

Applying the Social Ecological Framework and Social Cognitive Theory to food desert interventions:

What is effective, ineffective, and where to go from here

By

Brittany Cox

Thesis

Submitted to the Faculty of the
Graduate School of Vanderbilt University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

in

Medicine, Health, and Society

August 9, 2019

Nashville, Tennessee

Approved:

David G. Schlundt, Ph.D.

JuLeigh Petty, Ph.D.

This is for you, dad. You always told me I could do anything, and incredibly, I believed you.

Maybe one day I'll get to tell you all about this project!

Until then, love always,

Brittany

Acknowledgements

I am so grateful to have a long list of people to thank for their part in helping me to complete this project. This thesis would not ever have been possible without a wealth of information and resources always at my fingertips, thanks to the incredibly extensive digital library of information that being a graduate student at Vanderbilt gives me the privilege of accessing.

Although my master's program was only a year long, I have learned more in this one single year than perhaps any other year of education in my whole life. I am grateful to all the professors I had the pleasure of learning from this year; thank you to Dr. Jonathan Metzler, Dr. Kym Weed, Dr. Lauren Gaydos, Dr. John Janusek, Dr. Bethany Rhoten, Dr. Hector Myers, Dr. Aimi Hamraie, Dr. Carolyn Audet, Dr. Bill Heerman, and Dr. Aimalohi Ahonkhai. They taught me how to think about, understand, and conceptualize our world in ways that I truly never had before.

Thank you to Dr. Petty, who provided valuable guidance while I figured out how to be a graduate student and answered my endless barrage of emails with questions about the program and this thesis throughout the year.

I want to offer a very special thanks to Dr. David Schlundt. Thank you for answering an email from a complete stranger at the beginning of the year before I was even officially a student at Vanderbilt, and subsequently agreeing to mentor me throughout the year. I am profoundly and forever grateful for all your advice, wisdom, guidance, and encouragement. Thank you for knowing when to stay on task in our meetings, but also knowing when I needed a break to just sit and talk and drink coffee.

I highly doubt that my brain would have survived the year without the company of my good friends Netflix, Hulu, HBO, and YouTube. Thank you for always being there to give my tired brain a lovely break (sometimes for too long, but we won't dwell on that).

Thank you to all my friends this year who allowed me bounce ideas off them and who continually encourage me in my pursuit of a career fighting for equal rights and opportunities for all.

Thank you to my family in Michigan who always pick up the phone to talk when I need it. Even though you are all about 600 miles away, your unwavering love and support transcend the distance!

I am luckier than most to have a wonderful, kind, and hilarious family of in-laws. Thank you for believing in me this year, encouraging me when I needed it, and sometimes feeding me when I didn't feel like cooking.

And last but certainly not least, I would like to thank my husband Nate. Without your constant support, love, encouragement, company, and endless supply of humor, this year in graduate school would have been so much more difficult. I love you endlessly.

Preface

I would not be the person I am today without my dad's constant support, love, encouragement, and his belief that I could achieve absolutely anything I put my mind to. To my family's deep sadness, he passed away very suddenly from cancer when I had just turned 20 and started my junior year of college. I found myself reeling from the loss and wondering if things could have turned out differently. I have no idea the effect that my dad's diet high in processed foods, low in nutrients, and inactive lifestyle had on him getting cancer, but from a purely logical standpoint, I know that it can't have helped. To make a long story much shorter, the sudden loss of my dad eventually led to my passion for eating a healthy, balanced diet and leading an active lifestyle.

At some point in the last few years after I embarked on a quest to learn about the effects of what we eat on the health of our bodies, I learned about the existence of areas called food deserts. Food deserts are low-income areas without local access to healthy, affordable foods like fruits and vegetables. I was appalled – in a developed country like the U.S., how is it even possible for areas like that to exist? Eating a healthy diet is linked to so many positive health benefits, most notably, a longer life span. Even though I know most Americans don't eat enough fruits and vegetables, it struck me as almost evil to deprive large groups of people of even the opportunity to eat well based simply on where they live.

Once I started my year in graduate school in the Center for Medicine, Health, & Society, I learned all about the social and historical forces that led to the creation of these areas, which only furthered my interest in the topic and my passion to do something, *anything* about it, even if for this year I would just write about it – and that's when I decided to write my Master's thesis on the topic. The more I read, the more I realized that while there has been some research and several

policy attempts to help people who live in these areas, I couldn't find any articles that summarized all these interventions to get everyone on the same page moving forward. This is an absolutely crucial next step because we don't have time to waste by designing and testing interventions that don't work. People's literal lives and health are on the line.

It is my sincere hope that this thesis is a launching pad for a career spent fighting for structural level change so that all people regardless of their socioeconomic status have not only the opportunity, but also the necessary skills and motivation, to pursue a healthy lifestyle so they can live for as long and as happily as possible.

Table of Contents

DEDICATION	ii
ACKNOWLEDGEMENTS	iii
PREFACE	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS	x
INTRODUCTION	1
Social & Historical Context	2
Background	3
Significance	6
<i>Paradigm Shift: Social Conditions as Fundamental Causes of Disease</i>	7
Theoretical Foundations	8
<i>Social Ecological Framework</i>	9
<i>Social Cognitive Theory</i>	11
Research Gap	14
METHODS	15
Objectives	15
Data Collection	16
Grouping	18
Analysis	19
RESULTS	22
DISCUSSION	24
Individual Level	24
<i>Application of Social Cognitive Theory</i>	25
Individual-Level Component of Multilevel Interventions	25
Single-Level Individual Interventions	27
Interpersonal Level	28
Organizational Level	29
Community Level	29
<i>Natural Experiments</i>	30
Application of Social Cognitive Theory	31
<i>Mobile Markets, Farmers Markets, & Corner Stores</i>	32
Application of Social Cognitive Theory	33
Public Policy Level	34
<i>Supplemental Nutrition Assistance Program</i>	34
<i>Application of Social Cognitive Theory</i>	35
Multilevel	37
<i>Theoretical Applications</i>	37
CONCLUSION	40
Limitations	40
Implications for Future Work	42
Final Statement	44
REFERENCES	46

List of Tables

Table		Page
1.	Articles included in the literature review sorted by level of the Social Ecological Framework and intervention type	22

List of Figures

Figure	Page
1. U.S. Food deserts as defined by the USDA (USDA, 2017)	4
2. Levels of the Social Ecological Framework (Glanz, 2016)	9
3. Model of Social Cognitive Theory (Gill-Bailey, Bertram, & Cabiness, 2016)	12
4. Illustration of articles sorted by level of Social Ecological Framework and success	23
5. Model of Social Cognitive Theory applied to healthy eating in food deserts	26

List of Abbreviations

F&V	Fruits and vegetables
SCT	Social Cognitive Theory
SEF	Social Ecological Framework
SES	Socioeconomic status
SNAP	Supplemental Nutrition Assistance Program
USDA	United States Department of Agriculture

Introduction

Social scientists coined the term “food desert” in the 1990s to describe low-income areas without local access to healthy food (Beaulac, Kristjansson, & Cummins, 2009). Since then, researchers have studied how best to define them and what can be done to help people who live in these areas gain access to and increase consumption of healthy foods. Not eating enough fruits and vegetables (F&V) is associated with many negative health outcomes, and so the continued study of food deserts and the identification of effective interventions to improve access to and increase consumption of healthy foods like fruits, vegetables, and whole grains is crucial.

The research question that this thesis explores is the following: What accounts for the effectiveness of interventions in food deserts, and moving forward in this field, how can researchers use leading ecological frameworks and psychological theories of health behavior change to design interventions in this field with the greatest chance of success – success in this case being the long-term maintenance of increased consumption of healthy foods like F&V.

To address that question, this thesis reviews food desert interventions for how successful they were at increasing the consumption or sales of healthy food in the study population. Grounding the analysis in the Social Ecological Framework (SEF) and Social Cognitive Theory (SCT), possible explanations are offered for the success or failure of previously implemented and tested food desert interventions. Based on interventions that have been successfully implemented in food deserts, and on the predictions of SEF and SCT, this thesis concludes with suggestions for designing future interventions that have the greatest chance of success at improving access to and consumption of healthy food among residents of food deserts and other low-income populations in the U.S.

Social & Historical Context

In order to best conceptualize the problem of food deserts, it is essential to understand what led to the creation of these areas by examining the social and historical context of the problem. Every inequality in American society is stratified by race and class, including food injustice. Consequently, the existence of poorly resourced areas like food deserts is related to many other pervasive social injustices.

Due to their beginnings in this country as people who were brought here forcibly and enslaved, valued only as the property of their “owners”, African Americans have never been in a privileged position in America. They have experienced systemic injustice here for centuries; for the present purpose of understanding how this has led to the existence of food deserts, it is most important to observe the state of race relations in the early- to mid-twentieth century.

One manifestation of institutional racism were policies that enforced residential segregation, which forced African Americans to continue living in low-quality, poorly resourced areas. In the 1930s – 1960s, the Federal Housing Association denied mortgage loans to individuals living in areas that they often falsely deemed as “hazardous” (Lockwood, 2018). This practice, known as redlining, trapped people in these areas and kept them from moving into nicer, predominantly white, neighborhoods. Because of institutional racism, black people were much more likely than white people to live in areas that were actually hazardous as well as the areas falsely declared to be hazardous (Lockwood, 2018). Redlining prevented the African Americans who lived in these districts from purchasing and owning homes. Owning a home is one of the most effective ways to build wealth, and so consequently, the practice of redlining set off a chain of events that increased the racial wealth gap, discouraged businesses from opening in these areas,

caused red-lined districts to become even more poorly resourced, and contributed to the existence of what are now called food deserts.

Today, predominantly African-American neighborhoods have fewer healthy food options compared to areas with a lower percentage of African-American residents (Lewis et al., 2005), and compared to even the most impoverished white neighborhoods, African-American neighborhoods are still 1.1 miles further from the nearest supermarket (Zenk et al., 2005). And even in these supermarkets, while prices may be comparable to supermarket prices in predominantly white neighborhoods, the food is often of poorer quality (Block & Kouba, 2006). There are clear racial and socioeconomic disparities in access to healthy food, and so the continued study of food deserts will not only benefit all people who live in these areas but will be one more step on the path towards addressing racial injustices and fighting for racial equality in all areas of life, including food.

Background

Understanding the societal forces that led to unequal distribution of resources among income and racial groups and contributed to the existence of impoverished areas like food deserts provides valuable background information to understand the current state of the problem.

One of the primary areas of research in this field is how to best define and conceptualize food deserts, and one of the main critiques by researchers was that until 2015, the official food desert definition by the United States Department of Agriculture (USDA) was categorical, not a gradient (USDA, 2012). In order to be officially categorized as a food desert, census tracts had to have a poverty rate above 20%, and more than 33% of the population had to live more than one mile from a supermarket or major grocery store (this distance rose to 10 miles for rural areas) (Spears, Powell, & Yang, 2014). The map in Figure 1 below is based on this definition.

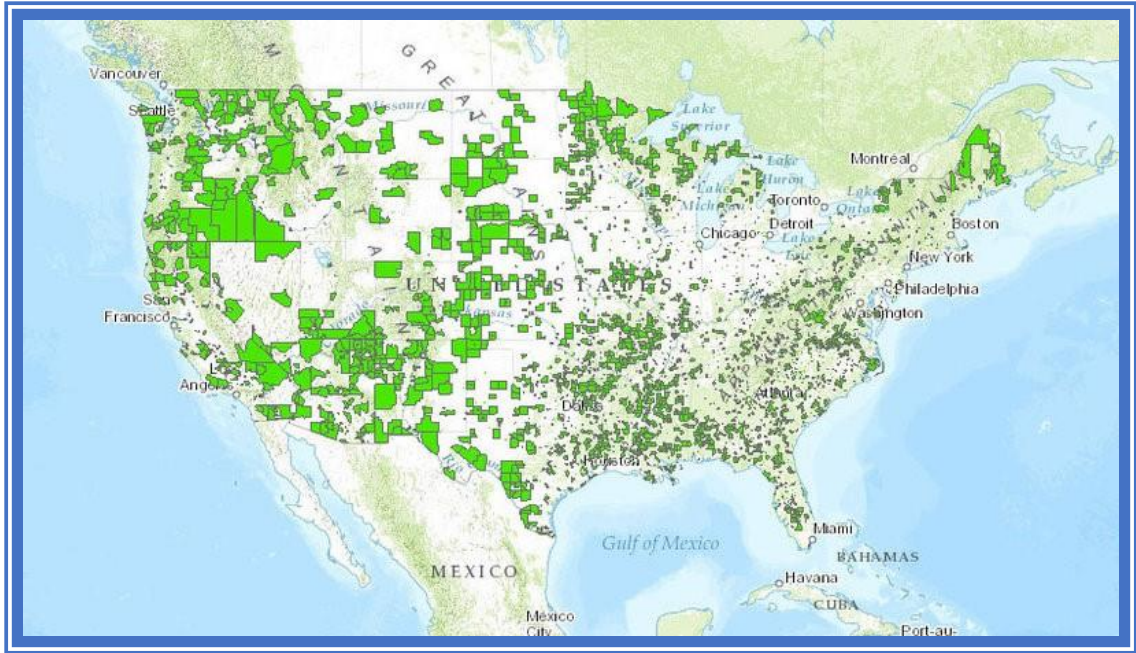


Figure 1. U.S. Food deserts as defined by the USDA
 Source: USDA, 2017

However, the USDA appears to no longer classify food deserts categorically. There is no official definition on their website anymore, and instead, features an interactive tool called the Food Access Research Atlas that allows users to understand three of the defining features of food desert census tracts; poverty rate, distance to the nearest grocery store, and household vehicle access (USDA, 2017). Users can look at the map of the whole country or click on individual census tracts to learn how many people in that area are low-income, live at varying distances from grocery stores, and how many households have access to a vehicle.

