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Exploring Community Gardens in a Health Disparate Population: Findings from a Mixed Methods Pilot Study

Jamie Zoellner, PhD, RD[1], Ashley Zanko, MS[1], Bryan Price[2], Jennifer Bonner[1], and Jennie L. Hill, PhD[1]

(1) Virginia Polytechnic Institute & State University, Department of Human Nutrition, Foods, and Exercise; (2) City of Danville, Office of Parks, Recreation and Tourism

Abstract

Background: Despite recommendations, there have been few efforts to apply the community-based participatory research (CBPR) approach in the development, implementation, and evaluation of community gardens.

Objectives: As guided by the CBPR approach and grounded in a social-ecological model and behavioral theory, the purpose of this mixed methods study was to understand opinions and interests in developing and implementing a community garden and to understand factors impacting fruit, vegetable, and gardening behaviors.

Methods: Community and academic members collaborated to develop and execute this study. The qualitative phase—targeting regional key informants—was designed to elicit perceived benefits and challenges of community gardens at the environmental, community, and individual levels. The quantitative phase targeted low resourced youth and parents and included a variety of validated theory-based questionnaires to understand factors impacting fruit, vegetable, and gardening behaviors.

Results: Major benefits of community gardens that emerged from the 10 qualitative interviews included increasing community cohesion and improving nutrition and physical activity factors. The quantitative phase included 87 youth and 67 parents. Across 16 items for fruits and vegetables, the average willingness to try was 1.32 (standard deviation [SD] = 0.40) on a 2-point scale. The majority of youth indicated they would work in a garden (n = 59; 68%) and eat food grown in their garden (n = 71; 82%). Among parents, gardening attitude, belief, and self-efficacy scores were all above average; however, gardening intentions were neutral.

Conclusion: This research illustrates the successful partnering a community–academic team and has provided the partnership with a clearer lens to conceptualize and launch future regional community garden efforts.

Keywords

Community-based participatory research, gardening, research pilot projects, environment and public health

It is increasingly clear that, when addressing complex health behaviors and social issues such as low fruit and vegetable intake among low-income communities, it is insufficient to rely solely on approaches directed at individuals.[1,2] Nonetheless, there is a continued lack of interventions based on social-ecological models that elucidate how health-related intervention and policy development could effectively address individual-level behaviors, social influences, environmental influences, and the interactions among these multiple levels. Community garden programs are an important example of how a social-ecological model could be applied to advance the health and well-being of a community across multiple levels of influence; however, there have been few efforts to fully apply social-ecological models to community gardens. The majority of published literature focuses on either short-term individual level-behaviors or social- and environmental-level processes, but not both.[3,4]

Related to individual behavior and specific to youth, a 2009 garden-based review revealed mixed findings related to the impacts of gardening on individual-level youth outcomes, including fruit and vegetable intake, willingness to try fruits and vegetables, preference for fruit and vegetables, self-efficacy, and

knowledge.[3] Inconsistencies in study findings are highlighted, in part, by lack of scientific rigor in the study design and evaluation methods. Although the social cognitive theory, which is based on reciprocal determinism among individual, behavioral, and environmental factors,[1,3,5] was the most consistent theory used in these education programs,[3,6-9] none of these studies examined impacts on socioenvironmental factors or examined impacts on longer term health outcomes. The theory of planned behavior (TPB) has been also been a useful individual level-behavioral model to promote understanding of gardening program effects on youth dietary and gardening behaviors.[10,11] In brief, the TPB is centered on the idea that behavioral intention is the most important determinant of a person's behavior and antecedents to behavioral intentions include three independent constructs including attitudes, subjective norms, and perceived behavioral control.[1,12]

In addition to efforts focused on individual-level behaviors, community gardens are also known to promote community building, beautification, civic engagement, social capital, and social well-being,[13-17] as well as other key social processes (e.g., collective efficacy, connection, reciprocity, mutual trust, and social norms) integral to community health promotion.[14,17,19] To advance the scientific, evidence-based for community gardens and to fully understand the potential public health impact, concerted efforts are needed to integrate individual level behavior change theories with social-ecological models.[3] Additionally, there are numerous other opportunities for research and practice. For example, given that current studies focus on established community gardens, little is known about how formative methods could inform the development and sustainability of community gardens. Furthermore, a recent key recommendation has been to apply CBPR methods in the development, implementation, and evaluation of community gardens.[3] In fact, several deficits in the scientific evidence base related to community gardens could be addressed by applying the CBPR approach, such as the engagement of local communities in revealing culturally relevant solutions to their regionally specific and complex health issues, creating a sense of ownership in the problems and solutions related to low fruit and vegetable intake, and promoting the likelihood for sustainable community garden efforts.[19,20]

