THE URBAN FOOD DESERT AS A MODEL FOR THE URBAN HEALTH CARE DESERT: FUNDAMENTAL CAUSES AND ECONOMIC CONSIDERATIONS

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THE URBAN FOOD DESERT AS A MODEL FOR THE URBAN HEALTH CARE DESERT: FUNDAMENTAL CAUSES AND ECONOMIC CONSIDERATIONS

A DISSERTATION

by

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Concentration: Health Policy and Management

Presented to the Faculty at the Graduate School of Public Health and Health Policy in partial fulfillment of the requirements for the degree of Doctor of Public Health

Graduate School of Public Health and Health Policy
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July, 2018

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ABSTRACT

THE FOOD DESERT AS A MODEL FOR THE URBAN HEALTH CARE DESERT:
FUNDAMENTAL CAUSES AND ECONOMIC CONSIDERATIONS

by

Estevan Garcia

Advisor: William Gallo, PhD

Introduction: A “health care desert” is a part of the country where needed medical, behavioral, mental, dental, and/or pharmaceutical health care services are extremely limited or altogether unavailable. This terminology is based on the concept of a “food desert,” which describes an area where people have limited access to affordable and healthy foods, and which, together with the negative health consequences of eating lower-quality foods, is well described in public health literature. The application of this terminology to an urban environment with ready access to transportation has been limited and is controversial. However, the recent increase in urban hospital closures in certain communities is clearly impacting health care and the overall health of the people who live there. This study applies economic theory and fundamental cause theory to explore what establishes and maintains an urban health care desert. Additionally, the impact of this condition on health care and overall health is examined by comparing selected health care desert communities to robust (non-desert) health care communities in Brooklyn, New York.

Objectives: The three overarching objectives of this study are to characterize an urban health care desert and describe the theoretical foundations that result in the creation and persistence of urban health care deserts; to examine the effects of living in Northern and Central
Brooklyn health care desert communities on medical health care access and quality; and to examine the effects of living in Northern and Central Brooklyn health care desert communities on mental and behavioral health care access and quality.

Methods: The outcomes of interest in this study are poor access to and quality of health care and resulting poor health. The risk factors for this outcome include: 1) preventable hospitalizations as defined using the Agency for Healthcare Research and Quality (AHRQ) Prevention Quality Indicators (PQIs) and selected high-risk mental/behavioral health diagnoses; 2) increased hospitalization length of stay (LOS); and 3) potentially preventable emergency department (ED) visits. Preventable hospitalizations and ED visits will be used to assess access and LOS will be used as a proxy for quality. The exposure for this study is living in a Brooklyn urban health care desert community. The health care desert communities are compared to nearby non-desert communities. This study also characterizes desert and non-desert community demographics.

Results: Using the food desert framework, several health care desert communities were identified in Brooklyn, New York. These communities were compared to non-desert (robust) health care communities, also in Brooklyn. For medical hospitalizations, significant differences between desert and non-desert communities for PQI 1, PQI 3, PQI 14, and PQI 15 were seen across all three study years. These differences showed higher admission rates for health care desert community patients with several diabetes diagnoses as well as asthma. PQI 90, the composite, also showed higher hospitalization rates for health care desert communities from 2010 to 2012. For PQI 92, the chronic illness composite, health care desert communities again showed higher rates of hospitalization. ED utilization was greater in the health care desert communities for 11 of the 12 PQIs, and for each of the composite measures. For mental and
behavioral hospitalizations, health care desert communities had higher rates for drug abuse, major depression, and schizophrenia for all three study years. For mental and behavioral emergency department utilization, desert communities showed higher rates. Additionally, the composite score, which included all diagnoses, also found higher overall utilization in desert communities. LOS data was only significant for PQI 2, perforated appendix; hospitalizations in health care desert communities and the Heckman correction were also significant. No difference was found in LOS for mental/behavioral conditions.

**Conclusion:** Health care desert communities face challenges with accessing health care. This difference of access for desert communities, versus non-desert communities, results in increased hospitalization rates for several chronic diseases including diabetes and asthma. Additionally, hospitalizations for severe mental health and behavioral illness, including schizophrenia and drug abuse, were greater in the health care desert communities. In general LOS findings for both medical and mental/behavioral hospitalizations did not support a difference in quality of care between desert and non-desert communities. Emergency department utilization was also greater in health care desert communities for the vast majority of medical, mental, and behavioral illnesses. It is clear from this study that health care desert communities face health disparities, especially when considering chronic illness. The approach to addressing these disparities should include identifying health care desert communities and applying a focused population health approach.
ACKNOWLEDGMENTS

Just over 10 years ago I began my journey towards a doctorate in public health at the newly created program at CUNY. I had no idea it would involve the better part of a decade to achieve this goal. Formal education has been my “go-to” as I have progressed in my career. As a new physician administrator I knew I needed formal education in order to succeed and advance. I obtained a Master in Public Administration in Health Care Management and Policy from NYU. My decision to pursue a doctorate was based on my need to strengthen my understanding and foundation of research methods as I had created a fellowship in pediatric emergency medicine and was now responsible for supporting the research activities of a small group of fellows. I turned to CUNY for the next journey along my academic career. During those 10 years I developed a love for public health and even had the opportunity to teach MPH students at Brooklyn College. While the journey to my doctorate is over, my work in public health continues.

To my husband, William Sherr – You have said that in the 18 years we have been together I’ve only been out of school for one year. I hope you can see the light at the end of the tunnel. Thank you for supporting, pushing, encouraging me, and just being there. We made it!

To my children, Jared, Miles and Bette – Thanks for understanding and allowing me to be in school this long. It became a way of life. I remember laughing when Bette asked, “Why do you still have homework to do? You work!”

To Bill Gallo – We did it! I remember first meeting you and thinking to myself that I needed to work with you. Your passion and sense of humor kept me going. You are responsible for motivating many students at CUNY. You will be missed.

To Betsy and Mimi – Thanks for hanging in with me over the years and for your support.
To many of the CUNY faculty – Thank you for your support over the years. I wish I could thank you all in person and share with you how influential you have been in my academic career. I remember one conversation with a faculty member in the school of social work early in my doctorate journey. As we were discussing my dissertation direction he said, “Your goal is to complete your dissertation before you bump into Jesus.” I laughed out loud. I think I accomplished that goal!

To José-Miguel Yamal – Thank you for the years of support and expertise as we navigated the SPARCS data sets.
DISCLOSURE

The author has no conflicts of interest and nothing to disclose.
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CHAPTER 1:
INTRODUCTION

Overview

A “health care desert” is a part of the country where needed medical, behavioral, mental, dental, and/or pharmaceutical health care services are extremely limited or altogether unavailable. This terminology is based on the concept of a “food desert,” which describes an area where people have limited access to affordable and healthy foods and which is well described in public health literature. Most health care desert studies have focused on resource-limited, rural areas of the world, given that people in urban settings have better access to transportation. As such, expanding the concept of health care deserts to include urban settings has been controversial. However, hospitals in these communities are often the only source of health care, and over the last several decades, many of these safety-net hospitals have closed due to financial pressures. Alan Sager, Professor of Health Law, Policy and Management at Boston University School of Public Health and an early proponent of the “medical” desert concept in the United States, warns that safety-net hospital closings are disproportionately affecting minority communities, occurring more frequently, for example, in African American neighborhoods (1). This results in increased travel time for, and decreased availability of, all health care services (including primary care) for members of these communities (1). Notably, these service reductions are seen in both hospital and community-based practices, as it has been shown that when hospitals close, primary care offices that are dependent on hospital infrastructure may also close.

Hospital closures have become routine and are not limited to one area of the country, but the particularly high prevalence of closings in New York City (NYC) has drawn national
attention; see, for example, “NYC’s Disappearing Neighborhood Hospitals” (2). Particularly troubling is the health care landscape in Brooklyn, a region with crumbling infrastructure and many neighborhoods with high-risk populations. Although New York State (NYS) has committed funding to unify and support failing Brooklyn hospitals, changes to Medicaid and other federal reforms, which have greatly decreased service reimbursements, continue to escalate pressures on local governments to determine and implement long-term solutions (3).

Brooklyn, the most populous of NYC’s five boroughs, is composed of multiple diverse neighborhoods with both robust and desert health care conditions. The health care system in Northern and Central Brooklyn is in crisis and has been for years. The communities in these regions have long been identified as underserved and disproportionately affected by chronic medical and behavioral health conditions. Furthermore, emergency department use and premature mortality in these communities are higher than in other Brooklyn areas, in NYC, NYS, or in the nation. Specifically, the neighborhoods of East New York/Brownsville, Crown Heights North/Bedford Stuyvesant, and Bushwick/Stuyvesant Heights have been shown to be underserved in all aspects of health care, including mental, behavioral, and medical. Additionally, these communities are at risk for worsening conditions as financially distressed hospitals (and secondary care options) are threatened by closures, mergers, or reductions in services. As the status of these communities as health care deserts becomes more pronounced, health disparities are likely to worsen as well.
Study Aims

In this study exploring the conceptualization and implications of urban health care deserts, there are three overarching objectives:

**Aim 1:** Characterize an urban health care desert and describe the theoretical foundations that result in the creation and persistence of urban health care deserts.

1a. Compare and contrast urban health care deserts and food deserts.

1b. Explore the potential impact of economic theory on the creation of health care deserts.

1c. Utilize fundamental cause theory to conceptualize the persistence of health care deserts in certain communities.

**Aim 2:** Examine the effects of living in Northern and Central Brooklyn health care desert communities on medical health care access and quality.


2b. Review current literature regarding Prevention Quality Indicators (PQIs), Length of Stay (LOS), and Potentially Preventable Emergency Department (PPED) visits.

2c. Utilize New York Statewide Planning and Research Cooperative System (SPARCS) data to compare quality of and access to medical health care for Brooklyn desert and non-desert communities.

**Aim 3:** Examine the effects of living in Northern and Central Brooklyn desert communities on mental and behavioral health care access and quality.

3a. Review literature regarding mental and behavioral health illness.

3b. Utilize SPARCS data to compare quality of and access to mental and behavioral health care for several Brooklyn desert and non-desert communities.
Research Theme

This study explores the theoretical foundations of what characterizes a health care desert and assesses the influence of living in urban Brooklyn health care desert communities on access to and quality of health care and on overall health.

Public Health Importance

Unlike a food desert, an urban health care desert has not been well defined, and the concept is far from accepted. The term has been used most recently to describe the impact of trauma and pharmacy “deserts” on underserved/serviced areas in Chicago. These studies were limited in scope and only recently published. Thus, a widely accepted definition of “urban health care deserts” does not exist, making it difficult to study the impact of living in these conditions. From a public health standpoint, identification of urban health care deserts and understanding their impact could assist public health officials target at-risk communities with selected interventions. This study attempts to define urban health care deserts and theorizes their creation and persistence based on food desert literature. Additionally, this study aims to explore the impact of living in a health care desert on both medical and mental/behavioral health care access and quality, which may not be effected in the same way or simultaneously. These findings are intended to contribute to the understanding of health care desert communities and help focus interventions for these communities.

Primary Research Question and Hypothesis

The primary research question of this study is what, if any, impact does living in urban health care desert communities have on access to and quality of health care, especially when individuals living in these communities have access to public transportation. This dissertation
hypothesizes that living in urban health care desert communities negatively impacts access to and quality of health care, even in communities with access to public transportation.

**Methods**

**Variables: Exposure and Outcome Definitions**

The outcomes of interest in this study are poor health care and resulting poor health. The risk factors for these outcomes include: 1) preventable hospitalizations as defined using the Agency for Healthcare Research and Quality (AHRQ) Prevention Quality Indicators (PQIs) and selected high-risk mental/behavioral health diagnoses; 2) increased length of stay (LOS); and 3) potentially preventable emergency department (ED) visits. Preventable hospitalizations and ED visits will be used to assess access and LOS will be used as a proxy for quality. The exposure for this study is living in a Brooklyn urban health care desert community. The health care desert communities are compared to nearby non-desert communities. This dissertation also characterizes desert and non-desert community demographics.

**Data Analysis Plan**

Preventable hospitalizations are based on the PQI measures developed by AHRQ. The premise underlying the PQIs is that appropriate outpatient care could prevent the need for hospitalization or prevent further complications. PQIs are population-based and adjusted for covariates. The rates are based on analysis of 45 States from 2012 AHRQ Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SIDs). The SIDs contain encounter-level information for all inpatient discharges for all payers, including demographics and up to 30 diagnoses from the International Classification of Diseases, Ninth Revision (ICD-9). For 2012, the HCUP databases represent greater than 95 percent of all annual discharges in the United
States. The area-level indicators are scaled to the rate of 1,000 persons at risk and involve 12 PQIs. The 12 diagnoses focused on in Chapter 3 include: (PQI 1) diabetes – short-term complications; (PQI 2) perforated appendix; (PQI 3) diabetes – long term complications; (PQI 5) chronic obstructive pulmonary disease (COPD) or asthma in older adults; (PQI 7) congestive heart failure (CHF); (PQI 8) hypertension (HTN); (PQI 10) dehydration; (PQI 11) pneumonia – bacterial; (PQI 12) urinary tract infection (UTI); (PQI 13) angina without procedure; (PQI 14) uncontrolled diabetes; and (PQI 15) asthma – young adults. The 12 PQIs have been assessed independently for both desert and non-desert communities, and an acute, chronic, and overall prevention quality composite score has been included in the calculations.

Preventable hospitalizations for high-risk mental/behavioral illnesses, which is the focus of Chapter 4, have been based on admissions for diagnoses commonly believed to be preventable if appropriately managed in the outpatient setting. Unlike the AHRQ medical PQIs, there are no universally accepted behavioral and mental health PQIs. The premise, similar to that underlying the medical PQIs, is that appropriate outpatient care could prevent the need for hospitalization or prevent further complications. The behavioral and mental health diagnoses that have been compared are: 1) alcoholism; 2) drug abuse; 3) major depression; 4) dysthymia; 5) generalized anxiety; 6) panic disorder; and 7) schizophrenia. For the behavioral and mental health diagnoses, the age was limited to 18 years and over. Additionally, as with all PQIs, rates are per 100,000 and transfers to the hospital and pregnancy were excluded.

All 2010–2012 discharges from Northern and Central Brooklyn communities, including Brownsville (11212), East New York (11207, 11208, and 11239), and Bedford Stuyvesant (11206, 11205, 11216, 11221, and 11233), have been included in the study sample. The diagnoses have been limited to the PQIs and high-risk diagnoses listed above. Additional
measures include the length of stay and emergency department utilization. Data for potentially preventable emergency department use was further limited to visits in 2012 only. The comparison neighborhoods include Carroll Gardens, Park Slope (11215, 11217, 11231, 11201), and Flatbush and Midwood (11218, 11230, 11226, and 11210).

The rates have been compared using the Poisson distribution (PD) model, first described by famed French mathematician Simean Denis Poisson in 1837 (4). This mathematical rule assigns probabilities to the number of occurrences. The distribution is characterized by a single parameter, or mean number, of occurrences during the specific interval. The distribution is used to fit count data. Data produced by medical research often follows the Poisson distribution model, and differences or ratios of the Poisson means can be compared. The Poisson model is appropriate for this situation because the number of potentially preventable admissions or events in each of the study years are being compared for each zip code, in each community. Additionally, because the number of events is small compared to the number at risk, the exact Poisson test is most appropriate. The confidence interval was calculated but a power analysis was not, as the width of the confidence intervals was clinically appropriate.

LOS was compared between desert and non-desert hospitalizations using the Wilcoxon rank sum test due to the non-normality of the LOS variables. This test is the nonparametric version of the 2-sample t-test without the assumption of normality. For visualization of the LOS, the log-transformation was used to reduce the right skewness. Additionally, because of the concern of selection bias—in that the LOS of the selected PQIs is dependent on the patients being admitted (non-random)—the Heckman correction was applied to the LOS data (5). The Heckman correction assumes normality and provides a test for sample selection bias and a formula to correct the bias. The two-step Heckman correction uses selected variables to correct
for any selection bias. The model does have disadvantages as it is considered a limited information maximum likelihood estimator.

**Literature Review: Food Deserts Versus Health Care Deserts**

Food deserts are thought to contribute to social disparities in diet and diet-related health outcomes, including cardiovascular disease and obesity. Limited access to healthy and affordable food is believed to be the contributing factor in food deserts. Cummings and Macintyre (2002) suggest that the term likely originated in Scotland in the early 1990s, used by a resident of public sector housing to describe poor access to an affordable, healthy diet. Food deserts first appeared in government publications in 1995, the authors assert, followed by increasingly prevalent warnings by academics, policy makers, and organizational leaders about the dangers of food deserts and their negative impact on public health (6).

As will be explored in more depth in Chapter 2, the food desert concept has been well studied, even though it is not without debate. Cummins and Macintyre explain that food deserts are an “idea whose time has come” but that “slender” empirical evidence has been used to support the concept (6). Beaulac and colleagues explore “deprivation amplification,” whereby area-level amplification compounds individual disadvantage (7). They conclude that food deserts exist in the United States, and that evidence clearly supports the notion that minority Americans living in low-income areas tend to have poor access to healthy food. They highlight a process of deprivation amplification pointing to ways structural problems related to food retailing appears to further disadvantage low-income minority Americans.

Health care desert research, which also will be discussed in Chapter 2, is more limited than food desert research. Health care deserts take a number of forms, including hospital, primary care, dental, mental health, and pharmacy deserts. Research regarding health care access
in urban areas tends to be focused on hospitals and specialty services, but is limited by unclear definitions. Mental health access research reveals that racial/ethnic minorities and low-income communities have limited access to integrated care, with high-poverty Latino communities more significantly impacted (8). Qato and colleagues find disproportionately more pharmacy deserts in medically underserved, low-income, and segregated black communities of Chicago (9). Crandall and colleagues studied the concept of trauma deserts by examining the impact of distance to a trauma center on the effect of mortality after a gunshot wound (GSW) (10). They conclude, specifically, that relative trauma deserts in urban areas of Chicago adversely affect mortality from GSW based on limited access to immediate care.

**Policy and Program Implications**

The goal of this study is to determine the effects of living in an urban health care desert on health care and on overall health. While this study is limited to Brooklyn, New York, the results can be generalized to broader urban desert communities. In order for this to happen, the urban health care desert concept needs further discussion and the development and acceptance of a standard definition. This dissertation proposes a definition that can be a starting point for discussion, that urban areas with limited access and low quality health care are indeed health care deserts despite availability of transportation. Furthermore, a community that is identified as an urban health care desert should be considered a health imperative requiring fundamental investment in resources and infrastructure. This study allows for application of the urban desert definition to other urban areas across the United States to better identify at-risk communities.
CHAPTER 2:

THE FOOD DESERT AS A MODEL FOR THE URBAN HEALTH CARE DESERT:
ECONOMIC CONSIDERATIONS AND FUNDAMENTAL CAUSES

Food Deserts: Background and Significance

Food deserts are areas with limited access to healthy and affordable food that are thought to contribute to disparities in diet and diet-related health outcomes for those who live there, including cardiovascular disease and obesity. Cummings and Macintyre (2002) suggest that the term food desert likely originated in Scotland in the early 1990s, used by a resident of public sector housing to describe poor access to an affordable, healthy diet. Food deserts first appeared in government publications in 1995, the authors assert, followed by increasingly prevalent warnings by academics, policy makers, and organizational leaders about the dangers of food deserts and their negative impact on public health (11). Coining the phrase food desert was critical in helping to trigger national interest, public policy debate, and research. The same could be said for the urban health care desert concept. Wide acceptance of the phrase could raise awareness of policy makers and others and move the concept forward in the national discourse.

Definitions and Causes

There are many ways to define food deserts, some specific and others more general. The Low Income Project Team defines food deserts as “areas of relative exclusion where people experience physical and economic barriers to accessing healthy food” (12). Hendrickson and colleagues define food deserts as urban areas with 10 or fewer stores and no stores with more than 20 employees, while Cummins and Macintyre define food deserts as poor urban areas where residents cannot buy affordable, healthy food (6,13). The Food, Conservation, and Energy Act of 2008 defines a food desert as “an area in the United States with limited access to affordable and
nutritious food, particularly such an area composed of predominantly lower-income neighborhoods and communities” (14). In 2011, the USDA launched a new website, the Food Desert Locator, which showed that 10 percent of the country could be considered a food desert (15). The USDA definition for a food desert is any census area where at least 20 percent of the inhabitants live below the federal poverty line and where 33 percent live at least one mile from a supermarket in urban areas, and at least 10 miles in rural areas.

One theory regarding the formation of food deserts in the United States focused on the impact of the expansion of large chain supermarkets on smaller, independent neighborhood stores (16,17). As part of a statewide collaborative in Delaware, Curtis and McClellan found that low-income shoppers had limited access to varieties of food by type, brand, and size, and paid higher prices. They hypothesized that the expansion of large chain supermarkets just outside of poor areas, thought to have better quality, variety, and lower prices, may have forced smaller independent neighborhood stores within the community to close (16). Another theory focused on changes in demographics in larger U.S. cities between 1970 and 1988 and highlighted how economic segregation due to out-migration of affluent families from inner cities led to decreasing median incomes and closure of nearly one-half of the supermarkets in the three largest U.S. cities (18–20). These theories illustrate the significance of urban segregation on food desert formation, a theme that can be seen in the development of health care deserts as well, and point to the complicated nature of analyzing and defining food deserts.

