

**GARDENING AND NUTRITION:
A SYSTEMS APPROACH TO AN INTERVENTION AND EVALUATION**

by

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The overarching goals of this paper are to promote the use of gardens as a systems approach to education, and propose that they should be evaluated as such. Current literature shows the positive effect of gardening education on nutrition, including consumption of fruits and vegetables and nutrition knowledge. A wealth of anecdotal evidence reveals that gardening education programs affect multiple domains in the lives of participants. The first objective of this paper is to review gardening programs with nutrition education components in literature to understand the areas where these programs are already effective and what gaps still need to be filled. Another objective is to propose evaluative tools for an existing gardening program entitled “My Garden Vegetables” in Wilksburg, PA. These proposed tools will assess both nutrition education components of the program and components related to cooperation, sharing, and the environment. Such evaluations provide information that is vital for reshaping the goals and objectives of future programs. The proposed evaluation tools consist of a food frequency questionnaire, food preference questionnaire, nutrition knowledge game, focus group questions, interview questions, and observations. Once implemented, this evaluation has the potential to add valuable data to the relatively minimal body of research related to systems effects of gardening programs. The public health significance of this paper is that with childhood obesity on the rise, we have the opportunity to create lasting programs that not only influence nutrition knowledge but integrate that knowledge into a child’s understanding of his or her role in changing the environment and developing cooperative networks.

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1.0 INTRODUCTION

In the summer of 2007 I completed a practicum entitled “My Garden Vegetables” at Hosanna House, Inc. in Wilkesburg, PA. Carrie Falvo, a dietitian and University of Pittsburgh student, also completed this practicum and we received help from other volunteer students from the Graduate School of Public Health (GSPH), University of Pittsburgh. The idea for this practicum was developed at a Community Health Assessment class at Hosanna House instructed by Dr. Christopher Keane of the University of Pittsburgh, GSPH, Department of Behavioral and Community Health Sciences (BCHS), in which several students assessed food availability and food choices in Wilkesburg. An existing partnership between GSPH and Hosanna House Inc. facilitated the foundational work for the practicum between Dr. Keane and Tammy Thomas, the Coordinator of Community Programs for BCHS, with administrative work from Steve Hellner-Burris and Emily Galbreth at Hosanna House. Dr. Keane, Tammy Thomas, Carrie Falvo, and I organized meetings, planned the curriculum, and developed the garden space. We also secured donations from local businesses and coordinated work with Hosanna House.

Using General Mills funding from a grant written by Dr. Keane, a nutrition education, gardening and art program (“My Garden Vegetables”) was developed for summer camp children ranging in age from six to twelve years. The purpose of “My Garden Vegetables” as stated in the grant application was to promote fruit and vegetable consumption and physical activity through participatory gardening (Keane, 2007). Gardening has proven to be a successful tool in

teaching nutrition to children (See Table 2). The program was treated as a pilot study that would need to be evaluated, modified, and implemented again the following summer (2008). Therefore, implementing a summative evaluation for several of the program's desired outcomes will provide insight into necessary improvements in the program as well as potential changes in fruit and vegetable consumption, fruit and vegetable preference and nutrition knowledge. Subsequently, this paper provides formative evaluation tools to assess how an intervention such as gardening and its attempts to improve nutrition affects a child's ideas about sharing, cooperation and the environment. The desired outcomes in the General Mills grant proposal were: to increase consumption of fruit and vegetables, to enjoy vegetables, and to compare personal and team progress of fruit and vegetable consumption with a goal. Activities that were hypothesized to lead to the outcomes were: to select healthy meals in the MyPyramid Blastoff game, to engage in physical activity each week, to acquire basic gardening skills, to grow vegetables and take home to parents and to create garden art and photovoice snapshots of meals and gardens (Keane, 2007). In this paper, evaluative tools are proposed for the following desired outcomes and program activities: increasing consumption of fruit and vegetables, enjoying fruit and vegetables, and selecting healthy meals from the MyPyramid Blastoff game. Additional tools are provided to assess children's attitudes towards cooperation, sharing and the environment after completing the program.

The overarching goal of this paper is to promote the use of gardens as a systems approach to education. It is proposed here that a simple nutrition education program devised with a systems approach has the potential to affect other domains of a child's life including sharing, cooperation and the environment. Fritjof Capra, a physicist and founder of the Center for Ecoliteracy (CEL) in Berkeley, CA states that, "thinking systematically requires several shifts in

thinking: from the parts to the whole; from objects to relationships; from objective knowledge to contextual knowledge; from contents to patterns; from quantity to quality; from hierarchies to networks; from structure to process” (Stone, 2002). Garden-based nutrition education can be consistent with Capra’s systematic approach to thinking and education if we begin to approach the interventions as tools to influence multiple domains of a child’s life.

Stemming from the overarching goal are several research questions. The first is “In regards to nutrition education, what do gardening programs already provide?” The second question involves evaluative tools for “My Garden Vegetables” and asks, “What evaluative tools can be produced for an already existing gardening program? How can we evaluate General Mills grant objectives and gather information about the participant’s understanding of environment, sharing, and cooperation?” Therefore, the first objective of this paper is to review gardening programs with nutrition education components in literature to see the areas in which gardening programs are already effective. The next objective is to propose evaluative tools for an existing gardening program entitled “My Garden Vegetables” in Wilkinsburg, PA. These proposed tools will assess both nutrition education components of the program and components related to cooperation, sharing, and the environment. The literature provides insight into the goals of urban gardening and its effectiveness at not only teaching nutrition, but also integrating that nutrition education into other domains of the child’s life such as the environment, community, and relationship to school. It also provides background on evaluative tools that have already been used in programs. In the long run, evaluation and quality systematic development of these garden programs should improve both the nutrition of the children, and their ability to apply integrated system thinking to other domains of their life and community.

2.0 BACKGROUND

The United States is currently facing a childhood obesity epidemic. Among children ages 6-19, 16% are overweight (Baskin, Ard, Franklin, & Allison, 2005). From 1980 to 2002 (according to NHANES data gathered from 1999-2002), child obesity (ages 6-11) doubled and adolescent obesity (ages 12-19) tripled (Baskin et al., 2005). Lack of fruit and vegetable consumption is a risk factor for obesity and data on fruit and vegetable consumption is also disheartening. Cullen et al. (2001) report that children ages 6 to 12 eat only 2.13 servings of fruit and vegetables per day, which is far less than the minimum requirement of 5 servings per day (Cullen et al., 2001). Low fruit and vegetable consumption is a risk factor for obesity because fruits and vegetables are replaced with increased consumption of energy-dense foods, beverages containing sugar and fast food (Ard et al., 2007). It is such an area of concern that Healthy People 2010 has set specific goals for fruit and vegetable consumption (FDA & NIH, 2000).

19-5 Increase the proportion of persons aged 2 years and older who consume at least two daily servings of fruit. The target for this goal is 75%.

19-6 Increase the proportion of persons aged 2 years and older who consume at least three daily servings of vegetables, with at least one-third of these servings being dark green or orange vegetables. The target for this goal is 50%.

Fruit and vegetable consumption is influenced by environmental, social, cultural, psychological, economic and behavioral factors which makes changing these patterns a multi-

faceted challenge (Granner et al., 2004). Table 1 lists several influences on fruit and vegetable consumption.

Table 1 General Influences on fruit and vegetable consumption

Influence	Reference
Home availability of fruit and vegetables	(Blanchette & Brug, 2005); (Dittus, Hillers, & Beerman, 1995); (Befort et al., 2006); (Baranowski et al., 1993); (Granner et al., 2004); (Weber Cullen et al., 2003)
Environmental availability of fruits and vegetables	(Baranowski et al., 1993); (Reinaerts, de Nooijer, Candel, & de Vries, 2007); (Weber Cullen et al., 2003)
Increased access to low-cost convenience foods (income for fruits and vegetables is displaced)	(Ard et al., 2007); (Befort et al., 2006)
Parental modeling	(Sylvestre, O'Loughlin, Gray-Donald, Hanley, & Paradis, 2007); (Baranowski et al., 1993)
Perceived high cost of fruits and vegetables	(Ard et al., 2007); (Dittus et al., 1995)
Avoiding diseases such as cancer increases fruit and vegetable consumption	(Dittus et al., 1995)
Attitudes and motivation toward health	(Dittus et al., 1995)
Concern about agrichemicals	(Dittus et al., 1995)
Preference	(Granner et al., 2004); (Domel Baxter & Thompson, 2002); (Fontenot Molaison, Connell, Stuff, Yadrick, & Bogle, 2005); (Lautenschlager & Smith, 2007b); (Blanchette & Brug, 2005); (Reinaerts et al., 2007)
Perceived Self-Efficacy realized through asking skills and selection	(Blanchette & Brug, 2005); (Granner et al., 2004)
Exposure to fruits and vegetables	(Koch, Waliczek, & Zajicek, 2006); (Morris & Zidenberg-Cherr, 2002) (Lineberger & Zajicek, 2000)
Access to unhealthy foods such as school snack bars (inversely associated with fruit and vegetable consumption)	(Blanchette & Brug, 2005); (O'Toole, Anderson, Miller, & Guthrie, 2007); (Wiecha, Finkelstein, Troped, Fragala, & Peterson, 2006)
Infrequent family meals negatively affects fruit and vegetable consumption	(Befort et al., 2006); (Granner et al., 2004); (Reinaerts et al., 2006)
Television Viewing (inversely associated with fruit and vegetable consumption)	((Blanchette & Brug, 2005); (Befort et al., 2006)
Cultural influences such as: where, when what, how and with whom children eat	(Reinaerts et al., 2006); (Koch et al., 2006)
Low-education produces barriers to consumption	(Koch et al., 2006)
Low SES produces barriers to consumption	(Koch et al., 2006)
Peer influence	(Granner et al., 2004); (Baranowski et al., 1993); (Reinaerts et al., 2006); (Blanchette & Brug, 2005)

Therefore, when developing goals and objectives for fruit and vegetable consumption, it must be realized that we are dealing with multiple influences on behavior. As Table 1 suggests, these influences come from the external environment, the home and school environments,

preference, and peer and familial pressure. Because of the many issues that affect proper nutrition and fruit and vegetable consumption among adolescents, it seems overwhelming for one nutrition education approach to address all of these issues. However, Ozer (2007) has recently suggested “school gardens as systemic school-level interventions with the potential for (a) promoting the health and well-being of individual students in multiple domains and (b) strengthening the school environment as a setting for positive youth development (Ozer, 2007). A garden can also be a fulfillment of the recommendation by the Centers for Disease Control and Prevention (CDC) to provide a school environment that is friendly to physical activity and healthful eating choices (CDC, 2003; Graham & Zidenberg-Cherr, 2005). It is a place where a child’s imagination is explored. Cason (1999) explains, “Gardens furnish a context for play, investigation, experimentation, and imagination. Children bring enthusiasm, interest, curiosity, and energy to cultivate and maintain a garden.” This enthusiasm can then be directed to other domains of the child’s life.