The community garden efforts reported here have emerged from a CBPR partnership in the Dan River Region, a health disparate region situated in south central Virginia and north central North Carolina.[21-24] Increasing access to healthy food among at-risk youth and their families via community garden efforts has been identified as a top priority by this CBPR team.[25] At the time of this study, influential stakeholders involved in this CBPR partnership had identified community gardens as a potential solution to address health concerns in the region, yet little was known about the interest level of community leaders and members who were not involved in the partnership and who would most likely be targeted to lead and participate in such efforts. Furthermore, little was known about factors influencing fruit and vegetable intake among at-risk youth and their families. Likewise, understanding the potential benefits and barriers of a community garden intervention were of great interest to the CBPR partnership. Therefore, the primary aims of this pilot study were to understand opinions and interests in developing and implementing a community garden program in the Dan River Region, and to understand factors impacting fruit, vegetable, and gardening behaviors. Grounded in the social-ecological model and constructs from individual level behavioral theories, this mixed methods study design included qualitative key informant surveys and quantitative surveys with low-income youth and their parents.

METHODS

Profile of the Dan River Region

The Dan River Region, which includes the city of Danville along with Pittsylvania and Caswell counties, meets the medically underserved area/population classification with high indices of poverty, low educational attainment, and health disparities.[26] Historically, this rural area relied largely on agriculture, manufacturing, and textile mills for its economic foundation. In recent years, many of the manufacturing and textile jobs have disappeared, creating the highest rates of unemployment in the Commonwealth of Virginia.[27] At the end of May 2011, unemployment in the region ranged from 12.3% to 18.9%, well exceeding state (6.0%) and national (9.1%) averages.[27] Low socioeconomic status, rural, and African-American populations in Virginia consistently experience higher mortality rates and poorer health status across a variety of outcomes (e.g., heart disease, cancer, infant mortality, diabetes mellitus) compared with higher socioeconomic status, urban, and non-Black

Virginians.[23,24] Thus, the geographic profile, sociodemographics, and current economic strain creates a vulnerable situation for residents and makes the Dan River Region among the most health disparate regions of the commonwealth.[21-24]

Three comprehensive needs assessments conducted in the Dan River Region[22,28,29] conclusively recognized obesity as a serious health concern for the region. Furthermore, these needs assessments indicated the need for community partnerships to promote community programs and policy changes that promote healthy living. In 2009, efforts were initiated to unify stakeholders to address obesity and build community partnerships.[25]

Establishing the Community–Academic Team and Setting Priorities

As described in detail elsewhere,[25] regional stakeholders representing numerous sectors (e.g., civic, faith-based, public/private healthcare, local government, education, small business owners, and grassroots social justice organizations) and research faculty from the Virginia Tech Department of Human Nutrition, Foods, and Exercise began meeting in November 2009 to discuss the development of a unified community effort to address obesity. Through several meetings over the next several months, the Virginia Tech researchers formally introduced the principles of CBPR and the Comprehensive Planning and Participatory Evaluation (CPPE) process as a possible approach to address obesity-related concerns. Given the overwhelmingly positive response from the community stakeholders to support a community–academic partnership, the CPPE process was initiated in April 2010. CPPE is an action-oriented and flexible approach consisting of four general steps aimed at moving a community through a series of steps that include needs assessment, priority setting, intervention development, and implementation.[30,31] The involvement of stakeholders in all planning phases aims to increase motivation, feasibility, and the ultimate success of the project. A skilled facilitator, independent of the community–academic team, led a two-part CPPE causal analysis workshop in Danville with the goal of creating obesity-related causal models to aid in priority setting and guide intervention development.[25] Of 38 invited stakeholders, 28 (74%) attended, along with four members of the research team on both days. Attendees identified obesity-related factors, root causes of those factors, and developed six obesity-related causal models, including one each for nutrition, physical activity, social norms, education, environment, and geographic planning. Furthermore, the participants identified and prioritized potential interventions. Across the models, three priority interventions emerged, including (1) community gardens to increase the accessibility of fresh, local foods, (2) social support for physical activity, and (3) health-related social marketing campaigns.

Since the CPPE workshops, the task force has been meeting monthly to advance intervention development and implementation in the identified priority areas. The attendance at the meetings averages about 18 community members and about 7 academic members. One subcommittee that immediately emerged was the nutrition subcommittee. Membership on this subcommittee includes, but is not limited to, representation from the Danville City Parks and Recreation, Virginia Cooperative Extension (including 4-H, Master Gardeners, and Supplemental Nutrition Assistance Program–Education), Camp Grove Baptist Church, Public Housing Authorities, and Virginia Tech. Congruent with the prioritized intervention areas identified in the CPPE workshops, community gardens was the first project idea aimed at exploring ways to promote increased access and availability of fresh fruits and vegetables in the region. The research methods and findings presented here detail the initial pilot project from this subcommittee.