United States Food Deserts

In the United States, urban and rural low-income neighborhoods are less likely to have access to supermarkets or grocery stores that provide healthy food choices. The United States Congress directed the U.S. Department of Agriculture (USDA) to identify characteristics and
causes of food deserts, assess the extent of the problem, and outline recommendations to address the issue (14). The report found the following: 1) access to a supermarket or large grocery store is a problem for a small percentage of households; 2) supermarkets and large grocery stores have lower prices than small stores; 3) low-income households shop where food prices are lower, when they can; 4) easy access to all food, rather than lack of access to specific healthy food, may be a more important factor in explaining increases in obesity; 5) understanding the market conditions that contribute to differences in access to food is critical to the design of policy interventions that may be effective in reducing access limitations; and 6) food has been used as a tool for community development. The report suggests that the current state of research is insufficient to determine conclusively whether some areas with limited access have inadequate access and recommends improved methods to measure access levels, availability, and food costs. These reports underscore that there is debate regarding food deserts in the United States, as has also been the case in food desert research conducted in other countries.

The Debate

Even though food desert research has become common, the concept is not without critique. Wrigley believes that “despite its rather imprecise definition the metaphor of the food desert was rapidly pressed into service in policy debate in the late 1990s, and food deserts were simply assumed to exist despite a lack of systematic research documenting their prevalence and distribution” (21). Cummins and Macintyre reviewed the three foundational United Kingdom studies often used to support the food desert concept—Mooney, 1990; Piachaud and Webb, 1996; and Sooman and colleagues, 1993. The article by Mooney has been used to support the claim that a healthy basket of food costs more in disadvantaged areas than in affluent areas, but the study actually found that both healthy and unhealthy baskets were cheaper in deprived areas.
In the Piachaud and Webb study, the authors do not discuss food deserts or affluent versus poor areas, but illustrate that the type and size of markets present is important in determining the price and availability of food (23). The pilot study by Sooman and colleagues reviewed 10 stores and found higher healthy food costs in poor areas than in affluent areas, however, the study lacked significant testing and was limited by non-random sampling (24). In an attempt to describe the popularity of the food desert concept, Cummins and Macintyre explained that the food desert was an “idea whose time has come” but that “slender” empirical evidence had been used to support the concept. They warned that “factoids” could become part of government health policy and should be examined more carefully (6).

Following this study, Walker and colleagues reviewed 31 empirical studies from 2008 to 2010. They focused on food desert and access articles, summarizing the research areas as follows: 1) access to supermarkets; 2) racial/ethnic disparities in food deserts; 3) income/socioeconomic status in food deserts; and 4) differences in chain versus non-chain stores (25). The access studies they reviewed suggest that disparities in access to supermarkets exist, with racial and ethnic minority communities and low-income communities disproportionately affected (13,26–28). The results from a review of racial and ethnic disparities were mixed, finding decreased availability of chain supermarkets in black neighborhoods (52 percent of the number found in white neighborhoods), but that among the least impoverished neighborhoods studied, supermarket access in both black and white neighborhoods was comparable. The socioeconomic food desert research reviewed found lower quality food in urban areas and suggested higher crime rates might be a factor in higher pricing (13). Additionally, lack of transportation limited travel to supermarkets outside the neighborhood, forcing urban residents to sacrifice cost-savings and quality. The chain versus smaller non-chain store research found that
supermarkets in urban areas had higher prices, and that there were fewer of them than in non-urban areas; the biggest disparity in price was in dry goods, with shoppers at chain supermarkets paying between 10 and 40 percent less (19). These studies validate access disparity in areas considered food deserts and also highlight the need for further research.

Alwitt and Donley recommend that research should take an ecological approach that considers the entire food environment, including factors such as transportation availability and residents’ preferences (19). This broader approach, which could include considering all of the types of food providers (corner stores and gas stations, for example) available to residents and how they interact with these venues, would allow for a better understanding of the highly complex issue of food access (25). Interestingly, although policy can have a major impact in contributing to or addressing limited access to healthy and affordable food, few studies have focused on this area.

**Deprivation Amplification**

Using an ecological public health focus, Cummins and Macintyre studied the impact of the neighborhood food environment, particularly in low-income areas, on individuals, hypothesizing an independent effect on diet and diet-related chronic diseases due to the environment’s influence on patterns of food purchasing and consumption (29). This effect is known as deprivation amplification and is believed to play a significant role in the negative effects of living in a food desert. The concept is important from both a theoretical and policy standpoint. Food desert research focused on individual characteristics involves examining the role of sociodemographic variables, such as age, sex, income, housing, and car access, as well as personal variables, such as taste preference, cognitions, motivations, awareness, efficiency, socialization, and experiences. Addressing the impact of individual characteristics in food deserts
with a policy focus would involve trying to improve personal resources, and attitudinal or motivational perspectives, among other factors. Researching the role of perspective, in particular, is important in understanding deprivation amplification. This concept can be applied to health care deserts as well, particularly in areas where we expect other desert conditions.

In a systematic review of food desert-related literature spanning 1966-2007, Beaulac and colleagues explored the existence of food deserts in socioeconomically disadvantaged areas. Their review of 49 studies included 22 market-based studies, 17 geographic studies, and 10 mixed-method studies. They strongly concluded that food deserts exist in the United States, as well as a process of deprivation amplification, whereby area-level amplification compounded individual disadvantage (7). Specifically, in addition to having less access to healthy options, Beaulac and colleagues suggest structural problems related to food retail appear to further disadvantage low-income minority Americans. Although the authors reported that the evidence supporting the impact of price differentiation was of poor quality and yielded mixed results among the studies reviewed, they found “robust” evidence to support that low-income and minority areas in the United States have fewer supermarkets, greater distances to supermarkets, and poor access to affordable healthy food.

While food desert literature is less available in countries other than the United States, in Scotland, Smith and colleagues explored the deprivation amplification process in four environmental settings (island, rural, small town, urban) (30). Their data suggests that contrary to the deprivation amplification process results found in other research, residents of the most deprived neighborhoods had shorter commute times to the nearest grocery store than residents of the least deprived neighborhoods; however, the authors stress that this relationship is dependent on the environment studied and is not universal. In another study on deprivation amplification,
Macintyre found that environmental resources are not always distributed in a way that supports the concept (31). In Glasgow, she found that there were more large supermarkets with lower pricing in poor localities; however, the richer communities she studied had twice as many health clinics, three times as many dentists and general practices, and one and one-half as many pharmacies. She concluded that the deprivation amplification pattern is “less well standard” than previously suggested and that research needs to consider the specific resources in question independently and with regard to their regional and national contexts.

Towards a Classification System

In an effort to better characterize food deserts, Shaw proposed the concept of a three-tiered classification of food deserts based on: ability, assets, and attitude (32). Ability issues are defined as those obstacles that physically prevent access to food, even when the consumer has the financial resources and mental desire to buy healthy food, and includes both individual challenges related to physical disabilities and problems related to the built environment. Asset issues are defined as a lack of financial resources to purchase healthy food that one has access to and desire to consume, or for other food-related expenses such as transportation, storage space, or cooking facilities. Attitude issues are defined as any state of mind preventing the consumer from obtaining food that they could physically access and financially afford—these obstacles may take the form of culturally-based prejudices, knowledge deficits, or other constraints. Shaw concluded that “classifying food deserts according to causative factors may facilitate the development of a more precise definition, or perhaps suggest an alternative name for the unsupportive food environments.” More importantly, the recognition that food deserts may take different forms could facilitate developing appropriate public health policy responses to health care deserts.
The application of Shaw’s tri-tiered classification system could also be used to investigate health care deserts in urban environments. Asset issues clearly limit health care for those under- and uninsured, while attitude issues may prevent individuals from seeking specific types of care or care outside a desert. Finally, ability issues also may interfere with the process of accessing health care.

**Health Care Deserts: Background and Significance**

Similar to a food desert, a health care desert is described as a part of the country where needed resources, including medical, behavioral, mental, dental, and pharmaceutical health care services, are extremely limited or altogether unavailable. This concept is relatively new in the United States, and controversial in urban settings where transportation may be readily available. In health care desert neighborhoods, safety-net hospitals may be the only source of care for the community. An early proponent of the “medical” desert concept, Alan Sager, Professor of Health Law, Policy and Management at Boston University School of Public Health, warns that safety-net hospital closings are disproportionately affecting minority communities—occurring more frequently in African American neighborhoods, for example—leading to increased travel time and decreased availability of all services, including primary care services, whether hospital-based or private practice (1).

**Limited U.S. Research**

Although the available literature is limited, studies on urban health care deserts in the United States recently have been published. Qato and colleagues explored disparities in the use of prescription medications in an attempt to understand the impact of residential segregation and geographic accessibility. Using the 2007-2011 American Community Survey, 2000 to 2010 U.S. Census, and Health Resource and Services Administration data, they were able to identify
pharmacy desert communities as having both low access and low income. Their research suggests that of Chicago’s 802 census tracts, 32 percent are pharmacy deserts, including 54 percent of the segregated black communities. They concluded that disproportionately more pharmacy deserts exist in medically underserved areas, low-income, and segregated black communities of Chicago (9).

Crandall and colleagues studied the concept of trauma deserts in order to examine the impact of distance to a trauma center after a gunshot wound (GSW) (10). Their study examined the State Trauma Registry of Illinois, limiting data to Chicago-area GSWs. Utilizing multivariate regression, they found that mean transport time and unadjusted mortality are higher for patients suffering a GSW more than 5 miles from a trauma center (P < 0.001 for both). Additionally, suffering a GSW more than 5 miles from a trauma center was associated with an increased risk of death (OR = 1.23; CI = 1.02, 1.47). They concluded that relative trauma deserts in urban areas of Chicago adversely affect mortality from GSWs by limiting access to immediate care. These studies serve as recent examples of interest in studying the health care desert concept, but this research is limited in scope and service.

Access and Related Research

While not specifically focusing on the concept of health care deserts, researchers have studied health care access focused on hospitals and specialty services in urban areas. Guagliardo reviewed primary care spatial accessibility research, noting that the effects of distance to and supply of primary care on primary care utilization, especially in dense urban populations, has not been well studied, and that, in general, health care access research is limited due to a lack of commonly understood definitions, an over-focus on affordability, and a need for better measures, especially in congested urban areas (33). Specifically, Guagliardo reviewed spatial analysis
measures employed for health care access research emphasizing urban areas, including provider-to-population ratios, distance to nearest provider, average distance to a set of providers, and gravitational models of influence by providers. He found that the use of provider-to-population ratios, popular due to their intuitiveness, suffer from limitations that include border crossings, limited appreciation of accessibility within borders, and travel impedance. He found that travel impedance, or travel cost, was often not an appropriate measure for urban areas since providers near the source of the study tended to be over-weighted. In addition, Guagliardo warned that the traditional methods for measuring distance to nearest provider and provider-to-population ratio do not account for social inequities in access and can be misleading in densely populated urban communities. He suggested that newer gravitational measure models that are being developed and that combine the concepts of distance and supply under a “spatial accessibility” rubric show promise for yielding more reliable results. Although these tools have become easier to use, they require more study. These newer models will likely play a role in better understanding complex health care desert conditions.

Research on access to care is not limited to medical care but includes behavioral and mental health services. Guerrero and Kao used 2010 data from the National Survey of Substance Abuse Treatment (SAT) Services and Geographic Information Systems (GIS) to explore access to integrated care (substance abuse and mental health treatment) (8). They stress the importance of considering the burden of traveling to integrated care for minorities and low-income individuals. Their outcome measure focused on SAT facilities that offered integrated care. The main independent variables were each facility’s coverage of “hot spots,” or neighborhoods with high concentrations of African Americans, Asians, Latinos, and low-income households. Their threshold was a 10-minute drive to a facility, which was based on health service and food desert
literature. The authors used spatial autocorrelation analysis to identify statistically significant clusters of census tracts with large concentrations of minorities (“hot spots”). Using independent sample t test, they found significantly less integrated facility coverage for Latino “hot spots” as compared to facilities without integrated care (17.6 percent versus 23.2 percent respectively; t = 2.26, p < 0.01). They also tested the interaction of Latinos and poverty “hot spots” coverage, finding statistically significant interaction with large odds ratio (OR = 1.70 x 10^6, p < 0.01). They concluded that racial/ethnic minorities and low-income communities had limited access to integrated care, with high-poverty Latino communities more significantly impacted. This research again supports the desert concept by identifying limited integrated resources in high-risk communities.

Some have recommended focusing efforts on expanding primary care supply in underserved areas as a solution to limited access and quality. It is clear from previous research that physician supply and access to care/quality of care is not a straightforward relationship. Grumbach and colleagues divided California into 394 communities based on state agency guidelines for defining primary care service areas. They analyzed a 1993 telephone survey of a probability sample of 6,674 California residents from 41 of the urban communities. In addition to comprehensive socioeconomic data, the survey included access to care questions. For example, respondents were asked to rate overall access to medical care using a measure shown to be highly predictive of preventable hospitalization rates at the community level, while other items focused on regular sources of care and travel time to that care. Additionally, the American Medical Association (AMA) Physician Masterfile and 1994 U.S. Census was used to calculate physicians per 100,000 population. The authors found that older, white, more educated, and privately insured individuals with higher incomes were more likely to live in areas with a larger
supply of primary care physicians. Unadjusted results of respondents living in shortage areas with fewer than 30 primary care providers (PCP) per 1000,000 population had the worst access to care on all six areas tested: 1) self-rated access; 2) number of visits in 3 months; 3) regular place for care; 4) travel time; 5) waiting time for appointment; and 6) percent of preventive services received. Once these results were adjusted using regression analysis to control for specific characteristics, however, physician supply no longer had significant independent association with visit rates, preventive care scores, or odds of having a regular source of care. Thus, the study concluded that poorer access to care in communities with lower physician supply could be explained by lack of insurance and other vulnerable population characteristics including socioeconomic status (SES) and minority/ethnic origin (34). From a public policy standpoint, this study supports the idea that the absolute number of physicians is not the only criteria that should be considered when examining health care access—the organizational structure in which physicians practice may be just as critical, and the racial and ethnic diversity of the physician workforce has been shown to be a significant factor as well. These results add to the literature supporting the need for not only addressing the absolute number of physicians but also holistically assessing impediments to care.

Regardless of the stage of care, patients with lower SES are at increased risk for being hospitalized for ambulatory care sensitive conditions (ACSC) (35–37). Low-SES patients are twice as likely as high-SES patients to have urgent ED visits (37,38). These patients are also four times more likely to require hospitalization, and more likely to return to the hospital after discharge (35,36,38–42). Additionally, low-SES patients require multiple hospitalizations for any given illness (43). Interestingly, these patients utilize 45 percent less ambulatory care services than high-SES patients. In an attempt to understand why patients with low-SES use
more acute care hospitals and less primary care than patients with high-SES, Kangovi and colleagues employed qualitative methods and found that low-SES patients perceived hospital care as less expensive, more accessible, and of higher quality (44). Most participants believed that hospital care provided better overall access and trusted the technical quality of hospital providers and services. The authors offered three insights from their research: 1) the preferential use of hospitals instead of ambulatory care was related to perceptions that hospitals offer better access and quality; 2) low-SES patients face a heterogeneous set of challenges; and 3) patients’ use of hospitals was not irrational, but based on strongly held beliefs. This research can be used to guide policy development when considering solutions for health care deserts.

Access to primary care is not the only issue to address in health care desert communities, but the positive impact of access to primary and preventative care has been well-documented. Chang and colleagues found that as compared to areas with the lowest levels of primary care, areas with the highest levels had fewer ACSC hospitalizations, lower mortality, and similar Medicare spending (45). Using statewide hospital discharge data for general acute care hospitals in Pennsylvania, Parchman and Culler investigated preventable hospitalization in primary care shortage areas (46). They found the number of family and general practice physicians per population had a significant association with the rate of admission for adult preventable hospitalizations \( (r = -0.53, p = 0.005) \). This relationship is negative, indicating that as the total number of physicians increases, the rate of avoidable hospitalizations decreases. Also, to determine whether the relationship between physicians and admissions was affected by income a regression equation was used, which supported the initial finding. These studies support the hypothesis that living and receiving care in a desert negatively impacts health outcomes.
Framework of Urban Health Care Desert

A formal, widely accepted framework for describing an urban health care desert does not exist. To assist in studying the impact of living in an urban health care desert, this study proposes the following framework: urban health care deserts are areas with limited access to hospitals and other health care services, particularly in low-income, minority neighborhoods and communities. The basic requirements include: 1) medically underserved area or population (MUA/MUP) designation; 2) an index of medically underserved (IMU) of 62 or lower; 3) health professions shortage area (HPSA); and 4) area characteristics with greater than 40 percent of population below 200 percent of the federal poverty line.

An MUP is also described as a low-income and Medicaid-eligible population, or a population that is culturally or linguistically challenged. The IMU is based on weighted values for: 1) ratio of primary care FTE per 1,000 population; 2) infant mortality rate; 3) percent of population with income below 100 percent federal poverty level; and 4) percent of population 65 years of age and older. The value of each of these areas is calculated based on set criteria, weighted, and added together to obtain an area’s IMU. An IMU of 62 or lower is generally accepted to designate an area as underserved. Traditionally, an underserved designation is used to prioritize distribution of federal and state funds to provider shortage areas. Shortage areas may include primary care shortages with a ratio of 1 provider to 3,500 population or greater; dental care shortage with a ratio of 1 provider to 5,000 population or greater; or behavioral care shortage with a ratio of 1 provider to 30,000 population or greater. When this ratio was selected in 1974, as described in the 2007 Ricketts and colleagues’ article, “Designating Places and Populations as Medically Underserved: A Proposal for a New Approach,” the average population-to-primary-care-provider ratio among all counties was 2,360:1, and the ratio was
selected at 1.5 times the normative (47). In addition, federal criteria for shortage areas also includes data related to an area’s: geography (unusually high needs area, for example), population (low income or Medicaid-eligible), or facilities (federal and state correctional, public or private).

This definition of an urban health care desert will allow for more widespread investigation of its impact on the health of the community. The Northern and Central Brooklyn desert communities selected for this study meet the inclusion criteria, while the comparison communities in other parts of Brooklyn do not.

**Economic Theory: Food Deserts Versus Health Care Deserts**

Bitler and Haider applied standard economic analysis to food deserts and food desert literature (48). Their analysis was comprised of four components that concerned issues related to: 1) defining the relevant products; 2) demand; 3) supply; and 4) the “market” (48). In defining the relevant products, the authors noted that when considering a food desert, the primary product is healthy and nutritious food. However, they asserted that defining what constitutes healthy food in a food desert is challenging; while fresh fruits and vegetables are an obvious choice, other considerations, including whether food is fresh or frozen, are critical. Place is a key factor in this determination. Expectedly, place impacts all four of the food desert areas reviewed, such as, among many factors, the ability to access food as related to the geographical proximity of markets to home or places frequently visited. When considering demand, the authors suggested the basic determinants include income, price, and preferences. If healthy food is thought of as a normal good, this suggests the demand for healthy food is likely to increase with income level. As such, fewer stores with healthy food would be located in low-income areas. With respect to food deserts, the primary concern is that a lack of financial resources and of a social safety net
impacts demand for food, and therefore availability of supply. In terms of supply, the basic
determinants are the input costs, such as those required for running a food outlet, which includes
labor, land, equipment, transportation, stocking, inventory, and product costs. Fixed costs and
economies of scale, scope, and agglomeration are also important considerations. For economies
of scale, the per unit operational costs decline with the size of the store, while economies of
scope refer to the situation where per unit operating costs decline with product variety.
Economies of agglomeration refers to the situation where per unit costs decline when stores are
located close together. Reviewing the fourth component, Bitler and Haider described how, in the
market, suppliers and demanders exchange money for products, thereby determining product
availability and price. Under conditions where consumers and supplying companies do not have
excess market power, competition results, and price is determined relative to supply and demand,
with less demand incurring lower prices, for example. This assumption of perfect competition
conditions suggests that the market should function this way anywhere and require no
government intervention. Food deserts, however, do not adhere to these market assumptions. The
authors concluded that market failures in food deserts may be caused by the lack of competition,
inadequate information for consumers, as well as externality, whereby individuals do not suffer
the full costs or reap the full benefits of the choices they make (48).

Leibtag of the USDA’s Economic Research Service outlined the dynamics of the food
shopping environment, highlighting the three main factors that determine retail food prices,
including costs of goods sold and operating costs, the dynamics of competition in the market,
and consumer demand (49). He further explained that almost 40 percent of every dollar that
consumers spend is labor related. Additional stress to the system includes the rise of
nontraditional food retailers that offer lower prices and larger quantities. Changing the food
shopping environment has many potential benefits, including: 1) limiting or expanding range of choices available to consumers; 2) increasing access to healthy food; 3) complementing individual behavioral change programs; and 4) providing long-term sustainability (49). Options for interventions have focused on increasing availability, reducing price, and promoting healthier choices. Wrigley, Warm, and Margett’s 2003 study, “The Leeds Urban Regeneration Supermarket Intervention Study,” described the “natural experiment” of opening a new supermarket in a food desert (50). This experiment involved a two-wave household panel study, which found 45 percent of respondents switching to the new store for their food shopping, and a small but significant increase in fruit and vegetable consumption. As for price manipulation, it is clear that price is a significant concern in food deserts. To improve food desert conditions, these studies suggest policy interventions from both top-down and bottom-up approaches can be applied to increase shopping options. Potential policy interventions include determining sites for supermarkets, encouraging supermarket entry, focusing on small stores, and expanding farmers’ markets in low-income communities. Unfortunately, the ability to measure the specific public health impact of each of these interventions is limited.