2.1 NUTRITION EDUCATION USING GARDENS

This section provides background on the use of gardens as educational tools and includes a general overview of garden-based nutrition programs and their results.

2.1.1 Overview of Programs

The use of gardening as an educational tool is not entirely new, and its benefits for the community include: promotion of sharing, mental health activity, increased willingness to go to

school, moral development, youth crime prevention, healing and therapy, increased produce accessibility, and enjoyment of nature, etc. (Armstrong, 2000; Ferris, Norman, & Sempik, 2001). In recent years gardening in schools has received revitalized attention as a way to teach not only science and math but also nutrition. This renewed attention to gardening has set the table for a number of nutrition education programs that address such issues as childhood obesity and the consumption of fruits and vegetables (domains that reinforce each other).

Table 2 gives an overview of gardening programs providing nutrition education to children. Target audiences vary as do the results of the programs. A mixture of urban and non-urban programs is included.

Table 2 Overview of Gardening Interventions offering Nutrition Education to Children

Article	Target Audience	Intervention	Behavioral Theory	Results/Evaluation
Cason, 1999	South Carolina Elementary School	“KinderGarden”. Children learn about nutrition, identify fruits and vegetables, prepare and consume fruits and vegetables, and develop behaviors that help their health.	Not stated	1) 43% increase in amount of students who could identify vegetables and 42% increase in amount of students who could identify fruits. 2) 53% decrease in number of students identifying junk food as the “best snacks”. 3) 69% increase in willingness to taste fruits and vegetables.
Koch et al., 2006	56 children (2 nd through 5 th grades) in Texas	“Health and Nutrition from the Garden”: Garden program to teach health and nutrition. Objectives relate to knowledge, attitudes and behaviors.	Not stated	1) Knowledge about benefits of eating fruits and vegetables significantly improved (by 3.69 points on a scale of 0-18 points). 2) No improvements in attitude scores. 3) There was an increase in reported healthy snack consumption. 4) Fruit and vegetable preference scores did not significantly improve.
Lautenschlager & Smith, 2007b	Youth ages 8-15 involved in a gardening program in Minneapolis/ St. Paul, Minnesota. Multi-ethnic, low-income sample of youth enrolled in Youth Farm Market Project.	“Youth Farm Market Project (YFMP)”: Educates youth about environmental responsibility, empowerment and cultural expression, racism and poverty using cooking groups, markets, activities in science, health, nutrition and literature, and field trips.	Theory of Planned Behavior-constructs include attitude, subjective norm, and perceived behavioral control.	1) Found that attitude is the most predictive of intention, compared with subjective norm or perceived behavioral control. 2) Program positively influenced fruit and vegetable consumption in boys. 2.01 servings pre mean, to 3.05 servings post mean for fruit. 2.05 servings pre mean to 3.43 servings post mean for vegetables. 3) The TPB model was successful in explaining the variance in intention and behavior in this group.
McAleese and Rankin, 2007	99 Sixth grade students at three different elementary schools (1 control group and 2 treatment groups- nonequivalent control group design).	“Nutrition in the Garden” -12 week nutrition education program. -1 treatment group also participated in gardening activities. -24 hour food recall- workbooks completed pre- and post- intervention.	Not Stated	1) Increased servings of fruits and vegetables in garden-based group. Fruit: increase of 1.13 servings. Vegetables: increase of 1.44 servings. 2) Increases in Vitamin A, Vitamin C, and fiber. Vitamin A: Increase of 181.99 ug RAE. Vitamin C: Increase of 85.27 mg/day. Fiber: Increase of 4.24 g.

Table 2 Continued

Morris, Neustadter, & Zidenberg-Cherr, 2001	First grade students Two schools selected; one experimental and one control, 97 students in total.	Pilot Garden Study: Assess feasibility of conducting and evaluating a garden-enhanced nutrition education program. -Education sessions integrated into classroom curriculum. -Planting, maintaining, and harvesting fall and spring gardens.	Social Cognitive Theory: knowledge, behavior, and environment	1) Increased willingness to taste vegetables grown in the garden. F=11.012, p<0.005 2) Improvement in ability to visually recognize food groups. 3) Students in intervention group were more willing to taste spinach, carrots, peas and broccoli at the post-test time. 4) Preference data was not significantly affected and no significant improvements in ability to correctly name vegetables.
Morris and Zidenberg-Cherr, 2002	Three schools from a local district (quasi-experimental design).	Nutrition lessons combined with planting and harvesting vegetables (1 year program).	Social Cognitive Theory-continuous visual reinforcement	1) Intervention with gardening improved both knowledge (33% improvement) and preference. 2) Improvements were maintained at the 6-month follow-up period.
O'Brien and Shoemaker, 2006	After-school gardening program: -17 in experimental group. -21 in control group. -Elementary schools in Manhattan, KS.	" <i>Junior Master Gardener: Health and Nutrition from the Garden</i> ": Eight lessons of gardening and nutrition education. 30 minutes of gardening time each lesson.	Self-efficacy and outcome expectations mentioned- Social Cognitive Theory.	1) Vegetable preference did not change. 2) Experimental group maintained high self-efficacy and outcome expectations scores.
Ozer, 2007	Review of literature on impact of school gardens.	Review of literature on impact of school gardens.	Ecological Theory	1) School gardens have the potential to promote health and well-being of students and strengthen the school environment. 2) There has been no systematic study of the impact of school gardens.

Table 2 clearly shows successes in affecting the nutrition of program participants, mainly in the areas of fruit and vegetable consumption and nutrition knowledge. However, it also displays a gap in extending nutrition goals of gardening programs to other domains. There are additional articles that examine gardening among adults or gardening programs that do not provide nutrition education and instead focus on domains such as lifeskills, enjoyment of school, moral development, and violence prevention (Alexander, North, & Hendren, 1995; Armstrong, 2000; Blair, Giesecke, & Sherman, 1991). These articles were not included in Table 2 because they did not also contain a nutrition education component to their program. However, from the articles, it is clear that gardening is being used as an intervention or teaching tool in multiple domains.

2.1.2 Nutritional Benefits of Gardening

A review of the literature confirms that gardens-based nutrition interventions can be effective at teaching nutrition to children. Table 2 displays the results of reviewed gardening programs among children and it is apparent that gains in nutrition knowledge were attained as well as changes in consumption and a reported change in preferences for fruits and vegetables. However, very few of these program goals and objectives extend beyond changing nutrition knowledge, consumption, and preference. Their evaluations also do not seek to understand how a change in a child's understanding of nutrition would affect broader elements such as the ones proposed in this paper (sharing, cooperation and the environment). A more detailed discussion of these programs will reveal the positive effects that they had (especially in areas of knowledge, consumption, and preference), and identify avenues for future work and improvement.

Nutrition knowledge and consumption patterns in children are key areas that gardening programs aim to affect. Fruit and vegetable consumption is an area of spotlight because of the low levels of fruit and vegetable intake among children and adolescents in the United States, despite the numerous health benefits of their consumption. Koch et al. (2006) evaluated whether or not their summer gardening program in Texas increased fruit and vegetable knowledge, attitude and consumption (Koch et al., 2006). The program operated under the assumption that exposure to fruits and vegetables and experience in preparing them can increase fruit and vegetable consumption (Koch et al., 2006). Using the program guide, “Health and Nutrition from the Garden”, a gardening program for 56 children in 2nd through 5th grades was implemented and evaluated. Knowledge about the benefits of eating fruits and vegetables and healthy snack consumption significantly improved, (See Table 2) but no improvements in attitude scores were recorded. Authors note that exposure to the program curriculum was expected to increase knowledge and that knowledge should influence attitudes. However, attitude scores were not affected. McAleese and Rankin (2007) additionally found an increase in fruit and vegetable consumption (higher in the experimental group with a gardening program than in the group with nutrition education alone) in their evaluation of the program entitled “Nutrition in the Garden” (McAleese & Rankin, 2007).

While fruit and vegetable preference does not always appear to change, several programs found increased knowledge about and willingness to taste new foods. Morris et al. (2001) reported an increased willingness to taste vegetables grown in the garden (essential to improving food preference) even though preference data was not significantly affected (Morris, Neustadter, & Zidenberg-Cherr, 2001). Because there are multiple influences on fruit and vegetable preference, it can be difficult to change preference scores through one intervention especially if

the child's environment returns to what it was before the intervention began. However, a change in willingness to taste fruits and vegetables is a promising score because it can lead to altered preference scores. Students in this intervention also showed great improvement in ability to visually recognize food groups and an increased willingness to taste spinach, carrots, peas and broccoli at the post-test time. Vegetable preferences also did not change in the O'Brien and Shoemaker (2006) evaluation of a gardening and nutrition education program in Kansas among fourth graders in an after-school program (O'Brien & Shoemaker, 2006).

Although Morris et al. (2001) did not find significant improvements in preference data, Morris and Zidenberg-Cherr (2002) reported significant changes in nutrition knowledge and vegetable preferences when evaluating the *Nutrition to Grow On* program in upper elementary school children (Morris, Koumjian, Briggs, & Zidenberg-Cherr, 2002; Morris & Zidenberg-Cherr, 2002). There were nine nutrition lessons with accompanying garden activities and in-class activities covering plant parts, nutrients, the Food Guide Pyramid, serving sizes, food labels, physical activity, goal setting, consumerism and healthful snacks. Each lesson included a family newsletter; parents receiving this newsletter scored higher on nutrition knowledge tests than parents in the control group who did not receive the newsletter. A similar program was implemented among Kindergarteners in South Carolina (Cason, 1999). Students participated in gardening and nutrition education to learn to identify nutritious snack foods, identify fruits and vegetables, try new fruits and vegetables, help prepare fruits and vegetables, and acquire healthy behaviors. Quantitative and qualitative evaluations were carried out on parents and teachers pre- and post- program and showed that correct identification of fruits and vegetables increased dramatically (43% for vegetables pre- and 86% for vegetables post-). There was also a 69% increase in willingness to taste fruits and vegetables (Cason, 1999).

