BARRIERS TO HOME FRUIT AND VEGETABLE CULTIVATION IN OHIO

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ABSTRACT

Home gardening is increasingly being used as a strategy for improving food quality, reducing food insecurity, saving money, and building a more sustainable food system. However, very few studies have been conducted to investigate what factors prevent individuals from engaging in this activity. The objective of this study is to identify what relationships exist between barriers to home gardening and certain sociodemographic groupings in the state of Ohio. These groupings are based on place of residence, homeownership, education level, household composition, and income. The data used for this project comes from the 2008 Ohio Survey of Food, Agricultural and Environmental Issues and descriptive and bivariate analysis was conducted using SPSS Statistics. The findings from this research will be able to inform efforts that aim to involve more people in edible gardening at the domestic scale.

INTRODUCTION

Overview

This study seeks to examine different barriers associated with home food production in the state of Ohio by using data from a voluntary survey sent to residents throughout the state. Understanding what keeps those who are interested in home gardening from engaging in this activity is important because it can increase the effectiveness of current programs that promote home food production. Programs encouraging individuals to participate in domestic food production are often knowledge-based, but there has been little academic exploration of whether this addresses the right barriers. The vast majority of literature that discusses self-provisioning in relation to food focuses on economic drivers and community gardening rather than home gardening. Overall, limited research has been conducted to understand why people choose not cultivate their own food. If the problem is not a lack of knowing how to grow food, the money and resources invested in such programs are being wasted and little is being done to create more home gardens.

Background

Interest in home gardening for food production exists in the U.S. for a number of reasons. There is a growing concern regarding the quality of food in terms of taste, nutritional content, freshness, and safety. This 'quality turn' is a strong motivator that has brought more people to grow some, if not all, of their own produce at home (Baker and Crosbie 1993; Goodman 2003). Pollan (2006; 2008) and Kingsolver (2008) emphasize quality in their books with particular focus on the value of taste and nutrition in food. They argue that taste and nutrient content are

both improved when the time between harvest and consumption of fruits and vegetables is shortened. The nutritional, physical, and mental health benefits of growing food for personal consumption are discussed in at least half of the academic publications on community gardening as well (Draper and Freedman 2009). Freshness is another aspect of quality that consumers are looking for (Mariola 2008; Born and Purcell 2006) and home-grown produce is the ultimate source of fresh food. The rising concerns with food safety are discussed extensively in the literature (Baker and Crosbie 1993; Hermann et al. 2006; Hill and Lynchehaun 2002; Wright and Lowell 2010). Delind and Howard (2008) approach food safety in terms of both produce and animal products. They suggest that decisions regarding food be made at "the smallest and simplest level of organization," and home-grown food is often the smallest and simplest form of production (313).

Food security is another reason that many Ohioans are interested in home gardening. According to the Economic Research Service, the average number of Ohio households experiencing low or very low food security was 15.5% between 2009 and 2011. Low food security is defined by the United States Department of Agriculture (USDA) as a diet with "reduced quality, variety, or desirability" and "little or no indication of reduced food intake." Very low food security involves "reports of multiple indications of disrupted eating patterns and reduced food intake" (ERS 2012). Domestic production of fruits and vegetables is a strategy for reducing food insecurity because it provides immediate access to fresh food for households (Kortright and Wakefield 2011). In an overview of food security in the U.S., the USDA defines food security as having "access by all people at all times to enough food for an active, healthy life" (ERS 2013). A healthy life requires fruits and vegetables for a healthy diet so home food production can play an important role in improving overall food security. The issue of food

security is identified as a key problem in the food system as a whole (Allen 2004) and is also a major topic within the literature on the benefits of community gardens (Draper and Freeman 2009). Such emphasis illustrates the importance home gardens can have in addressing the dilemma of food insecurity as a source of nutritious, accessible food.

Economic conditions also have an impact on food choices. Schupp and Sharp (2012) cite a number of authors that tie economic decline to an increase in domestic fruit and vegetable production. Bentley (1998) examines a survey in which American respondents with 'war gardens' during World War I said the gardens served economic purposes significantly more often than they were grown for patriotism. Tucker (1993) also argues that domestic food production in the 1910's was due to high food prices as well as food scarcity. Outside of wartime there is also evidence of gardening being used as a tool to cope with economic hardship (Campbell et al. 1993; Mingione 1991). The economic downturn in 2008 is likely to have had a similar impact on the number of Americans engaging in home self-provisioning. In a more recent study, Flachs (2010) identified economic drivers among individuals engaged in community gardens in Cleveland, and he found that across the socioeconomic spectrum environmental concerns also attracted individuals to alternative food strategies.

The association between gardening and environmental values is echoed in the examination by Schupp and Sharp (2012) of Ohioans with home gardens. They identify a relationship between households growing their own food and engagement in other local food system activities. These are often focused on sustainability, indicating problems with the overall food system which drive people to find alternative means of obtaining food. Such problems include pollution from the use of chemicals (Allen 2004; Eubanks 2009), reliance on fossil fuels (Allen 2004; Gomiero, Paoletti, and Pimentel 2008), degradation of soil quality (Allen 2004;

Eubanks 2009; Gomiero, Paoletti, and Pimentel 2008), reduction in biodiversity on and around farms (Avery and Avery 2003 as cited in Angelo 2011; Walsh 2008 as cited in Leathers and Foster 2009), and exacerbation of climate change (Dow and Downing 2006; Gomiero, Paoletti, and Pimentel 2008). Additionally, there are goals pertaining to social and economic sustainability within alternative food systems, though these are more associated with local foods at the community and regional scale (Bourne and Purcell 2006; Mariola 2008).