This is an important conceptual shift by the USDA because while living one mile away from a supermarket in an urban area may be a reasonable shopping distance for some people, it may not be a reasonable distance for someone without access to a vehicle, the elderly, or people with disabilities (Spears et al., 2014). Some issues remain to be worked out with how the USDA officially conceptualizes food deserts, but that is beyond the scope of this thesis. For purposes of

this project, food deserts are low-income areas, defined as 20% or more of the population living below the poverty level, with a lack of local access to healthy food (access is measured by varying distances depending on if a census tract is urban or rural).

As of 2015, an estimated 19 million of 39.4 million individuals living in low-income, low-access census tracts, or 6.2 percent of the total U.S. population, had limited access to a grocery store using the previous official definition of access – one mile for urban areas, 10 miles for rural areas (Rhone, VerPloeg, Dicken, Williams & Breneman, 2015).

About 15% of households in food deserts have no vehicle available to them (Dutko, Ploeg, & Farrigan, 2012), and car ownership aside, the cost of time and gas to travel to another town for food is too high for some residents. As a result, people who live in food deserts often resort to shopping at corner stores, sometimes referred to as bodegas, which are small stores that in addition to other household items sell a variety of mostly high-calorie, high-fat foods in the grocery section (LeClair & Aksan, 2014).

The prevailing term used to describe under-resourced areas without local access to healthy food options is food desert, as defined above, but other terms are also gaining popularity in this field – the newest one being food swamp. Food swamps are areas with a high density of establishments selling high-calorie fast food and junk food relative to healthier food options (Khazan, 2017). In food swamps, at least four unhealthy options exist for every healthy option – healthy options including grocery stores and supermarkets, unhealthy options including corner stores and fast food restaurants (Khazan, 2017). This is a newer area of research, but there is thought to be significant overlap between areas considered food deserts and food swamps.

Significance

The 2015–2020 Dietary Guidelines for Americans recommend that adults eat 1.5-2.0 cups of fruit per day and 2-3 cups of vegetables per day (Burwell & Vilsack, 2015). Although most Americans regardless of if they live in a food desert do not meet these recommendations, what is important in this context is the matter of choice, as many residents of America’s food deserts do not even have the option to eat healthy foods like fruits and vegetables (Lee-Kwan, Moore, Blanck, Harris, & Galuska, 2017). Research in self-determination theory, a theory that emphasizes innate psychological needs (Deci & Ryan, 1985), has provided support to show that when these innate needs are met, people experience enhanced self-motivation and mental health (Ryan & Deci, 2000). When these needs are thwarted, individuals may experience diminished motivation and well-being (Ryan & Deci, 2000). In food deserts, not only do people not have easy access to healthy food, but their food choices overall are severely limited. According to self-determination theory, the lack of freedom to choose healthy food could have negative effects not only on their physical health, but on their mental health as well.

Lee-Kwan et al. (2017) found that although most Americans do not eat enough fruits and vegetables, a greater percentage of people with high SES met the recommended daily F&V intake. Eating enough F&V as part of a balanced diet is critical because this has been shown to reduce the risk of several chronic diseases, such as cardiovascular disease, type 2 diabetes, some types of cancer, and obesity (Kaur & Kapoor, 2001). A diet high in healthy foods like fruits and vegetables can also keep blood pressure lower, promote gastrointestinal health, and improve vision (Harvard School of Public Health, 2019). In fact, even a one portion increase in daily consumption of F&V has been correlated with a 4% lower risk of coronary heart disease, a 6% lower risk of stroke, and a 14% lower incidence of diabetes (Carter et al., 2010; Joshipura et al., 1999; & Joshipura et al.,

2001). Most importantly, consuming plenty of fruits, vegetables, and whole grains as part of an overall healthy diet can increase one's odds of living a longer, more satisfying life (Harvard Medical School, 2019).

Paradigm Shift: Social Conditions as Fundamental Causes of Disease

Health has been traditionally understood as a product of the interaction between genetics and lifestyle choices. Conceptualizing health in this way makes it easy to blame individual people for being unhealthy and shame them for not making healthier choices. A paradigm shift occurred in the mid-1990s when Link & Phelan (1995) popularized the idea that genetics and lifestyle choices were not the sole determinants of health. Rather, they argued in their landmark paper "Social Conditions as Fundamental Causes of Disease" that social conditions such as SES, race, gender, and social support directly influence health because these conditions impact access to resources that ultimately affect health (Link & Phelan, 1995).

For example, consider a woman living in a low-income area like a food desert who may be at risk for developing type 2 diabetes. Link & Phelan (1995) would argue that her situation must be contextualized by examining the social conditions in her life that put her at risk for developing type 2 diabetes in the first place. Maybe she is someone who works three jobs in order to support her family and therefore does not have time to exercise; could not afford a gym membership even if she had time; cannot safely walk or run alone in her neighborhood because it is a high-crime area; and does not have a car and so has to shop at her local corner store where few healthy foods are stocked to choose from.

On the surface, it is easy to say that a lack of exercise and poor dietary choices cause this woman to be at risk for developing type 2 diabetes. However, when examining her situation through the lens that Link & Phelan suggest, it becomes clear that the social conditions of her life

are the root cause of her risk, not her lifestyle choices. It is crucial to recognize this difference in order to shift intervention research away from individually-based interventions toward broad-based societal interventions that recognize and remove environmental barriers to making healthy choices. Once these barriers are removed, individually-based intervention strategies that empower individuals to make healthier choices in their environments are more appropriate.

The continued study of food deserts is incredibly important because all people regardless of socioeconomic status (SES) should have equal opportunity and ability to purchase healthy foods like fruits, vegetables, and whole grains that will nourish and promote their body's health.

Theoretical Foundations

According to Karen Glanz in her textbook *Social and Behavioral Theories*, "A theory is a set of interrelated concepts, definitions, and propositions that explains or predicts events or situations by specifying relations among variables" (2016, p. 4). Frameworks are similar but slightly different; Glanz et al. (2015) defines a framework as: "A structure that elicits a hypothesized set of relationships among constructs and one or more behavior(s) or environmental factor(s) leading to health outcomes" (p. 359). The main difference is that theories can be used to explain and predict behavior whereas frameworks are used more conceptually to understand the nature of a problem.

Theories and frameworks are essential to health research because not only can they help explain human health behavior, but they can also guide the design of interventions to most effectively influence and change human behavior to better promote overall health and well-being (Glanz, 2016). Without a guiding theory, the structure of and vision for a study is unclear (Grant & Osanloo, 2014).

In this thesis, the Social Ecological Framework was chosen to conceptualize how individuals interact with and are influenced by society, and Social Cognitive Theory was chosen to understand the conditions under which individual health behavior is most likely to actually change. These are two of the four most widely accepted and implemented theoretical models in health behavior, used in many publications by multiple authors over the course of the past two decades (Glanz, 2016). Consequently, this thesis enters that conversation and contributes to a large body of research on these two theoretical models.

Social Ecological Framework

Although more than a dozen different ecological models used in health research consider upstream influences on individual behavior, throughout this thesis, the Social Ecological Framework was chosen to conceptualize the problem of food deserts and guide the evaluation of which levels are most important for food desert interventions (Glanz et al., 2016). This framework was chosen because as Figure 2 below demonstrates, it takes into account the many spheres of society that influence health behavior. Additionally, the SEF was designed to guide health behavior change interventions, so it can be easily applied to the current study (Glanz et al., 2016).

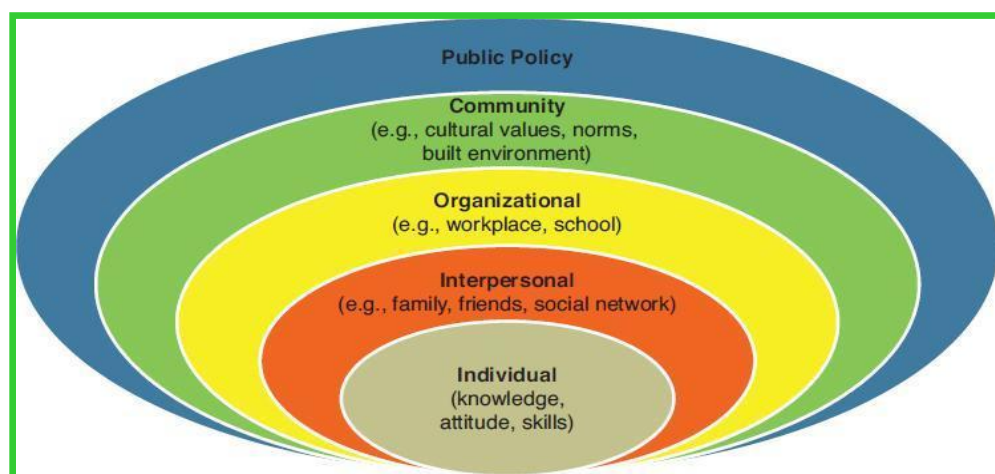


Figure 2. Levels of the Social Ecological Framework
Source: Glanz, 2016

According to the SEF, as social creatures, all people are nested in a series of hierarchical societal levels, starting at the level of the individual, and then ascending to the interpersonal, the organizational, the community, and lastly to the highest level of society, public policy (Glanz, 2016). In this framework, the degree to which an environment promotes or hinders health is understood as the cumulative and interactive impact of factors at each of these levels on individuals' mental, physical, social, and emotional health (Stokols, 1996). Health outcomes, therefore, are a product of much more than an individual's behavior. The greatest strength of the SEF is that it considers everything in an individual's environment that ultimately determines, or at the very least influences, their behavior. Although it is not yet known exactly how factors at each level interact to promote or hinder behavior, healthy behaviors are thought to be most facilitated when factors at all levels of the SEF support the enactment of any given health behavior (Canadian Public Health Association, 1986).

The Social Ecological Framework is particularly relevant to this thesis because to understand any health behavior – in this instance, the foods people eat – it is essential to understand the structures that shape it, and there are structures at every level of the SEF that influence the food people eat. At the individual level, each person has their own preferences and purchasing habits. Food is also inherently social, and so what people eat is affected by the types of gatherings and parties they attend and what food they see their friends and family eat. The organizational level of the SEF encompasses places like schools and workplaces, and the food environment and culture of these places can have an enormous impact on what people eat because of how much time people spend there. Several community-level factors affect food environments, such as the density of grocery stores, farmers markets, corner stores, and fast food restaurants; and the public transportation system (for people in food deserts who wish to travel elsewhere to purchase healthy

foods). Finally, at the highest level of this framework, many policies affect what people eat. Examples include agricultural subsidies for foods like soy, wheat, and corn but not fruits and vegetables (making healthy foods more expensive than processed foods), as well policies within the Supplemental Nutrition Assistance Program (SNAP), a federal program that provides a hunger safety net for those who need it.

Food is an essential, social, pleasurable, and complicated part of daily life. On average, people make 200 decisions about food every single day – and every time someone eats, they have the opportunity to impact their health positively or negatively (Wansink & Sobal, 2007). Whether or not people are consciously aware of it, these decisions are the product of influences at all five levels of the Social Ecological Framework, not just their individual choices at the moment of eating. In order to achieve lasting behavior change, the food environment at all five levels of the Social Ecological Framework must be changed to ultimately facilitate healthy behavior at the individual level.

Social Cognitive Theory

While the Social Ecological Framework is most useful for understanding influences on health behavior at every level of society and designing interventions to target these many determinants, Social Cognitive Theory is most helpful for predicting behavior at the individual level (Glanz, Rimer, & Vizwanath, 2015). SCT was a revolutionary theory at the time Bandura was developing it because in the 1970s, most people believed that behavior was either totally determined by forces outside one's control, or it was completely determined by one's own self-control (Glanz et al., 2015). SCT was one of the first behavior change theories to recognize that human beings are not mindless automatons responding to stimuli, but cognitive beings who make choices that are influenced by the complexity of their surroundings (Bandura, 1977).