Garden-based nutrition interventions have many benefits in the realm of nutrition education especially in increasing nutrition knowledge. Several studies found changes in attitudes and an increased willingness to taste vegetables; it is this initial willingness to taste that has the potential to increase preferences for foods (Cason, 1999; Morris et al., 2002; Morris et al., 2001; Morris & Zidenberg-Cherr, 2002). Research has shown that increasing exposure (and thus, opportunities for tasting) of food affects preference scores for that food in a positive direction (Bom Frost, 2006; Cooke, 2007; Wardle, Herrera, Cooke, & Gibson, 2003). Some programs found an increase in fruit and vegetable consumption as well as an increase in healthy snack consumption (McAleese & Rankin, 2007). In addition to changes in knowledge and consumption, there is positive feedback on these programs from children, parents, teachers, and administrators. While continuing to work on improving nutrition knowledge and fruit and vegetable preference and consumption, we can increase the benefits to children even more by expanding program goals and objectives to other domains.

2.1.3 Systems Thinking: Gardening and Nutrition Education Extended Beyond Knowledge and Consumption

Few of the articles reviewed extend the benefits of gardening as a form of nutrition education to a systems understanding of benefits. This thesis proposes that a garden intervention for the purpose of nutrition education can expand beyond nutrition knowledge, fruit and vegetable consumption, and fruit and vegetable preference to a child's comprehension of sharing, cooperation and relationships between environmental elements. As stated by Capra previously, "thinking systematically requires a shift from objects to relationships" (Stone, 2002). Trochim et al. (2005) also state that, "Systems thinking is a general conceptual orientation concerned with

the interrelationships between parts and their relationships to a functioning whole” (Trochim, Cabrera, Milstein, Gallagher, & Leischow, 2005). Rather than compartmentalizing goals of a program, a systems approach addresses multiple domains and relationships that affect behavior; the ecological model can be used as a framework (Trochim et al., 2005). Systems thinking is often illustrated as either a mechanical system with machines consisting of interacting parts or a biological system composed of a living and evolving organism (Trochim et al., 2005). Both of these metaphors emphasize the dynamic nature of a system and the fact that numerous parts work together to make up a whole that is not the sum of the parts. Homer and Hirsch (2005) highlight in their discussion of system dynamics modeling that, “It has been argued that many public health interventions fall short of their goals because they are made in a piecemeal fashion, rather than comprehensively and from a whole-system perspective” (Homer & Hirsch, 2005). Although a challenge, it should be our purpose in public health to develop programs that are focused on building system thinkers.

Several reviewed articles briefly mention that benefits extended beyond the program’s original objectives. Cason (1999) mentions that the behaviors learned through the gardening intervention contribute to a healthy lifestyle and that children learn the relationships among people, plants and good nutrition (Cason, 1999). DeMarco et al. (1999) also site the benefits of nature interaction and the cooperation opportunities that gardening gives to children (DeMarco, Relf, & McDaniel, 1999). Using focus groups, Lautenschlager and Smith (2007a) found that youth in the Youth Farmer’s Market Program (YFMP) related gardening to dietary habits, social influences, nutrition knowledge and cooking (Lautenschlager & Smith, 2007a). YFMP had the potential to affect diet, environmental awareness, and appreciation for the environment. Lautenschlager and Smith (2007a) cite work done by Jennifer Wilkins with the Cornell

Cooperative Extension stating that gardens “provide space for community interaction, decision-making, problem solving, creativity, and celebration, thereby fostering neighborhood ownership, and civic pride” (Wilkins, 2000) in (Lautenschlager & Smith, 2007a). YFMP Participants learned social values, working with others, respecting others, and appreciating differences (Lautenschlager & Smith, 2007a).

Most articles mention the need for more evaluation of these programs. Ozer discusses the potential to promote health and well-being of students in “multiple domains” using school gardens (Ozer, 2007). Much of the groundwork laid in this evaluation proposal is from insight provided through Ozer’s review of gardening programs. Ozer sees several domains as interdependent such as physical health, mental health, peer relationships, and academic performance, and they can therefore be influenced through one intervention (i.e. the garden) (Ozer, 2007). Ozer states that although there has been growth of these garden programs, they have not been appropriately followed with assessments of their impacts. According to her review of peer-reviewed literature, there is promising evidence of positive results (both through evaluations and also through significant anecdotal evidence) but the body of peer-reviewed literature is very small at this point and there needs to be more research “using rigorous evaluation designs and sufficiently large samples” (Ozer, 2007). Ozer recommends using a social-ecological approach to evaluation that situates the child within his or her immediate context and emphasizes how one domain influences another.

Other articles independently discuss the benefits of gardening on domains of life other than nutrition. Gardens can improve the way one looks at his or her neighborhood, offer job skills, address depression, and lower crime in urban neighborhoods (Armstrong, 2000). Blair et al. (1991) found that people in Philadelphia worked in urban gardens for multiple reasons

including: recreation, mental health, physical health and exercise, produce quality and nutrition, spiritual reasons, self-expression and self-fulfillment, and cost and convenience (Blair et al., 1991). Gardens can also teach children about working with groups, self-understanding, leadership, decision-making, communication and volunteerism (Robinson & Zajicek, 2005). However, many of these articles also state the need for further research and evaluation of gardening programs especially if there is going to be an integration of social and physical environments (Armstrong, 2000).

2.2 EVALUATION

The “My Garden Vegetables” pilot program has already been implemented but has not been thoroughly evaluated. After implementation of the program again in the summer of 2008 and utilization of the evaluative tools proposed in this paper, effects of the program on nutrition knowledge and behavior can be understood and the program can be adjusted to better meet the needs of the community and reach the goals of the program. Summative evaluative tools (outcome measures) are provided in this paper (Sections 4.1.1 through 4.1.3) to evaluate whether there is any change from the start of the program to the end of the program in several of the grant objectives including fruit and vegetable consumption, fruit and vegetable preference, and nutrition knowledge. Summative evaluations seek to answer whether or not program goals and objectives were met but do not seek to establish causal relationships between programs and outcomes (Royse, Thyer, Padgett, & Logan, 2006). The design for implementation of the proposed evaluative tools is pre-test, post-test (A-B) because the tools will be administered at the start and at the end of the intervention (Royse et al., 2006).

Formative evaluative tools for “My Garden Vegetables” are also provided in the form of focus groups, interviews and observations to explore the systems benefits of the program and improve the program for future use (Section 4.1.4). Formative evaluations or process measures are conducted to improve and guide interventions by providing information about how the program is functioning (Royse et al., 2006). They also describe and monitor the program (Royse et al., 2006). Process measures usually focus on organizational functions of the program. Rather than employing a scientific methodology, the focus of formative evaluations is on information gathering (Royse et al., 2006). The purpose of conducting a formative evaluation for “My Garden Vegetables” is to gain an understanding as to whether or not the program is actually addressing gardening and nutrition within a system. The focus groups, interviews, and observations will gather information on the participant’s understanding of cooperation, sharing and the environment that are addressed by program lesson plans.

3.0 “MY GARDEN VEGETABLES” GARDENING INTERVENTION



Figure 1 A Gardening Plot at Hosanna House

3.1 PROGRAM OVERVIEW

Insight into the food environment of Wilkinsburg, PA was gathered from a Community Health Assessment course taught by Dr. Christopher Keane at Hosanna House in the fall of 2006. Key informant interviews, a walking tour of Wilkinsburg, and a community visioning exercise revealed several aspects of this food environment. According to Keane, “In Wilkinsburg, PA, nutritional health has several challenges including the accessibility of fast-food restaurants such as Taco Bell, KFC, McDonalds, Wendy’s, Subway, and a Get-Go-Giant Eagle food mart. A grocery store within the community has only recently opened to provide easy access to more nutritious foods” (Keane, 2007). Keane also notes that despite this fast-food culture there are several youth programs, some community gardens, a local food co-op and farmers’ markets, and

community house programming that can provide a healthy food environment and nutrition education to youth and adults in Wilkinsburg (Keane, 2007).

As stated in the introduction, the original purpose of “My Garden Vegetables” was to promote vegetable and fruit consumption and physical activity through participatory gardening. Nutrition education was taught to low-income urban youth using MyPyramid for Kids and materials that Carrie Falvo and I developed using the Team Nutrition curriculum from the United States Department of Agriculture (USDA) and information gathered from nutrition education literature. The children at the Summer Camp were led by dietitians, gardeners, and volunteers to grow and taste vegetables, create garden art, try healthy snack recipes, play games, and chart team vegetable and fruit consumption.

3.1.1 Activities of “My Garden Vegetables”

The following activities were carried out during the Summer of 2007.

- Participatory Gardening: Children envisioned and planned what they wanted their garden to look like. They also worked in the garden.
- Container Gardens: Each child took a container home with a vegetable to grow.
- Garden Art: Children completed garden art projects including painting boards, creating garden markers, and painting pots and containers.
- Taste-testing: Children were encouraged to sample fruits and vegetables to counteract food neo-phobias.
- Mini-cooking participatory lessons: Children were actively involved in creating their own healthy snacks.

- Nutrition Education: Team Nutrition and other successful nutrition education ideas were integrated into fun time of learning about food.
- Vegetable Eating Team Competition: Children set goals for their fruit and vegetable consumption as a team and kept track of this consumption on a poster
- Newsletters: Bi-weekly newsletters were sent home to parents informing them of their child's activities and recipes to try.

3.1.2 Desired Outcomes and Hypothesized Activities to meet Outcomes

The desired outcomes and activities below were defined in the General Mills Grant that provided funding for “My Garden Vegetables” (Keane, 2007).

