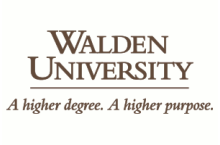

2019

Community Risk Factors and Health Inspection Violations in Mississippi Delta Census Tracts

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This is to certify that the doctoral dissertation by

Chrystal Early

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Dr. David Anderson, Committee Chairperson, Public Health Faculty
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The Office of the Provost

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2019

Abstract

Community Risk Factors and Health Inspections in Mississippi Delta Census Tracts

by

Chrystal Shona Early

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

A concerning public health issue in America is about food deserts urban and rural communities that lack grocery retailers that offer affordable, nutritious, and diverse foods. Empirical evidence has shown significant associations between neighborhood disadvantage/disorder risk factors of high poverty and high percentages of ethnic minority residents with presence/ absence of healthy food retailers in food deserts. The purpose of this quantitative correlational study, framed by the disparities in food safety conceptual model, was to examine if county-level poverty, number of African American residents, number of elderly (i.e., age 65 or older) residents, vehicle ownership, and crime rates were significantly associated with presence/absence of healthy food retail environments in a stratified random sample of 160 Mississippi Delta Region counties. Variables were measured using SPSS 25.0 data set from federal sources. Data were analyzed using binary logistic regression. Findings indicated that the percentage of households below poverty level was significantly associated with absence of healthy food retailers, ($Wald\ \chi^2 = 7.62$, $p = .006$). Logistic regression findings further showed that the county percentage of households with at least one vehicle was significantly associated with the presence of healthy food retailers, ($Wald\ \chi^2 = 8.75$, $p = .003$). As a result of this study, residents of the Mississippi Delta Region (MDR) may begin to petition their local, county, and state governments to enhance access to healthy foods, and in turn, such government institutions may develop programs and initiatives that help to make healthy foods affordable.

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Dedication

I began my journey at Walden with one goal set in mind, to finish strong. I dedicate this dissertation to my family members who are younger than I am. I also would like to dedicate this to the Jerusalem Youth Department, an awesome group of young people who reminded me that I am on display and it is imperative to finish strong for them.

This dedication is for my family: Geola B. Early, my inspiration, rock, and who are long to be. She made me realize to be thankful for what I had, never dress how I felt, and always reach back to those who are not as fortunate. She instilled in me to put God first, to read when no one else finds it important, and to use what I had to get to where I was going. She also taught me to age gracefully and to ignore insults; my sister and brother Shawneequa Beal & Byron Early, who always answered my phone calls throughout the long days of writing, overthinking, and having random rants.

In addition, I dedicate this to my aunt, Bobbie Slaughter, who allowed me to stay in her presence for so long without complaining. She has been the leaning post for me throughout the years. She instilled the importance of education and stability into my life. She worked hard to make life easier for me and taught the importance of serving others, loving yourself, and community involvement. I was able to keep busy, helping where it is needed most, and traveling around the world having a life outside of the dissertation.

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I am extremely thankful to my dissertation committee: my chair, Dr. David Anderson, who stepped in when I had no idea who would give me a chance, and to my content expert, Dr. Bruce Ragon, who offered expertise and guidance. My URR, Dr. Diane Nassar, who helped me to look further down the road for future generations. Our collective teamwork kept things moving to successfully complete my dissertation. I am also grateful to Jen, my academic advisor and to those who answered my call on the Student Support Team. Finally, my friend Pearlean Day & the lovely women of Alpha Kappa Alpha, Sorority, Inc., who taught me to hold fast to my dreams.

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Chapter 1: Introduction to the Study

While adult obesity rates are high in America -- in 2016, approximately 30% of American adults were obese – these rates tend to be highest in southern states (Centers for Disease Control [CDC], 2017. Adult obesity rates exceed 35% in the Mississippi Delta Region (MDR), a geographical area of 252 counties located across the eight Midwestern and Southern states of Alabama, Arkansas, Kentucky, Illinois, Louisiana, Mississippi, Missouri, and Tennessee (CDC, 2016, 2017a; Delta Health Alliance [DHA], 2016. In 2016, six of the top 10 states with the highest adult obesity were MDR states: Mississippi, with an obesity rate of 37.3%, Alabama, with an obesity rate of 35.7%; Arkansas, with an obesity rate of 35.7%; Louisiana, with an obesity rate of 35.5%; Tennessee, with an obesity rate of 34.8%; and Kentucky, with an obesity rate of 34.2% (CDC, 2016, 2017a; DHA, 2016; DRA, 2015).

Public health researchers (e.g., Black, Moon, & Baird, 2014; Dubowitz et al., 2015; Friel & Ford, 2015) have acknowledged geographical disparities with regard to obesity, which has led to a substantial body of theoretical and empirical work on the role that community/neighborhood factors contribute not only to obesity rates but access to healthy foods. Studies have documented that obesity rates are higher in communities designated as *food deserts*, which are geographical regions lacking food retailers that have affordable, nutritious, and diverse foods, especially vegetables, fruits, lean meats, and healthy grains and legumes (Food Research and Action Center [FRAC], 2010a, 2010b; United States Department of Agriculture [USDA], 2009, 2017). Food deserts have

common community characteristics. They are often impoverished and have high percentages of Hispanic and/or African American residents (Shannon, 2016; Widener & Shannon, 2014). Many food desert residents are unable to afford adequate levels of nutritious food and/or are malnourished as a result of eating foods having low nutritional value and high fat and sugar content (Feeding America, 2014; Lenardson, Hansen, & Hartley, 2015). In rural food deserts, chain supermarkets and grocery stores are scarce, requiring residents to travel over 30 miles to be able to access nutritious and affordable foods (Lenardson et al., 2015). The MDR, with a population that is over 70% African American, is recognized as being the most impoverished region in the United States (DHA, 2016; DRA, 2015). Moreover, 70% of the 252 MDR counties are considered food deserts, and over 75% of MDR food desert residents are African American (DHA, 2016; DRA, 2015; Southern Rural Black Women's Initiative [SRBWI], 2016).

There is a considerable body of empirical literature that has linked the community disadvantage factors of poverty and percentage of ethnic minority residents to not only individual-level outcomes related to health and well-being but also macro-level food retail and marketing factors (Chen & Kwan, 2015; Dutko & Ver Ploeg, 2013). However, there exists a gap in the macro level food marketing empirical literature as to whether other community disadvantage factors contribute to lack of access to healthy food retailers in food deserts. Pothukuchi, Mohamed, and Gebben's (2008), in delineating their disparities in food safety (DFS) conceptual model, posited linkages between specific community disadvantage risk factors and numerous food retailer characteristics as they

pertained to the market, the store owner, the supply chain, and food inspection processes. The purpose of this study, informed by Pothukuchi et al.'s (2008) DFS conceptual model, examined if five theoretical community risk factors identified by Pothukuchi et al. (2008) – (a) county-level percentage of African American residents, (b) county-level poverty rate, (c) county-level percentage of elderly (i.e., age 65 or older) residents, (d) county-level vehicle ownership rate, and (e) county-level (violent and property) crime rate- are significantly associated with presence/absence of healthy food retail environments in 160 MDR counties.

The purpose of this chapter is to provide an overview of the study. The chapter opens with a background section, which leads to the problem statement and purpose of the study sections. The study research questions, with associated null and alternative hypotheses, are presented. The chapter then turns to a review of the two guiding theories of this study, Ross and Mirowsky's (2001) ecological theory and Pothukuchi et al.'s (2008) DFS conceptual model. The chapter continues with a nature of the study section. Subsequent to that section is a section on pertinent study definitions. Sections on study assumptions, scope and delimitations, limitations, and significance round out the chapter. The chapter concludes with a summary section.

Background

There is an extensive body of literature that has examined the associations between geographical-based poverty rates and percent of ethnic minority (i.e., Hispanic and African American) residents and food retailer outcomes. Since 2010, at least five

literature review studies (i.e., Black et al., 2016; Caspi, Sorenson, Subramanian, & Kawachi, 2012; Hilmers, Hilmers, & Dace, 2012; Pinard, Shanks, Harden, & Yaroch, 2016) have summarized the body of literature on the linkages between the neighborhood disadvantage factors of poverty and high ethnic minority resident rates and the presence/absence of unhealthy and healthy food retailers and related food retail outcomes. Despite inconsistencies in the operational definition of neighborhood (e.g., as a census tract, a census block group, zip code area, postal district, or county), the conclusions drawn from the empirical findings were that residents in high poverty ethnic minority neighborhoods have a significant lack of access to healthy food retailers (Black et al., 2016; Caspi et al., 2012; Pinard et al., 2016).

Despite the higher rate of obesity in rural versus urban American communities (CDC, 2017a), there is a dearth of studies that have examined the role that community disadvantage factors may play with regard to lack of access to healthy food retailers in rural communities in the United States. One of the reviews of the literature, conducted by Pinard, Shanks, Harden, and Yaroch (2016), discussed community influences on rural food deserts. However, only five of the 19 studies reviewed by Pinard et al. (2016) were conducted in rural communities, and all studies focused on rural communities in Nebraska. Based on their review, Pinard et al. concluded that rural communities face different challenges than did urban communities. Two or these challenges were that rural store owners were felt customers would not purchase healthy foods (for cultural and price reasons) and distribution difficulties. Vilaro and Bennett (2013) did examine the type of

food retailers as well as access to healthy foods and food prices in one rural community in Florida. The researchers found that, of the 13 food retailers in the rural Florida community, nine (72%) were convenience stores (Vilaro & Bennett, 2013). Only four food retailers (three supermarkets and one convenience store) sold fruits and vegetables (Vilaro & Bennett, 2013). Further, food prices were higher for healthy foods, and convenience stores had higher food prices for both healthy and unhealthy food in comparison to supermarkets (Vilaro & Bennett, 2013).

Most community/neighborhood disorganization/disadvantage theories (Kawachi & Berkman, 2000; Sampson, 1992; Yen & Syme, 1999) have focused on two community risk factors, high percentage of ethnic minority (i.e., African American, Hispanic, Native American) and high poverty rates (measured not only by poverty rates, but also annual household income, average education level of residents, and percentage of single-parent households headed by a female), and their effects on crime and delinquency. Ross and Mirowksi (2001) were the first theorists to propose a link between neighborhood disorganization/disadvantage factors of poverty rates, mean education level of residents, and percentage of single-parent households headed by a female and health outcome. Pothukuchi et al. (2008), in their DFS conceptual model, were the first to extend neighborhood disorganization/disadvantage theory to the food retail context. They extended neighborhood risk factors to include high percentages of elderly (age 65 or older) residents, low vehicle ownership rates, and high (property and personal) crimes (in addition to resident ethnic minority and poverty, which they measured as poverty rate and

median household income). Pothukuci et al. further postulated that education level of residents is not only an indicator of poverty/wealth but also community social capital.

Few studies have included (in addition to ethnic minority percentage and poverty rates) the community risk factors of percentage of elderly residents (age 65 and older), vehicle ownership rates, and crime rates and lack of access to healthy foods in urban and rural communities. The studies (see Moore & Diez Roux, 2006; Morland, 2007; Sharkey, Horel, & Huber, 2009) have reported equivocal findings. Sharkey (2008) found a significant association between low vehicle ownership rates and increased numbers of convenience stores in neighborhoods located in Hidalgo, Texas, in a qualitative study on access to vegetables and fruit in Nashville, Tennessee, urban food deserts, noted that store owners identified neighborhood crime as a barrier to providing healthy foods. Shanks et al. (2015), examining information from 12 Montana counties, found that, in addition to poverty rates and high percentage of Hispanic and Native American residents, a high percentage of elderly (age 65 or older) residents were significantly associated with a low number of healthy food retailers. A review of the literature revealed no studies that comprehensively examined community risk factors identified in Pothukuchi et al.'s (2008) DFS conceptual model.

Numerous stakeholders may benefit from the results of this study, and in turn, create positive social change. As a result of this study, residents of the MDR may begin to petition their local, county, and state governments to enhance access to healthy foods, and in turn, such government institutions may develop programs and initiatives that help

to make healthy foods affordable. Findings from this study may prompt the growth of healthy food outlets, including farmer's markets and public gardens food as well as encourage food outlet owners to begin to sale healthy foods, perhaps partnering with area farmers to also increase the economic vitality of the region. Results from this study may inform the development and implementation of community-driven public health initiatives aimed at reducing food-related health issues and disparities. Social change implications are discussed in detail in the Significance of the Study section in this chapter.

Problem Statement

The problem addressed in this study is the lack of access to healthy food retailers in rural communities characterized as food deserts. Over 40 years of neighborhood research has provided substantial support that impoverished and disadvantaged communities play a profound role in influencing numerous resident health outcomes, including obesity and obesity-related medical conditions (Breyer & Voss-Andreae, 2013; Caspi, Sorensen, Subramanian, & Kawachi, 2012; Clark, Morenof, Debbink, Golberstein, Elliott, & Lantz, 2014; Eberhardy & Pamuk, 2004; Ezzati, Martin, Skjold, Noorn, & Murray, 2006; Fahimi, Link, Schwatrz, Levy, & Mokdad, 2008; Kawachi & Berkman, 2000). Due to persistent residential segregation in American communities, ethnic minority residents more so than White residents tend to live in disadvantaged communities and resultantly are more likely to lack access to healthy foods and, in turn, are at increased risk for becoming obese and developing Type II diabetes, hypertension,

heat failure, and other obesity-related diseases (Robert Wood Johnson Foundation, 2010, 2015).

Certain gaps in the literature on community disadvantage and lack of access to healthy food retailers remain. This study addressed these gaps. The first gap was the lack of studies examining community/neighborhood disorganization/disadvantage risk factors associated with lack of healthy food retailers in rural food deserts. The second gap concerned the lack of research testing and providing evidence (or lack thereof) of Pothukuchi et al.'s (2008) DFS model that posits relationships between community risk factors and food retail characteristics in rural communities. Despite theoretical justification as posited by Pothukuchi et al., there is minimal empirical understanding as to whether community disadvantage factors of percentage of elderly residents, vehicle ownership rates, and crime rates are significantly associated with presence/absence of healthy food retailers in food deserts. This is third gap in the literature addressed in his study.

Purpose of Study

The purpose of this quantitative study, which uses a quantitative correlational research design, examined if five county-level community risk factors are significantly associated with presence/absence of healthy food retailers in a stratified random sample of 160 counties across the eight states located in the MDR (i.e., Alabama, Arkansas, Kentucky, Illinois, Louisiana, Mississippi, Missouri, and Tennessee. In a correlational study, independent variables are called predictor variables and dependent variables are

called criterion variables (Asamoah, 2014). The nomenclature of *predictor* and *criterion* is used in this dissertation. Guided by Pothukuchi et al.'s (2008) DFS model, the study examined if the predictor variables of county-level poverty rate, percentage of African American residents, percentage of elderly (age 65 or older) residents, vehicle ownership rate, and property and personal crime rates are significantly associated with the criterion variable of access (yes/no) to healthy food retailers in these 160 MDR counties.

Data used to measure the county-level community disadvantage predictor variables was retrieved from the United States census bureau, the Federal Bureau of Investigation (FBI), and related federal databases. The criterion variable of presence/absence of healthy food retailers were measured using the CDC's (2015) modified retail food environment index (mRFEI) data, measured at the county level. This study methodology has been structured to minimize two threats to internal validity for correlational studies, presence of confound variables/covariates and lack of temporal precedence (i.e., not being able to document that the effect came before the cause; Stangor, 2014). Specifically, the use of proportional stratified random sampling of counties precludes the need to control for covariates. An attempt toward temporal precedence was made by using 2016 data for the predictor variables and 2017 data for the dependent variable.

Research Questions and Hypotheses

Five research questions and associated null and alternative hypotheses are posed for this study.

RQ1. Is the 2016 county-level poverty rate significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties?

$H_0$1: The 2016 county-level poverty rate significantly is not significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties.

H_a1: The 2016 county-level poverty rate is significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties

RQ2. Is the 2016 county-level percent of African American residents significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$2. The 2016 percentage of African American residents is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

H_a2: The 2016 percentage of African American residents is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties

RQ3. Is the 2016 county-level percent of elderly (i.e., age 65 and older) householders significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$3: The 2016 county-level percent of elderly (i.e., age 65 and older) householders is not significantly associated with the 2015 presence/absence of healthy food retailers in 160 MDR counties.

H_a3: The 2017 county-level percent of elderly (i.e., age 65 and older) householders is significantly associated with the 2015 presence/absence of healthy food retailers in 160 MDR counties.

RQ4. Is the 2016 county-level vehicle-ownership rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$4: The 2016 county-level vehicle-ownership rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties

H_a4: The 2016 county-level vehicle-ownership rate is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

RQ5. Is the 2016 county-level crime rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$5: The 2016 county-level crime rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

H_a5: The 2016 county-level crime rate is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

Theoretical/Conceptual Framework

This study is based on the neighborhood disadvantage theory (NDT) as it pertains to health (see Ross & Mirowsky, 2001). I sought to provide empirical evidence for the

DFS conceptual model (Pothukuchi et al., 2008). Ross and Mirowksy's (2001) NDT made a significant contribution to public health theoretical literature as the first ecological model to link neighborhood disadvantage to poor health outcomes. Empirical evidence exists for Ross and Mirowsky's (2001) NDT as it relates to environmental health, sexual health, tobacco and alcohol use, and other public health issues (Browning et al., 2016; Clarke et al., 2016).

The NDT was the basis Pothukuchi et al.' (2008) DFS conceptual model. The DFS is a comprehensive ecological model. This model posits that specific communities, retailers, supply chains, markets, and regulatory ecological systems interact to influence food store inspection outcomes. The community characteristics element of the model shares considerable conceptual overlap with the neighborhood disadvantage theory. Five theoretically-identified community risk factors (i.e., county-level poverty, percentage of African American residents, percentage of elderly [65 or old] residents, vehicle ownership rate, crime rate) characteristics and their relationships to the presence/absence of healthy food retailers in 160 MDR counties are the focus of this study.