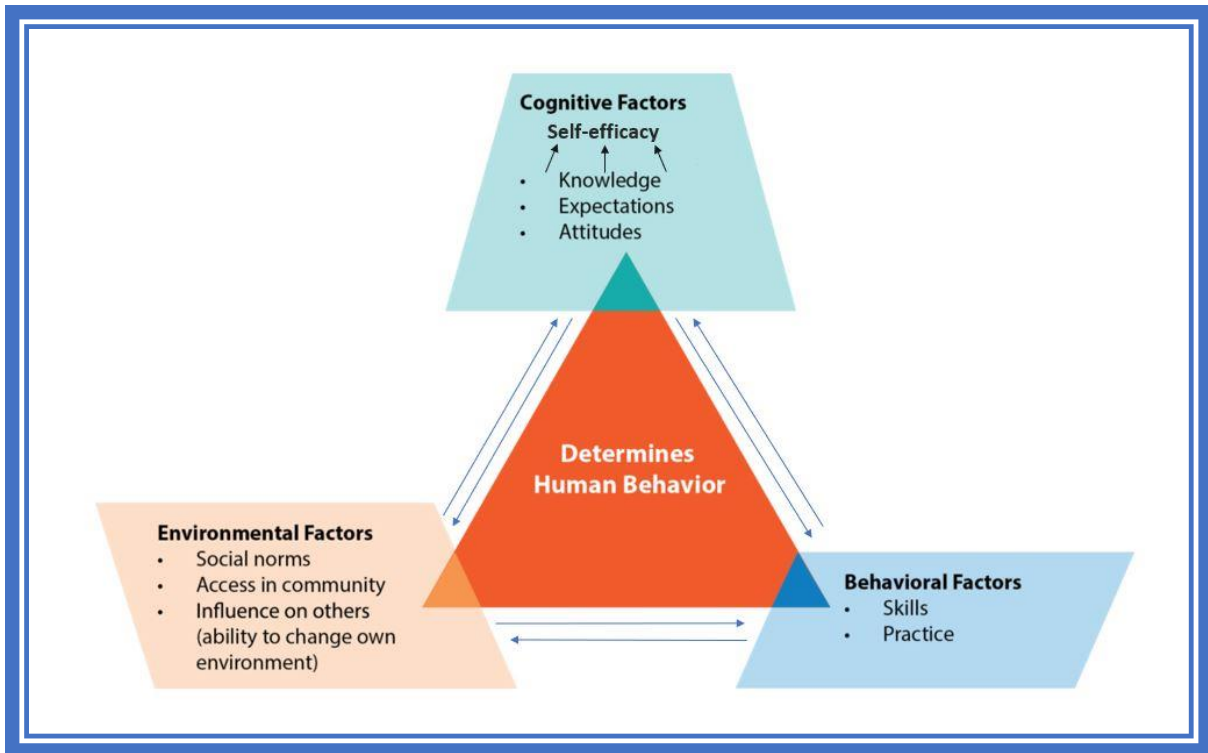


Figure 3. Model of Social Cognitive Theory
 Source: Gill-Bailey, Bertram, & Cabiness, 2016

There is a large body of scholarship on Social Cognitive Theory, and while there are many facets of SCT, the most central concept is **reciprocal determinism**. As Figure 3 above demonstrates, Bandura theorized that reciprocal determinism is the interaction of cognitive factors, environmental factors, and behavioral factors to influence individual behavior (Gill-Bailey, Bertram, & Cabiness, 2016). This theory has been extensively applied in health behavior change research because reciprocal determinism takes into account the complexity of an individual’s environment in promoting or hindering decisions they make to improve their health.

Central to reciprocal determinism is the cognitive factor of **self-efficacy**, which Bandura defines as “a personal judgment of how well one can execute courses of action required to deal with prospective situations” (Bandura, 1982, p. 122). Put simply, self-efficacy is synonymous with *confidence*. Self-efficacy is by far and away the most validated, most tested construct of health

behavior research because to engage in a health behavior, one *must* have the self-efficacy to do it (Glanz, et al., 2015). It is possible for someone to have many behavioral, cognitive, and environmental factors that facilitate behavior change but still lack self-efficacy – however, the prediction of SCT is that the more factors are in place to facilitate behavior change, the more self-efficacy an individual has to change that behavior. One of the best ways interventions can increase participants’ self-efficacy is to practice engaging in a certain behavior. The more practice someone has, the more skills they gain, which leads to increased self-efficacy for engaging in that behavior.

The last important construct from Social Cognitive Theory that the current study applies to understand why some interventions worked and some did not is another cognitive factor, **outcome expectations**. Outcome expectations are exactly what they sound like; what an individual expects to be the outcomes, physical or social, of enacting a specific behavior (Glanz, 2015). Outcome expectations can be short-term or long-term, positive or negative. Outcome expectations about any particular behavior can vary significantly from person to person, which partly accounts for variation in all behaviors.

For example, consider healthy eating. One person might have a negative short-term outcome expectancy of eating healthy; they perceive healthy foods as tasting bad, and this decreases their likelihood of eating fruits and vegetables because humans typically engage in behaviors they believe will benefit them in some way, and eating foods perceived to be distasteful does not benefit this person in the short-term. Another person might have a long-term positive outcome expectancy; eating healthy will help them live longer, so they consume a diet high in fruits and vegetables to work towards this long-term goal. Improving positive outcome expectations is critical for health behavior interventions because *even if* someone has a very high level of self-efficacy for engaging in a particular behavior because of all the environmental,

behavioral, and cognitive factors enabling that action, if that person does not expect to benefit from this behavior in a way that they value, they may *still* not engage in it. Because of this, increasing positive outcome expectations is arguably the most important aspect of health behavior change interventions.

Behavioral, environmental, and cognitive factors all interact in the process called reciprocal determinism to influence an individual's behavior. Of all these influences, the cognitive factors of self-efficacy and outcome expectations are two of the most important. To increase the likelihood of engaging in any particular behavior, an individual must have positive outcome expectations of that behavior and enough self-efficacy to enact it.

Research Gap

Since the concept of food deserts emerged in the U.K. in the 1990s, research in this field has been on the rise in developed countries like the U.S., the U.K., and Canada (Beaulac, Kristjansson, & Cummins, 2009). Researchers have studied how to best define food deserts (examples including Ploeg et al., 2009; Dutko et al., 2012); how to map them (examples including Pearce, Witten, & Bartie, 2006; LeClair & Aksan, 2014); and review articles summarizing what had been discovered in the field up until that time (examples including Beaulac et al., 2009; Walker, Keane, & Burke, 2010).

As the body of research on these topics has increased and solidified public understanding of the extent and scope of the problem, interventions to address the issue have been implemented and their success measured. While there have been many of these interventions, a review of the literature reveals a lack of theoretically-based literature reviews of these interventions to determine why some were successful, some were not, and how to use that knowledge to develop maximally effective interventions in the future. The current study aims to fill that gap.

Methods

Objectives

As originally stated in the introduction, the research question that this thesis explores is the following: What accounts for the effectiveness of interventions in food deserts, and moving forward in this field, how can researchers use leading ecological frameworks and psychological theories of health behavior change to design interventions in this field with the greatest chance of success – success in this case being measured as the long-term maintenance of increased consumption of healthy foods like fruits, vegetables, and whole grains.

A literature review was chosen as the most suitable method for investigating this question because there has not yet been a literature review conducted of food desert interventions. In order to most effectively continue research in this field, it is essential to look back at what has already been done to understand what accounts for the success of previously tested interventions, so that moving forward, interventions can be designed that have the greatest chance of success.

The first objective of this thesis was to conduct a thorough literature review of food desert interventions. Once the literature was gathered, all articles were sorted by level of the Social Ecological Framework they intervened on and if they were successful at increasing either consumption or sales of healthy foods like fruits and vegetables. The second objective was to analyze these groups of interventions based on the Social Ecological Framework and Social Cognitive Theory to explain the reasons for the success or failure of these interventions. Based on the predictions of the SEF and SCT and on the results of this study, the last objective was to develop a set of best practices for designing future interventions with the greatest chance of success at improving diets among residents of food deserts in the U.S.

Data Collection

Searches were conducted on Google Scholar to identify food desert interventions to analyze in this thesis. Google Scholar was the chosen search engine because it pulls results from many different electronic databases including ScienceDirect, PubMed, and EBSCOhost. First, a list was made of all the search terms that would be used to gather articles. These search terms were selected because after becoming familiar with the food desert literature, it was clear that these were the most commonly attempted intervention types in the field.

Next, searches were conducted for each exact phrase by putting it in quotations marks in the search box. Then, the quotations marks were removed to search articles for all the words in the phrase without needing to contain the exact phrase. For each phrase searched, the first five pages of the results on Google Scholar were looked through to identify articles to include in this literature review. Five pages was chosen as an arbitrary limit because at that point in each search, very few, if any, new articles met the criteria for inclusion. Phrases searched include:

- Food desert intervention
- Food desert natural experiment
- Food desert health behavior change intervention
- Food desert education intervention
- Food desert solution
- Food desert mobile market
- Food desert corner store intervention
- Food desert farmers market
- Food desert farmers market intervention
- Food desert farm stand intervention
- Food desert farm stand
- Supplemental assistance nutrition program intervention

To qualify for inclusion in this literature review, studies that appeared in these searches had to be implemented in food deserts, food swamps, with people in the Supplemental Nutrition Assistance Program, or with other low-income populations. It was decided upon to include interventions that otherwise met inclusion criteria but were implemented with low-income

populations in general rather than explicitly identified food deserts because there are still some issues with how to best conceptualize food deserts, and low-income populations are more likely to live in low-resource areas like food deserts than people of higher SES.

The second criteria for inclusion was that studies had to either measure sales or consumption of healthy foods before and after an intervention. There were many closely related and interesting areas of study that had to be excluded from this review because they did not meet the specified inclusion criteria. Excluded studies included:

- Studies that measured the healthfulness of different food environments
- Studies that interviewed food desert residents about barriers to healthy eating
- Studies of food insecurity but not consumption patterns
- Articles that offered strategies for increasing availability of healthy foods but did not measure dietary changes of participants
- Studies that measured health outcomes but did not measure changes in dietary intake; this is an essential area of study, however, the goal of this study is to first establish a greater consensus in the field about which intervention strategies are most effective at improving dietary intake to lead to better health outcomes
- Healthy eating initiatives and interventions that otherwise met inclusion criteria but were conducted with populations other than those with low income

A form of snowball sampling was also utilized to identify some of the studies ultimately included in this analysis. When articles were opened on certain databases such as Science Direct, articles on similar topics would be listed on the side of the web page. When these studies met the criteria for inclusion, they were added to the literature to review. In a few cases, articles included in the literature review were identified from the reference list of other articles, although this method was not systematically employed.

There was no limit on when a study had to have been published in order to be included in this literature review. Food deserts became a burgeoning area of study in the 1990s, and consequently, literature on this topic has steadily increased since this time (Beaulac et al., 2009).

Additionally, no geographic limits were placed on what studies were included in this literature review. Although most of the interventions identified for inclusion took place in the U.S. in more than 10 states, because this study was primarily concerned with identifying what contributed to the overall effectiveness of food desert interventions, five studies were chosen to be included from the United Kingdom and one study from Canada that were identified by the terms searched during data collection and met criteria for inclusion. After all, the concept of “food desert” was conceived in the U.K., and three of the first natural experiments measuring the effects on diet of opening a new grocery store in a former food desert took place there (Wrigley, Warm, & Margetts, 2003; Cummins et al., 2005; and Cummins et al., 2008).

Grouping

After an article was identified on Google Scholar and it met all the inclusion criteria, it was added to a folder in Zotero created specifically for this project. After each article was added to Zotero, the PDF version of the article was downloaded and saved to the computer. Each downloaded article was then sorted into a folder based on which level of the Social Ecological Framework the intervention targeted. This was determined by reading about the intervention in the method section of each article. In order to be assigned to a level of the Social Ecological Framework, the intervention had to change something at that level during the intervention and then measure the effect of that change on either the sales or consumption of healthy foods like fruits and vegetables. For example, a federal policy that provides an incentive for purchases of F&V in farmers markets is an intervention at the public policy level, *not* the community level. This is because nothing about the environment of the farmers market changed; the policy affecting purchases at the farmers market changed. If the farmers market itself offered an incentive for purchasing fruits and vegetables, that would be considered a community-level intervention.

Interventions were categorized as multilevel if two or more main components of the intervention targeted different levels of the Social Ecological Framework. Multilevel interventions were grouped together in their own folder.

In each folder, articles were sorted into two further groups for analysis: successful or unsuccessful, based on what the researchers themselves concluded. Although some interventions may have achieved a greater magnitude or more lasting success at improving participants' intake of healthy food, for purposes of this literature review, all articles were categorically classified as successful or unsuccessful. In all cases, for researchers to have concluded that the intervention was successful, there had to be a statistically significant increase in consumption or sales of healthy foods after the intervention. The results are presented in Table 1 and Figure 4 in the results section.

Analysis

Once all articles were sorted by intervention type and success, they had to be analyzed for what most likely accounted for their success. Constructs that were analyzed differed by intervention type.

Individual-level components of multilevel interventions were analyzed with the single-level individual interventions in the individual-level section of the discussion rather than waiting until the multilevel section to discuss them. Although all other components of multilevel interventions are analyzed in that section, this exception was made because change at the individual level is clearly necessary to change behavior, and it is easier to understand patterns that lead to success at this level with more examples to analyze.

For individual-level interventions and the individual-level components of all multilevel interventions, it was most important to determine what aspects of the intervention contributed to

participants' sense of self-efficacy and increased positive outcome expectations for healthy eating. These were the constructs chosen to be analyzed because Social Cognitive Theory predicts that for behavior to change, people must develop a sense of self-efficacy for and positive outcome expectations of engaging in that behavior.

