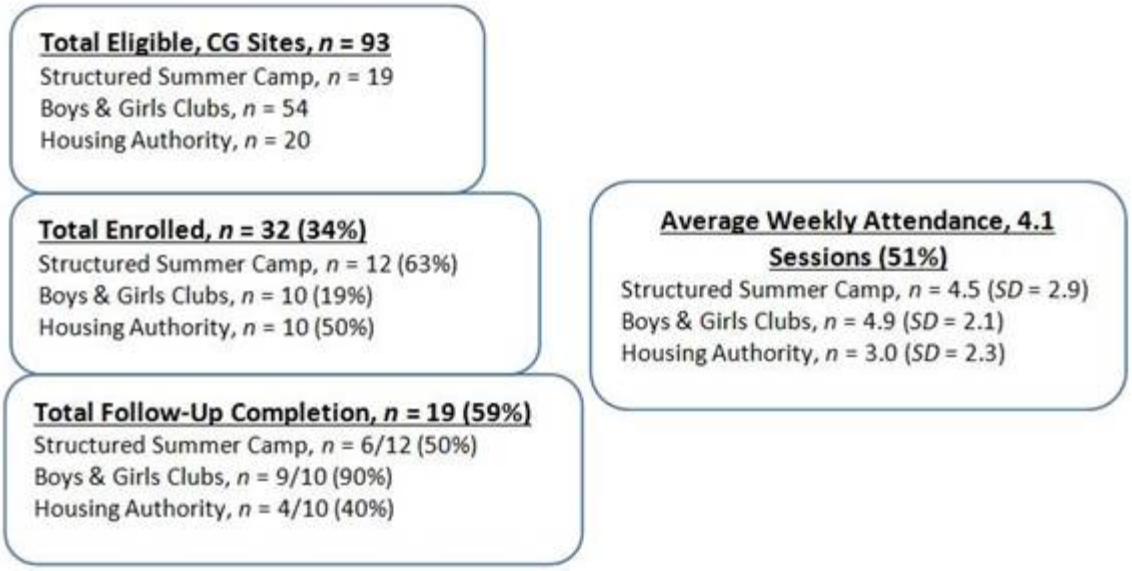
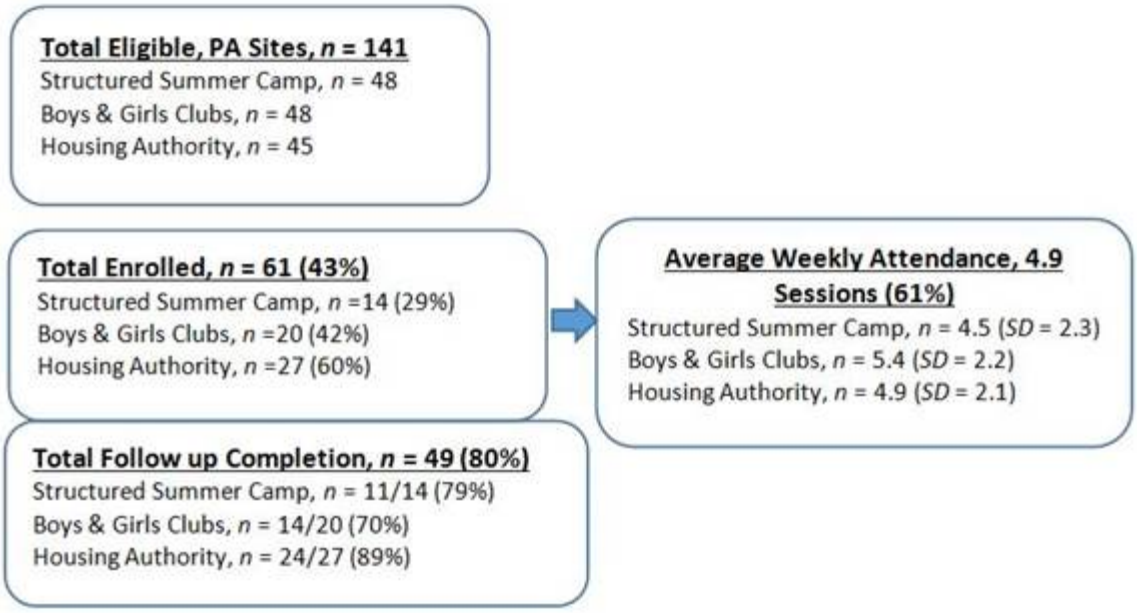


Figure 2.