- Increase consumption of fruits and vegetables
- Enjoy vegetables more, measured by before and after preference scores
- Count the number of fruits and vegetables eaten during lunch
- Compare personal and team progress with a goal
- Select healthy meals in the MyPyramid Blastoff game
- Acquire basic gardening skills
- Grow vegetables and take home to parents

3.1.3 Planning and Development

Lesson plans were developed to focus on gardening, nutrition and art. Team Nutrition materials published by the USDA served as the basis for nutrition education. Team Nutrition materials consist of a series of lesson plans developed for various age groups. Worksheets and game ideas

are also provided along with a CD containing the MyPyramid Blastoff game and food pictures helpful for teaching lessons. Art lesson plans included decorating container gardens, painting murals and creating garden markers. Objectives built into the art lesson plans included brainstorming, cooperation, collaboration and teamwork. These lesson plans were evaluated by Kathy Keane, a PhD student in the Art History Department at the University of Pittsburgh. See Appendix A for a sample art lesson plan and a sample nutrition education lesson plan. Nutrition education topics covered included:

- MyPyramid for Kids: Children learned about the new Food Guide Pyramid and what food belonged to each food group.
- Healthy vs. unhealthy snacking: Children made collages of healthy snacks on green paper (signifying that it is good to eat these foods) and unhealthy snacks on red paper (signifying to stop eating these foods).
- Taste-testing fruits, vegetables and grains: With cooperation from the East End Food Co-op and Giant Eagle, fruits, vegetables, and items with whole grains were offered for taste-testing.
- Creating healthy snacks: On several occasions, children were encouraged to make their own snacks following recipes with the ingredients that were provided.
- The importance of drinking water: Children played water balloon games, learned how much water they should drink each day, and watered the garden.
- Alternatives to soda: Children enjoyed mixing juice with seltzer water as an alternative to high sugar soda.

- Healthy choices when eating out: Menus from several restaurants were provided along with calorie and nutrient information for children to choose which options were the healthiest.

The main goals and objectives of these lesson plans were to increase nutrition knowledge and the ability to prepare one's own healthy snacks. The goal of serving healthy snacks every day was to increase preference and consumption of fruits and vegetables.

IRB approval for "My Garden Vegetables" was received from the University of Pittsburgh. Lessons were offered four days a week from the middle of June through the middle of August to children ages 6 through 12 participating in the Summer Camp program at Hosanna House, Inc. The children were divided into ten groups of ten to fifteen students each that rotated throughout the day to different education and activity programs at camp. As long as there were no special programs or field trips, each group participated in the gardening program twice a week. Children in the program were predominantly African American. Evaluations were not performed with the children although they did fill out food frequency questionnaires and food preference surveys at the beginning of the program.

3.1.4 Results and Evaluation

This section is a subjective discussion of program results based upon my experience with this program. One of the difficulties with the program was the large age span of the children who attended camp. We taught boys and girls from ages 6 to 12 and the same lesson plans could not be used for each group. So while I believe the younger children found the lessons and activities interesting, we had a more difficult time holding the attention of the older children. Recognizing this, we modified lesson plans to include a daily snack time, reviews of restaurant menus, and

how-to's of preparing recipes. Still, further changes need to be made for the next implementation, such as including additional games, art projects, and perhaps field trips to local gardens and stores for the older age groups.

It was clear from the beginning that the "My Garden Vegetables" project was needed in Wilkinsburg, not only to address the city's shortcomings in healthy food availability, but also to learn how to tap into the amazing amount of community resources available in the area. Even within the Summer Camp, the children and counselors consumed low quality, high calorie snacks and the government supplied lunches were high in saturated fat and processed sugar and low in whole grain, fruit and vegetable content. There were quite a few children (mostly in the older age groups) who were already overweight. We enjoyed introducing them to new fruits and vegetables and seeing their reactions (both good and bad). This is a high risk population and I believe continuing an improved version of the "My Garden Vegetables" program has the potential to greatly improve many lives.

IRB (Institutional Review Board) approval was received for the staff satisfaction surveys but very few were completed and returned. Some surveys expressed concern about the older students' receptiveness and attention to the lesson plans while others felt that the lessons were interesting and affected the way children think about nutrition. These comments should guide the modification of future lesson plans for this program.

As noted earlier, children filled out food preference and food frequency questionnaires that I developed based upon the literature. These were internal pilot surveys which were developed to provide valuable information on the feasibility of the surveys and whether or not children could understand them. Modified versions of these surveys are available in Appendix B.

As with any program, and particularly since this was a pilot program, many things should be improved before implementing the program again. With what we have learned and will learn through more evaluation, I believe that we can build a better program. A look at evaluations of other garden-based nutrition education programs provides background for the development of our program-specific evaluative tools.

3.2 EVALUATION METHODS OF GARDEN-BASED NUTRITION EDUCATION PROGRAMS

3.2.1 Evaluation in Literature

The desired outcomes from the General Mills Grant that need to be evaluated are nutrition knowledge (utilizing MyPyramid Blastoff Game), preference for fruits and vegetables, and consumption of fruits and vegetables. IRB approval must be obtained before these evaluations can occur because the children in the summer camp are ages six through twelve. Evaluation tools must be submitted to the Review Board before approval can be obtained.

These objectives have been evaluated in other gardening education programs (See Table 3). Tools that have become standard for evaluating these objectives include diet recalls, food frequency questionnaires, pre-and post- tests, and preference questionnaires. However, there is still discussion about the validity of several of these evaluation tools especially when consumption and preference are self-reported. Table 3 reviews evaluation techniques from the literature on general nutrition education programs and garden-based nutrition education programs as well as evaluation techniques used in nutrition research.

Table 3 Evaluation of Nutrition Education Programs and Evaluative Techniques used in Research from a Review of the Literature

Article	Type of Evaluation	Evaluation Method	Strengths of Evaluation Technique as noted by author	Limitations of Evaluation Technique as noted by author
Baranowski et al., 1993	Formative	Focus group discussions in preparation for school nutrition education program (held with students, parents, teachers, and food service workers).	Able to detect beliefs as well as diversity of beliefs and behaviors.	Bias in answers and answers were limited to only those questions that were asked.
Befort et al., 2006	Research on home food availability and settings for consumption.	Cross-sectional survey in adolescent clinic (ages 10-19).	Not mentioned	There is a need for validation of adolescent dietary instruments.
Blair et al., 1991	Summative	Food frequencies (non-quantitative) patterned after National Nutrition Health Examination Survey included 23 categories of vegetables, 6 of fruit, and 6 others. Dietary habits questionnaire and measures of life satisfaction also used.	Not mentioned	Not mentioned
Cason, 1999	Summative	Qualitative and quantitative techniques used. Parent and teacher surveys provided pre- and post-information about children's eating habits, attitudes, and knowledge. Student assessments included colorful picture pre- and post- tests measuring fruit and vegetable identification, willingness to taste, and an identification of the best snack.	Not mentioned	Not mentioned
Crawford, Obarzanek, Morrison, & Sabry, 1994	Research on best consumption measures to use.	Validity of 24-hour recall, 3-day food record and 5-day food frequency tested through observations of 9-10 year old girls.	Not mentioned	Low literacy, lack of knowledge of foods and food measurement, lack of experience in food preparation, lack of familiarity with components of mixed dishes, lack of interest, short attention spans.
Dirks and Orvis, 2005	Summative	Qualitative and quantitative measures including pre- and post- testing and a post- only survey.	Mixed methods approach used.	No specific evaluation measures for the Junior Master Gardener program. Materials had to be developed.

Table 3 Continued

Dittus et al., 1995	Research on attitudes toward nutrition and reported fruit and vegetable intake.	Survey addressing nutrition concern, perceived susceptibility to cancer, benefits of fruit and vegetable intake, and barriers to fruit and vegetable consumption. Food frequency questionnaire also used.	Series of statements was pre-tested and modified.	“Generality of attitudes toward nutrition may have been too vague to translate directly into the nutrition behaviors measured.”
Domel Baxter and Thompson, 2002	Research on child preference for and consumption of fruits and vegetables in school lunches.	Same-day diet recalls. Next-day diet recalls. Observations of school lunch. Child interviews about consumption.	Observations conducted meant that researchers did not have to solely rely on children self-reporting their dietary intake. Preferences recorded for specific fruits and vegetables in the lunches provided rather than fruits and vegetables in general.	Children may have confused how much they ate of an item with their preference for the item.
Fontenont Molaison et al., 2005	Research on influences on fruit and vegetable consumption.	Focus groups using SCT constructs.	Not mentioned	Peer pressure can influence response. Children vary in their skills at verbal expression.
Friel et al., 1999	Summative	Food-pairing questionnaire combining knowledge, preference, and behavior. Each section contained pictures of a healthy choice and an unhealthy choice.	Diary and questionnaire were consistent with each other.	Not mentioned
Gortmaker et al., 1999	Summative	Dietary intake measured with 24-hour recalls administered through interviewers conducted twice (at two week intervals). Food and Activity Survey (FAS). Dietary and Physical Activity Knowledge Scale measured knowledge of healthy food and activity choices.	24-hour recall shown to be reliable and valid in children grade 3 and up.	Noted that research after this study has indicated low-validity of the Food and Activity Survey.
Granner et al., 2004	Research on demographic differences affecting fruit and vegetable intake.	Self-report questionnaires containing 83 items including: family dinner frequency, normative beliefs, outcome expectations, parental food management, modeling, self-efficacy, fruit and vegetable availability index, food preference, attributes of food choice, and fruit and vegetable snack choice index.	Not mentioned	Data was collected by self-report. Fruit and vegetable intake measure not validated for adolescents.