Study Design, Procedures, and Measures

A parallel, mixed methods study design was conceptualized to allow for concurrent qualitative and quantitative data collection. This simultaneous data collection, separate analysis, and then "merging" of results allows us to meet the overall aim of this study to understand region-wide interest in community gardens.[32] All study activities and survey instruments were approved by the Virginia Tech Institutional Review Board. Figure 1 illustrates the recruitment process of data collection methods.

Qualitative Phase

The qualitative phase consisted of key informant interviews with community stakeholders who were external to the obesity task force at the time of the interview. At a monthly CBPR obesity task force meeting, the nutrition subcommittee members informed attendees of the goals of the qualitative interviews and encouraged members to suggest relevant stakeholders

representing a variety of community sectors. Through snowball sampling procedures, a total of 52 community stakeholders from a variety of sectors (e.g., education, church, community, recreation, health care, farming) were identified.[33] Of these 52 stakeholders, 10 agreed to participate in the study.

The semistructured key informant interview script was developed using the social-ecological model and included 11 questions, with 12 potential probes. Interviews were conducted over the telephone by a trained research assistant from Virginia Tech. In addition to two opening broad health questions, the majority of the questions were intended to elicit perceived benefits and challenges of community gardens at the environmental, community, and individual levels. For example, a few questions include: "Describe to me what you feel some of the barriers of initiating or maintaining a community garden would be," "Tell me about some groups or organizations in the community who would benefit from a community garden," and "What, if any, changes in health do you feel gardeners would experience?" No incentives were given to key informant participants in the qualitative phase.

Quantitative Phase

The quantitative phase targeted youth and parents who were identified as potential participants and benefactors of future community gardening programming efforts. Partners at Danville City Parks and Recreation suggested and helped to facilitate participation of youth and parents enrolled in four different summer camps. Danville City Parks and Recreation promoted correspondence among camp counselors and the researchers, including researcher involvement in the camp counselor orientation. At a time convenient for each camp, trained research assistants from Virginia Tech read the surveys to the youth and recorded their answers. Researchers provided parents with the survey that was self-administered at the camp site or returned the survey the following day. All data on the parent survey, including height and weight, were obtained

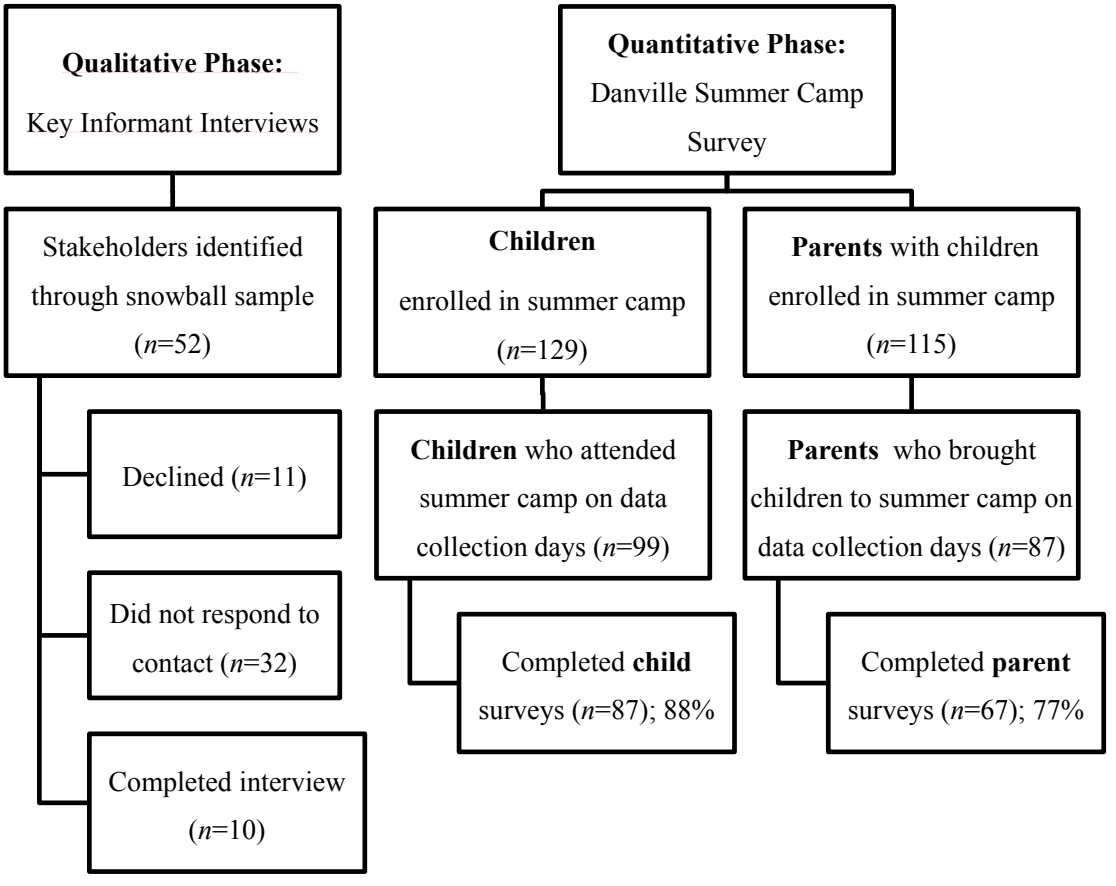

Figure 1. Process of mixed methods study recruitment.

using self-report measures.