Economic theory can be extended to health care deserts because many of the same economic forces are at play. Hospital closures secondary to market failure could further exacerbate desert conditions. Sager, studying hospital closures from 1937 to 1980, found that “hospital closings have reinforced patterns of care under which this nation’s poorest urban citizens are served in the world’s costliest hospitals, or not served at all” (51). What we understand regarding hospital closure is that hospitals that are for-profit, have financial losses, are smaller in size, provide fewer services, or have lower occupancy rates are more likely to close regardless of location. Studies examining hospital closure can be divided into two
categories: those investigating financial factors and those investigating non-financial factors. At the most basic financial level, it seems to make sense that inefficient, underutilized hospitals should close (52). While it would be beneficial if the hospitals serving urban communities were highly efficient and well utilized, even when less efficient or underutilized hospitals close in inner cities, it negatively impacts access and outcomes for minority, elderly, and poor populations (53). From a financial perspective, hospitals with higher leverage, low liquidity, low resource availability, and low profitability are more likely to close. In addition, researchers have also investigated hospital characteristics and environmental influences as they relate to hospital closures. While small hospitals with low occupancy and less complicated case mix index (CMI) are more likely to close, length of stay was not found to impact closure. Williams and colleagues examined per capita income, population density, and unemployment on closures, finding no difference (54). This research illustrates the complex environment impacting health care deserts and the hospitals that serve these communities.

Using data from the American Hospital Association (AHA) annual survey, Medicare cost reports, area resource files, and local area unemployment statistics, Ramamonjiarivelvo and colleagues studied whether financial distress was associated with privatization among public hospitals (55). They found that public hospitals in financial distress had greater likelihood of being privatized than non-distressed hospitals at 1 year (OR = 4.53, p < 0.001) and at 2 years (OR = 3.05, p = 0.001). They concluded that privatization eases access to resources and may provide financial relief to government entities. Additionally, privatization may prevent closure and preserve access to care for certain communities. While this study seems to support privatization, the option does raise concerns in certain urban communities and has faced strong opposition in NYS.
Another economic influence on the viability of hospitals and providers is the role of Medicare. Feldman and colleagues of the George Mason University Mercatus Center published “Medicare’s Role in Determining Prices Through the Health Care System” in 2015 (56). The study had four purposes: 1) to explain the relationship between the prices paid by Medicare and those paid by private insurers; 2) to define the optimal prices and issues encountered when pursuing them for both Medicare and private insurers; 3) to describe the process for “real world” Medicare price setting and problems related to that approach; and 4) to examine different ways that Medicare fee-for-service could set prices closer to an optimal price. The report explained how Medicare sets prices through a set of administrative calculations using the Resource-Based Relative Value Scale (RBRVC). It also revealed a number of problems related to price setting, including that: the AMA committee responsible for setting prices was dominated by medical specialty groups; incentives to reduce prices for services with productivity increases were not present; and work values were not based on a broad representation of physicians, but instead a small and nonrandom sampling. While health care legislation was implemented that was expected to limit Medicare physician payments to small or zero annual increases in the foreseeable future, other provisions would also impact payments, including a value-based provision that would offer adjusted physician payments based on the cost and quality of services. In addition the report described a pilot program that was initiated to develop and test a bundled payment approach, which would include physician, inpatient, outpatient, and post-acute care fees, that could be extended if found successful in meeting its objectives. Considering models for evaluating the relationship between Medicare prices and prices paid by private insurers, the authors described how the standard economic model assumes that providers maximize profits, and when Medicare cuts prices, providers cut prices to attract more patients; while the cost-
shifting model assumes that providers have unexploited ability to increase profits, and providers exploit their market power by raising prices for private patients when Medicare cuts its prices. Debate regarding the two models suggested that hospitals that may have participated in the cost-shifting model no longer were, but also that the standard economic model could be implicated in serving fewer Medicare patients to maximize profits. The authors concluded that reductions in Medicare hospital prices were unlikely to increase prices paid by private insurers; lowering Medicare prices would result in reduced hospital services and quality for Medicare recipients; and that Medicare payment reductions to physicians were associated with decreased private insurer prices and access. With respect to the optimal pricing for public and private plans, insurance tended to increase the use of health care services and weaken consumer incentives to protect their health. Additionally, many health care markets were concentrated and imperfectly competitive because providers had market power to increase costs above marginal costs. Finally, markets for both health insurance and health care suffered from market failure based on poor information for those procuring insurance or care, the pricing power of providers, and distorted pricing.

Another approach to investigating hospital closures was conducted by Jervis and colleagues, who applied financial ratios models and a behavioral model of health services use to examine inner-city hospital closure (57). They used Office of Inspector General data that identified closed hospitals from 1997 to 2000, and, for comparison, selected open general medical surgical facilities within 25 miles of closed hospitals’ zip codes. The financial variables included leverage, liquidity, resource availability, and capital efficiency, while behavioral model variables included population age, minority status, and rates of poverty, unemployment, and mortality rate. They also considered hospital variables, including system relationship and
teaching status, case mix index, occupancy rate, percentage Medicare and Medicaid, and supply of physicians. The authors found that based on the financial ratio hypotheses, hospitals with high levels of debt were more likely to close. Applying the health service use model, hospitals with high proportion of minorities were more likely to close, while those with higher levels of elderly were more likely to remain open. Other variables that predict closure include low CMI and low occupancy. These models may be helpful in identifying urban desert hospitals that are critical to their communities, but at-risk for closure, which would thus compound the desert conditions.

In well-functioning markets, insolvency results from inefficiency and/or low demand. A study examining the closures of hospitals in the mid-1990s found that hospitals destined to close had occupancy rates around 48 percent, versus 64 percent in more stable alternatives (58). Capps and colleagues have suggested that the hospital industry “is comprised of a large number of non-profit and local government-owned hospitals and operates in a market that is rife with moral hazard and adverse selection” (59). Additional complications of the hospital industry include set rates for hospital services by Medicaid and Medicare, price disruptions, and adjustments based on supply and demand conditions. The authors go on to describe the market distortions that may justify hospital bailouts. These distortions include: 1) imperfect competition as hospitals cannot price discriminate and some prices are regulated; 2) absence of profit motivation; and 3) utility loss from hospital closure that impact local communities, while the cost savings accrue locally as well as federally. Using a structural demand model and information about actual choices, they computed the value of each hospital in their sample and the reduction in utility should the hospital close. Additionally, they measured changes in market costs, or the costs of treating the closed hospitals’ patients at other hospitals as opposed to costs at the closed hospitals, using the simulation methods of Lindrooth and colleagues (58). The authors calculated total welfare
changes due to closure as the total sum of access and cost effects. They asserted that most urban hospital closures increased total welfare. Specifically, a hospital that is unable to at least break even also is unable to create more value than costs. They did note that in their selected hospital markets, occupancy rates varied between 55 and 63 percent. They concluded that barring unique circumstances, policy makers should resist the pressure for bailout. This study should be viewed with caution in densely populated urban settings where closures occur even with high occupancy rates and where total number of beds per population is low.

Buchmueller and colleagues studied hospital closures in Los Angeles County between 1997 and 2003 in order to assess effects on access and health outcomes (53). The authors noted that while significant attention had been paid to hospital closures, little was actually known about the impact on patients; most of the research had focused on the supply side of the market, specifically determinants of closure and operating efficiencies of remaining hospitals. Research was conducted on the impact of closure on access and health outcomes on rural communities (34,60) using analysis of two data sources: the household surveys conducted by Los Angeles County Department of Health Services between 1997 and 2002, and annual administrative zip code-level mortality data. The authors reported that increased distance to the nearest hospital was associated with lower probability of identifying an emergency room or an outpatient hospital clinic as a usual source of care, and increased probability of reporting a doctor’s office as a place for usual care. Distance was negatively related to perceived access for lower-income residents who have an increased reliance on hospitals. As for unintentional injuries and acute myocardial infarctions, increased distance was associated with increased deaths, together translating into an additional 0.873 deaths per affected zip code. Interestingly, hospital closures were associated
with increased probability of colon cancer screenings among those with insurance. While these results appear mixed, overall the impact of closure was negative in this urban community.

Another unique aspect of the hospital market is the financial impact of adverse events. Adler and colleagues examined the impact of all-cause inpatient harm on hospital finances and patient clinical outcomes (61). They conducted a retrospective analysis of 24 hospitals from 2009 to 2012 using the Institute of Healthcare Improvement Global Trigger Tool for measuring adverse events. They examined 716,172 hospital inpatient discharges across the Southern and Central U.S., ultimately including a study population of 21,007. Employing traditional health services research methods, multivariate logistic models were used to measure binary outcomes including mortality and readmission, while linear regression was used to estimate continuous outcomes measures including costs, contribution margin and length of stay. A patient with harm was found to have higher total and variable costs, lower contribution margin, longer length of stay, and higher mortality probability. The study concluded that adverse clinical and financial outcomes exist for inpatients that experience harm, including a three-fold increase for readmission after adjusting for severity of illness and other cofounding factors. Clearly, adverse events negatively impact the patient and their family, but also the hospital providing the care.

A key provision of the Affordable Care Act was to reduce Medicare hospital readmissions by improving quality of hospital care. This program financially incentivizes hospitals to focus on transitions of care after discharge. Shin and colleagues discuss the unintended consequences of this program by examining readmit rates following coronary artery bypass graft surgery, finding that hospitals serving a larger proportion of African American Medicare patients had higher rates of readmission than non-minority-serving hospitals (62). They also found that the Hospital Readmission Reduction Program (HRRP) had a negative financial
impact on minority-serving hospitals, and that minority patients undergoing surgery in minority-serving hospitals had higher rates of comorbidities. Tsai examined readmission rates for both black and white patients, finding black patients more likely to be readmitted even at non-minority-serving hospitals (63). These two studies suggest that structural characteristics and lack of resources in minority-serving hospitals underlie the higher postoperative readmission rate. Hawn’s research suggests that the HRRP is a cost-shifting measure that penalizes hospitals caring for the sickest and most vulnerable populations (64). As can be seen from this discussion, the health care industry is unique in that straightforward economics cannot adequately begin to describe the complex nature of the market.

From an economic standpoint, urban health care desert communities form when there is little incentive for primary, specialty, behavioral health, and hospital-based services to develop and thrive in urban communities. These communities are typically impoverished, minority communities that lack many basic health care services. Because community members are often under- or uninsured, they have limited ability to pay for needed services. While there is no requirement for primary care practices to treat patients without insurance, hospitals are required to provide emergency care and stabilize patients. The fact that these hospitals provide uncompensated or poorly compensated care leads to financial instability and possible closure without public support. These negative economic conditions allow for the development of health care desert communities, ultimately affecting the health of their residents.

Fundamental cause theory, proposed by Link and Phelan, attempts to explain why the association between SES and health disparities persists over time, even when diseases and risk factors have radically changed (65). The four key components they highlight related to SES-associated disparities are: 1) multiple disease outcomes; 2) disease outcomes related to multiple
risk factors; 3) limited access to resources that assist in avoiding health risks or minimizing damage once disease occurs; and 4) the reproduction of the association over time “via the replacement of intervening mechanisms” (65). The theory regarding intervening mechanisms points to ways that advances in knowledge about a disease, for example, reduces the disease impact in high-SES communities and yet often does not in low-SES communities. Key resources that are implicated in this effect on low-SES individuals include a lack of: 1) knowledge; 2) money; 3) power; 4) prestige; and 5) beneficial social connections. Thus, the theory of fundamental cause purports that despite intervening mechanisms, persistence of resource disparities perpetuates unequal outcomes. Using this theory to explore the impact of health care desert communities allows for a better understanding of why these conditions persist over time.

In consideration of fundamental causes and food deserts, Powell—using data from the American Chamber of Commerce Research Association and Dun and Bradstreet—investigated food desert demographics and socioeconomic status (49). They reported that, controlling for other factors: 1) African American populations had one-half as much access to chain supermarkets as Caucasians; 2) Hispanic populations had one-third the access to chain supermarkets as non-Hispanics; 3) lower-income neighborhoods overall had less access to chain stores than middle- and upper-income neighborhoods; and 4) independent, non-chain stores were more prevalent in predominantly African American and Hispanic communities than in predominantly Caucasian communities (49). In an attempt to investigate longitudinal data, Powell reviewed changes in food availability in 1997 versus 2008 for African American predominant and Caucasian predominant neighborhoods (greater than 70 percent of either race), finding African American neighborhoods with the smallest increase in overall availability. By
income, lowest income neighborhoods had the smallest growth in access and the largest decrease in number of stores.

Urban residential segregation between black and white populations remains high. This segregation affects health outcomes through a variety of pathways including: 1) socioeconomic advancement constrained by limited educational quality and employment; 2) increased exposure to unfavorable neighborhood environments (crimes, hazards, limited municipal services, food deserts); and 3) segregation of health care settings with disparities in quality of treatment (66–69). Gaskin and colleagues recently published a study linking residential segregation to availability of primary care providers, finding a 67 percent higher likelihood for African Americans to reside in a primary care shortage area (70). They applied fundamental cause theory to explain how residential segregation operates to influence access and utilization of health care services. They assert that the theory can be extended to describe how other mechanisms of structural inequality operate to influence access to and use of health care services (70).

Mackenbauch and colleagues tested the fundamental cause theory in health by comparing the magnitude of inequities in mortality between more- or less-preventable causes of death in 19 European populations (71). They examined the impact of larger resources inequalities in larger countries on mortality from preventable causes. They reported that their study generally supported the fundamental cause theory with the exception of Southern Europe, where resource inequalities are more significant but inequalities in mortality from preventable causes are small.

Applying the theory of fundamental causes to the persistence of food deserts and health care deserts may answer some important questions. Some may question why either desert population would continue living in a desert. For example, why would a community member knowingly remain in an underserved or under-resourced area? The application of the theory
illustrates how this could happen. Desert residents potentially lack the knowledge, money, power, prestige, and beneficial social connections to leave the desert. Living in either desert community, unequal outcomes persist, including multiple disease outcomes, multiple risk factors, limits access to resources, and the reproduction over time, despite intervening mechanisms. The theory of fundamental causes can be applied to both food desert and health care desert persistence, and may help guide public policy interventions to address these conditions.

**Conclusion**

The food desert concept has found a place in both academic research and public policy debate. The widespread acceptance of the concept has allowed for dedicated research and policy interventions to address concerns related to the effects of living in a food desert. It is clear that coining the term “food desert” was an important step in advancing both academic study and policy engagement. An urban health care desert is also a concept whose time has come. The proposed framework of an urban health care desert includes: 1) medically underserved area or population designation (MUA/MUP); 2) an index of medically underserved (IMU) of 62 or lower; 3) health professions shortage area (HPSA); and 4) area characteristics with greater than 40 percent of the population below 200 percent of the federal poverty line. Urban health care desert communities must be identified in order to further research and develop public policy interventions. These communities are at significant risk secondary to poor living conditions and limited access to health care. Desert communities have formed because of economic market failures that lead to safety-net hospital closures and limited primary/preventive and mental/behavioral health services, while fundamental causes act to keep many residents from seeking care outside the desert. The remainder of this study will explore the impact of living in a
Brooklyn health care desert community on medical and mental/behavioral health utilizing secondary data analysis of the SPARCS database. This study will conclude with specific public policy recommendations to attempt to improve the health of high-risk urban health care desert communities.
CHAPTER 3:

THE INFLUENCE OF LIFE IN A HEALTH CARE DESERT ON MEDICAL HEALTH CARE ACCESS AND QUALITY

Brooklyn and the Brooklyn Health Care Crisis

Brooklyn’s population is 2.5 million, or approximately one-third of the total NYC population. According to information based on the 2013 U.S. Census, approximately 1 in 3 residents in Brooklyn (34.2 percent) self-identify as African American, a much larger proportion than in NYC (25.1 percent) or NYS (15.7 percent) (72). Approximately 16 percent report being of Caribbean descent. One-fifth of the population identifies as Hispanic/Latino of any race, while 1 in 10 identify as Asian. The diversity of the Brooklyn population is also seen in the economic composition of the borough, ranging from areas of wealth to areas with high concentrations of extreme poverty.

A report released by New York City Comptroller Scott M. Stringer in November 2015 finds that more than 962,000 NYC residents lack health insurance (73). His analysis, based on data from the 2014 American Community Survey, also reflects that the majority of uninsured are adults over the age of 18. In Brooklyn, approximately 344,000 people are uninsured (about 16 percent of the total uninsured population of NYS). Neighborhoods within Brooklyn with some of the highest uninsured rates include: Brownsville, 15,178 (12.3 percent of residents); Flatbush/Midwood, 21,379 (11.8 percent); Bedford-Stuyvesant, 11,809 (8.9 percent); and East New York, 13,754 (8.8 percent). By comparison, 7,037 residents in Park Slope (or 5.7 percent) are uninsured.

The Brooklyn health care landscape is a tale of two cities. Northern and Central Brooklyn communities suffer from a significant burden of disease, lack of services, and failing hospitals,
while the Western and Southern communities have a more robust health care infrastructure with
greater access to care and higher quality hospitals. The health care crisis in Brooklyn has been
evolving over time, but gained increased attention from local and state officials in the summer of
2011 when the Commissioner of the NYS Department of Health (DOH) created the Brooklyn
Medicaid Redesign Team. The Redesign Team was charged with assessing the viability of
Brooklyn hospitals and developing recommendations that would support the creation of a high
quality, financially sustainable health system. They produced the report “At the Brink of
Transformation: Restructuring the Healthcare System in Brooklyn” (74). The Team found the
following:

- Brooklyn faces daunting population health challenges. High rates of chronic disease
  are exacting a human and economic toll.
- Community health needs and health care resources vary widely by neighborhood.
  Disparities in health status are also associated with poverty, race, and ethnicity.
- Brooklyn hospitals compete for market share amongst themselves and with academic
  medical centers in Manhattan. Brooklyn patients, particularly those with commercial
  insurance and those seeking high-end surgical services, are increasingly seeking care
  in Manhattan.
- More than 15 percent of adult medical-surgical hospital admissions and 46 percent of
  all emergency department visits that do not result in a hospital admission in Brooklyn
could be averted through high quality, accessible care in the community. High rates
  of primary care treatable and preventable emergency department (ED) use and
  preventable (PQI) hospitalizations suggest that many Brooklyn patients are not using
appropriate, effective, and less costly primary care necessary to keep them healthy and out of the hospital.

- While nearly one-third of the residents of several Brooklyn neighborhoods report that they lack a primary care provider, there is also evidence that many Brooklyn patients seek care in the ED, not because they lack a primary care provider, nor because they believe their condition is urgent, but rather based on convenience or the nature of their primary care provider’s practice.

- High rates of preventable hospitalizations and above-average length of stay suggest that a significant portion of inpatient care in Brooklyn hospitals would not be necessary if primary and other outpatient care were improved and inpatient care were managed more efficiently.

- Heavy use of hospital services among people with mental illness and substance misuse disorders suggests that these conditions, and associated co-morbidities, could be managed better in the community.

- As currently structured, six Brooklyn hospitals—Brookdale Hospital Medical Center, Brooklyn Hospital Center, Interfaith Medical Center, Kingsbrook Jewish Medical Center, Long Island College Hospital, and Wyckoff Heights Medical Center (collectively referred to as the “focus hospitals”)—do not have business models or sufficient margins to remain viable and provide high-quality care to their communities. Three of these hospitals—Interfaith, Brookdale, and Wyckoff—are experiencing financial crises and require aggressive action.

Further, in 2012 the Brooklyn Healthcare Improvement Project (BHIP)—a 33-member group including six hospitals, two federally-qualified health centers, numerous community-based
organizations, nine public and commercial health insurance companies, a pharmaceutical company, primary and behavioral health care advocacy groups, the NYC DOH, and others—issued an additional report, “Making the Connection to Care in Northern and Central Brooklyn,” which includes a community health needs assessment and several recommendations (75). The BHIP reported the following:

- There appears to be a shortage of quality, accessible primary care throughout much of the study area coupled with only partial utilization of existing primary care providers.
- Patients’ perceptions of their own emergency department usage suggest that a significant number could be seen in a more appropriate venue but that available options are inadequate to address patient needs.
- The majority of emergency department visitors are insured but are not well connected to primary care or other ambulatory care.
- The higher than average rates of potentially preventable emergency department visits and ambulatory care sensitive condition (ACSC) hospitalizations in the study area correlate to certain demographic and insurance categories.
- The most problematic health services utilization is concentrated in three distinct places: 1) Brownsville/East New York; 2) Crown Heights North/Bedford-Stuyvesant; and 3) Bushwick/Stuyvesant Heights.

These two reports, dating back to 2011, illustrate the precarious position of hospitals and overall health care in Northern and Central Brooklyn. Unfortunately, the situation has not improved significantly since their publication. Additionally, while some public policy interventions were initiated secondary to these findings, very little sustainable improvements have occurred.
A 2013 community survey, “The Need for Caring in North and Central Brooklyn,” looks at health care needs, barriers, and access in 15 Brooklyn zip codes (76). These zip codes were chosen because over 50 percent of respondents have Medicaid or are uninsured, they have the least number of full time equivalent primary care providers per 1000 population, and they have the highest percent of African American and Latino residents. The priority one zip codes include: 11237, 11221, 11233, 11207, 11206, and 11212.

The survey includes both qualitative and quantitative sections, and was administered to 644 residents in the 15 zip codes. Of the respondents, slightly more than 54 percent are between 26 and 50 years of age; nearly 66 percent are women; 44 percent self-identify as African American, and 25 percent as Caribbean/West Indian; 39 percent are foreign-born; more than 80 percent are black or Latino; and 58 percent report incomes less than $30,000 per year. The study also finds that 51.5 percent of African American respondents reported using emergency departments within the last two years. Additionally, over 50 percent of the insured African American respondents reported coverage by Medicaid as their source of medical insurance.

This study also provides information to better characterize the neighborhoods, allowing for precise recommendations. Regarding burden of disease, the authors recommend targeting specific illnesses by neighborhood. Throughout the study area, asthma, diabetes, and hypertension are reported as the most frequent reasons for visiting the ED. The highest prevalence of asthma is found in the following zip codes: 11212, 11208, 11207, and 11237. From the perspective of access to primary care, there is a need for more primary care practitioners that accept Medicaid and other government programs, especially in the 11212 zip code. Additional providers are needed in obstetrics and pediatrics in the 11212 and 11211 zip codes. Dental care services are needed in 11211, 11212, and 11205 zip codes. These six priority-
one zip codes are heavily concentrated in the Northern and Central Brooklyn neighborhoods, the
same neighborhoods examined in this study.