Table 3 Continued

Hendy, Williams, & Camise, 2005	Formative (provide demographic information on children and parent ratings of their fruit and vegetable preferences). Summative	Lunch observations, Child interviews. Preference ratings during the interviews using cards with smiley faces.	Not mentioned	Not mentioned
Koch et al., 2006	Summative	Written Exam, fruit and vegetable preference questionnaire, and five interview questions.	Not mentioned	Not mentioned
Lautenschlager and Smith, 2007a	Summative	Focus Groups.	Not mentioned	Not mentioned
Lautenschlager and Smith, 2007b	Formative (for survey development). Summative	24-hour recall, survey.	Pilot study indicated good to excellent validity on the survey.	Not mentioned
Lineberger & Zajicek, 2000	Summative	Fruit and vegetable preference questionnaire. 24-hour recall journals.	Not mentioned	Not mentioned
McAleese and Rankin, 2007	Summative	Food recall workbook.	Food recall workbooks included: age-appropriate instructions, portion size illustrations, and other explanations for completion of workbook.	Self-reported data can be unreliable.
Morris et al., 2001	Summative	Pre-test and post-test evaluation consisting of a one-on-one interview to assess knowledge and attitudes. It included a vegetable tasting section.	Allowing children to taste foods in the interview gives more accurate taste preference results. Carrots were included to make the children feel more comfortable.	Not mentioned
O'Brien and Shoemaker, 2006	Summative	Nutrition knowledge questionnaire derived from Family Nutrition Program (FNP), Fruit and Vegetable Preference Questionnaire, Self-efficacy questionnaire.	Not mentioned	Not mentioned

Table 3 Continued

Reinaerts et al., 2006	Research on influences on fruit and vegetable consumption.	Written Questionnaire for background characteristics, psychological factors, social influence, accessibility and self-efficacy. Food frequency questionnaire.	Questionnaire based on previously validated questionnaire.	Parents reporting on habits of children may be unreliable. Self-reported data requires cognitive skills in children ages 8 and up.
Sylvestre et al., 2006	Research on influences on fruit and vegetable consumption.	Focus group discussions on fruit and vegetable consumption. Food frequency questionnaire- Ammerman's Dietary Risk Assessment.	By age 8, children can self-report intake. By age 10, children can reliably self-report intake.	Not mentioned
Tak, Te Velde, De Vriest, & Brug, 2006	Research	Food frequency questionnaires to compare parent reports of child intake with the child's report of their intake.	Not mentioned	Young children not able to do food frequency questionnaires. Children have low ability to estimate portion size. Low agreement between children and parent reports.
Wakefield, Yeudall, Taron, Reynolds, & Skinner, 2007	Formative	Participant observation, focus groups.	Inclusion of community members in development of research questions and interpretation of results.	Not mentioned
Weber Cullen et al., 2003	Research	Food record for consumption. Dietary Questionnaires.	Not mentioned	Two days of food records may provide unreliable results.

Table 3 shows that diet recalls and food preference questionnaires were common evaluation techniques although the researchers recognized that these techniques can be biased because they are based upon self-report. Focus groups and interviews were also used in some studies to supplement or replace questionnaires, but answers can also be influenced by societal norms and peer pressure. A review of evaluation tools used in other interventions provides insight into what tools are beneficial to use for the intended information. However, it is also clear that there have been few rigorous, comprehensive evaluations of garden-based nutrition programs. This is the gap that needs to be filled in research.

There are several measures that are frequently used to gather information about food consumption, including the 24-hour diet recall, 3-day diet recall and the food frequency questionnaire. There are strengths and limitations to each of these tools but the major limitation of all three is that they consist of potentially biased self-reports. Crawford et al. (1994) site that there are additional difficulties when using these kinds of measurements with children, including: low literacy, lack of knowledge of foods and food measurement, lack of experience in food preparation, lack of familiarity with components of mixed dishes and added ingredients, lack of interest, and short attention spans (Crawford, Obarzanek, Morrison, & Sabry, 1994). After testing the 24-hour recall, 3-day food record, and 5-day food record through evaluation of 9- and 10-year-old girls, Crawford et al. (1994) found the 3-day food record to be the most accurate between observed and reported consumption. Unfortunately, in our study we cannot observe every meal the child is eating to evaluate consistency in reporting. The problem with the 24-hour recall is that it is not appropriate for those people who have trouble remembering portion sizes (one of the major issues with self-report among children) (Mitchell, 2003).

Five studies in Table 3 used the food frequency questionnaire to measure consumption. A food frequency questionnaire is more focused upon food groups than specific nutrients and can calculate food consumed per day, per week or per month (Mahan & Escott-Stump, 2004). Because it may be difficult in our study to calculate consumption based upon serving sizes, it is beneficial to look at consumption during a week long period based upon how many times a week the child consumes fruits and vegetables (either alone or in a mixture of other foods).

4.0 PROPOSED METHODOLOGY FOR EVALUATION OF “MY GARDEN VEGETABLES”

4.1.1 Increasing Consumption of Fruits and Vegetables

One of the desired outcomes of this program was to increase the consumption of fruits and vegetables in participants from the beginning of summer camp (June) to the end of summer camp (August). An evaluation for “My Garden Vegetables” is proposed based upon a review of the literature.

Ideally, this summative evaluation is meant to show whether or not there is a change in fruit and vegetable consumption after children have participated in the program. Results from this questionnaire will help to direct future program lesson plans and activities. I developed a food frequency questionnaire using pictures of fruits and vegetables and categories for how many times a week the child eats each fruit or vegetable. The purpose behind using the food frequency questionnaire was to make reporting simpler than recording each food eaten during the day along with the portion size (and hopefully eliminating some error). Pictures of the food are included for those children who may have difficulty reading. This food frequency questionnaire will need to be tested for validity by using other food recall measures and comparing results.

Objectives for consumption:

1) *75% of children aged 6-12 enrolled in Hosanna House's Summer Camp will consume fruit at least two times per day by the third week of August 2008 (end of camp).*

2) *50% of children aged 6-12 enrolled in Hosanna House's Summer Camp will consume vegetables at least three times per day by the third week of August 2008 (end of camp).*

Evaluation Technique:

1) Food frequency questionnaire (Appendix B) completed by all children ages 8-12 in class the first day of camp (June) and the last Monday of camp (August).

2) Food frequency questionnaire (Appendix B) for children ages 6-7 given to each parent/guardian upon check-in at camp Monday and asked to be returned at check-in Friday of that first week. Questionnaire also given at check-in on Monday of the last week of camp and asked to be returned at check-in on Friday of the last week of camp (August).

3) Reported amounts tabulated for each fruit and vegetable as well as for the total fruit and vegetable consumption per week.

Changes from category of fruit or vegetable consumption will be analyzed using a two time-point logistic regression model with GEE (Zeger, Liang, & Albert, 1988). The categories of ≥ 2 fruits and ≥ 3 vegetables will be assigned the value "1" while the categories of < 2 fruits and < 3 vegetables will be assigned the value "0". Totals from the first week of camp will be compared with the last week of camp to evaluate whether or not any changes in consumption have occurred with the outcome being no change, a positive change (< 2 fruits and < 3 vegetables to ≥ 2 fruits and ≥ 3 vegetables), or a negative change (≥ 2 fruits and ≥ 3 vegetables to < 2 fruits and < 3 vegetables). Other covariates that will be analyzed include: age, preference at the end of

summer camp from the results of the food preference questionnaires, and gender. A chi-square test will be done for the entire population at the beginning of camp and again at the end of camp.

Food frequency questionnaires will be supplemented with interview questions to a sampling of children who will be asked about whether or not they think the gardening program is affecting their own fruit and vegetable consumption patterns (interviews described in section 4.1.4) because it will more clearly allow us to see whether or not the children are relating what they have learned in the program to their consumption. A summative evaluation is not meant to establish causal relationships and is hampered by the short amount of time during which the intervention is taking place as well as the fact that the intervention is taking place during the summer when fresh produce is more readily available at local farmer's markets. Food frequency questionnaires will not be able to clarify whether it is only "My Garden Vegetables" that is affecting consumption or whether it is a combination of factors. The intervention period is short and therefore may have reduced impact on consumption in general. However, it will indicate whether or not there are changes which can be explored through additional methods. The data will also contribute to consumption patterns of urban African-American youth.

4.1.2 Increasing Preference for Fruits and Vegetables

Preference for fruits and vegetables can be gauged through various questionnaires. The purpose behind this objective was to increase exposure of fruits and vegetables while children were in attendance at summer camp and allow them to try the fruits and vegetables available. Through the provision of a friendly and safe food environment and the offering of new foods, we hoped to increase preference for fruits and vegetables. Morris et al. (2001) included vegetable taste-testing in their assessment of vegetable preference (Morris et al., 2001). Once students tasted the

vegetable (if they wanted to), they were asked what they thought of it via a three point smiley face scale (Morris et al., 2001). I developed a similar fruit and vegetable preference questionnaire and piloted it at the beginning of Hosanna House's summer camp in June 2007 with positive results. Pictures were used for each fruit and vegetable and children were asked to circle the smiley face that corresponded with their like or dislike for that particular fruit or vegetable. The six-year-olds enjoyed filling out the survey and found it easy to do with the staff there for guidance if necessary. See Appendix B for the Food Preference Questionnaire. There are three smiley faces to choose from instead of five as would be present in a Likert Scale. The reason behind this is to simplify the questionnaire for the younger children. Hendy et al. (2005), O'Brien and Shoemaker (2006), and Koch et al. (2006) also used an abbreviated Likert Scale when asking about fruit and vegetable preference for the purpose of simplifying choices (Hendy, Williams, & Camise, 2005; Koch et al., 2006; O'Brien & Shoemaker, 2006). This food preference questionnaire will need to be tested for validity by comparing with results from similar questionnaires.

The recommended evaluation method for fruit and vegetable preference is based upon the objective "enjoy vegetables" for "My Garden Vegetables" and will evaluate whether or not this objective was met (Keane, 2007). Please note that fruit was also added to the preference questionnaire.

Objectives:

1) At the August evaluation (third week of August 2008), there will be a 15% increase in the amount of students ages 6-12 at Hosanna House's Summer Camp who enjoy (meaning: like the flavor) vegetables, indicated by the Food Preference Questionnaire.

2) *At the August evaluation (third week of August 2008), there will be a 15% increase in the amount of students ages 6-12 at Hosanna House's Summer Camp who enjoy fruit, indicated by the Food Preference Questionnaire.*

Evaluation Technique:

1) Food preference questionnaire (Appendix B) completed by all children ages 6-12 in class the first day of camp (June) and in class Monday of the last week of camp (August).

2) Preference scores tabulated for each fruit and for each vegetable as well as for the total fruit and vegetable preference. Total tabulations should be done per age and gender.