Table 1 illustrates the constructs, number of items, Cronbach's alphas derived from this study, sample questions and scale response options, and scale descriptives for the youth and parent surveys. The 44 youth questions reported here were based on previously developed instruments, including (1) 26 items to measure willingness to try fruits and vegetables,[34] (2) six task self-efficacy questions,[35,36] (3) six intake self-efficacy questions,[35,36] (4) two questions related to if they would like to work in a garden and if they would eat the food grown in their garden, and (5) four demographic questions.

The parent survey included a total of 58 questions. A previously developed instrument was used to assess the home availability of 17 fruits and 24 vegetables.[37] At the time of this study, no validated instruments were identified that specifically met our needs to explore gardening attitudes, beliefs, self-efficacy, and intention among adults. Because our time was limited, full development and validation of such an instrument was not practical; therefore, we gleaned research findings from the community garden literature along with recommendations on defining TPB and self-efficacy constructs to adapt a previously validated instrument to make the referent behaviors specific to gardening.[1,3-5,12,38,39] The resulting adaptations included (1) six gardening attitudes questions of a 7-point scale (from 1 [unenjoyable] to 7 [enjoyable] and 1 [boring] to 7 [exciting]); (2) nine gardening belief questions on a scale from 1 (extremely unlikely) to 7 (extremely likely; e.g., How likely that working in a garden would 'make you feel good,' 'take too much of your time,' 'help you lose weight,' 'reduce your chances of disease'"); (3) seven gardening self-efficacy questions on a scale from 1 (not at all confident) to 5 (very confident; e.g., "How confident are you in being able to: 'prepare the soil and plant seeds or young plants for a garden,' 'choose plant or seed varieties appropriate for your garden,' 'weed, water and maintain a garden,' 'harvest and use the vegetables you have grown in your garden,'?"); and (4) two gardening intention questions, one each for gardening intention 'at home' and 'in the community where I live.' Before survey administration, each parent provided informed consent and parental consent and children provided assent. Each parent/child dyad was eligible to enter a lottery drawing for a $20 Wal-Mart gift card at each camp.

Table 1. Characteristics of Youth and Parents Participating in the Quantitative Survey Phase

Characteristics	Child *n* (%)	Parent *n* (%)
Gender		
Female	42 (48.3)	54 (80.6)
Male	45 (51.7)	13 (19.4)
Race/ethnicity		
Black	47 (54.0)	34 (50.7)
White	36 (41.4)	31 (46.3)
Hispanic	2 (2.3)	1 (1.5)
Other	2 (2.3)	1 (1.5)
Body mass index		
Underweight		1 (1.7)
Normal		19 (32.2)
Overweight		20 (33.9)
Obese		19 (32.2)
Income ($)		
0–19,999		10 (15.6)
20,000–49,999		29 (45.3)
>55,000		25 (39.1)
Education		
High school diploma or less		14 (20.9)
Some college or specialized training or 2-year degree		42 (62.7)
Received bachelor's degree (4-year college graduate)		5 (7.5)
Attended graduate school		6 (9.0)

Data Analysis

Qualitative interviews were recorded and transcribed verbatim by a trained researcher. Three researchers used a deductive approach to independently code raw data and extracted meaning units from the transcribed interviews. Then, researchers used constant comparative thematic analysis[32] to reveal major emerging themes. Each meaning unit was coded as involving individual-, community-, environmental-, and/or policy-level influences of community gardens to determine the social-ecological factors. Quantitative data were analyzed using the SPSS 18.0 software package (SPSS, Inc., Chicago, IL). Statistical analyses of the pilot data consisted of descriptive statistics, including means, standard deviations, frequencies, Cronbach's alphas, paired *t*-tests, and multiple regression modeling.

RESULTS

Qualitative Phase

Ten individuals representing four sectors (one from education, three from churches, three from the community, and three from recreation) participated in the key informant interviews. Other sectors were not represented based on refusal to participate or inability to reach stakeholder after multiple attempts. The most common reason stated for refusal to participate was stated lack of knowledge and/or familiarity with community gardens in the region.