After reading the description of each individual-level intervention in the method section of all articles, it became clear that several common components were included in these types of education interventions that likely contributed to the development of self-efficacy and positive outcome expectations for healthy eating. They were: cooking demonstrations, cooking practice, in-class tastings, take-home recipe cards, and take-home meal kits. All individual-level interventions were sorted into an excel spreadsheet and a box was checked for each activity included in the intervention.

A different set of constructs were analyzed to explain what led to an intervention's success at the community level. In order to understand why some community-level interventions worked to change behavior and others did not, constructs from Social Cognitive Theory were once again employed. SCT posits that one of the three major areas of influence on human behavior are environmental factors, and so because these interventions took place at the community level, the environmental factors that the interventions targeted were examined.

The articles included in this literature review as well as other literature in this field read for background knowledge overwhelmingly indicate that the most important environmental barriers to healthy eating are access and cost. Therefore, all community-level interventions were sorted into an excel spreadsheet and a box was checked for each barrier removed during the intervention.

Although the primary focus was on which environmental barriers the community-level interventions removed to promote access to healthy food, one cognitive barrier to healthy eating –

beliefs about food preparation – was analyzed in addition to these two environmental barriers in order to provide a possible explanation for why intake of healthy food may not have increased in cases where interventions removed both access and cost barriers.

The numerical results of these analyses and how they relate to the predictions of SCT are described in the discussion section. They are not presented numerically in the results section because it is necessary to state them in the discussion section in order to provide a more seamless explanation for the results.

Policy level and multilevel interventions did not require additional excel spreadsheets to sort them by constructs targeted. They are discussed more generally in relation to the Social Ecological Framework and Social Cognitive Theory in their respective sections of the discussion.

Results

Forty-five articles were identified through the searches on Google Scholar that met inclusion criteria. Table 1 below presents these results. Each article was assigned an identifying number that is used in Figure 4 and throughout the discussion section.

Table 1. Articles included in the literature review sorted by level of the Social Ecological Framework and intervention type

Level	Intervention Type	Author(s)	Year	Identifier
Individual	Education	Dollahite et al.	2014	1
		Hershey et al.	2015	2
		Ko et al.	2016	3
		Rustad et al.	2013	4
		Wrieden et al.	2007	5
		Campbell et al.	2004	6
		Williams et al.	2015	7
Community	Corner Store	Dannefer et al.	2012	8
		Martin et al.	2012	9
		Song et al.	2009	10
		Lawman et al.	2014	11
		Ortega et al.	2016	12
	Farmers Market	Dimitri et al.	2015	13
		Evans et al.	2012	14
		Freedman et al.	2013	15
		Hanson et al.	2017	16
		Ruelas et al.	2011	17
		Woodruff et al.	2016	18
	Mobile Market	Gary-Webb et al.	2018	19
		Jennings et al.	2012	20
	Grocery Store	Fuller et al.	2015	21
		Wrigley et al.	2003	22
		Cummins et al.	2005	23
		Cummins et al.	2008	24
		Cummins et al.	2014	25
		Dubotwitz et al.	2015	26
Richardson et al.		2017	27	
Sadler et al.		2013	28	
Weatherspoon et al.		2012	29	
Public Policy	SNAP Incentive	Cohen et al.	2017	30
		Collins et al.	2017	31
		Freedman et al.	2014	32
		Herman et al.	2011	33
		Olsho et al.	2016	34
		Savoie-Roskos et al.	2016	35
		USDA	2014	36
		Young et al.	2013	37
		Olsho et al.	2014	38
Multilevel	Education, Farmers Market	Bowling et al.	2016	39
	Education, Family	Chen et al.	2014	40
	Education, Mobile Market	Gans et al.	2018	41
	Education, Mobile Market	Leone et al.	2018	42
	Education, Family	Overcash et al.	2018	43
	Education, Grocery Store	Wedick et al.	2016	44
	Education, Grocery Store	Moran et al.	2019	45

After articles were sorted into Table 1, they were plotted visually in Figure 4, seen below. Every article from Table 1 is visually represented in Figure 4 by its identifying number assigned in the last column of Table 1. The text color of the number signals if the intervention was successful or not. Multilevel interventions are highlighted in green, and their assigned numbers appear at each level of the Social Ecological Framework that the intervention targeted.

Legend
 black number = successful intervention
 white number = unsuccessful intervention
 green highlighted number = multilevel intervention, number will appear on each level the intervention targeted

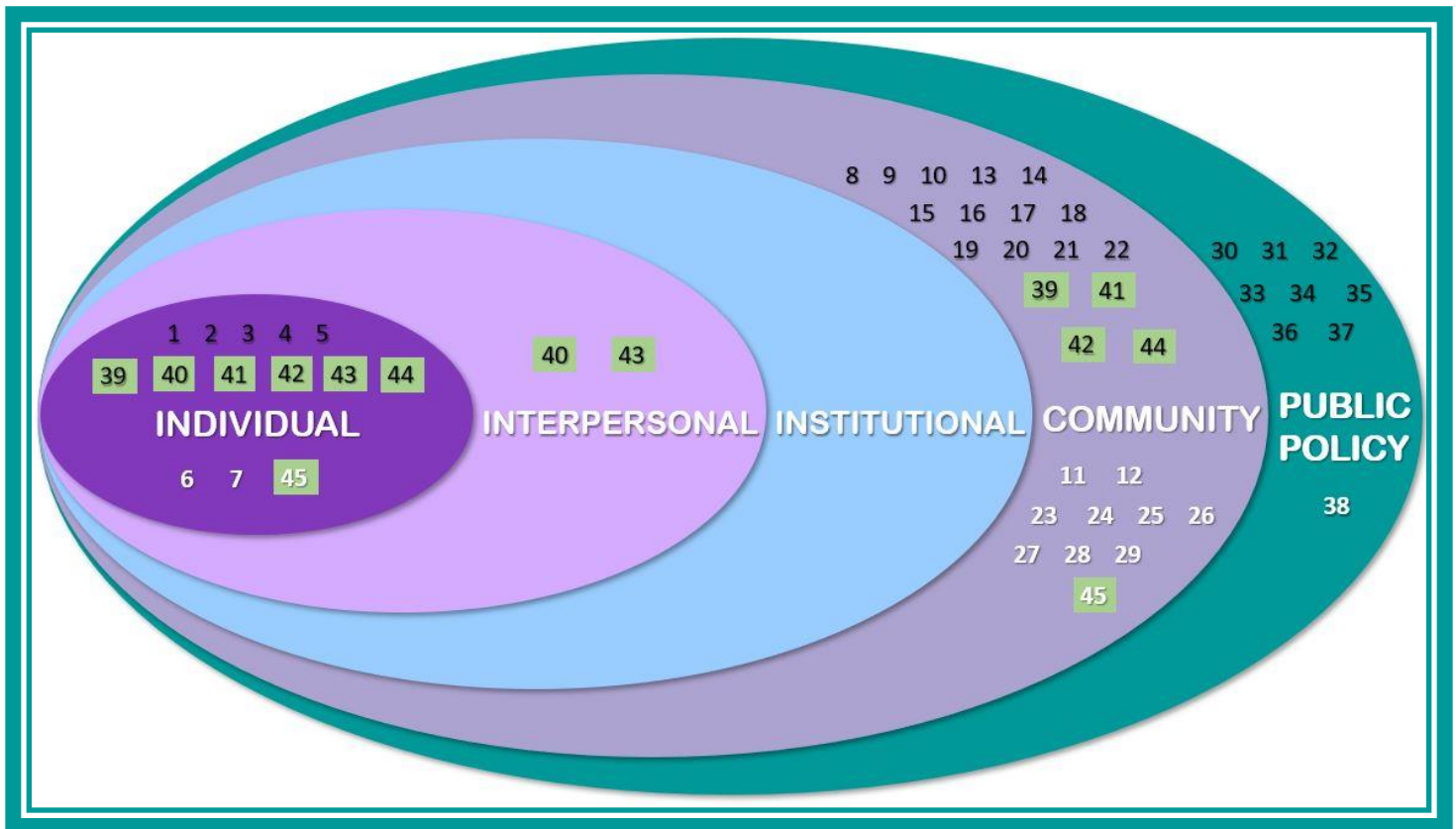


Figure 4. Illustration of articles sorted by level of Social Ecological Framework and success

Discussion

In this section of the thesis, time is spent at each level of the Social Ecological Framework to discuss what types of interventions at that level succeeded at increasing sales or consumption of healthy foods like fruits and vegetables and which ones failed. Multilevel interventions are discussed at the end in a separate section. Throughout each section explanations are offered based on the Social Ecological Framework and/or Social Cognitive Theory for what might account for the success, or lack thereof, of certain types of interventions.

This literature review was designed as a broad overview of the field of food desert intervention research, and consequently, not all interventions and categories are analyzed in detail, because that is not the objective of this thesis. The objective was to identify overarching patterns in the research and use these patterns to suggest guidelines for future intervention research in this area, which is what follows in the upcoming sections.

Individual Level

All seven of the multilevel interventions included individual-level components, and six of them were successful (numbers 39 – 44 in Figure 4). There were seven single-level individually-based interventions, and five of them were successful (numbers 1 – 5 in Figure 4).

Every level of society needs to change to better promote and encourage healthy eating. However, because eating is such a deeply ingrained behavior, unless people actively work on their beliefs and habits about eating on an individual, psychological level, their eating habits will not change (DiSalvo, 2017). Unless they are given a strong, sufficiently motivating reason to do otherwise, people will continue to eat what they prefer and are familiar with (Worsley, 2002). This is the role that individually-based interventions have to play in this field of study, and Social

Cognitive Theory is highly useful for developing individual-level interventions because of its widespread use in the field of health behavior due to its ability to explain the mechanisms that cause behavior.

The Social Ecological Framework is most useful for understanding how factors at every level of society affect all behaviors, health-related or otherwise – it is less easily applied to understand what causes individual behavior to actually change. This is the point at which application of the Social Cognitive Theory is necessary to better understand what accounts for the success of certain individual-level interventions and not others.

Social Cognitive Theory is a multi-faceted behavior change theory, but the single most important, validated, and widely used construct to emerge from it is self-efficacy (Glanz et al., 2015). If someone does not have enough self-efficacy, which is the confidence to successfully engage in a certain health behavior, they will likely not do it. Additionally, if someone does not have positive outcome expectations of healthy eating, they are also less likely to do it.

Application of Social Cognitive Theory

Individual-Level Component of Multilevel Interventions: Rather than analyze all 14 individual-level interventions to determine which specific set of factors (cognitive, behavioral, and environmental) these interventions targeted, only an intervention's overall attempt and/or ability to increase self-efficacy and build positive outcome expectations are analyzed in this section. However, Figure 5 below demonstrates many of the relevant factors in each of these areas that interventions may target when aiming to increase healthy eating among people who live in food deserts.

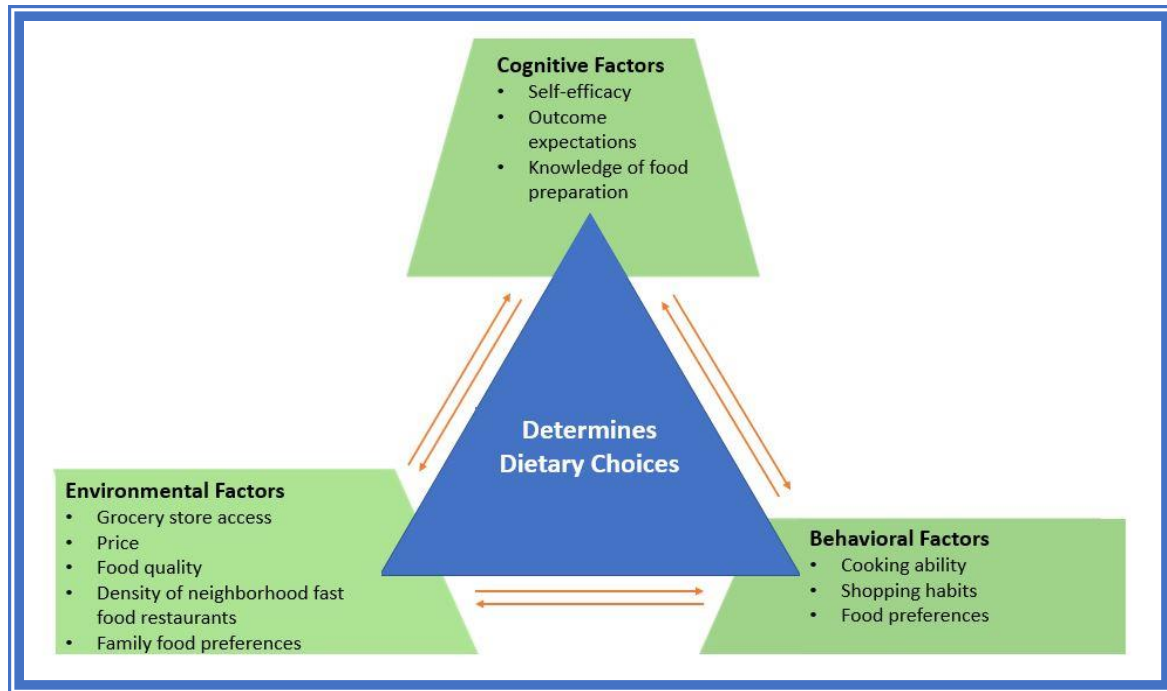


Figure 5. Model of Social Cognitive Theory applied to healthy eating in food deserts

Four of the six successful multilevel interventions explicitly state that an increase in participants' self-efficacy is one of the targeted outcomes of the educational component of the intervention (numbers 41 – 44 in Figure 4). The goal of increasing self-efficacy for healthy eating was likely achieved through the chosen intervention strategies, as all six included activities to increase self-efficacy for healthy eating by increasing positive outcome expectations of doing so through social learning and practice. These activities included cooking demonstrations, cooking practice, in-class tastings, take-home recipe cards, and take-home meal kits. All six successful individual-level components of the multilevel interventions included at least two of these activities, and all but one included three or more.