Nature of the Study

This is a quantitative study that used a correlational research design. The five community risk factors characteristics (i.e., county-level poverty, percentage of African American residents, percentage of elderly [65 or old] residents, vehicle ownership rate, crime rate) as identified in the DFS conceptual model (Pothukuchi et al., 2008) are the predictor variables, and presence/absence of healthy food retailers is the criterion

variable. The level of measure is the county level. The data sources for this study are three established U.S. federal government institutions: the U.S. Census, the FBI Uniform Crime Reporting (UCR) program, which have historically been used in research literature on neighborhood provide sound and consistent measurement of neighborhood factors, including neighborhood marketing factors (Sampson, 2013; Strominger, Anthopolos, & Miranda, 2016; United Nations Department of Economic and Social Affairs-Population Division [UNDESA-PD], (2014).

The purpose of the research was deductive to assess if a theoretical pathway proposed in the DFS conceptual model (see Pothukuchi et al. 2008) is empirically valid. Therefore, a quantitative statistical approach was appropriate for this study (see Bowling, 2014; Pedhazur & Schmelkin, 2013). This study is quantitative as I posed testable hypotheses, used numerical data, and examined these data using statistical methods (see Bowling, 2014; Stangor, 2014). I used a correlational research design to determine if significant relationships between community risk factors and presence/absence of healthy food retailers. This was done by conducting one binary logistic regression, in alignment with the coding of the study variables; the independent variables are ratio coded and the dependent variable is dichotomously coded (see Hosmer, Lemeshow, & Sturdivant, 2013). The use of a binary logistic regression analysis allowed for results that provide information as to the overall model of seven predictors as well as to each individual predictor (Hosmer et al., 2013). Furthermore, a quantitative approach tends to provide more tangible data to support policy making, for example, which must make socially

consequential and sometimes politically controversial decisions that affect large populations (Costa et al., 2017).

Definitions

Crime Rate:

The FBI (2015), in their UCR, delineates crimes into two categories: property and violent crime. Property crimes include the offenses of burglary, larceny-theft, motor vehicle theft, and arson (FBI, 2015). Violent crime rates are based on murder/manslaughter, rape, robbery, and aggravated assault (FBI, 2015, para. 1). The crime rate is the number of offenses per 100,000 residents (FBI, 2015).

Food Deserts: Food deserts are geographical locations in the United State where residents lack access to healthy and affordable foods yet can easily purchase high-fat, high-sugar foods, with shopping most frequently occurring at convenience stores (USDA, 2009, 2017).

Food Insecurity: The USDA (2017) defines food insecurity as a "household-level economic and social condition of limited or uncertain access to adequate *food*" (, para. 1).

Mississippi Delta Region (MDR): The MDR is a geographical location in the United States that includes 252 counties across eight Midwestern and Southern states: (a) Illinois, (b) Missouri, (c) Kentucky, (d) Tennessee, (e) Alabama, (f) Arkansas, (g) Louisiana, and (h) Mississippi (DRA, 2015).

Modified Food Retail Index (mFREI) Score: This index score was created by the CDC to denote: $\frac{Healthy\ Food\ Retailer\ N}{Total\ Food\ Retailer\ N}\ X\ 100$ (CDC, 2017).

Assumptions

This study, as it is quantitative, aligns with the positivist paradigm. The positivist paradigm has ontological (i.e., nature of reality), epistemological (i.e., nature of knowledge), and axiological (i.e., nature of values and ethics) assumptions (Antwi & Hamza, 2015). In accordance with the ontological assumption of positivism, this study was based on the argument that a single reality exists eternal to the researcher and can be observed, measured, and operationally defined. In alignment with the epistemological assumption of positivism, I posited that the use of deductive reasoning through the scientific method can provide results that are objective and true. This study furthered to follow the axiological assumption that value-free results can be obtained using ethical research practices (e.g., honesty, absence of bias, admission of study limitations; see Antwi & Hamza, 2015).

The positivist paradigm informs certain methodological assumptions (Antwi & Hamza, 2015). However, most methodological assumptions (e.g., ethical treatment of human subjects, participant honesty) pertain to human subjects and thus are not relevant to this study. This study does have other methodological assumptions that align with the positivist paradigm and the deductive approach to quantitative research. One methodological assumption is that the DFS conceptual model (Pothukuchi et al., 2008) is relevant and meaningful to the study topic and that the proposed hypotheses adequately test this theory. A second methodological assumption is that the study variables are appropriately operationally defined, as these operational definitions were based on

relevant theoretical (Pothukuchi et al., 2008; Ross & Mirowksy, 2001) and empirical literature (Larson, 2013; Sharkey, 2008; Vilaro & Bennett, 2013). The methodological assumption that the study has adequate power to detect significant results should they be present is verified by the results of a power analysis conducted using G*power (Faul, year) that determined that power of .80 can be achieved using a sample size of 160 MDR counties. The use of proportional random sampling confirms that the assumption that confounding was minimized or eliminated in this study. The assumption that the study showed evidence of temporal precedence is supported through the use of 2016 data for the community risk factor predictor variables and the use of 2017 data for the criterion variable of presence/absence of healthy food retailers.

Scope and Delimitations

This study was specific in scope in regards theoretical frameworks, geographical location, and variables of interest. It was necessary to use a theoretical framework that applied to the study 'participants' of counties (as a neighborhood type) as opposed to human subjects. It was also important that the selected theoretical framework focus on postulated associations between neighborhood risk factors and health and food retail characteristics. Numerous theoretical frameworks were considered prior to selecting the theories proposed by Ross and Mirowsky (2001) and Pothukuchi et al. (2008).

The relationships addressed in Ross and Mirowsky (2001) NDT are those between the neighborhood risk factors of high poverty, percentage of ethnic minority residents, family disruption, family mobility and conditions such as crime and

delinquency. The majority of NDT-informed studies have focused on resident-level factors, and while some have focused on community-level factors, these were more crime- rather than health-related (e.g., home foreclosure and motor-vehicle rates, number of pay-day loan businesses, and alcohol and gambling outlets) (Browing, Cagney, & Boettner, 2016; Martin, Gaine, Inchley, & Currie, 2017; Sampson, 2012; Tillyer & Wilcox, 2017). As Ross and Mirowsky's (2001) posited relationships between NDT factors and community health outcomes, it was used to inform this study.

Stubblefield, Steinberg, Ollar, Ybarra, and Stewart's (2010) rural food system (RFS) conceptual framework was a promising model, as the authors posited that economic and environmental factors influence food access, food insecurity, and community health. However, Stubblefield et al.'s (2010) RFS was considered too general, as did not identify specific economical/environmental risk factors. Moreover, two of the three outcomes – food insecurity and community health – posited by Stubblefield et al. (2010) were not variables in this study. Freedman's (2009) theory of food access (TFA) was also considered too broad. The premise of the TFA model is that community-level spatiotemporal, economic, social, service delivery, and personal factors directly influence food access (Freedman, 2009), but Freedman did not delineate the specific risk factors in each domain. Pothukuchi et al.'s (2008) DFS model was selected due to its comprehensiveness and detail regarding both neighborhood risk factors and food retailer constructs.

Scholars emphasize the importance of the operational definition of neighborhood when studying community disorganization/disadvantage (Browning, Cagney, & Boettner, 2016; Hart & Waller, 2013; Sampson, 2012, 2013). The decision to measure community disorganization/disadvantage at the county level in this study was driven by a few key factors. The primary factor was that the counties under examination in this study are overwhelmingly rural, and many of these counties do not have a single food establishment where healthy foods can be purchased. For example, two grocery stores serve Mississippi Delta residents who live in the 840-square mile geographical region that includes Sharkey and Issaquena counties in Mississippi (Evans, Thompson, Zimmerman, Woolf, & Haley, 2015). There was a concern that, should census tracts be used in this study, an overwhelming number would have no healthy food retailers. Further, the MDR is described as a 252-county geographical region (DRA, 2015), placing importance and meaning on county-level factors. The study focused on one pathway outline by Pothukuchi et al. (2008) in their DFS conceptual model: that which concerns the relationship between community characteristics and the neighborhood market characteristic of presence/absence of healthy food retailers.

Limitations

The scope and methodology of this study influenced its internal and external validity. Internal validity concerns the certainty to which one can conclude that the effects in the dependent variable(s) are, in fact, a result of the independent variable(s) (Bowling, 2014; Stangor, 2014). There are four primary threats to the internal validity of

a correlational research study: (a) self-selection bias, (b) social desirability response bias, (c) confound bias, and (d) reverse causation (Asamoah, 2014; Stangor, 2014). Self-selection bias and social desirability bias are not concerned in this study, as they pertain to research using human subjects. Confound bias is likely to be reduced by proportional stratified random sampling, and reverse causation is addressed by enhancing temporal precedence in the study. However, a primary limitation of correlational research studies is the inability to determine causality (Asamoah, 2014; Stangor, 2014).

External validity pertains to the generalizability of study findings to the population and/or to other samples, settings, or times (Bowling, 2014; Stangor, 2014). As the external validity of a study is highly dependent upon the degree to which the study participants represent the population (Bowling, 2014), it was crucial in this study to ensure a large enough sample size and to randomize variables so that some generalizations could be made to the population of MDR counties. Results from this study cannot, however, be generalized to counties outside of the MDR, to smaller (e.g., census tracts, zip codes) or larger (e.g., states) geographical regions, or to data collected at an earlier or later time point.

Significance

The study contributed to the existing literature in three ways. The study added to the small body of literature (e.g., Larson, 2013; Sharkey, 2008; Vilaro & Bennett, 2013) that has examined relationships between community disadvantage and access to healthy food retailers in rural communities. Studies that have examined relationships between

community factors and food retailer outcomes (e.g., Bower et al., 2016; Lamichhane et al., 2016; Laxy et al., 2015; Zenk et al., 2016) have tended to focus on two community risk factor variables: community poverty levels and percentage of ethnic minority (i.e., Hispanic and African American) residents. It was important to include these two neighborhood factors to determine if they were applicable to the MDR, thus contributing to the existing literature. However, this study goes beyond the existing literature by including in its examination the factors of percentage of elderly (age 65 and older) residents, vehicle ownership rates, and crime rates that have been theoretically linked to food disparities and have received some attention in food access literature (Black et al., 2016; Walker et al., 2010). Previous studies have further lacked a theoretical focus (Caspi et al., 2012; Pinard et al., 2016). This study had a primary goal of determining the theoretical value of the DFS conceptual model (Pothukuchi et al., 2008). The MDR is one of the most theoretically valid regions in the United States in which to test this public health model (McGee et al, 2011).

This study has numerous implications for social change. The extensive theoretical and empirical works on food deserts have prompted social change at the local, state, regional, and national level (Horst, 2017). While social change implications have been posited for rural communities (Honeycutt, Wile, Doe, Hawkins, & Orenstein, 2015), minimal attention has been given to social change specific to the MDR (Hossfield & Mendez, 2018). Many USDA initiatives already exist for rural communities (e.g., loans and grants to purchase farmland, equipment, and livestock) (USDA, 2015), but many

residents may not be aware of these opportunities or may think they do not qualify for such programs. It is hoped findings from this study increase federal and state supports for education and training on how residents can access and apply to such programs.

Findings from this study may prompt the develop of federal and state food retail legislation and policy on *retail interventions*, which include tax incentives, grants, loans, zoning law changes that encourage the large grocery chains to build in rural communities, and develop partnerships between food distributors and small grocery and convenience stores that allow them to sell more diverse health foods without having to increase prices (The Food Trust, 2014). This would enhance the economic base of the community by increasing job opportunities and local tax revenues and may subsequently reduce unemployment and crime rates (The Food Trust, 2014). This study may also affect change by informing changes in federal programs that pertain to child nutrition, food distribution, and supplemental nutrition assistance (e.g., de-incentivizing unhealthy food purchases and the incentivize healthy food purchases, both which in turn could make food retailers to stock healthier foods).

Results from this study could assist in the formation of the development and implementation of grass-roots community-driven initiatives such as farmer's markets, community gardens, food trucks, food co-ops, and ride-share programs to large grocery stores that could not only enhance the health of MDR community members but may also increase their entrepreneurial spirit, further improving the economic basis of the MDR region. This study may prompt further research that examines the interplay between

community risk factors, food access, obesity, and obesity-related medical conditions. Perhaps most importantly, this study could increase public awareness of the substantial and disquieting economic, social, and public health needs of those individuals who live in the Mississippi Delta. This awareness can encourage positive social change initiatives focused on improving the health and wellbeing of Mississippi Delta residents.

Summary

The first chapter of this study provided an overview of the proposed quantitative study. The chapter presented information regarding the theoretical and empirical literature that informed the study, the problem to be addressed in the study, and the study purpose. The chapter included discussions of the study scope; the methodological nature of the study; assumptions, limitations, and delimitations of the study; and study significance. Chapter 2 elaborates provides a comprehensive examination of the theories that informed this study and reviews of pertinent empirical literature.

Chapter 2: Literature Review

The purpose of this study was to determine whether five community disadvantage factors (i.e., county-level poverty, percentage of African American residents, percentage of elderly [age 65 or older] residents, vehicle ownership rates, and property and violent crime rates) are significantly associated with lack of access to healthy food retailers in 160 randomly selected counties in the MDR area of the United States. Healthy food, such as fruits and vegetables, are often inaccessible in food deserts, and when such foods are available, they are often of poor quality and have high microbial loads (Gould, Rosenblum, Nicholas, Phan, & Jones, 2013; Koro, Anandan, & Quinlan, 2010; Quinlan, 2013). Moreover, very few food deserts have grocery stores, resulting in residents having to travel -sometimes at great distance – to obtain healthy foodstuffs or shopping for their food at small, independently-owned convenience stores, which are much costlier and yet have fewer healthy food options (Frohlich & Abel, 2014; Quinlan, 2013).

This chapter provides a review and discussion of the literature search strategy, the guiding theories, and a comprehensive review of pertinent empirical literature. The chapter opens with a summary of the literature review strategy. The chapter continues with a review of the two guiding theories. Substantial attention is given to the pertinent literature. A summary concludes the chapter.

Literature Research Strategy

The literature search for this study centered on peer-reviewed journal articles in the fields of public health, epidemiology, preventative medicine, sociology, and

psychology. The search focused primarily on theoretical works and pertinent peer-reviewed studies published between 2012 and 2017. The literature search strategy for this study entailed the use of ProQuest databases, including Nursing and Allied Health Sources, Health Management, and Research Library: Health & Medicine, and EbscoHost databases, including MEDLINE and to a lesser extent, PsycARTICLES, PsychINFO, and SocINDEX Theoretical and empirical literature was also retrieved using the Google Scholar search engine. The literature searches included the use of single and combinations of key words and phrases such as *food access*, *healthy food retailers, access to healthy foods, disparity in food access, food safety, food insecurity, food deserts, food retailers, social/neighborhood disorganization, community disadvantage/disorganization, neighborhood disadvantage/disorganization, community risk factors, rural, health disparities, ethnic disparities, African Americans, poverty, low-income, vehicle ownership, crime rates, elderly residents, vehicle ownership,* and *Mississippi Delta Region (MDR)*. I used peer-reviewed articles published in such journals as *Preventive Medicine*, *American Journal of Preventive Medicine*, *Public Health Nutrition*, *American Journal of Public Health*, *Journal of the American Medical Association (JAMA*), *Journal of Community Health*, *Health & Place*, *American Journal of Epidemiology*, *Journal of Food Protection*, and *Journal of Nutrition*. Specific foundation (e.g., The Food Trust, Feeding America, Food Research and Action Center, Robert Wood Johnson Foundation) and federal government agency websites (e.g.,

USDA, CDC) were also used to retrieve pertinent data and statistics and obtain other relevant information on key study topics. Scholarly books augmented empirical literature.

Theoretical Foundation

Social disorganization and disadvantage theories concern how the developing individual is influenced and influences the community in which he/she lives (Kubrin, 2009; Sampson & Groves, 1989). Social disorganization theories (SDTs), also called NDTs, are a type of ecological system theories that focus on how specific neighborhood disadvantage and disorder factors may affect human behaviors (Kubrin, 2009; Sampson & Groves, 1989; Sampson, 1992, 2012). The central premise of SDT/NDT is that the neighborhood factors of low socioeconomic status, high residential mobility, high ethnic heterogeneity, and high family disruption directly and indirectly influence human outcomes, directly and indirectly, by influencing neighborhood control/disorder factors (Kubrin, 2009; Sampson & Groves, 1989; Sampson, 1992, 2012).

Neighborhood disadvantage applied to human health lacked theoretical guidance until Ross and Mirowsky's (2001) seminal work on NDT specific to health. Pothukuchi et al. (2008), in their DFS conceptual model, advanced Ross and Mirowsky's (2001) NDT. Pothukuchi et al.'s DFS model postulated linkages between specific community disadvantage factors – percent of African American or Hispanic residents, community poverty (as measured by poverty rates, median household income, and resident education level), percent of elderly (i.e., age 65 and older) residents, low vehicle ownership rates, and high crime rates – and food environment outcomes, including market, retailer, and

supply chain characteristics, and those that concerned food regulations and inspections. Included in the DFS model is the market characteristics of number of types of food stores in a geographical area, the focus of this study.

This study is based on information provided by Ross and Mirowsky's (2001) NDT and tests a theoretical pathway proposed in Pothukuchi et al.'s (2008) (DFS) model relationship. The DFS model framework provides a rationale for the relationship's existence as shown in Figure 1. Ross and Mirowksy's NDT made a significant contribution to public health theoretical literature as it was the first ecological model to link neighborhood disadvantage to poor health outcomes. The NDT recognizes the complex interplay between substantial resident and neighborhood economic and social disadvantages, and the structural, physical, and social disorders elements of disadvantage neighborhoods that create conditions that promote poor physical and mental health outcomes (Browning, Cagney, & Boettner, 2016; Ross & Mirowsky, 2001).