Despite these motivators, significant barriers inhibit many Ohioans who are interested in having a household fruit or vegetable garden. The potential barriers included in this study were interest, time, space, knowledge, and cost.

Research Questions

The question guiding this research is: *To what extent are particular barriers significantly related to certain sociodemographic groups, including current place of residence, homeownership, education level, household composition, and income?* The focus is on non-gardeners who indicated interest was not a barrier to becoming engaged in home fruit and vegetable gardening. Though this does not specifically identify a desire to have a household garden, it suggests some level of interest and enables a closer concentration on the material and non-material barriers to gardening rather than the more amorphous barrier of interest. The Diffusions of Innovations framework is applied to this research to explain the presence of such barriers and how these inhibit people from maintaining home gardens for food production. Each of the sociodemographic groupings is justified in terms of the inequalities they create and how these inequalities are tied to the barriers.

Existing Research

The Diffusion of Innovations framework has not been used specifically for studying the barriers to home fruit or vegetable cultivation or how these barriers might be associated with certain demographic groups. Self-provisioning had been explored in the context of food and gardenging but more often with the intent of determining why people engage in such behaviors. Schupp and Sharp (2012) identify home gardening as a type of self-provisioning and summarize that much of the literature examines economic justifications for growing food domestically. This economic perspective is important for understanding the drivers of home gardening but does not reveal any barriers that keep interested households from producing some of their own food.

Local foods and community gardening have been a popular topic of study, examining the various potentials of the movement and assessing how successful they have been in achieving their goals. The data collected in the studies on community gardens has been largely qualitative and focused primarily on urban areas rather than suburban or rural (Draper and Freedman 2010). Additionally, more research looks at themes of nutritional benefits and green space development rather than social implications (Flachs 2010; Ghosh 2010). In general, the research examines what is happening in the current alternative food movement by studying existing farmers' markets, community gardens, and school gardening projects. However, significant gaps remain in the research pertaining to community gardens, and even more in the research on home food production (Draper and Freedman 2010; Schupp and Sharp 2012). The data used for this particular research project has been analyzed to identify what demographic groups are more or less likely to produce some of their own food, but the data has not been studied to determine why non-gardeners do not garden (Schupp and Sharp 2012).

Theoretical Framework

The Diffusion of Innovations framework can be used to anticipate what barriers may inhibit the adoption of home gardening of fruits and vegetables. This framework, which Rogers (1983) is credited with developing, asserts that it is both the individuals and the innovations which determine whether or not an innovation will be adopted. There is a temporal element to the framework because people are classified according to the time it will take them to adopt. These groups include the inventors, early adopters, early majority, late majority, and laggards. Diffusion of Innovations views these groups as static; it is the innovations which are expected to change in order to suit the needs or desires of society. The qualities of an innovation have a significant impact on whether or not it will spread and innovations that can be readjusted are the ones most likely to be successful.

Rogers (1983) also identifies five characteristics that an innovation must have in order for it to be adopted, which Robinson (2009) summarizes as relative advantage, compatibility with existing values and practices, simplicity and ease of use, trialability, and observable results. The absence of any of these qualities may act as a barrier to adoption. A lack of interest can be seen as an incompatibility of home gardening with an individual's existing values or practices. Time, space, and knowledge as barriers are inhibitors to the simplicity and ease of growing food domestically since any of these three barriers would require an individual to invest more effort. Cost is tied to the relative advantage of home gardening in a financial capacity. It can also be related to the trialability of the innovation because there can be high initial costs associated with the construction of a garden or other method of growing food that could dissuade engagement.

Others have applied the Diffusion of Innovations framework to similar research questions. Inwood et al. (2008) apply this framework in the context of alternative food

acquisition by investigating the use of local foods in restaurants. Part of their research involves a study of the structural barriers which inhibit the adoption of local foods by restaurants and how these might be addressed. Padel (2001) assesses whether or not the Diffusion of Innovations framework is one that ought to be applied to the adoption of organic agriculture. She concludes that it is not perfectly suited for this but highlights the ways that Diffusion of Innovations could benefit the promotion of organic production. In an interview with McGrath and Zell (2001), Rogers himself makes it clear that he sees his framework as an appropriate tool for promoting gardening. He describes how Diffusion of Innovations is sometimes used to switch back to previous practices after an innovation has already been adopted, using the example of agriculture. Chemical use in industrial agriculture was adopted quickly, but Rogers discusses how there has been a more recent push for the production of food through organic agriculture and gardening.