SCT predicts that these activities increased participants' positive outcome expectations of and self-efficacy for healthy eating, and this is what accounts for their increase in consumption of healthy foods like fruits and vegetables after the intervention.

There was only one unsuccessful multilevel intervention (number 45) that included an individual-level component. The individual-level aspect of this intervention was more removed from participants than in the other multilevel interventions. Whereas the individual-level components of the other multilevel interventions were hands-on activities, Moran et al. (number 45) sent weekly text message reminders to purchase healthy meal kits bundled throughout the store (the community-level component). SCT would predict that these text messages were not powerful enough to increase positive outcome expectations in the same way that classes, demonstrations, and tastings were able to in the other interventions. Additionally, because there were no demonstrations or cooking classes, participants could not increase their self-efficacy for cooking the healthy foods that were included in the meal kits by practicing the behavior, and this also likely accounts for the intervention's lack of success at changing behavior.

In all successful multilevel interventions with individual-level components, the other component – community-level or otherwise – no doubt contributed to participants' increase in self-efficacy to engage in healthier eating habits. However, what is most important to note in this section on individual-level interventions is the importance of increasing positive outcome expectations and self-efficacy during the educational, individual-level component of multilevel interventions, regardless of what other levels they target.

Single-Level Individual Interventions: One of the five successful single-level individual interventions (number 2 in Figure 4) was only published in the journal as a longer version of an abstract and does not include a lengthy description of the intervention. Consequently, it cannot be determined how the intervention increased participants' self-efficacy or positive outcome expectations, and if increases in these cognitive factors account for participants' increased intake of healthy foods.

Of the four remaining successful single-level individual interventions, two of them (numbers 1 and 3 in Figure 4) explicitly state an objective to increase self-efficacy for cooking healthy foods. And like the individual-level components of the successful multilevel interventions, all the successful single-level individual interventions included at least three of the five following activities: cooking demonstrations, cooking practice, in-class tastings, take-home recipe cards, and take-home meal kits. These aspects of the intervention increased self-efficacy for and positive outcome expectations of healthy eating, which increased the likelihood of engaging in these behaviors after the intervention ended.

Neither of the unsuccessful single-level individual interventions stated an increase in self-efficacy as a goal of the program. Although both handed out recipe cards to participants as one of the intervention strategies, neither of them included any of the other activities mentioned above. All the successful single-level individual interventions that handed out recipe cards paired this with cooking demonstrations, cooking practice, or both. Recipe cards are not as useful if not paired with education on how to cook them.

Including multiple activities designed to increase participants' self-efficacy for and positive outcomes expectations of healthy eating are therefore crucial components for successful individual-level interventions.

Interpersonal Level

There were no interventions that targeted only the interpersonal level of the Social Ecological Framework. However, two of the seven multilevel interventions included interpersonal components in the design of their interventions, and they are discussed in that section.

Organizational Level

There were no organizational-level interventions identified by the chosen search terms that met inclusion criteria. This literature review searched for and included only interventions implemented among low-income populations, and it is likely that many interventions in organizations like workplaces and schools take place among mixed-SES populations, and so were excluded from this study.

For example, a great body of research exists on workplace healthy eating interventions (review articles of this literature include Mhurchu, Aston, & Jebb, 2010; Hutchinson & Wilson, 2012). However, the articles reviewed either did not appear in any of the search results for the terms listed in the method section, or they did appear but did not meet inclusion criteria.

Additionally, several popular press articles describe interventions in organizations like churches but they were not research-based, and so none of these types appeared in the results for terms searched. They would not have been included even if they had because they did not collect data on healthy food consumption before and after the intervention to determine if there was a statistically significant change (examples include Nania, 2019; Ford, 2019).

Although change at every level of the Social Ecological Framework is necessary to facilitate increased intake of healthy foods among low-income populations, as of right now, this level is not the focal point for research-based single-level or multilevel interventions.

Community Level

The majority of interventions reviewed targeted the community level: 22 of 38 single-level interventions, and five of the seven multilevel interventions included a community-level component. Only the single-level community interventions are discussed in this section.

One of the main tenets of the Social Ecological Framework is that to most effectively change long-term individual behavior – the lowest level in the SEF – all other levels above it must also change to facilitate that behavior. Keeping this in mind, it is encouraging to know that many researchers in this field are investigating the effects of broader social change on individual behavior rather than relying on educational interventions that seek to change individual behavior without addressing the structures shaping it. Individual behavior is often a symptom of larger societal issues, which in this case is society’s general lack of value placed on healthy eating, especially for low-income populations.

Natural Experiments

There were nine interventions that are often referred to as a **natural experiment**: measuring study participants’ intake of healthy food before and after a grocery store opens in a former food desert. Natural experiments are classified as intervening on the community level because the introduction of a new grocery store is a change in the built environment, or part of the community (Glanz, 2016). Seven of these nine interventions (numbers 23 – 29 in Figure 4) failed to find an increase in consumption of healthy foods as a result of a new grocery store opening.

There are several possible reasons for the general ineffectiveness of natural experiments. Opening a grocery store intervenes on the community level of the Social Ecological Framework by making healthy food more accessible for people in the area, but it does nothing to impact people at the individual level. Expecting people to change their eating habits on their own once they have obtained access to healthier foods is unrealistic and will only reasonably work for highly motivated individuals who want to eat healthier and for whom access is the only barrier.

This is where a limitation of the Social Ecological Framework becomes clear. While this framework is immensely useful for conceptualizing the myriad factors that influence human

behavior and using this perspective to design interventions that target more than one of these factors, the SEF does not provide specific constructs for understanding why some interventions work at one level while others on the same level do not (Glanz, 2015). Social Cognitive Theory and the Social Ecological Framework therefore work as complements to each other in an incredibly useful way, because SCT can pick up the work at this point. In conceptualizing individual behavior, SCT posits that one of the three areas of influence are environmental factors. One way to understand why some community-level interventions work when others do not is to analyze which environmental barrier(s) to healthy eating the intervention removes.

Application of Social Cognitive Theory: Although a few of the natural experiments (Cummins, Flint, & Matthews 2014; Dubowitz et. al, 2015) did find that residents' perception of healthy food availability increased because of the new grocery store, there was not a corresponding increase in consumption of healthy foods because even with access to a grocery store, low-income individuals may face other environmental barriers to eating a healthy diet, the most important of which is cost.

Evans et al. (2015) conducted focus groups with residents of low-income communities and they found that although participants had a high level of knowledge about healthy eating, they also reported that price was one of the most important factors affecting food purchasing decisions, and healthier foods were perceived as being more expensive and less satiating. As one participant noted, "I look at the asparagus and I realize that I can buy a big rib eye for the same price so I get the rib eye" (Evans et al., 2015).

A group of researchers at Harvard conducted a meta-analysis of studies that included price data for healthier and unhealthier foods, and they found that eating a healthier diet only costs about \$1.50 more per day per person than eating an unhealthier diet (Rao et al., 2013). This adds up to

about \$550 more per person per year, which is a small price to pay for the savings in healthcare costs in the long run, but is a potential financial burden in the short-term, especially for low-income families with multiple people in the household. Regardless of access, price remains a significant barrier to healthy eating for many people.

However, even if barriers at the community level like access and price are removed, there may be individual, psychological barriers still in place. In focus groups with residents of food deserts conducted by Whelan, Wrigley, Warm, & Cannings (2002), several participants reported that convenience was a major factor when deciding what to cook for their families, and as one participant reported, “It takes hours to prepare a decent meal, a healthy, decent, home-cooked meal”. Regardless of if someone has access to healthy, affordable food, if convenience is important to them and they do not believe that they can prepare it quickly, they are most likely not going to purchase it. Similarly, Allcott, Diamond, Dubé, Handbury, Rahkovsky, & Schnell (2017) found that exposing low-income households to the same products and prices available to high-income households reduces nutritional inequality by only nine percent, while differences in demand account for the remaining 91 percent. Access is therefore necessary but not sufficient for behavior change. As the qualitative findings of Whelan et al. (2002) demonstrate, for dietary habits to change, in many cases, beliefs about cooking healthy food must also change.

Community-level changes removing barriers to healthy eating including access and price must therefore be paired with individually-based education interventions that change beliefs about healthy eating for the greatest chance of success at cultivating healthier eating habits.

Mobile Markets, Farmers Markets, & Corner Stores

The biggest focus in this field for many years was advocating for grocery stores to open in food deserts. One of the difficulties of opening new grocery stores in food deserts is that they are

usually required to provide parking based on store square footage, nearly doubling the amount of land needed to open a store (Huffington Post, 2015). This is especially expensive and logistically difficult in densely populated urban areas. Additionally, new grocery stores that do open in food deserts often struggle to remain profitable and, in some cases, ultimately shut down (Huffington Post, 2015). In light of these challenges, and once it became clear after several failed natural experiments that access to healthy foods in grocery stores was not a silver bullet for solving nutritional inequality, other types of interventions in food deserts began to be implemented and measured.

Although most of the natural experiments identified in this literature review were not effective at producing an increasing in healthy food intake, the other types of community-level interventions all demonstrated greater potential for changing behavior.

The other common types of community-level interventions identified in the literature were changes in the food environment at corner stores, farmers markets, and mobile produce markets. Excluding multilevel interventions that included one of these components, 11 out of 13 corner store, mobile market, and farmers market interventions achieved some degree of success at either increasing sales of healthy foods like fruits and vegetables or increasing study participants' consumption of healthy foods.

Application of Social Cognitive Theory: In order to understand why these interventions were more successful than natural experiments it is necessary to analyze which barriers to healthy eating these community-level interventions removed. Two of the most important environmental barriers to healthy eating identified in the literature are access and price, and one of the most important cognitive factors discovered through qualitative research from Whelan et al. (2002) is beliefs about food preparation. All community-level interventions increase access to healthy foods,

but as demonstrated by the findings from natural experiments, access is necessary but not always sufficient for behavior change.

Further analysis revealed that all six successful farmers market interventions (numbers 13 – 18 in Figure 4) and one of the successful mobile markets (number 20) provided healthy food at discounted rates to relieve the burden of cost for intervention participants. The other successful mobile market (19) and two of the three successful corner store interventions (numbers 8 and 10) provided nutrition education pamphlets at check-out as part of the intervention strategy to increase knowledge of healthy food preparation. However, the two unsuccessful corner store interventions (numbers 11 and 12) also did this but the strategy did not work.

More research is needed to determine what accounts for the success of some farmers markets, mobile markets, and corner store interventions rather than others. However, the results of this study suggest that off-setting the cost of healthy foods and simply providing something as simple as nutrition education pamphlets at check-out has the potential to increase consumption of healthy foods like fruits and vegetables.

Public Policy Level

Eight of nine interventions identified in this literature review that targeted public policy were successful at increasing the healthy food intake of study participants (numbers 30 – 37 in Figure 4). In order to understand why these interventions were successful, it is important to understand the specific program all nine of them targeted – policies that govern the Supplemental Nutrition Assistance Program.

Supplemental Nutrition Assistance Program

SNAP is the largest program in the domestic hunger safety net, as it offers nutrition assistance to millions of eligible, low-income individuals and families (USDA, 2018). Because

African Americans are more likely to be low-income individuals due to institutional racism, among SNAP users, white Americans are under-represented when compared to their percent of the American population as a whole, and African Americans are over-represented (USDA, 2017).

Many grocery stores and even small corner stores throughout America accept SNAP benefits to purchase food from these stores. Unfortunately, healthy foods like F&V are not federally subsidized in SNAP. Many grants and programs have been tested to measure if subsidies of healthier foods in SNAP would increase consumption of these foods among SNAP users, and most have achieved slight to moderate degrees of success. However, there is no nationwide initiative to subsidize F&V consumption of SNAP recipients, even though these are likely to be people at the greatest structural disadvantage, health-wise, and would therefore benefit most from the incentive to eat healthier by subsidizing F&V purchases (Perkes, 2018). Although there is no federally standardized incentive for purchasing F&V with SNAP benefits, foods like soft drinks, candy, cookies, snack crackers, and ice cream can be bought using SNAP benefits with no penalty (USDA, 2018).

In the absence of policy change at the federal level, several states and cities have implemented and tested their own SNAP interventions that incentivize the purchase of healthier foods like F&V, nine of which were included in this literature review, and eight of which were successful.