In April 2014, the Centers for Medicaid & Medicare Services (CMS) agreed with NYS’s
waiver to allow for reinvestment of approximately $8 billion in savings resulting from the state’s
Medicaid Redesign Team reforms. These funds are to be used to transform the state’s health care
system, promoting clinical and population health, and distributed through a Delivery System
Reform Incentive Payment (DSRIP) program. Preferred Provider Systems (PPS)—collaborative
partnerships across the continuum of care including hospitals, providers, and community-based
organizations—are key in the process.

To further inform the process, the NYC Health Provider Partnership published the
“Brooklyn Community Needs Assessment” in September 2014 (77). Conducted by the New
York Academy of Medicine, this borough-wide community needs assessment aimed to: describe
health care and community resources; describe communities served by the PPSs; identify the
main health and human service challenges facing the community; and summarize the assets,
resources, and needs for DSRIP projects.

The report identifies the following health care and community resources in Brooklyn: 1) 14 major hospital systems; 2) 16 ambulatory surgery centers and 103 office-based surgical
practices; 3) 21 urgent care centers; 4) 4 DOH designated health homes; 5) 19 FQHCs; and 6) 7,074 primary care physicians in 2013, or 282 per 100,000 population. In addition, as Brooklyn
is a diverse borough, pronounced health disparities exist. Racial and ethnic groups include
African American and Caribbean, Latino, Chinese, Russian, Polish, South Asian, and Arab
populations. Neighborhood characteristics range from extremely high incomes to very low
incomes, with high concentrations of public housing. The report found the distribution of
primary care providers uneven in Brooklyn, with low-income neighborhoods having the least number of providers—those neighborhoods with extensive public housing are believed to lack sufficient services to meet even the basic needs of the communities. The borough neighborhoods of Northern and Central Brooklyn in particular consistently rank poorly in markers of socioeconomic determinants of health, showing high degrees of household poverty and unemployment, lack of health insurance, low levels of education, and prevalence of disease. Further, these neighborhoods are perceived to have insufficient ambulatory capacity, poor quality and limited linkages to broader health care delivery systems. This report provided a comprehensive assessment of the “hot spot” communities in an effort to better inform local and state officials.

In November 2015, NYC DOHMH released updated community health profiles for the city’s 59 community districts (78). These districts were established citywide by local law in 1975, and correspond to NYC community boards. According to the Commissioner of the DOHMH, Dr. Mary Bassett, longstanding and rising income inequality and racial residential segregation have driven health inequalities between neighborhoods in disturbing ways: poor health outcomes are clustered in high poverty, minority neighborhoods. As she stated, “A person’s health should not be determined by the zip code in which they live.”

The data sources used for these community profiles included: U.S. Census/American Community Survey; NYC DOHMH Community Health Service; NYC DOHMH Vital Statistics; New York State SPARCS; NYC Housing and Vacancy Survey; NYC Community Air Survey; NYC Department of Consumer Affairs; NYC Department of Agriculture and Markets; NYC Department of Education; NYC Department of Corrections; NYC DOHMH Citywide Immunization Registry; and NYC DOHMH HIV/AIDS Surveillance Registry. For most data, 95
percent confidence limits were calculated for neighborhoods, boroughs, and NYC estimates. Additionally, most estimates were evaluated for statistical stability using the relative standard error. These reports provide the most up-to-date assessment of the desert and non-desert communities that will be compared in this study.

Desert Districts

District 16—the Brownsville neighborhood—has a population of 86,377 composed of 76 percent black and 20 percent Hispanic. Average life expectancy is 74.1 years, lowest in NYC and 11 years less than in Manhattan’s financial district, and 37 percent of residents live below the federal poverty level, making Brownsville the poorest neighborhood in Brooklyn. Also, 16 percent of residents are unemployed. Review of housing quality revealed that 73 percent of homes reported at least 1 maintenance deficit, ranking 12th in NYC, and 56 percent spend more than 30 percent of their gross income on rent. Tobacco retail stores are more prevalent in Brownsville than in the city overall, but supermarket access is better than in NYC as a whole. Almost one-quarter of adults have not completed high school and only 18 percent of adults have a college degree, while 40 percent of children miss 20 or more school days per year, the highest percentage in the city. Preterm birth, a major contributor to infant death, is the second highest in the city and the teen birth rate is higher than in both the rest of Brooklyn and the city. The incarceration rate in Brownsville is the second highest in the city, or 3 and 1/2 times the Brooklyn and NYC rates, while non-fatal injury assaults ranked 1st in the city.

Thirty-two percent of adults in Brownsville are obese with 15 percent diagnosed with diabetes. When evaluating access to health care, 18 percent of adults without health insurance reported late or no prenatal care. Examining health outcomes, Brownville ranks 4th in new HIV diagnoses and 10th in stroke hospitalizations among all NYC neighborhoods. Asthma
hospitalizations in both adults and children are twice the Brooklyn and city rates, and the avoidable diabetes hospitalization rate is highest in the city. The premature mortality (less than 65 years of age) rate is highest in the city, with infant mortality the fourth highest. The leading causes of death include: diabetes, HIV, HTN, and homicide—all at more than twice the city rates. It is estimated that 54 percent of Brownsville deaths could have been prevented.

The East New York and Starrett City communities of district 5 have a population of 183,971, composed of 52 percent black and 37 percent Hispanic. The average life expectancy is 77.7 years. Seventy percent of homes in this neighborhood reported at least 1 maintenance deficit, and 50 percent of district residents spend more than 30 percent of their gross monthly income on rent. Availability of tobacco retailers and supermarkets is similar to access citywide. With respect to educational attainment, the district has 19 percent of adults with college degrees, while 24 percent did not graduate from high school. Thirty-two percent of the population lives below the federal poverty level, and 14 percent are unemployed.

The rate of preterm births in this district is fourth highest in the city, and the teen birth rate is higher than NYC and Brooklyn overall. Thirty percent of children report missing 20 or more days of school, 8th highest in the city. The rate of incarceration is twice the Brooklyn and city rates, while the injury assault rate is almost twice the city rate. Thirty-one percent of adults in the district are obese, while 18 percent suffer from diabetes, ranking the district 1st in the city.

Twenty-six percent of district 5 residents were uninsured and 11.4 percent reported late or no prenatal care. Strokes are also common, ranking 9th highest for hospitalizations across the city. Asthma hospitalization rate among children and adults is higher than in Brooklyn or NYC, as are avoidable hospitalizations for adults with diabetes. The leading causes of death for district 5 include: heart disease, cancer, diabetes, and stroke. The infant mortality rate is higher than in
Brooklyn and NYC, ranking 5th. Regarding premature mortality, district 5 ranked 9th overall, higher than both Brooklyn and the city. It is estimated that 40 percent of district 5 resident deaths could have been averted.

District 3, also known as Bedford-Stuyvesant, has a population of 154,332, composed of 64 percent black and 20 percent Hispanic. The average life expectancy is 75.1 years. Sixty-seven percent of homes in this neighborhood reported at least 1 maintenance deficit, and 55 percent spend more than 30 percent of their gross monthly income on rent. Availability of tobacco retailers is higher than in Brooklyn and the city, while access to supermarkets is similar to access citywide. With respect to educational attainment, 30 percent of adults in district 3 earned a college degree, while 25 percent did not graduate from high school. Thirty-three percent of the population lives below the federal poverty level, and 17 percent are unemployed.

The rate of preterm births and the teen birth rate is higher than the city and Brooklyn average. Thirty-one percent of children report missing 20 or more days of school, 6th highest in the city. The rate of incarceration is more than double the Brooklyn and city rates, while the injury assault rate is twice the city rate. Thirty-three percent of adults in district 3 are obese, and 15 percent suffer from diabetes.

Regarding access to care, 20 percent of district 3 residents lack health insurance, and 8 percent reported late or no prenatal care. Strokes are also common, and the district ranked 8th highest for stroke hospitalizations. Asthma hospitalization rate among children and adults is higher than in Brooklyn or NYC, as are avoidable hospitalizations for adults with diabetes. The leading causes of death for district 3 are heart disease and cancer, while the death rates due to diabetes, HIV, and homicide are more than twice the citywide rates. The infant mortality rate is similar to the Brooklyn and NYC rates. Premature mortality in district 3 ranked 3rd overall,
higher than both Brooklyn and the city. It is estimated that 49 percent of district 3 resident deaths could have been averted.

These three districts meet the criteria set forth in Chapter 2 used to define urban health care deserts: 1) medically underserved area or population (MUA/MUP) designation; 2) an index of medically underserved (IMU) of 62 or lower; 3) health professions shortage area (HPSA); and 4) area characteristics with greater than 40 percent of population below 200 percent of the federal poverty line (FPL). In fact poverty is so extreme in the Brooklyn communities that over 30 percent are below the FPL.

**Non-Desert Districts**

District 6, also known as Park Slope and Carroll Gardens, has a population of 108,432, composed of 64 percent white, 18 percent Hispanic, and 10 percent black. The average life expectancy is 80.3 years. Sixty-nine percent of homes in this district reported at least 1 maintenance deficit, and 37 percent spend more than 30 percent of their gross monthly income on rent. Availability of tobacco retailers and supermarkets is similar to access citywide. Seventy-two percent of adults in district 6 earned a college degree, while 9 percent did not graduate from high school. Eleven percent of the population lives below the federal poverty level, and 7 percent are unemployed.

The rate of preterm births and the teen birth rate are lower than the city and Brooklyn average. Seventeen percent of children report missing 20 or more days of school, 30th in NYC. The rate of incarceration is lower than the Brooklyn and city rates, while the injury assault rate is half the city rate. Thirteen percent of adults in district 6 are obese, while 7 percent have diabetes.

Regarding access to care, 16 percent of residents lack health insurance, and 1.6 percent reported late or no prenatal care. The rate of hospitalization for stroke is lower than the Brooklyn
and citywide rates. Asthma hospitalization rate among children is lower than the Brooklyn and the city rates, but the adult rate is similar. Avoidable hospitalizations for adults with diabetes are similar to Brooklyn and city rates. The leading causes of death for district 6 are heart disease and cancer, while the death rates due to heart disease, flu, pneumonia, hypertension, and Alzheimer’s disease are higher than the citywide rates. The infant mortality rate is lower than the Brooklyn and city rates. Regarding premature mortality, district 6 ranked 38th overall, lower than both Brooklyn and the city. It is estimated that 28 percent of district 6 resident deaths could have been averted.

District 14, also known as Flatbush and Midwood, has a population of 165,840, composed of 37 percent white, 36 percent black, and 16 percent Hispanic. The average life expectancy is 81.5 years. Seventy-two percent of homes in this neighborhood reported at least 1 maintenance deficit, and 58 percent spend more than 30 percent of their gross monthly income on rent. Availability of tobacco retailers and supermarkets is similar to access citywide. With respect to educational attainment, 41 percent of adults in this district have a college degree, while 18 percent did not graduate from high school. Twenty-one percent of the population lives below the federal poverty level, and 10 percent are unemployed.

The rate of preterm births is similar to the citywide rate, but the teen birth rate is lower than the city and Brooklyn average. Seventeen percent of children report missing 20 or more days of school, 30th in the city. The rate of incarceration is similar to the Brooklyn and city rates, while the injury assault rate is lower than the city rate. Twenty-eight percent of adults in district 14 are obese, while 11 percent have diabetes.

Regarding access to care, 24 percent of residents lack health insurance and 8 percent reported late or no prenatal insurance. The rate of stroke hospitalization is similar to the city rate
but lower than the Brooklyn rate. Asthma hospitalization rate among children and adults is lower
than in Brooklyn or NYC, as are avoidable hospitalizations for adults with diabetes. The leading
causes of death for district 14 are heart disease and cancer, while the death rates due to diabetes,
stroke, hypertension and accidents are lower than the citywide rates. The infant mortality rate is
similar to the Brooklyn and NYC rates. Regarding premature mortality, district 14 ranked 29th
overall, lower than both Brooklyn and the city. It is estimated that 18 percent of district 14
resident deaths could have been averted.

These recent community reports underscore the difference in health between the desert
communities in Northern and Central Brooklyn and non-desert communities in Western
Brooklyn. The desert communities are characterized by limited primary care availability, high
utilization of emergency departments, and increased hospitalizations for Prevention Quality
Indicators (PQIs). Community safety-net hospitals, the primary providers of health care in these
communities, are struggling to continue operations. This crumbling health care infrastructure is
unable to support appropriate access, which will only worsen the poor quality of care provided to
these communities and further propagate the desert phenomena. This study will compare the
effects of living in desert and non-desert communities on health of the residents.

**Prevention Quality Indicators (PQIs): A Review**

PQIs were derived from late-1990s measures that were created by the Agency for
Healthcare Quality (AHRQ) as indicators of area-level outpatient access to quality care. Both the
AHRQ and the National Quality Forum have endorsed these indicators, and studies have found a
correlation between rates of potentially preventable hospitalization indicators with area-level
income, insurance status, and other socioeconomic measures (35). Higher hospitalization rates
have been associated with self-ratings of poor access to care and higher physician-to-population
ratios. These measures have been used to investigate issues of access at the regional level as well as in comparative reporting and pay-for-performance initiatives.

While the PQIs have been used for many years to evaluate access to care, Davies and colleagues used clinical expert review panels to assess expanding the use of PQIs (79). For this study, the authors convened a clinical panel using methods previously used to develop other quality and safety indicators. The clinical panel review processes were based on the RAND appropriateness method—a modified Delphi process also known as a nominal group technique. The nominal panel approach allows for open discussion between panel members, better consensus building, and thorough exploration of issues and questions, but is limited by size and reliability. Alternately, the Delphi method used a larger group of experts to independently evaluate indicators via a questionnaire. The questionnaire results were then distributed to a second round of experts for ratings. Advantages to this approach include the larger size and independent nature of the rating process, but it offers limited information sharing and is time-consuming. Panelists in this study were assigned to one of four groups: 1) nominal panel core (generalists); 2) nominal panel specialty; 3) Delphi core; and 4) Delphi specialty. They evaluated 12 indicators, eliminating pediatric and uncontrolled diabetes, for three potential uses (quality improvement, comparative reporting, and pay-for-performance) at four levels (area, payer, provider group, and long-term care). Additionally, the importance of risk adjustment was assessed using a four-point scale. Potential data elements included comorbidities, prior hospitalizations, emergency department visits, and pharmaceutical use in the past year, as well as socioeconomic status, race, age, gender, and need for interpretation services.

The results of the study were summarized in three ways: by indicator, specific use, and denominator level. Overall, most indicators were rated as useful for at least one application and
denominator level. Three indicators were rated as less useful, including perforated appendix, dehydration, and angina, with perforated appendix receiving low ratings for all applications and denominator levels. As for results by use, overall, panelists showed more support for quality improvement applications than for comparative reporting, with pay-for-performance garnering the least support. Three indicators were rated as “full support for use,” including diabetes short-term complications, asthma admission rates, and congestive heart failure. Panelists did not favor any one denominator, but did believe that all levels should be included when applying the indicators. Panelists rated all covariates presented as at least somewhat important to include in a risk-adjustment model. The panelists generally felt skeptical about utilizing the indicators in pay-for-performance initiatives, citing strong correlation with socioeconomic status and patient compliance. Though the results of this study were mixed, it supports the continued use of the PQIs in evaluating access to care and quality of care.

This study utilizes 12 Prevention Quality Indicators (PQIs), including: (PQI 1) diabetes – short-term complications; (PQI 2) perforated appendix; (PQI 3) diabetes – long term complications; (PQI 5) chronic obstructive pulmonary disease (COPD) or asthma in older adults; (PQI 7) hypertension (HTN); (PQI 8) congestive heart failure (CHF); (PQI 10) dehydration; (PQI 11) pneumonia – bacterial; (PQI 12) urinary tract infection (UTI); (PQI 13) angina without procedure; (PQI 14) uncontrolled diabetes; (PQI 15) asthma – young adults. This study explores the impact of living in an urban health care desert on access to and quality of medical care, and ultimately on health. It compares potentially preventable hospitalizations, length of stay (LOS), and potentially preventable emergency department (PPED) visits in desert and non-desert communities.

Potentially Preventable Hospitalizations: What We Know
Healthcare Cost and Utilization Project (HCUP) reviewed trends in potentially preventable hospitalizations from 2005 to 2010 (80). They specifically used AHRQ’s PQIs, including diabetes, circulatory diseases, chronic respiratory disease, and acute illnesses (pneumonia, dehydration, and UTI). For diabetes, there were no statistically significant changes in rates for long-term diabetes complications from 2005 to 2010 (122/100,000 to 116/100,000), lower-extremity amputations (35/100,000 to 33/100,000), or uncontrolled diabetes without complications (20/100,000 to 19/100,000). Rates of admission did increase by 23 percent for short-term diabetes complications (56/100,000 to 60/100,000). For circulatory diseases the rate of admission for CHF decreased by 21 percent (422/100,000 to 332/100,000), and angina without procedure decreased by 49 percent (36/100,000 to 19/100,000), while HTN admissions increased by 33 percent (46/100,000 to 62/100,000). For chronic respiratory illnesses, the rates of admission for asthma (214/100,000 to 213/100,000) and COPD (127/100,000 to 119/100,000) remained stable. For acute illnesses, admission for bacterial pneumonia decreased by 30 percent (419/100,000 to 296/100,000), and dehydration decreased by 38 percent (118/100,000 to 73/100,000). In contrast, the rate for UTI admissions increased by eight percent (180/100,000 to 194/100,000). These results show trends in hospitalizations for PQIs across the United States, revealing a mixed picture with some increases and some decreases from 2005 to 2010.

HCUP has also investigated racial and ethnic disparities in potentially preventable hospitalizations (81). For diabetes and diabetes with complications, black (relative rate of 4.98) and Hispanic (relative rate of 3.56) individuals were at significantly higher risk of being hospitalized than non-Hispanic white patients. For long-term diabetes complications and amputations, admission rates for black patients were 3.5 and 3.4 times higher, while for Hispanics the rates were 2.9 and 2.8 times higher. For HTN, black patients were five times more
likely to be hospitalized while Hispanics were 2.4 times more likely. This trend was also seen for CHF, 2.5 times more likely for black patients and 1.7 times for Hispanics. The rate of admission for COPD was similar for all groups. For acute conditions including perforated appendix, UTI, bacterial pneumonia, and dehydration, the differences were less pronounced but still noticeably higher for black and Hispanic patients.

The greatest proportion of PQI hospitalizations are for chronic conditions including asthma, COPD, HTN, CHF, and diabetes. Specifically looking at Medicaid recipients in NYS, the largest numbers of preventable admissions are concentrated in the areas of Northern and Central Brooklyn (82)—the desert neighborhoods focused on in this study.

Length of Stay (LOS): What We Know

HCUP also reviewed hospital stays in the United States in 2012 (83). The report found that the mean LOS was 4.5 days. LOS decreased by 0.2 percent per year between 2003 and 2012. Hospital utilization was significantly influenced by patient and hospital characteristics, with lowest income neighborhoods at 4.6 days and higher income neighborhoods at 4.4 days. Among adults, LOS increased as age increased with those over 65 years of age with the longest average length of stay (5.2 days). Though females were admitted at higher rates, their LOS mean was shorter than males (4.3 days versus 4.8 days). Additionally, differences were noted by region of the country, with the Northeast having the longest average LOS at 4.9 days compared to the West at 4.2 days. Medical stays were responsible for the largest proportion of hospital stays at 56 percent.

Looking at specific LOS per diagnosis, in 2010, CHF LOS was 5.0 days, while pneumonia LOS averaged 5.2 days. Angina LOS was 2.3 days and diabetes LOS averaged 4.6 days. Admissions for hypertension averaged 2.2 days. In 2008, admissions for COPD averaged
4.7 days. For acute conditions, UTIs were hospitalized for 3.6 days, asthma for 4.1 days, and dehydration for 2.7 days. These LOS by condition represent national comparisons and inform this study’s use of LOS as a measure to compare desert and non-desert health care.

LOS has been viewed as one of the most important metrics for assessing efficiency and cost effectiveness of hospital care. Reducing LOS and avoiding hospital-acquired conditions has gained widespread attention across the health care industry for both the potential impact on cost and quality. Interestingly, both shorter and longer LOS have been raised as potential markers for poor quality (84,85). Understanding that LOS is impacted by both clinical and non-clinical variables, this study utilizes LOS as a proxy measure for quality of care asserting that poor quality of care results in longer LOS.

Potentially Preventable Emergency Department (PPED) Visits: What We Know

With respect to PPED visits, HCUP reviewed treat-and-release visits from 2008 to 2012, using AHRQ PQI indicators (80). These indicators were examined individually as well as grouped by acute and chronic conditions. Over this time period the rate of PPED visits increased by 11 percent. The largest increase seen, 13 percent, was among visits for acute conditions, followed by a 10.2 percent increase in visits for chronic conditions. These rates increased at a faster rate than ED visits overall, which were 7.5 percent. The breakdown by individual diagnosis found that visits for uncontrolled diabetes without complication increased by 32.3 percent (17/100,000 to 23/100,000), while visits for HTN increased by 23.3 percent (258/100,000 to 318/100,000). Diabetes with short-term complications visits increased by 20.2 percent (7/100,000 to 9/100,000), while visits for COPD increased by 11.8 percent (629/100,000 to 703/100,000) and asthma by 8.6 percent (527/100,000 to 572/100,000). With respect to acute conditions, UTI visits increased by 16.7 percent (841/100,000 to 981/100,000), while visits for
dehydration (171/100,000 to 179/100,000) and pneumonia (218/100,000 to 223/100,000) increased by only 4.9 and 2.1 percent, respectively. Modest decreases were noted for diabetes with long-term complications (6.3 percent) and CHF (3.0 percent).