Empirical evidence exists for Ross and Mirowsky's (2001) NDT as it relates to environmental health, sexual health, and tobacco and alcohol use, and other public health issue (Browning et al., 2016; Clarke et al., 2016). However, very few studies have posited – as this study does – that critical food inspection violations is a public health corollary of neighborhood disadvantage. The NDT has elements in Pothukuchi et al.' (2008) conceptual model. The DFS is a comprehensive ecological model. This model indicates that specific community, retailer, supply chain, market, and regulatory ecological systems interact to influence food store inspection outcomes (see Figure 1). The community

characteristics element of the model shares considerable conceptual overlap with the neighborhood disadvantage theory, and these characteristics are the focus of this study.

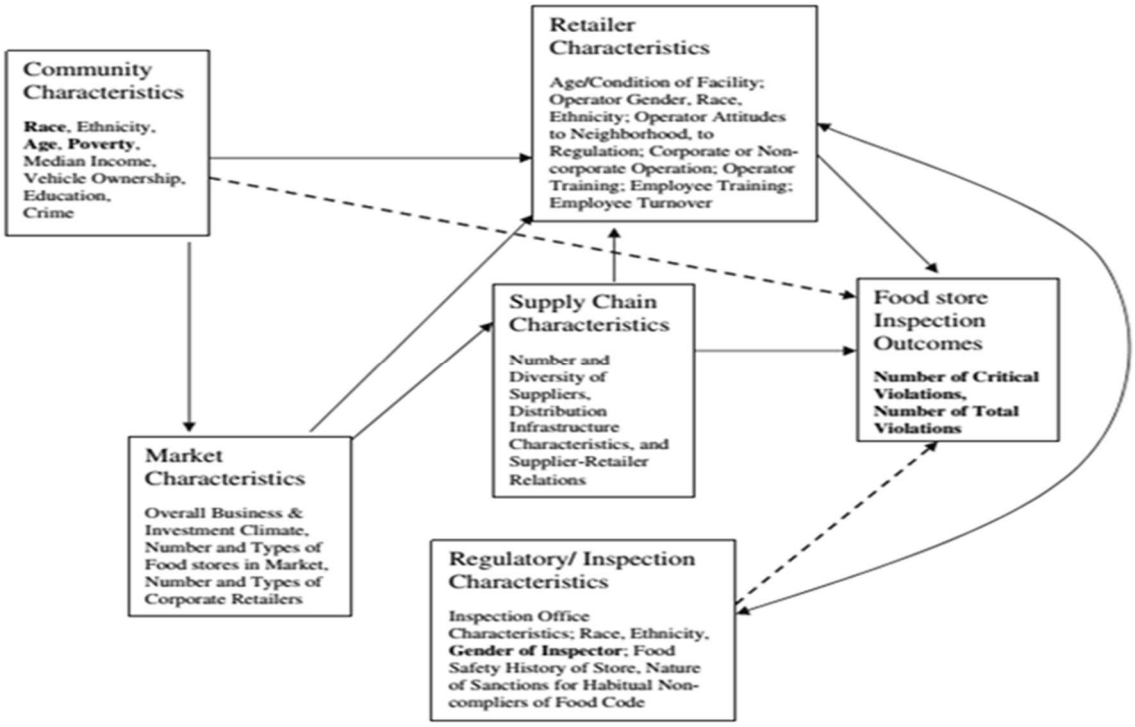

Figure 1 Disparities in food safety theoretical model. From: Pothukuchi et al. (2008). Explaining disparities in food safety compliance by food stores: Does community matter? *Agriculture and Human Values, 25,* 319-332. Reprinted with permission.

Availability, access, and affordability are some intermediate variables related to the food insecurity and safe food handling relationship (Siegal, Ali, Srinivasiah, Nugent, & Narayan, 2016). For example, the increase in the number of food deserts in rural areas

may cause convenience stores and fast food restaurants to become outlets for meals, thereby increasing the likelihood of the consumption of low quality foods (Tagtow & Hinkle, 2008).

Review of Literature

The recognition of the multifaceted grouping of environmental, social, and behavioral factors is clearly an indication of the complexity of the link between community/neighborhood factors, food marketing characteristics and individual health outcomes (Tagtow & Hinkle, 2008; Pampel, Krueger, & Denney, 2014; Pitts et al., 2013). Food environment factors such as food prices, government assistance programs, and proximity to convenience stores or restaurants may influence food choices and diet quality (McKenzie, 2014; Miller, Middendorf, & Wood, 2015). Food insecurity encompasses not only food choices, dietary habits, and diet quality; it also includes uncertainty to secure the next meal (USDA, 2017). A variety of personal factors, such as socioeconomic status, educational level, age, gender, food choices and diet quality (Barnes et al., 2016). Residents' income and assistance, retailers' acceptance of federal food assistance vouchers, and product prices influence food choices, dietary habits, and diet quality (Barnes, 2016; Miller et al., 2015). In addition, food environment factors could lead to healthier communities.

Food Deserts & Food Insecurity

Food deserts are geographical locations, such as neighborhoods, that have limited food retail, especially as it pertains to affordable, healthy, and fresh foods (USDA, 2009,

2017). The USDA (2017) reported that, in 2015, approximately 19 million Americans resided in food deserts across the United States. Food deserts are disproportionately more likely to have larger populations of low-income and ethnic minority (i.e., Hispanic, African American) populations, and individuals who reside in rural food deserts often live more than 10 miles from a supermarket (USDA, 2017). Residing in a food desert often contributes to household food insecurity, in which individuals lack financial resources to obtain quality food and may resultantly have reduced food intake (USDA, 2017). The percentage of food-insecure households increased from 3.8% in 2001 to 4.9% in 2016, affecting 6.1 American households (USDA, 2017). Moreover, in 2016, 38% of households with incomes below the poverty line were food-insecure, 23% of African American households were food-insecure, and 15% of individuals living in rural areas were food-insecure (USDA, 2017). The USDA (2017) reported that in 2016, that 75% of individuals in food insecure households could not make balanced meals, 40% ate less than should, and 35% skipped meals.

Food environment factors such as food prices, government assistance programs, and proximity to convenience stores or restaurants may influence food choices and diet quality. The recognition of the multifaceted grouping of environmental, social, and behavioral factors is clearly an indication of the complexity of the link between those factors and health outcomes. Food insecurity encompasses not only food choices, dietary habits, and diet quality; it also includes uncertainty to secure the next meal. A variety of personal factors, such as socioeconomic status, educational level, age, gender, and

cultural preferences, are associated with food choices and diet quality. Drewnowski and Specter (2004) stated that income and prices influence food choices, dietary habits, and diet quality. The results of a study Drewnowski & Specter (2004) conducted indicate that income disparities had more of an effect on the quality of the diets than the total energy intake. For example, food purchased by low income households differed significantly from food purchased by high-income households (USDA, 2017). In addition, more households are spending a lower percentage of their throwaway income on food.

Changes in safety of practices over the survey years are consistent with the change in the number of media articles. The findings suggest that attention through the media about food safety issues should raise awareness of food safety hazards. Food access may increase patterns of overconsumption of high-fat foods, high sugar foods, and beverages (Park, Onufrak, Sherry, & Blanck, 2016; Gittelsohn, Rowan, & Gadhoke, 2012). The overconsumption of these high calorie foods and beverages significantly contribute to the obesity challenge faced in the United States (Park et al., 2016). Hartline-Grafton, Rose, Johnson, Rice and Webber (2009) agree that food insecurity may lead to weight gain because the least expensive food items are typically high in calories and low in nutrients (Drewnoski & Specter, 2004; Hartline-Grafton et al., 2009; Lugwig & Pollack, 2009). Energy intake and food choice as they relate to obesity have been addressed in terms of physiology, biology, and behavior. There is a strong correlation between racial/ethnic and socioeconomic disparities and diet quality, obesity, and diet-related diseases (Neff et al., 2009). In a study conducted in 36 counties in the Lower

Mississippi Delta region, a predominat rural, minority, and traditional agricultural region of Arkansas, Louisiana, and Mississippi, researchers found that food insecurity was associated with lower quality diet (Connell et al., 2007). Psychological mechanisms are examined through inadequate nutritional knowledge, the consumption of high-fat foods in search of comfort, and excessive vulnerability to the external environment, which includes easy access to unhealthy food options (Drewnoski & Specter, 2004).

Rural environments and food access and insecurity. Although poverty is a national challenge, poverty is experienced at higher rates in rural areas (Befort et al., 2012). A rural infrastructure is diverse in terms of culture, society, economic, and ethnicity (Connell et al., 2007). There are some challenges that are common in rural populations such as limited amounts of transportation, access to fresh fruit and vegetable, lack of funding an infrastructure. Challenges that are common among rural populations include limited transportation and availability of healthy foods, lack of public health funding and infrastructure, and barriers to access and environmental physiognomies (RAC, 2016). Many of these challenges also contribute to the obesity challenges in rural populations (Befort et al., 2012; Moore et al., 2008; Nord, Coleman-Jensen, & Gregory, 2016).

Approximately 70 million people or at least 23% of U.S. population live in rural areas (Befort et al., 2012). In rural populations, the population tends to have lower income, less educated, and older (Befort et al., 2012; Eberhardt & Pamuk, 2004). Chronic disease and mortality in rural and urban areas differ between rural and urban areas. There

is a significant difference in the chronic disease and mortality rates between rural and urban areas, thus potentially contributing to geographic health disparities (Befort et al., 2012). Befort et al. (2012) noted that rural and urban areas have distinctive characteristics in social, behavioral, and environmental determinants of safe food handling practices. Their study revealed that a diet high in calories from fat was the biggest predictor of obesity and a major contributor to the high obesity rates in rural America, more so than in U.S. cities. The Rural Assistance Center (2016) agrees that rural residents are more inclined to eat diets higher in fat and calories and have less access to services that promote healthy eating.

Another factor in food insecurity is instability of the food availability (Barnes, 2016; Browning et al., 2016; Miller et al., 2015). For example, the decrease in crop production in rural populations has been credited with some contributing to increases in food insecure households (Rural Poverty Report, 2011). Small-scale farming and droughts are forces of change and common themes that exist in rural populations. Crop production decline and the decrease in purchasing power is another combination that contributes to food insecurity in rural populations (DHA, 2016; Rural Poverty Report, 2011).

In both urban and rural populations, health is measured by indicators that show mortality, morbidity, lifestyle behaviors, and other health-related risk factors; however, these adverse events are significantly greater in rural populations (Eberhardt & Pamuk, 2004; Friel & Ford, 2015). A body of research associates the factors with low income

(Eberhardt & Pamuk, 2004; Leung et al., 2012; Pinard et al., 2016; Wang et al., 2011). Poverty has been around for long periods of time. In 1970, Hansen stated that rural areas are often the last areas to experience new technologies, and low wages and competitive pricing dominate production of such. In an *obesogenic* environment, high energy foods are heavily consumed. Reducing energy density shows in some laboratory and clinical trial data as an effective approach to weight management (Rolls, Drewnowski, & Ledikwe, 2005). The status of local food environments is particularly important in food insecure populations (Coleman-Jensen et al., 2014; Freedman & Bell, 2009).

Poverty and food access and insecurity Freedman and Bell (2009) explained that, in 2007, households with incomes below the poverty line had higher food insecurity rates, and those rates were higher than the food insecure national average. Also, 30.2% of households with children led by single women were food insecure, and 22.2% African American and 20.1% Hispanic households were insecure. They reported that food insecurity is associated with an increased risk for obesity in both adults and children (USDA, 2016).

According to Shah (2016), global hunger is a dreadful indicator of world poverty. People who do not have access to health care, education, and other services are usually the poorest. These individuals less access to health care, education, and other services are usually the poorest. Individuals are caught in the cycle of poverty because they have little representation in public and political debates. It is said to relieve a population of hunger is to alleviate poverty, assuming poverty is credited for hunger (FAO, 2016). Increasing

food production was not fix the worldwide food insecurity challenge if it is not done in conjunction with the addition of resources that limit poverty (FAO, 2016).

Food insecurity and poverty are different concepts although they may be directly related. Goldman et. al, (2005) found that the elderly adult outcomes were more associated with food insecurity than child outcomes. The outcomes were reverse. Among the elderly, poverty was associated with low BMI. Additionally, the study showed that poverty was associated more with outcomes of young children than older children. Goldman et al. (2005) showed that poverty is just one factor that is associated with food access. As shown in the conceptual framework from Rutten et al. (2010), poverty portrays a direct association with food insecurity but there may be other indirect influences. Pampel, Krueger, and Denney (2016) explained that socioeconomic status could influence health outcomes. Coleman-Jensen, Gregory, and Singh (2013) stated that higher unemployment, lower household assets, and certain demographic characteristics are associated with food access whilelinked to limited access to adequate and nutritious food.

Higher priced foods are sold at convenience stores and small, independent stores as they are more prevalent in low-income and African American communities. According to Piontak and Schulman (2016), Southern households that include a large number of rural areas, have the highest food insecurity rates. In a study conducted by Connell and colleagues (Connell et al., 2007), several counties in the lower Mississippi Delta have been classified as food deserts due to the limited access to large retail food distributions

centers. The study indicated that in this region over two-thirds of low –income households were located greater than 30 miles from a supermarket or large food retailer (Campagne et al., 2007; Connell et al., 2007; Kaufman, 1999). Additionally, research shows that higher food prices found in an economic analysis conducted in neighborhoods suggest that energy-dense diets cost less than healthier diets. Furthermore, in a study where market basket surveys were conducted, research suggests that individuals with limited spending power and availability may have limited ability to buy healthy foods (Jetter & Cassady, 2006). Jetter and Cassady (2006) revealed that there was limited access to whole-grain foods, low fat cheese, and ground meat with less than 10 percent fat in neighborhoods where smaller grocery stores existed. French (2003) suggested that food choices are influenced by cost, convenience, and taste. Sarlio-Lahteenkora and Lahelma (2001) examined the relationship between body size and trends of economic disadvantage. They proposed that constraints in income likely limit the available dietary options in economically disadvantaged areas.

Food access and obesity. There is a body of research that links food access to obesity and poor health outcomes. Gunderson (2013) explains that demographic and socioeconomic factors associated with food insecurity are well documented, even as researchers control for them. Income is a key factor of food access. In part, food insecurity is thought to be the result of the national economic crisis during 2001-2012. During this time, there was an increase in caloric purchases, as the unemployment rates increased. Research suggests that food insecure households involuntarily shift to coping

strategies, depending on the time of the month or availability and access to healthy food (Sarlio-Lahteenkorva & Lahelma, 2001).

In some studies, food insecurity and obesity varied among women and not men (Franklin et al, 2012; Wilde & Peterman, 2006). More research is needed to determine if food insecure individuals are obese due to the increased tendency for to purchase cheap, high calorie-dense foods, or if scarcity increases the tendency of these individuals to overeat in periods when there is abundance (Fernandez et al., 2016). Cook et al. (2006) used the Household Food Security Scale and the Early Childhood Longitudinal Study-Kindergarten Cohort data to confirm that women in marginally food-secure households were significantly different from women in food secure households on all socio-demographic characteristics. Few studies have explored the physiological, behavioral, and psycho-social-culture associated with the food insecurity, obesity, and poverty relationship. However, Cook et al. (2006) found using that several socio-demographic and psychosocial indicators were significantly associated with higher odds of both marginal food security and food insecurity. To this end, Cook and colleagues (Cook et al., 2006) argue that marginal food security be clearly underestimated affecting health outcomes at the same rate as food access.

The availability of foods has largely shifted to highly refined and excessive processed foods, and meat and dairy products containing extreme levels of saturated fats (Moubarac et al., 2012). In the study conducted by Moubarac et al. (2012), food supplies and diets were highly concentrated with high energy density foods and these high levels

exceeded the World Health Organization's upper limit recommendations for the unhealthy foods. According to Friel and Ford (2015), the global shift has been a parallel trend with the high consumption of the unhealthy food options, which may be adding to the obesity challenge in the U.S. Thow, Leeder, and Swinburn (2010) agreed that the current obesity challenge emulates increasingly *obesogenic* food environments and long-term sedentary lifestyles and low energy expenditures.

Some distinct psychiatric conditions are considered contributory to obesity. There are bidirectional associations between mental health problems and obesity with levels of obesity, gender, age and socioeconomic status being key risk factors (National Obesity Observatory, 2011). Some may question whether obesity is a cause for mental health disorders, or mental health is a cause for obesity. According to the National Obesity Observatory (2011), the mediating factors for obesity and mental health are dieting and weight cycling and low self-esteem.

According to Florez, Duboqitz, Ghosh-Dastidar, Beckman, and Collins (2015), depression symptomatology is a factor that is associated with obesity across varied age groups. The directionality of the association is unclear. However, Florez et al. (2015) found that weight reduction and improved diet may promote mental health. The National Obesity Observatory (2011) found an association between specific BMI categories and depression. In this study, they found that a lack of social well-being may contribute to or maintain atypical BMI. Results of an observation study conducted by Klurfeld (2015) suggest that there are many factors that correlate with high meat consumption.

Furthermore, Klurfeld stated that the relationship between meat consumption and chronic disease is unclear.

Summary

This chapter provided an overview of the guiding theories of the study as well as the pertinent literature on food deserts, access to food in food deserts, and food insecurity. Key studies were summarized and data on food deserts and food insecurity was presented. The following chapter presents the study methodology.

Chapter 3: Methodology

Introduction

Community disadvantage has long been theoretically and empirically associated with numerous negative health outcomes (Black et al., 2014; Sampson, 2013; Strominger et al., 2016). Much of this research has been conducted in food deserts, defined as geographical locations in the United State where residents lack access to healthy and affordable foods yet can easily purchase high-fat, high-sugar foods, with shopping most frequently occurring at convenience stores (USDA, 2016). The increased rates of obesity and health problems associated with obesity in food deserts has led to an increased theoretical and empirical examination of the influences of community risk factors associated with related health outcomes, most notably, those associated with food access and food safety (USDA, 2016). This body of research has been greatly informed by the theoretical and empirical work by Pothukuchi et al. (2008). Pothukuchi et al., in their DFS conceptual model, posited that numerous ecological factors play a role in food retail characteristics.