Eligible Youths Who Completed Baseline and Follow-Up Assessments and Average Attendance of Youths in the PA Program



At program completion, 40 youths participated in seven focus groups, with approximately five to seven youths in each group. Focus group sessions were conducted at four of the six sites, and each lasted about 25 min. For the CG program sites, 96% of the youths expressed positive impressions, with the "most liked" components including sampling foods and playing games. For the PA program sites, 92% of the youths had positive feedback, and playing games and learning about being active were "most liked" components. The most common suggestion for making both programs more enjoyable was increasing the number of games incorporated in the lessons.

Key informant interviews, averaging 15 min, were conducted with site leaders at five of the six program sites. Site leaders at both CG program sites and PA program sites expressed enthusiasm for continuing the program. For example, one site leader said, "The kids enjoyed the staff and would like to have the program again." Site leaders also noticed increased cohesiveness, excitement, and anticipation of the program among youth participants. They did not report any major threats to acceptability.

Implementation

Table 2 shows data related to implementation of learning objectives and time spent on programming. On a 4-point scale, the average degree to which objectives were met was 3.6 (*SD* = 0.35) for the CG program and 3.6 (*SD* = 0.29) for the PA program. For both conditions, the highest degree of objectives met occurred in the programs at the structured summer camps.

For the CG program, overall time in minutes spent on nutrition lessons averaged 57.7 (*SD* = 7.6), whereas time in minutes spent on gardening averaged 22.0 (*SD* = 5.2). Program delivery personnel at the housing authority site generally spent less time on the lesson, and those at the Boys & Girls Clubs site spent less time in the garden. However, program delivery personnel at both the structured summer camp and the Boys & Girls Clubs site slightly exceeded the allotted time for instruction. This finding was attributed to two main factors: the time needed to manage classroom distractions and the time needed to prepare ingredients for food sampling. Time spent delivering the curriculum at the housing authority site was approximately 10 min shorter than intended, largely due to the age variation of attendees. Lesson content was adjusted as needed to account for lower comprehension levels and allow for participation of all youths present.

For the PA program, overall time in minutes spent on lessons averaged 34.5 (*SD* = 7.2), whereas the time in minutes spent on PA averaged 51.3 (*SD* = 6.7). Program delivery personnel at the housing authority site spent more time on the lesson, largely due to classroom management needs. Program delivery personnel at the structured summer camp spent the least amount of time engaged in PA, due to the summer camp schedule.

Table 2.

Average Implementation of Learning Objectives and Time Spent on Programming

Metric	Overall average *M* (*SD*)	Structured summer camp *M* (*SD*)	Boys & Girls Clubs *M* (*SD*)	Housing authority *M* (*SD*)
Community garden program sites				
Average implementation of learning objectives[a]	3.6 (0.35)	3.9 (0.01)	3.6 (0.5)	3.2 (0.7)
Average amount of time spent on lesson (min)[b]	57.7 (7.6)	61 (6.8)	63 (17.0)	49 (15.0)
Average amount of time spent on gardening (min)[b]	22.0 (5.2)	25.0 (5.0)	16.0 (8.0)	25.0 (15.0)
Physical activity program sites				
Average implementation of learning objectives[a]	3.6 (0.29)	3.9 (0.2)	3.4 (0.6)	3.4 (0.6)
Average amount of time spent on lesson (min)[b]	34.5 (7.2)	31.0 (14.0)	30.0 (4.5)	43.0 (11.0)
Average amount of time spent on physical activity (min)[b]	51.3 (6.7)	44.0 (12.0)	53.0 (10.0)	57.0 (15.0)

[a]Implementation was the degree to which learning objectives were met and was assessed on a 4-point Likert scale: 1, *not met*; 4, *met completely*. [b]Reported as time per day.