In this research, sociodemographic groupings are examined in comparison to each of the survey barriers to identify any significant relationships that exist between such groupings and the barriers. Each of the groupings is related to status or inequality in some capacity, affecting how likely individuals in the group are to adopt the innovation of home gardening. Rogers (1983) discusses the influence of status on the innovation-development process within Diffusion of Innovations. He explains that inherent inequalities from status shape the innovativeness of people as well as the contact that people have with the change agents who help facilitate diffusion. The research and development that goes into the innovation-development process affect whether or not individuals of a particular status adopt the innovation. Rogers (1983) uses examples from agriculture to illustrate this and identifies other status variables beyond socioeconomic standing that influence adoption. Barriers that result from status exist as

structural barriers that are beyond the control of the individual, as opposed to individual-level barriers which a person can control. There is reason to expect that some barriers are more significant for some groups than for others because of the structural problems that keep innovations from being accessible to all.

One of the sociodemographic groupings is based on the current place of residence of the survey respondents. Bell (1992) argues that there are inherent differences between rural and urban areas and that these must be taken into consideration in sociological study. Ecological differences along this continuum are used by Whitaker (1982) as a way to define what constitutes rural or urban in terms of the spatial distribution of individuals and population density. This makes the domestic space available to a household highly dependent on where it is located because population density is highest in the city core and decreases the farther away an area is from the city. Property size is affected by this because population density is based on the number of people housed within a geographical area. The survey included five different options for current residence in order to gain insight beyond a rural/urban distinction, but this relationship between geography and spatial access still apply. The space barrier is connected to where a person currently lives because this shapes the amount of land available to them. *The first hypothesis (H_1) guiding this research predicts a significant relationship between the current place of residence of respondents and space as a barrier.*

Similarly, homeownership determines the physical area available for domestic gardening in regard to both indoor and outdoor space. Just as ecological differences between geographical locations impact the availability of space, homeownership shapes the amount of space that can be used for gardening. Apartment renters often do not have much space outside for growing food and home renters can be inhibited by rules dictating their use of the outdoor property. On the

other hand, homeowners usually have a yard and with more square footage they have a greater potential for production inside as well. *Because of this, there is also an anticipated relationship between homeownership and space as a barrier to home fruit or vegetable production (H_2).* These expected relationships are based on the material nature of property size and type of house and the presence of space as a material barrier.

Another sociodemographic grouping used in this research was based on respondents' highest level of education achieved. A report commissioned by the Australian Department of Education, Employment and Workplace Relations (Smith et al. 2012) identifies higher education, particularly at the university level, as being a driver of innovative capacity. There are other factors that influence this, but education plays a key part in increasing human capital and the chance of innovation adoption. There is also a connection between more time spent in schools and general access to information. Darling-Hammond (1995) discusses inequalities in the education system in terms of the quality of schooling different social classes receive, particularly among minority groups. She concludes that due to vast differences in public education funding lead to unequal educational experiences and access to resources during schooling.

The likelihood of a person learning about edible gardening through formal education also rises the longer that person is in the school. Student gardens and farms exist in elementary, junior, and high schools as well as in many colleges and universities. Though fruit and vegetable cultivation is not a core education requirement, it can be incorporated into many academic subjects and used to improve overall academic performance (Lieberman and Hoody 1998). School gardens in California have been used mostly in the context of science, environmental studies, and nutrition (Graham et al. 2005). A review of the literature on U.S. school gardens by Blair (2009) shows improvements in science and food behaviors, as well as changing social and

environmental behaviors. Other factors influence whether or not an individual is exposed to the process of growing food, but in general the chance of this exposure in school increases the longer a person stays in school. *For these reasons, it is anticipated that this research will reveal a statistically significant connection between a person's level of education and knowledge as a barrier to home gardening (H_3).*

Household composition was measured by the presence of children and this was a fourth grouping expected to be important in studying barriers to home gardening. Households with children might be particularly interested in growing food domestically because of the health and safety of their kids. School gardens have resulted in increased physical activity and preference for fruits and vegetables (Hermann et al. 2006; Wright and Lowell 2010) and such benefits can result from home gardens if children are engaged in the process. The large portion of organic consumers that have children and buy organic products because of food safety concerns (Hill and Lynchehaun 2002) illustrates the link between parents and food safety, which itself is a strong motivator for home food cultivation (Kortright and Wakefield 2011). Families with children are also inherently different than those without kids because children have needs that are different from adults' and they require a large amount of attention. This suggests that households with children are unique and have different barriers to home gardening than households without kids. Bianchi (2000) found that mothers are still investing similar amounts of time with their children despite the increase in women's employment and that fathers are now spending more time at home to raise their kids. *Therefore, another hypothesis guiding this research expects that there will be a relationship between households with children and time (H_4).*

Income is the sociodemographic grouping that has the most significant impact on social class and status because of the effect it has in shaping general wealth, power, and knowledge

(Allen 2004). This automatically justifies its inclusion in looking at the barriers to home gardening because individuals of different economic classes have very different life experiences. The most obvious connection income has to barriers inhibiting home fruit or vegetable cultivation is through cost as a barrier. Not only do those in lower income groupings have less money overall, they also lack the disposable income that is necessary for starting a garden. Though growing food domestically can be used as a strategy for coping with financial stress (Flachs 2010), there are costs associated with starting a garden which a household might not be able to overcome. Fitchen (2008) describes how those who qualify for federal assistance usually run out of money for food towards the end of the month, illustrating the unavailability of spare funds. These low income groups are likely to be food insecure because of their financial status and therefore most in need of accessible, nutritious food but also least able to start a garden to supply these foods. *Considering these conditions, the last expected outcome of this research is statistical significance between the income groupings and cost as a barrier to home cultivation of fruit or vegetables (H_5).*