Application of Social Cognitive Theory

There are several reasons why interventions at the policy level are likely to be successful even in the absence of change at the other levels of society. One of the key features of public health as a field of study is right there in the name – its emphasis on the role of policies, laws, and procedures to protect and promote the health of the general public (McLeroy et al., 1988).

A powerful example of the dramatic effect that regulatory policies can have on the general population's health is that improvements in public policy governing water supply, sanitation, housing, and food quality are estimated to have accounted for the majority of the decline in mortality that occurred in the U.S. between 1900-1973 (McKinlay & McKinlay, 1977).

The major way that policies affect individual lives is through mediating structures in the community that bridge the gap between individuals and their overarching social environment (McLeroy et al., 1988). Although all public policy interventions included in this literature review targeted only that level (none were multilevel), all of them provided incentives for healthy eating, and all of them incentivized these healthy foods at community food retailers like grocery stores, supermarkets, and farmers markets. So, although these interventions were not technically multilevel, when SNAP users redeemed their benefits, they may have utilized a community resource that they previously had not been aware of or had not explored because they believed that they could not afford it. Consequently, due to mediating community structures, policy interventions may be experienced as multilevel interventions, which are more likely to be successful due to their impact on multiple levels of an individual's environment.

Additionally, the role of incentives in these interventions cannot be understated. Many low-income families desire to eat healthier but price remains the most significant barrier to healthy eating after access has been obtained. If incentive policies remove or diminish this barrier, habits are more likely to change, as the results of these interventions demonstrate. Even among people who either do not like the taste of healthy foods or do not have much knowledge of how to cook with these foods, they are receiving SNAP benefits because they are struggling to buy enough groceries to feed themselves or their families; and so regardless of personal preference, any extra food is likely welcome.

Multilevel

Several of the articles included in this literature review suggest that one of the future directions in the field of food desert intervention research should be to increase education on healthy eating or conduct cooking classes to teach people how to make healthy choices for themselves and their families. When discussing future directions in the study of food deserts, both the Cummins et al. (2014) and Dubowitz et al. (2015) research studies suggest implementing and measuring the effect of interventions that would help consumers bridge the gap between improvements in perception of food accessibility and actions leading to changes in consumption.

Theoretical Applications

Six of the seven multilevel interventions (numbers 39 – 44 in Figure 4) identified in the literature review found an increase in healthy food consumption after the intervention. Of these six, four (numbers 39, 41, 42, and 44 in Figure 4) followed up on the suggestion of the two studies referenced above and paired educational interventions at the individual level with changes to the food environment at the community level. The self-efficacy and positive outcome expectations gained in the educational component of these interventions gave participants the tools they needed to make healthier choices in the broader community at the same time that something at the community level also changed to encourage and facilitate healthier eating.

Three of these four interventions (numbers 39, 41, and 42) offered farmers market or mobile market purchase incentives to study participants. Healthy eating incentives are a powerful tool because cost remains one of the most significant barriers to healthy eating for many low-income families. The last successful intervention in this sub-set, number 44, implemented an education intervention in a former food desert among participants who now had access to healthy foods at a nearby grocery store. This intervention provides preliminary support for the idea that

new grocery stores in food deserts can improve residents' healthy food intake when paired with an individual-level education intervention.

The other two multilevel interventions (numbers 40 and 43) were likely successful at producing positive dietary change because although there were no changes in the broader community food environment, they targeted the interpersonal level as well as the individual level. Participants' self-efficacy for and positive outcome expectations of healthy eating were increased through the individual-level activities; and because food is deeply social by nature, the partnership and accountability gained through the interpersonal component of the intervention ultimately facilitated participants' behavior change (Fisher, Boothroyd, & Velicer, 2017).

The only unsuccessful multilevel intervention targeted the individual and community levels (number 45 in Figure 4). This intervention was more removed from participants than the other four successful multilevel interventions that targeted these levels (numbers 39, 41, 42, and 44). Whereas these four all paired community-level changes to the food environment with hands-on educational interventions, Moran et al. (2019) paired text message reminders with healthy meal kits bundled throughout the store (number 45 in Figure 4). Because there was no cooking class or healthy food tasting to increase positive outcome expectations and self-efficacy at the individual level, there was no subsequent increase in purchases of the healthy meal kits promoted at the community level.

There is a growing shift in health research toward recognizing the importance of, and need for, multilevel interventions to change health behavior (Trickett & Beehler, 2013). The findings of this literature review support the main prediction of the Social Ecological Framework that multilevel interventions should be the most effective at changing health behavior because they target multiple areas of society that work together to influence individual behavior. It is impossible

to determine in this literature review what intervention components account for the greatest amount of change in behavior, but that is also not the goal of multilevel intervention research.

Researchers who implement and test multilevel interventions are leading the shift in health research away from individual-level interventions because although these can be very effective and are important for understanding the psychological mechanisms that actually cause people to change their behavior, individual behavior does not occur in a vacuum. When it comes to large-scale societal issues such as the existence of food deserts, they fail to address the full scope of the problem. Since influences at each level of society affect individual behavior, to cause an increase in long-term healthy food intake, multilevel interventions must be designed and tested to target all levels of society. This will allow researchers to determine the changes at each level that combine to produce the most effective multilevel interventions. Multilevel interventions give researchers, community members, and policymakers the opportunity to more effectively address the complexities and various sources of health inequities in society today (Trickett & Beehler, 2013).

Conclusion

Limitations

Like all studies, the current study is not without its limitations. There is a strong possibility that there were other interventions tested at all levels of the Social Ecological Framework that were ineffective; but because there is a publication bias for publishing studies that found statistically significant results, interventions that were tested but did *not* achieve statistically significant findings may have never been published. If studies like this exist and they had been published, the findings of this literature review may have been different. However, all review articles suffer from this same limitation, as there is no way of knowing how many unpublished studies exist.

Additionally, this study is a literature review, not a systematic review. Because this was written to fulfill the requirements for a graduate school thesis, there was not enough time or resources to be able to conduct a systematic review of all the possible literature on this topic. Consequently, there are likely articles that would have met inclusion criteria for this review that simply were not found due to the lack of time and resources. However, Google Scholar was chosen as the preferred search engine for this literature review because it pulls search results from many other online databases. Even if there had been enough time and resources to conduct all the search phrases on multiple databases, it is likely that many of the same articles would have been discovered that were ultimately selected for inclusion from searching only Google Scholar.

A common limitation of quantitative research is the reliance on self-report data to measure change in attitudes, beliefs, or behaviors, and most of the studies included in this literature review utilized self-report data survey to determine if intervention participants increased their consumption of healthy foods. The issue with self-reporting is that respondents may suffer from the social desirability bias, which occurs when respondents answer questions in way that they

believe the researchers will view favorably, thus potentially biasing the results of the study. Fortunately, because this is such a common limitation of survey research, researchers have developed many methods that are frequently implemented to prevent this bias from skewing results, and it is likely that most studies included in this review employed these methods during data analysis.

Another possible area of weakness is that this study grouped interventions categorically; they were either classified as successful or unsuccessful. There was no gradient of success based on magnitude of behavior change or how long study participants maintained positive behavior change. Consequently, two articles both classified as successful and treated the same throughout this thesis may in fact have achieved two very different amounts of success. However, that was not what this study set out to do. The goal of this study was to identify overarching patterns in the research, and so it would have been contrary to this goal to create even more sub-groups for analysis.

Lastly, because this was a graduate thesis, there was only one person involved in conducting this study. Consequently, inter-rater reliability could not be determined, and so there is no way of knowing if someone else would have sorted and analyzed the articles the same way. To combat this limitation, great care was taken to pre-specify the inclusion criteria before the data collection phase. After all articles were selected, downloaded, and sorted, they were double and triple checked for meeting all inclusion criteria, and to confirm that they were sorted as well as possible based on levels intervened and success. If any study was found during the sorting process that did not meet inclusion criteria, it was sorted into a separate folder for excluded studies.

Implications for Future Work

Based on the results of the literature review of healthy eating interventions in food deserts and among other low-income populations, this thesis recommends several best practices for future work in this field.

1. Individual-level education interventions are most effective if they are based on a health behavior change theory, preferably Social Cognitive Theory because of its widespread acceptance, use, and effectiveness in the field of health behavior. Self-efficacy and positive outcome expectations are the two most important cognitive constructs to target during individual-level interventions because without sufficient levels of both constructs, behavior is very unlikely to change. Even with increased knowledge gained from education, without the confidence to successfully enact a behavior and an expectation of benefiting from the behavior in some way, people are unlikely to engage in that behavior.
2. An effective way to increase self-efficacy for and positive outcome expectations of healthy eating in individual-level, education interventions is to include as many of the following activities as is feasible: Cooking demonstrations, cooking practice, tastings, recipe cards, and take-home food kits.
3. There must be a shift away from research that measures the effects of grocery stores on diet in former food deserts; these studies were very important in the beginning of research in this field to investigate the assumption that once people in former food deserts had access to healthy foods, they would begin to eat healthier. The results of this literature review strongly indicate that they do not, and that this is not an effective

- way to improve the diets of people in food deserts without also addressing other barriers to healthy eating such as cost and personal beliefs about eating healthy foods.
4. There is less research on the effects of other community-level interventions, including farmers markets, mobile markets, and corner stores on the healthy food intake of people in food deserts. Each of these three types of community-level interventions included in the literature review showed greater potential for improving the diets of residents of food deserts than opening a new grocery store because these interventions often offered healthy foods at discounted rates to low-income populations. More research is needed on these types of interventions to determine the overall effectiveness of these types of community-level interventions, and to better understand the reasons for their success.
 5. Multilevel interventions that paired individual-level education with community-level improvements in food access and healthy eating incentives were found to be very effective. Researchers in this field may benefit from bearing this in mind when designing future multilevel interventions.
 6. The results of this literature review indicate that access, cost, and beliefs about healthy food preparation are the three most important factors that affect consumption of healthy foods. However, more research is needed to corroborate these findings.
 7. In order to actually improve the eating habits of not only people who live in food deserts, but all people everywhere, there needs to be a societal shift away from researching the effects of temporary interventions, and toward permanent changes at each level of the Social Ecological Framework. For this to happen, eating healthy foods like fruits, vegetables, and whole grains must become an urgent priority in the U.S. and elsewhere to improve overall public health and well-being.

Final Statement

Food is one of the most common denominators of the lives of all people at all times in human history. It is one of the most central components of all places, cultures, and relationships. Michael Pollan, a prominent food activist, puts it this way in his book *In Defense of Food: An Eater's Manifesto* (2008): “The shared meal elevates eating from a mechanical process of fueling the body to a ritual of family and community, from the mere animal biology to an act of culture” (p. 193).

All bodies require regular sustenance to not only survive, but the right kinds of food can also help everyone to *thrive*. Eating a healthy diet is linked to a wide variety of positive health outcomes – better mental health, a reduced risk of cancer and other chronic diseases, and a longer life span (Kaur & Kapoor, 2001). Unfortunately, due to intergenerational poverty and institutional racism, access to, ability to afford, and education about healthy foods that can provide these many benefits is deeply unequal. Fighting for social justice has been on the rise in recent decades, especially among the younger generations, and food justice is its own movement within this larger fight (Alkon & Agyeman, 2011).

There has been an increasing amount of research on food deserts in the U.S. and other developed countries in recent years. As more information on this issue has been gathered and contributed to a better understanding of the problem, many interventions have been implemented and tested in food deserts and other low-income areas to begin to address the growing issue of nutritional inequality by race and class. While many types of interventions have been tested, there have not been any systematic or literature reviews of these interventions to not only analyze which types of interventions were successful and which ones were not, but to attempt to answer the question of *why* they did or did not work.

This study addresses that gap in the literature by starting a conversation about what types of interventions work in this field, which ones do not, and the reasons for their success or lack thereof. This study also adds to the literature on how to apply the Social Ecological Framework and Social Cognitive Theory to complex public health issues like food deserts.

It is essential that researchers start doing more of this type of analysis so that valuable research time and funding is not wasted on interventions that are unlikely to be successful. Instead, all areas of society must be equipped to devote more time and resources to interventions and lasting structural changes that are most likely to be successful in slowing closing the nutrition gap so that all people have a truly equal opportunity and ability to live long, happy, healthy lives.