Limited-Effectiveness

Of the 19 youths who completed baseline and follow-up assessments at the CG program sites, the average age in years was 10.54 (*SD* = 1.63), 81% were males, and 90.5% were African Americans. BMI *z* scores indicated that 5.2% of CG program participants were overweight. Of the 49 youths who completed baseline

and follow-up assessments at the PA program sites, the average age in years was 10.76 (*SD* = 1.89), 52% were males, and 72.9% were African Americans. Also, 14.3% of PA program participants were overweight, and 6.1% were obese. Related to race and gender, there were no between-group differences for the CG and PA groups, or for study completers and noncompleters.

There were few preprogram and postprogram differences of effectiveness outcomes between the two conditions. Results indicated that there was a statistically significant difference between groups for fruit and vegetable consumption. Specifically, participants in the CG program decreased their fruit and vegetable consumption between pretesting and posttesting, whereas participants in the PA program increased their fruit and vegetable consumption between pretesting and posttesting (Table 3).

Table 3.

Pretest and Posttest Differences Between CG Intervention Group and Matched Contact-Control PA Intervention Group

			CG (*n* = 19)			PA (*n* = 49)				
Measure	**α**	**# of items**	**Baseline *M* (*SD*)**	**Follow-up *M* (*SD*)**	**Change score**	**Baseline *M* (*SD*)**	**Follow-up *M* (*SD*)**	**Change score**	**Overall effects *p***	**Between-group effects *p***
Gardening measures										
Willingness to try FV[a]	.965	24	1.12 (.43)	1.26 (.41)	0.13 (.30)	1.21 (.36)	1.25 (.38)	0.06 (.22)	.006	.253
Food frequency[b]	.924	6	1.46 (.82)	.80 (.58)	-0.66* (1.01)	1.06 (.83)	1.11 (.87)	0.05 (1.08)	.044	.020*
Self-efficacy for eating FV[c]	.522	13	2.46 (4.89)	1.25 (.42)	-1.21 (5.08)	1.26 (.44)	1.29 (.45)	0.23 (.43)	.108	.092
Self-efficacy for asking for FV[c]	.940	8	2.11 (2.64)	1.51 (.43)	-0.61 (2.73)	1.68 (1.63)	1.45 (.49)	-0.22 (1.62)	.130	.477
Self-efficacy for gardening[c]	.942	6	1.21 (.41)	1.38 (.54)	0.17 (.59)	1.41 (.46)	1.79 (2.32)	0.38 (2.34)	.363	.722
Expectations for eating FV[d]	.780	7	1.47 (.40)	1.62 (.37)	-0.15 (.51)	1.47 (.47)	1.61 (.42)	0.14 (.51)	.042	.971
Gardening knowledge[e]	.637	6	80.8% (.16)	87.2% (.01)	0.06 (.17)	79.1% (.21)	86.3 (.13)	0.07* (.20)	.034	.892
Nutrition knowledge[e]	.681	10	54.4% (.25)	70.6% (.29)	16* (.20)	51% (.24)	55.5% (.27)	0.05 (.32)	.020	.181
PA measures										
Self-efficacy for PA[c]	.906	8	1.35 (.40)	1.57 (.344)	0.22 (.48)	1.41 (.42)	1.53 (.35)	0.12* (.32)	.001	.300
PA knowledge[e]	.493	9	56.2%	69.1%	0.13	60.0%	76.1%	0.16*	.001	.714

			(.26)	(.22)	(.35)	(.17)	(.27)	(.28)		
Screen time[f]	.697	2	2.65 (1.25)	2.70 (1.75)	0.06 (2.31)	2.17 (1.48)	2.50 (1.50)	0.08 (1.64)	.792	.962
No. of days active for 60 min over preceding 7 days		1	3.94 (2.29)	5.11 (2.00)	1.17 (3.13)	4.31 (2.36)	5.45 (1.62)	1.14 (2.75)	.005	.976

Note. CG = community garden. PA = physical activity. FV = fruits and vegetables.