METHODOLOGY

Source of Data

The data used to test these hypotheses comes from the 2008 Ohio Survey of Food, Agriculture, and Environmental Issues. This is a biennial survey created and sent out by the Social Responsibility Initiative, which is a research group within Ohio State's School of Environment and Natural Resources that conducts research relating to agriculture, food, community development, and the environment. The Survey asks questions about issues of food safety, agriculture, policy, the environment, and food choices that vary from year to year. The following methodological information comes from the Methodology Report (Sharp and Adua 2008) for the 2008 Ohio Survey.

Sampling Procedure

In 2008, 3,500 surveys were sent out to each of the 88 Ohio counties with half going to the 22 counties classified by population as core metro counties and half to 66 metro-fringe or non-metro counties, listed in Appendix 1.

Appendix 1: Sampling Strata for 2008 Ohio Survey of Food, Agriculture and Environmental Issues

Stratum	**Counties in Strata**
Core Metro Counties	Allen, Butler, Clark, Clermont, Cuyahoga, Erie, Franklin, Greene, Hamilton, Lake, Licking, Lorain, Lucas, Mahoning, Medina, Montgomery, Portage, Richland, Stark, Summit, Trumbull, and Warren
Metro-Fringe/ Nonmetro Counties	Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Carroll, Champaign, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Fairfield, Fayette, Fulton, Gallia, Geauga, Guernsey, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Logan, Madison, Marion, Meigs, Mercer, Miami, Monroe, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Ross, Sandusky, Scioto, Seneca, Shelby, Tuscarawas, Union, Van Wert, Vinton, Washington, Wayne, Williams, Wood, and Wyandot

The sample addresses used came from the private list vender Experian. Following a similar method design as Dillman (2000), five mailings were sent to each household, including: a pre-notification letter, a survey mail out package, a reminder postcard, a replacement survey, and a second reminder postcard. As Table 1 from the 2008 Methodology Report (Sharp and Adua 2008) indicates, the number of effective surveys for both groups was very close, as was the

Table 1: Response Rate by Stratum

Stratum	Effective Sample	Response	Response Rate (%)
Metro	1574	713	45.3
Metro Fringe/Nonmetro	1570	799	50.9
Unknown[a]	9	9	100.0
Total	3153	1521	48.2

[a] Unknown represents those respondents who removed information linking them to county of residence

response rate, with 45.3% of the core metro county surveys being returned and 50.9% of those from the metro-fringe or non-metro counties. Some of the surveys were counted ineffective because of incorrect or missing forwarding information, lost tracking data, unknown addresses, or other reasons. Data from the surveys was entered into Microsoft Excel as they were received and 5% of the data was checked over to account for accuracy.

Sample Limitations

In order to determine how accurately the demographics represented those of the state, the nationwide American Community Survey (ACS) from 2007 was used to make comparisons. The results from this, as seen in Table 2, show that the respondents from the Ohio Survey closely reflect the state percentages for educational level, estimated economic values of homes, and employment status. Income distribution overall is mostly representative with the exception of the

income categories $9,999 or less and $10,000-34,999. There are more notable differences in the number of white and female respondents, as well as married-couple families, household members under five years of age, and owner-occupied housing units. More significant disparities can be seen with the percentages of Asians and Black or African Americans.

Table 2: Characteristics of State of Ohio Population (ACS) and Survey Sample

	2007 American Community Survey (Percent)	**2008 Ohio Survey (Percent)**
Sex (18 years and over)		
Male	48.7	42.6
Female	51.3	57.4
Race (Ethnicity)[1]		
Black or African American	11.7	5.9
Asian	1.6	1.0
Native America/American Indian[2]	0.2	0.5
White	84.0	89.4
Other Race	2.0	2.2
Educational Attainment		
Percent High School Graduate	36.8	37.7
Percent Bachelor's Degree	15.2	16.8
Household Demographics and Housing		
Married-Couple Families	49.0	60.3
Household Members Under Five	6.5	12.2
Owner-Occupied Housing Units	69.7	83.9
Renter-Occupied Housing Units	30.3	14.1
Other Arrangement	-	2.0
Value of Home		
Less than $50,000	3.6	5.0
$50,000 - 99,999	20.9	19.0
$100,000 – 149,999	28.5	29.1
$150,000 – 199,999	19.3	20.6
$200,000 – 299,999	16.9	16.0
$300,000 or more	16.9	10.6
Household Income		
$9,999 or less	7.1	5.3
$10,000-34,999	29.1	27.2
$35,000-49,999	15.5	16.1
$50,000-74,999	20.2	21.9
$75,000-99,999	12.0	13.7
$100,000 or more	16.1	15.7
Employment Status		
Employed	60.1	59.2
Unemployed	4.6	4.8

[1] The Ohio Survey include Latino/Hispanic as category for the race/ethnicity, but the ACR did not include this option
[1] For the ACS, this includes Alaska native

Questions

Since the 2008 survey data has already been collected and entered, this study is aimed at further analysis of two particular questions on the survey. The first appears below (Figure 1) and will be used to determine whether there has been any increase or decrease in the number of respondents that grow their own fruits or vegetables.