Interviews took place in the summer of 2010 and on average took 22 (SD, 12) minutes. As illustrated in Table 2, community- and environmental-level as well as individual-level themes emerged from stakeholders. Increasing community cohesion, physical activity, and improving nutritional outcomes emerged as the major potential benefits to the region from a community garden initiative. Congruent with

Table 2. Major Themes and Supporting Quotes revealed by Stakeholders Participating in the Qualitative Phase

Social-Ecological Level	Theme	Example Quote(s)
Community/ Environmental	Community cohesion	"I think when the community is working together and is cohesive they begin addressing not just their food issues, but other issues they may be facing as a community." "I think that the primary function of the community garden would be to bring the community together."
	Nutrition	"The benefits of a community garden would be local produce that perhaps would be certainly traveling less distance and would be available to those who need it to supplement their diet with healthier foods to eat." "[Community gardens] would definitely potentially increase [fruit and vegetables consumption] and this would be beneficial because it would definitely help out a lot of these neighborhoods which are basically low income, not low-middle class and it's a good way for them to benefit not only by increasing their [fruit and vegetables] but by decreasing the money they had spent on food." "Access to vegetables and fruits and making them aware of what's out there and what is available in the city even though it's limited at this point…"
	Physical activity	"We don't have very many places where you can do physical fitness such as gyms and the city parks are not as well distributed as they should be for exercise." "I think if there were more opportunities and convenience and easy ways to be physically active that would help."
Individual	Nutrition	"Fresh fruits and vegetables, the stuff you get right out of the garden has more nutrients and stuff, than the stuff you buy at the grocery store, because it's fresh. It's right out the ground, you're not losing any nutrients in storage or in transportation. So I think the benefits there pretty much speak for themselves." I think without a doubt [gardeners] would increase [fruit and vegetable] intakes in the community especially if we could develop several community gardens throughout the city where people basically anyone who wants to have access to fresh vegetable can with some work obviously. They have to put in the time and the work. I do think it's important for the community because just the health benefits and all. "Obviously [gardeners] are gonna take part and consume what they grow … be less apt to go out and eat fast food… they're eating home grown stuff, so if that would increase the nutrition part of it they would be healthier through the diet."
	Physical activity	"[A community garden] gets people active and doing something, investing in their community and that has a benefit not only to the community, but to the individuals who do it, a physical benefit." "[Gardeners experience a change in] improved physical health just from the activity. I know when I work in the garden, which is not every day, even though it should be, I'm really sore the next day. Sometimes the same day. So it obviously produces some kind of exercise benefit."

prior needs assessments in the region, obesity emerged as a major health concern among the key informants. Respondents generally agreed that community gardens would increase and improve physical activity and nutrition and that both were important. There were more comments on nutritional outcomes of community gardens (i.e., increase fruit and vegetable accessibility, affordability, and intake) than physical activity outcomes (i.e., nontraditional form of exercise, outdoor activity to change sedentary lifestyles). Stakeholders also reported low educational levels and lack of education programs (i.e., nutrition and physical activity education) as barriers to health within the area. Churches, schools, and organizations were identified as prime locations for community gardens, with the most positive responses for church participation. The planning phase of implementing community garden was thought to be the most time intensive and a lack of resources was shown to be of concern; however, stakeholders were confident of the ability of community gardens to engage community members. Other relevant findings included concerns over who might initiate and lead a community garden as well as the sustainability of community gardens.

Quantitative Phase

Of the youth (n = 99) and parents (n = 87) exposed to study recruitment efforts, this study yielded a relatively high participation rate (Figure 1). As illustrated in Table 3, comparable race distribution was achieved among children and parents. Although children were equally distributed by gender, male parents were underrepresented because more female parents brought their children to the camp when surveys were administered. Youth ranged from 5 to 13 years of age, with an average of 8.69 (SD = 2.04), and parents ranged from 25 to 61 years of age with an average of 39.1 (SD = 9.16). Taking the midpoint of each categorical household

Table 3. Findings from Youth and Parents Participating in the Quantitative Survey Phase

Construct	Number of Items	Cronbach's Alpha	Content/Sample Questions	Mean (SD)
Children (n = 87)				
Task self-efficacy: Fruit and vegetable[a]	6	0.74	How sure are you that you can eat a piece of fruit (not including fruit juice) for snack?	1.28 (0.48)
Intake self-efficacy: fruit and vegetable[a]	6	0.64	How sure are you that you can eat 2 servings of vegetables each day?	1.41 (0.46)
Willingness to try fruit[b]	6	0.63	Would you be willing to taste mandarin oranges?	1.43 (0.44)
Willingness to try vegetables[b]	10	0.73	Would you be willing to taste baby carrots?	1.28 (0.46)
Parents (n = 67)				
Gardening attitudes[c]	6	0.88	For you, working in a garden would be enjoyable?	5.4 (1.20)
Gardening beliefs[d]	9	0.77	For you, how likely is it that working in a garden would increase the amount of vegetables you eat?	5.4 (0.90)
Gardening self-efficacy[e]	7	0.87	How confident are you in being able to harvest and use the vegetables you have grown in your garden?	3.6 (0.90)
Fruit availability in home[f]	16	0.87	How often did you have pineapple (fresh, canned, or frozen) in your house?	2.02 (0.65)
Vegetable availability in home[f]	23	0.85	How often did you have peas (fresh, canned, or frozen) in your house?	2.32 (0.60)
Fruit variety in home	16	NA		6.27 (3.42)
Vegetable variety in home	23	NA		11.49 (4.85)