**Statewide Planning and Research Cooperative System (SPARCS) Data**

SPARCS is a comprehensive NYS all-payer hospital discharge data system. The system was established in 1979 as a partnership between the health care industry and NYS government. The system was initially created to collect hospital discharge data. Currently, data collected includes patient-level information (characteristics, diagnosis, treatment, services, charges) for every hospital discharge, ambulatory surgery patient, and emergency department visit in NYS.

The legislation for SPARCS is located under section 28.16 of the public health law, with regulations under section 400.18 of Title 10 of the Official Compilation of Codes Rules and Resolutions of New York State. The SPARCS Data Governance Committee was formed in September 2014 to review identifiable data releases. The committee supersedes the SPARCS Data Protection Review Board (DPRB). All previously approved DPRB requests were grandfathered in under the new governance structure. For this study, the original request for access to SPARCS data was approved under the DPRB.

SPARCS data may be used for medical or scientific research. A request to use identifiable data must be submitted to SPARCS operations using standard data request forms. Approved data users will take all necessary precautions to prevent revealing personal private information. There are 3 primary data file types: identifiable, limited, and de-identified. Identifiable data involves specific individual facility admission information, which, if disclosed, would constitute invasion of personal privacy. Identifiable data elements include dates of service, date of birth, address, and other unique personal identifiers. Limited data files have been stripped
of direct unique identifiers but still contain information that has potential to be identifying according to HIPPA standards. De-identified data is considered public use, because it no longer contains information protected by HIPPA—for example, generalized health care statistics and anonymous health care records. Publicly available data tables are accessible based on statewide, county, and hospital data. Data categories include: age, gender, principle reimbursement, service, major diagnosis, and disposition.

For the purpose of this study, limited data files for years 2010 to 2012 and specific to Brooklyn, NY, were requested. The data files were mailed to CUNY Graduate Center once use was approved. The files were accessed using an SAS read-in program for inpatient and outpatient encrypted files.

Methods

This chapter answers the following research question: What effect does living in the Northern and Central Brooklyn health care desert have on medical health care access and quality and thus overall medical health? As described above, this study utilizes SPARCS inpatient and outpatient data files from 2010 to 2012 as the primary data source and employs secondary data analysis to investigate the research question. The outcome of interest is poor medical health. The predictive variables for this outcome include: 1) potentially preventable hospitalizations as defined using AHRQ’s PQIs; 2) LOS rates; and 3) PPED visits. The exposure of interest is whether the hospital visits were within a desert or non-desert zip code.

Preventable hospitalizations are based on the PQI measures developed by AHRQ. The premise underlying the PQIs is that appropriate outpatient care could prevent the need for hospitalization or further complications. PQIs are population-based and adjusted for covariates. The rates are based on analysis of 45 states from the 2012 AHRQ HCUP SID. The SID contains
encounter-level information for all inpatient discharges for all payers, including demographics. For 2012, the HCUP database represents greater than 95 percent of all annual discharges in the United States. AHRQ released benchmark data for these quality indicators. The area-level indicators are scaled to the rate of 1,000 persons at risk. The 12 PQIs include: (PQI 1) diabetes – short-term complications; (PQI 2) perforated appendix; (PQI 3) diabetes – long term complications; (PQI 5) chronic obstructive pulmonary disease (COPD) or asthma in older adults; (PQI 7) hypertension (HTN); (PQI 8) congestive heart failure (CHF); (PQI 10) dehydration; (PQI 11) pneumonia – bacterial; (PQI 12) urinary tract infection (UTI); (PQI 13) angina without procedure; (PQI 14) uncontrolled diabetes; (PQI 15) asthma – young adults. For all but PQI 15 age was limited to 18 years and over. For PQI 15 the age was limited to adults 18 to 39 years old. The total population was reduced by 25 percent to account for the population under age 18. For PQI 15 an exact estimate was provided for adults aged 18 to 39 in each community. PQI 16, diabetes-associated amputations was eliminated from the study due to small numbers, which would limit reliability. Additionally, acute, chronic and overall PQI composite scores were calculated for both communities as well. The rates and confidence intervals will be compared using the Poisson model.

The Poisson Distribution was first described by famed French mathematician Simean Denis Poisson in 1837 (4). This mathematical rule assigns probabilities to the number of occurrences. The distribution is characterized by a single parameter, or mean number, of occurrences during the specific interval. The distribution is used to fit count data. Data produced by medical research often follows the Poisson Distribution, and differences or ratios of the Poisson means can be compared. The Poisson model is appropriate for this situation because the number of potentially preventable admissions or events in each of the study years are being
compared for each zip code, in each community. Additionally, because the number of events is small compared to the number at risk, the exact Poisson test is most appropriate. Finally, the confidence interval was calculated but a power analysis was not, as the width of the confidence intervals was clinically appropriate.

LOS was compared between desert and non-desert hospitalizations using the Wilcoxon rank sum test due to the non-normality of the LOS variables. This test is the nonparametric version of the 2-sample t-test without the assumption of normality. For visualization of the LOS, the log-transformation was used to reduce the right skewness. Additionally, because of the concern of selection bias—in that the LOS of the selected PQIs is dependent on the patients being admitted (non-random)—the Heckman correction was applied to the LOS data (5). The Heckman correction assumes normality and provides a test for sample selection bias and a formula to correct the bias. The two-step Heckman correction uses selected variables to correct for any selection bias. The model does have disadvantages as it is considered a limited information maximum likelihood estimator.

Results

Potentially Preventable Hospitalizations: Desert Versus Non-Desert

Table 3.1 illustrates the hospitalization rates for the 12 PQIs with confidence intervals and p values for both the desert and non-desert communities from 2010 to 2012. As illustrated, significant differences in hospitalizations between desert and non-desert communities for PQI 1, PQI 3, PQI 14, and PQI 15 were seen in all three years. These differences showed higher admission rates for desert community patients with several diabetes diagnoses as well as asthma. Significant differences are also seen for PQI 7, PQI 8, and PQI 13 in 2010 and 2011. These differences again showed higher rates of hospitalization for desert patients with HTN, CHF, and
angina. In 2010, desert community patients were hospitalized at higher rates for PQIs 5 and 11, for COPD and pneumonia, respectively. In 2011, desert community patients were admitted at higher rates for PQI 10, or dehydration. No significant differences were seen for PQI 2 and PQI 12.

We additionally calculated PQI 90 (1, 3, 5, 7, 8, 10, 11, 12, 13, 14, 15), or the composite, for all three years, and these differences were significant and in the direction of the desert communities. For PQI 91 (10, 11, 12), or the acute illness composite, significant differences were seen in 2012 in the direction of the non-desert communities and in 2010 in the direction of the desert communities. For PQI 92 (1, 3, 5, 7, 8, 13, 14, 15), or the chronic illness composite, significant difference was seen in all three years in the direction of the desert communities. To note, the composite, acute and chronic PQIs did not include perforated appendicitis nor lower extremity amputations because, by convention, perforated appendix is not included, and the rates of hospitalizations for amputation were too low to be reliable.

Length of Stay (LOS)

Because of skewness and non-normality, LOS data were log-transformed prior to analysis. Figures 3.1 to 3.12 illustrate the log LOS for each diagnosis by year. Table 3.2 illustrates the unadjusted arithmetic mean values for the LOS and p values from a Wilcoxon rank sum test. When comparing the log-LOS for desert versus non-desert communities, we found a significant difference in LOS for UTI (p < 0.001, p = 0.008, 0.006) and perforated appendix (p = 0.004, 0.005, 0.015) from 2010 to 2012, respectively. For bacterial pneumonia and COPD significant difference was found in 2011 and 2012 (p < 0.001, p = 0.007; p < 0.001, 0.001 respectively). For diabetes long-term complications, a significant difference was seen only in 2012 (p = 0.003). For dehydration, significant difference was seen in 2010 and 2011 (p = 0.009,
There were no significant differences between the desert and non-desert communities for the remainder of the PQIs across the three years. Hospitalizations for all but appendicitis in non-desert communities showed longer LOS. For perforated appendix, desert communities showed a longer LOS.

**Heckman Procedure**

For the 2012 LOS data, the Heckman procedure was employed. This two-step procedure corrects for the probability of having been admitted to the hospital in the first place. The probability of being admitted was modeled using age, sex, race, ethnicity, homelessness, and Medicare status. Table 3.3 illustrates these adjustments. As illustrated in the table, PQI 2 and 3 both had significantly different LOS. These adjusted LOS were also significant unadjusted. Adjusted LOS for PQI 1, 5, 8, 11, 12, 13, 14, and 15 were not significant.

**Potentially Preventable Emergency Department (PPED) Visits: Desert Versus Non-Desert**

Table 3.4 illustrates the emergency department utilization yearly rates (for each 100,000 residents) for the 12 PQIs with confidence intervals and p values for both the desert and non-desert communities for 2012. As illustrated there are significant differences between desert and non-desert communities for emergency department utilization rates for all PQIs except for PQI 2. The 11 PQIs that were significantly different showed that ED utilization was greater in the desert communities. Additionally, PQI 90 (1, 3, 5, 7, 8, 10, 11, 12, 13, 14, 15), or the composite, was also found to be significant, also showing greater utilization in desert communities. PQI 91 (10, 11, 12), or the acute illness composite, and PQI 92 (1, 3, 5, 7, 8, 13, 14, 15), or the chronic illness composite, were also significantly different, showing greater utilization in the desert communities.
Discussion

Potentially Preventable Hospitalizations

Diabetes diagnoses displayed the most consistent and persistent difference between the
desert and non-desert communities with respect to potentially preventable hospitalizations.
Hospitalizations for both short- and long-term complications of diabetes were found to be
significantly higher for desert communities for all three years. Specifically, PQI 1 refers to short-
term complications including ketoacidosis, hyperosmolarity, or coma, while PQI 3 refers to
diabetes-associated renal, eye, neurologic, circulatory, or other complications. Additionally,
admissions for uncontrolled diabetes were also significantly higher for desert communities
across all three years. It is clear from community data that our desert communities face a
significant diabetes-related burden of disease, but more importantly, our data indicates that desert
communities also receive less primary and preventive care, resulting in increased admissions for
this chronic illness. These results are worrisome as the long-term consequences of poorly-
controlled diabetes will continue to adversely impact these high-risk communities well into the
future.

With respect to cardiac and respiratory illness, admissions for HTN (PQI 8), CHF (PQI
7), and angina without a procedure (PQI 13) were significantly greater in desert communities in
years 2010 and 2011. As with diabetes, the data illustrates that for two of the three study years,
desert community residents were admitted for cardiac illness at an increased rate, indicating
either worse disease burden or less ability to manage these diseases on an outpatient basis—or
both. While the cardiac admissions were higher for the desert communities in 2012, the
difference was not significant; it is unclear as to why 2012 rates were different. Admissions for
asthma in young adults (PQI 15) were significantly higher in desert communities across all three
years, while COPD (PQI 5) admissions were only significantly higher for desert communities in 2010. As most asthma can be managed by primary care providers with detailed action plans and close follow-up, our data indicates that primary and preventative asthma care is limited in desert communities. Regarding COPD, it appears that better maintenance care is available in desert communities.

The acute care PQIs, dehydration, pneumonia, and UTI (10, 11, 12), essentially showed no difference between desert and non-desert communities. The only significantly increased admissions were seen in 2010 for pneumonia and 2012 for dehydration. Again, it is unclear why the hospitalization rates would vary over our study period. We know from community profiles that the desert community populations seek care in emergency departments at higher rates. This study’s results of emergency department utilization will be reviewed later in the chapter.

PQI 90, overall composite score, revealed that the desert communities had greater potentially preventable hospitalizations over all three years, thus supporting this study’s hypothesis that living in desert communities adversely impacts the health of residents as compared to non-desert communities. PQI 91, acute composite score, was only significantly different in 2010 for desert communities and in 2012 for non-desert communities, which is inconclusive and does not support nor refute the null hypothesis. This is the only PQI score that was significant in the direction of non-desert residents, indicating higher hospitalizations for acute conditions. PQI 92, chronic illness composite, was significantly higher for all three years in desert communities, again indicating a lack of primary and preventive care for several significant chronic illnesses. Finally, PQI 2, perforated appendicitis, was the only PQI that showed no significant difference between the two groups across all three years.
**Length Of Stay (LOS)**

The evaluation of LOS was limited to the 12 PQIs. The results were mixed. The overall trend was for longer LOS in non-desert communities, but the only diagnosis with consistently longer LOS across all three years was UTI. Others, including pneumonia (2011, 2012), dehydration (2010, 2011), COPD (2011, 2012), and diabetes with long-term complications (2012), were not consistent across the study period. Again, it is difficult to explain these findings, but they suggest longer hospitalizations for non-desert communities. The only diagnosis to have a longer LOS in the desert communities was perforated appendix, which showed a significantly longer LOS across the study period. This likely indicates a more protracted course, possibly secondary to a delayed diagnosis and increased complication rate. Interestingly, the hospitalization rate was not significantly different between desert and non-desert communities, but desert community patients hospitalized for perforated appendicitis required longer hospitalizations.

As previously described, the Heckman process was applied to the 2012 LOS data for admitted PQIs. Factors associated with having been hospitalized were controlled, including: age, sex, race, ethnicity, homelessness, and Medicare status. Significant differences were found for hospitalizations associated with perforated appendix (PQI 2) and diabetic long-term complications (PQI 3). For PQI 2, non-health desert communities had shorter LOS as compared to desert communities, consistent with unadjusted LOS data. For PQI 3, non-desert communities had longer LOS, also consistent with unadjusted LOS data for 2012, but not across all three study years. For short-term diabetes complications, COPD, CHF, dehydration, pneumonia, UTI, angina, uncontrolled diabetes, and asthma (PQI 1, 5, 8, 10, 11, 12, 13, 14, and 15) the differences in LOS were not significant. With the exception of UTI (PQI 12) hospitalizations, these findings
were consistent with unadjusted LOS data. For PQI 12 the unadjusted LOS was significant, with longer LOS in non-desert communities. This difference likely represents the introduction of bias into the LOS data.

*Potentially Preventable Emergency Department (PPED) Visits*

The results of the ED utilization analysis found that in all instances desert communities utilized emergency departments more frequently than non-desert communities. We did omit PQI 2, as the number of visits for perforated appendix were too small to be reliable. This data supports the previous findings that similar communities utilize emergency departments at a much higher rate. Our study specifically evaluated the use of emergency departments for acute and chronic illness visits. The most concerning finding is the use of emergency departments for chronic illness evaluation and management. It is clear that robust primary and preventive care in chronic disease can mitigate and delay disease progression. Unfortunately, episodic emergency department use in chronic disease management is a poor substitute.

**The Problem with Multiple Comparisons**

To investigate the impact of living in a health care desert on medical health, hospitalization rates of 12 PQIs were compared across three years (36 variables) and three composite scores (nine variables) in health care desert and non-desert communities. 2012 PPED visits for the 12 PQIs and an overall composite (13 variables) were also investigated. Additionally, the LOS rates for the 12 PQIs were compared in both groups across the three years (36 variables). The total number of variables tested to investigate the impact of living in a health care desert on medical health was 94. Testing this number of variables raises a concern for the multiple comparison problem—that some tests will have p values less than 0.05 purely by chance (type 1 error).
There is no universally accepted approach for dealing with this problem. The classic approach is to control the familywise error rate, also known as the Bonferroni correction (86). This method sets the p value for significance (alpha) lower by dividing 0.05 by the number of tests. In our example the p value of 0.05 would be divided by 117, resulting in a corrected p value of 0.004. It is appropriate to use the Bonferroni correction when a single false positive in a set of tests would be problematic. Fortunately, this is not a problem in this study where multiple hospitalization rates, LOS, and PPED visits are being compared. The Bonferroni correction would likely increase the false negative rate to unacceptable levels. An alternative to the Bonferroni correction is the Benjamini-Hochberg procedure that controls the false discovery rate, or the proportion of discoveries that are false positives (87). This rate would be set before collecting the data—typically to a high value of 0.1 or 0.2 if the cost of a false negative is high. The test is less sensitive than the Bonferroni correction when considering which tests constitute a “family.”

The goal of correcting multiple comparisons is to reduce the number of false positives. However, aggressively controlling the false positive rate can lead to increasing the number of false negatives. In certain situations it is appropriate not to control for multiple comparisons (88). As this study is an exploratory study, the decision was made not to correct the multiple test problem, but to limit the significant findings to only those diagnoses that have significance across all three study years and in the same communities. This decision limits significant findings for health care desert PQI hospitalizations to diabetes (short-term, long-term, and uncontrolled) and asthma in young adults. The importance in discovering all possible significant differences across the three years and in the same communities is that the findings may support future investigation. Additionally, significant difference was found for the composite PQI and
the chronic PQI. No significant difference was found in PQI hospitalizations in the non-desert direction. Significantly longer LOS in perforated appendix hospitalizations was found in the health care desert, while in the non-desert, UTI LOS difference was significant. The Heckman data for 2012 also found this significant difference. For PPED visits, access was limited to the 2012 data and the multiple comparison problem was not an issue for this limited scope.

Conclusion

This study has identified that living in an urban health care desert adversely impacts medical health, especially when considering chronic diseases such as diabetes and asthma. Desert community residents hospitalized for perforated appendix also are hospitalized for longer lengths of time as compared to non-desert communities. For 2012 PPED visits, desert communities utilized emergency departments more frequently than non-desert communities. This finding is of concern because it was significant for both acute and chronic illness evaluation and management. It is clear from this study that the burden of chronic disease in the desert communities results in increased hospitalizations and increased emergency department utilization. Clearly, chronic disease management outside of the emergency department and inpatient units in desert communities need to be evaluated and redesigned.
Table 3.1: Yearly Hospitalization Rates (per 100,000) for PQIs

<table>
<thead>
<tr>
<th>Year</th>
<th>Desert Rate (95% CI)</th>
<th>Non-desert Rate (95% CI)</th>
<th>P-value</th>
<th>Year</th>
<th>Desert Rate (95% CI)</th>
<th>Non-desert Rate (95% CI)</th>
<th>P-value</th>
<th>Year</th>
<th>Desert Rate (95% CI)</th>
<th>Non-desert Rate (95% CI)</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td></td>
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<td>2011</td>
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<td></td>
<td>2010</td>
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<tr>
<td>PQI 1 –</td>
<td>208 (181-238)</td>
<td>109 (90-131)</td>
<td>&lt;0.001</td>
<td>154 (131-180)</td>
<td>62 (48-79)</td>
<td>&lt;0.001</td>
<td>86 (69-106)</td>
<td>17 (10-27)</td>
<td>86 (69-106)</td>
<td>17 (10-27)</td>
<td>&lt;0.001</td>
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<td>Diabetes Short-term</td>
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<tr>
<td>PQI 2 –</td>
<td>34 (24-48)</td>
<td>49 (36-65)</td>
<td>0.124</td>
<td>17 (10-27)</td>
<td>28 (19-40)</td>
<td>0.135</td>
<td>10 (5-18)</td>
<td>8 (3-16)</td>
<td>8 (3-16)</td>
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<tr>
<td>Perforated Appendicitis</td>
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<td>PQI 3 –</td>
<td>405 (367-446)</td>
<td>319 (285-356)</td>
<td>0.002</td>
<td>338 (303-376)</td>
<td>233 (204-265)</td>
<td>&lt;0.001</td>
<td>193 (167-222)</td>
<td>116 (96-139)</td>
<td>50 (45-76)</td>
<td>&lt;0.001</td>
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<tr>
<td>Diabetes Long-term</td>
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<tr>
<td>PQI 5 –</td>
<td>274 (243-308)</td>
<td>256 (226-289)</td>
<td>0.46</td>
<td>188 (162-217)</td>
<td>161 (137-188)</td>
<td>0.164</td>
<td>118 (98-141)</td>
<td>59 (45-76)</td>
<td>59 (45-76)</td>
<td>&lt;0.001</td>
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<tr>
<td>COPD</td>
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<td>PQI 7 –</td>
<td>179 (154-207)</td>
<td>157 (133-184)</td>
<td>0.252</td>
<td>152 (129-178)</td>
<td>97 (79-118)</td>
<td>&lt;0.001</td>
<td>81 (64-101)</td>
<td>42 (30-57)</td>
<td>42 (30-57)</td>
<td>&lt;0.001</td>
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<td>HTN</td>
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<td>PQI 8 –</td>
<td>164 (140-191)</td>
<td>142 (120-167)</td>
<td>0.23</td>
<td>117 (97-140)</td>
<td>85 (68-105)</td>
<td>0.029</td>
<td>76 (60-95)</td>
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<td>PQI 10 –</td>
<td>152 (129-178)</td>
<td>142 (120-167)</td>
<td>0.6</td>
<td>79 (63-98)</td>
<td>44 (32-59)</td>
<td>0.002</td>
<td>102 (83-124)</td>
<td>83 (66-103)</td>
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<tr>
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<tr>
<td>PQI 11 –</td>
<td>336 (301-374)</td>
<td>383 (346-423)</td>
<td>0.086</td>
<td>255 (225-288)</td>
<td>229 (200-261)</td>
<td>0.256</td>
<td>131 (110-155)</td>
<td>74 (58-93)</td>
<td>74 (58-93)</td>
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<tr>
<td>PQI 12 –</td>
<td>286 (254-321)</td>
<td>334 (299-372)</td>
<td>0.059</td>
<td>207 (180-237)</td>
<td>231 (202-263)</td>
<td>0.272</td>
<td>126 (105-150)</td>
<td>114 (94-137)</td>
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<td>PQI 13 –</td>
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<td>40 (29-54)</td>
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<tr>
<td>PQI 14 –</td>
<td>111 (91-134)</td>
<td>79 (63-98)</td>
<td>0.024</td>
<td>90 (74-111)</td>
<td>58 (44-75)</td>
<td>0.011</td>
<td>53 (40-69)</td>
<td>24 (15-36)</td>
<td>24 (15-36)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Diabetes Uncontrolled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>PQI 15 –</td>
<td>117 (97-140)</td>
<td>46 (34-61)</td>
<td>&lt;0.001</td>
<td>91 (73-112)</td>
<td>31 (21-44)</td>
<td>&lt;0.001</td>
<td>47 (35-63)</td>
<td>12 (6-21)</td>
<td>12 (6-21)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>PQI 90 –</td>
<td>2289 (2196-2385)</td>
<td>2008 (1921-2098)</td>
<td>&lt;0.001</td>
<td>1738 (1657-1822)</td>
<td>1296 (1226-1369)</td>
<td>&lt;0.001</td>
<td>1023 (961-1088)</td>
<td>566 (520-615)</td>
<td>566 (520-615)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Overall Composite</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PQI 91 –</td>
<td>775 (721-832)</td>
<td>860 (803-919)</td>
<td>0.038</td>
<td>564 (518-613)</td>
<td>544 (499-592)</td>
<td>0.568</td>
<td>335 (300-373)</td>
<td>232 (203-264)</td>
<td>232 (203-264)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Acute Composite</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PQI 92 –</td>
<td>1514 (1439-1592)</td>
<td>1148 (1083-1216)</td>
<td>&lt;0.001</td>
<td>1174 (1108-1243)</td>
<td>753 (700-809)</td>
<td>&lt;0.001</td>
<td>688 (638-741)</td>
<td>334 (299-372)</td>
<td>334 (299-372)</td>
<td>&lt;0.001</td>
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<tr>
<td>Chronic Composite</td>
<td></td>
<td></td>
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### Table 3.2: Length of Stay for PQIs