Figure 1: Question F

F. Do you or does anyone in your household engage in the following gardening or food preservation activities?

	Yes	No
a. Maintain a fruit or vegetable garden?	1	2
b. Canned or froze fresh vegetables or fruit that you grew or purchased?.....	1	2
c. Compost yard, garden, or kitchen waste?	1	2

The second question (Figure 2) is used for more in-depth comparisons between single barriers and demographic information. Each of the barriers was pre-defined so respondents were not able to express any barriers besides the six listed. They were also able to indicate more than one barrier though there is no ranking system for which was the most significant. For the purpose of this research, only barriers a through d and f were used; mobility or physical impairment as a barrier was excluded from the data analysis.

Figure 2: Question H

H. There are several possible obstacles to getting started in fruit and vegetable gardening. Which of the following are obstacles for your household? If someone in your household already grows fruits and vegetables, which are obstacles for increasing the amount of fruits or vegetables grown?

	Yes	No
a. No interest in fruit or vegetable gardening	1	2
b. Not enough time to garden	1	2
c. Don't have the space or access to a place to grow fruits or vegetables	1	2
d. Don't know how to grow fruits or vegetables	1	2
e. Mobility or physical impairments limit ability to garden	1	2
f. It costs too much to get started growing fruits or vegetables	1	2

ANALYSIS

Summary

The demographic groups used in analysis include place of current residency, homeownership, education, household composition, and income. Descriptive and bivariate analysis was conducted utilizing SPSS Statistics and the bivariate analysis was used to determine whether the research hypotheses were accepted or rejected. Gardeners and non-gardeners who indicated interest as a barrier were filtered out for the bivariate analysis to isolate individuals with some level of interest in starting an edible garden. This left a sample size of 459 individuals for the bivariate tests. The demographical characteristics served as the independent variables while each of the barriers was the dependent variable in the bivariate analysis. Chi-square tests and p-values were used to determine significant relationships; any p-value between 0.00 and 0.05 indicated significance (Fisher and Yates 1995).

Descriptive Analysis

Breaking down the percentage of gardeners and non-gardeners that positively indicate each barrier allows for a basic understanding of which barriers are generally more important. The results from the descriptive analysis of the barriers for gardeners and non-gardeners can be seen in Table 3. There is a higher percentage of respondents who indicated each barrier as a barrier among the non-gardener population than among the gardeners. More than half of the non-gardeners say that both time and space keep them from starting a garden, though the percentage indicating time is slightly higher. The number of non-gardeners claiming knowledge and interest as barriers is almost identical, and only about a fifth of the respondents list cost as a reason why

they have not started a fruit or vegetable garden. Time is the most significant barrier for the gardeners as well; just under half of the groups identify it as something inhibiting them from expanding their current gardens. Space has the second highest percentage of positive responses, similar to the non-gardeners except that the percentage is much smaller. Knowledge, cost, and interest follow in this order, with each of them making up less than a fifth of the gardening respondents and only about a tenth of them indicating cost.

Table 3: Barriers (% Yes)

	Gardeners	Non-Gardeners	Non-Gardeners w/ Interest
Interest	11.0	36.2	-
Time	45.7	56.8	47.7
Space	38.8	55.1	50.5
Knowledge	14.6	36.1	31.5
Cost	10.4	21.0	19.3

The descriptives for the sociodemographic characteristics used in this research are current place of residence, homeownership, education level, household composition, and income. The descriptive analysis for these groupings and how they differ between all survey respondents, non-gardeners, and non-gardeners without interest as a barrier can be seen in Table 4. Certain characteristics are fairly consistent across these three categories. Percentages for current place of residence, education, and income are within a six percentage point range for the three types of respondents.

For homeownership, the differences among non-gardeners without interest as a barrier and the other two categories are mirrored between renters and homeowners. While the percentage of total renters or those with gardens is somewhat low (about 14% and 18% respectively), over three-fourths of those who have some interest in gardening are renters. The opposite is true for the homeowners; the total percentage of respondents who are homeowners is

similarly high to that of the non-gardeners with homes (84%-80.5%) yet homeowners only make up about 20% of the non-gardeners who are interested in starting a home garden. Household composition, which is defined by the presence of individuals in certain age ranges, also shows variation across the categories. Though about one tenth of the respondents have one or more children under the age of five, about 47% of the non-gardeners and 53% of the non-gardeners with an interest in gardening fit into this group. This relationship is seen for households with one or more children that are between five and eighteen years of age as well. Approximately one fifth of all the respondents fit into this demographic group, yet they make up about 75% of the non-gardeners and nearly 78% of those who do not indicate interest as a barrier to gardening. The percentages for households with individuals above age nineteen is close to 100% across these categories because surveys were sent to be filled out by adults and in reality every respondent had to at least count themselves in the nineteen and above group.