References

- Alkon, A. H., & Agyeman, J. (2011). *Cultivating food justice: Race, class, and sustainability*. Cambridge, MA: The MIT Press.
- Allcott, H., Diamond, R., Dubé, J., Handbury, J., Rahkovsky, I., & Schnell, M. (2017) Food deserts and the causes of nutritional inequality. *The National Bureau of Economic Research*. Retrieved from <https://www.nber.org/papers/w24094>
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215. <http://dx.doi.org/10.1037/0033-295X.84.2.191>
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37(2), 122–147. <https://doi.org/10.1037/0003-066X.37.2.122>
- Beaulac, J., Kristjansson, E., & Cummins, S. (2009). A systematic review of food deserts, 1966-2007. *Preventing Chronic Disease: Public Health Research, Practice, & Policy* 6(3). Retrieved from https://www.cdc.gov/pcd/issues/2009/jul/08_0163.htm
- Block, D., Kouba, J., (2006). A comparison of the availability and affordability of a market basket in two communities in the Chicago Area. *Public Health Nutrition*, 9(7), 837–845.
- Bowling, A. B., Moretti, M., Ringelheim, K., Tran, A., & Davison, K. (2016). Healthy foods, healthy families: Combining incentives and exposure interventions at urban farmers’ markets to improve nutrition among recipients of U.S. federal food assistance. *Health Promotion Perspectives*, 6(1), 10–16. <https://doi.org/10.15171/hpp.2016.02>
- Burwell, S. M. & Vilsack, T. J. (2015). 2015–2020 dietary guidelines for Americans. Retrieved from <https://health.gov/dietaryguidelines/2015/guidelines/message/>
- Campbell, M. K., Carbone, E., Honess-Morreale, L., Heisler-MacKinnon, J., Demissie, S., & Farrell, D. (2004). Randomized trial of a tailored nutrition education CD-ROM program for women receiving food Assistance. *Journal of Nutrition Education and Behavior*, 36(2), 58–66. [https://doi.org/10.1016/S1499-4046\(06\)60134-6](https://doi.org/10.1016/S1499-4046(06)60134-6)
- Canadian Public Health Association. (1986). *Ottawa Charter for Health Promotion*.
- Carter, P., Gray, L. J., Troughton, J., Khunti, K., Davies, M. J. (2010). Fruit and vegetable intake and incidence of type 2 diabetes mellitus: Systematic review and meta- analysis. *British Medical Journal*, 341, c4229. <https://doi.org/i:10.1136/bmj.c4229>
- Chen, Q., Goto, K., Wolff, C., Bianco-Simeral, S., Gruneisen, K., & Gray, K. (2014). Cooking up diversity: Impact of a multicomponent, multicultural, experiential intervention on food and cooking behaviors among elementary-school students from low-income ethnically diverse families. *Appetite*, 80, 114–122. <https://doi.org/10.1016/j.appet.2014.05.009>
- Cohen, A. J., Richardson, C. R., Heisler, M., Sen, A., Murphy, E. C., Hesterman, O. B., Davis, Matthew M., & Zick, S. M. (2017). Increasing use of a healthy food incentive: A waiting room intervention among low-income patients. *American Journal of Preventive Medicine*, 52(2), 154–162. <https://doi.org/10.1016/j.amepre.2016.11.008>
- Collins, A. M., & Klerman, J. A. (2017). Improving nutrition by increasing Supplemental Nutrition Assistance Program benefits. *American Journal of Preventive Medicine*, 52(2, Supplement 2), S179–S185. <https://doi.org/10.1016/j.amepre.2016.08.032>
- Cummins, S., Findlay, A., Higgins, C., Petticrew, M., Sparks, L., & Thomson, H. (2008). Reducing inequalities in health and diet: Findings from a study on the impact of a food retail development. *Environment and Planning A: Economy and Space*, 40(2), 402–422. <https://doi.org/10.1068/a38371>

- Cummins, S., Flint, E., & Matthews, S. A. (2014). New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity. *Health Affairs*, *33*(2), 283–291. <https://doi.org/10.1377/hlthaff.2013.0512>
- Cummins, S., Petticrew, M., Sparks, L., & Findlay, A. (2005). Large scale food retail interventions and diet. *British Medical Journal*, *330*(7493), 683–684. <https://doi.org/10.1136/bmj.330.7493.683>
- Dannefer, R., Williams, D. A., Baronberg, S., & Silver, L. (2012). Healthy bodegas: Increasing and promoting healthy foods at corner stores in New York City. *American Journal of Public Health*, *102*(10), e27–e31. <https://doi.org/10.2105/AJPH.2011.300615>
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum.
- Dimitri, C., Oberholtzer, L., Zive, M., & Sandolo, C. (2015). Enhancing food security of low-income consumers: An investigation of financial incentives for use at farmers markets. *Food Policy*, *52*, 64–70. <https://doi.org/10.1016/j.foodpol.2014.06.002>
- DiSalvo, D. (2017, July 22). 8 reasons why it's so hard to really change your behavior. *Psychology Today*. Retrieved from <https://www.psychologytoday.com/us/blog/neuronarrative/201707/8-reasons-why-its-so-hard-really-change-your-behavior>
- Dollahite, J. S., Pijai, E. I., Scott-Pierce, M., Parker, C., & Trochim, W. (2014). A randomized controlled trial of a community-based nutrition education program for low-income parents. *Journal of Nutrition Education and Behavior*, *46*(2), 102–109. <https://doi.org/10.1016/j.jneb.2013.09.004>
- Dubowitz, T., Ghosh-Dastidar, M., Cohen, D. A., Beckman, R., Steiner, E. D., Hunter, G. P., Florez, K. R., Huang, C., Vaughan C. A., Sloan, J. C., Zenk, S. N., Cummins, S., & Collins, R. L. (2015). Diet and perceptions change with supermarket introduction in a food desert, but not because of supermarket use. *Health Affairs*, *34*(11), 1858–1868. <https://doi.org/10.1377/hlthaff.2015.0667>
- Dutko, P., Ploeg, M. V., & Farrigan, T. (2012). Characteristics and influential factors of food deserts. *USDA Economic Research Report 140*, 1-36. Retrieved from <https://www.ers.usda.gov/publications/pub-details/?pubid=45017>
- Evans, A. E., Jennings, R., Smiley, A. W., Medina, J. L., Sharma, S. V., Rutledge, R., Stigler M. H., & Hoelscher, D. M. (2012). Introduction of farm stands in low-income communities increases F&V among community residents. *Health & Place*, *18*(5), 1137–1143. <https://doi.org/10.1016/j.healthplace.2012.04.007>
- Fisher, E. B., Boothroyd, R. I., & Velicer, C. (2017). Peer support of complex health behaviors in prevention and disease management with special reference to diabetes: systematic reviews. *Clinical Diabetes and Endocrinology*, *3*(4). Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5471959/#!po=1.19048>
- Ford, A. (2019, February 19). A church and community partnership helps bring fresh groceries to a Chicago food desert. *Faith & Leadership*. Retrieved from <https://www.faithandleadership.com/church-and-community-partnership-helps-bring-fresh-groceries-chicago-food-desert>
- Freedman, D. A., Choi, S. K., Hurley, T., Anadu, E., & Hébert, J. R. (2013). A farmers' market at a federally qualified health center improves fruit and vegetable intake among low-income diabetics. *Preventive Medicine*, *56*(5), 288–292. <https://doi.org/10.1016/j.ypmed.2013.01.018>
- Freedman, D. A., Mattison-Faye, A., Alia, K., Guest, M. A., & Hébert, J. R. (2014). Comparing farmers' market revenue trends before and after the implementation of a monetary incentive for recipients of food assistance. *Preventing Chronic Disease*, *11*. <https://doi.org/10.5888/pcd11.130347>

- Fuller, D., Engler-Stringer, R., & Muhajarine, N. (2015). Examining food purchasing patterns from sales data at a full-service grocery store intervention in a former food desert. *Preventive Medicine Reports*, 2, 164–169. <https://doi.org/10.1016/j.pmedr.2015.02.012>
- Gans, K. M., Risica, P. M., Keita, A. D., Dionne, L., Mello, J., Stowers, K. C., Papandonatos, G., Whittaker, S., & Gorham, G. (2018). Multilevel approaches to increase fruit and vegetable intake in low-income housing communities: Final results of the ‘live well, viva bien’ cluster-randomized trial. *International Journal of Behavioral Nutrition and Physical Activity*, 15(1), 80. <https://doi.org/10.1186/s12966-018-0704-2>
- Gary-Webb, T. L., Bear, T. M., Mendez, D. D., Schiff, M. D., Keenan, E., & Fabio, A. (2018). Evaluation of a mobile farmer’s market aimed at increasing fruit and vegetable consumption in food deserts: A pilot study to determine evaluation feasibility. *Health Equity*, 2(1), 375–383. <https://doi.org/10.1089/heq.2018.0003>
- Gill-Bailey, A., Bertram, K., & Cabiness, J. (2016). Social cognitive learning theory. *Johns Hopkins University*. Retrieved from <https://sbccimplementationkits.org/sbcc-in-emergencies/social-cognitive-learning-theory/>
- Glanz, K. (2016). Social and behavioral theories. *National Institutes of Health: Office of Behavioral & Social Sciences Research*. Retrieved from <http://www.esourceresearch.org/tabid/724/default.aspx>
- Glanz, K., Rimer, B. K., & Vizwanath, K. (2015). Health behavior: Theory, research, and practice. San Francisco, CA: Jossey Bass
- Grant, C., & Osanloo, A. (2014). Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your “house”. *Administrative Issues Journal*, 4(2). Retrieved from <https://dc.swosu.edu/aij/vol4/iss2/4>
- Hanson, K. L., Kolodinsky, J., Wang, W., Morgan, E. H., Pitts, S. B. J., Ammerman, A. S., Sitaker, M., & Seguin, R. A. (2017). Adults and children in low-income households that participate in cost-offset community supported agriculture have high fruit and vegetable consumption. *Nutrients*, 9(7), 726. <https://doi.org/10.3390/nu9070726>
- Harvard School of Public Health. (2019). Vegetables and fruits. *The Nutrition Source*. Retrieved from <https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/vegetables-and-fruits/>
- Harvard Medical School. (2019). Tips for a longer life. *Harvard Health Publishing*. Retrieved from <https://www.health.harvard.edu/healthbeat/tips-for-a-longer-life>
- Herman, D. R., Harrison, G. G., Afifi, A. A., & Jenks, E. (2008). Effect of a targeted subsidy on intake of fruits and vegetables among low-income women in the Special Supplemental Nutrition Program for Women, Infants, and Children. *American Journal of Public Health*, 98(1), 98–105. <https://doi.org/10.2105/AJPH.2005.079418>
- Hersey, J. C., Cates, S. C., Blitstein, J. L., Kosa, K. M., Rivera, O. J. S., Contreras, D. A., Long, V. A., Singh, A., & Berman, D. A. (2015). Eat smart, live strong intervention increases fruit and vegetable consumption among low-income older adults. *Journal of Nutrition in Gerontology and Geriatrics*, 34(1), 66–80. <https://doi.org/10.1080/21551197.2015.1007199>
- Huffington Post. (2015, May 7). Eliminating food deserts will take a marriage of private and public enterprise. *Life: Wellness*. Retrieved from https://www.huffpost.com/entry/eliminate-food-deserts_n_7097984
- Hutchinson, A. D., & Wilson, C. (2012). Improving nutrition and physical activity in the workplace: A meta-analysis of intervention studies. *Health Promotion International*, 27(2), 238–249. <https://doi.org/10.1093/heapro/dar035>

- Jennings, A., Cassidy, A., Winters, T., Barnes, S., Lipp, A., Holland, R., & Welch, A. (2012). Positive effect of a targeted intervention to improve access and availability of fruit and vegetables in an area of deprivation. *Health & Place, 18*(5), 1074–1078. <https://doi.org/10.1016/j.healthplace.2012.05.001>
- Joshiyura, K. J., Ascherio, A., Manson, J. E., Stampfer, M. J., Rimm, E. B., Speizer, F. E., Hennekens, C. H., Spiegelman, D., Willett, W. C. (1999). Fruit and vegetable intake in relation to risk of ischemic stroke. *Journal of the American Medical Association 282*(13), 1233–1239. <https://doi.org/10.1001/jama.282.13.1233>
- Joshiyura, K. J., Hu, F. B., Manson, J. E., Stampfer, M. J., Rimm, E. B., Speizer, F. E., Colditz, G., Ascherio, A., Rosner, B., Spiegelman, D., Willett, W. C. (2001). The effect of fruit and vegetable intake on risk for coronary heart disease. *Annals of Internal Medicine 134*(12), 1106–1114. <https://doi.org/10.7326/0003-4819-134-12-200106190-00010>
- Kaur, C., & Kapoor, H. C. (2001). Antioxidants in fruits and vegetables – the millennium’s health. *International Journal of Food Science & Technology, 36*(7), 703–725. <https://doi.org/10.1111/j.1365-2621.2001.00513.x>
- Khazan, O. (2017, December 28). Food swamps are the new food deserts. *The Atlantic*. Retrieved from <https://www.theatlantic.com/health/archive/2017/12/food-swamps/549275/>
- Ko, L. K., Rodriguez, E., Yoon, J., Ravindran, R., & Copeland, W. K. (2016). A brief community-based nutrition education intervention combined with food baskets can increase fruit and vegetable consumption among low-income Latinos. *Journal of Nutrition Education and Behavior, 48*(9), 609-617.e1. <https://doi.org/10.1016/j.jneb.2016.06.010>
- Lawman, H. G., Vander Veer, S., Mallya, G., McCoy, T. A., Wojtanowski, A., Colby, L., Sanders, T. A., Lent, M. R., Sandoval, B. A., Sherman, S., Wylie-Rosett, J., & Foster, G. D. (2015). Changes in quantity, spending, and nutritional characteristics of adult, adolescent and child urban corner store purchases after an environmental intervention. *Preventive Medicine, 74*, 81–85. <https://doi.org/10.1016/j.ypmed.2014.12.003>
- LeClair, M. S., & Aksan, A. M. (2014). Redefining the food desert: Combining GIS with direct observation to measure food access. *Agriculture and Human Values, 31*(4), 537–547. <https://doi.org/10.1007/s10460-014-9501-y>
- Lee-Kwan, S. H., Moore, L. V., Blanck, H. M., Harris, D. M., & Galuska, D. (2017). Disparities in state-specific adult F&V consumption — United States, 2015. *Morbidity and Mortality Weekly Report, 66*(45), 1241–1247. <https://doi.org/10.15585/mmwr.mm6645a1>
- Leone, L. A., Tripicchio, G. L., Haynes-Maslow, L., McGuirt, J., Grady Smith, J. S., Armstrong-Brown, J., Gizlice, Z., & Ammerman, A. (2018). Cluster randomized controlled trial of a mobile market intervention to increase fruit and vegetable intake among adults in lower-income communities in North Carolina. *The International Journal of Behavioral Nutrition and Physical Activity, 15*(1), 2. <https://doi.org/10.1186/s12966-017-0637-1>
- Lewis, L.B., Sloane, D.C., Nascimento, L.M., Diamant, A.L., Guinyard, J.J., Yancey, A.K., et al. (2005). African Americans’ access to healthy food options in South Los Angeles restaurants. *Research and Practice 95*(4), 668–673.
- Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior*. <https://doi.org/10.2307/2626958>
- Lockwood, B. (2018, February 14). The history of redlining. *ThoughtCo*. Retrieved from <https://www.thoughtco.com/redlining-definition-4157858>