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</thead>
<tbody>
<tr>
<td>1</td>
<td>Diabetes – ST</td>
<td>4.663</td>
<td>6.083</td>
<td>0.067</td>
<td>4.656</td>
<td>4.527</td>
<td>0.819</td>
<td>4.234</td>
<td>4.781</td>
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<td>2</td>
<td>Perforated appendix</td>
<td>7.212</td>
<td>3.812</td>
<td>0.004</td>
<td>7.648</td>
<td>4.475</td>
<td>0.005</td>
<td>6.138</td>
<td>5.069</td>
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<td>3</td>
<td>Diabetes – LT</td>
<td>6.934</td>
<td>6.942</td>
<td>0.117</td>
<td>6.503</td>
<td>7.257</td>
<td>0.279</td>
<td>6.262</td>
<td>7.18</td>
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<tr>
<td>5</td>
<td>COPD</td>
<td>5.068</td>
<td>5.443</td>
<td>0.168</td>
<td>4.843</td>
<td>5.67</td>
<td>&lt;0.001</td>
<td>4.661</td>
<td>5.244</td>
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<td>7</td>
<td>HTN</td>
<td>3.163</td>
<td>3.636</td>
<td>0.212</td>
<td>3.341</td>
<td>3.222</td>
<td>0.825</td>
<td>3.36</td>
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<td>8</td>
<td>CHF</td>
<td>4.585</td>
<td>5.208</td>
<td>0.148</td>
<td>5.36</td>
<td>6.062</td>
<td>0.31</td>
<td>5.252</td>
<td>5.495</td>
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<td>10</td>
<td>Dehydration</td>
<td>3.575</td>
<td>4.56</td>
<td>0.009</td>
<td>3.459</td>
<td>4.115</td>
<td>0.002</td>
<td>3.346</td>
<td>3.5</td>
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<td>11</td>
<td>Pneumonia</td>
<td>6.419</td>
<td>6.422</td>
<td>0.14</td>
<td>5.615</td>
<td>6.341</td>
<td>&lt;0.001</td>
<td>5.694</td>
<td>6.07</td>
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<td>12</td>
<td>UTI</td>
<td>4.586</td>
<td>5.966</td>
<td>&lt;0.001</td>
<td>4.716</td>
<td>5.576</td>
<td>0.008</td>
<td>4.74</td>
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<td>13</td>
<td>Angina</td>
<td>2.356</td>
<td>2</td>
<td>0.258</td>
<td>2.475</td>
<td>2.204</td>
<td>0.063</td>
<td>2.417</td>
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<td>14</td>
<td>Uncontrolled diabetes</td>
<td>3.424</td>
<td>4.431</td>
<td>0.248</td>
<td>3.729</td>
<td>3.558</td>
<td>0.513</td>
<td>3.591</td>
<td>3.555</td>
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<td>15</td>
<td>Asthma</td>
<td>2.314</td>
<td>2.48</td>
<td>0.318</td>
<td>2.928</td>
<td>2.609</td>
<td>0.327</td>
<td>2.68</td>
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### Table 3.3: 2012 Heckman Estimate Length of Stay for PQIs

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<th>PQI</th>
<th>Desert coefficient</th>
<th>P value</th>
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<tr>
<td>1</td>
<td>Diabetes – ST</td>
<td>0.10171</td>
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<td>Perforated appendix</td>
<td>-0.19886</td>
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<td>3</td>
<td>Diabetes – LT</td>
<td>0.13417</td>
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<td>5</td>
<td>COPD</td>
<td>0.07417</td>
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<td>10</td>
<td>Dehydration</td>
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<td>11</td>
<td>Pneumonia</td>
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</tr>
<tr>
<td>12</td>
<td>UTI</td>
<td>0.009579</td>
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<tr>
<td>13</td>
<td>Angina</td>
<td>0.03873</td>
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<tr>
<td>14</td>
<td>Uncontrolled diabetes</td>
<td>0.005501</td>
</tr>
<tr>
<td>15</td>
<td>Asthma</td>
<td>0.05197</td>
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Table 3.4: 2012 Emergency Department Utilization Rates (per 100,000 visits) for PQI’s

<table>
<thead>
<tr>
<th>PQI</th>
<th>Condition</th>
<th>Desert Rate (95% CI)</th>
<th>Non-desert Rate (95% CI)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diabetes Short-Term</td>
<td>88367 (87785-88952)</td>
<td>21050 (20767-21336)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2</td>
<td>Perforated Appendicitis</td>
<td>2 (0-7)</td>
<td>1 (0-6)</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>3</td>
<td>Diabetes Long-Term</td>
<td>332 (297-370)</td>
<td>42 (30-57)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>5</td>
<td>COPD</td>
<td>728 (676-783)</td>
<td>92 (74-113)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>7</td>
<td>HTN</td>
<td>1038 (976-1103)</td>
<td>148 (125-174)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>8</td>
<td>CHF</td>
<td>46 (34-61)</td>
<td>13 (7-22)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>10</td>
<td>Dehydration</td>
<td>103 (84-125)</td>
<td>38 (27-52)</td>
<td>&lt;0.001</td>
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<tr>
<td>11</td>
<td>Pneumonia</td>
<td>170 (145-198)</td>
<td>55 (41-72)</td>
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<td>12</td>
<td>UTI</td>
<td>1796 (1714-1881)</td>
<td>265 (234-299)</td>
<td>&lt;0.001</td>
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<td>13</td>
<td>Angina W/O Procedure</td>
<td>80 (63-100)</td>
<td>33 (23-46)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>14</td>
<td>Diabetes Uncontrolled</td>
<td>179 (154-207)</td>
<td>14 (8-23)</td>
<td>&lt;0.001</td>
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<td>15</td>
<td>Asthma</td>
<td>1435 (1362-1511)</td>
<td>120 (99-143)</td>
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<td>90</td>
<td>Overall Composite</td>
<td>94306 (93705-94910)</td>
<td>21876 (21587-22168)</td>
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<td>91</td>
<td>Acute Composite</td>
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<td>92</td>
<td>Chronic Composite</td>
<td>92237 (91643-92834)</td>
<td>21518 (21231-21807)</td>
<td>&lt;0.001</td>
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Figure 3.1 Hospitalization Length of Stay (LOS) – Diabetes, Short-Term Complications

Figure 3.2 Hospitalization Length of Stay (LOS) – Diabetes, Long-Term Complications
Figure 3.3 Hospitalization Length of Stay (LOS) – COPD

Figure 3.4 Hospitalization Length of Stay (LOS) – Hypertension
Figure 3.5 Hospitalization Length of Stay (LOS) – CHF

Figure 3.6 Hospitalization Length of Stay (LOS) – Dehydration
Figure 3.7 Hospitalization Length of Stay (LOS) – Bacterial Pneumonia

Figure 3.8 Hospitalization Length of Stay (LOS) – UTI
Figure 3.9 Hospitalization Length of Stay (LOS) – Angina Without Procedure

Figure 3.10 Hospitalization Length of Stay (LOS) – Perforated Appendix
Figure 3.11 Hospitalization Length of Stay (LOS) – Uncontrolled Diabetes

Figure 3.12 Hospitalization Length of Stay (LOS) – Asthma
CHAPTER 4:
THE INFLUENCE OF LIFE IN A HEALTH CARE DESERT ON MENTAL AND
BEHAVIORAL HEALTH CARE ACCESS AND QUALITY

Introduction

Using the same Brooklyn communities identified in Chapter 3, this chapter explores the impact of desert and non-desert conditions on residents’ mental and behavioral health. Mental and behavioral health in New York City has received increased attention by the current administration, Mayor Bill de Blasio and First Lady Chirlane McCray. They produced “Thrive NYC: A Roadmap for Mental Health for All,” a report that provides an overview of current mental and behavioral health issues and statistics and outlines actions for improving services and mental health outcomes (89). According to the report, major depressive disorder is the single greatest source of disability in NYC. Depression is estimated to cost the city 2.4 billion dollars in lost productivity. Alcohol misuse is estimated to cost 6 billion dollars in economic losses, while illicit prescription drug use is estimated to cost 3 billion dollars in criminal justice expenditures.

The specific aim of this chapter is to examine the effects of living in Brooklyn urban health care desert and non-desert communities on mental and behavioral health care quality and access, and on overall health. Utilizing SPARCS data and selected high-risk mental and behavioral diagnoses, potentially preventable hospitalizations, hospitalization length of stay (LOS), and potentially preventable emergency department (PPED) visits are compared.

Mental and Behavioral Health Overview

The World Health Organization (WHO) defines mental health as “a state of well-being in which every individual realizes his or her own abilities, can cope with the normal stresses of life,
can work productively and is able to make a contribution to his or her community […] In this positive sense, mental health is the foundation of well-being and the effective functioning of a community” (90). Mental health conditions profoundly affect quality of life and productivity across an individual’s life span. Additionally, determinants of mental and behavioral health are found within the demographic, socio-cultural, and environmental contexts in which individuals develop and live their lives. While mental illness can present at any point in life, young adults are more susceptible to significant illness, and three quarters of all mental health and substance use disorders begin by age 24 (91). The average life expectancy of people with mental illness is approximately eight years less than people without mental illness (92). This chapter focuses on the impact of living in a health care desert on mental and behavioral health.

To further complicate their overall health care issues, many individuals with mental or substance misuse disorders experience limited access to and poor quality of routine medical care, especially general medical or cardiovascular care (93). Mental illness and medical illness are directly linked; experiencing periods of mental illness has been shown to increase the likelihood of developing diabetes, hypertension, and elevated cholesterol (94–96). Additionally, prolonged depression more than doubles the risk of developing a stroke in people over age 50 (97). Comorbid conditions, including diabetes, cardiovascular disease, and hypertension, can potentiate negative mental health outcomes.

Looking specifically at populations with schizophrenia, the prevalence of metabolic disorders—including diabetes, hypertension and hyperlipidemia—exceeds 50 percent. Unfortunately, this high-risk population has limited access to primary care and treatment (98). Using data from the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) schizophrenia study, the authors examined the point prevalence of diabetes, hypertension, and
hyperlipidemia treatment at time of enrollment for the entire cohort (N=1460). The overall prevalence of hypertension was 33.2 percent, 10.4 percent for diabetes, and 47.3 percent for hyperlipidemia. They found that 30.2 percent of individuals with diabetes were not treated, further reporting that nonwhite women were substantially undertreated as compared to nonwhite males (82 percent versus 50 percent, p = 0.005). Non-treatment for dyslipidemia was 88 percent and 62.4 percent for hypertension. Hispanic CATIE subjects were less likely to be treated for hypertension as compared to non-Hispanics (21 percent versus 39 percent, p = 0.023) (98).

The Epidemiologic Catchment Area Study was the first attempt at obtaining accurate general population data on mental health treatment (99). The study found that 19 percent of respondents with recently diagnosed mental illness received any treatment within the previous 12 months. The National Comorbidity Survey, conducted a decade later, found that 25 percent of respondents with mental illness received treatment during the previous 12 months (100). Wang and Lane utilized the National Comorbidity Survey Replication data for 2001 through 2003 (101) to analyze what proportion of respondents with a diagnosis of anxiety, mood, impulse control, and substance misuse disorders received treatment in the previous 12 months in these four sectors: specialty mental health, general medical, human services, and complementary/alternative. The number and type of treatment visits and proportions of patients receiving minimally-adequate treatment were also assessed. Forty-one percent of patients received some treatment within the past 12 months, with almost 23 percent treated by a general medical provider. Notably, those patients who received specialty mental health services received a media of 7.4 visits, while those treated in the general medical clinic received only 1.7. Correspondingly, 48 percent of patients obtaining care in specialty settings received treatment that exceeded a minimal threshold of adequacy, while only 12 percent of general medicine patients received...
treatment that achieved the threshold. The authors concluded that unmet need for treatment was greatest in traditionally underserved groups, including elderly, racial-ethnic minorities, uninsured, and those with low incomes. This overview of mental health illness and treatment supports the widely-held belief that many patients with mental illness are underserved, and that “traditionally” underserved groups are at greatest risk.

**Mental and Behavioral Health in the United States**

Mental Health America (MHA), formerly the National Mental Health Association, released the report “The State of Mental Health in America 2017” (102). The key findings of the report are: 1) 1 in 5 adults have a mental health condition; 2) youth depression rates have increased from 8.5 percent in 2011 to 11.1 percent in 2014; 3) while access to services has increased with health reform, 19 percent remain uninsured in states that did not expand Medicaid, and 13 percent in states that did; and 4) 56 percent of American adults with a mental illness have not received treatment. The report also highlights the shortage in the mental health workforce from state to state. In the state with the lowest number of mental health professionals, the ratio was 1 mental health professional to 1,000 lives. Also of significance is the fact that less access to care corresponds to higher rates of incarceration of people with mental illness. As an example, Arkansas, Mississippi, and Alabama have “the least access to care and the highest rates of imprisonment.” In these three states alone, the report states that 57,000 people with mental health conditions are imprisoned.

The MHA report used 15 measures to rank all 50 states and the District of Columbia on rates of mental illness and mental health care access. Measures include: Adults with Any Mental Illness (AMI); Youth with Dependence or Abuse of Illicit Drugs or Alcohol; and Adults with AMI Reporting Unmet Need. Based on comparisons of overall state rankings in 2011 and 2014
(certain 2011 measures also relied on data from 2009 and 2010), New York State ranked 7th overall in 2011, but dropped to 12th in 2014. Based on 9 measures ranking access to treatment, the state ranked 19th in 2014, representing a drop from 11th place in 2011. Looking specifically at the Mental Health Workforce Availability measure, NYS ranks 19th, reflecting the state’s availability of 1 mental health provider for every 420 individuals requiring mental health care. For Adults with AMI who Did Not Receive Treatment, NYS ranks 43rd, with just over 60 percent not receiving any treatment. These results highlight the need for more mental/behavioral health services in NYS.

Race and ethnicity are also implicated in mental health findings. In the United States, Caucasian Americans are more likely to be diagnosed with depression and anxiety (and other common mental illnesses) than African Americans (103,104). Unfortunately, when diagnosed, African Americans are more likely to experience more persistent and severe illness. Further complicating mental health difference assessments is the fact that African Americans are more likely to receive diagnoses of schizophrenia and other psychotic disorders despite having identical symptoms as their Caucasian counterparts (105). Nationally, African Americans are half as likely as Caucasians to receive community-based mental health care, but nearly twice as likely to be hospitalized. Surprisingly, nearly half of all treatment offered for major depressive illness in the United States does not follow evidence-based recommendations, potentially leading to longer and more severe illness (106).

In the study, “Prevalence and Treatment of Mental Disorders: 1990-2003,” Kessler and colleagues examine U.S. trends in prevalence and treatment of mental health disorders for people aged 18-54 (107). Based on data collected from face-to-face interviews in the years 1990-1992 and 2001-2003, the study’s authors find that the 12-month prevalence of any DSM-IV disorder
did not differ significantly across surveys (29.4 percent in 1990-1992, 30.5 percent in 2001-2003, \( p = 0.52 \)). Additionally, there was no significant difference in prevalence of serious (5.3 percent versus 6.3 percent, \( p = 0.27 \)), moderate (12.3 percent versus 13.5 percent, \( p = 0.30 \)), or mild (11.8 percent versus 10.8 percent, \( p = 0.37 \)) disorders. The prevalence of treatment for mental health diagnoses in the 12-month period was 12.2 percent in 1990-1992 and 20.1 percent in 2001-2003 (RR of 1.7 percent, \( p < 0.001 \)). A minority of respondents with serious disorders received treatment (24.3 percent in 1990-1992; 40.5 percent in 2001-2003). Trends in type of treatment were similar to overall trends in that severity was related to overall treatment (\( p < 0.001 \)) and the association did not change over time (\( p = 0.399 - 0.975 \)), but a significant difference was found across treatment type (\( p < 0.001 \)). General medicine treatment increased from 3.9 percent to 10.0 percent (RR = 2.6, \( p < 0.001 \)), psychiatry from 2.4 percent to 5.2 percent (RR = 2.2, \( p < 0.001 \)), other mental health services from 5.3 percent to 8.4 percent (RR = 1.6 percent, \( p < 0.001 \)), and human services from 2.6 percent to 3.5 percent (RR = 1.3, \( p = 0.05 \)). Distributional shift in treatment did occur but did not vary by severity (\( p = 0.89 - .99 \)). The authors concluded that: 1) no changes occurred in prevalence or severity of mental disorders between the 2 time periods; 2) a substantial increase occurred between the 2 time periods in the proportion of the population treated for mental health problems, even though the majority did not receive treatment; 3) increased treatment varied across sectors, with general medicine increasing 150 percent; 4) the increase in treatment was unrelated to socio-demographic correlates, with inequalities increasing in absolute terms; and 5) severity did not interact with time in predicting treatment. This study highlights the continued challenges to accessing mental health services, especially in underserved areas, further increasing disparities.

**NYC Mental and Behavioral Health**
The mental and behavioral health of NYC residents received increased attention from Mayor Bill de Blasio and First Lady Chirlane McCray. They produced “Thrive NYC: A Roadmap for Mental Health for All,” which provides an overview of the current state of mental and behavioral health in NYC and outlines the actions needed to improve services and the health of New Yorkers (89). The NYC data described below is presented in this report and involves communications with the department of health, homeless services, and city council, as well as other NYC stakeholders and leaders. It is believed that one in five adults in NYC experience a mental disorder in any given year. A closer look at the subgroups in NYC finds that 35 percent of homeless shelter clients suffer from serious mental illness, while 33 percent of those jailed in NYC are diagnosed with mental illness. Additionally, 70,000 alcohol-related emergency department visits and 1,800 alcohol-related deaths among adults aged 18 to 64 occur every year in NYC.

Major depressive disorder is the single greatest source of disability in NYC. Depression is estimated to cost the city 2.4 billion dollars in lost productivity, while alcohol misuse costs 6 billion dollars in economic losses, and illicit use of prescription drugs costs 3 billion in criminal justice expenditures. Disability Adjusted Life-Years (DALYs), a common metric used to describe the impact of mental illness on society relative to other problems, measures the number of years lost to a given disease in terms of loss of life (YLL) or disability (YLD). Major depressive disorder, substance use, and anxiety disorders were three of the top five causes of DALYs in 2013. In 2013, more than 630,000 NYC residents with health insurance were diagnosed with a mental illness—accounting for 8.3 percent of the population but representing 25.6 percent of total health care expenditures.
Socioeconomic and ethnicity demographics are indicators of susceptibility for mental and behavioral illnesses in NYC. People of color and those in poverty disproportionately bear the greatest mental health burden, but are the least likely to get treatment. According to the 2009-2010 Community Health Survey, African Americans and Asians are less likely to take medications or receive therapy for their mental illness. For Latinos and African Americans, treatment rates for mental health issues are lower than for Caucasians. Serious mental illness is more than twice as likely to be diagnosed in adults living at or under the 200 percent Federal Poverty Level (FPL) as compared to those living above 200 FPL. Additionally, 70 percent of children between 2 and 12 years of age with a common mental health disorder live in poverty. In NYC, residents from the city’s poorest neighborhoods are twice as likely to be hospitalized for mental illness as compared to those living in the highest income neighborhoods. These higher rates of hospitalizations likely reflect the challenges residents face accessing preventative care, a greater exposure to stressors, and a higher likelihood of interrupted insurance coverage.