Table 4: Demographic Frequencies

	All	Non-Gardeners	Non- Gardeners without Interest Barrier
Current place of residence			
City	28.0	32.2	32.1
Suburbs	34.3	37.0	37.6
Small town	17.9	18.7	18.8
Countryside (not a farm)	16.1	10.6	10.3
Farm	3.7	1.5	1.2
Homeownership			
Rent	14.1	17.9	78.5
Own	83.9	80.5	19.5
Education level			
Mean (years)	14.0	14.1	14.1
< High school	6.1	5.9	5.9
High school	44.7	42.8	41.9
College	36.9	36.8	38.3
Higher education	12.3	14.4	13.9

Household Composition (% with 1+ in age group)			
Under 5 years	10.1	47.1	52.6
5-18 years	26.2	74.3	77.7
19 years-older	99.5	99.8	100.0
Income			
<$19,999	16.9	19.0	18.1
$20,000-49,999	30.7	30.5	29.3
$50,000-99,999	34.7	31.9	33.9
$100,000 +	17.7	18.7	18.8

Bivariate Analysis

The bivariate analysis confirms several of the hypotheses and reveals additional relationships between certain demographic characteristics and barriers. A summary of the accepted and rejected original research hypotheses can be seen in Table 5 below. Significance was determined by the p-values of chi-square tests, and the notable relationships are highlighted on Tables 6 through 10.

Table 5: Predicted Significant Relationships & Statistical Outcomes

	Research Prediction	Statistical Outcome
H_1: Current place of residence & space	(+)	(+)
H_2: Homeownership & space	(+)	(+)
H_3: Education & knowledge	(+)	(-)
H_4: Household composition & time	(+)	(+)
H_5: Income & cost	(+)	(+)
(+): Statistically significant relationship (-): Non-significant relationship		

As anticipated by the hypothesis, there is a relationship between current place of residence and the space barrier to starting a home fruit or vegetable garden. Over half of the respondents from the city, the suburbs, or a small town say space is a barrier and though only about 17% of countryside residents indicate space, this is a barrier for a third of those living on

farms. Space is also significant for the homeownership grouping, with a higher percentage of renters indicating space than homeowners. Time and cost also have p-values that illustrate their significance among the homeownership group, with time as a barrier for a larger proportion of homeowners and cost as a barrier for a higher percentage of renters. Education and knowledge as a barrier are not related in a statistically significant way as expected, though relationships did exist for each of the other barriers- time, space and cost. The only obvious pattern among the education grouping is with cost as a barrier, for which the percentage of positive responses gradually diminishes as education level rises. Again, as the hypothesis predicted there is a correlation between household composition and time though there is also a relationship between household composition and knowledge. Significantly more respondents with children indicate time as a barrier while the percentage is lower for those without any children. Income and cost are related too, and the percentages very closely resemble those for education level and cost. Additionally, a relationship is present for income and time with positive responses increases with income level. Time as a barrier is significant for four of the five sociodemographic groupings, while space and cost are significant for three of the five and knowledge is only correlated with one of these groupings.

Table 6: Current Place of Residence (% Yes)

	City	Suburb	Small Town	Countryside (not a farm)	Farm	Chi-square
Time	42.9	55.9	40.2	50.0	33.3	.089
Space	52.1	55.2	54.1	19.5	33.3	.001
Knowledge	38.6	30.5	29.6	16.7	33.3	.102
Cost	22.9	16.0	15.7	14.6	16.7	.513

Table 7: Homeownership (% Yes)

	Homeowner	Renter	Chi-square
Time	51.3	34.5	.014
Space	47.4	64.0	.018
Knowledge	31.7	29.5	.748
Cost	14.0	30.7	.001

Table 8. Education level (% Yes)

	Less than high school	High school degree	College	Higher Education	Chi-square
Time	29.2	37.0	60.5	50.0	.000
Space	34.6	39.4	58.5	65.6	.000
Knowledge	16.7	35.3	28.7	34.4	.215
Cost	31.8	22.3	16.8	6.2	.011

Table 9: Household composition (% Yes)

	No Children	Under 5 years	5-18 years	Child(ren) 0-5 & 5-18 years	Chi-square
Time	42.2	65.5	51.0	76.0	.001
Space	50.2	57.1	44.6	66.7	.191
Knowledge	27.4	53.6	34.0	42.3	.017
Cost	17.0	14.3	20.6	22.2	.747

Table 10: Income (% Yes)

	Less than $19,000	$20,000-49,999	$50,000-99,999	$100,000 or more	Chi-square
Time	23.9	40.9	54.2	66.2	.000
Space	43.8	51.7	50.3	56.2	.491
Knowledge	37.8	28.7	34.3	27.5	.421
Cost	36.6	22.4	11.2	5.0	.000

CONCLUSION

Discussion of Results

In order to address the original research question, this discussion aims to connect the results from the descriptive and bivariate analyses to illustrate which populations are most affected by each barrier. While the theory and results sections approach the research from the standpoint of the sociodemographic groupings, this section is organized by barrier and identifies which groups are most impacted by each barrier.

As indicated in the summary of results, time is the biggest barrier for gardeners and non-gardeners alike. Additionally, time has a significant relationship with four of the five demographic groupings, including homeownership, education, household composition, and income. The only one of these relationships that the research hypotheses anticipated was that between household composition and time. In terms of homeownership, time as a barrier can be explained by the reality that homeowners have more responsibilities in taking care of their homes than renters do because that responsibility usually falls to the rental company or landlord. If a person is already tending to the usual tasks of maintaining a house, there might be less inclination to invest in starting an edible garden.