While numerous studies have examined associations between neighborhood and community deprivation and disadvantage and food accessibility, as noted in the review studies by Black et al. (2016) and Hilmers et al. (2012), most of these studies have been conducted in urban environments. Moreover, this body of research lacks theoretical cohesiveness. The purpose of this quantitative study, which used a correlational research design, was to address these gaps in the literature by examining if the seven community

risk factors identified in Pothukuchi et al.'s (2008) DFS conceptual model are significant predictors of presence/absence of healthy food retail environments across a stratified random sample of 175 (out of 252) Mississippi Delta region counties, with counties proportionately stratified across the eight Midwestern and Southern states that comprise this region.

The purpose of this chapter was to provide a comprehensive overview of the research methodology of this study. The chapter opens with the study research design section. The chapter continued with a methodology section, which contains substantive information on (a) the study population, sample, sampling procedures, (b) archival data access and collection procedures, (c) identification and operationalization of study variables, and (d) the planned data analyses. The penultimate section of this chapter addressed threats to validity and ethical concerns. The chapter ends with a summary.

Research Design and Rationale

The purpose of this study, informed by Pothukuchi et al.'s (2008) DFS conceptual model, was to examine if five theoretical community risk factors are significantly associated with presence/absence of healthy food retail environments in 160 MDR counties. The independent/predictor variables, measured for the 2016 year, in this study are (a) county-level percent of African American residents, (b) county-level percentage of residents age 65 or older (i.e., elderly population), (c) county-level poverty rate, (d) county-level median household income, and (e) county-level vehicle ownership rate. The dependent variable in this study is a dichotomous variable: the 2017 presence/absence of

healthy food retailers per county as indicated by the (CDC, 2017). The dependent variable is treated as a dichotomous variable instead of a ratio variable based on the mRFEI index as many counties in the MDR do not have any healthy food retailers (Blum & Roberts, 2012; Delta Health Alliance, 2016). As counties were proportionately randomly sampled across the eight states, there was no need to control for state. However, the county population size acted as a potential covariate was found to be significantly associated with presence/absence of healthy food retailers.

This study is quantitative, and I used a correlational research design. Qualitative and quantitative research methods were founded on and are guided by different—actually opposing—philosophical principles (Herms, 2013). Qualitative researchers embrace inductive reasoning; they develop studies in which they use results to derive general principles or theories (Herms, 2013). In contrast, quantitative scholars advocate for the scientific method aspects of deductive reasoning and test the relevance of existing theories by developing hypotheses (Herms, 2013). Differences in qualitative versus quantitative philosophical approaches greatly influence the creation of research questions, the use of hypotheses, the type and means of data collected, and the tools to interpret findings (Stangor, 2014). Qualitative studies do not have hypotheses; in them, the researcher is seen as the instrument (Stangor, 2014). Further, qualitative studies focus on word or image data arrived at through focus groups, interviews, or observations (Stangor, 2014). Quantitative studies have testable hypotheses and use statistical analyses to examine numerical data (Stangor, 2014). My study is deductive in nature, has testable

hypotheses, and was collected and analyzed numerical data, all of which align with the quantitative approach.

The research problem and study hypotheses require examinations of relationships between the independent and dependent variables. The problem under examination in this study concerns whether community risk factors significantly predict presence/absence of healthy food retailers. To address this problem, the study used U.S. Census and CDC numerical data (see Ormachea, Haarsma, Davenport, & Eagleman, 2015). The U.S. Census and FBI UCR data are ratio variables while the CDC healthy food retailer data is dichotomous, which requires that hypotheses be tested using binary logistic regression. These quantitative study factors call for the use of a correlational research design (Stangor, 2014).

Methodology

Population

The sample of 160 MDR counties in this study represented the 252 counties of the MDR in the United States. The 252 Delta region counties are located across eight Midwestern and Southern states: (a) Illinois, (b) Missouri, (c) Kentucky, (d) Tennessee, (e) Alabama, (f) Arkansas, (g) Louisiana, and (h) Mississippi (Delta Regional Authority [DRA], 2015). While the MDR encompasses eight states, it is home to only slightly under 10 million people, 3.1% of the American population (DRA, 2015). The majority of the MDR counties are in the states of Louisiana and Mississippi (both states having over 50 counties located in the Delta Regions); in contrast, only 16 (6.3%) and 21 (8.3%) of

Delta Region counties are situated in the states of Illinois and Kentucky, respectively (DRA, 2015).

Scholars have suggested that much consideration should be given to the operational definition of neighborhood when studying community disorganization/disadvantage (Hart & Waller, 2013; Sampson, 2013). The decision to measure community disorganization/disadvantage at the county level in this study was driven by a few key factors. The primary factor was that the counties under examination in this study are overwhelmingly rural, and many of these counties do not have a single food establishment where healthy foods can be purchased. For example, two grocery stores serve Mississippi Delta residents who live in the 840-square mile geographical region that includes Sharkey and Issaquena counties in Mississippi (Evans et al., 2012). Further, the MDR is described as a 252-county geographical region, placing importance and meaning on county-level factors. Another concern was the lack of available crime data at the census block and census tract level. As no studies to date have examined associations between crime rates and food access, it was considered crucial that crime rates be included in this study. Crime data on the county level is available through the FBI UCR.

Sampling and Sampling Procedures

The sample for this study was limited to $N = 160$ counties located across the eight states (i.e., Louisiana, Mississippi, Arkansas, Alabama, Missouri, Tennessee, Kentucky, Illinois) of the MDR. A power analysis using G*Power (Faul, Erdfelder, Lang, &

Buchner, 2007) for a binary logistic regression (two-tailed) determined the sample size needed for this study. The number of independent variables was set to 9 and the number of covariates was set to 1. Power was set at .80. Significance was set at $p < .05$. As results from relevant studies (see Kirkpatrick et al., 2014; Sohi et al., 2014) have documented small to moderate effect sizes in studies on neighborhood disadvantage and food access, the odds ratio was set to 1.61, a small-to-moderate effect size, representing a .559/.441 probability level. The mean and standard deviation of the distribution of scores for the predictor variables were set to 0 and 1, respectively. Based on these parameters, the total sample size required to achieve adequate statistical power was $N = 160$. This value is slightly higher than the general rule of thumb of 15 cases per one predictor for binary logistic regression (Harrell, 2016; Hosmer, Lemeshow, & Sturdivant, 2013).

A proportional number of counties were randomly selected from each of the eight states located in the MDR. Table 1 presents the number and percent of MDR counties by state and the associated number of counties per state that was selected for the study. Counties by state were randomly selected by (a) assigning a number to each county; (b) setting on online random number generator to the total *n* MDR counties per state (i.e., for the state of Louisiana, setting the range of random numbers between 1 and 53); and (c) using the random number generator to select the required sample of counties per state.

Table 1

Proportional Random Selection of County Sample (N = 160)

State	N (%) Counties in MDR	N Random County Sample
Louisiana	53 (21%)	34
Mississippi	47 (19%)	30
Arkansas	42 (17%)	27
Missouri	29 (11%)	19
Tennessee	22 (9%)	14
Kentucky	22 (9%)	14
Alabama	20 (8%)	12
Illinois	17 (6%)	10
Total	**252**	**160**

Procedures for the Collection of Data

This study does not involve the recruitment of human subjects; as such, informed consent is not relevant to this study. I used county-level archival data from various sources, all of which are in the public domain and free to use for research purposes. All the independent variables and the covariate of county population was measured using 2016 data from the U.S. Census. The dependent variable of presence/absence of healthy food retailers was obtained from the CDC (2017) modified Retail Food Environment Index data, measured at the census tract and county level.

Instrumentation and Operationalization of Study Variables

I used archival data from two sources: the U.S. Census and the CDC mRFEI datasets. Data from the U.S. Census have historically and consistently been utilized in

studies across a variety of disciplines (i.e., criminology, sociology, psychology, epidemiology, public health, urban studies). In addition to collecting numerous types of data on the American population, the Census Bureau sets data collection standards and conducts evaluations to ensure that the data collected is valid, accessible, and meaningful for researchers and scholars (U.S. Census Bureau, 2016). The annual American Community Survey, disseminated by the U.S. Census to 5% of the American population each year, provides for the most up-to-date and accurate estimates on census data (U.S. Census Bureau, 2016).

The CDC (2017) first developed the modified Retail Food Environment Index dataset in 2011, to increase empirical research on and subsequent awareness of geographical health disparities regarding access to healthy foods. The goal of the mFREI program was to "estimate access to healthier food retailers across the United States and regionally" (CDC, 2017. para. 5). CDC mapped the locations of health food retailers at the census tract and county levels using a list of 54,666 healthy food retailers (i.e., national chain supercenters, chain and non-chain supermarkets and grocery stores, specialty food stores) obtained from two national retail food directories, InfoUSA and Supplemental Nutrition Assistance Program (SNAP) (CDC, 2017). The CDC used these data to calculate, for each census tract and county in the United States, an mFREI index score, denoted as: $\frac{Healthy\ Food\ Retailer\ N}{Total\ Food\ Retailer\ N}\ X\ 100$ (CDC, 2017). The CDC then published census tract and county-level mFREI data mapped for each state.

Independent Variable 1: County-level poverty rate. The independent variable of county-level poverty rate was assessed using 2016 U.S. census data that assess the county-level percentage of individuals living below the poverty level. This is a ratio variable. The possible range of scores was 0% to 100%, with a higher percentage indicating a higher county-level percentage of individuals living below the poverty level.

Independent Variable 2: County-level percentage of African American residents. The independent variable of county-level percentage of African American was assessed using 2016 U.S. census data that measure the county-level percentage of individuals classified as African American. This is a ratio variable. The possible range of scores is was 0% to 100%, with a higher percentage indicating a higher county percentage of African American individuals.

Independent Variable 3: County-level percentage of elderly residents. Empirical literature has defined an elderly person as someone who is age 65 or older (Addington, 2013; Orimo, Ito, Suzuki, Araki, Hosoi, & Sawabe, 2006; Sabharwal, Wilson, Reilly, & Gupte, 2015). The independent variable of county-level percentage of elderly African American was assessed using 2016 U.S. census data on the county-level percentage of individuals who are age 65 or older. This is a ratio variable. The possible range of scores was 0% to 100%, with a higher percentage indicating a higher county percentage of elderly persons, that is, persons age 65 or older.

Independent variable 4: County-level vehicle ownership. Another community risk factor denoted in the DFS conceptual model (Pothukuchi et al., 2008), the

independent variable of county-level vehicle ownership was measured using 2016 U.S. census data on the percent of occupied households that have one or more vehicles. This is a ratio variable. The possible range of scores is 0% to 100%, with a higher value indicating a higher percent of occupied households with one or more vehicles.

Independent variable 5: County-level crime rate. A DFS conceptual model (Pothukuchi et al., 2008) community risk factor, the independent variable of Type I (violent and property) crime rate was measured using FBI UCR data for 2014. The offenses included under the Type I category are murder, rape, robbery, aggravated assault, burglary, larceny, auto theft, and arson (FBI, 2016). This is a ratio variable. The possible range of scores is 0% to 100%, with a higher value indicative of a higher Type I crime rate.

Dependent variable: County-level presence/absence of healthy food retailers. The dependent variable of county-level presence/absence of healthy food retailers was measured using CDC (2017) modified Retail Food Environment Index (mRFEI) data. The mRFEI index is calculated by dividing the number of healthy food retailers by the number of healthy and less healthy food retailers' times 100 (CDC, 2016). These data are available at the census tract and county levels. As many of the counties in the Mississippi Delta Region lack health food establishments (CDC, 2016), this variable was treated as dichotomous, coded where 0 = absence of healthy food retailers and 1 = presence of healthy food retailers.

Data Analysis Plan

This study focused on the relationships between Pothukuchi et al.'s (2008) seven community risk factors and the market characteristic of presence/absence of healthy food retailers in a theoretically-valid location of the MDR. In this study, 160 counties in the MDR was used as study participants. The use of proportional stratified random sampling of counties precludes the need to control for covariates. Temporal precedence was addressed by using 2016 U.S. Census and FBI UCR data and 2016 CDC mFREI data. Seven research questions are posed for this study.

RQ1. Is the 2016 county-level poverty rate significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties?

Ho_1. The 2016 county-level poverty rate significantly is not significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties.

Ha_1. The 2016 county-level poverty rate is significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties

RQ2. Is the 2016 county-level percent of African American residents significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

Ho_2. The 2016 percentage of African American residents is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

Ha_2. The 2016 percentage of African American residents is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties

RQ3. Is the 2016 county-level percent of elderly (i.e., age 65 and older) householders significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

Ho_3. The 2016 county-level percent of elderly (i.e., age 65 and older) householders is not significantly associated with the 2015 presence/absence of healthy food retailers in 160 MDR counties.

Ha_3. The 2017 county-level percent of elderly (i.e., age 65 and older) householders is significantly associated with the 2015 presence/absence of healthy food retailers in 160 MDR counties.

RQ4. Is the 2016 county-level vehicle-ownership rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

Ho_4. The 2016 county-level vehicle-ownership rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties

Ha_4. The 2016 county-level vehicle-ownership rate is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

RQ5. Is the 2016 county-level crime rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

Ho_5. The 2016 county-level crime rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

Ha_5. The 2016 county-level crime rate is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

All study data was entered manually into an SPSS 25.0 software data file. Each randomly selected county was entered as the study participant variables. A string variable was created to record the associated state. Data from the U.S Census and FBI UCR datasets that correspond with the county was entered into the data file for the study independent and dependent variables. The data was reviewed and adjusted for any entry error. As data was retrieved from national data sets on county information, there was no missing data.

Prior to conducting a binary logistic regression to test study hypotheses, preliminary statistics was conducted. Descriptive statistics (i.e., mean, standard deviation, minimum and maximum scores) was computed on all independent variables and the covariate of county population. Frequencies and percentages were reported for the dependent variable of presence/absence of healthy food retailers.

Binary logistic regression has few assumptions. The most concerning assumption is lack of multicollinearity between the independent variables (and covariate). Variance inflation factors (VIFs) was computed to determine if multicollinearity is present; a VIF equal to or greater than 10.00 is indicative of multicollinearity. If any variables show multicollinearity, was removed from analyses. The overall significance of the binary

logistic regression model was determined by its model chi-square value, with significance set at $p < .05$. The Hosmer-Lemeshow chi-square was included as an additional indicator of model significance. Unlike most statistics, a non-significant (i.e., $p > .05$) Hosmer-Lemeshow chi-square value indicates that the overall binary logistic regression model is a good fit to the data. Effect size was documented by the Nagelkerke R^2. Specific statistics was reported to indicate if the individual predictor variables are significant. The variable's Wald statistic and corresponding significance set at $p < .05$ was reported. The odds ratio and 95% confidence interval of the odds ratio was reported for each predictor variable as an indicator of effect size.

Threats to Validity

Internal validity concerns the certainty to which one can conclude that the effects in the dependent variable(s) are, in fact, a result of the independent variable(s) (Bouffard et al., 2010). There are four primary threats to the internal validity of a correlational research study: (a) self-selection bias, (b) social desirability response bias, (c) confound bias, and (d) reverse causation (Bouffard et al., 2010). Self-selection bias and social desirability bias are not concerning in this study, as they pertain to research using human subjects.

This study does have an internal validity threat of confound bias, where a third unmeasured variable—a confound variable—was systematically associated with and resultantly distorts the relationship between the independent and dependent variables (Bouffard et al., 2010). Confound bias can result in spurious associations between the

independent and dependent variables, leading to Type I (i.e., rejecting the null hypothesis when it is true) and Type II (i.e., failing to reject the null hypothesis when it is not true) errors (Bouffard et al., 2010). While confound bias cannot be completely eliminated in correlational studies (Bouffard et al., 2010), certain methodological procedures were incorporated into the research design to reduce this bias. The use of stratified random sampling of counties precludes the need to control for county size, thus eliminating county size as a potential confound variable (Bouffard et al., 2010). Confound bias can be reduced by using a large sample size (Bouffard et al., 2010). A small to medium effect size was used in the power analysis, which resulted in a relatively large sample size of 160 counties, a larger size than would be employed had a medium or large effect size been used in the power analysis. Another internal validity issue for correlational studies is reverse causation, which concerns the inability to determine temporal precedence of variables (Edmonds & Kennedy, 2012). To help to establish temporal precedence, independent variable data for 2016 was used while presence/absence of healthy food retailer data from 2017 was used.

External validity pertains to the generalizability of study findings to the population and/or to other samples, settings, or times (Bouffard et al., 2010). As the external validity of a study is highly dependent upon the degree to which the study participants represent the population, it was crucial in this study to ensure a large enough sample size and to randomize variables so that some generalizations could be made to the population of MDR counties (Jackson, 2015). Results from this study cannot, however,

be generalized to counties outside of the MDR, to smaller (e.g., census tracts, zip codes) or larger (e.g., states) geographical regions, or to data collected at an earlier time point.

Ethical Assurances

The proposed study was utilized MDR counties as 'participants.' The ethical procedures for human subjects, such as participant informed consent and confidentiality, do not apply to this study. The study data are in the public domain and freely available by accessing the U.S. Census and FBI websites.

Other ethical guidelines do apply to this study. The researcher obtained IRB approval on September 6, 2018. Institutional Review Board (IRB) approval number 09-06-18-0248261. The counties selected for this study was identified by name and results was reported at the aggregate. The researcher saved the study data in a password-protected SPSS 25.0 data set kept on her home computer, which is password-protected. At the end of five years, the data set was deleted from the computer and any related materials shredded or otherwise destroyed.