[a] Scale: 0 (not sure), 1 (somewhat sure), or 2 (very sure).
[b] Scale: 0 (no), 1 (maybe), or 2 (yes).
[c] Scale: 1 (negative attitude) to 7 (positive attitude).
[d] Scale: 1 (negative belief) to 7 (positive belief).
[e] Scale: 1 (not at all confident) to 5 (very confident).
[f] Scale: 0 (never), 1 (rarely), 2 (sometimes,) 3 (frequently), or 4 (always).

income, the median household annual income of the parents is approximated at $37,968.75 (SD = $16,690). This is somewhat higher than the median family income for Danville, which is estimated at $29,482 per year.[40] Of parent respondents, 16.5% had earned a bachelor's degree or higher, which is representative of the average educational achievement in Danville (15.7% with a bachelor's degree or higher).[40]

As illustrated in Table 1, youth's intake self-efficacy was higher than task self-efficacy for fruits and vegetables ($t = 2.4$; $p = 0.02$). Across all 16 items for fruits and vegetables, the average willingness to try was 1.32 (SD = 0.40) on a 2-point scale. Overall willingness to try fruits was statistically higher compared with willingness to try vegetables ($t = 3.8$; $p < 0.01$). The individual items for each of the self-efficacy items and

Table 4. Individual Items for Self-Efficacy and Willingness to Try Fruits and Vegetable Among Youth ($n = 87$)

Questions	Not Sure at All (%)	Somewhat Sure (%)	Very Sure (%)
Child task self-efficacy			
How sure are you that you can eat a piece of fruit (not including fruit juice) for breakfast?	16 (18.4)	18 (20.7)	53 (60.9)
How sure are you that you can eat a piece of fruit (not including fruit juice) for lunch?	13 (14.9)	22 (25.3)	52 (59.8)
How sure are you that you can eat a piece of fruit (not including fruit juice) for dinner?	19 (21.8)	23 (26.4)	45 (51.7)
How sure are you that you can eat a piece of fruit (not including fruit juice) for snack?	11 (12.6)	20 (23.0)	56 (64.4)
How sure are you that you can eat a vegetable (not including French fries) for lunch?	16 (18.4)	26 (29.9)	45 (51.7)
How sure are you that you can eat a vegetable (not including French fries) for dinner?	17 (19.5)	17 (19.5)	53 (60.9)
Child intake self-efficacy			
How sure are you that you can eat 1 serving of fruit each day?	4 (4.6)	18 (20.7)	65 (74.7)
How sure are you that you can eat 2 servings of fruit each day?	15 (17.2)	33 (37.9)	39 (44.8)
How sure are you that you can eat 3 servings of fruit each day?	36 (41.4)	30 (34.5)	21 (24.1)
How sure are you that you can eat 1 serving of vegetable each day?	9 (10.3)	10 (11.5)	68 (78.2)
How sure are you that you can eat 2 servings of vegetable each day?	14 (16.1)	31 (35.6)	42 (48.3)
How sure are you that you can eat 3 servings of vegetable each day?	35 (40.2)	30 (34.5)	22 (25.3)
Child willingness to try fruits and vegetables	**No**	**Maybe**	**Yes**
Would you be willing to taste a new dish (i.e. casserole)?	30 (34.5)	16 (18.4)	41 (47.1)
Would you be willing to taste a new vegetable?	9 (10.3)	12 (13.8)	66 (75.9)
Would you be willing to taste green squash?	44 (50.6)	20 (23.0)	23 (26.4)
Would you be willing to taste yellow squash?	43 (49.4)	13 (14.9)	31 (35.6)
Would you be willing to taste cauliflower?	38 (43.6)	19 (21.8)	30 (34.5)
Would you be willing to taste grape tomato?	28 (32.2)	11 (12.6)	48 (55.2)
Would you be willing to taste cucumber?	26 (29.9)	9 (10.3)	52 (59.8)
Would you be willing to taste celery sticks with dip?	22 (25.3)	10 (11.5)	55 (63.5)
Would you be willing to taste broccoli?	14 (16.1)	7 (8.0)	66 (75.9)
Would you be willing to taste baby carrots?	9 (10.3)	9 (10.3)	69 (79.3)
Would you be willing to taste a new fruit?	3 (3.4)	9 (10.3)	75 (86.2)
Would you be willing to taste apricot?	32 (36.8)	19 (21.8)	36 (41.4)
Would you be willing to taste honeydew melon?	25 (28.7)	25 (28.7)	37 (42.5)
Would you be willing to taste plum?	18 (20.7)	19 (21.8)	50 (57.5)
Would you be willing to taste blueberries?	18 (20.7)	18 (20.7)	51 (58.6)
Would you be willing to taste mandarin oranges?	4 (4.6)	5 (5.7)	78 (89.7)

willingness to try fruit and vegetable items are further detailed in Table 4. Most children (n = 59; 68%) said they would work in a garden and the majority (n = 71; 82%) answered they would eat food grown in their garden.