Education is difficult to explain in this context because there is no clear pattern in the data between level of education and time as a barrier, nor can these two variables be related in an intuitive way. Education levels can be related to income and status, but the percentages for this particular static do not mirror any of the other relationships in the data. The connection between income and time is one of the more interesting results of this research. Rather than exploring why the poor seem to have more free time, the results can be better explained by examining how

high income groups use their free time. Doing so shifts attention to the behaviors of the rich and avoids the ‘culture of poverty’ argument that is still alive today and claims the poor are impoverished because they are lazy (Cohen 2010). Sullivan and Gershuny (2004) cite Veblen (1967) to explain that in the early years of capitalism in Europe during Medieval times, leisure time was an indication of wealth and high status. They go on to argue that in modern liberal markets this is no longer true; on the contrary, those with higher incomes and status use consumption to display their wealth and take less time for leisure.

Time as a barrier is followed by space in the percentage of gardeners and non-gardens indicating it as an inhibitor for expansion or creation of a garden, respectively. This importance is reflected in the disproportionate percentage of renters who have some level of interest in growing their own produce but are not doing so. Three-fourths of the interested non-gardeners are renters while renters only make up about 15% of the total respondents. This suggests that renters are less able to pursue interests in gardening than homeowners and the main difference between these categories is the physical amount of space available to them for household use. In the bivariate analysis, space has a relationship with current place of residence and homeownership, as expected by the hypotheses, in addition to education. The reasons for space being a significant barrier for the first two sociodemographic groupings is explained in the literature review. Property size is generally shaped by where a residence is located and the space available for growing food is influenced by whether a home is owned or rented. The connection between education and space is more difficult to explain. The percentage of respondents indicating it as a barrier increases steadily from the lowest education grouping to the highest, suggesting a specific trend. In this case, additional statistical analysis would help to isolate the factors influencing this pattern and explain the relationship.

In terms of the barrier descriptives, knowledge and cost are less notable than the barriers of time and space. The interest barrier is not discussed here because it was filtered out for the bivariate analysis and is not relevant to the task of determining what can be done to overcome barriers keeping those with an interest from growing their own food. Knowledge is only correlated household composition though this does not necessarily mean that it is an unimportant barrier. The percentage of respondents who indicated it as a barrier is high enough that it should not be ignored, though from this research data it does not stand out as the most critical issue to address. As a barrier among families with children, this could be tied to the fact that time was also statistically significant for this grouping and obtaining the knowledge to grow food can be time-consuming. However, further analysis would need to be conducted to determine the reasons behind the particular connection between knowledge and households with children.

Despite the fact that less than a fifth of interested non-gardeners indicated cost as a barrier, it can be associated with specific populations because it is tied to three of the five demographic groupings. There are significant relationships with cost as a barrier and homeownership, education, and income. Homeownership is connected to socioeconomic status because of the strong preference for single-family suburban homes in the United States and the fact that not all can afford such homes. The suburban development boom occurred post-World War II (Stahura 1986) and though trends began shifting towards living in denser, more central locations in the 1990's, single-family homes are still the ideal for the majority of Americans (Myers and Gearin 2001). Therefore, those who own their houses are generally have higher incomes than those living in apartments or rental properties. Distinct inequalities also exist between level of income and education all across the United States, both in terms of the quality of education and the highest level of school achieved. Those with lower incomes have lower

quality educational experiences and are more likely to drop out of school than those with higher incomes (Matthews 2009). In general, individuals with less schooling also obtain lower-paying jobs than those who graduate from high school and college. The data illustrates these connections; the percentage of respondents indicating cost as a barrier among the level of education groupings and income groupings were nearly identical (see Tables 8 and 10).

Confirmation that several material and nonmaterial barriers exist to home gardening can contribute to more effective strategies for promoting domestic food production. In fact, the finding that knowledge is not a serious barrier for many sociodemographics suggests that one of the more common strategies of increasing gardening, education to improve knowledge, is either being very effective or is not as substantial barrier as other material barriers. To summarize the bivariate analysis results, the following relationships are seen in bivariate analysis of barriers and sociodemographic groupings:

- Current place of residence & space
- Homeownership & time, space, cost
- Education level & time, space, cost
- Household composition & time, knowledge
- Income & time, cost

Understanding some of the core barriers to various populations can aid in developing more targeted strategies for promoting home fruit and vegetable cultivation, beyond what the descriptive analysis provided.

Research Limitations

The most immediate limitation of this data is that the barriers listed in the survey were pre-determined and respondents could not write in additional answers. A number of other factors outside the six that were chosen might influence people's decision-making when it comes to home gardening. Most notably, the survey question lacks strong cultural or community context in the barriers, both of which have potential to influence gardening behaviors. In the five characteristics necessary for an innovation to be adopted as described by Rogers (1982), the components of relative advantage and compatibility with existing beliefs and practices encompass these additional barriers. Robinson (2009) includes social prestige and past experiences in his explanation of what can be a part of these two overall characteristics, both of which are shaped by cultural or social forces. For example, a household in a neighborhood where few people have their own edible gardens might feel outside the norm to grow their own food, whereas in a community with many growers home food production would be more socially accepted. While fewer options make the data easier to analyze and draw conclusions from, some degree of understanding and accuracy is sacrificed. Personal needs are also in the list of things which might inhibit adoption; this is another material barrier similar to cost or space, but it was not a part of the survey question.