Summary

The purpose of the third chapter was to present an extensive overview of this quantitative correlational research study that was examined the relationship between community risk factors and presence/absence of healthy food retailers in 160 MDR counties. This chapter contained the research questions and associated hypotheses and included information on the theoretical frameworks research design, methodology (e.g., sample, variables, data collection and analyses), assumptions, limitations, and

delimitations, and ethical procedures. The research methodology in this chapter provides the blueprint for understanding the results discussed in Chapter 4.

Chapter 4: Results

The problem addressed in this study was the lack of access to healthy food retailers in rural communities characterized as food deserts, geographical regions in which residents lack access to food retailers selling affordable, nutritious, and diverse foods (FRAC, 2010a, 2010b; USDA, 2009, 2017). There is sound empirical evidence linking community disadvantage factors of high poverty rates and high percent of ethnic minority residents to macro-level food retail and marketing factors, most notably lack of access to healthy food retailers, in urban communities (e.g., Calancie et al., 2015; Chen & Kwan, 2015; Dutko & Ver Ploeg, 2013). However, as research conducted in rural food deserts is lacking, it is less understood as to if, and if so, to what degree, community disadvantage risk factors are significantly associated with lack of access to healthy food retailers in rural food deserts (Alviola et al., 2013; Rodriguez & Graham, 2016).

The intent of this quantitative correlational research study, which used Pothukuchi et al.'s (2008) DSF conceptual model, was to examine the relationships between community disadvantage risk factors and lack of access to healthy food retailers in a theoretically valid and meaningful geographical area: the MDR. The study participants were a proportional random sample of 160 counties across the eight MDR states. The five community risk factors, all of which were predictor variables, were (a) poverty rate, (b) percent of African American and elderly (i.e., age 65 or older) residents, and (c) vehicle ownership rates, measured using U.S. Census 2016 data; and (d) violent crime (i.e., murder, manslaughter, rape, robbery, aggravated assault) rate, assessed using FBI (2016)

UCR data. County-level presence/absence of healthy food retailers, the criterion variable, was measured using the CDC's (2017) modified Retail Food Environment Index data**.** The study had five research questions, each having associated null and alternative hypotheses**.**

RQ1: Is the 2016 county-level poverty rate significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties?

$H_0$1: The 2016 county-level poverty rate significantly is not significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties.

H_a1: The 2016 county-level poverty rate is significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties

RQ2. Is the 2016 county-level percent of African American residents significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$2: The 2016 percent of African American residents is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

H_a2: The 2016 percent of African American residents is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties

RQ3. Is the 2016 county-level percent of elderly (i.e., age 65 and older) householders significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$3: The 2016 county-level percent of elderly (i.e., age 65 and older) householders is not significantly associated with the 2015 presence/absence of healthy food retailers in 160 MDR counties.

H_a3: The 2017 county-level percent of elderly (i.e., age 65 and older) householders is significantly associated with the 2015 presence/absence of healthy food retailers in 160 MDR counties.

RQ4. Is the 2016 county-level vehicle-ownership rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$4: The 2016 county-level vehicle-ownership rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties

H_a4: The 2016 county-level vehicle-ownership rate is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

RQ5. Is the 2016 county-level crime rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?

$H_0$5: The 2016 county-level crime rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

*H*a5: The 2016 county-level crime rate is significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties.

This chapter is devoted to the presentation and assessment of the study findings. The chapter opens with a restatement of the five research questions and associated null and alternative hypotheses**.** The chapter continues with a review of the data collection procedures; in this section is a detailed appraisal of the proportional random selection of the 160 counties and their associated data. The sections that follow present the descriptive statistics of the study variables. The remainder of the chapter is devoted to the study findings, with attention given to the testing of the multicollinearity assumption for binary logistic regression, point biserial correlations, and binary logistic regression findings in relation to hypothesis testing. A summary concludes the chapter.

Data Collection

This study utilized archival data. The 2016 community indicators data retrieved from the U.S. Census database pertained to county-level percent of residents living below poverty, percent of African American and elderly (i.e., age 65 and older) and percent of households with at least one vehicle. County-level violent crime rate data, calculated as the number of arrests for murder, manslaughter, rape, robbery, and aggravated assault per 100,000 persons in 2016, was retrieved from the FBI (2016) UCR database. The presence/absence of healthy food retailer's county-level data were derived from the CDC's (2017) mRFEI database, which denotes the presence or absence of healthy food retailers per census tract. If there was at least one healthy food retailer in at least one census tract in the county, the county was coded as having an accessible healthy food retailer.

The data collection period lasted almost two months, from September to early November 2018, a result of the preciseness and the attention to detail that was required to access, collate, and enter the necessary and correct data. The data collection process was conducted in steps. The first exercise was the random selection of the counties across the eight MDR states. The researcher accessed a U.S. census Excel data file of all counties in the United States, saved it, and then deleted the data from all of the non-MDR states. The second step entailed the proportional random selection of the 160 MDR counties across the eight MDR states, conducted using an online random number generator and in accordance with the methodology presented in Chapter 3.

I entered the variable data into the Excel file upon the completion of the random selection of the 160 MDR counties. Using the respective databases, I first entered the census tract data, then the FBI UCR violent crime data, and finally the CDC (2017) mRFEI data. I double-checked the data entries then compared the entered data against other U.S. census and crime data resources to ensure that the data were valid. The data set was then transferred from Excel and saved to an SPSS 25.0 data file. SPSS 25.0 was used for all data analyses.

Proportional Random Sample of 160 MDR Counties

The study data were a proportional random sample of 160 MDR counties. . The majority of the MDR counties are in the states of Louisiana and Mississippi (both states having over 50 counties located in the Delta Regions) (DRA, 2015; Gennuso et al., 2016). In contrast, only 16 (6.3%) and 21 (8.3%) of Delta Region counties are situated in

the states of Illinois and Kentucky, respectively (DRA, 2015; Gennuso et al., 2016). Table 2 presents the number and percent of MDR counties by state and the associated number of counties per state that were selected for the study. In alignment with the population percentages, the highest number of MDR counties came from the states of Louisiana (*n* = 34, 21.3%), Mississippi (*n* = 30, 18.8%), and Arkansas (*n* = 27, 16.9%). The sample was comprised of 14 (8.8%) counties from the MDR Tennessee and Kentucky regions, respectively. Twelve (7.5%) MDR counties were selected from the state of Alabama and 10 (6.25%) from Illinois.

Table 2.

Frequencies & Percents: All MDR Counties (N = 252) and Proportional Random Selection of MDR Counties (n = 160)

State	All MDR Counties (N = 252)		Selected MDR Counties (n = 160)	
	N	*%*	*n*	*%*
Louisiana	53	21	34	21.3
Mississippi	47	19	30	18.8
Arkansas	42	17	27	16.9
Missouri	29	11	19	11.7
Tennessee	22	9	14	8.8
Kentucky	22	9	14	8.8
Alabama	20	8	12	7.5
Illinois	17	6	10	6.2
Total	**252**	**100**	**160**	**100**

Descriptive Statistics: Study Variables

This study had five predictor variables, all of which were ratio-coded. Four of these variables were county-level community disadvantage factors (i.e., county-level poverty rate, percent of African American and elderly residents, percent of households with at least one vehicle) measured using U.S. Census (2016) data. The fifth predictor variable was county-level violent crime rate, calculated using FBI UCR (2016) violent crime rate data (i.e., the number of arrests for murder, manslaughter, rape, robbery, and aggravated assault per 100,000 persons). The dichotomously coded criterion variable was the presence/absence of a healthy food retailer, assessed using CDC (2017) mRFEI data. The descriptive statistics of these variables are presented in the following sections.

County-level community disadvantage predictor variables. The descriptive statistics (i.e., mean, median, standard deviation, minimum and maximum scores) for the five community disadvantage predictor variables are presented in Table 3. The mean percent of households below poverty level was 22.05% (*Md* = 21%, *SD* = 6.72%), with poverty rates ranging from 8.7% to 48.0%. The mean percent of African American residents was 26% (*Md* = 20%, *SD* = 23.92%), with the percentage of African American residents ranging from 1% to 85%. The mean percent of elderly (i.e., 65+) residents was 17.3% (*Md* = 17%, *SD* = 4.37%), with the percentage of elderly residents ranging from 4.7% to 31.6%. A mean of 43% (*Md* = 42%, *SD* = 15%) of the households in the counties had at least one vehicle, with the percentage of households with at least one vehicle ranging from 0% to 81%.

The violent crime rate for each county was calculated as the number of arrests for murder, manslaughter, rape, robbery, and aggravated assaults per 100,000 persons in 2016 (FBI, 2016). The county-level mean violent crime rate was 308.61 reported arrests per 100,000 persons (*SD* = 250.60), while the county-level median violent crime rate was 251 reported arrests per 100,000 persons (crime rates ranged from 0 to 1613 reported arrests per 100,000 persons). The mean and median violent crime rates for these 160 MDR counties were lower than the mean violent crime rate of 386 arrests per 100,000 persons for the United States as a whole (FBI, 2017). Indeed, 73% of all the counties had a violent crime rate lower than the 386 average for the United States; and five (3.1%) counties – all of which were located in Mississippi – reported no violent crime arrests in 2016. Only a few counties had exceedingly high violent crime rates, and these were close to large cities: Alexander County, Illinois, with a violent crime rate of 1613 arrests per 100,000 persons, and Crittenden County, Arkansas, with a violent crime rate of 1357 arrests per 100,000 persons. Descriptive statistics for the variables are shown in Table 3.

Table 3.

Descriptive Statistics: County-level Percent of Households Below Poverty Level, Percent of African American Residents, Percent of Elderly (Age 65+) Residents, Type 1 Crime Rate, and Percent of Households with at Least One Vehicle (N = 160)

	M	*Md*	*SD*	*Minimum*	*Maximum*
Percent of households below poverty level	22.05	21.00	6.72	8.70	48.00
Percent of African American residents	26.00	20.00	23.92	1.00	85.00

Percent of elderly (i.e., age 65+) residents	17.30	17.00	4.37	4.70	31.60
Violent crime rate (per 100,000 persons)[a]	308.61	251.00	250.69	0.00	1613.00
Percent of households with at least one vehicle	43.00	42.00	15.00	0.00	81.00

Note. *M* = mean, *Md* = median, *SD* = standard deviation. [a]Violent crime rate is inclusive of the number of arrests for murder, manslaughter, rape, robbery, and aggravated assaults per 100,000 persons (FBI, 2016).

County-level presence/absence of healthy food retailer criterion variable.

This study had one criterion variable, which was measured at the county level and dichotomously coded where 0 = *absence of healthy food retailer* and 1 = *presence of healthy food retailer*. Table 4 provides information on the number and percent of counties per state that did or did not have a healthy food retailer. There were *n* = 94 (58.8%) counties with a healthy food retailer and *n* = 66 (41.3%) counties without a healthy food retailer. As seen in Table 4, the majority (*n* = 19, 63.3%) of Mississippi counties and the majority (*n* = 8, 57.1%) of Tennessee counties lacked a healthy food retailer. Five (41.7%) Alabama counties and four (40.0%) Illinois counties did not have a health food retailer, and over a third (*n* = 13, 38.2%) of Louisiana counties lacked a healthy food retailer. The states with the smallest number of counties lacking a healthy food retailer were Missouri (*n* = 6, 31.6%), Arkansas (*n* = 8, 29.6%), and Kentucky (*n* = 3, 21.4%).

Table 4

Frequencies and Percents: Counties With our Without A Healthy Food Retailer(N = 160)

State	Healthy Food Retailer NO		Healthy Food Retailer YES		Total Number of Counties
	N	*%*	*N*	*%*	
Louisiana	13	38.2	21	61.8	34
Mississippi	19	63.3	11	36.7	30
Arkansas	8	29.6	19	70.4	27
Missouri	6	31.6	13	68.4	19
Tennessee	8	57.1	6	42.9	14
Kentucky	3	21.4	11	78.6	14
Alabama	5	41.7	7	53.3	12
Illinois	4	40.0	6	60.0	10
Total	**66**		**94**		**160**

A chi-square (χ^2) test of independence was conducted to examine if the states significantly differed in the number of counties with and without healthy food retailers. The chi-square was not significant, χ^2 (7, N = 160) = 12.14, p = .096, indicating that the states did not have a significantly different number of counties with and without healthy food retailers.

Results

This study had five research questions and the analyses for hypothesis testing included both point biserial correlations and binary logistic regression. Correlational and logistic regression statistical analyses have few assumptions (Hosmer et al., 2013). One

assumption that was tested was the absence of multicollinearity to ensure that the predictor variables were not so highly correlated with each other to the degree that they were essentially measuring the same construct (see Hosmer et al., 2013). Testing the assumption of lack of multicollinearity entailed my calculating of Pearson bivariate correlations and VIFs. Multicollinearity is present if the Pearson bivariate correlation between independent/predictor variables is $r >= .80$, $p < .001$ (Hosmer et al., 2013). Moreover, a VIF equal to or greater than 10.00 is indicative of multicollinearity (Hosmer et al., 2013).

Table 5 presents the Pearson bivariate correlations and VIFs, calculated to test for multicollinearity. County poverty rate was significantly correlated with the percentage of African American residents, $r(160) = .656$, $p < .001$, but as the correlation did not exceed $r(160) = .80$, $p < .001$, these variables were not considered to be collinear. County poverty rate was not significantly associated with percentage of elderly (i.e., age 65+) residents, $r(160) = .002$, $p = .979$, and it was only moderately correlated with violent crime rate, $r(160) = .223$, $p = .005$ and percentage of households with at least one vehicle, $r(160) = .184$, $p = .020$. The county percentage of African American residents was significantly but moderately correlated with the county percentage of elderly (i.e., age 65 or older) residents, $r(160) = -.177$, $p = .025$. The negative association indicated that, as the county-level percentage of African American residents increased, the percent of elderly residents (i.e., age 65 or older) decreased. The percentage of African American residents was significantly correlated with county-level violent crime rates, $r(160) = .250$, $p = .001$, but

not to the degree that they were collinear. The county percentage of African American residents was not significantly correlated with percent of households with at least one vehicle, $r(160) = -.013$, $p = .874$.

The percent of elderly (i.e., age 65 or older) residents in the county was not significantly correlated with county violent crime rates, $r(160) = -.142$, $p = .074$ nor with county percent of households with at least one vehicle, $r(160) = -.137$, $p = .084$. County percent of households with at least one vehicle was significantly associated county violent crime rate, $r(160) = .280$, $p < .001$, but not to the degree that multicollinearity was evident. All VIFs were less than 10.00, confirming that the absence of multicollinearity assumption was met.

Table 5.

Pearson Bivariate Correlations and Variance Inflation Factors (VIFs): Percent of Households Below Poverty Level, Percent of African American Residents, Percent of Elderly Residents, Violent Crime Rate, and Percent of Households with at Least One Vehicle (N = 160)

	Percent of households below poverty level	*Percent of African American residents*	*Percent of elderly residents*	*Violent crime rate (per 100,000)*	*VIF*
Percent of households below poverty level	--				1.96
Percent of African American residents	.656***	--			2.02
Percent of elderly (i.e., age 65 or older) residents	.002	-.177*	--		1.10
Violent crime rate (per 100,000	.223*	.250**	-.142	--	1.17

persons)					
Percent of households with at least one vehicle	-.184*	-.013	-.137	.280***	1.20

Note. *$p < .05$; **$p < .01$; ***$p < .001$

Results: Point Biserial Correlations

A series of point biserial correlation analyses were conducted between the five community disadvantage indicators, which were all ratio-coded variables, and presence/absence of healthy food retailers, the dichotomously coded criterion variables. A point biserial correlation, denoted as $r_{p,}$ is the appropriate correlational statistic to use when examining the relationship "between a continuous variable and a true dichotomous one" (Dănăcică, 2017, p. 154). Point biserial correlations do not adjust for the shared variance (e.g., proportion of statistical overlap) between predictor variables; binary logistic regression analyses do (Field, 2013; Peng & So, 2002). In contrast, binary logistic regression findings provide information between each individual predictor-criterion variable relationship with the predictor variable shared variance (e.g., proportion of statistical overlap) removed (Field, 2013; Peng & So, 2002). Because of these statistical differences, relationships found to be significant in point biserial correlation analyses may no longer be significant in binary logistic regression analyses (Field, 2013; Peng & So, 2002).

Results from the series of point biserial correlation analyses are presented in Table 6. There was a significant relationship between the county-level percent of households below poverty level and absence of healthy food retailers, $r_{pb}(160) = -.299$, p

< .001. County-level percent of African American residents was also significantly associated with absence of healthy food retailers, $r_{pb}(160) = -.299$, $p < .001$. The only other significant relationship was between county-level percent of households with a least one vehicle and *presence* of healthy food retailers, $r_{pb}(160) = .299$, $p < .001$. That is, as the percent of households with at least one vehicle increased, so did the likelihood of the presence of a healthy food retailer in the county. Neither county-level percent of elderly (i.e., age 65 or older) residents nor violent crime rate was associated with presence/absence of healthy food retailers, $r_{pb}(160) = .031$, $p = .694$, and $r_{pb}(160) = .001$, $p = .994$, respectively.

Table 6.

Point Biserial Correlations: Percent of Households Below Poverty Level, Percent of African American Residents, Percent of Elderly Residents, Violent Crime Rate, and Percent of Households with at Least One Vehicle and Presence/Absence of Healthy Food retailers (N = 160)

	r_{pb}
% Households below Poverty Level	-.299***
% African American Residents	-.288***
% Elderly (Age 65+) Residents	.031
Violent Crime Rate	.001
% Households with at Least One Vehicle	.199*

Note. *$p < .05$; **$p < .001$

Binary Logistic Regression Findings

One binary logistic regression was conducted to address all five research questions. Results from the logistic regression are presented in Table 7. Results for the overall model were significant, omnibus model $\chi^2(4, N = 160) = 28.84$, $p < .001$. The Hosmer-Lemeshow chi-square (χ^2) was included as an additional indicator of model significance. Unlike most statistics, a non-significant (i.e., $p > .05$) Hosmer-Lemeshow chi-square (χ^2) value indicates that the overall binary logistic regression model is a good fit to the data (Hosmer et al., 2013). The non-significant Hosmer-Lemeshow χ^2 confirmed good model fit, $\chi^2(8, N = 160) = 16.20$, $p = .040$. The Nagelkerke R^2 was .222, indicating a small effect size.