[a]Responses were on a 3-point scale: 0, *not willing*; 1, *maybe willing*; 2, *willing*. [b]Reported as times per day. [c]Responses were on a 3-point scale: 0, *no*; 1, *maybe*; 2, *yes*. [d]Responses were on a 3-point scale: 0, *not sure*; 1, *somewhat sure*; 2, *sure*. [e]1, correct; 0, incorrect. [f]Reported as hours per day.

*Denotes significance ($p < 0.05$).

Discussion

Building on the ongoing CG initiative of the Dan River Partnership for a Healthy Community and the feasibility framework suggested by Bowen et al. (2009), we set out to answer the question "Does it work?"—or more precisely, "Does an experiential theory-based gardening and nutrition program work in the Dan River Region?" Given the mixed findings related to acceptability and demand, implementation, and limited-effectiveness, perhaps the answer to this question is "not yet." Qualitative information related to acceptability and demand revealed that both youths and program site leaders enjoyed the program and would be interested in participating in the future. Likewise, findings related to implementation indicated that Extension agents partnered with researchers were able to deliver the program successfully with a high level of fidelity. However, the limited-effectiveness results reveal that neither the CG program nor the PA program improved targeted outcomes. The between-group effect—the CG program participants' decreased fruit and vegetable consumption and the PA program participants' increased fruit and vegetable consumption—was unexpected. Given that overestimation of healthful food intake is common in the dietary assessment literature and that youths in the CG program learned about fruit and vegetable portion sizes throughout the curriculum, these factors could have accounted for improved accuracy in reporting during the postprogram assessment. Another factor may be the occurrence of the preprogram assessment the week after the release of school, where youths likely had been enrolled in both the School Breakfast Program and the National School Lunch Program. The postprogram assessment occurred during the summer months, when youths had access to only the USDA Summer Feeding Program (i.e., one instead of two federal meals) and, therefore, may have had less opportunity to consume fruits and vegetables. These factors, as well as limited statistical power, influenced our limited-effectiveness outcome findings and should be considered in future studies examining program effects.

Of the 103 youths who provided consent, only 66% participated, possibly due to activities built into the youths' schedules prior to program enrollment. However, Extension was an invaluable partner and led delivery of the CG program. Strengthening the collaborative relationship between local Extension agents and university partners is vital to offering, evaluating, and sustaining future youth programming efforts.

Several factors may explain the lack of improvement in targeted outcomes. The age eligibility was restricted to 8- to 14-year-olds; however, all youths were welcome to participate. Consequently, children under age 8 largely outnumbered eligible participants. On many days, there were as many, if not more, nonenrolled

youths participating. Lesson content for both programs was adjusted to account for lower comprehension levels and allow participation for all youths present, which complicated the goal of delivering the program as planned. Second, there were unforeseen challenges with the survey administration. These included issues related to youths' abilities to stay engaged to complete the survey in the face of outside distractions from nonenrolled youths. If possible, and if size of staff permits, future researchers should consider interview-administering the survey instrument one-on-one with all involved youths. Also, the short time frame for project execution within the academic summer was a challenge. Finally, we recognize that the small postprogram sample influenced our ability to examine between-group effects. We encourage future researchers to consider these lessons learned when implementing similar programs.

Conclusion

In application of the CBPR approach, there is always the balance between making a difference and measuring a difference (Resnik & Kennedy, 2010). The general sense is that both the CG program and the PA program made a difference. We were able to successfully implement the programs at USDA Summer Feeding Program sites and engage at-risk youths in a nutrition or activity initiative aimed at promoting healthful behaviors. However, future efforts are needed to refine the measurement and evaluation processes and procedures related to effectiveness testing. Similar to other researchers (Brennan, Barnett, & Baugh, 2007; Landry, Chittendon, Coker, & Weiss, 2015; Phelps, Hermann, Parker, & Denney, 2010), we found that Extension plays a vital role in engaging youths in the local community.

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