Additionally, there was no system for ranking the barriers on the survey so it is not possible to determine the comparative importance of the options a respondent could choose. In analyzing the data we can only assume that each barrier was of equal significance to each individual, though this is unlikely to be true for any individual. The descriptive analysis revealed a basic understanding of which barriers were indicated more than others, and the bivariate analysis identified relationships that exist between sociodemographic groups and barriers. These

allow for a general comparison of barriers but no statistical test can reveal how the importance varies by individual. Similarly, there was no limit to the number of barriers a person could indicate. Had respondents been limited to a certain number of barriers to mark on the survey there would have been some measure of importance for the barriers indicated.

Potential Applications

Whether or not educational efforts to increase home food production are actually effective or knowledge about growing food is simply a less significant barrier, attention must also be paid to the other barriers in order to reduce the influence they have on decisions about home gardening. Below are a few possibilities for how time, space, and cost could be addressed.

Time may be one of the more challenging barriers to address because it is not a barrier like space or cost that can be directly impacted by outside intervention. Both physical space and money can be provided for growing food, but free time cannot be given to a person. Referring back to the Diffusion of Innovation framework (Rogers 1982), this problem is connected to a lack of ease and simplicity so it could be partially remedied by making home production easier and simpler. Streamlining the process of planning, constructing, planting, tending, and harvesting a fruit or vegetable garden could increase the ease and simplicity of home gardening. An online tool could serve this purpose and allow households to personalize a plan for the needs and restrictions. Users could indicate their growing zone and select the plants they want to grow to create a calendar for when to start seeds, plant outdoors, and harvest. Crop varieties could be labeled as low, medium, or high maintenance to suit the time and knowledge of the grower, and profiles for each would provide more detailed information and growing tips. Additional

resources might include creative ways to use space, which crops to plant together, how to amend poor soil, and so on.

Reframing this issue of time can also be a useful strategy for lessening its role as a barrier to home fruit and vegetable production. For households with children, gardening could be framed as a fun family activity instead of an alternative to running errands at the grocery store. Gardens are created specifically for children in schools, communities, and churches with a variety of goals. Hands-on learning, physical activity, and time spent outdoors are all benefits of engaging youth in gardening, and these can be applied at home as well (Draper and Freedman 2010). Beyond these, having a home garden can also be a family activity that simply serves the purpose of growing food together.

The issue of space can be solved more directly by demonstrating how food can be grown in unconventional ways by creatively using space or by connecting growers with community gardens. People might generally associate growing food with rectangular plots of land dedicated singularly to production, but edible plants can be raised in other ways. A wealth of ideas exists for those who take the time to look for or design their own production system that does not involve a large backyard. This is where an online tool could also be helpful because it could act as a central location for suggestions on gardening indoors, on porches, and in vertical spaces. Some homes do not have any location that is suitable for growing food, however. The goal of this research is to provide insight into the ways home gardening can be encouraged but in some cases it makes more sense to join an already existing community garden. Unfortunately, many neighborhoods do not have community gardens. In these cases, zoning laws or city programs can open up areas where people can grow or raise food creating space in the community for production.

Cost is perhaps the barrier which can be dealt with most directly on both an individual or community basis. Financial assistance would help specific households or fund community efforts. Small grant programs could be established to cover the start-up costs of the infrastructure needed for growing food. These could also be used to establish tool share programs or similar resource-sharing networks within communities or neighborhoods that would reduce the cost per household of starting and maintaining home gardens. In some situations, costs might also be perceived as higher than they actually are. Already existing knowledge-based programs could work to better inform people about the specific costs involved in home gardens. An online tool used for streamlining garden planning would be able to properly inform individuals about the approximate costs of growing food based on the crops they selected and the area where they live.

Further Research

The next phase of this research would include multivariate analysis of the barriers and sociodemographic groups. Doing so would provide a more complete understanding of the influences that act on individuals and cause certain barriers to home fruit or vegetable production. The bivariate analysis identified relationships between groupings and barriers that are statistically significant, but this only reveals the basics of the actual situation. In reality there are multiple factors that together lead to particular outcomes and multivariate analysis is needed to isolate some of these factors. This would be particularly helpful for the education grouping because the bivariate analysis that revealed a significant relationship between education and the time and space barriers.

Including this same question on later versions of the Ohio Survey would also be beneficial for furthering this line of research. Data from upcoming years would indicate any

trends that exist in barriers to home gardening and a more up-to-date survey would better guide policy or programming efforts. Later surveys might also include more barriers to choose from by incorporating cultural or community-based barriers to generate a more comprehensive assessment of the barriers to home cultivation. It could also be useful to conduct an assessment of the programs in Ohio which support or advocate for home gardens. This would provide some context for the barriers and potentially help explain changes over time in the most significant barriers. The creation or removal of certain programs or policies might be temporally associated with certain trends, further informing the research suggestions and applications.

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