Each predictor's Wald χ^2 statistic and associated significance level (with significance set at $p < .05$) was examined to determine which, if any, predictor variable was significantly associated with presence/absence of healthy food retailers. The Wald χ^2 statistic and associated *p*-value is also presented in Table 7. Findings indicated that the percent of households below poverty level was significantly associated with absence of healthy food retailers, *Wald* $\chi^2 = 7.62$, $p = .006$. As indicated by the negative unstandardized beta coefficient (B), counties with higher poverty rates were likely to *not* have a healthy food retailer as compared to counties with lower poverty rates. The odds ratio and 95% odds ratio confidence interval denoted that higher-poverty counties were 90% (95% CI: 83% to 97%) more likely than lower-poverty counties to not have a healthy food retailer. Logistic regression findings further showed that the county percent

of households with at least one vehicle was significantly associated with the *presence* of healthy food retailers, *Wald* $\chi^2 = 8.75$, $p = .003$. As indicated by the positive unstandardized beta coefficient (B), counties with a higher percent of households with at least one vehicle were more likely to have a healthy food retailer than were counties with a lower percent of households with at least one vehicle. The odds ratio and 95% odds ratio confidence interval denoted that counties with a higher lower percent of households with at least one vehicle were 1.03 times (95% CI: 102 to 108) more likely to have a healthy food retailer than were counties with a lower percent of households with at least one vehicle. Neither county percent of African American nor elderly (i.e., age 65 or older) residents were significantly associated with presence/absence of healthy food retailers, *Wald* $\chi^2 = 0.67$, $p = .414$, and *Wald* $\chi^2 = 0.57$, $p = .451$, respectively. County violent crime rate was also not significantly correlated with presence/absence of healthy food retailers, *Wald* $\chi^2 = 0.05$, $p = .829$.

Table 7.

Binary Logistic Regression: Percent of Households Below Poverty Level, Percent of African American Residents, Percent of Elderly Residents, Violent Crime Rate, and Percent of Households with at Least One Vehicle Predicting Presence/Absence of Healthy Food retailers
(N = 160)

	B	*SE*	*Wald* χ^2	*p*	*Odds Ratio*	*95% CI for Odds Ratio*
Percent Households below Poverty Level	***-0.11***	***0.04***	***7.62***	***.006***	***0.90***	***0.83 - 0.97***

Percent African American Residents	-0.01	0.01	0.67	.414	0.99	0.97 - 1.01
Percent Elderly (age 65 or older) Residents	0.03	0.04	0.57	.451	1.03	0.95 - 1.12
Violent Crime Rate	0.00	0.00	0.05	.829	1.00	0.99 - 1.01
Percent Households with at Least One Vehicle	***0.46***	***0.02***	***8.75***	***.003***	***1.05***	***1.02 - 1.08***

Note. Significant findings are bolded and in italics.

The first research question of this study was, "Is the 2016 county-level poverty rate significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties?" The county percent of households below poverty level was significantly associated with absence of healthy food retailers, *Wald* $\chi^2 = 7.62$, $p = .006$. As such the null hypothesis, **"**The 2016 county-level poverty rate significantly is not significantly associated with the 2017 presence/ absence of healthy food retailers in 160 MDR counties," was rejected (failed to be retained).

The second research question was, "Is the 2016 county-level percent of African American residents significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?" The percent of African American households was not significantly associated with presence/absence of healthy food retailers, *Wald* $\chi^2 = 0.67$, $p = .414$, As such, the null hypothesis for the second research question, "The 2016 percent of African American residents is not significantly associated with the 2017

presence/absence of healthy food retailers in 160 MDR counties," was retained (failed to be rejected).

The third research question was, "Is the 2016 county-level percent of elderly (i.e., age 65 and older) householders significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?" The county percent of elderly (i.e., age 65+) residents was not significantly associated with presence/absence of healthy food retailers, $Wald\ \chi^2 = 0.57$, $p = .451$. As such the null hypothesis for the third research question, "The 2016 county-level percent of elderly (i.e., age 65 and older) householders is not significantly associated with the 2015 presence/absence of healthy food retailers in 160 MDR counties, " was retained (failed to be rejected).

The fourth research question was, "Is the 2016 county-level vehicle-ownership rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?" The county percent of households with at least one vehicle was significantly associated with presence of healthy food retailers, $Wald\ \chi^2 = 8.75$, $p = .003$. As such, the null hypothesis for the fourth research question, "The 2016 county-level vehicle-ownership rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties," was rejected (failed to be retained).

The fifth research question was, "Is the 2016 county-level crime rate significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties?" County violent crime rate was not significantly correlated with presence/absence of healthy food retailers, $Wald\ \chi^2 = 0.05$, $p = .829$. As such, the null

hypothesis for the fifth research question, "The 2016 county-level crime rate is not significantly associated with the 2017 presence/absence of healthy food retailers in 160 MDR counties," was retained (failed to be rejected).

Summary

This study tested the relevance of Pothukuchi et al.'s (2008) DFS conceptual mode by examining if five theoretical community risk factors identified by Pothukuchi et al. (2008) – county-level percent of African American residents, county-level poverty rate, county-level percent of elderly (i.e., age 65 or older) residents, county-level vehicle ownership rate, and county-level (violent and property) crime rate -- were significantly associated with presence/absence of healthy food retail environments in 160 MDR counties. The study 'participants' were a proportional sample of 160 counties across the eight MDR states.

Descriptive statistics denoted that the 160 MDR counties had a relatively large average percent of households below poverty level (22%), African American residents (26%), and elderly (i.e., age 65 or older) residents (17.3%). The 160 counties also had a relatively low percent of households with at least one vehicle (43%). The crime rates were, on average, low across the 160 MDR counties. There was $n = 94$ (58.8%) counties with a healthy food retailer and $n = 66$ (41.3%) counties without a healthy food retailer.

Point biserial correlations and one binary logistic regression was conducted to address the five research questions. Point biserial correlations indicated that county-level poverty and percent of African American residents were significantly associated with the

absence of a healthy food retailer, while the county-level percent of households with at least one vehicle was significantly associated with the *presence* of healthy food retailer, in the county. The binary logistic regression findings were slightly different. County-level poverty rate remained a significant predictor of the absence of a healthy food retailer in the county; moreover, higher-poverty counties were 90% more likely than lower-poverty counties to not have a healthy food retailer. However, county-level percent of African American residents was no longer significantly associated with the absence of a healthy food retailer. The relationship between county-level vehicle ownership rate and presence of a healthy food retailer found in the point biserial analyses remained significant in the binary logistic regression analyses. Results indicated that counties with a higher (as opposed to lower) vehicle-ownership rate were 1.03 times more likely *to* have a healthy food retailer. No other significant findings were found.

The following chapter, Chapter 5, concludes the dissertation study. The purpose of Chapter 5 is to review the study findings in relation to prior research studies and the guiding theory. Study limitations, recommendations for practical applications, and recommendations for future research studies are also discussed in the last chapter.

Chapter 5: Discussion

Introduction

Concern over the alarming rates of obesity and associated health and healthcare issues that stem from the obesity epidemic has prompted investigations as to how community disadvantage factors influence obesity both directly and indirectly, by influencing access to healthy foods and, on the community level, healthy food retailers (Townshend & Lake, 2017). Empirical work examining relationships between community disadvantage factors and access to healthy food retailers is extensive, and since 2009, six studies have provided comprehensive reviews of the empirical literature (i.e., Food & Dzewaltowski, 2008; Hilmers et al., 2012; 2009; Pinard et al., 2016; Walker et al., 2010). Two key conclusions can be drawn from these studies. One, most of the empirical literature has focused on urban food deserts that have few healthy food retailers. Two, the two community disadvantage factors of poverty and high rates of ethnic minority residents have been extensively examined and consistently linked to the absence of healthy food retailers. As indicated in these studies, there is a need to conduct theoretically-guided studies that focus on rural communities and expand the focus beyond the two community disadvantage factors of poverty and race (Black et al., 2016; Hilmers et al., 2012; Larson et al., 2009; Pinard et al., 2016; Walker et al., 2010). This study addressed these two gaps in the literature.

The purpose of this quantitative correlational study was to empirically test the theoretical pathways generally described in NDT (Mirowsky & Ross, 2008, 2015) and

specifically identified in Pothukuchi et al.'s (2008) DSF model. In this study, I examined if the community disadvantage factors of high poverty rates, high presence of African American and elderly residents, low vehicle ownership rate, and high Type I crime rates were significantly associated with absence of healthy food retailers. I focused on the theoretically relevant geographical area of the MDR and used a random sample of 160 MDR counties.

One binary logistic regression was conducted to address the study's five research questions. Results from the logistic regression indicated that county poverty rate and the percentage of households with at least one vehicle were significantly associated with the absence of healthy food retailers located within the MDR counties. In contrast to findings in previous studies (Black et al., 2016; Food & Dzewaltowski, 2008; Hilmers et al., 2012; Larson et al., 2009), the county percentage of African American residents was not significantly related to the absence of a healthy food retailer. The county percentage of elderly residents and the county Type I violent crime rate were also not significantly associated with absence of healthy food retailers.

This last chapter of the dissertation provides a comprehensive review and examination of the study findings. The first sections of the chapters are devoted to discussions of the study findings in relation to the guiding theories and prior empirical literature. The following sections provide information on the study limitations, recommendations for future research studies, and implications for practices that promote positive social change. The chapter ends with a conclusion.

Interpretation of the Findings

My study is one of the few that examined the relationships between five community disadvantage factors (i.e., high poverty rates, high presence of African American and elderly residents, low vehicle ownership rate, and high Type I crime rates) posited in Pothukuchi et al.'s (2008) DSF model to be significantly linked to absence of healthy food retailers. It is also one of the few studies to examine these relationships in rural communities, and my focus on MDR counties made it especially theoretically relevant. The study findings shared some similarities from those found in prior studies; the study findings also differed from those found in prior literature. There were also similarities and differences with the relationships posited in Mirowsky and Ross' (2008, 2015) NDT and Pothukuchi et al.'s (2008) DSF model. The empirical and theoretical aspects of the study are discussed in the following sections.

Study findings in relation to prior literature.

In this study, I expected that all five community disadvantage factors, namely, high poverty rates, high presence of African American and elderly residents, low vehicle ownership rate, and high Type I crime rates, would be significantly associated with lack of access to healthy food retailers. Results from the series of point biserial correlations as opposed to the binary logistic regression slightly differed. Both types of analyses yielded significant relationships between the predictor variables of county-level poverty rates and percentage of households with at least one vehicle and the criterion variable of absence of healthy food retailers. The point biserial correlation analysis revealed a significant

relationship between county-level percentage of African American residents and absence of healthy food retailers. However, when all five predictor variables were entered collectively into the binary logistic regression model, this relationship lost its significance. The difference in findings suggested substantial shared variance (i.e., statistical overlap) between the county-level poverty and race variables. Indeed, the two variables were highly correlated, as indicated by the significant Pearson bivariate correlation coefficient, $r(160) = .656$, $p < .001$.

It is well-established that poverty rate and percentage of ethnic minority residents are significantly linked to low access to healthy food retailers in urban communities (Browning et al., 2016). Reviews of numerous peer-reviewed studies published across 20 to 30 years confirmed that access to healthy food retailers is significantly lower in urban communities that are impoverished and have a high percentage of ethnic minority residents (Black et al., 2016; Food & Dzewaltowski, 2008; Hilmers et al., 2012; Larson et al., 2009; Pinard et al., 2016; Walker et al., 2010). There has been much less empirical research conducted in rural communities. Connell et al. (2007), using data from 36 counties in the lower MDR, found that less disadvantaged communities had a significantly higher presence of large supermarkets and grocery stores. The authors however did not examine relationships between specific community disadvantage factors and food accessibility (Connell et al., 2007).

Only two studies have examined relationships between community poverty, operationalized as *community deprivation*, and ethnic minority residence rates,

operationalized as *racial disparity*, and food accessibility in rural communities.Results in this study differed from findings found in Dai and Wang's (2011) and Sharkey and Horel's (2008) studies. Dai and Wang and Sharkey and Horel both found that, when the community deprivation and racial disparity variables were entered as collective predictors of access to healthy food retailers in statistical analyses, community-level racial disparity but not community deprivation was significantly associated with limited food accessibility. I found the opposite effects. The differences in findings are very intriguing, as they indicate that community poverty/deprivation and racial disparity variables share considerable statistical and conceptual overlap. These differences further suggest that the specific rural community context – for example, the state(s) or county(ies) in which the communities are located, area population density, even access to public transportation may play a role in shaping the relationships between the two community disadvantage factors and food accessibility outcomes.

The lack of alignment in findings may be explained by certain methodological differences between my study and Dai and Wang's (2011) and Sharkey and Horel's (2008) studies. I used data at the county level whereas the other researchers used census tract-level data (see Dai & Wang, 2011; Sharkey & Horel, 2008). In this study, poverty was operationalized as the county-level average percentage of households below poverty level, whereas Dai and Wang and Sharkey and Horel used a socioeconomic deprivation composite measures that included census tract-level measures related to (a)

unemployment rates, (b) income level, (c) education level, (d) public assistance, and notably (e) vehicle availability.

In accordance with Pothukuchi et al.'s (2008) DSF model, vehicle ownership rate was operationalized as a single community disadvantage factor, which differs from the use of this variable in the studies by Dai and Wang (2011) and Sharkey and Horel (2008). In those studies (e.g. Dai & Wang, 2011; Sharkey & Horel, 2008), vehicle ownership rate was treated as a component of overall community deprivation, as noted in the previous paragraph. Sharkey & Horel (2008), using data from rural Texas communities, conducted the only study that examined the role of vehicle ownership rates in relation to food accessibility. Sharkey & Horel found a significant association between low vehicle ownership rates and increased numbers of convenience stores in neighborhoods located in Hidalgo, Texas.

Study findings in relation to the guiding theories.

I used two theories for this study: Ross and Mirowsky's (2001) NDT specific to health outcomes and Pothukuchi et al.'s (2008) DSF model. Ross and Mirowsky were the first scholars to postulate that disorganized communities could potentially influence health outcomes. Ross and Mirowsky's NDT were conducted in urban communities and/or examined resident health outcomes. My study differed from these studies by focusing on rural communities and food retailer characteristics. The significant finding in these studies provide support that SDT/NDT is applicable to rural communities and that

neighborhood disorganization factors may affect resident health through the mediating food retailer factors.

Very few studies have posited that food access is a public health corollary of neighborhood control/disorder. Pothukuchi et al. (2008) developed one of the very few theoretical models applied SDT/NDT constructs to the food environment. The DSF is a comprehensive ecological model that posits that community disadvantage influences the relationships and interactions between four specific food environment factors to ultimately affect food store inspection outcomes Pothukuchi et al. (2008). Due to the complexity of the DSF model, it is difficult to empirically examine all components of the model. I examined the theoretical pathway between the community characteristics of poverty, race/ethnicity, age, vehicle ownership, and crime and the market characteristic of number and type of food stores in the community. Results from my study provided partial support for the DSF model, denoting that high poverty rates and low vehicle ownership were significantly associated with the absence of healthy food retailers.

Study findings, both significant and not, also provide key information on the DSF model. Point biserial results showed that a high percentage of African American residents was significantly associated with absence of healthy food retailers; however, this relationship was no longer significant in the binary logistic regression results. These disparate findings suggest that there may be conceptual overlap between poverty and race/ethnicity. It may also be that there is conceptual overlap between poverty and the community factors of income and resident education levels. In fact, the variables of

income and education level were not included in this study as poverty rate, income, and education are often used interchangeability in research as they all assess the general construct of poverty (Kubrin, 2009; Kubrin & Wo, 2016). Alternatively, poverty, race/ethnicity, income, and education may collectively measure a larger construct, as suggested byDai and Wang (2011) and Sharkey and Horel (2008) in their development and use of a community deprivation variable.

An additional theoretical contribution of this study concerns the focus on rural communities. Pothukuchi et al.'s (2008) DSF was considered by the authors to be most relevant to urban communities, and they validated their theory using data from urban communities (Pothukuchi et al., 2009, 2011, 2012, 2015), as did other researchers (Freedman & Kuhns, 2016; Lowery et al., 2016, Romano et al., 2017). In contrast to these studies, this study did not provide empirical support for all community predictors. It may be that the DSF model is less relevant to rural communities. This argument is supported by the consistent lack of empirical evidence in support of the SDT/NDT applicability to rural communities (Chilenski, Syvertsen, & Greenberg, 2015; Kaylen & Pridemore, 2013; Moore & Sween, 2015). However, Pothukuchi et al.'s (2008) DSF model is the only neighborhood disorganization theory that includes vehicle ownership as an important indicator of disadvantage. In this regard, study findings did support a link between low vehicle ownership rates and absence of healthy food retailers.

Limitations

As with all empirical work, this study had strengths and limitations. One strength was the elimination of potential internal validity threats of the self-selection bias and the social desirability response bias, which are concerns in human subjects research. The internal validity threat of lack temporal precedence, or the ability to state that the independent variable occurred prior to the dependent variable, was minimized in this study by using 2016 data for the predictor variables and 2017 data for the criterion variable. The internal validity threat of confound bias was, however, a concern in this study with regard to the community disadvantage variables. Other community factors not assessed in this study may covary with those examined in this study, especially those identified in prior studies (e.g., county-level education rates, average income, residential mobility, family disruption) (Kubrin, 2009; Kubrin & Wo, 2016). The use of a correlational research design introduces another limitation: the inability to determine causality. Causality can only be confirmed in experimental studies (Bowling, 2014).