Among parents, the internal consistency of each theory-driven construct was high (Cronbach's alpha, 0.77–0.88; Table 1). Mean gardening attitude, belief, and self-efficacy scores among parents were all above average (Table 1). When asked about the availability of 16 fruits and 23 vegetables in the home, the general response was that these were 'sometimes' available in the home, with higher vegetable availability compared with fruit availability. Similarly, the variety of vegetables in the home was higher than fruit variety. Parents were neutral in their intention to garden in the community where they lived and slightly more positive about their intention to garden at home, with an average of 4.9 (SD = 2.9) and 6.28 (SD = 2.84) on a scale of 1 (strongly disagree) to 10 (strongly agree), respectively. On a similar 10-point scale, parents scored high on eating food grown out of a community and home garden (mean = 7.2, SD = 3.0; and mean = 8.0, SD = 2.7, respectively) and stated it was important to eat more fruits and vegetables, both for themselves and their children (mean = 8.4, SD = 1.9; and mean = 8.9, SD = 1.4, respectively).

Regression modeling showed parent gardening attitudes and beliefs strongly predicted intentions to garden at home (R^2 = 0.40; F = 20.7; $p < 0.01$), with attitudes providing the strongest prediction followed by beliefs. Intentions for community garden engagement was also significant, yet weaker (R^2 = 0.10; F = 5.0; $p < 0.01$), and indicated that gardening beliefs were most important compared with nonsignificant attitudes.

DISCUSSION

Although recommendations have been made to apply the CBPR approach to community garden efforts, this is the first known community garden study to apply CBPR principles.[3,4] The overarching CBPR approach, mixed methods design, and application of a social-ecological framework integrated with individual-level behavior change theories yields several important lessons. The successful progression of a CBPR partnership is not merely defined by the significance of the data, but also by intermediate outcomes such as capacity building and cogenerative learning.[20] Important principles central to CBPR are signified through utilization of the CPPE process and engagement of community members in identifying problems and solutions as well as conceptualizing and participating in the research process. As a result of this study, the community has gained confidence and appreciation for their ownership in the research process and developed trust in the researchers' motives to advance research initiatives that have been deemed a priority by the community. Furthermore, the researchers have begun to learn and value the unique needs, strengths, and dynamics of the Dan River Region community.

The qualitative phase of this study helped to identify important factors that will promote implementation and maintenance of community garden programs in the region. Congruent with the CPPE workshop,[25] stakeholders external to the task force held positive attitudes toward community gardens and identified community gardens as a means to increase fruit and vegetable intake in a region plagued by limited access to fresh produce. Results from the key informant interviews strongly support the need for multifaceted interventions that span individual and community/environment levels within the region, which is consistent with recommendations about community gardens.[3,4,41] As efforts progress to develop community gardens in the region, it will be important to address key barriers, such as concerns of leadership, resources, and sustainability of community garden efforts.

The quantitative data provided by the youth provide important baseline data for understanding factors impacting gardening interests as well as fruit, vegetable, and gardening behaviors. Given the youth's high interest in gardening, community gardens maybe a viable strategy to engage and educate the children on healthful nutrition behaviors. A recent youth gardening–based review revealed inconsistent results of youth self-efficacy to consume fruits and vegetables.[3] When involved in community garden programs, two studies found no improvements in youth self-efficacy to consume fruits and vegetables,[8,42] whereas another stated an improvement, but did not provide test statistics on the significance of the change.[43] These prior studies and the fact that self-efficacy of youth in our study were relatively high, suggest the importance of programming that goes beyond individual-level factors to also address social, environmental, and policy influences of fruit of vegetable intake among youth. Related to willingness to try fruit and vegetables, two studies involving younger children have shown an increased willingness to taste fruits and/or vegetables when exposed to garden-based nutrition

education[7,44]; however, one study showed no improvement in willingness to try.[6] Our findings of greater willingness to try fruit than vegetables are consistent with previous studies that reveal higher fruit preferences than vegetable preferences.[3] Of particular interest, our results revealed that youth are least likely to try the types of vegetables grown in a garden (i.e., green squash, yellow squash, cauliflower, grape tomatoes), which provides important information to inform the development and implementation of community garden programs.