Medicaid is the source of insurance for over 3 million NYC residents, and in 2013 the overall costs for people with a mental illness or substance misuse disorder was more than 3 times the costs for those without these diagnoses. Almost 18 percent of Medicaid beneficiaries in Brooklyn utilized behavioral health related services in 2012. These beneficiaries were clustered in the Williamsburg, Crown Heights, Brownsville, and East New York neighborhoods (77). Additionally, individuals with any mental illness or substance misuse diagnosis utilize the emergency department 3 times more frequently for medical care issues, and require 6 times the number of medical inpatient days as compared to people without those conditions. Further complicating the issue, in the first half of 2014, only 1 in 3 people completing a psychiatric hospitalization were successfully linked to outpatient treatment within 30 days.
Mental and Behavioral Health Quality Metrics

Hospitalization and Length of Stay (LOS): What We Know

Hospital care for patients with mental and behavioral disorders in the United States has changed significantly in the last 20 to 30 years. Most patients are now hospitalized in general or private psychiatric hospitals. HCUP reports that one-third of inpatient hospitalizations include at least one mental and behavioral diagnosis as a primary or secondary diagnosis (108). Additionally, hospitalizations involving co-occurring mental and behavioral conditions are between 16 and 200 percent higher than inpatient stays, with either as a primary diagnosis alone. Mental and behavioral health patients are also twice as likely to be uninsured. The majority of mental disorder admissions are female (58.3 percent), whereas males account for the majority of behavioral and co-occurring admissions (74.5 percent and 60 percent, respectively). In 2011, mood disorders and schizophrenia were the most frequent principal diagnoses, with mood disorder hospitalizations accounting for nearly 900,000 admissions—the 6th most common diagnosis overall (109). In 2011, approximately 37 percent of all disabled Medicare beneficiaries had a severe mental illness. The most common admissions for mental illness in 2012 included mood, schizophrenia/psychotic, anxiety, adjustment, and impulse disorders (108). For behavioral health disorders, alcohol, drug-induced, opioid-related, cocaine-related, and hallucinogen-related disorders were the most common hospitalizations. The vast majority of these hospitalizations presented via the emergency department.

LOS has also been studied nationally for selected diagnoses. In 2010, Centers for Medicare and Medicaid Services (CMS) reported a mean LOS of 7.2 days for psychosis hospitalizations, 10.6 days for schizophrenia, and 6.5 days for major depressive disorder. In 2012, when comparing hospitalizations for mood disorders, rates for LOS were 39 percent longer.
and hospitalizations for schizophrenia were more than twice as long as medical stays (6.6 days and 10.4 days, respectively, versus 4.8 days) (108). Understanding that LOS is impacted by clinical and non-clinical variables, this study utilizes LOS as a proxy measure for quality of care asserting that poor quality of care results in longer LOS.

**Potentially Preventable Emergency Department (PPED) Visits: What We Know**

Behavioral or mental health issues accounted for 12.5 percent of the 95 million emergency department (ED) visits in 2007, and they were the primary reason for 4.1 million of the visits (110). Almost 41 percent of ED visits resulted in hospitalization, an admission rate 2.5 times that of other conditions. Women accounted for the majority (53.9 percent) of the mental/behavioral admissions, with 46.6 percent aged 18 to 44. Over 63 percent of all hospital admissions were for mental health conditions only, while 24.4 percent of admissions were limited to substance abuse conditions. For co-occurring conditions, the percentage of hospitalization was 11.9.

Reviewing specific diagnoses, the most common mental and behavioral health reason for an ED visit was mood disorder (42.7 percent) followed by anxiety (26.1 percent). Alcohol disorders accounted for 22.9 percent of ED visits while drug misuse disorders accounted for 17.6 percent. Schizophrenia and other psychoses resulted in 9.9 percent of ED visits. From 2006 to 2011, substance-related disorders, excluding alcohol, increased by 48 percent (136/100,000 ED visits to 201/100,000) (111). For alcohol-related disorders, a 34 percent increase was observed over the same time period (277/100,00 0ED visits to 371/100,000). These data illustrate the extent to which patients with mental and behavioral health illnesses access care via the ED.
Statewide Planning and Research Cooperative System (SPARCS) Data

As described in Chapter 3, SPARCS is a comprehensive all-payer hospital discharge data system. The system was established in 1979 as a partnership between the health care industry and NYS government. The system was initially created to collect hospital discharge data. Data currently collected includes patient-level data (characteristics, diagnosis, treatment, services, charges) for every hospital discharge, ambulatory surgery patient, and emergency department admission in New York State.

SPARCS data may be accessed for medical or scientific research, and this study utilizes this data in both Chapters 3 and 4. There are 3 primary data file types: identifiable, limited, and de-identified. Identifiable data involves specific individual facility admission information, which, if disclosed, would constitute invasion of personal privacy. Identifiable data elements include dates of service, date of birth, address, and other unique personal identifiers. Limited data files have been stripped of direct unique identifiers but still contain information that has potential to be identifying according to HIPPA standards. De-identified data is considered public use, because it no longer contains information protected by HIPPA—for example, generalized health care statistics and anonymous health care records. Publicly available data tables are accessible based on statewide, county, and hospital data. Data categories include: age, gender, principle reimbursement, service, major diagnosis, and disposition.

Again, for the purpose of this study, limited data files for years 2010 to 2012 and specific to Brooklyn, NY, were requested. The data files were mailed to CUNY Graduate Center once use was approved. The files were accessed using an SAS read-in program for inpatient and outpatient encrypted files.
Methods

This dissertation chapter answers the following research question: What effect does living in Northern and Central Brooklyn health care deserts have on mental and behavioral health care access and quality and thus overall mental health? As described above, this study utilizes SPARCS inpatient and outpatient data files from 2010 to 2012 as the primary data source, and employs secondary data analysis to investigate this research question. The outcome of interest is poor mental and behavioral health. The predictive variables for this outcome include: 1) admission for high-risk mental and behavioral health diagnoses; 2) potentially preventable emergency department (PPED) use for those high-risk diagnoses; and 3) length of stay (LOS).

Preventable hospitalizations are based on admissions for mental and behavioral diagnoses commonly believed to be preventable if appropriately managed in the outpatient setting. Unlike the AHRQ medical PQIs, there are no universally accepted behavioral and mental health PQIs. The premise, similar to that underlying medical PQIs, is that appropriate outpatient care could prevent the need for hospitalization or prevent further complications. The behavioral and mental health diagnoses that will be compared are: 1) alcohol misuse; 2) drug abuse; 3) major depression; 4) dysthymia; 5) generalized anxiety; 6) panic disorder; and 7) schizophrenia. For the behavioral and mental health diagnoses, the age was limited to 18 years and over. Additionally, as with all PQIs I excluded transfers to the hospital and pregnancy, and rates are per 100,000. These rates were calculated using the Poisson distribution.

The Poisson Distribution was first described by famed French mathematician Simean Denis Poisson in 1837 (4). This mathematical rule assigns probabilities to the number of occurrences. The distribution is characterized by a single parameter, or mean number, of occurrences during the specific interval. The distribution is used to fit count data. Data produced
by medical research often follows the Poisson Distribution, and differences or ratios of the Poisson means can be compared. The Poisson model is appropriate for this situation because the number of potentially preventable admissions or events in each of the study years are being compared for each zip code, in each community. Additionally, because the number of events is small compared to the number at risk, the exact Poisson test is most appropriate. Finally, the confidence interval was calculated but a power analysis was not, as the width of the confidence intervals was clinically appropriate.

LOS was compared between desert and non-desert hospitalizations using the Wilcoxon rank sum test due to the non-normality of the LOS variables. This test is the nonparametric version of the 2-sample t-test without the assumption of normality. For visualization of the LOS, the log-transformation was used to reduce the right skewness. Additionally, because of the concern of selection bias—in that the LOS of the selected PQIs is dependent on the patients being admitted (non-random)—the Heckman correction was applied to the LOS data (5). The Heckman correction assumes normality and provides a test for sample selection bias and a formula to correct the bias. The two-step Heckman correction uses selected variables to correct for any selection bias. The model does have disadvantages as it is considered a limited information maximum likelihood estimator.

**Results**

*Potentially Preventable Hospitalizations: Desert Versus Non-Desert*

Table 4.1 provides an overview of the hospitalization rates for the mental and behavioral health hospitalizations from 2010 to 2012 for the desert and non-desert communities. For drug abuse (p = 0.009, 0.028, 0.017), major depression (p = 0.002, 0.013, 0.005), and schizophrenia (p < 0.001, 0.001, 0.001), significant differences in hospitalizations were found in 2010, 2011, and
2012, respectively. These differences show higher admission rates in desert communities. For alcohol misuse, hospitalizations in desert communities were significantly higher (p = 0.015) in 2010. Hospitalizations for anxiety were also significantly greater (p = 0.019, 0, 0) for non-desert communities from 2010 to 2012. For dysthymia, hospitalizations rates were greater in non-desert communities for 2011 (p = 0.001) and 2012 (p = 0.008). No significant difference was found for panic disorder hospitalizations across the three years.

Length of Stay (LOS): Desert Versus Non-Desert

Because of skewness and non-normality, LOS data were log-transformed prior to analysis. Figures 4.1 to 4.7 illustrate the log LOS for each diagnosis by year. Table 4.2 illustrates the unadjusted arithmetic mean values for the LOS and P values from a Wilcoxon rank sum test. In general, across all three years the health care desert versus non-desert LOS differences were not significant or consistent. LOS for panic disorders and schizophrenia in 2010 (p = 0.037, 0.001 respectively) were significantly longer in non-desert hospitalizations. In 2011, LOS for dysthymia and anxiety (p = 0.038, 0.048 respectively) were also significantly longer in non-desert hospitalizations. In 2012, LOS was significantly longer for anxiety disorder hospitalizations (p = 0.01) in desert communities, while psychotic disorder LOS was significantly longer (p = 0.004) for non-desert communities.

Heckman Procedure

The Heckman procedure was employed for the 2012 LOS data. This two-step procedure corrects for the probability of having been admitted to the hospital in the first place. The probability of being admitted was modeled using age, sex, race, ethnicity, homelessness, and Medicare status. Table 4.3 illustrates these adjustments. As illustrated, adjusted LOS for alcohol
misuse, drug abuse, dysthymia, anxiety, and panic disorder were not significant. With the exception of the diagnosis of anxiety, unadjusted LOS were also not significant.

_Potentially Preventable Emergency Department (PPED) Visits: Desert Versus Non-Desert_

Table 4.4 illustrates the emergency department utilization yearly rates (for each 100,000 residents) for selected high-risk behavioral and psychiatric diagnoses with confidence intervals and p values for both desert and non-desert communities for 2012. As illustrated, there are significant differences between desert and non-desert communities for all diagnoses, indicating higher utilization in desert communities. Additionally, the composite score, which included all diagnoses, also found higher overall utilization in desert communities.

**Discussion**

_Potentially Preventable Hospitalizations_

In assessing hospitalization rates for high-risk psychiatric diagnoses, both mental and behavioral illnesses were evaluated. Recent reports have highlighted the disproportionate burden of disease desert communities suffer when considering these diagnoses. The hospitalization rates for mental illness were significantly greater for major depression and schizophrenia across all 3 years for desert communities. This is a concerning finding because these mental illness diagnoses tend to have more severe symptoms. The increased hospitalizations for these patients (routinely reserved for the most severe cases) indicates fewer community-based resources and less support. Hospitalizations for dysthymia, a less severe but chronic mood disorder, were significantly increased in the non-desert communities in 2011 and 2012, while anxiety hospitalizations were increased across all three years in the non-desert communities. These results indicate that desert communities have increased hospitalizations for more severe illnesses while non-desert
communities hospitalize at higher rates for more mild psychiatric illness. No difference was seen for admissions for panic disorder across the 3 years in health care desert versus non-desert communities.

When evaluating the impact of living in desert and non-desert communities on hospitalizations for behavioral illness, desert community residents were hospitalized at significantly higher rates for drug misuse across all 3 years. Alcohol abuse admissions were also significantly higher in the desert communities, but only for 2010. Hospitalizations for these two behavioral diagnoses are concerning, as these disorders can be life-threatening and very difficult to manage and treat on an inpatient basis, and usually require intense and ongoing outpatient services.

Length of Stay (LOS)

As was observed when reviewing the LOS for PQIs, inconsistent patterns emerged, with some longer LOS rates in the desert communities and some in non-desert communities. Additionally, no consistency was found in LOS rates across all 3 study years. Using LOS as a proxy measure for quality of care does not support a difference in quality between desert and non-desert communities.

As previously described, the Heckman process was applied to the LOS data for admitted selected high-risk behavioral and psychiatric diagnoses for 2012. Factors associated with having been hospitalized were controlled, including age, sex, race, ethnicity, homelessness, and Medicare status. No significant differences were found for adjusted hospitalizations associated with alcohol misuse, drug abuse, dysthymia, anxiety, or panic disorder. With the exception of anxiety hospitalizations, these findings were consistent with unadjusted LOS data. For anxiety,
the unadjusted LOS rate was significant with longer LOS rates in non-desert communities. This difference likely represents the introduction of bias in the LOS data.

_Potentially Preventable Emergency Department (PPED) Visits_

The result of the behavioral and psychiatric high-risk emergency department utilization analysis found that in all instances desert communities utilized emergency departments more frequently than non-desert communities. This data is similar to the medical or PQI utilization data that also found higher emergency department utilization in desert communities. Our study specifically evaluated emergency department utilization for both behavioral and psychiatric illness visits. Most concerning was the use of emergency department visits for severe mental illness. It is clear from the literature that robust ambulatory mental health care can successfully manage chronic mental illness. Unfortunately, while readily available, episodic emergency care is a poor substitute for ongoing mental and behavioral health care.

**The Problem with Multiple Comparisons**

To investigate the impact of living in a health care desert on mental and behavioral health, hospitalization rates of seven high-risk diagnoses were compared across three years (21 variables) and an overall composite (3 variables) in health care desert and non-desert communities. 2012 PPED visits were also investigated for the 7 mental/behavioral health diagnoses and overall composite (8 variables). Additionally, the LOS for the 7 diagnoses were compared in both groups across the three years (21 variables). The total number of variables tested to investigate the impact of living in a health care desert on medical health was 53. Testing this number of variables raises a concern for the multiple comparison problem, or that some tests will have p values less than 0.05 purely by chance (type 1 error).
As previously mentioned, no universally accepted approach for dealing with this problem exists. The classic approach is to control the familywise error rate, also known as the Bonferroni correction (86). This method sets the p value for significance (alpha) lower by dividing 0.05 by the number of tests. In our study the p value of 0.05 would be divided by 63, resulting in a corrected p value of 0.008. It is appropriate to use the Bonferroni correction when a single false positive in a set of tests would be problematic. Fortunately, this is not a problem in this study where multiple hospitalization, LOS, and PPED visit rates are being compared. The Bonferroni correction would likely increase the false negative rate to unacceptable levels. An alternative to the Bonferroni correction is the Benjamini-Hochberg procedure that controls the false discovery rate, or the proportion of discoveries that are false positives (87). This rate would be set before collecting the data. Typically, if the cost of a false negative is high, the rate is set to a high level of 0.1 or 0.2. The test is less sensitive than the Bonferroni correction when considering which tests constitute a “family.”

The goal of correcting multiple comparisons is to reduce the number of false positives. However, aggressively controlling the false positives can lead to increasing the number of false negatives. In certain studies, such as this one, it is appropriate not to control for multiple comparisons (88). Instead of correcting the multiple test problem, this study limits significant findings only to those diagnoses that display significant difference in the same direction across all 3 study years. For mental and behavioral illness, this decision limits our significant findings to hospitalizations for drug abuse, major depression, and schizophrenia in health care desert communities. For non-desert communities, hospitalization for anxiety was the only significant finding of difference. No significant differences were seen for LOS rates between health care deserts and non-desert communities across all 3 years. With the exception of the LOS rate for
anxiety hospitalizations, this finding was supported by the 2012 Heckman correction. For PPED visits we used 2012 data, thus limiting the multiple comparison problem.

**Conclusion**

This study identifies that living in a health care desert adversely affects mental and behavioral health. This is especially concerning when considering hospitalizations for drug abuse, major depression, and schizophrenia. These illnesses are considered major mental and behavioral disorders and often require lifelong treatment and management. Interestingly, hospitalizations for anxiety were greater in non-desert communities, but no significant difference was found for panic disorder hospitalizations. Hospitalization rates for alcohol abuse and dysthymia were only significantly different for one or two of the study years, but not all three. When considering LOS rates for the high-risk diagnoses, inconsistent differences were found across each year, with no significant difference across all three years. For PPED visits in desert communities, patients with high-risk behavioral/mental health diagnoses utilized emergency departments at significantly greater rates than non-desert communities. This finding is especially concerning because it includes major mental and behavioral disorders. These results illustrate greater use of emergency departments and inpatient services in desert communities. The lack of community-based mental/behavioral services outside the acute care setting needs to be addressed to meet community needs.
| Table 4.1: Yearly Hospitalization Rates (per 100,000) for High-Risk Mental/Behavioral Diagnoses |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| Diagnosis                                        | Desert Rate (95% CI)                             | Non-desert Rate (95% CI)                          | P-value  | Desert Rate (95% CI)                             | Non-desert Rate (95% CI)                          | P-value  | Desert Rate (95% CI)                             | Non-desert Rate (95% CI)                          | P-value  |
| Alcoholism                                       | 55 (41-72)                                      | 67 (52-85)                                       | 0.319    | 27 (18-39)                                      | 31 (21-44)                                       | 0.694    | 19 (11-30)                                      | 6 (2-13)                                         | 0.015    |
| Drug Abuse                                       | 95 (77-116)                                     | 64 (49-82)                                       | 0.017    | 52 (39-68)                                      | 31 (21-44)                                       | 0.028    | 28 (19-40)                                      | 11 (5-20)                                        | 0.009    |
| Major Depression                                | 184 (158-213)                                   | 148 (125-174)                                   | 0.005    | 145 (122-171)                                   | 105 (86-127)                                     | 0.013    | 84 (67-104)                                     | 47 (35-63)                                       | 0.002    |
| Dysthymia                                       | 150 (127-176)                                   | 201 (174-231)                                   | 0.008    | 114 (94-137)                                    | 169 (144-196)                                    | 0.001    | 63 (48-81)                                      | 80 (63-100)                                      | 0.181    |
| Anxiety                                         | 546 (501-594)                                   | 846 (790-905)                                   | <0.001   | 334 (299-372)                                   | 443 (403-486)                                    | <0.001   | 177 (152-205)                                   | 225 (197-256)                                    | 0.019    |
| Panic Disorder                                  | 64 (49-82)                                      | 66 (51-84)                                      | 0.93     | 41 (29-56)                                      | 43 (31-58)                                       | 0.913    | 29 (19-42)                                      | 26 (17-38)                                       | 0.788    |
| Schizophrenia                                   | 501 (458-547)                                   | 350 (314-389)                                   | <0.001   | 341 (306-379)                                   | 232 (203-264)                                    | <0.001   | 172 (147-200)                                   | 85 (68-105)                                      | <0.001   |
| Composite                                       | 1390 (1318-1465)                                | 1540 (1464-1619)                                | 0.006    | 939 (880-1001)                                  | 953 (893-1015)                                   | 0.765    | 504 (461-550)                                   | 443 (403-486)                                    | 0.051    |

| Table 4.2: Length of Stay for High-Risk Mental/Behavioral Diagnoses |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| Alcoholism                                       | 5  (3.462)                                      | 6 (3.579)                                       | 0.579    | 5.512 (4.169)                                    | 4.169 (3.579)                                    | 0.197    | 4.567 (5.317)                                    | 5.317 (4.169)                                    | 0.176    |
| Drug Abuse                                       | 6.429 (6.045)                                   | 6.068 (6.174)                                   | 0.068    | 7.219 (7.219)                                    | 7.219 (6.174)                                    | 0.746    | 6.412 (8.522)                                    | 8.522 (6.412)                                    | 0.334    |
| Depression                                       | 7.277 (9.052)                                   | 0.161 (8.293)                                   | 0.161    | 9.457 (9.129)                                    | 9.457 (8.293)                                    | 0.3     | 8.578 (9.129)                                    | 9.129 (8.578)                                    | 0.921    |
| Dysthymia                                       | 4.759 (5.572)                                   | 0.278 (5.168)                                   | 0.278    | 6.281 (6.038)                                    | 6.281 (5.168)                                    | 0.038    | 5.614 (5.603)                                    | 5.603 (5.614)                                    | 0.353    |
| Anxiety                                         | 5.277 (5.611)                                   | 0.3 (5.427)                                     | 0.3     | 5.592 (5.048)                                    | 5.592 (5.427)                                    | 0.048    | 5.661 (6.015)                                    | 6.015 (5.661)                                    | 0.011    |
| Panic Disorder                                  | 3.548 (4.852)                                   | 0.037 (4.855)                                   | 0.037    | 5.589 (0.656)                                    | 5.589 (4.855)                                    | 0.656    | 4.88 (0.474)                                     | 4.474 (0.487)                                    | 0.349    |
| Schizophrenia                                   | 9.75 (12.22)                                    | 0.001 (13.872)                                  | 0.001    | 14.256 (0.96)                                    | 14.256 (13.872)                                  | 0.96    | 13.81 (0.313)                                    | 13.912 (0.313)                                   | 0.531    |

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Table 4.3: 2012 Heckman Estimate for High-Risk Mental/Behavioral Diagnoses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Health Desert Coefficient Estimate</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoholism</td>
<td>-0.07074</td>
<td>0.454</td>
</tr>
<tr>
<td>Drug Abuse</td>
<td>0.1108</td>
<td>0.284</td>
</tr>
<tr>
<td>Dysthymia</td>
<td>0.004535</td>
<td>0.935</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.01567</td>
<td>0.615</td>
</tr>
<tr>
<td>Panic Disorder</td>
<td>-0.01415</td>
<td>0.883</td>
</tr>
<tr>
<td>Composite</td>
<td>-0.08885</td>
<td>0.000223</td>
</tr>
</tbody>
</table>

Table 4.4: 2012 Emergency Department Utilization Rates (per 100,000 Visits) for High-Risk Mental/Behavioral Health Diagnoses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Desert Rate (95% CI)</th>
<th>Non-Desert Rate (95% CI)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Misuse</td>
<td>710 (659-764)</td>
<td>124 (103-148)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Drug Misuse</td>
<td>296 (263-332)</td>
<td>49 (36-65)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Major Depression</td>
<td>125 (104-149)</td>
<td>21 (13-32)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dysthymia</td>
<td>63 (48-81)</td>
<td>26 (17-38)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Anxiety</td>
<td>900 (842-961)</td>
<td>301 (268-337)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Panic disorder</td>
<td>133 (111-158)</td>
<td>45 (33-66)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>423 (384-465)</td>
<td>67 (52-85)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Composite</td>
<td>1615 (1537-1696)</td>
<td>449 (408-493)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Figure 4.1 Hospitalization Length of Stay (LOS) – Alcoholism

Figure 4.2 Hospitalization Length of Stay (LOS) – Anxiety
Figure 4.3 Hospitalization Length of Stay (LOS) – Panic

Figure 4.4 Hospitalization Length of Stay (LOS) – Depression
Figure 4.5 Hospitalization Length of Stay (LOS) – Drug Abuse

Figure 4.6 Hospitalization Length of Stay (LOS) – Schizophrenia
Figure 4.7 Hospitalization Length of Stay (LOS) – Psychiatric Disorders
CHAPTER 5:
CONCLUSION

Overview of Papers and Contributions

The results of this study illustrate the impact on health of living in an urban health care desert. The first paper, presented in Chapter 2, provides the foundation for the development and persistence of the health care desert phenomenon by reviewing the available food desert literature. Using economic theory, this paper explains the development of desert conditions in both food and health care industries. The theory of fundamental causes is extended to food deserts and health care deserts. Additionally, a general framework of a health care desert is provided. The second paper, presented in Chapter 3, examines the effect of living in a health care desert on medical health. This paper uses administrative data from the SPARCS database to compare the effects of desert and non-desert living on hospitalizations for PQIs, LOS rates of those hospitalization, and PPED visits. This paper clearly demonstrates the negative impact life in an urban health care desert has on residents, resulting in increased hospitalization rates for several chronic conditions including diabetes and asthma, and higher rates of potentially preventable emergency department visits. The third paper, presented in Chapter 4, examines the desert impact on mental/behavioral health care. Again utilizing the SPARCS database, this study investigated potentially preventable hospitalizations for select mental and behavioral health conditions, LOS rates for those hospitalizations, and potentially preventable emergency department visits. The results of this paper clearly demonstrate that hospitalizations for several of the behavioral and mental conditions were significantly greater in the urban health care desert communities, as were emergency department visits. This study included LOS as a proxy for quality of care asserting that longer LOS would be associated with poor quality of care.
The results of the LOS data for medical conditions found longer LOS in health care desert communities for perforated appendix only. This was also found when applying the Heckman correction. In non-desert communities, hospitalizations for UTI were significantly longer, but the Heckman correction did not find a significant difference. For mental/behavioral conditions, LOS data was not significantly different between desert and non-desert communities. Using LOS data as a proxy for quality of care, this study found little evidence to support a difference in quality of care between health care desert and non-desert communities.