- Martin, K. S., Havens, E., Boyle, K. E., Matthews, G., Schilling, E. A., Harel, O., & Ferris, A. M. (2012). If you stock it, will they buy it? Healthy food availability and customer purchasing behaviour within corner stores in Hartford, CT, USA. *Public Health Nutrition*, *15*(10), 1973–1978. <https://doi.org/10.1017/S1368980011003387>
- McKinlay, J. B., & McKinlay, S. M. (1977). Medical measures and the decline of mortality. *Milbank Memorial Fund Quarterly: Health & Society, Summer Issue*, 405-428.
- McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, *15*(4), 351–377. <https://doi.org/10.1177/109019818801500401>
- Mhurchu, C. N., Aston, L. M., & Jebb, S. A. (2010). Effects of worksite health promotion interventions on employee diets: A systematic review. *BMC Public Health*, *10*(1). <https://doi.org/10.1186/1471-2458-10-62>
- Moran, A. J., Khandpur, N., Polacsek, M., Thorndike, A. N., Franckle, R. L., Boulos, R., Sampson, S., Greene, J. C., Blue, D. G., & Rimm, E. B. (2019). Make it fresh, for less! A supermarket meal bundling and electronic reminder intervention to promote healthy purchases among families with children. *Journal of Nutrition Education and Behavior*, *51*(4), 400–408. <https://doi.org/10.1016/j.jneb.2019.01.012>
- Nania, R. (2019, February 4). ‘I wanted to do more for people than just pray’: Pastor blends faith, farms to end food insecurity in black churches. *WTOP*. Retrieved from <https://wtop.com/living/2019/02/i-wanted-to-do-more-for-people-than-just-pray-pastor-blends-faith-farms-to-end-food-insecurity-in-black-churches/>
- Olsho, L. E. W., Klerman, J. A., Wilde, P. E., & Bartlett, S. (2016). Financial incentives increase fruit and vegetable intake among Supplemental Nutrition Assistance Program participants: A randomized controlled trial of the USDA Healthy Incentives Pilot. *The American Journal of Clinical Nutrition*, *104*(2), 423–435. <https://doi.org/10.3945/ajcn.115.129320>
- Olsho, L. E. W., Payne, G. H., Walker, D. K., Baronberg, S., Jernigan, J., & Abrami, A. (2014). Impacts of a farmers’ market incentive programme on fruit and vegetable access, purchase and consumption. *Public Health Nutrition*, *18*(15), 2712–2721.
- Ortega, A. N., Albert, S. L., Chan-Golston, A. M., Langellier, B. A., Glik, D. C., Belin, T. R., Garcia, R. E., Brookmeyer, R., Sharif, M. Z., & Prelip, M. L. (2016). Substantial improvements not seen in health behaviors following corner store conversions in two Latino food swamps. *BMC Public Health*, *16*(1), 389. <https://doi.org/10.1186/s12889-016-3074-1>
- Overcash, F., Ritter, A., Mann, T., Mykerezzi, E., Redden, J., Rendahl, A., Vickers, Z., & Reicks, M. (2018). Impacts of a vegetable cooking skills program among low-income parents and children. *Journal of Nutrition Education and Behavior*, *50*(8), 795–802. <https://doi.org/10.1016/j.jneb.2017.10.016>
- Pearce, J., Witten, K., & Bartie, P. (2006). Neighbourhoods and health: A GIS approach to measuring community resource accessibility. *Journal of Epidemiology & Community Health*, *60*(5), 389–395. <https://doi.org/10.1136/jech.2005.043281>
- Perkes, C. (2018, January 16). Food stamp program makes fresh produce more affordable. *NPR*. Retrieved from <https://www.npr.org/sections/health-shots/2018/01/16/577662116/food-stamp-program-makes-fresh-produce-more-affordable>

- Ploeg, M. V., Breneman, V., Farrigan, T., Hamrick, K., Hopkins, D., Kaufman, P., Lin, B.H., Nord, M., Smith, T., Williams, R., Kinnison, K., Olander, C., Singh, A., & Tuckermanty, E. (2009). Access to affordable and nutritious food: Measuring and understanding food deserts and their consequences. *United States Department of Agriculture: Economic Research Service*. Retrieved from https://www.ers.usda.gov/webdocs/publications/42711/12716_ap036_1_.pdf
- Pollan, M. (2008). *In defense of food: An eater's manifesto*. New York, NY: The Penguin Group
- Rao, M., Afshin, A., Singh, G., & Mozaffarian, D. (2013). Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *BMJ Open*, 3(12), e004277. <https://doi.org/10.1136/bmjopen-2013-004277>
- Rhone, A., VerPloeg, M., Dicken, C., Williams, R., & Breneman, V. (2015). Low-income and low-supermarket-access census tracts, 2010-2015. *United States Department of Agriculture: Economic Research Service*. Retrieved from <https://www.ers.usda.gov/webdocs/publications/82101/eib-165.pdf?v=0>
- Richardson, A. S., Ghosh-Dastidar, M., Beckman, R., Flórez, K. R., DeSantis, A., Collins, R. L., & Dubowitz, T. (2017). Can the introduction of a full-service supermarket in a food desert improve residents' economic status and health? *Annals of Epidemiology*, 27(12), 771–776. <https://doi.org/10.1016/j.annepidem.2017.10.011>
- Ruelas, V., Iverson, E., Kiekel, P., & Peters, A. (2012). The role of farmers' markets in two low income, urban communities. *Journal of Community Health*, 37(3), 554–562. <https://doi.org/10.1007/s10900-011-9479-y>
- Rustad, C., & Smith, C. (2013). Nutrition knowledge and associated behavior changes in a holistic, short-term nutrition education intervention with low-income women. *Journal of Nutrition Education and Behavior*, 45(6), 490–498. <https://doi.org/10.1016/j.jneb.2013.06.009>
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Sadler, R. C., Gilliland, J. A., & Arku, G. (2013). A food retail-based intervention on food security and consumption. *International Journal of Environmental Research and Public Health*, 10(8), 3325–3346. <https://doi.org/10.3390/ijerph10083325>
- Savoie-Roskos, M., Durward, C., Jeweks, M., & LeBlanc, H. (2016). Reducing food insecurity and improving fruit and vegetable intake among farmers' market incentive program participants. *Journal of Nutrition Education and Behavior*, 48(1), 70-76. <https://doi.org/10.1016/j.jneb.2015.10.003>
- Song, H.-J., Gittelsohn, J., Kim, M., Suratkar, S., Sharma, S., & Anliker, J. (2009). A corner store intervention in a low-income urban community is associated with increased availability and sales of some healthy foods. *Public Health Nutrition*, 12(11), 2060–2067. <https://doi.org/10.1017/S1368980009005242>
- Spears, K., Powell, P., & Yang, W. (2014). What is a food desert? *University of Nevada Cooperative Extension*, 1-4. Retrieved from <https://www.unce.unr.edu/publications/files/hn/2014/fs1405.pdf>
- Stokols, D. (1996). Translating social ecological theory into guidelines for community health promotion. *American Journal of Health Promotion*, 10(4), 282–298. <https://doi.org/10.4278/0890-1171-10.4.282>
- Trickett, E.J. & Beehler, S. (2013). The ecology of multilevel interventions to reduce social inequalities in health. *American Behavioral Scientist*, 57(8), 1227-1246.

- United States Department of Agriculture (2012). Access to affordable and nutritious food: Updated estimates of distance to supermarkets using 2010 data. *Economic Research Service*. Retrieved from https://www.ers.usda.gov/webdocs/publications/45032/33844_err143_summary.pdf?v=0
- United States Department of Agriculture. (2017). Characteristics of supplemental nutrition assistance program households: Fiscal year 2017. *Food and Nutrition Service*. Retrieved from <https://fns-prod.azureedge.net/sites/default/files/ops/Characteristics2017.pdf>
- United States Department of Agriculture. (2014). Evaluation of the healthy incentives pilot. *Food and Nutrition Service*. Retrieved from <https://www.fns.usda.gov/snap/hip>
- United States Department of Agriculture. (2017). Food access research atlas. *Economic Research Service*. Retrieved from <https://www.ers.usda.gov/data-products/food-access-research-atlas/go-to-the-atlas/>
- United States Department of Agriculture. (2018). Supplemental Nutrition Assistance Program (SNAP). *Food and Nutrition Service*. Retrieved from <https://www.fns.usda.gov/snap/eligibility>
- Walker, R. E., Keane, C. R., & Burke, J. G. (2010). Disparities and access to healthy food in the United States: A review of food deserts literature. *Health & Place, 16*(5). <https://doi.org/10.1016/j.healthplace.2010.04.013>
- Wansink, B., & Sobal, J. (2007). Mindless eating: The 200 daily food decisions we overlook. *Environment and Behavior, 39*(1), 106–123. <https://doi.org/10.1177/0013916506295573>
- Weatherspoon, D., Oehmke, J., Dembele, A., & Weatherspoon, L. (2015). Fresh vegetable demand behaviour in an urban food desert. *Urban Studies, 52*(5), 960–979. <https://doi.org/10.1177/0042098014529340>
- Wedick, N. M., Ma, Y., Olendzki, B. C., Procter-Gray, E., Cheng, J., Kane, K. J., Ockene, I. S., Pagoto, S. L., Land, T. G., & Li, W. (2015). Access to healthy food stores modifies effect of a dietary intervention. *American Journal of Preventive Medicine, 48*(3), 309–317. <https://doi.org/10.1016/j.amepre.2014.08.020>
- Whelan, A., Wrigley, N., Warm, D., & Cannings, E. (2002). Life in a “food desert.” *Urban Studies, 39*(11), 2083–2100. <https://doi.org/10.1080/0042098022000011371>
- Williams, P. A., Cates, S. C., Blitstein, J. L., Hersey, J. C., Kosa, K. M., Long, V. A., Signh, A., & Berman, D. (2015). Evaluating the impact of six Supplemental Nutrition Assistance Program education interventions on children’s at-home diets. *Health Education & Behavior, 42*(3), 329–338. <https://doi.org/10.1177/1090198114558589>
- Woodruff, R. C., Raskind, I. G., Harris, D. M., Gazmararian, J. A., Kramer, M., Haardörfer, R., & Kegler, M. C. (2018). The dietary impact of introducing new retailers of fruits and vegetables into a community: Results from a systematic review. *Public Health Nutrition, 21*(5), 981–991. <https://doi.org/10.1017/S1368980017003226>
- Worsley, A. (2002). Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour? *Asia Pacific Journal of Clinical Nutrition Banner, 11*(3), 579–585. <https://doi.org/10.1046/j.1440-6047.11.supp3.7.x>
- Wrieden, W. L., Anderson, A. S., Longbottom, P. J., Valentine, K., Stead, M., Caraher, M., Lang, T., Gray, B., & Dowler, E. (2007). The impact of a community-based food skills intervention on cooking confidence, food preparation methods and dietary choices – an exploratory trial. *Public Health Nutrition, 10*(2), 203–211. <https://doi.org/10.1017/S1368980007246658>
- Wrigley, N., Warm, D., & Margetts, B. (2003). Deprivation, diet, and food-retail access: Findings from the Leeds ‘food deserts’ study. *Environment and Planning A: Economy and Space, 35*(1), 151–188. <https://doi.org/10.1068/a35150>

- Young, C. R., Aquilante, J. L., Solomon, S., Colby, L., Kawinzi, M. A., Uy, N., & Mallya, G. (2013). Improving fruit and vegetable consumption among low-income customers at farmers markets: Philly Food Bucks, Philadelphia, Pennsylvania, 2011. *Preventing Chronic Disease, 10*. <https://doi.org/10.5888/pcd10.120356>
- Zenk, S.N., Schulz, A.J., Israel, B.A., James, S.A., Bao, S., Wilson, M.L. (2005). Neighborhood racial composition, neighborhood poverty, and the spatial accessibility of supermarkets in metropolitan Detroit. *American Journal of Public Health 95*(4), 660–667.