A strength of this study was that it addressed a gap in the literature by focusing on the theoretically relevant rural MDR region. However, findings from this study cannot be generalized to other rural regions in the United States or other countries. Results may be different, for example, in studies conducted on rural regions with higher vehicle ownership and Type I crime rates, both of which were low in the MDR counties. A major criticism of neighborhood effects research is the use of numerous and diverse definitions of neighborhood (Hart & Waller, 2013). The definitions of neighborhood within the

context of a geographically bound space have included a neighborhood block, a census block, a census block group, a census tract, a school district, a geographically designated city neighborhood, a neighborhood ward/district, a zip code, a county, and a state (Hart & Waller, 2013; Sampson, 2012; Siordia & Saenz, 2013). Oftentimes, scholars base their definition of neighborhood not on theory per se but instead on data accessibility (Siordia & Saenz, 2013), as was done in this study and was a limitation. Findings from other studies that utilize other types of community-level data may differ from those found in this study.

Recommendations

There are numerous recommendations for future studies. While this study addressed a key gap in the neighborhood disadvantage literature concerning the lack of research testing the validity of SDT/NDTs within the context of rural communities, there remains a need for additional rural community studies. There is also a need for replication studies. As noted previously, studies have not found support for the SDT/NDT in rural communities. In this study, while there was some support for Ross and Mirowsky's (2001) SDT/NDT, but this study did not include the community variables of residential mobility and family disruption. Additional studies are needed that examine NDT with regard to food market outcomes, and these studies should include examination of all NDT variables (i.e., poverty, resident race/ethnicity, resident mobility, family disruption).

Only partial support was found for Pothukuchi et al.'s (2008) DSF model in this study. Only higher levels of poverty and lower vehicle ownership rates were significantly associated with the absence of healthy food retailers. Moreover, findings from this study suggested that there is considerable conceptual overlap between poverty and percent of ethnic minority residents. It should be noted that this study did not include community income and education predictor variables that are identified as separate constructs in Pothukuchi et al.'s (2008) DSF model, as poverty, income, and education are commonly used to measure socioeconomic status (Kubrin, 2009; Kubrin & Wo, 2016). Nonetheless, studies testing the various pathways denoted in Pothukuchi et al.'s (2008) DSF model in both urban and rural communities are very much needed. Studies that examine the potential overlap and potentially different relationships with regard to the seven community factors and food market outcomes are needed. It would be intriguing to see if similar findings are found in studies using data from urban communities or data from rural communities that are distinctly different from those in the MDR region.

An inherent problem in NDT studies is the use of numerous and diverse definitions of neighborhood (Hart & Waller, 2013). This may be less of a problem in rural community studies, as most of these studies conducted in America often utilize county-level data (Bofard & Muftic, 2006; Kaylen & Pridemore, 2011; Moore & Sween, 2015; Ward, Kurchner, & Thompson, 2018).

While the NDT has not been supported in these studies (Bofard & Muftic, 2006; Kaylen & Pridemore, 2011; Moore & Sween, 2015; Ward, Kurchner, & Thompson,

2018), the community variables identified in NDT differ from those posited in Pothukuchi et al.'s (2008) DSF model. Additional studies testing the relevance of Pothukuchi et al.'s (2008) DSF model to rural communities using county-level data would add much empirical understanding of county-level factors that contribute to food retailer outcomes.

Implications for Positive Social Change

Findings from this study have many implications for positive social change. This study found that county-level poverty rates and percent of African American residents share conceptual overlap and are associated with an absence of healthy food retailers. It is concerning that poor African American residents – especially those without a vehicle - in the MDR cannot access healthy foods in this so-called land of plenty. It is hoped findings such as these prompted the development of USDA Rural Development and federal Office of Rural Health initiatives and programs that address and reduce what appears to be racial segregation regarding food access in the MDR region. Findings from this study can be used to prompt legislative changes that de-incentivize unhealthy food purchases and incentivize healthy food purchases, which in turn could make food retailers to stock healthier foods (Block & Subramanian, 2015) and provide incentives for large food chain stores to move into poor rural communities locations (Meikle, 2016; The Food Trust, 2014). Federal and state grant funding as well as university-community partnerships, which invest in rural communities, could also assist communities in establishing food cooperatives and community gardens. Participatory research studies on rural university-

community partnerships that have resulted in the creation of community gardens and farmer's market have shown promising findings, such as increased produce and vegetable intake among adults and children in rural communities in Missouri (Nanney, Johnson, Elliott, & Haire-Joshu, 2007), Oregon (Carney et al., 2012), and South Carolina (Freedman, Choi, Hurley, Anadu, & Hebert, 2013). On a local level, the findings from this study can be used to inform community leaders of food access problems, develop community-level grassroots organizations, and involve churches, often a center of socialization in rural African American communities.

Findings from this study as well as earlier empirical work have documented significant links between lack of vehicle ownership and the absence of healthy food retailers. The lack of public transit systems in rural communities contributes to this problem. The availability of food co-ops, community gardens, and farmer's markets may help to increase the availability to healthy foods. Other initiatives can be developed that enhance residents' access to healthy food retailers. These initiatives include (a) the expansion of bus services and the implementation of food shopping shuttles in to rural communities, especially those that surround urban areas; (b) ride-share programs; (c) programs that assist families in purchasing vehicles; or (d) even the development or expansion of rural-based Uber or Lyft services, including horse-and-buggy "Uber" services, like those in rural Michigan (Cheromcha, 2018).

Summary

The purpose of this quantitative study, which utilized a quantitative research design, was to expand upon the existing NDR empirically tested a theoretical pathway posited in Pothukuchi et al.'s (2008) DSF conceptual model to advance the body of literature on neighborhood/community disadvantage and food environment factors. The study was conducted with a theoretically valid sample of 160 rural counties across the eight MDR states. Findings from this study showed that high county-level poverty rates, low vehicle ownership rates, and to a lesser extent, high county-level percent African American residents were significantly associated with the *lack* access to healthy food retailers.

A major impetus for this study was to gather evidence to emphasize the profound food access disparities and high levels of food insecurity in one of the richest and largest contiguous agricultural regions of the United States – a region that should not have this problem (Merem et al., 2016). The implications of food insecurity in rural communities not only pertain to resident health, it is directly tied to the loss of agribusiness and employment in related fields (e.g., farm equipment sales) (Meikle, 2016). It is hoped that this study prompted the examination of the corporate takeover of food production in the MDR region but in rural communities.

It is hoped that findings from this study are used to inform the development and implementation of community-driven public health initiatives aimed at reducing food-

related health issues and disparities, for example, the development of community-based businesses and partnerships.

References

Asamoah, M. K. (2014). Re-examination of the limitations associated with correlational research. *Journal of Educational Research and Reviews, 2*(4), 45-52. Retrieved from http://sciencewebpublishing.net/jerr/archive/2014/July/pdf/Asamoah.pdf

Barnes, T. L., Colabianchi, N., Hibbert, J. D., Porter, D. E., Lawson, A. B., & Liese, A. D. (2016). Scale effects in food environment research: Implications from assessing socioeconomic dimensions of supermarket accessibility in an eight-county region of South Carolina. *Applied Geography, 68*, 20-27. doi:10.1017/S136899901099912

Bower, K. M., Thorpe, R. J., Rohde, C., & Gaskin, D. J. (2014). The intersection of neighborhood racial segregation, poverty, and urbanicity and its impact on food store availability in the United States. *Preventive Medicine*, *58*, 33-39.

Bowling, A. (2014). *Research methods in health*. New York, NY: McGraw-Hill. Black.

C., Moon, G., & Baird, J. (2014). Dietary inequalities: What is the evidence for the effect of the neighbourhood food environment? *Health & Place, 27*, 229-242.

Blum, M. D., & Roberts, H. H. (2012). The Mississippi Delta region: Past, present, and future. *Annual Review of Earth and Planetary Sciences, 40*, 655-683. doi:10.1146/annurev-earth-042711-10524

Brooks, G. P., & Barcikowski, R. S. (2012). The PEAR method for sample sizes in multiple linear regression. *Multiple Linear Regression Viewpoints, 38*(2), 1-16.

Browning, C. R., Cagney, K. A., & Boettner, B. (2016). Neighborhood, place, and the

life course. In C.E. Ross & J. Mirowsky (Eds.). *Handbook of the life course* (pp. 597-620). New York, NY: Springer International Publishing.

Casagrande, S. S., Franco, M., Gittelsohn, J., Zonderman, A. B., Evans, M. K., Fanelli Kuczmarski, M., & Gary-Webb, T. L. (2011). Healthy food availability and the association with BMI in Baltimore, Maryland. *Public Health Nutrition, 14*(6), 1001-1007. doi:10.1017/S1368980010003812

Caspi, C. E., Sorensen, G., Subramanian, S. V., & Kawachi, I. (2012). The local food environment and diet: a systematic review. *Health & Place*, *18*(5), 1172-1187. doi:10.1016/j.healthplace.2012.05.006.

Centers for Disease Control & Prevention (2014). *Food safety*. Retrieved from http://www.cdc.gov/foodsafety/index.html

Centers for Disease Control & Prevention (2015). *Challenges to food safety*. Retrieved from http://www.cdc.gov/foodsafety/cdc-and-food-safety.html

Centers for Disease Control & Prevention (2017). *Census tract level state maps of the Modified Retail Food Environment Index (mRFEI)*. Retrieved from https://ftp.cdc.gov/pub/publications/dnpao/census-tract-level-state-maps-mrfei_TAG508.pdf

Clarke, P., Morenoff, J., Debbink, M., Golberstein, E., Elliott, M. R., & Lantz, P. M. (2014). Cumulative exposure to neighborhood context consequences for health transitions over the adult life course. *Research on Aging, 36*(1), 115-142. doi:10.1177/0164027512470702

Coleman-Jensen, A., Gregory, C., & Singh, A. (2014). Household food security in the United States in 2013. *USDA-ERS Economic Research Report*, (173), 1-170. Retrieved from https://www.ers.usda.gov/webdocs/publications/45265/48787_err173.pdf?v=42265

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). *Applied multiple regression/correlation analysis for the behavioral sciences*. Florence, KY: Routledge.

Cook, J. T., Frank, D. A., Levenson, S. M., Neault, N. B., Heeren, T. C., Black, M. M., … & Chilton, M. (2006). Child food insecurity increases risks posed by household food insecurity to young children's health. *Journal of Nutrition*, *136*(4), 1073-1076.

Delta Health Alliance (2016). *Demographics and health statistics of Mississippi Delta service area*. Retrieved from http://www.deltahealthalliance.org/about-dha/overview/demographics/

Drewnowski, A., & Specter, S.E. (2004). Poverty and obesity: the role of energy density and energy costs. *American Journal of Clinical Nutrition, 79*(1), 6-15. Retrieved from http://ajcn.nutrition.org/content/79/1/6.full

Dubowitz, T., Zenk, S.N., Ghosh-Dastidar, B., Cohen, D.A., Beckman, R., Hunter, … & Collins, R.L. (2015). Heathy food access for urban food desert residents:

examination of the food environment, food purchasing practices, diet and BMI. *Public Health Nutrition. 18*(12), 2220-2230. doi:10.1017.S1368980014002742

Eberhardt, M. S., & Pamuk, E. R. (2004). The importance of place of residence: examining health in rural and nonrural areas. *American Journal of Public Health, 94*(10), 1682–1686. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1448515/pdf/0941682.pdf

Evans, B.F, Thompson, C.A., Zimmerman, E., Woolf, S.H., & Haley, A.D. (2015). *Access to food providers and recreational facilities in South Delta, Mississippi, and its relationship to health*. Retrieved from http://www.societyhealth.vcu.edu/media/society-health/pdf/PMReport_South_Delta.pdf

Ezzati, M., Martin, H., Skjold, S.A., Noorn, S.V., & Murray, C.J.L. (2006). Trends in national and state-level obesity in the USA after correction for self-report bias: analysis of health surveys. *Journal of Research of the Sociology of Medicine, 99*(2), 250-257.

Fahimi, M., Link, M., Schwartz, D.A., Levy, P., & Mokdad, A. (2008). Tracking chronic disease and risk behavior prevalence as survey participation declines: statistics from the behavioral risk factor surveillance system and other national surveys. *Preventing Chronic Disease, 5*, 1-16. Retrieved from https://www.cdc.gov/pcd/issues/2008/jul/07_0097.htm

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160. doi:10.3758/BRM.41.4.1149

Feeding America (2014). Hunger in America 2014: National report. Retrieved from http://help.feedingamerica.org/HungerInAmerica/hunger-in-america-2014-full-report.pdf

Fernandez, J.M., Callivet, F., Lhuissier, A. & Chauvin, P. (2014). Food insecurity, a determinant of obesity? An analysis from a population-based survey in the Paris metropolitan area, 2010. *Obesity Facts, 7*(2), 120-9. doi:10.1159/000362343.

Flegal, K.M., Carroll, M.D., Kit, B.K., & Ogden, C.L. (2012). Prevalence of obesity and trends in the distribution body mass index among US adults, 1999-2010. *Journal of the American Medical Association, 307*(5), 491-497. doi:10.1001/jama.2012.39

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences*. New York, NY: Worth Publishers.

Franklin, B., Jones, A., Love, D., Puckett, S., Macklin, J., & White-Means, S. (2012). Exploring mediators of food insecurity and obesity: A review of recent literature. *Journal of Community Health. 37*(1), 253-264. doi:10.1007/s10900-011-9420-4

Freedman, D. A. (2009). Local food environments: They're all stocked differently. *American Journal of Community Psychology*, *44*(3-4), 382-393. doi:10.1007/s10464-009-927-6

Freedman, D.A., & Bell, B.A. (2009). Access to healthful foods among an urban food insecure population: perceptions versus reality. *Journal of Urban Health, 86*(6), 825-838. doi:10.1007/s11524-009-9408-x.

Frohlich, K. L., & Abel, T. (2014). Environmental justice and health practices: Understanding how health inequities arise at the local level. *Sociology of Health & Illness, 36*(2), 199-212. doi:10.1111/1467-9566.12126

Food Research and Action Center (2010a). *Why low-income and food insecure people are vulnerable to overweight and obesity*. Retrieved from http://frac.org/initiatives/hunger-and-obesity/why-are-low-income-and-food-insecure-people-vulnerable-to-obesity/

Food Research and Action Center (2010b) *Understanding the connection between food insecurity and obesity*. Retrieved from http://frac.org/wp-content/uploads/frac_brief_understanding_the_connections.pdf

Freedman, D.A., & Bell, B.A. (2009). Access to healthful foods among an urban food insecure population: perceptions versus reality. *Journal of Urban Health, 86*(6), 825-838. doi:10.1007/s11524-009-9408-x.

French, S.A. (2003). Pricing effects on food choices. *Journal of Nutrition, 133*(3), 841S-843S.

Friel, S., & Ford, L. (2015). Systems, food security, and human health. *Food Security, 7*(2), 437-451. doi:10.1007/s12571-015-0433-1

Gallup (2013). *State of well-being: Mississippi, 2012*. Retrieved from http://cdn1.hubspot.com/hub/162029/WBI2012/Mississippi_2012_State_Report.pdf

Gittelsohn, J., Rowan, M., & Gadhoke, P. (2012). Interventions in small food stores to change the food environment, improve diet, and reduce risk of chronic disease. *Preventing Chronic Disease, 9*(1), 110-115. doi: 10.5888/pcd9.110015oi

Gorard, S. (2012). Statistical and correlational techniques. In J. Arthur (Ed.), *Research methods and methodologies in education* (pp. 119-127). Thousand Oaks, CA; Sage.

Gould, L. H., Rosenblum, I., Nicholas, D., Phan, Q., & Jones, T. F. (2013). Contributing factors in restaurant-associated foodborne disease outbreaks: 2006 and 2007. *Journal of Food Protection, 76*(11), 1824-1842. doi: 10.4315/0362-028X.JFP-13-037

Grilo, S.A., Shallcross, A.J., Ogedegbe, G., Odedosu, T., Levy, N., Lehrer, S., … & Spruill, T.M. (2015). Food insecurity and effectiveness of behavioral interventions to reduce blood pressure, New York City, 2010-2013. *Preventing Chronic Disease, 12*(1), E16-E32. doi: 10.5888/pcd12.140368

Gundersen, C., (2013). Food insecurity is an ongoing national concern. *Advances in Nutrition, 4*(1), 36-41. doi: 10.3945/an.112.003244

Gundersen, C., & Ziliak, J. P. (2014). *Childhood food insecurity in the U.S.: trends, causes, and policy options.* Retrieved from https://assets.aspeninstitute.org/content/uploads/files/ content/docs/ee/N.Childhood_Food_Insecurity_in_the_U.S..pdf

Gundersen, C., Garasky, S., & Lohman, B.J. (2009). Food insecurity is not associated with childhood obesity as assessed using multiple measures of obesity. *Journal of Nutrition Community and International Nutrition, 139*(13), 1173-1178. doi: 10.3945/jn.109.105361

Harris, K. J., Murphy, K. S., DiPietro, R. B., & Rivera, G. L. (2015). Food safety inspections results: A comparison of ethnic-operated restaurants to non-ethnic-operated restaurants. *International Journal of Hospitality Management, 46*, 190-199. doi: 10.1016/j.ijhm.2015.02.004

Hart, T. C., & Waller, J. (2013). Neighborhood boundaries and structural determinants of social disorganization: examining the validity of commonly used measures. *Western Criminology Review, 14*(1), 16-28.