These papers allow for a coherent way of evaluating the impact of urban health care desert conditions on the health of those living in these communities. These results are intended to assist policy makers in identifying health care deserts across the country, and addressing their impacts—especially in urban population centers. The remainder of this paper describes some ongoing public health interventions and advocates for future research regarding health care deserts, as well as a more holistic approach to addressing health care desert conditions.

**Weighting Influences on Health**

The solution to addressing health disparities that develop and persist for people living in health care desert communities should include a holistic approach to increasing and managing the availability and quality of medical and mental/behavioral health care. However, it is clearly understood that health is complex and influenced by more than medical care. While no universally accepted “system” for assigning weights to determinants of health exists, several distribution schemes have been proposed. Booske and colleagues used the following domains to arrive at their method: historical perspective; review of literature; previous weighting schemes; analytic approach; pragmatic approach (112). The historical perspective includes discussion regarding the sanitary revolution and improvements in environmental health that took place from
1930 to 1950. The authors highlight the successful policies that led to dramatic reductions in communicable diseases and maternal death/infant death. From 1950 to 1970, the role of health care increased, as did “clinical preventive services.” According to Evans and Stoddart, “By midcentury the providers of health care had gained an extraordinary institutional and even more intellectual dominance, defining both what counted as health and how it was to be pursued” (113). Health behaviors (smoking, diet, exercise) increased in importance from 1970 to 1990, as large-scale studies including the “Framingham Heart Study,” the “Seven Countries Study,” and the “British Doctor Study” linked behaviors to chronic diseases (114) (115). Additionally, the “Lalonde Report,” published in Canada in 1974, was the first modern government report to emphasize that health care alone was not sufficient to improve population health (116,117). The report proposed breaking health into four components: human biology, environment, lifestyle, and health care organization. Expert opinion at the time asserted that behaviors had unambiguously measured effects on health, and that those behaviors were under the control of individuals. From 1990 to present day, “upstream” factors, including social and economic determinants, have gained significance. The Canadian Institute for Advancement published “Why Are Some People Healthy and Others Not? The Determinants of Health and Populations,” which advanced the Evans-Stoddart multiple field model as well as independent effects of social determinants (118). Marmot investigated the social and economic status of the health of British civil servants, demonstrating “social gradient” on the increased mortality rate from heart disease at each of four occupational levels (119). This research underscores the complexity of health and describes how degree of health is impacted by knowledge, environment, genetics, and occupation. In order to begin to address the health of our urban health care desert communities, we must consider and address the many factors that influence health in addition to health care.
In an attempt to evaluate the varying degrees to which different factors impact health, McGinnis and colleagues state “…using the best available estimates, the impacts of various domains on early deaths in the United States distribute roughly as follows: genetic predispositions, about 30 percent; social circumstances, 15 percent; environmental exposures, 5 percent; behavioral patterns, 40 percent; and shortfalls in medical care, 10 percent” (120). The authors point out that the longstanding estimate of 10 percent for medical care is actually based on expert estimates of health care system deficiencies to total mortality. Thus, this estimate represents the contribution of medical care deficiencies to early death, rather than the positive contribution health care has on avoiding mortality. Also important is the nature of where the varied domains intersect. Bunker and colleagues estimate that 3 of the 7.5 years of life expectancy gained after 1950 were due to medical care (121). Cutler, Deaton, and Lleras-Muney assign 50 percent weight to medical care, while Elo and Preston show a 103 percent reduction in mortality rates for each additional year of education achieved (122,123).

Several weighting schemes have been proposed including: 1) America’s Health Ranking (AHR) – combining outcomes (25 percent) and determinants (75 percent); 2) University of Wisconsin Population Health Institute (Tennessee and Kansas) – 40 percent health behaviors, 10 percent health care, 40 percent socioeconomic factors, 10 percent physical environment; 3) University of New Mexico, which made slight modifications to the Wisconsin rankings – 40 percent health behaviors, 15 percent health care, 40 percent socioeconomic factors, 5 percent physical environment (112). Using an analytic approach, Booske and colleagues, at the University of Mexico, regressed social and economic factors, health behaviors, and health care on premature death. They then converted the resulting coefficients to the following weights: 49
percent social and economic determinants, 39 percent health behaviors, 12 percent health care (112).

Booske and colleagues also promote a pragmatic approach that asserts that the goal of improving health should engage multiple sectors in community health improvement (112). The authors describe five sectors, including health care, education, government, business, and the nonprofit sector. As an example, they suggest that even though clinical care has a smaller impact on outcomes than behaviors, the “health sector” can influence health behaviors as well as clinical care. This approach assigns each of four determinant categories an equal weight of 25 percent.

Another scheme proposed by Dr. Karen Lee and the Regional Planning Association adapted the University of Wisconsin Population Health Institute scheme to include the following weights: socioeconomic factors – 40 percent; health opportunities (exercise and healthy eating) – 30 percent; clinical care (access and quality) – 20 percent; and the physical environment – 10 percent (124). As is obvious from the review of these different weighting systems, clinical care plays a small but significant role in the overall health of individuals and communities, but must be looked at in the context of other global factors including genetics, environmental, and socioeconomic influences.

**Other Forces that Influence Health**

Much work has been done to investigate the various forces that shape the health of communities. While access to and quality of health care clearly impact overall health, so does the air people breathe, the streets people drive and walk on, and employment and education opportunities. When considering the socioeconomic factors that impact health, poverty is an increasingly important factor to consider. Those communities with high poverty levels have worse health outcomes than more economically stable communities. According to a recent
analysis by the National Academies of Science, Engineering, and Medicine, “The Growing Gap in Life Expectancy by Income: Implications for Federal Programs and Policy Responses,” overall life expectancy in the United States has increased, but these gains are not seen by those in the lowest income brackets (125). The analysis, which compares life expectancy of individuals born in 1930 to those born in 1960, finds an increase of 5.7 years for women and 7.1 years for men in the top income quintile, but a decrease by 4 years for women and 0.5 years for men in the bottom quintile. When looking specifically at NYC, life expectancy for blacks is consistently lower than whites and Hispanics. Interestingly, life expectancy for Hispanics in NYC and nationally is slightly higher than that for whites, despite socioeconomic factors. Scommegna has explored this finding and has asserted that it may be related to diet and social ties, but the determining factors remain unclear (126). With respect to quality of life, NYC-area residents reported feeling physically unhealthy 3.4 days per month, and mentally unhealthy 3.5 days per month.

Income inequality has increased in the United States and specifically in NYC over the last decades. Poverty has also increased from 11 percent in 1990 to 14 percent in 2013 (124). The results show that households in the top income quintile make 15 times as much as those in the bottom income quintile. Income is directly correlated with access to health care: as income increases the less likely someone is to be uninsured. Poverty impacts health beyond access to care, limiting options for healthy activities and diet. Poverty is higher in communities of color throughout the United States and in NYC. In fact, Hispanics and blacks are three times more likely to live in poverty than whites. Another important area to consider is that of housing affordability. In NYC between 1990 and 2013, the share of households where housing costs exceeded 30 percent—the federal government’s benchmark for affordability—increased from 35
percent to 45 percent. It is important to note that blacks and Hispanics are nearly 50 percent more likely to be severely housing cost-burdened than whites.

Public Health Relevance of the Urban Health Care Desert

Total Population Health

In a commissioned paper, Jacobson and Teutsch coin the term “Total Population Health” (TPH), defining a population by geographic location rather than attributed population (127). In connection with promoting the use of TPH in health research, they seek to: provide an integrated set of definitions for population health, the determinants of health, and activities that improve health; review frameworks used to assess and track TPH, its determinants, and improvement activities; propose an integrated measurement framework; and outline the challenges and opportunities for aligning health improvement activities and measurements. They recommend the following: abandoning the term “Population Health” and replacing it with TPH, allowing for the use of population-based surveys with a geopolitical sampling frame; adopting a “system within systems” approach to allow for clinical care and government public health systems to independently define their service populations; using an integrated measurement framework to define the determinants of health at the TPH level; using the general term “health improvement activities” to describe terms across the prevention-diagnosis-treatment continuum; accepting and adopting a set of shared TPH measures; using a systems within systems measurement framework with a focus on TPH, determinants of health, and health improvement activities; and having stakeholders work together to complete an integrated community health needs assessment and develop agreed-to prioritized activities with appropriate measurements and targets. Additional recommendations include making use of: existing national indicator sets, such as National Quality Forum (NQF), when and where possible; existing state and local-sponsored TPH
surveys, clinical administrative data, and government registries; terminology for the integrated TPH approach that reflects the perspective of current data collection systems; NQF data to measure disparities using distributive methods; indicators of TPH based on a combination of unhealthy risk behaviors and/or burden of disease; priority health improvement activities for both clinical and governmental public health preventive systems; and small-scale starting processes that can identify synergies and overlap where buy-in and collaboration are possible. The authors conclude that the key to success in developing and implementing a TPH approach is the synchronization of leadership and communication between the government public health and clinical care systems. The TPH framework could serve as a solid foundation to approach needed improvements in urban health care desert communities by clearly defining the geographic population and by establishing practices for coordinating public policy initiatives with local health system activities.

**Hospitals and Community Needs Assessment**

The primary purpose of hospitals is to provide efficient, safe, effective, timely, equitable medical care. Hospitals also have a unique role in their communities as they are often one of the primary, if not the primary, employers. Their role in leading total population health initiatives cannot be underestimated. Clearly, hospitals have played a role in improving public health. Two recent policy developments have supported public health investments as part of a community benefit plan. In 2009, the Internal Revenue Service (IRS) developed Schedule H to capture complete and reliable information regarding community benefit activities (128). The IRS clarified the meaning of “community benefit” under the law, defining the term in a way that fosters reliable and comparative information across the country. Schedule H includes “community building” activities, encompassing expenditures including physical improvements
and housing; economic development; community support; environmental improvements; leadership development and training for community members; coalition building; community health improvement advocacy; and workforce development (129). The second major policy advancement came as a result of the Affordable Care Act (ACA) in 2010. Hospitals are now required to undertake a triennial Community Health Needs Assessment, and develop and annually update an implementation strategy detailing how each organization will invest in identified priorities. These two policy developments have led to a more transparent analysis of the needs of a community and the role hospitals play in their communities.

New York Methodist Hospital, located in a non-desert community area, has focused on these public health priorities: physical activity and nutrition; and chronic diseases (130,131). The goals for the physical activity and nutrition focus are as follows: to reduce the number of obese children 2 to 16 years of age; to reduce the number of obese adults; to increase the percentage of children and adults engaged in leisure physical activity; to increase the percentage of adults eating at least five fruits or vegetables per day; and to increase the percentage of mothers in the Women, Infants and Children (WIC) program who are breastfeeding at six months. The goals for the chronic disease focus are to reduce: the prevalence of diabetes in adults; diabetes short-term complication hospitalization rate (per 1,000) for patients ages 6 to 17, and ages 18 and above; coronary heart disease hospitalizations; congestive heart failure hospitalization rate; cerebrovascular disease mortality; and cancer mortality, with attention to breast, cervical, and colorectal cancers.

For the Brooklyn desert communities, Kings County Hospital Center has chosen to focus on chronic disease, violence, mental illness/substance abuse, HIV, and cancer (132). The chronic disease priorities include: hypertension; diabetes and obesity; renal disease; heart disease; staff
wellness; and women’s health services. The focus was to expand ambulatory care services to enhance community access. For its violence priority, the hospital focused on: domestic violence, trauma, and child abuse. The hospital is partnering with community agencies to address all aspects of violence in the communities it serves. To address the mental illness and substance abuse priority areas, the hospital enhanced its chemical dependency services and integrated mental health screening into community events and primary care visits. To address the HIV/AIDS priority area, the hospital sought grant funding to expand testing in the emergency department and co-located testing in the ambulatory services areas. The hospital’s last priority area was cancer and enhancing radiation oncology and screening services.

Brookdale Hospital Medical Center prioritized obesity and HIV/AIDS based on their community needs assessment (133). The obesity focus goals include: developing and implementing an obesity training and wellness module for clinicians; early identification and tracking of obese patients using body mass index (BMI); ensuring the EMR has capacity to capture and track obese patients and impact of counseling; developing an obesity prevention program for use across the health care system; coordinating workshops on healthy living for staff, patients, and community members; developing employee wellness programs and weight loss challenges; partnering with local gyms and fitness facilities for discount memberships; identifying outpatient nutritional resources in the community; and applying for grant support to meet the goals. To address its goals, the hospital’s primary focus has been its Live Right Live Light (LRLL) program. To address the HIV/AIDS priority area, the hospital has focused on a partnership with a Federally Qualified Health Center to relocate ambulatory services back into the community, while continuing to improve emergency department testing and early identification of at-risk patients.
Reviewing the priorities for these hospitals, it is clear that regardless of the overall access and quality of care, obesity and cancer remain significant concerns for hospitals in both desert and non-desert communities. For the desert areas alone, HIV/AIDS remains a significant priority area. Additionally, one hospital in the desert community selected violence as a priority area. These priority areas help to illuminate the challenges facing urban desert health care communities and how the local hospitals are moving to address these concerns.

In addition to identifying and managing the medical/behavioral needs of their communities, hospitals must begin to identify nonmedical determinants of health to better improve the health of their communities. According to “The Role of Hospitals in Improving Nonmedical Determinants of Community Population Health,” 46 percent of reviewed community service plans had programs addressing upstream behavioral lifestyle factors, including access to healthy food and exercise options (134). Twenty-nine percent included programs addressing the environment, housing, education, and crime. This report also computed the mean portion of hospitals’ net community benefits expenses attributed to financial assistance/means-testing government programs and community health improvements. The mean percent of total expenses spent on community benefits for hospitals reviewed in New York State was 1 percent, while the mean percent of community benefits attributed to cover losses from uninsured and government programs was 69.3 percent. The report also investigated barriers to community population health programs. The primary barriers involve financial, technological, leadership, and policy issues. In NYS, the continued focus on the fee-for-service payment model has not allowed for widespread investments in population health initiatives. Additionally, the need for upfront capital to invest in population health initiatives is problematic for many financially distressed hospitals. With urban desert hospitals facing significant funding gaps,
addressing these needs will be slow and limited. In New York State it is hoped that Delivery System Reform Incentive Payment (DSRIP) funding initiatives will address some of these barriers. Additionally, the shift to value-based payments and risk contracting may also allow hospitals to begin to address nonmedical determinants of health, but without a well-focused and funded combined public/private initiative, improvements, if any, will be limited.

**Future Research Opportunities**

It is clear from this research that desert communities have less access to (and often lower quality) medical, behavioral, and mental health care than their non-desert counterparts, resulting in worse overall health. The community health profiles released in 2015 describe tremendous health disparities faced by many desert communities in NYC. In fact, the Brownville community, which was included as a desert community in this study, has the lowest life expectancy of all NYC communities. It would be simple but incorrect to attribute these disparities in health solely to access and/or quality of the desert health care. While this study has focused on the impact of living in an urban desert on health of the community, it is clear from the literature that health is a complex concept that is influenced by numerous inputs. Future research should focus on specifically identifying these nonmedical impacts and quantifying their influence on the health of desert communities. Additional research could investigate community intervention strategies that have been recommended for desert communities.

As an example of the direction for future research, a recent CUNY School of Public Health’s report, “Exploring Health and Wellness Trust in Brooklyn,” provides an assessment of the key elements needed for developing and implementing a Trust, or funding that supports wellness and prevention interventions in community settings to improve population health (135). Most Trusts focus primarily on keeping populations healthy and preventing disease, but many
also endeavor to reduce progression of disease or mitigate the impact on the populations they cover. It has been suggested that a 10 dollar per-person investment in prevention-based community programming would result in a 16 billion dollar annual return on investment after 5 years (136). This report recommends the following actions: conducting comprehensive outreach to the broad range of involved stakeholders to pursue formal commitment to develop a Trust using the Collective Impact framework; building local community capacity to access and utilize readily available data, while expanding data collection to include qualitative measures; implementing a “proof of concept” or pilot program to demonstrate intermediate health outcomes; and ensuring rigorous study design to improve upon previous prevention program studies using experimental or quasi-experimental research. This report serves as a guide for future research addressing preventive interventions directed at the Brooklyn urban health care desert communities as well as other health care desert communities nationwide.

Strengths and Limitations

This study is the first of its kind to explore the concept and impact of an urban health care desert in a major American city with well-developed and readily available transportation infrastructure. This dissertation examines the impact of living in an urban desert environment on health care and overall health. Because the concept of an urban health care desert was vague and ill-defined, a definition was recommended. This definition, if applied to other urban centers, may allow for identification of desert communities. These communities can be considered “hot spots” that require attention by public health officials. Once these communities are identified, policy makers can focus energy and resources on addressing disparities. This study also explored medical and mental/behavioral health care using SPARCS data, a robust NYS database. While SPARCS is unique to NYS, it would be possible to use the HCUP database, as well as specific
state databases, to investigate desert communities in other states. Our study found significant differences in desert communities with respect to hospitalizations and emergency department utilization for ACSC/PQIs, which indicates a need to address the primary care infrastructure of desert communities. Additionally, with regard to mental/behavioral illness hospitalizations and emergency department utilization, desert communities were also negatively impacted, again raising the concern for sufficient access to mental/behavioral services. It is understood that access to health care is only one part of the larger determinants of health, but improved access is clearly needed in these desert communities. A 2016 NYS-commissioned study, “The Brooklyn Study: Reshaping the Future of Healthcare,” was conducted by the business advisory services division of Northwell Health and states: “The most important transformational element of this plan is the development of a comprehensive ambulatory care network to significantly expand the availability of primary care services” (137). The study was commissioned to investigate and make recommendations on how to restructure health care and bring independent, stand-alone hospitals together to transform care in Central and Northeast Brooklyn. The study specifically focused on those two desert communities and recommended the recruitment of an additional 120 health care providers and development of 36 new facilities, with a goal of providing 500,000 visits annually. Many additional recommendations were made to address the creation of an integrated health care delivery system. Interestingly, the authors of the study did use the term “health care desert” to describe parts of the service area and certain communities.

Our study looked specifically at urban health care deserts in Brooklyn, New York. Thus, generalizability of the study results may not apply to nonurban communities, or urban communities in different states. This study also focused only on medical and mental/behavioral illnesses as a way to explore the impact of living in desert communities on health. It is clear that
health is influenced by many factors including social and economic factors, personal choices, health behaviors, and environmental issues. Our primary focus was health as influenced by health care access, but our policy recommendations go further to include nonmedical social determinants of health. As recommended by the 2016 Brooklyn Study, “The health system should create a public and private partnership and invest in infrastructure and resources to better integrate clinical care with coordinated continuum of safety-net programs that address the social determinants of health and the economic health of the service area” (137). The authors specifically reference economic development programs as a model, and suggest that the service area be designated a “Health Enterprise Zone” to provide infrastructure and resources to facilitate the integration of clinical care with a coordinated continuum of social programs to address the many social determinants of health.
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