Statistical analysis will include: descriptive statistics, paired t-tests, and ANCOVA tests to compare outcome (additive score for either fruit or vegetable). The score is a continuous variable that is added separately for fruit and for vegetable, and the outcome is the score for either fruits or vegetables. Totals from the first week of camp will be compared with the last week of camp to evaluate whether or not any changes in preference have occurred, with the outcome being no change, a positive change, or a negative change. Other covariates that will be analyzed include: age, frequency of consumption at the end of summer camp from the results of the food frequency questionnaires (coded 0= <2 fruits and <3 vegetables and 1= ≥2 fruits and ≥3 vegetables), and gender. Values placed on the smiley faces are: 0 for frown, 1 for neutral face, 2 for smile (See Appendix B for food preference questionnaire).

Again, interview questions with the children will also pertain to how the children felt "My Garden Vegetables" affected their preference for fruit and vegetables.

4.1.3 Increasing Nutrition Knowledge

The MyPyramid Blastoff game was developed by the USDA for their Team Nutrition educational series (USDA, 2005). The game is played on the computer and consists of choosing healthy food options in order to educate on healthy food choices and how these options fit into the Food Guide Pyramid. The objective behind the use of this game at Summer Camp was to improve knowledge about healthy eating measured by improved game scores from the start of summer camp to the end of camp. Unfortunately, because the computers were being used for another class, we were not able to play MyPyramid Blastoff with the children. Instead, four MyPyramid/Team Nutrition lesson plans were taught incorporating the Food Guide Pyramid, physical activity needs, serving sizes, nutrition labels, healthy and unhealthy snacking, and restaurant menus.

It would be very beneficial to incorporate the MyPyramid Blastoff game into the lesson plans the next time this program is implemented. If the computers are not available during the garden time, a plan can be worked out for several computer classes to be dedicated to playing this game. The game allows for the input of name, gender, and age. Players must choose foods for meals and snacks, and add activity throughout the day. A running tally of choices is kept and in order for a rocket to launch, the child must pick the correct amount of food for each food group and add the appropriate amount of daily activity. A mission report is given at the end of the game to tell the child how well he or she did at the game and where the child can improve.

The recommended evaluation method for increasing nutrition knowledge is based upon the objective “select healthy meals from the MyPyramid Blastoff game” and will help to see whether or not there is a change in nutrition knowledge from the beginning to the end of the program (Keane, 2007).

Objectives:

1) At the August evaluation (third week of August 2008), there will be a 15% increase in the amount of students ages 6-12 at Hosanna House's Summer Camp who choose the correct amounts of foods needed to fit in the Food Guide Pyramid for their MyPyramid Blastoff game.

Evaluation Technique:

1) Each child will play the MyPyramid Blastoff Game on Tuesday or Wednesday (groups alternate days when they have access to a computer) of the first week of Summer Camp and the last week of Summer Camp. Scores will be printed and recorded for each child by age, gender, and total scores.

Scores from this game will allow us to see what areas of knowledge were gained and what areas were not affected. Statistical analysis of the MyPyramid Blastoff game will include: descriptive statistics, paired t-tests, and ANCOVA tests (Dirks & Orvis, 2005; Koch et al., 2006). The outcome will be the change in score from start to end of the program. Two points will be awarded for each food group that is given the correct amount of food while one point will be given if at least half of the food requirements for a food group are met. Two points will be awarded for choosing the correct amount of activity for the day while one point will be awarded for meeting this goal halfway. Covariates will include age and gender.

4.1.4 Focus Groups, Interviews, and Observations

The formative evaluation focuses upon gathering information about cooperation, sharing and the child's relationship to the environment. These concepts will be incorporated into lesson plans through planting in the garden and in containers, caring for the garden, cooperation in planning and developing artwork and playing various games. At the Summer Camp there are 10 groups of

about 10-15 children each assigned to groups based upon age and gender. The purpose for using focus groups, interviews, and observations is to see what the children are learning in regards to the environment, sharing and cooperation. If there are no connections made between the program and these items, lesson plans will have to be changed for the following year. There will also be questions asked during the interviews and focus groups about how the gardening program is affecting consumption of fruits and vegetables.

There will be four focus groups held with children ages 10-12. The children will be kept within their original groups, meaning that there will be two focus groups of 10-15 children each with boys and two focus groups of 10-15 children each with girls. These focus groups should be held in August during camp hours in a room separate from the classroom where there is both privacy and a quiet environment. Ideally, the focus groups should not last longer than is allotted for their garden class which is one hour.

Focus Group Questions:

Consumption:

1) Why do you eat fruits and/or vegetables? How do you eat them? (Lautenschlager & Smith, 2007a)

2) Since participating in this program, do you plan to eat more fruits and vegetables? Why? Why not? (Lautenschlager & Smith, 2007a)

3) Are there any fruits or vegetables that you tried while at camp that you plan to eat again when camp is over?

Environment:

3) What are some things that you learned about the environment this summer when you were gardening?

- 4) What are the benefits of gardening?
- 5) Did you like working and playing outside? Why or why not?

Sharing and Cooperation:

- 6) Would you rather do art projects like we did this summer by yourself or with other people? Why or why not?
- 7) What would be some benefits of a garden to people in your community?

These focus groups will be recorded and analyzed for content. Themes will be coded by three different people and summarized for each question.

Interviews will be conducted with a sampling of the younger children (ages 6-9). These children did not participate in focus groups, therefore the questions will be similar to those asked during the focus group time but modified to be age-appropriate. A random sample of students will be taken from each group (groups are based on gender and ages, in this case ages 6-9). The interview is projected to take 30 minutes to complete. If it is done with 3 students from each of these younger groups (6 groups), there will be 18 interviews for a total interview time of nine hours. The children for interviews can be chosen out of a hat or via a database of numbers.

Interview Questions:

Consumption:

- 1) What are some fruits and vegetables that you ate at camp this summer?
- 2) Do you think you will eat these fruits and vegetables again? Why or why not?

Environment:

- 3) What is something that you learned this summer while gardening?
- 4) What was your favorite part of working in the garden?
- 5) Did you like working and playing outside? Why or why not?

Sharing and Cooperation:

6) Was it easier to do things in the garden alone or with other people?

7) Did you get to share anything that you made or grew? How did that make you feel?

In addition to focus groups and child interviews, observations will be conducted each week of camp to supplement the information gained through other parts of the evaluation. Field notes will be kept for each observation period and transcribed at the end of each week.

Plan for observation:

1) 3 hours a week of recorded observation of children while working in the garden, learning about nutrition, playing games or creating artwork.

Analysis of data will take place through scanning transcripts of focus groups and interviews as well as field notes from observations for themes. These themes will be generated into codes and analyzed in statistical software such as SPSS.

4.2 DISSEMINATION OF RESULTS

Results of this evaluation should not only be available for the scientific community but also for the Wilkinsburg community. Parents of children attending Summer Camp should be notified of results through a newsletter. In addition, Hosanna House could post the results of the evaluation on their website and host a “Harvest Party” where parents and community members will not only look at all of the artwork and pictures of the summer gardening program but also learn about the results of the questionnaires, game scores, interviews, focus groups, and observations.

5.0 CONCLUSION

Current gardening literature contains a wealth of anecdotal evidence revealing that gardening education programs affect multiple domains in the lives of participants. The purpose of this paper is to promote the use of gardens as a systems approach to education. A review of the literature reveals the strengths that gardening programs have, especially when teaching nutrition, and the possibility to integrate that nutrition education into broader domains of a child's life. Therefore, evaluative tools are provided for an existing gardening and nutrition education program. The hope is that these tools will be utilized in "My Garden Vegetables" and adapted for other gardening programs in order to guide program goals and development.

5.1 STRENGTHS AND LIMITATIONS

Once implemented, these evaluative tools will add valuable data to the relatively minimal body of research related to systems effects of gardening programs containing nutrition education components. Nutrition education program goals in general have been compartmentalized, whereas the systems approach offers an integrated program for children highlighting relationships between humans and the environment. If the values and objectives of a program are to create systems thinkers, then the program must be evaluated on the ground that it can affect domains other than nutrition education. Fritjof Capra states,

You need to instill a certain passion for nature. You can't do that in the classroom alone. By growing and eating vegetables, they learn to see themselves as part of natural cycles. Our health depends on the health of our food, which depends on the health of the soil. Children learn that we are embedded in the soil. They see that we are not apart from nature but a part of it, and that therefore we must play our part (Stone, 2002).

It is proposed here that a basic nutrition education program devised with a systems approach has the potential to affect other domains of a child's life including sharing, cooperation and the environment. It therefore, extends beyond the objectives of many other nutrition education programs with the hope that participants will not only change consumption patterns but be able to relate that change to other areas of their lives.

Another strength of this paper is found in the food frequency questionnaire and food preference questionnaire developed specifically for children. Once implemented, these questionnaires will provide information on consumption and preference of mostly African American urban youth participating in "My Garden Vegetables".

A limitation in utilizing the provided evaluative tools is that there is no control group for comparison. This makes it difficult to know if it is "My Garden Vegetables" creating change in the lives of participants. Future evaluations should identify a control group for comparison. Another limitation is the short duration of the "My Garden Vegetables" program. Summer Camp lasts from the middle of June to the middle of August. Although participants attend camp every day of the week, it may not be enough time to significantly affect knowledge, attitudes and behavior.

5.2 IMPLICATIONS FOR FURTHER RESEARCH AND PROGRAM DEVELOPMENT

Not only should these gardening programs be evaluated based upon a control group, but future research should include other domains of interest such as food security, lifeskills, and a child's relationship to school. If gardening programs are to be implemented in schools across the nation, research must prove their benefit on multiple domains.

“My Garden Vegetables” can also be improved for future implementation. It would be beneficial for children to play games that not only encourage activity but also facilitate cooperation and sharing. An increased amount of hands-on work in the garden can also facilitate cooperation and sharing as well as provide for additional opportunities to interact with the environment. Lesson plans should be altered to provide education in additional areas where garden programs have been proven to be effective.

A systems approach offers us the chance to create integrated thinkers who can relate choices that are made in one domain with consequences or rewards in another. The Center for Ecoliteracy (CEL) in Berkeley, CA has taken this idea very seriously and pushed for the establishment of a garden on every school campus in addition to the creation of “curriculum integrating classrooms with hands-on gardening and cooking instruction” (Stone, 2002). Policies supporting these goals in other states have the potential to transform learning and food environments into places that look at entire systems rather than merely increasing the knowledge that a child has of daily fruit and vegetable servings.