Among parents, the low home availability and variety of fruits and vegetables indicates a clear target for community-garden intervention strategies. Only one known study has examined change in fruit and vegetable home availability from the gardening program and found no change.[42] Additional experimental studies that are adequately powered and of sufficient length and duration are needed to further explore the potential of a community-garden program to increase the home availability of fruits and vegetables along with the subsequent impact this has on consumption behaviors. The intention to garden at home and in their community was neutral, despite the overall findings that parents would eat the fruits and vegetables from the garden and generally agreed that it was important for themselves and their children to each more fruits and vegetables. As supported by the literature,[10] our study found that attitudes were the best indicator of intentions to garden among parent. Our findings suggest that intervention efforts to improve attitudes and beliefs about gardening may increase the intention to garden. As suggested by the TPB, intentions are the most important determinant of a person's behavior.[1] Our findings of gardening beliefs as an indicator for community garden engagement are also consistent with a recent review,[4] that reported health benefits as a motivator of adult gardening participation. Finally, our quantitative results explain previous qualitative studies reporting access to fresh foods and health benefits as primary motivations for community garden participation.[17,41] In summary, the quantitative phase of this study helps identify numerous targets that community gardens could focus on to assist youth and parents in making healthy behavior changes.

Dissemination of Findings and Progress of the Community–Academic Team

Outcomes facilitated by this study helped the task force ignite community-wide interest for the first regional Community Garden Forum in January 2011, which had 46 attendees and aroused local media attention. The forum included (1) a presentation on this study's findings and evidence-based literature associated with community gardens, (2) a moderated panel discussion facilitating local community members to share experiences and/or visions for community gardens, and (3) small group discussions on the logistics on planning, implementation, and evaluation of community gardens.

Subsequently, the nutrition subcommittee has continued to explore methods for community garden initiation and sustainability. The documented progression of the partnership and data generated from this community garden pilot study were used to secure grant funds, which include aims to advance community capacity and community garden efforts. In addition, four organizations in the region (including two organizations involved with the CBPR partnership) received funding and launched a community garden in the spring of 2011. Six community gardens are currently participating in an evaluation using the RE-AIM framework[45-47] to understand the reach and effectiveness of community gardens. Furthermore, the CBPR partnership is currently engaging two local housing authorities to design a youth garden-based nutrition education intervention. Finally, the community–academic team has recently formalized their organizational structure with bylaws and an elected steering committee, as well as established their name 'The Dan River Partnership for a Healthy Community' with the mission "to foster community partnerships to combat obesity in the Dan River Region through healthy lifestyle initiatives."

Limitations

This study is not without limitations. First, the overall scope of this pilot project is relatively small and results may not be generalizable to other communities or CBPR partnerships. Second, although participation rates were high for the quantitative survey, only 10 of 52 stakeholders responded to the qualitative survey. This large nonresponse may impose bias related to the overall conclusions and enthusiasm toward community gardening efforts in the region. As mentioned, the most common reason stated for refusal to participate was stated lack of knowledge and/or familiarity with community gardens in the region. Timing and inconvenience of this study is another explanation of the low response rates. Numerous members of the farming population were identified as stakeholders; however, the

timing of the study was when they were busy harvesting. Also, interviews took place when schools were out of session; thus, it was difficult to interview more stakeholders from schools. We further suspect that many of the people identified through our snowball sampling approach were not familiar with regional community garden efforts. Next, although we surveyed parents from four summer camps that were recommended by our CBPR community partners as serving low socioeconomic residents, the income level of respondents was higher than the broader region and should be considered in the interpretation of our findings. Finally, because a suitable theory-guided instrument to assess community gardens constructs (i.e., gardening attitudes, beliefs, self-efficacy, and intention) did not exist, we used a solid methodological approach and adapted previous instruments to gardening.[38,39] Although time and resource intensive, open-ended and in-depth elicitation studies are needed to fully understand the salient beliefs associated with gardening in the target population and to promote the development of appropriate and valid instruments.[4] Even so, the high internal consistency of each constructs provides evidence that the theoretically derived and adapted items performed sufficiently well in this study. Despite these limitations, this research illustrates the successful partnering a community–academic team and has provided the partnership with a clearer lens to conceptualize and launch future community garden efforts within the region.

CONCLUSION

Although the popularity of community gardens has risen dramatically over recent years, the potential impacts of community gardens across numerous levels of influence remains largely understudied. Combining the strengths of a cohesive and engaged CBPR partnership along with a social-ecological perspective to understand factors that will promote the success of a community garden initiative has tremendous potential to improve health disparities in this vulnerable region, as well as advance the scientific evidence related to community gardens. Unlike "community-placed" interventions,[3,20] the Dan River Partnership for a Healthy Community offers an organizational structure and capitalizes on local expertise to ensure long term follow-up and promote the sustainability of this community garden initiative. As a result of this pilot study and successful community–academic collaboration the Dan River Partnership for a Healthy Community will continue to target a social-ecological approach to understand the potential impacts of community gardens in the region.

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