Hartline-Grafton, H.L., Rose, D., Johnson, C.C., Rice, J.C. and Webber, L.S. (2009). Energy density of foods, but not beverages, is positively associated with body mass index in adult women. *European Journal of Clinical Nutrition, 63*, 1411–1418 doi: 10.1038/ejcn.2009.102

Henley, S. C., Stein, S. E., & Quinlan, J. J. (2012). Identification of unique food handling practices that could represent food safety risks for minority consumers. *Journal of*

Food Protection, 75(11), 2050-2054. doi: 10.4315/0362-028X_JFP-12-146

Hilmers, A., Hilmers, D. C., & Dave, J. (2012). Neighborhood disparities in access to healthy foods and their effects on environmental justice. *American Journal of Public Health, 102*(9), 1644-1654. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3482049/pdf/AJPH.2012.300865.pdf

Hoffman, L., Maculloch, J., & Batz, P. (2015). *Economic burden of major foodborne illnesses acquired in the United States*. Retrieved from http://ageconsearch.umn.edu/bitstream/_205081/2/eib140.pdf

Honeycutt, A. A., Wile, K., Dove, C., Hawkins, J., & Orenstein, D. (2015). Strategic planning for chronic disease prevention in rural America: looking through a PRISM lens. *Journal of Public Health Management and Practice, 21*(4), 392-399. doi: 10.1097/PHH.0000000000000062

Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression*. New York, NY: John Wiley & Sons.

Horst, M. (2017). Food justice and municipal government in the USA. *Planning Theory & Practice, 18*(1), 51-70. doi: 10.1080/14649357.2016.1270351

Hossfeld, L. H., & Mendez, G. R. (2018). Looking for Food: Food access, food insecurity, and the food environment in rural Mississippi. *Family & Community Health, 41*, S7-S14. doi: 10.1097/FCH.0000000000000182

Inderbitzin, M., Bates, K. A., & Gainey, R. (2014). *Perspectives on deviance and social control*. Thousand Oaks, CA: Sage.

Institute of Medicine of the National Academies (IMNA) (2012). *Accelerating progress in obesity prevention: Solving the weight of the nation*. Retrieved from http://iom.nationalacademies.org/~/media/Files/Report%20Files/2012/APOP/APOP_rb.pdf

International Fund for Agricultural Development (IFAD) (2011). *Rural poverty report, 2011: New realities, new challenges new opportunities for tomorrow's generation.* Retrieved from http://www.ifad.org/rpr2011/report/e/rpr2011.pdf

James, P., Arcaya, M. C., Parker, D. M., Tucker-Seeley, R. D., & Subramanian, S. V. (2014). Do minority and poor neighborhoods have higher access to fast-food restaurants in the United States?. *Health & Place, 29*, 10-17. doi:10.1016/j.healthplace.2014.04.011.

Jetter, K.M., & Cassady, D.L. (2006). The availability and cost of healthier food alternatives. *American Journal of Preventive Medicine, 30*(1):38-44. Retrieved from http://www.aahf.info/pdf/youth_articles/PIIS0749379705003351.pdf

Jones, A.D.M., Ngure, F., Pelto, G., & Young S.L. (2013). What are we assessing when we measure food security? A compendium and review of current metrics. *Advances in Nutrition, 4*(5), 481–505. doi: 10.3945/an.113.004119

Karpyn, A., Young, C., & Weiss, S. (2012). Reestablishing healthy food retail: Changing the landscape of food deserts. *Childhood Obesity, 8*(1), 28-30. doi: 10.1089/chi.2011.0113

Kawachi, I., & Berkman, L. (2000). *Social epidemiology.* Oxford, UK: Oxford University Press.

Kersten, E. (2012). Small food stores and availability of nutritious foods: a comparison of database and in-store measures, Northern California, 2009. *Preventing Chronic Disease, 9*, 110-118. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/22789445

Kirkpatrick, S. I., Reedy, J., Butler, E. N., Dodd, K. W., Subar, A. F., Thompson, F. E., & McKinnon, R. A. (2014). Dietary assessment in food environment research: a systematic review. *American Journal of Preventive Medicine, 46*(1), 94-102. doi:10.1016/j.amepre.2013.08.015

Klurfeld, D.M. (2015). Research gaps in evaluating the relationship of meat and health. *Meat Science, 109*, 86-95. doi:10.1016/j.meatsci.2015.05.022.

Knofczynski, G. T., & Mundfrom, D. (2008). Sample sizes when using multiple linear regression for prediction. *Educational and Psychological Measurement, 68*(3), 431-442. doi: 10.1177/00131644073101.31

Koro, M. E., Anandan, S., & Quinlan, J. J. (2010). Microbial quality of food available to populations of differing socioeconomic status. *American Journal of Preventive Medicine, 38*(5), 478-481. doi: 10.1016/j.amepre.2010.01.017

Kubrin, C. E. (2009) Social disorganization theory: Then, now and the future. *Handbooks of Crime and Deviance.* 225–236.

Laaksonen, M., Sarlio-Lahteenkorva, S., Lahelma, E. (2004). Multiple dimensions of socioeconomic position and obesity among employees: The Helsinki Health Study. *Obesity Research. 12*(11), 1851-1858. doi: 10.1038/oby.2004.230

Lamichhane, A. P., Warren, J. L., Peterson, M., Rummo, P., & Gordon-Larsen, P. (2014). Spatial-temporal modeling of neighborhood sociodemographic characteristics and food stores. *American Journal of Epidemiology (10)*2, 1019-1033. doi: 10.1093/aje/kwu250.

Lavie, C.J., Milani, R.V., & Ventura, H.O. (2009). Obesity and cardiovascular disease: risk factor, paradox, and impact of weight loss. *Journal of the American College of Cardiology. 53*(21), 1925-32. doi: 10.1016/j.jacc.2008.12.068.

Laxy, M., Malecki, K. C., Givens, M. L., Walsh, M. C., & Nieto, F. J. (2015). The association between neighborhood economic hardship, the retail food environment, fast food intake, and obesity: Findings from the Survey of the Health of Wisconsin. *BMC Public Health, 15*(1), 1-9.

Leung, C.W., Epel, E.L., Ritchie, L., Crawford, P.B., & Laraia, B.A. (2014). Food insecurity is inversely associated with diet quality of lower-income adults. *Journal of the Academy of Nutrition and Dietetics. 114*(12):1943-53.e2. doi: 10.1016/j.jand.2014.06.353.

Li C., Balluz, L.S., Ford, E.S., Okoro, C.A., Zhao, G., & Pierannunzi, C. (2012). A comparison of prevalence estimates for selected health indicators and chronic diseases or conditions from the Behavioral Risk Factor Surveillance System, the National Health Interview Survey, and the National Health and Nutrition Examination Survey, 2007-2008. *Preventive Medicine*. *54*(6):381-7. doi: 10.1016/j.ypmed.2012.04.00

Lucan, S. C., Barg, F. K., Karasz, A., Palmer, C. S., & Long, J. A. (2012). Perceived influences on diet among urban, low-income African Americans. *American Journal of Health Behavior, 36*(5), 700-710. Retrieved from https://www.researchgate.net/profile/Sean_Lucan/publication/224956950_Perceived_Influences_on_Diet_Among_Urban_Low-income_African_Americans/links/00b7d519bc141e5518000000.pdf

Ludwig, D., & Pollack, H.A., (2009). Obesity and the economy from crisis to opportunity. *Journal of the American Medical Association. 301*(5). 533-535. doi:10.1001/jama.2009.52.

Markwic, A., Ansari, Z., Sullivan, M., & McNeil, J. (2014). Social determinants and lifestyle risk factors only partially explain the higher prevalence of food insecurity among Aboriginal and Torres Strait Islanders in the Australian state of Victoria: a cross-sectional study. *BMC Public Health. 14*(598), 1-15. doi: 10.1186/1471-2458-14-598.

Martin, G., Gavine, A., Inchley, J., & Currie, C. (2017). Conceptualizing, measuring and evaluating constructs of the adolescent neighbourhood social environment: A systematic review. *SSM-Population Health, 3*, 335-351. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5769065/pdf/main.pdf

Martin K.S., & Ferris, A.M. (2007). Food insecurity and gender are risk factors for obesity. *Journal of Nutrition Education and Behavior, 39*(1), 31-6. doi: 10.1016/j.jneb.2006.08.02

Mayer, V. L., Hillier, A., Bachhuber, M. A., & Long, J. A. (2014). Food insecurity, neighborhood food access, and food assistance in Philadelphia. *Journal of Urban Health, 91*(6), 1087-1097.

McGee, B. B., Johnson, G. S., Yadrick, M. K., Richardson, V., Simpson, P. M., Gossett, J. M., ... & Bogle, M. L. (2011). Food shopping perceptions, behaviors, and ability to purchase healthful food items in the lower Mississippi delta. *Journal of Nutrition Education and Behavior, 43*(5), 339-348.

McKenzie, B. S. (2014). Access to supermarkets among poorer neighborhoods: a comparison of time and distance measures. *Urban Geography, 35*(1), 133-15.

Miller, D. E., & Kunce, J. T. (1973). Prediction and statistical overkill revisited. M*easurement and Evaluation in Guidance, 6*, 157-163.

Miller, M., Middendorf, G., & Wood, S. D. (2015). Food availability in the heartland: Exploring the effects of neighborhood racial and income composition. *Rural Sociology, 80*(3), 340-361.

National Advisory Committee on Rural Health and Human Services (NACRHHS). (2011). *The 2011 report to the secretary: Rural health and human services issue*s. Retrieved from http://www.hrsa.gov/advisorycommittees/rural/2011secreport.pdf

Pampel, F.C., Krueger, P.M., & Denney, J.T. (2010). Socioeconomic disparities in health behaviors. *Annual Review of Sociology. 36*(13), 349-370. doi: 10.1146/annurev.soc.012809.102529

Pampel, F.C., Krueger, P.M., & Denney, J.T. (2014). Socioeconomic status and health behaviors. *The Wiley Blackwell Encyclopedia of health, Illness, Behavior and Society, 12*(1), 2223-2227. doi: 10.1002/9781118410868.wbehibs54

Park, S., Onufrak, S., Sherry, B., Blanck, H.M. (2014). The relationship between health-related knowledge and sugar-sweetened beverage intake among US adults. *Journal of the Academy of Nutrition and Diet. 114*(10), 1059–66. doi: 10.1016/j.jand.2013.11.003

Pedhazur, E. J., & Schmelkin, L. P. (2013). Measurement, design, and analysis: An integrated approach. Chicago, IL: Psychology Press.

Pinard, C. A., Shanks, C. B., Harden, S. M., & Yaroch, A. L. (2016). An integrative literature review of small food store research across urban and rural communities in the US. *Preventive Medicine Reports*, *3*, 324-332.

Piontak, J.R. & Schulman, M.D. (2014). Food insecurity in rural America. *Contexts, 13*(3), 75-77. doi: 10.1177/1536504214545766

Pitts, S. B. J., Smith, T. W., Thayer, L. M., Drobka, S., Miller, C., Keyserling, T. C., & Ammerman, A. S. (2013). Addressing rural health disparities through policy change in the Stroke Belt. *Journal of Public Health Management and Practice: JPHMP, 19(6)*, 503.

Pothukuchi, K., Mohamed, R., & Gebben, D. A. (2008). Explaining disparities in food safety compliance by food stores: Does community matter? *Agriculture and Human Values, 25*(3), 319-332. doi: 10.1007/s10460-008-9132-2

Powell, L. M., Auld, M. C., Chaloupka, F. J., O'Malley, P. M., & Johnston, L. D. (2007). Access to fast food and food prices: relationship with fruit and vegetable consumption and overweight among adolescents. *Advances in Health Economics and Health Services Research, 17*, 23-48. doi: 10.1016/S0731-2199(06)17002-8.

Quinlan, J. J. (2013). Foodborne illness incidence rates and food safety risks for populations of low socioeconomic status and minority race/ethnicity: a review of the literature. *International journal of Environmental Research and Public Health*, *10*(8), 3634-3652. doi:10.3390/ijerph10083634

Robert Wood Johnson Foundation (RWJF). (2013). *Campaign to end obesity*. Retrieved from http://www.rwjf.org/content/dam/farm/reports/reports/2013/rwjf405694/subassets/rwjf405694_1

RWJF. (2010). *Food insecurity and risk for obesity among children and families: Is there a relationship?* Retrieved from http://healthyeatingresearch.org/wp-content/uploads/2013/12/HER-Food-Insecurity-042910_FINAL.pdf

Rolls, B.J., Drewnowski, A., & Ledikwe, J.H. (2005) Changing the energy density of the diet as a strategy for weight management. *Journal of the American Dietetic Association, 105*, S98–S103. Retrieved from https://pdfs.semanticscholar.org/123b/496694f1810620320a3cde37b1e66d3a40c4.pdf

Ross, C. E., & Mirowsky, J. (2001). Neighborhood disadvantage, disorder, and health. *Journal of Health and Social Behavior, 42*(3), 258-276. Retrieved from https://pdfs.semanticscholar.org/1f4b/c57445ecddf7501d46d5dbe9444bbf3da6b8.pdf

Rural Assistance Center (RAC) (2014). *Rural obesity prevention toolkit*. Retrieved from http://www.raconline.org/communityhealth/obesity/files/obesity-prevention-toolikit.pdf

Rutten, L.F., Finney, J., Yaroch, A.L., Colon-Ramos, U., Johnson-Askew, W., & Story, M. (2010). Poverty, food insecurity, and obesity: a conceptual framework for research, practice, and policy. *Journal of Hunger and Environmental Nutrition, 5*(4), 403-415. doi. 10.1080/19320248.2010.527275

Rutten, L.F., Yaroch, A.L., Patrick, H., & Story, M. (2012). *Obesity prevention and national food security: A food systems approach*. Retrieved from

http://healthyeatingresearch.org/research/obesity-prevention-and-national-food-security-a-food-systems-approach/

Sampson, R. J. (1992). Family management and child development: Insights from social disorganization theory. *Advances in Criminological Theory, 3*, 63-93.

Sampson, R., & Groves, W. (1989). Community structure and crime: Testing social disorganization theory. *American Journal of Sociology*, *94*(4), 774-802.

Sampson, R. J. (2012). *Great American city: Chicago and the enduring neighborhood effect*. University of Chicago Press.

Sampson, R. J. (2013). The place of context: a theory and strategy for criminology's hard problems. *Criminology*, *51*(1), 1-31.

Shaw, W. (1996). *The geography of United States poverty*. New York, NY: Garland Publishing.

Siegel, K.R., Ali, M.K., Srinivasiah, A., Nugent, R.A., & Narayan, K.M.V. (2014) Do we produce enough fruits and vegetables to meet global health need? *PLoS ONE 9*(8), e104-e159. doi:10.1371/journal.pone.0104059

Stubblefield, D., Steinberg, S.L., Ollar, A., Ybarra, A., & Stewart, C. (2010). *Community food assessment*. Retrieved from http://www2.humboldt.edu/ccrp/wp-content/uploads/2013/12/Food-Report-Final.pdf

Sullivan, G. M., & Feinn, R. (2012). Using effect size-or why the *p* value is not enough. *Journal of Graduate Medical Education*, *4*(3), 279–282. doi:10.4300/JGME-D-12-00156.1

Tagtow, A., & Hinkle, A. (2008). *A vision for good food for public health linking sustainable food systems to healthy people & healthy communities*. Retrieved from https://clu-in.org/conf/tio/foodsys101/AVisionforGoodFoodforPublicHealth.APHA.Tagtow.Hinkle.Oct2008.pdf

Thow, A.M., Jan, S., Leeder, S., & Swinburn, B. (2010) The effect of fiscal policy on diet, obesity and chronic disease: A systematic review. *Bulletin of the World Health Organization, 88*(8), 609–614. Retrieved from http://www.who.int/bulletin/volumes/88/8/09-070987/en/

Treuhaft, S., & Karpyn, A. (2010). *The grocery gap: Who has access to healthy foods and why it matters*. Retrieved from https://ftp.cdc.gov/pub/publications/dnpao/census-tract-level-state-maps-mrfei_TAG508.pdf

Tillyer, M.S., & Wilcox, P. (2017). Place and neighborhood contexts. In D. Weisburd & J.E. Eck (Eds.). *Unraveling the crime-place connection* (pp. 129-159). New York, NY: Taylor Francis Publishers.

United Nations Department of Economic and Social Affairs-Population Division (UNDESA-PD) (2014). *World urbanization prospects: The 2014 revision, methodology*. Retrieved from http://www.esa.un.org/unpd/wup/Methodology/WUP2014-Methodology.pdf

United States Census Bureau. (2016). *Geography: Urban and rural*. Retrieved from http://www.census.gov/geo/reference/urban-rural.html

United States Department of Agriculture (USDA). (2015). *Definitions of food security*. Retrieved from https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/definitions-of-food-security.aspx

USDA. (2009). *Access to affordable and nutritious food: Measuring and understanding food deserts and their consequences: Report to Congress.* Retrieved from https://www.ers.usda.gov/webdocs/publications/42711/12716_ap036_1_.pdf?v=41055

USDA. (2017). *The influence of foodstore access on grocery shopping and food spending*. Retrieved from https://www.ers.usda.gov/webdocs/publications/85442/eib-180.pdf?v=43024

Vargas, S., & Penny M.E. (2008). Measuring food insecurity and hunger in Peru: A qualitative and quantitative analysis of an adapted version of the USDA's food insecurity and hunger module. *Public Health Nutrition. 12*(10), 1488-1497. doi: 10.1017/S136898000999214X

Wang, Y.C., McPherson, K., March, T., Gortmaker, S.L., & Brown, M. (2011). Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet, 378*(9793), 812-825. doi:10.1016/S0140-6736(11)60814-3.

Wilde P.E., & Peterman J.N. (2006). Individual weight change is associated with household food security status. *Journal of Nutrition, 136*(5), 1395-1400. Retrieved from http://jn.nutrition.org/content/136/5/1395.full.%20pdf+html

World Health Organization (WHO) (2015). *Obesity and overweight: Fact shee*t. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/

Zenk, S. N., Powell, L. M., Rimkus, L., Isgor, Z., Barker, D. C., Ohri-Vachaspati, P., & Chaloupka, F. (2014). Relative and absolute availability of healthier food and beverage alternatives across communities in the United States. *American Journal of Public Health, 104*(11), 2170-2178. doi: 10.2105/AJPH.2014.302113