At a time when childhood obesity is on the rise, we have the opportunity to create lasting programs that not only influence nutrition knowledge but integrate that knowledge into a child's

understanding of his or her role in a system, a system where people interact with each other and nature in a way that completely reshapes how a child looks at food.

APPENDIX A

LESSON PLANS

The following two lesson plans were developed for use at Hosanna House during Summer Camp. One plan focuses on art while the other teaches nutrition education. The plans are meant to be implemented with children ages 6-12.

A.1 SAMPLE ART LESSON PLAN

Garden Art 1

Painting Murals on Boards

Needed Supplies:

Boards (one large board per group)

Acrylic Paint

Large Paintbrushes

Containers for the paint, ones with broad openings that won't spill easily

Old t-shirts or aprons for the children to wear-remind them: don't wipe

hands on shirt and wear old clothing under paint-shirts

Newspapers or old sheet (mainly if inside)

I. Goals and Objectives

A. Goal: Children will begin a garden art project of board painting to decorate the garden space.

B. Objectives:

- 1) Children will brainstorm and come to a consensus on what pictures to paint and what colors to use on the boards.
- 2) After decision on design is made, there needs to be some kind of outline drawn (it can be very general) in pencil. The teacher would probably be the best to do this. This way the children have a guide for the large painted areas. Remind them that the large color areas are first and small details go on last. They can add the details later with the smaller brushes, after the first color dries.
- 3) Painting will begin.
- 4) Children will practice collaboration, cooperation, and teamwork skills. Everyone must play a role. If a child is being left out, encourage others to include them as part of the group.

II. Introduction

A. Discuss the necessity of creating a beautiful space and how important their artwork is to the garden. Be careful not to take up too much time talking.

- 1) Have them each work on an individual space on one mural unless the older students want to coordinate a mural.
- 2) What kinds of things might the community members like to see as they walk or drive by the garden space? What issues are important to communities?

B. This art will later be carried and placed in the garden for everyone to enjoy.

III. Set of Procedures

A. Boards should already be laid outside (best spot for painting). If concerned with paint going everywhere, put newspaper under the boards.

B. Brainstorm ideas for the murals until the children can agree on several ideas and who will do what part.

C. A very simple outline of large images should be drawn by teacher or counselor.

D. Begin painting. Encourage creativity and collaboration.

- 1) As the children are painting, go around to each child and ask them to share about their artwork.

E. Make sure enough time is left for clean up (at least 15 minutes) so that there can be preparation for the next group.

IV. Conclusion

A. Clean up: leave enough time for children to get cleaned up. This should be 15 minutes.

V. Assessment

A. None

VI. Assignment

A. None

A.2 SAMPLE NUTRITION LESSON PLAN

Team Nutrition 3

Vary Your Veggies and Focus on Fruit

Needed Supplies:

- Sensational Food Poster (already hanging up)
- MyPyramid for Kids Poster (already hanging up)
- Read it Before you Eat it Poster (already hanging up)
- Serving Size Poster (already hanging up)
- Copies of “Make a Fruit and Vegetable Diary”, enough for Groups 1, 2, 6, 7
- Yarn cut in pieces
- Handouts of Steps to a Healthier You (enough for Groups 3, 4, 8, 9)
- Markers
- Dry erase marker (these came with the Team Nutrition Fruit and Vegetable Challenge packets)
- Pictures of vitamin deficiencies from Krause’s Nutrition Book (tabbed in yellow)
- Copies of fast food and restaurant menus
- Nutrition labels
- Box of cereal and 1 c. measuring cup, Bowl

I. Goals and Objectives

A. Goals:

- 1) Children will identify fruits and vegetables they like and expand the variety of fruits and vegetables they eat.
- 2) Children learn about the nutritional qualities of vegetables and fruits and set goals to eat more fruits and vegetables.
- 3) Children will learn about nutritional content on several restaurant menus.

B. Objectives:

- 1) Students will be able to identify various fruits and vegetables.
- 2) Students will be able to count the number of fruits and vegetables eaten at lunchtime. (already doing this through the fruit and vegetable challenge).
- 3) Students will be able to record their progress on a chart.

II. Introduction

A. Today we’re going to learn some more nutrition facts and talk about fruits and vegetables. Our food comes in a variety of colors and flavors. Fruits and vegetables can be exciting ways to add variety to your meals. We’re also going

to evaluate the nutritional content from several nutrition facts labels and some restaurant menus.

III. Set of Procedures

A. Taste test (dried fruit, vegetable with dip?)

- 1) Set out the food for the children to test and discuss what they think of it.
- 2) You can try to do taste-testing score cards and explain that companies hire people to taste-test their food before they sell it to customers.

B. (Groups 1, 2, 6, 7) Challenge the children to name as many fruits and vegetables as they can in 1 minute. Write these on the board by food group with a dry erase marker.

- 1) Ask the children to look at the list they just developed. Are there any fruits and vegetables they have never tried? Introduce additional fruits or vegetables that they may not have mentioned.

C. Talk to the children about the importance of fruits and vegetables. Eating fruits and vegetables can help them to be healthy because of the vitamins that they contain. Show pictures of vitamin deficiencies.

- 1) Fruits and vegetables are excellent sources of many nutrients, including vitamins A and C, potassium and fiber.
- 2) Most fruits and vegetables are naturally low in fat and calories and do not contain cholesterol.
- 3) Vitamin A keeps eyes and skin healthy and helps to protect against infections.
- 4) Vitamin C helps heal cuts and wounds and keeps teeth and gums healthy.
- 5) Fiber keeps food moving through the digestive tract.
- 6) Dark green and orange vegetables are important to eat. Can you name some?

D. Pass out “Make a Fruit and Vegetable Diary” (for Groups 1, 2, 6, 7)

- 1) They will already be cut with a hole punched but they will need to be put in order and tied with string. Every day for a week have students write (or draw a picture of) all the fruits and vegetables they ate.

E. Pass out worksheet: “Steps to a Healthier You” for Groups 3, 4, 8, 9

- 1) Ask the students to look at the worksheet to see which of the steps they could take to meet their goal of increasing their intake of fruits and vegetables. Have the children circle on the worksheet the steps they plan to take. Point out that small changes really add up. Once they add new food and like it, they can add it to the foods they eat regularly. That’s how they can meet their goal.

F. Serving Size Activity

- 1) It’s time to see what accurate serving sizes actually look like.
- 2) Activity: Have someone pour cereal into a bowl to show how much they would eat for breakfast. A serving is 1 c. Measure out with the measuring cup how much they should be eating and then measure how much they actually put in the bowl.

a) According to the nutrition label, how many calories are they getting with what they put into the bowl? Is it more than the serving size states?

3) Objects for serving sizes:

a) Baseball=1 cup=1 cup cooked dry beans, 8 fluid ounces of milk or yogurt, 1 cup raw vegetables, 1 small apple, 1 medium pear, or 1 cup ready to eat cereal.

b) Deck of cards=2 to 3 ounces of meat

c) CD=1 slice of bread

d) Small computer mouse=1/2 cup=1/2 cup vegetables, 1/2 cup cooked rice, pasta or cooked cereal, or 1/2 cup fruit canned or chopped.

e) Two 9 volt batteries=1 1/2 ounces=1 1/2 ounces of cheese

f) One 9 volt battery=1 tablespoon=1 tablespoon butter

g) 4 fluid ounce juice box=1/2 cup=4 fluid ounces fruit juice

h) Is this what you expected? Is it less or more? Do you think you get more than what you should be getting?

G. What is in what you eat? (Nutrition Labels activity)

1) You can refer to the poster for this activity as well as the available nutrition labels.

2) Compare the available nutrition labels for % Daily Value. Which ones are high versus low? Is that a good or a bad thing?

3) What does the % Daily Value show you about the amount of nutrients in the foods you choose?

a) It shows the amount of nutrients in one serving of a food compared to the recommended amount of the nutrient for 2000 calories.

4) How can you use the Nutrition Facts label to make food choices?

a) See how the nutrients and calories change with amounts of food that are bigger or smaller than the serving size.

b) Compare the nutrients in two similar kinds of foods.

c) Choose to get less of some nutrients and get enough of others.

H. Fast food and restaurant menus for Groups 4, 5, 9, 10

1) There are menus from Eat'n Park, McDonald's, Wendy's, Taco Bell, Popeye's, and Ruby Tuesday.

2) The kids can look at these but the main point is to make them aware of how many calories (especially fat calories) are in these foods. Also point out how much of their daily calories these foods take up.

3) Divide them into groups and give each group a menu. Have them choose a poor option and a better option from each menu and explain why they chose what they did.

IV. Conclusion

A. We learned a lot today about nutrition. Are there any questions? How might the things you went over today affect the decisions you make in the future about what you choose to eat?

V. Assessment
A. None

VI. Assignment
A. Meeting the goals that they set for fruit and vegetable consumption.

APPENDIX B

EVALUATION INSTRUMENTS

B.1 FOOD FREQUENCY QUESTIONNAIRE

Food Frequency Questionnaire

Fruits and vegetables

Name of Child: _____



Age of Child:









Child's Gender:








Today's Date:







Study ID #

How many times a week do you think your child eats these fruits and vegetables either alone or in other dishes?

FRUITS	1 time	2-5 times	6 or more times
Apple 			
Banana 			

Orange				
Plum				
Strawberry				
Blueberry				
Pineapple				
Grapes				
Cherry				
Kiwi				
Other: (Please List Below)				

Vegetables	1-2 times	3-5 times	6 or more times
Green Beans 			
Peas 			
Corn 			
Squash 			
Tomatoes 			
Broccoli 			
Cauliflower 			

Spinach				
Lettuce				
Potatoes				
Sweet Potatoes				
Peppers				
Carrots				
Other: (Please List Below)				

B.2 FOOD PREFERENCE QUESTIONNAIRE

Name:

Study ID #

Age:

Gender:

Today's Date:

Do you like these fruits and vegetables?

Carrots

Circle which smiley best fits



Green Beans



Peas



Corn



Squash



Broccoli



Cauliflower



Tomatoes



Spinach



Lettuce



Potatoes



Sweet Potatoes



Peppers



Apples



Oranges



Bananas



Grapes



Strawberries



Plums



Blueberries



Pineapples



Cherries



Kiwi



BIBLIOGRAPHY

- Alexander, J., North, M., & Hendren, D. (1995). Master gardener classroom garden project: An evaluation of the benefits to children. *Children's Environements*, 12(2), 123-133.
- Ard, J. D., Fitzpatrick, S., Desmond, R. A., Sutton, B. S., Pisu, M., Allison, D. B., et al. (2007). The impact of cost on the availability of fruits and vegetables in the homes of schoolchildren in Birmingham, Alabama. *Am J Public Health*, 97(2), 367-372.
- Armstrong, D. (2000). A survey of community gardens in upstate New York: implications for health promotion and community development. *Health Place*, 6(4), 319-327.
- Baranowski, T., Domel, S., Gould, R., Baranowski, J., Leonard, S., Treiber, F., et al. (1993). Increasing fruit and vegetable consumption among 4th and 5th grade students: Results from focus groups using reciprocal determinism. *J Nutr Educ*, 25(3), 114-120.
- Baskin, M. L., Ard, J., Franklin, F., & Allison, D. B. (2005). Prevalence of obesity in the United States. *Obes Rev*, 6(1), 5-7.
- Befort, C., Kaur, H., Nollen, N., Sullivan, D. K., Nazir, N., Choi, W. S., et al. (2006). Fruit, vegetable, and fat intake among non-Hispanic black and non-Hispanic white adolescents: associations with home availability and food consumption settings. *J Am Diet Assoc*, 106(3), 367-373.
- Blair, D., Giesecke, C. C., & Sherman, S. (1991). A dietary, social and economic evaluation of the Philadelphia Urban Gardening Project. *Journal of Nutrition Education*, 23(4), 161-167.
- Blanchette, L., & Brug, J. (2005). Determinants of fruit and vegetable consumption among 6-12-year-old children and effective interventions to increase consumption. *J Hum Nutr Dietet*, 18, 431-443.
- Bom Frost, M. (2006). Liking and exposure: First, second and tenth time around. *Physiology & Behavior*, 89, 47-52.
- Cason, K. L. (1999). Children are "Growing Healthy" in South Carolina. *Journal of Nutrition Education*, 31, 235A.

- CDC. (2003). Physical activity and good nutrition: essential elements to prevent chronic diseases and obesity 2003. *Nutr Clin Care*, 6(3), 135-138.
- Cooke, L. (2007). The importance of exposure for healthy eating in childhood: a review. *J Hum Nutr Diet*, 20(4), 294-301.
- Crawford, P. B., Obarzanek, E., Morrison, J., & Sabry, Z. I. (1994). Comparative advantage of 3-day food records over 24-hour recall and 5-day food frequency validated by observation of 9- and 10-year-old girls. *J Am Diet Assoc*, 94(6), 626-630.
- Cullen, K. W., Baranowski, T., Rittenberry, L., Cosart, C., Hebert, D., & de Moor, C. (2001). Child-reported family and peer influences on fruit, juice and vegetable consumption: reliability and validity of measures. *Health Educ Res*, 16(2), 187-200.
- DeMarco, L. W., Relf, D., & McDaniel, A. (1999). Integrating gardening into the elementary school curriculum. *HorTechnology*, 9(2), 276-281.
- Dirks, A., & Orvis, K. (2005). An evaluation of the Junior Master Gardener program in third grade classrooms. *HorTechnology*, 15(3), 443-447.
- Dittus, K. L., Hillers, V. N., & Beerman, K. A. (1995). Benefits and barriers to fruit and vegetable intake: Relationship between attitudes and consumption. *Journal of Nutrition Education*, 27(3), 120-126.
- Domel Baxter, S., & Thompson, W. O. (2002). Fourth-grade children's consumption of fruit and vegetable items available as part of school lunches is closely related to preferences. *Journal of Nutrition Education and Behavior*, 34, 166-171.
- FDA, & NIH. (2000). *Healthy People 2010*: FDA
NIH.
- Ferris, J., Norman, C., & Sempik, J. (2001). People, land and sustainability: Community gardens and the social dimension of sustainable development. *Social Policy & Administration*, 35(5), 559-568.
- Fontenot Molaison, E., Connell, C. L., Stuff, J. E., Yadrick, M. K., & Bogle, M. (2005). Influences on fruit and vegetable consumption by low-income black American adolescents. *J Nutr Educ Behav*, 37(5), 246-251.
- Graham, H., & Zidenberg-Cherr, S. (2005). California teachers perceive school gardens as an effective nutritional tool to promote healthful eating habits. *J Am Diet Assoc*, 105(11), 1797-1800.
- Granner, M. L., Sargent, R. G., Calderon, K. S., Hussey, J. R., Evans, A. E., & Watkins, K. W. (2004). Factors of fruit and vegetable intake by race, gender, and age among young adolescents. *J Nutr Educ Behav*, 36(4), 173-180.

- Hendy, H. M., Williams, K. E., & Camise, T. S. (2005). "Kids Choice" school lunch program increases children's fruit and vegetable acceptance. *Appetite*, 45(3), 250-263.
- Homer, J. B., & Hirsch, G. B. (2005). Systems dynamics modeling for Public Health: Background and opportunities. *Am J Public Health*, 96, 452-458.
- Keane, C. (2007). General Mills Foundation Champions for Healthy Kids Grant (Vol. \$10,000). Wilkinsburg, PA: Hosanna House, Inc.
- Koch, S., Waliczek, T. M., & Zajicek, J. M. (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. (2007a). Beliefs, knowledge, and values held by inner-city youth about gardening, nutrition, and cooking. *Agriculture and Human Values*, 24, 245-258.
- Lautenschlager, L., & Smith, C. (2007b). Understanding gardening and dietary habits among youth garden program participants using the Theory of Planned Behavior. *Appetite*, 49(1), 122-130.
- Lineberger, S., & Zajicek, J. (2000). School gardens: Can a hands-on teaching tool affect students' attitudes and behaviors regarding fruit and vegetables? *HortTechnology*, 10(2), 593-597.
- Mahan, L., & Escott-Stump, S. (2004). *Food, Nutrition, & Diet Therapy* (11th ed.). Philadelphia: Elsevier (USA).
- McAleese, J. D., & Rankin, L. L. (2007). Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *J Am Diet Assoc*, 107(4), 662-665.
- Mitchell, M. (2003). *Nutrition Across the Lifespan* (2nd ed.). Philadelphia: Elsevier Science (USA).
- Morris, J. L., Koumjian, K. L., Briggs, M., & Zidenberg-Cherr, S. (2002). Nutrition to grow on: a garden-enhanced nutrition education curriculum for upper-elementary schoolchildren. *J Nutr Educ Behav*, 34(3), 175-176.
- Morris, J. L., Neustadter, A., & Zidenberg-Cherr, S. (2001). First-grade gardeners more likely to taste vegetables. *California Agriculture*, 55(1), 43-46.
- Morris, J. L., & Zidenberg-Cherr, S. (2002). Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge of nutrition and preferences for some vegetables. *J Am Diet Assoc*, 102(1), 91-93.

- O'Brien, S. A., & Shoemaker, C. A. (2006). An after-school gardening club to promote fruit and vegetable consumption among fourth grade students: The assessment of Social Cognitive Theory constructs. *HorTechnology*, 16(1), 24-29.
- O'Toole, T. P., Anderson, S., Miller, C., & Guthrie, J. (2007). Nutrition services and foods and beverages available at school: results from the School Health Policies and Programs Study 2006. *J Sch Health*, 77(8), 500-521.
- Ozer, E. J. (2007). The effects of school gardens on students and schools: conceptualization and considerations for maximizing healthy development. *Health Educ Behav*, 34(6), 846-863.
- Reinaerts, E., de Nooijer, J., Candel, M., & de Vries, N. (2007). Explaining school children's fruit and vegetable consumption: the contributions of availability, accessibility, exposure, parental consumption and habit in addition to psychosocial factors. *Appetite*, 48(2), 248-258.
- Robinson, C., & Zajicek, J. (2005). Growing minds: The effects of a one-year school garden program on six constructs of life skills of elementary school children. *HortTechnology*, 15(3), 453-457.
- Royse, D., Thyer, B. A., Padgett, D. K., & Logan, T. K. (2006). *Program Evaluation: An Introduction*. Belmont: Thomson Brooks/Cole.
- Stone, M. K. (2002). A food revolution in Berkeley. *Whole Earth, Spring*, 38-47.
- Sylvestre, M. P., O'Loughlin, J., Gray-Donald, K., Hanley, J., & Paradis, G. (2007). Association between fruit and vegetable consumption in mothers and children in low-income, urban neighborhoods. *Health Educ Behav*, 34(5), 723-734.
- Trochim, W. M., Cabrera, D. A., Milstein, B., Gallagher, R. S., & Leischow, S. J. (2005). Practical challenges of systems thinking and modeling in Public Health. *Am J Public Health*, 96, 538-546.
- USDA. (2005). MyPyramid Blast Off Game.
- Wardle, J., Herrera, M. L., Cooke, L., & Gibson, E. L. (2003). Modifying children's food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable. *Eur J Clin Nutr*, 57(2), 341-348.
- Weber Cullen, K., Baranowski, T., Owens, E., Marsh, T., Rittenberry, L., & De Moor, C. (2003). Availability, accessibility, and preference for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Educ Behav*, 30(5), 615-626.
- Wiecha, J. L., Finkelstein, D., Troped, P. J., Fragala, M., & Peterson, K. E. (2006). School vending machine use and fast-food restaurant use are associated with sugar-sweetened beverage intake in youth. *J Am Diet Assoc*, 106(10), 1624-1630.

Wilkins, J. (2000). Community Food Systems-Linking food, nutrition and agriculture. *Journal*. Retrieved from www.cce.cornell.edu/programs/foodexpfiles/topics/wilkins/wilkinsoverview.html.

Zeger, S. L., Liang, K. Y., & Albert, P. S. (1988). Models for longitudinal data: a generalized estimating equation approach. *Biometrics*, 44(4), 1049-1060.